2009 program

RV *Southern Surveyor*

MARINE NATIONAL FACILITY

voyagesummary SS03/2009-TRANSIT

CSIRO

SS03/2009 – TRANSIT

The composition of shelf and deep sea benthos in the Bass Canyon and the distribution of larval fish off the Eastern Tasmanian coast

Voyage period

10/10/2009 to 15/10/2009
Port of departure: Hobart, Australia
Port of return: Sydney, Australia

Responsible laboratory

School of Biological Sciences, The University of Sydney.

Dr Sebastian Holmes
Heydon Laurence A08, Science Road, Sydney, NSW 2006 Australia

Chief Scientist

Dr Sebastian Holmes (1st watch), Dr Will Figueria (2nd watch).

Scientific Objectives

For Holmes & Figueira, the main purpose on the voyage is to introduce University students to life and work on board an oceanographic research vessel, experience a variety of different sampling methods, carry out some on board experimentation and expose them to some of Australia's deep sea fauna. The students will have two scientific aims:

1) to examine the deep sea fauna of the Bass Canyon and investigate how faunal composition changes with bathymetry and bottom composition;

2) to examine the distribution of larval fish along the Eastern shelf of Tasmania and conduct a series of onboard experiments to examine the relationship between temperature and otolith growth increments.

Specimens collected under the first aim will potentially feed back into the work of two Ph.D. students at Sydney University (one looking at food webs with stable isotopes) and one looking at connectivity (population genetics). They may also feed into the research of Holmes (connectivity and phylogeny). In addition, there are obvious synergies between the data collected by the students and the aims of Kloser et al. For the second aim, the data collected will feed into the research of Figueria (climate change and population distribution/connectivity).

For Kloser, the voyage provides an ongoing opportunity to use vessel transit time to complete a national mapping of the upper-mid slope seabed with multi-beam mapping and associated ecological interpretation. The upper-slope and mid-slope seabed 100 m to 1500 m depth range, are regions important for regional marine planning, biodiversity and conservation assessments and fisheries habitat mapping.

The projects objectives relevant to this voyage are:

1) using transit time, map key areas within 100 to 1500 m identified in gap analysis;

2) develop methods of improving data quality and calibrating the EM300 bathymetry and backscatter data;

3) develop and test new rapid methods of seabed optical and physical sampling;

4) develop multi-scale methods to provide ecological interpretations and identify key areas for more detailed function and process investigations.

On this voyage we will test a newly developed piece of equipment, Benthic Optical, Acoustic and Grab sampler (BOAGS), which can both survey, by video and acoustically, and selectively sample (surface fired Smith-Macintyre grab) the benthos (see appendix 2). The benthic sampling carried out by the students will supplement the testing of BOAGS. Conversely and importantly, BOAGS will allow the students to survey a much broader area and ensure the correct gear is deployed, thereby increasing their exposure to deep sea fauna. In addition, time permitting, it is intended to fill in some of the swath gaps, including a presently unmapped region of Bass Canyon, on the transit to Sydney.

Voyage Objectives

The voyage objectives fall into two categories, benthic sampling and pelagic sampling for larval fish. Pelagic sampling will be carried out using a vertical neuston trawl at six stations on route to Bass Canyon, two stations at Bass Canyon and two stations, time permitting, on route to Sydney. In addition to the trawl, CTD (including bottles) and expendable bathythermograph (XBT) casts will be made to characterise the water masses and absorption and sound velocity profiles for calibrating the swath mapper. Larval fish collected during the early part of the voyage will be used in a series of on board experiments examining the relationship between otolith growth increment and temperature. All fish collected will be indentified to the lowest taxonomic level possible and key specimens photographed.

The benthic sampling activities can be split into three components. The physical sampling of the benthos, the testing of BOAGS and the fine scale Swath mapping of Bass Canyon. Physical sampling will be carried out using the beam trawl, epi-benthic sled, rock dredge, the Smith-Macintyre grab and BOAGS. Benthic sampling will occur at six different sites, the first site just out of port to test BOAGS and the five remaining sites at Bass Canyon at 400, 1600, 2800, 1600 and 400 m from the southern to the northern flank. Before any physical sampling takes place, BOAGS will be used, as a part of its testing procedure, to carry out a 30 minute video survey to characterise the site (students will log the fauna seen and nature of the sea floor) which will then determine what sampling gear is deployed, e.g. beam trawl versus rock dredge. It is hoped that each piece of the gear will be deployed at least once during the voyage so that the students can gain an idea of their efficacy. BOAGS will take a grab sample at each site which will be used to examine the meiofauna and provide sediment samples for geological (Kloser) and microbial characterisation (Holmes). All macro fauna collected will be identified to the lowest taxonomic level possible, key specimens photographed and all organisms preserved. All data and specimens collected by the students will be made freely available to the key voyage participants (Holmes, Figueria, Kloser (Williams) and Trull).

Results

Deep sea fauna of Bass Canyon

Although not intended as a true scientific investigation (i.e. the purpose was expose students to benthic sampling methodologies), the organisms and data collected are of considerable scientific value. For one Ph.D. student (University of Sydney) the samples collected will result in a Ph.D. chapter looking a trophic linkages (stable isotopes) in Bass Canyon, whilst for another (University of Wollongong) they have a provided a range of material for an investigation into novel natural products. For the Australian Museum, some of the specimens collected are unique to their collection and are being used to inform the FISHBOL and MarBOL initiatives. The serolid isopods and Fusitriton collected will be used as part of population genetic study of deep sea fauna and the abundance of salps collected and observed on the seafloor is being written up as a note. See appendices 3-6 for details of the fauna collected.

Larval fish

Although very worthwhile to give the students an experience of pelagic sampling, unfortunately we were not so successful with this objective. In reality, the gear we were using (neuston net) was unsuitable for the purpose, given the density of salps in the water and low abundance of fish larvae. For future cruises, we will use a coarser mesh net and the EZ net to overcome this.

Student experience

Apart from station activities. All students took a turn in operation and processing the swath, marine mammal watching and filtering the sea water for POM. For them and for us, the voyage was very enjoyable and a resounding success, perhaps best exemplified in their own words, as follows:

“The voyage gave me a unique feeling for real life marine biology research that I couldn't have received from any other trip. It also made identifying species much more practical and useful for my interests. It was also an amazing experience for its value as a feel of sea life, the opportunities to watch amazing sunsets, etc”.

“For me the voyage has reaffirmed my decision to go back to University next year. The time at sea gave me a good reminder of why I chose to study marine biology in the first place – it wasn't to sit in an office in Canberra, wearing a suit”.

“I found the voyage an extremely enjoyable and educational experience. It would highly recommend to anyone that is ever given the opportunity to go on such a voyage to take it; you will certainly not regret it. It think the idea of giving student the opportunity to experience how research vessels like CSIRO’s Southern Surveyor operate is a great and eye opening experience”.

“In terms of the value of the voyage, it was a fantastic experience to conduct deep-sea sampling and be there on the deck to see what comes up. It really reinforces the techniques that we learn about in uni, but never (well hardly ever) actually do. Especially the really deep samples – we know it’s going a long way down when it takes about 30 minutes to reach the bottom! It was also great the work as a team with other scientists who were all interested in deep sea biology/ecology, and also to work with CSIRO staff and their new BOAGs machine. They were excellent in explaining how everything worked, particularly the computer systems etc. It was an incredibly enjoyable voyage, everyone was very helpful and knowledgeable so it made the overall experience a fun one. It definitely was valuable in terms of contributing to our interests and understandings of marine science, and extending our experiences from university”.

“I had an excellent time aboard the RV Southern Surveyor. I learnt a lot about the ocean I had never even considered before. I saw marine life with my own eyes that would have made David Attenborough jump for joy. Observing the BOAGS system in action made me feel like I was on the forefront of marine exploration. It was definitely an experience I will remember for the rest of my life”.

“I found the trip both enjoyable and valuable, especially with my upcoming exam in which I may have to identify a salp... think I have that one down. For me all the identifying stuff was great, it supported what I’d learnt first semester 'invertebrate zoology and re-enforced some of the species descriptions from 'vertebrates and their origins' this semester. It was also great just to be out on a research vessel, see how things work, get an idea about what life could be like as a scientist. And also the food and the people were amazing. Would do it again in an instant, especially if it went over the next 2 weeks. Oh exams”.

BOAGS

The testing of BOAGS was complete success. Aside from a few teething issues with the winch, BOAGS did exactly what it was supposed to each and every time it was deployed. It is an invaluable tool and it's full potential is only just beginning to be realised. For a full report on the trial of BOAGS , see:

Ryan, T.E. (2009) Trial of Benthic Optical Acoustic Grab Sampler (BOAGS) – Voyage summary for FRV Southern Surveyor's Hobart-Sydney transit. Voyage report for Southern Surveyor National Facility, Copy held at CSIRO Marine and Atmospheric Research, Hobart.

From this voyage, the video footage collected by BOAGS is being used alongside other data to write a short note about the relative abundance of salp carcasses on the seafloor.

Surface POM

We successfully collected 31+ samples of POM along the East coast of Tasmania into Bass Canyon. These are currently undergoing analysis (N15 & C13) and will inform the research of Tom Trull. From our perspective, piggy-back projects such as these are very easy to incorporate and add considerable value to the voyage.

Voyage narrative

A daily blog of the voyage activities can be found at:
http://blogs.usyd.edu.au/allatsea/2009/10/budding_marine_biologists_prep.html

A full voyage track is given in Figure 1.

Saturday 11th October 2009: Cast off. Once everyone was onboard and the gear stowed, we cast off late afternoon to begin the voyage.

Sunday 12th October 2009: Salps salps and some more salps. A nice easy day for the first watch, with a lie in to 5 am rather than 2 am, apart from the poor individual tasked with looking after the POM sampling. The first activities of the day were surface tows with the neuston net to collect larval fish. First tow for ten minutes (0.5 - 0.75 knot) at 6:33 am, produced lots of salps some zooplankton and no fish. We had problems with the weighting of the net (too light) so added some shackles to force it below the surface. Given the lack of success with the first tow, a second tow was performed immediately (06:50), with better performance by the net (it sank) but without capturing any fish only salps. Steamed for an hour and then made the third tow of the morning (07:53), again no larval fish, just salps. CTD was deployed (08:47) to 100m, with a system crash resulting in no data.

Following a solid steam for 4+ hours and a change in watch we were ready for the next neuston net (15:14), capturing for the first time some larval fish (not many but some), naturally we had a substantial haul of salps. CTD was successfully deployed (15:39) with a full profile from 100 m and then off to the next station. Just after tea another surface tow (18:15) again capturing larval fish (and salps) followed by another successful CTD (18:42) with a full profile from 100 m. At 23:00, we made the last surface tow for Sunday.

Monday 12th of October 2009: BOAGS and the Beam trawl. Just after midnight, a surface tow (00:23) capturing some larval fish and salps was made, followed by a CTD (00:39) to 100 m and that was it for the wee hours. Up at 07:00 am for the 1st watch, ready for breakfast and surface tow at 08:37, capturing some larval fish and salps, followed by a CTD (08:54) to 100 m.

After breakfast, it was time for BOAGS to make its first ever foray into the water. Deploying BOAGS at 08:39 (see Figure 2) , it slowly dropped to 429 m (no leaks so far), was towed along the bottom (see Figure 3) for 20 minutes to 441 m and then fired from the surface to successfully collect a sediment sample. A resounding success. The trainee scientists (students) had now seen what was on the bottom courtesy of the live feed from BOAGS so it was now time to sample the bottom. The beam trawl was deployed at 11:59 to 450 m and towed on the bottom for 20 minutes. Upon retrieval, it had fished, but one of the shear bolts had snapped and one tang was bent, although there was a good haul of specimens (see Figure 4 & appendix 3), with a large quantity of salps.

A plot of the station location and deployments in Bass Canyon is shown in Figure 5.

Once the specimens from the beam trawl had been processed and we had steamed further into the canyon, it was time to make a second deeper deployment of BOAGS. BOAGS was deployed at 18:52 to 645 m, towed along the bottom (Figure 6) for 20 minutes and took a grab sample, before retrieval.

Tuesday 13th of October 2009: Into the deep. An early morning start (the first) for the 1st watch with a beam trawl (20 minute bottom tow) to 800m at 02:40. The beam had fished, with a reasonable haul (appendix 4), but one shear bolt had snapped with the tangs bent (bent back into place). Following some intensive swathing and repairing the beam trawl, it was deployed for a second time (07:43) to 1631 m (20 minute bottom tow). The beam successfully fished again (appendix 5), but was retrieved with broken shear bolts. Once the specimens had been sorted after some intensive swathing to trying to locate a suitable site, the beam trawl was deployed again (13:42) to its deepest site, 2685 m. It was a successful deployment, but with a reduced catch (appendix 6), likely to have resulted from the shear bolts snapping soon after the beam reached the bottom.

Moving upslope to a shallower site, BOAGS was deployed (15:41) to 1560 m, towed along the bottom (see Figure 7) for 20 minutes and a grab sample taken. It had been originally intended to re-deploy BOAGS at the deeper beam trawl site, however, because of time and weather considerations this was abandoned with the possibility of an additional deployment station near Wollongong, time dependant.

A plot of the station location and deployments in Bass Canyon is shown in Figure 4.

Wednesday 14th of October 2009: Homeward bound. Leisurely morning (again) for the first watch, with the first neuston net at 09:05, capturing larval fish but no salps! After lunch, with both watches together, an XBT was deployed (14:00) to 170 m as a demonstration to the trainee scientists. A second neuston net, some larval fish and few salps, was taken at 14:28 with the final one of the trip at 18:40.

Thursday 15th of October: What's off Wollongong and home

We arrive off Wollongong just after midnight to use BOAGS to look at a feature with very high backscatter reflectance, that has been picked up by the swath on previous voyages. BOAGS is deployed (00:28) initially down to 243 m where we see a hard rocky reef (see Figure 8) teeming with life, a short transect (10 minutes) is made and then we are off to a slightly deeper section (301 m) to make a second transect. Again, it is clearly a hard rocky reef teeming with life. Of all the sites we have observed with BOAGS, this would definitely appear to be the most abundant and bio-diverse. Originally following BOAGS, it was intended to deploy the rock dredge, however due time constraints this is abandoned and we steam to Sydney, arriving at White Bay at 10 am.

Summary

The voyage was a resounding success. BOAGS was successfully tested and deployed several times, a series of POM samples were collected along the transit and the students got to examine the benthic fauna of Bass Canyon as well as undertaking pelagic sampling.

Principal investigators

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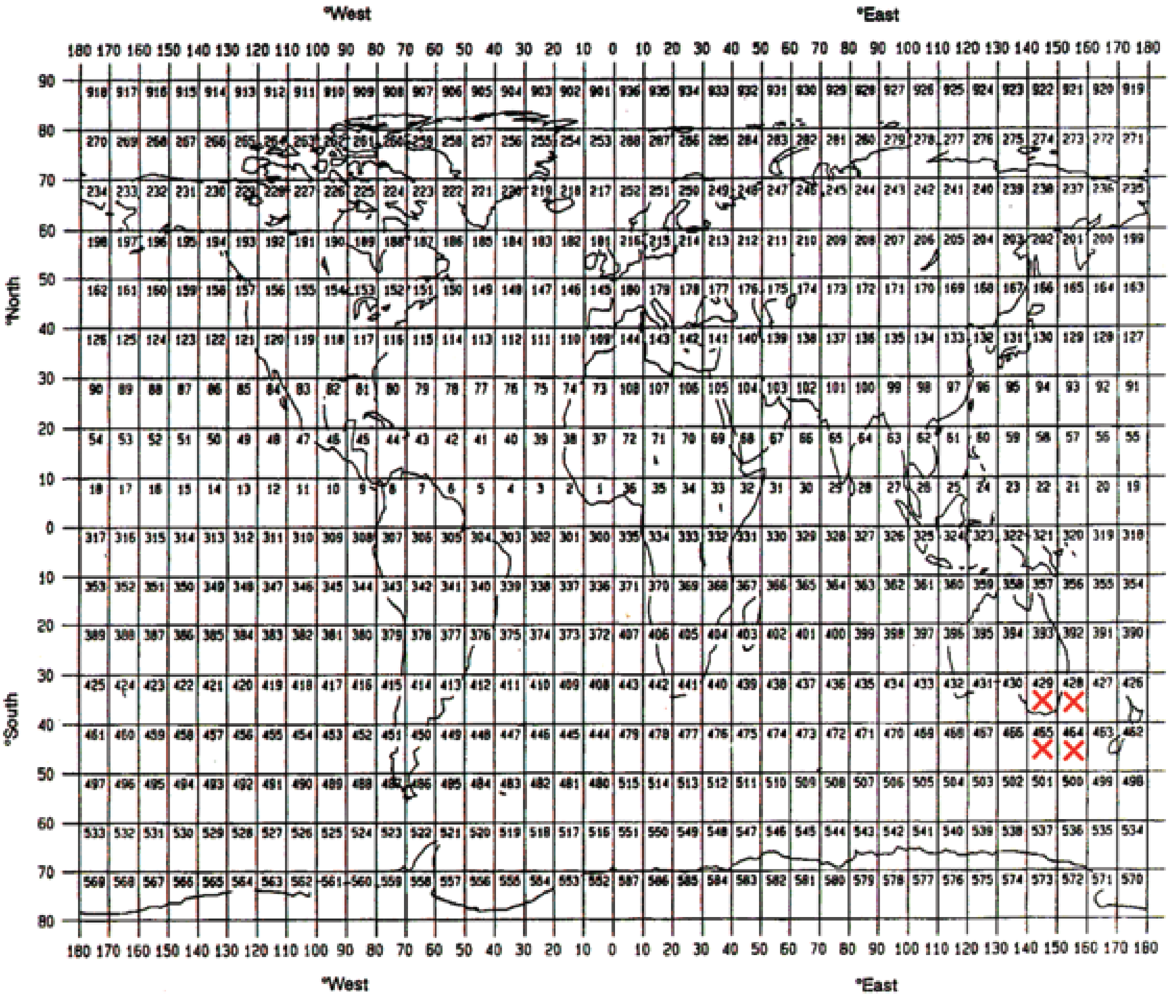
C. Dr Rudy Kloser, CSIRO Marine and Atmospheric Research, GPO Box 1538, Hobart, TAS 7001, Australia. **Phone:** 00 61 3 6232 5222 **Email:** rudy.kloser@csiro.au

D. Dr Tom Trull, Institute of Antarctic and Southern Ocean Studies, University of Tasmania, Hobart, TAS 7001, Australia. **Phone:** 00 64 3 6226 2988 **Email:** tom.trull@utas.edu.au

GEOGRAPHIC COVERAGE - INSERT 'X' IN EACH SQUARE IN WHICH DATA WERE COLLECTED



MOORINGS, BOTTOM MOUNTED GEAR AND DRIFTING SYSTEMS									
Item No	**PI** See page above	**APPROXIMATE POSITION**						**DATA TYPE** enter code(s) from list on last page	**Description** Identify, as appropriate, the nature of the instrumentation the parameters (to be) measured, the number of instruments and their depths, whether deployed and/ or recovered, dates of deployments and/or recovery, and any identifiers given to the site.
		LATITUDE			**LONGITUDE**				
		deg	min	N/S	deg	min	E/W		
1	A/B	41	34	S	148	44	E	B10	Neuston net surface tow for 10 minutes to collect larval fish.
2	A/B	41	34	S	148	44	E	B10	Neuston net surface tow for 10 minutes to collect larval fish.
3	A/B	41	34	S	148	35	E	B10	Neuston net surface tow for 10 minutes to collect larval fish.
4	A	41	35	S	148	35	E	H10	CTD to 130m, no profile system crashed.
5	A/B	40	84	S	148	73	E	B10	Neuston net surface tow for 10 minutes to collect larval fish.
6	A	40	50	S	148	43	E	H10	CTD to 100m
7	A/B	40	17	S	148	86	E	B10	Neuston net surface tow for 10 minutes to collect larval fish.
8	A	40	16	S	148	86	E	H10	CTD to 100m
9	A/B	39	31	S	148	46	E	B10	Neuston net surface tow for 10 minutes to collect larval fish.
10	A/B	39	21	S	148	43	E	B10	Neuston net surface tow for 10 minutes to collect larval fish.
11	A	39	21	S	148	43	E	H10	CTD to 100m
12	A/B	38	30	S	148	26	E	B10	Neuston net surface tow for 10 minutes to collect larval fish.
13	A	38	30	S	148	26	E	H10	CTD to 100m
14	C	38	39	S	148	32	E	B64/G71	First test and deployment of BOAGS to 430 m
15	A	38	24	S	148	32	E	B18	Beam trawl to 450 m, 20 min tow.
16	C	38	33	S	148	34	E	B64/G71	Second deployment of BOAGS to 620 m
17	A	38	32	S	148	36	E	B18	Beam trawl to 800 m, 20 min tow.
18	A	38	34	S	148	37	E	B18	Beam trawl to 1631 m, 20 min tow.
19	A	38	34	S	148	50	E	B18	Beam trawl to 2685 m, 20 min tow.
20	C	38	34	S	148	37	E	B64/G71	Third deployment of BOAGS to 1560 m.
21	A/B	36	46	S	150	19	E	B10	Neuston net surface tow for 10 minutes to collect larval fish.
22	C	35	55	S	150	28	E	H11	XBT to 140 m
23	A/B	35	52	S	150	30	E	B10	Neuston net surface tow for 10 minutes to collect larval fish.
24	A/B	35	16	S	150	56	E	B10	Neuston net surface tow for 10 minutes to collect larval fish.
25	C	34	47	S	151	16	E	B64/G71	Two tows (1 deployment) of BOAGS to 240 ma and then to 305 m.

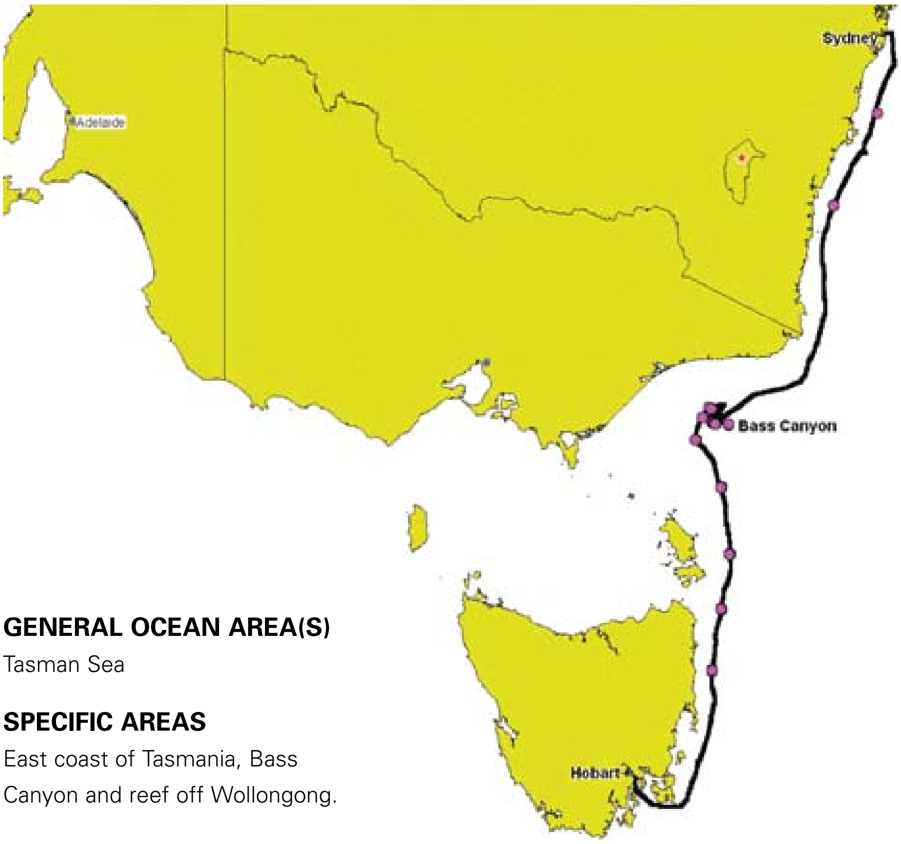
MOORINGS, BOTTOM MOUNTED GEAR AND DRIFTING SYSTEMS					
Item No	**PI** See page above	**NO** (Stations/ tototal)	**UNITS**	**DATA TYPE** enter code(s) from list on last page	**Description**
Neuston net					
1	A/B	11		B10	10 minute surface (0 – 5 m) tows. Plankton and larval fish (few) collected and preserved. Salps discarded. Iain Suthers neuston net.
2	A/B				
3	A/B				
5	A/B				
7	A/B				
9	A/B				
10	A/B				
12	A/B				
21	A/B				
23	A/B				
24	A/B				
Beam trawl					
15	A	4		B18	20 minute bottom tows for benthic macrofauna. All fauna preserved. Alan Williams beam trawl.
17	A				
18	A				
19	A				
BOAGS					
14	C	4		B64/G74	Test and deployment of BOAGS. 20 + minutes of benthic video footage collected at each site (transect tows) and grab samples take for sediment analysis.
16	C				
20	C				
25	C				
CTD					
4	C	5		H10	Standard CTD data from100 m.
6	C				
8	C				
11	C				
13	C				
Underway isotope signatures of surface POM					
26	D	31		H32	N15-PON and C13-POC signature from filtered POM along the Eastern Coast of Tasmania up to Bass Canyon.
XBT					
C	1			H11	Standard XBT data to 170 m.
Swathe data					
C				G74	Various sections of seafloor along the transit route. Particularly, the eastern coast of Tasmania, Bass canyon and the reef off Wollongong.

CURATION REPORT

Item No.	
1 2 3 5 7 9 10 12 21 23 24	**Macro fauna from beam trawls** Samples have been take from all of the macro fauna collected for stable isotope analysis undertaken by a Ph.D. student (David Cummings) at the University of Sydney. Sebastian Holmes has retained the Bruceserolis nowra (isopods) collected for a future population genetic study. All fauna that was collected and frozen has been donated to the Australia Museum where it is being curated and will be retained and some of duplicate specimens have been donated to Danielle Skropeta at the University of Wollongong for research into any potentially beneficial natural products. Specimens fixed in formalin have been donated to the teaching collection at the University of Sydney where they will be retained for use (Heather Sowden). Full details of what was collected, how it was preserved and where it is curated are given in appendices 3, 4, 5 & 6.
1 2 3 5 7 9 10 12 21 23 24	**Neuston net samples** Plankton and larval fish collected by the neuston net will be retained and used for research by Will Figueria at the University of Sydney.
4 6 8 11 13 22	**CTD/XBT data** Data requests should be directed to: www.marine.csiro.au/datacentre/request.htm or data-requests-hf@csiro.au
27	**Swathe** The swath data is held by CSIRO (CMAR) and Geosciences Australia, and will be available for public use 2 years after the standard moratorium for such data. Data requests should be directed to: www.marine.csiro.au/datacentre/request.htm or data-requests-hf@csiro.au POM collected underway Tom Trull (UTAS) will retain all N15 and C13 data pertaining to the surface water POM collected.
14 16 20 25	**BOAGS footage and sediment samples** Rudy Kloser (CMAR) will retain all BOAGS footage (video) and data on the sediment characteristics.
26	**POM collected underway** Tom Trull (UTAS) will retain all N15 and C13 data pertaining to the surface water POM collected.

TRACK CHART

Figure 1: Voyage track, pink circles denote locations of gear deployment



GENERAL OCEAN AREA(S)

Tasman Sea

SPECIFIC AREAS

East coast of Tasmania, Bass Canyon and reef off Wollongong.

Scientific Participants

Name	Affiliation	Role
Steven Hawes	University of Sydney	Trainee scientist (student)
Belinda McArthy	University of Sydney	Trainee scientist (student)
Melissa Tan	University of Sydney	Trainee scientist (student)
Zachary Jason Warburg	University of Sydney	Trainee scientist (student)
Antony Pax Gould	University of Western Sydney	Trainee scientist (student)
Joshua Humphries	University of New South Wales	Trainee scientist (student)
Christopher Baiada	University of Technology Sydney	Trainee scientist (student)
Mattias Roth	Macquarie University	Trainee scientist (student)
Matt Sherlock	CMAR	Engineer
Sebastian Holmes	University of Sydney	Chief scientist
Will Figueria	University of Sydney	Watch leader
Tim Ryan	CMAR	Swath CMAR
Jeff Cordell	CMAR	MNF Voyage manager
Bernadette Heaney	CMAR	MNF Swath support
Anoosh Sarraf	CMAR	MNF computing support

Marine Crew

Name	Role
Ian Taylor	Master
John Boyles	First mate
Rob Ferries	Second mate
John Morton	Chief Engineer
Arthur King	2nd Engineer
Jamie Wheatcroft	3rd Engineer
John Howard`	Bosun
Matt Barrett	IR
Jonathon Lumb	IR
George Jarvis	IR
Ben McLucas	IR
Paul Brown	Chief Cook
Ken Rawson	2nd Cook
Charmayne Aylett	Steward

ACKNOWLEDGEMENTS

Thanks are due to all of the crew and MNF staff onboard the Southern Surveyor who went out of their way to ensure that we accomplished as much as possible and beyond. Especial thanks are due to Jeff Cordell and Matt Sherlock for tirelessly making sure BOAGS worked and everything ran like clockwork, Tim Ryan for helping select sites, producing the voyage track and letting us borrow his figures, Mark Lewis for sorting us out with the beam trawl and Alan Williams for letting us borrow it. Finally, additional thanks are due to Don McKenzie and Lisa Woodward, both who went beyond the call of duty to make sure the voyage was a success.

Dr Sebastian Holmes
Chief Scientist

Figure 2: First deployment of BOAGS

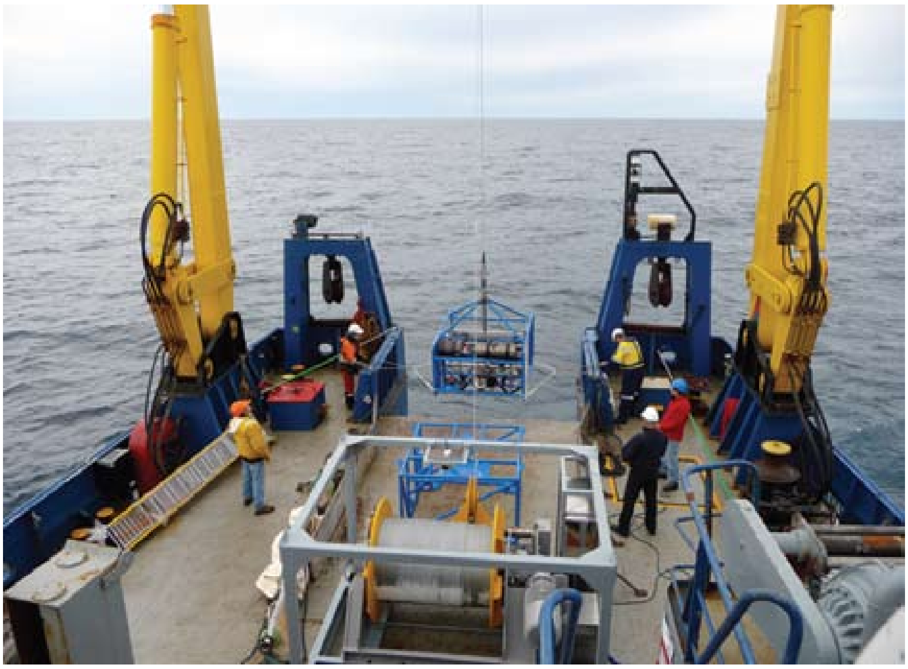


Figure 3: Seafloor at 429 m as seen by BOAGS

Figure 4: Fauna obtained from the beam trawl at 450 m

Figure 5: Station locations and gear deployed in Bass Canyon

Figure 6: Seafloor at 645 m as seen by BOAGS

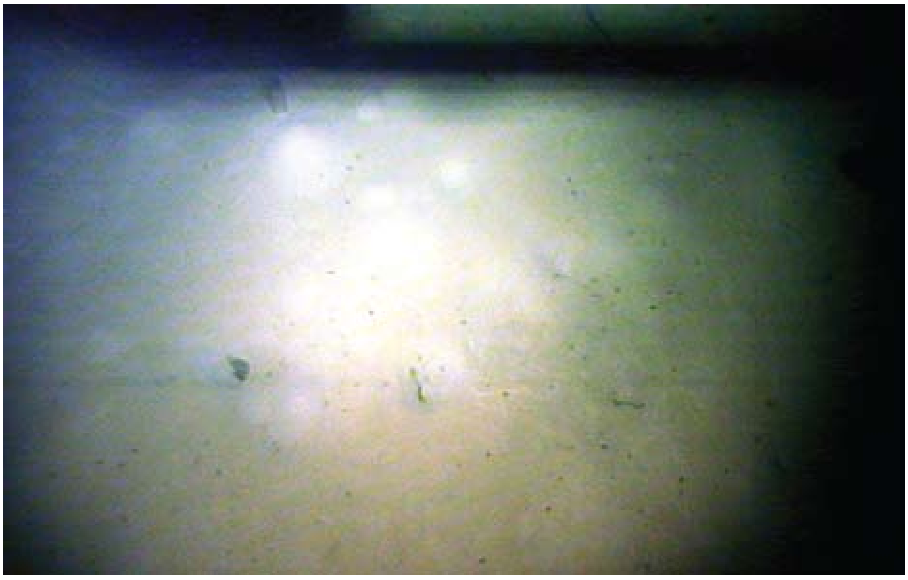


Figure 7: Seafloor at 1560 m as seen by BOAGS

Figure 8: Reef off Wollongong as seen by BOAGS

Appendix 2
Description and technical specifications of BOAGS

Benthic Optical Acoustic Grab Sampler (BOAGS)

System objectives – Rapid assessment of benthic habitat

- Real time video allowing operators to assess suitability of terrain prior to a grab sample. Operator arming of grab sampler trigger to prevent firing at the wrong time. Chance of failed grabs greatly reduced compared to conventional Smith-McIntyre grab.
- Video information provides information for positioning grab samples and scoring biological and geological features.
- 120 kHz echosounder to give calibrated measures of seafloor reflectivity.
- Optic fibre winch with 6000 m of cable.
- Stereo digital stills for high resolution imagery of the seafloor and quantitative metrics of benthic habitat.
- Characterisation of water column micronekton using acoustic and video information.
- CTD for water temperature and salinity measurement.
- Modular design to allow future alternative physical sampling devices to be fitted (e.g. box corer, multi-corer).

BOAGS Specifications

Item	Details
Winch system	Jayden Optic Fibre Winch with 6000 m cable, under 8 tonnes
Grab sample	Smith-McIntyre with operator arming of trigger mechanism
Video	2 Hitachi HVD30P 1/3” 3CCD PAL Camera. One optimised for seafloor imaging1 and one for grab observation.
Lights	2 x LED Multi Sealite (Deep Sea Power and Light)
Imaging sonar	Kongsberg/Mesotech MS1000 sonar for obstacle avoidance
Acoustics	Simrad EK60 120 kHz with ES120-7D transducer
Geolocation	Sonardyne positioning beacon
CTD	Seabird SBE37SI
Altimeter	Kongsberg/Mesotech Model 1007
Still cameras	Canon 5DMk2/EF20mm F2.8 DSLR camera (stereo pair)

Appendix 3:

List of fauna caught by the beam trawl at 450 m, method of preservation and site of curation

Species	Type of organism	Preservation method and site of curation
Helicolenus barathri	Fish	Discarded
Salps (mainly Thetys vagina)	Tunicate	Discarded
Unidentified (not salp)	Tunicate	A/B.#
Azygpus pinnifasciatus	Fish	A/B.
Hoplichthys haswelli	Fish	A.
Symphurus australis	Fish	B.
Porifera spp.	Sponge	A/B.#
Porifera spp.	Sponge	A/B.#
Kophobelemnon sp.	Cnidarian	A.
Coelorinchus gormani	Fish	A/B.
Trypterophycis gilchristi	Fish	B.
Lucigadus nigromaculatus	Fish	A/B.
Lepidorhynchus denticulatus	Fish	A/B.
Brisingida spp.	Echinoderm	A/B.
Echiura spp.	Polychaete	B.
Unidenfied	Sipunculid	B.
Aphrodite spp.	Polychaete	B.
Fusitriton magellanicus	Mollusc	A/B.
Porifera spp.	Porifera	B.
Porifera spp.	Porifera	A/B.#
Hoplostethus intermedius	Fish	B.
Fusitriton magellanicus	Mollusc	A/B.
Bassanago bulbiceps	Fish	B.
Porifera spp.	Sponge	B.
Unidentified (Gastropod)	Mollusc	B.
Caridea (mixed taxa) including Haliporoides sibogae	Crustacean	B.
Prysoma spp.	Tunicate	B.
Unidentifed (Gastropod)	Mollusc	B.
Unidentifed (Gastropod)	Mollusc	B.
Unidentifed (Gastropod)	Mollusc	B.
Porifera spp.	Porifera	B.
Goneplacidae spp.	Crustacean	B.
Unidentifed (Gastropod)	Mollusc	B.
Unidentifed	Polychaete	B.
Majidae; Teratomaia spp.	Crustacean	A/B.
Dagnaudus petterdi	Crustacean	B.
Unidentifed (decapod)	Crustacean	B.
Porifera spp.	Porifera	B.
Unidentifed (Nudibranch)	Mollusc	B.
Unidentifed (Holothurian)	Echinoderm	B.

A denotes frozen, lodged with the Australian museum, *B* denotes formalin maintained by the University of Sydney, # denotes excess specimens donated to The University of Wollongong for natural products chemistry.

Appendix 4:

List of fauna caught by the beam trawl at 800 m, method of preservation and site of curation

Species	Type of organism	Preservation method and site of curation
Salps (mainly Thetys vagina)	Tunicata	Thrown
Synaphobranchus affinis	Fish	A/B.
Actinostolidae species (smooth)	Cnidarian	A/B.
Aphroditie spp.	Polychaete	A.#
Pyrosoma spp.	Tunicate	A.
Bassango bulbiceps	Fish	A.
Coryphaenoides subserrulatus	Fish	A.
Coryphaenoides serrulatus	Fish	A.
Lepidion microcephalus	Fish	A.
Bathygadus cottoides	Fish	A.
Ventrifossa sp. ?	Fish	A.
Psychrolutes marcidus	Fish	B.
Parapagurus latimanus sp.	Crustacean	B.
Hydriod (unknown)	Cnidarian	A.
Epizoanthus paguriphilus	Cnidarian	B.
Psilaster acuminatus	Echinoderm	A.
Caridea (unknown)	Crustacean	A.
Pasiphaea sp.	Crustacean	A.
Campylonotus rathbunae	Crustacean	A.
Echinocardium spp.	Echinoderm	A.#
Unidentifed (Holothurian)	Echinoderm	B.
Caridea	Crustacean	A.
Laetmogone spp.	Echinoderm	B.
Unidentified (gastropod)	Mollusc	B.
Unideintified (bivalve)	Mollusc	A.
Unidentified (asteroidea)	Echinoderm	A.
Bathypectinura heros	Echinoderm	A.
Unidentified (asteroidea)	Echinoderm	A.
Echinothuriidae	Echinoderm	A/B.
Caryophyliidae (Stephanocyathus platypus?)	Cnidarian	B.
Unidentified (polychaete)	Polychaete	B.
Unidientifed (nudibranch)	Mollusc	B.
Acanella sp.	Cnidarian	B.
Ophiuroidea	Echinoderm	A.
Ophiuroidea	Echinoderm	A.
Laetmogone spp.	Echinoderm	B.
Unidentified (asteroidea)	Echinoderm	B.
Goneplacidae	Crustacean	A.
Anthomastus sp.	Cnidarian	B.
Sympagurus dimorphus	Crustacean	B.
Unidentified (amphipod)	Crustacean	A.
Porifera spp.	Porifera	B.
Porifera spp.	Porifera	A.

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Appendix 5:

List of fauna caught by the beam trawl at 1631 m, method of preservation and site of curation

Species	Type of organism	Preservation method and site of curation
Salps (mainly Thetys vagina)	Tunicate	Thrown
Caridea	Crustacean	A.
Dipsacaster magnificus	Echinoderm	B.
Priapulida spp.	Check species	B.
Dentalium spp. (Cadulus spretus?)	Mollusc	A.
Zoroaster spp.	Echinoderm	A.
Brucerolis nowra	Crustacean	A/B.
Benthodytes spp.	Echinoderm	B.
Alcyoniidae spp.		B.
Paxillosida spp.	Check species	A/B.
Penion maximus/grandis + zoanthids on shells	Mollusc	A.
Volutidae spp. (Alcithoe spp.)	Mollusc	A.
Naticidae spp. (Polinices?)	Mollusc	A.
Asteroidea	Echinoderm	A.
Benthopecten sp.	Echinoderm	A.
Ophiomusium spp.	Echinoderm	A.
Paxillosida, Porcellanasteriidae spp.	Echinoderm	B.
Unidentified (gastropod)	Mollusc	B.
Ophiomusium spp.	Echinoderm	A.
Molpadiidae spp.	Echinoderm	B.
Unidentified (sipunculid)	Sipunculids	B.
Unidentified (sipunculid)	Sipunculids	B.
Unidentified (holothurian)	Echinoderm	B.
Pyrosoma spp.	Tunicate	B.
Pennatulacea	Cnidiarian	A.
Pennatulacea	Cnidiarian	B.
Unidentified	Crustacean	B.
Aphrodite spp.	Polychaete	B.
Unidentified (tunicate)	Tunicate	B.
Unidentified (polychate)	Polychaete	B.

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Appendix 6:

List of fauna caught by the beam trawl at 2685 m, method of preservation and site of curation

Species	Type of organism	Preservation method and site of curation
Salps (mainly Thetys vagina)	Tunicate	A/B.#
Zoroaster spp.	Echinoderm	A.
Dipsacaster magnificus	Echinoderm	A/B.
Pyrosoma atlanticum	Tunicate	A.#
Corallimorphus spp.	Cnidarian	A/B.
Atolla spp.	Cnidarian	B.
Gracilechinus multidentatus	Echinoderm	A/B.
Ophiocten spp.	Echinoderm	A/B.#
Unidentified (holothurian)	Echinoderm	A/B.
Unidentified (polycheate)	Polychaete	B.
Ophiactidae spp.	Echinoderm	B.
Ophiactidae spp.	Echinoderm	B.
Histiobranchus bruuni ?	Fish	B.
Diretmus argenteus	Fish	B.
Lampanyctus sp, probably australis	Fish	B.
Unidentified (Eel)	Fish	B.
Amphipoda	Crustacean	B.
Unidentified (asteroid)	Echinoderm	B.
Plutonaster spp. (check with Owen)	Echinoderm	B.
Unidentified (gastropod)	Mollusc	B.
Unidentified (gastropod)	Mollusc	B.

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