RV *Investigator* Voyage Summary

Voyage #:	IN2016_E02		
Voyage title:	MNF & ASP Equipment Sea Trials & DECAF Experiments		
Mobilisation:	Thales Shipyard, Garden Island, Sydney, Wednesday, 14 and Thursday, 15 December, 2017		
Depart:	1500: Thales Shipyard, Garden Island, Sydney, Thursday, 15 December 2017		
Return:	0700: CSIRO Wharf Hobart, Tuesday December 20th, 2017		
Demobilisation:	CSIRO Wharf Hobart, Tuesday, 20 December 2017		
Voyage Manager:	Don McKenzie	**Contact details:**	Don.mckenzie@csiro.au
Deputy Voyage Manager:	Max McGuire	**Contact details:**	Max.mcguire@csiro.au
Principal Investigator:	Dr Rudy Kloser		
Project name:	Deep Water Calibration Facility Experiments (DECAF)		
Affiliation:	CSIRO O&A	**Contact details:**	Rudy.kloser@csiro.au
Principal Investigator:	John Pogonoski		
Project name:	MNF Fish Trawling Trials		
Affiliation:	CSIRO NF&C	**Contact details:**	John.pogonoski@csiro.au

Voyage Summary

Objectives and brief narrative of voyage

The transit voyage departed from the Thales Shipyard on Garden Island, Sydney Harbour, NSW, and ended alongside CSIRO Wharf, Hobart, Tasmania. It comprised of various sea trials including the testing of ship's equipment post dry dock modifications along with demersal trawling equipment and deep towed camera trials in preparation for upcoming 2017 voyages. This voyage also included 12 hours of allocated sea time for the calibration of the Deep Water Calibration Facility (DECAF) for Dr. Rudy Kloser and his team from CSIRO O&A.

Scientific objectives

The primary objective of the voyage was to test and verify equipment in a series of sea trials. As such the scientific objectives were a secondary objective for the voyage. The trawling required to meet the scientific objectives was 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.

Voyage objectives

The Primary objective of IN2016_E02 was 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;
- 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;
- Relocate *RV Investigator* from Sydney to Hobart;
- Deep water calibration of DECAF (Kloser research charter).

Tests & Trials Activities

Net Drum Function Test (From Main Deck)

During the dry dock period the net drum was 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 was installed during dry dock. A range of load tests & pressure testing of the system was completed in the dock to demonstrate the integrity of the modifications. Once at sea the net drum was function tested in the form of over boarding and recovering a weight to a nominated depth. Other post dry dock function tests at sea were on the newly modified gallows and various other ship's winches.

Trawling Trials

The purpose of the trawling trials was to trial the safe deployment and retrieval of trawling equipment from *RV Investigator*.

Net monitoring Equipment

The Range limits of acoustic telemetry systems used to monitor trawl net depth and trawl door openings was observed during the sea trials. *RV 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.

- Tests evaluated the long range transmission capabilities of two deep rated telemetry systems as follows:

Compatt6

The MNF's newly acquired Compatt6 directional beacon was mounted on the trawl headline and interrogated from the vessels existing hull mounted Ranger 2 USBL system.

- Tested the long range transmission capability of the Compatt6.

EvoLogics acoustic modem system

An independent CSIRO O&A owned long range EvoLogics acoustic modem system was trialed. This system comprises two parts: the deck side transceiver and the underwater transponder.

- Successful testing allowed acoustic communications to be evaluated (vertically) over variable distances as transponder is lowered.

Specimen unloading and handling

One of the key objectives of the trials was the removing of scientific material from a laden net into fish bins and subsequent transfer to the dirty wet laboratory. Procedures were developed around:

- Assessing catch in net & determining the number of bins required;
- Placing fish bins on deck in net unloading location;
- Transferring catch to fish bins by:
  - Using A frame to assist in upending 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).
- Transfer of live specimens to anaesthesia / euthanasia baths

A key outcome of the trials was determining improvements to the system, and detailing personnel requirements for unloading, transfer & cataloguing for future voyages.

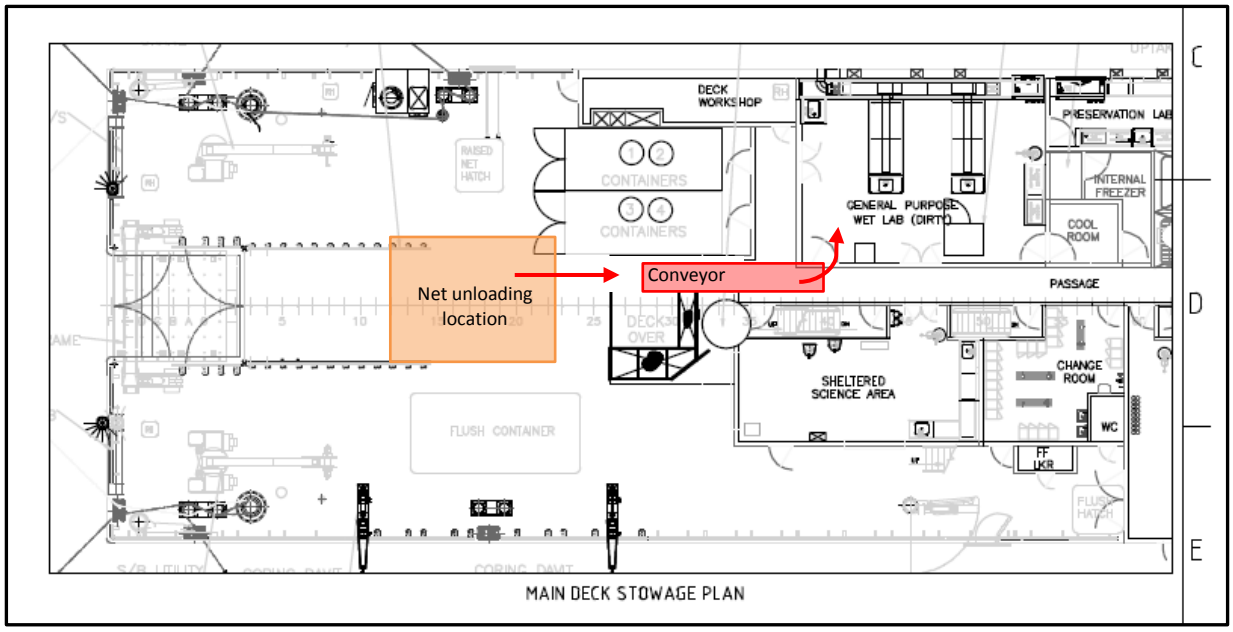

Figure 3: unloading and transfer of scientific material from nets to dirty wet lab

Figure 4: Longreach B/F200 conveyer system

UDHAS Commissioning

The UHDAS commissioning tests included:

- Testing interference between the ADCPs and other acoustic devices;
- Collected data with bottom track on anddeployed drop keel to confirm offsets when deployed and between deployments.

Deep towed camera function test

- Various tests performed throughout the voyage improved performance

CSIRO Seagoing Instrumentation Team tests & trials

CSIRO SIT function tests included:

- 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

Voyage Narrative

RV Investigator cleared Thales Shipyard dock on Garden Island at 1500 on Thursday December 15 and proceeded into Sydney Harbour and out through the heads to a position 6 miles offshore to begin Dynamic Positioning (DP) tests utilising the bow thruster and Konsberg DP systems.

At 1900, after successful DP tests, *RV Investigator* moved back into Sydney Harbour to disembark the Konsberg and Lloyds technicians onto a harbour launch before again departing Port Jackson in SSE winds and heading south east with a compliment of 33 science participants and MNF support staff, 24 crew and 1 Rapp technician.

Two ARGO floats were deployed early the following morning at the deep offshore site off the southern NSW coast (ID7605 @ lat: 35*40.00 S / lon: 150*50.74 E) & (ID0633 @ lat: 35*40.53 S / lon: 150*50.17 E) while the ASP crew completed post-dry dock winch tests in the ~3000m of deep water.

In the afternoon the trawl net was shot away from the new aft main deck net drum location and recovered successfully both without and then with the trawl boards attached. Further trawling trials were conducted into the late afternoon south-east of Bermagui, NSW, to safely fine tune the trawling procedures with the final cast of the day recovering samples for the fish specialists to analyse. During the night the ASP crew ran further GP winch functionality tests and the MNF's Compatt trials were conducted throughout the night until first light.

Earlier today during our third day at sea Dr Rudy Kloser's deep water calibration facility (DECAF) was deployed into 1100m of water off the very southern end of the NSW coast opposite Merimbula.

Following on from yesterday's demersal trawling trials the trawling equipment was shot away again at 1100 south-east of Green Cape, NSW, for a 30 minute deployment along the sea floor in ~200m of water. A significant sample was returned and processed efficiently from the trawl net to the dirty wet lab for cataloguing and analysis by the fish and invertebrate specialists.

Late in the afternoon forecast gale force westerly winds hit the vessel as we crossed the northern boundary of Bass Strait with the sea and swell climbing to 4 – 5 metres and the strong winds restricting all scientific and ASP managed activities throughout the night.

The low sweeping across Bass Strait continued to impact *RV Investigator* as we moved south into Tasmanian waters which precluded any scientific operations on our fourth morning at sea except for the final ARGO float deployment at 0100 into 3087m of water on the easterly edge of Bass Strait (ID0763 lat: 39*00.74 S / lon: 149*38.19 E).

At 0700 ship based trials were able to continue with the GP winch tow and spooling running until lunchtime while *RV Investigator* headed offshore in preparation for the deep water acoustic trawl monitoring and performance trials.

The trawling gear was shot away and recovered twice this afternoon with the new acoustic sensors attached reaching depths approaching 1400m in over 4000m of water.

RV Investigator's ASP crew and Dr Rudy Kloser's team continued their deep water calibrations (DECAF) throughout the night until 0700 breakfast this morning before the ship re-positioned inshore to the St Helens Seamount for Deep Towed Camera trials.
The Deep Towed Camera system was deployed four times from St Helens Seamount and deep water sites south en-route to our final trawling equipment trials site for this voyage off Maria Island on the east coast of Tasmania.

The final trawling trials got underway at 2000 with the net shot away into 420 metres of water and successfully recovered just east of the northern end of Maria Island. Further good samples were collected and processed on board throughout the night.

0600 Tuesday December 20th *RV Investigator* boarded the Port of Hobart pilot for the short run alongside CSIRO Wharf (Princes 4) and was all secure by 0700.

Summary

IN2016_E02 was a transit voyage for *RV Investigator* from Sydney to Hobart designed to test and trial both ship based equipment manged by the ship's ASP crew and MNF equipment in preparation for 2017 scientific voyages.

Dr Rudy Kloser's team from CSIRO O&A was also awarded 12 hours of sea time to calibrate their deep water calibration facility (DECAF) which complimented the IN2016_E02 Voyage Plan as outlined by the MNF Ship Management team.

Despite losing ~14 hours of sea time to adverse weather as *RV Investigator* entered Bass Strait and the unexpected and open ended nature of the ship based general purpose winch spooling tests the primary objectives of this voyage have been met.

Trials with the newly located net drum have been successful and deployment and recovery of the trawl gear in various depths coupled with the testing of two different acoustic net monitoring sensors has highlighted the necessary manning levels and trawling procedures required to develop this important capability.

The successful trials and resulting procedural development is also due to the close working relationship that developed between the on board trawling consultants and *RV Investigator's* Master and crew.

Sample collection, analysis and processing also proceeded as planned and highlighted procedural requirements for future voyages utilising the vessel's trawling capability.

Deep towed camera and underway equipment trials were included in the voyage plan to compliment the ship based post-dry dock tests and trials.

The scientific objectives were also met with Dr Rudy Kloser's DECAF experiments utilising nearly all of their allotted 12 hours of sea time plus the successful deployment of three Argo floats in line with the Argo integrated global observation strategy for this voyage track.

Marsden Squares

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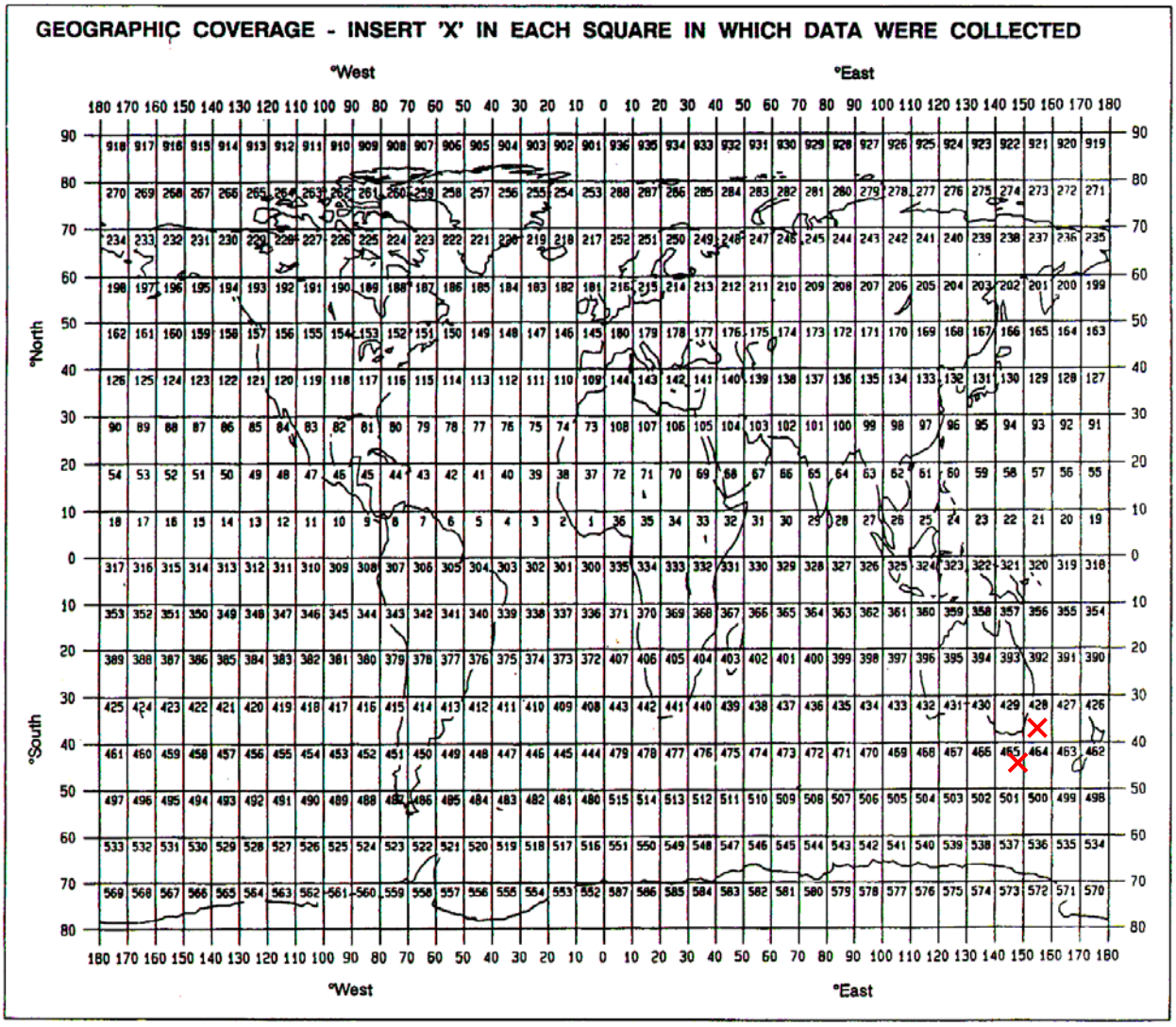


Summary of fish samples taken

John Pogonoski – CSIRO NF&C

On the afternoon of Friday December 16 a 15 minute demersal trawl was conducted in 119-120 m depth south-east of Bermagui, NSW for a total catch weight of 22 kg. Nine fish species (162 specimens) and one parasitic isopod, *Ceratothoa imbricata* were collected. Numerically dominant fish species were Ocean Jacket (*Nelusetta ayraud*), Roundsnout Gurnard (*Lepidotrigla mulhalli*) and Common Jack Mackerel (*Trachurus declivis*).

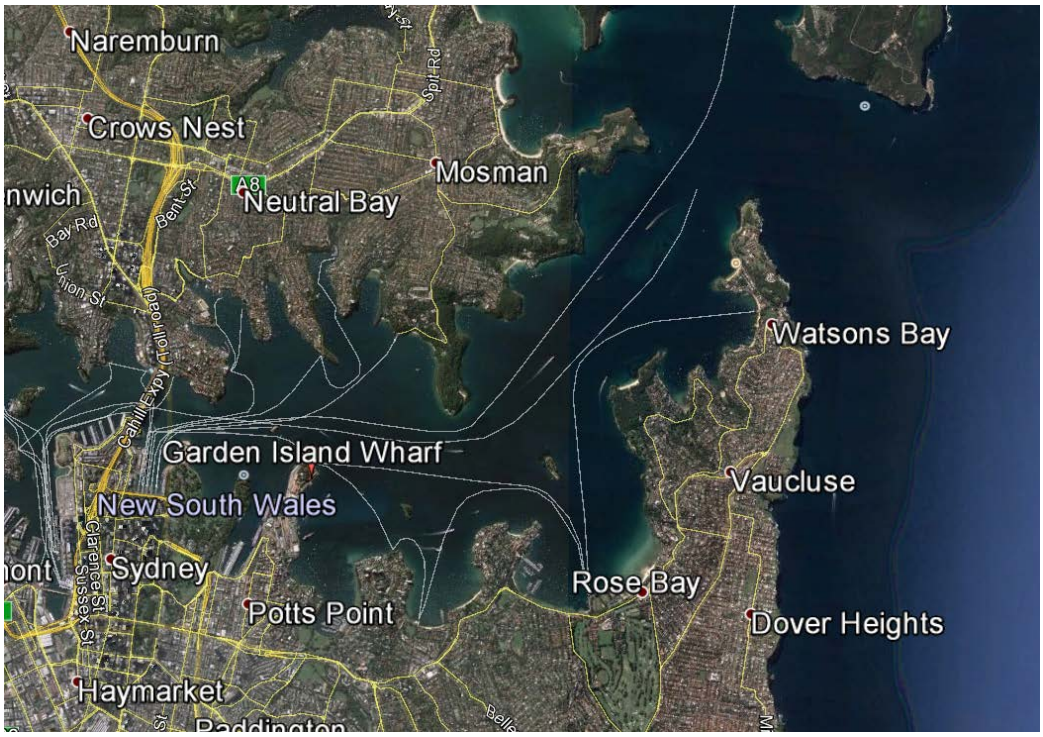
On Saturday December 17 a 30 minute demersal trawl was conducted in 150-192 m depth south-east of Green Cape, NSW for a total catch weight of 112 kg. Nineteen fish species (1029 specimens) and 84 coarsely sorted invertebrate 'taxa' (mainly crustaceans, sponges, molluscs, ophiuroids, octocorals and ascidians) were collected. Numerically dominant fish species were Blacktip Cucumberfish (*Paraulopus nigripinnis*), Common Jack Mackerel *Trachurus declivis,* Reef Ocean Perch *Helicolenus percoides* and Common Bellowsfish, *Macroramphosus scolopax.*

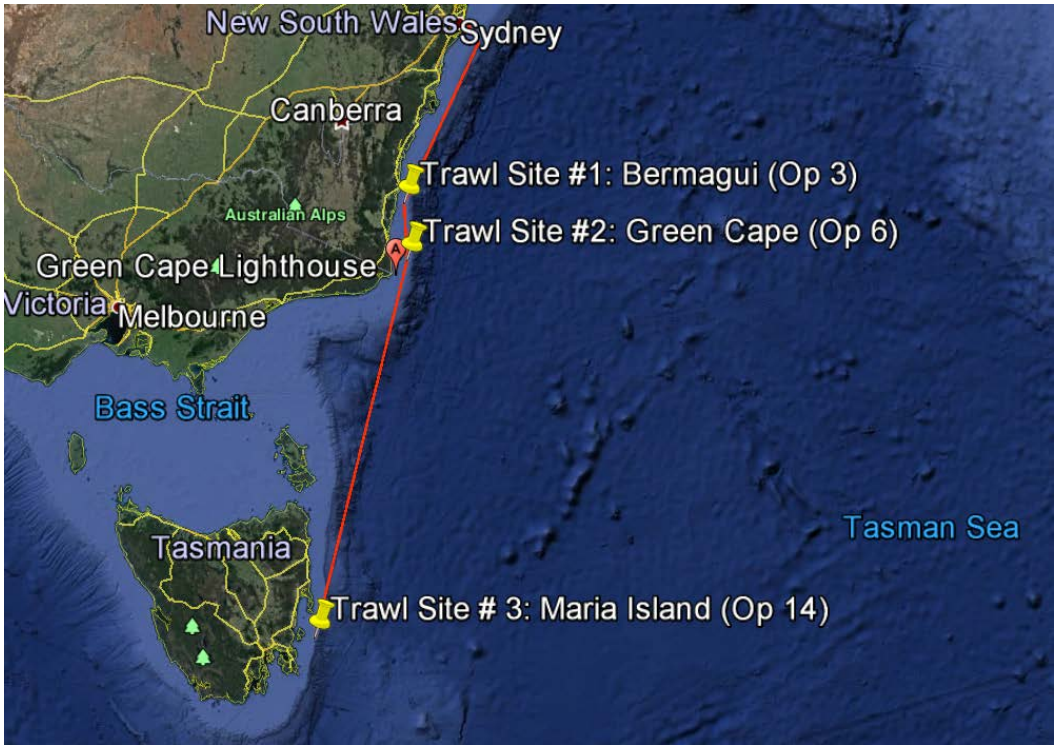
On Monday December 19 a 30 minute demersal trawl was conducted in 422-430 m depth east of Maria Island, Tasmania for a total catch weight of 106 kg. Twenty fish species (about 800 specimens) and at least 7 invertebrate 'taxa' (squid, jellyfish, molluscs, crustaceans, sponges and a scale worm) were collected. Numerically dominant fish species were Faintbanded Whiptail (*Coelorinchus amydrozosterus*), Toothed Whiptail (*Lepidorhynchus denticulatus*), Banded Bellowsfish (*Centriscops humerosus*) and Bigeye Deepsea Cardinalfish (*Epigonus lenimen*). Blue Grenadier (*Macruronus novaezelandiae*) and Pink Ling (*Genypterus blacodes*) were also significant components by weight.

Although scientific trawling had occurred at the above sites during the 1980's or 1990's, it was a good opportunity to test the trawling equipment and collect voucher specimens, genetic samples and images from the species collected. From three demersal trawl stations, 43 fish species were collected and voucher specimens were deposited into the CSIRO Australian National Fish Collection, Hobart. At least 100 genetic samples of fishes were extracted and 32 fish species were photographed.

The demersal fish trawling capability demonstrated on RV *Investigator* during this trial voyage will be critical to the ongoing need for scientific assessment of Australia's marine jurisdiction, including fisheries, protected zones and habitats.

Track Chart


Naremburn
Crows Nest
Mosman
Neutral Bay
A8
Bay Rd
Union St
Cahill Expy
Garden Island Wharf
New South Wales
Sydney
Potts Point
Haymarket
Watsons Bay
Vaucluse
Rose Bay
Dover Heights


New South Wales
Sydney
Canberra
Trawl Site #1: Bermagui (Op 3)
Australian Alps
Trawl Site #2: Green Cape (Op 6)
Green Cape Lighthouse
Victoria
Melbourne
Bass Strait
Tasmania
Tasman Sea
Trawl Site # 3: Maria Island (Op 14)

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 Tas.	Invertebrate Specialist
17	Hummon	Jules	Uni of Hawaii	ADHP Specialist
18	McKee	Merrilyn	CSIRO	Hydrochemist
19	Rees	Christine	CSIRO	Hydrochemist
20	Sherlock	Matt	CSIRO	Technician
21	Keesing	John	CSIRO	Observer (2017 Voyage)
22	Strzelecki	Joanna	CSIRO	Observer (2017 Voyage)
23	Kloser	Rudy	CSIRO	12hr Research Charter
24	Kunnath	Harris	CSIRO	12hr Research Charter
32	Wakeford	John	AMC	Trawling Consultant
33	MacGibbon	Hamish	NIWA	Trawling Consultant
34	Sorvag	Roger	Rapp	Rapp Technician

ASP Marine Crew

	Surname	First name	Role
1.	Highton	John	Master
2.	Gurmukh	Nagra	Chief Mate
3.	Eakin	Brendan	Second Mate
4.	Watson	Thomas	Third Mate
5.	Minness	Chris	Chief Engineer
6.	Ellicott	Mark	First Engineer
7.	Sinclair	Michael	Second Engineer
8.	Agnew	Ryan	Third Engineer
9.	Curran	John	Electrical Engineer
10.	Hall	Gary	Chief Caterer
11.	Lade	Emma	Caterer
12.	Shepherd	Keith	Chief Cook
13.	Hamilton	Wayne	Cook
14.	McDougall	Graham	Chief Integrated Rating
15.	Langford	Paul	Integrated Rating
16.	Ellis	Jarod	Integrated Rating
17.	Bassi	Dennis	Integrated Rating
18.	McNeil	Matthew	Integrated Rating
19.	Taylor	Peter	Integrated Rating
20.	Langham	Roderick	Integrated Rating
21.	Edwards	Samuel	Supernumerary
22.	Grinham	Patrick	Supernumerary
23.	Boddy	Stephen	Supernumerary
24.	Milnes	Nathan	Supernumerary

Signature

Your name	Rudy Kloser
Title	Principal Investigator
Signature	Rudy Kloser
Date:	21 December 2016