

VOYAGE PLAN SS04/2004

Title

Testing, refinement and application of methodology for optimised seabed mapping on the continental shelf and slope (200-2000 m depth) to support sustainable management of biodiversity and fisheries

Itinerary

Depart Hobart 1000 hrs, Saturday 10th April 2004
Arrive Sydney 1000 hrs, Thursday 29th April 2004
(Note: This voyage includes 5 days of CMR Research Charter)

Principal Investigators

Dr Alan Williams (Chief Scientist)
Mr Rudy Kloser
CSIRO Marine and Atmospheric Research
CMR Marine Laboratories, PO Box 1538, Hobart, Tasmania 7001.
Phone: 03 62 325222
Fax: 03 62 325000
e-mail: alan.williams@csiro.au

Scientific Objectives

Ecosystem-based, integrated regional marine planning for the Australian marine environment depends initially on the identification of natural regions as planning units. Therefore, there are near-term requirements for regionalisation and mapping at a range of relatively fine scales throughout the Australian Marine Jurisdiction (AMJ). Given the vast size of the AMJ and the cost of marine surveys, Australia needs to develop the most efficient and cost-effective suite of methods for surveys, and to establish a national mapping program using an optimal methodology. It has been argued for some time that the most cost-efficient way to conduct such surveys will be by using multibeam acoustics (swath mapping) together with an optimally-designed, targeted program of geological and biological 'ground-truth' sampling. However, despite the already-demonstrated benefits of multibeam acoustics for mapping the physical seabed at fine resolution (10s m) over intermediate scales (10s to 100s of sq km), there are still many technical and methodological issues to investigate before a multibeam-based, optimised method for predictive and reliable habitat assessment is developed and tested.

This voyage provides an opportunity to test and refine optimal techniques to map and assess seabed habitat developed in a previous CMR project (NOO OP2000-SE02). Importantly, this voyage will use the National Facility's high-resolution EM300 swath mapper for its first program of biological and physical habitat mapping.

The sampling locations are a number of submarine canyons on the west coast of Tasmania and east of Bass Strait. These are prime targets for our methods development because each is characterised by a great variety of seabed topography and benthic communities concentrated in a relatively small area (< 300 sq km).

This voyage is also an opportunity to apply the data collected to marine resource management planning in the South East Region. Submarine canyons represent a habitat unit ('Level 3 biogeomorphological units') that has a strong influence on the location of offshore Marine Protected Areas on the continental slope and rise, and many are likely to be biodiversity 'hotspots'. Several canyons are also the locations of the largest known aggregations of feeding and spawning fishes in the South-East Fishery region, and these support a range of intense, increasing and, in places, conflicting fishing activities. Given the immediate and increasing relevance of submarine canyons to conservation and fishery managers, it is then surprising to realize that virtually all those in the SE region remain unsampled by scientists, and are named only by commercial fishers.

Sampling on this voyage will focus on the "Big Horseshoe Canyon" mapped previously with the EM1002 and EM12 swath instruments (to enable comparison of data types, and to investigate temporal persistence of features), and several 'new' areas. Selection of new target areas for this voyage is being based on three factors: 1) their immediate relevance to the roll-out of offshore MPAs as part of the National Representative System of MPAs and the SE Regional Marine Planning process; 2) their relevance to understanding the efficacy of spatial planning initiatives for fishery management purposes; and 3) their overlap with two existing CMR projects investigating fishing impacts on shelf-edge habitat, and spawning biomass of blue grenadier. In the event of insufficient time to sample all target areas, prioritisation will take into account the requirements of each of the above three factors.

Targeted sampling with the biological and physical sampling 'toolkit' will be based on swath acoustic maps made in real time at sea using data from the Simrad EM300 multibeam, and existing, but unsampled, swath maps made using the EM1002 and EM12, and guided by the predictive methods developed in CMR project OP2000-SE02. The physical and biological attributes of target areas will be assessed by sampling sediments, consolidated sediments, invertebrates and fishes with a rock dredge and benthic sleds, and by obtaining image data with a towed, high-resolution video system. Acoustic position-tracking beacons mounted on these instruments will allow them to be positioned accurately, and for data to be precisely georeferenced.

Voyage Objectives

At each of several target areas on the west coast of Tasmania and east of Bass Strait:

1. Generate swath acoustic maps of submarine canyons and their immediately adjacent continental shelf and slope (~200-2000 m) with the Simrad EM300 multibeam.
2. Collect biological, physical and photographic ground-truth samples with a grab, dredge, sleds and the CMR SVS camera platform from regions of upper continental slope seabed (~200-700 m) to classify and test predictions of seabed habitat types based on acoustic swath data (primarily backscatter, bathymetry and bathymetry-derived variables such as slope and aspect).
In addition, to enable identification of biodiversity values and the refinement of biophysical regionalisation at continental slope depths by
3. Collecting and curating benthic invertebrates to provide a biological inventory at various scales of taxonomic resolution
4. Collecting and curating demersal fishes to provide a biological inventory at species-level.

Voyage Track

Shelf edge/ upper slope west of Tasmania, north to King Island, east through Bass Strait to shelf edge/ upper slope in Banks Strait, north to the eastern arm of Bass Canyon and north to Sydney (see Figure 1).

Time Estimates

Note: timing will be highly dependent on the EM300 performance in various sea states (swath width and maximum transecting speed) that is presently estimated only from preliminary trails; several other minor sites will be swath mapped during transit legs.

Sampling strategy for SS04/04	Distance or area	Time
Leg 1	(nm or nm ²)	(hours)
Hobart to "Strahan Canyon" transit	202	19
Swath: "Davey shelf edge" during transit		4
Swath: "Strahan Canyon"	110	20
Mooring deployment (PULSE test mooring)	----	6
Swath: "Pieman Canyon"	220	36
Swath: "Ling Hole"	170	24
"Ling Hole" to "King Is Canyons" transit	100	9
Swath "King Is Canyons"	300	48
X-shelf swath transect	17	3
Staff transfer at King Island (Day 7)	----	3
Sub-total (days)		7
Leg 2		
X-shelf swath transect	17	3
X-shelf transect: camera/ sled/ dredge		12
Camera/ sled/ dredge "King Is Canyons"	----	64
"King Is Canyons" to "Ling Hole" transit	100	9
Camera/ sled/ dredge: "Ling Hole"	----	24
Camera/ sled/ dredge: "Pieman Canyon"	----	24
"Pieman Canyon" to "Babel Canyons" transit	310	28
Swath/ sled/ dredge: "Babel Canyons"	----	14
"Babel Canyons" to "Big Horseshoe Canyon" transit	110	10
Camera/ sled/ dredge: "Big Horseshoe Canyon"	----	72
"Big Horseshoe Canyon" to Sydney transit	280	26
Swath/ dredge small sites in transit	75	8
Total (days)		19

Piggy-back Projects

1) Deployment of PULSE mooring (Griffiths/ McLaughlan)

This work forms part of a co-operative project with the ACE-CRC, and as part of the Biogeochemical Modelling project in the Wealth from Oceans Flagship. The mooring design for the TEST and PUSE moorings is unique in that most of the instruments (thermistors, MiniCat CTD, PAR sensors, fluorometers) will be in the surface mixed layer (upper 130m or so). The purpose of this TEST mooring is to collect engineering data to allow us to refine the design of the PULSE mooring that is to be deployed at 47S, 142E in September 2004. This is an adaptation of the WaveRider buoy mooring design to support our mixed layer instrument packages. Engineering data on accelerations and tensions in the surface marker, and the mooring string, is needed before a fully instrumented mooring is deployed in the Southern Ocean. The site is most likely to be in 400m of water at a location close to the WaveRider site off Strahan.

2) Sampling for larval fish and larval lobsters using surface nets (Bradford/ Bruce)

Surface net samples will be taken according to a design that incorporates location and time-of-day.

Southern Surveyor Equipment

- Inmarsat B & C, Minisat M, Optus Mobilesat, CDMA - Voice/Data/Fax
- Navigation - One minute archiving of the underway data including Time, GPS position and bottom depth (plus DGPS within Optus mobilesat footprint)
- 3DGPS (for accurate heading, pitch and roll)
- Meteorological Data (temp, humidity, wind speed & dir, barometric pressure)
- Sea Plot Navigation package
- Simrad EK 500 sounder (12, 38 and 120KHz)
- Simrad EM300 multibeam swath mapper
- Simrad sub-bottom profiler
- Sea Surface Temperature and Salinity
- Sea Surface Fluorescence
- XBTs
- ADCP
- Lowered ADCP
- Smith-McIntyre grabs (2)
- Rock dredges (2)
- CTD (Seabird SBE 911 plus) — primarily for sound velocity profiling
- Wet and Dry Laboratory Spaces
- Dark room
- Photo/Preservation Lab
- Walk-in Freezer
- Laboratory Fridges and Freezer
- UNIX Computers, Personal Computers
- Trawl winches with 5,000m of 24mm wire
- CTD/Hydro winches each with 7,000m of 8mm single core conducting cable
- Hydrographic A-frame (stbd)
- Stern A-frame (SWL 15 tonnes)
- 7 tonne knuckleboom crane
- Gilson winches (15 tonne, 5 tonne)
- Tugger winch (5 tonne)
- Scanmar net monitoring system (for use with benthic sled)

User Equipment

- CMR SVS towed video system
- 35 mm Photosea camera system, cage frame, 'Skipper sounder' and transducer
- Sherman benthic sled
- Combination benthic sled (inc. camera frame)
- Sonardyne tracking system

Personnel List

Staff are from CSIRO Marine and Atmospheric Research unless otherwise specified. Staff changeover by small vessel transfer off King Island is planned for Day 7 (Friday April 16).

Alan Williams (Chief Scientist) Full voyage

Bruce Barker (Voyage manager) Full voyage

Gordon Keith (swath mapping) Full voyage

Lindsay MacDonald (electronics support) Full voyage

Mirosław Ryba (computing support) Full voyage

Pamela Brodie (data manager/ ADCP) Full voyage

Cameron Buchanan (GA) (swath mapping) Full voyage

Danny McLaughlan (PULSE mooring) Leg 1 only

Lindsay Pender (PULSE mooring) Leg 1 only

Andrea Courtese (GA) (swath mapping) Leg 1 only

Michele Spinoccia (GA) (swath mapping) Leg 1 only

Mark Lewis (camera and gear support) Leg 2 only

Matt Sherlock (camera and electronics support) Leg 2 only

Karen Gowlett-Holmes (invertebrate taxonomy) Leg 2 only

Dave Mills (TAFI) (invertebrate biology) Leg 2 only

Robin Wilson (Museum Victoria) (invertebrate taxonomy) Leg 2 only

This voyage plan is in accordance with the directions of the National Facility Steering Committee for the Research Vessel Southern Surveyor.

Chief Scientist

Alan Williams

Figure 1- SS0404 proposed voyage track

