RV *Investigator* Voyage Plan

Voyage #:	IN2015_C02		
Voyage title:	GAB deep-water pelagic and benthic ecosystem study		
Mobilisation:	Port Lincoln, 12:00, Saturday, 28 November 2015		
Depart:	Port Lincoln, 18:00, Sunday, 29 November 2015		
Return:	Fremantle, 10:00, Tuesday, 22 December 2015		
Demobilisation:	Fremantle, 17:00, Tuesday, 22 December 2015		
Voyage Manager:	Don McKenzie	**Contact details:**	Don.mckenzie@csiro.au
Chief Scientist:	Dr Rudy Kloser		
Affiliation:	CSIRO O&A	**Contact details:**	Rudy.kloser@csiro.au
Principal Investigators:	Drs, Paul van Ruth, Jason Tanner, Alan Williams, Rudy Kloser		
Project name:	Great Australian Bight Research Program		
Affiliation:	www.bpgabproject.com.au	**Contact details:**	steven.lapidge@sa.gov.au

Scientific objectives

This voyage will characterise deep-water pelagic and benthic community structure and identify key ecological processes in the central and eastern GAB, and forms part of the GAB Research Program that aims to describe the key elements of the GAB marine ecosystem. This understanding of the structure and function of the ecosystem will be used to inform future integrated and sustainable ocean management and assessment/mitigation of potential future impacts. An overarching objective of the voyage is to contribute to developing models of ecosystem-level structure and function for the GAB

The pelagic ecosystem structure in the eastern GAB, which is characterised by seasonal upwelling and a narrower continental slope, will be compared with the poorly sampled central GAB, where year-round downwelling is predicted and the shelf and slope are wider with the following GAB Research Program objectives;

1. Compare the eastern and central GAB continental margin zooplankton and micronekton communities in terms of their species composition, size range, biomass, nutrient source/trophic pathways and habitat.

2. Testing the hypothesis that the “microbial food web” is the dominant planktonic food web over the deep GAB continental margin, particularly in the central GAB where year-round downwelling is thought to be the prevailing cross-margin flow, and that the more efficient “classic food web” only dominates in the eastern GAB during periods of nutrient-rich upwelling.

3. Describing the community structure, dynamics, biodiversity and endemism of microbes (i.e., viruses and bacteria), plankton (i.e., phytoplankton, zooplankton, ichthyoplankton) and micronekton (including squids, small pelagic and mesopelagic fish and gelatinous organisms).

Benthic characterisation is important because there are virtually no existing benthic biological data beyond continental shelf depths (<200 m); because conservation values attributed to Commonwealth Marine Reserves (CMR) spanning wide depth ranges are untested on the mid- and lower continental slope; and because oil and gas lease areas extend across the GAB Marine Park (GAB MP).

Within the GAB Research Program, the Benthic Biodiversity project has the following objectives:

1. Quantify spatial patterns in the physical environment, and composition and abundance of benthic fauna in BP leases and adjacent continental slope areas of the Great Australian Bight (GAB) to provide baseline metrics relevant to monitoring the potential future impacts of oil and gas exploration on benthic communities.

2. Determine requirements (including identifying indicators and metrics), and identify suitable control sites, for future ecological monitoring in the GAB – especially to detect and quantify ecological impacts from oil and gas exploration on benthic communities of the GAB Marine Park.

Voyage objectives

Pelagic

The voyage will characterise pelagic community structure and function with a focus on the outer continental shelf, slope and "open ocean" in the central GAB (the Ceduna Terrace) and eastern GAB (Figure 1). Pelagic sampling will be on at least one cross-shelf transects in each region, with day and night depth-stratified sampling stations at the mid-shelf (~100m) and upper slope (~400 m) the outer slope and "off shore". Samples will extend to outer stations at ~3000 m depth in the central GAB and nominally 40 n.miles from the shelf break, considered "open ocean" in the eastern GAB. The primary pelagic sampling voyage tasks are:

1. Collect and process a full set of water samples to characterize and quantify primary production, microbial communities (virus/bacteria/ picophytoplankton) and determine a variety of water column environmental and chemical parameters.
2. Collect and process phytoplankton, zooplankton and micronekton samples from vertical tow, side, EZnet (LOPC) and IYGPT MIDOC tows during day and night. Opportunistically collect nekton (e.g. squids and tuna) for food web studies.
3. Conduct experiments investigating microbial and planktonic physiology and productivity
4. Collect and process profiling lagrangian acoustic, optical (PLAOS) measurements day and night.
5. Collect and process underway pelagic acoustic measurements and target unique layers with TRIAXUS, net and PLAOS samplers.
6. Collect underway acoustic and water chemistry to investigate effects of eddies.

Benthic

The survey will sample a set of sampling sites on the continental slope in the central GAB (the Ceduna Terrace) and eastern GAB established during voyage SS2013-rc0-2. These are based on depth x longitudinal strata (Figure 1). The primary voyage tasks are to:

1. Collect and process a full set of beam trawl samples (1 sample per site = 30 individual tow samples) to assess megafaunal biodiversity (composition and abundance).
2. Collect and process a set of sediment cores from the five 3000 m depth sites (unsampled in 2013) and 3 sites that were inadequately sampled in 2013 (1 multicore sample per site = 8 individual ICP samples) to assess macrofaunal biodiversity, characterize and quantify the structure and function of sediment microbial communities (including hydrocarbon degrading bacteria), and determine a variety of sediment environmental and chemical parameters.
3. If time permits, an additional 3-5 2013 sites will be resampled using the ICP to assess temporal changes in assemblages, so as to distinguish if differences between the 2015 sites and 2013 sites are spatial or temporal. One of these sites may be sampled multiple times to build a species accumulation curve, to provide information on how complete a representation of the fauna is sampled by a single ICP deployment.

Operational Risk Management

No potentially high risk work has been identified outside standard operations and most operations were tested on recent trials voyages IN2015_E02 and IN2015_E03.

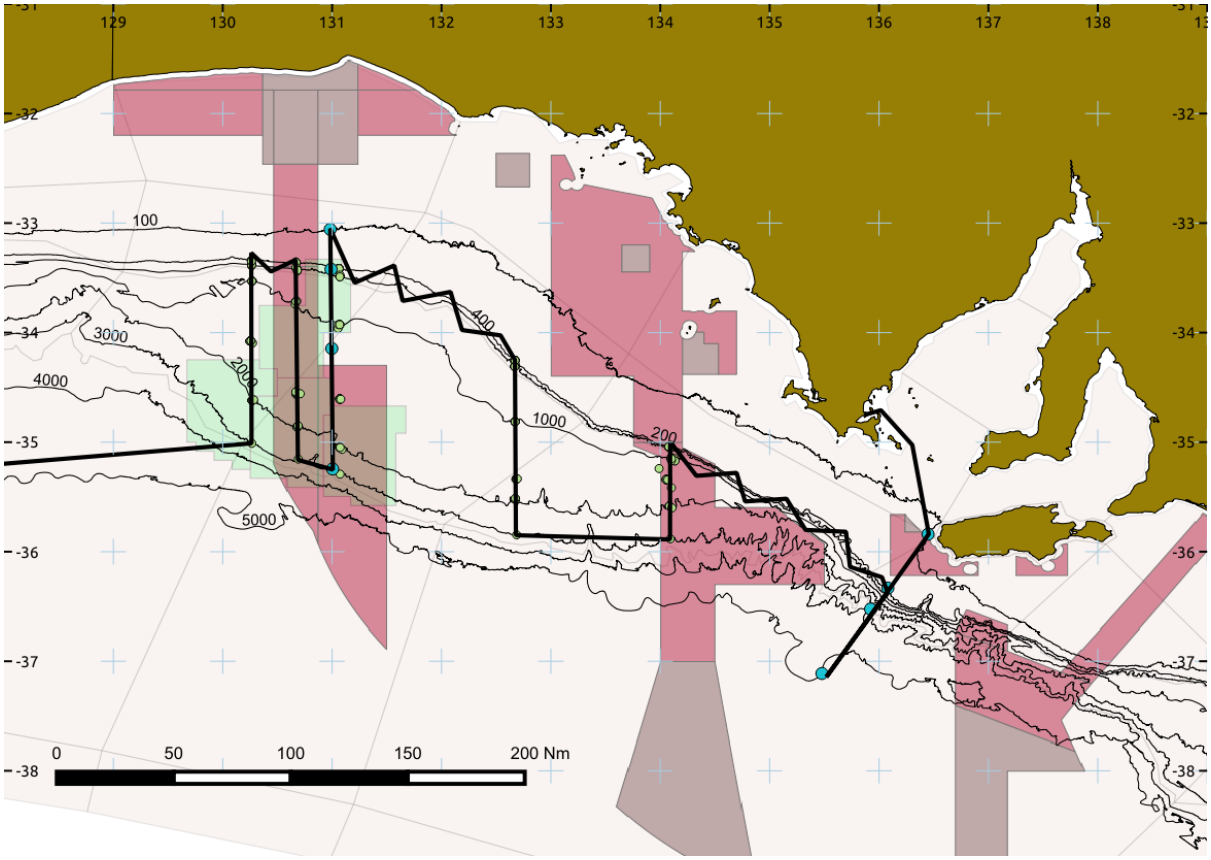
Overall activity plan including details for first 24 hours of voyage

Activity	Region	Distance	Time (days)	Date
Transit to sampling	Port Lincoln to IMOS site	80 n.miles	0.5	29 November
Sampling time on station, and contingencies	GABRP study area		14.8	1-18 December
Transit between sites	GABRP study area	1180 n.miles	4.1	1-18 December
Transit	GAB to Fremantle	950 n.miles	3.3	18 -22 December
Mobilisation/ demob			1	
		TOTAL	**23**	

For the first 24 hrs the vessel will steam from Port Lincoln to the IMOS 100 m station where it will commence a series of pelagic stations starting with CTD profile, water sampling, vertical net, and side net tows. The vessel will then steam offshore to the first 24 hr pelagic sampling site.

Voyage track example

Figure 1. The indicative pelagic sites in blue and benthic stations in green with a cruise track showing start and end of the sampling locations and the shelf edge acoustic survey, actual track may vary depending on the oceanic environment, weather and the sequence and number of benthic and pelagic samples. Extra effort for pelagic sampling is shown in upper slope blue regions.



Waypoints and stations

	Decimal Latitude	Decimal Longitude	Distance (nm)	Total Distance (nm)	Steaming time (hrs)	Total Steam (hrs)
Port Lincoln	-34.72	135.87	0	0	0.0	0.0
IMOS mooring site	-35.837	136.448	80	80	6.7	6.7
Central GAB 3000m site	-35.51	131.00	1180	1260	98.3	105.0
Fremantle	-32.061	115.732	950	2210	79.3	184.2

Time estimates

The following time estimates are based on a steaming speed of 12 knots.

Date	Time (hrs)	Activity
29/11/2015	9.3	Depart wharf steam to IMOS site
30/11/2015	5.0	T1 East shelf IMOS site pelagic
30/11/2015	14.3	T1 Steam to offshore site
30/11/2015	28.0	T1 offshore 24 hr site
2/12/2015	10.1	T1 steam - acoustics
2/12/2015	12.0	T1 outer slope site
3/12/2015	2.1	T1 Steam - acoustics
3/12/2015	22.5	T1 upper slope 24 hr site
4/12/2015	7.5	T1 East upper slope site
4/12/2015	19.6	Steam zig zag upper slope
5/12/2015	58.5	T2 and T3 Benthic sites
7/12/2015	33.5	Steam between transects
9/12/2015	16.5	Steam zig zag upper slope
9/12/2015	6.0	T4 Central shelf site night pelagic
9/12/2015	6.1	Steam - acoustics
10/12/2015	27.0	Central upper slope 24 hrs
11/12/2015	34.0	T4 Benthic sampling
12/12/2015	13.0	T4 Central outer slope pelagic
13/12/2015	25.0	T4 Central offshore 24 hrs pelagic
14/12/2015	9.6	Steam - acoustics
14/12/2015	62.0	T5 and T6 Benthic sampling
17/12/2015	12.1	Steam between sites
18/12/2015	100.0	Steam - Central GAB to Fremantle
22/12/2015	7.0	**Fremantle - decommissioning**

Investigator equipment (MNF)

Pelagic

1. All water column acoustic systems and drop keel
2. Twin door pelagic trawling with IYGPT and MIDOC system
3. Net monitoring system for 2000 m operation
4. EZ net – with 335 micro mesh 5 nets to 1000 m operation deeper operation if possible with LOPC
5. Side net
6. CTD, lowered ADCP, PAR, fluorometers, oxygen, ISUS Nitrate sensor and 36 bottles
7. Sonardyne and USBL beacons for MIDOC and PLAOS to 3000 m
8. Deployment rope and blocks for PLAOS
9. Microscopes
10. -80^{o} C Freezers (x1)
11. Wet lab for biological sampling
12. Dry Lab for microbial and planktonic sample processing, filtration and fluorometry
13. Radvan and incubation platform for production experiments
14. Lab space for electronic equipment and acoustic data analysis
15. Photographic space for Krysal
16. HAZMAT container for chemicals

Benthic

1. MNF Beam trawl (x 2)
2. Smith-McIntyre grab
3. Large diameter block mounted on stern A-frame
4. Multibeam sonar, ADCP, Sub-bottom Profiler – no targeted mapping
5. Rear deck facilities
6. Wet laboratory facilities
7. Biological processing areas
8. -80 and walk-in freezers
9. Communication/control systems (e.g. Operations Room, Bridge, rear deck).
10. Stereomicroscope with camera (check availability)
11. Deep water camera system

User Equipment

Pelagic

1. PLAOS – (Profiling Lagrangian Acoustic Optical System - broad band acoustics)
2. PLAOS tether and acoustic release system
3. MIDOC – IKMT net system – 10 mm mesh to 2500 m
4. Vertical tow nets (70 µm, 150 µm, 350 µm mesh) and side nets
5. Lab fast repetition rate fluorometers
6. Turbulence probe
7. Filtration equipment
8. Deck incubators for productivity experiments
9. Photosynthetron for primary productivity experiments
10. Broad band EK80 to trial on RV Investigator transducers and user supplied transducers
11. Self-contained broadband for attachment to CTD/TRIAXUS to 1000 m
12. Photographic gear and kreisel tank
13. Tuna trolling fishing gear and squid jigs.
14. Lagrangian drifter with communications
15. Turbomap microstructure probe
16. Profiling fast repetition rate fluorometers
17. Dissecting microscope

Benthic

1. Instrumented Corer Platform with 6-barrel KC Multi-corer
2. D&N Francis electric hydraulic winch with ~3000 m of armoured fibre-optic cable
3. Core sample elutriation system
4. CSIRO Beam trawl (x 2)
5. Stereomicroscope with camera (if not available from MNF)

Special Requests

1. The user-supplied D&N Francis winch will be operated by the science team on board. Crew will assist with deployment and operating the A-frame.
2. The PLAOS will be deployed and retrieved from the side of the vessel by the crew assisted with the science team.
3. Need vessel to track tethered gear with data integrated and recording.
4. Need vessel to position towed gear to 3000 m with appropriate recording.
5. Dance floor out.

Permits

Animal Ethics permit – submitted

Commonwealth marine parks permit – submitted

Commonwealth waters permit – submitted

AFMA permit to be submitted.

Personnel List Draft

1	Don McKenzie	Voyage Manager	CSIRO MNF
2	Phil De Boer	SIT Support (gear technician)	CSIRO MNF
3	Ian McRobert	SIT Support	CSIRO MNF
4	Will Ponsonby	SIT Support	CSIRO MNF
5	Stuart Edwards	GSM Support	CSIRO MNF
6	Amy Nau	GSM Support	CSIRO MNF
7	Christine Rees	Hydrochemist	CSIRO MNF
8	Anoosh Sarraf	DAP Support	CSIRO MNF
9	Steve Van Graas	DAP Support	CSIRO MNF
10	Rudy Kloser	Chief Scientist	CSIRO, O&A
11	Tim Ryan	Acoustics/optics sampling	CSIRO, O&A
12	Matt Sherlock	Instrumentation/PLAOS	CSIRO, O&A
13	Ryan Downie	Biological sampling/Acoustics	CSIRO, O&A
14	Caroline Sutton	Biological sampling/Data base	CSIRO, O&A
15	Adrian Flynn	Biological sampling	
16	Gordon Keith	Voyage data integration	CSIRO, O&A
17	Arti Verma	PhD student acoustics PLAOS	CURTIN UNI
18	Kelly Merrin	Invertebrates - imagery	MV
19	Paul van Ruth	Production leader/ co PI	SARDI
20	Mark Doubell	Oceanographer	SARDI
21	Nicole Patten	Microbial ecologist	SARDI
22	Ian Moody	Plankton technical	SARDI
23	David Hughes	PhD student plankton	UTS
24	Bonnie Laverock	Microbial physiology	UTS
25	David Spencer	PhD student microstructure	Griffith
26	Alan Williams	Shift leader co-PI	CSIRO, O&A
27	Jason Tanner	Benthic ecologist co-PI	SARDI
28	Lisa Gouldie	Biological Processing	TBA
29	Mark Green	Benthic gear and sampling	CSIRO, O&A
30	Karen Gowlett-Holmes	Biological sampling - imagery	CSIRO, O&A
31	Shirley Sorokin	Biological processing (inverts)	SARDI
32	Maylene Loo	Biological processing (inverts)	SARDI
33	Alastair Hirst	Biological processing (inverts)	MV
34	Mandy Reid	Biological processing (inverts)	AM
35	Deb Osterhage	Biological sampling imagery	CSIRO
36	Amelia Lewis	PhD student – Crustacea	U of Adelaide
37	Jon Pogonoski	Biological processing (fishes)	CSIRO
38	Al Graham	Biological processing (fishes)	CSIRO
39	Martin Gomon	Biological processing (fishes)	MV
40	Dianne Bray	Biological processing (fishes)	MV

Signature

Your name	Dr Rudy Kloser
Title	Chief Scientist
Signature	
Date:	18 November 2015

List of additional figures and documents

None.