

MARINE
NATIONAL FACILITY

2005

RV Southern Surveyor
program

voyageplan

SS07/2005

Mapping benthic ecosystems on the deep continental shelf and slope in Australia's South West Region to understand evolution and biogeography and support implementation of the SW Regional Marine Plan and Commonwealth Marine Protected Areas.

Itinerary

Leg 1: Depart Dampier 1000 hrs, Thursday 21 July 2005
Arrive Fremantle 1700 hrs, Wednesday 3 August 2005

Leg 2: Depart Fremantle 1000 hrs, Thursday 4 August 2005
Arrive Fremantle 0800 hrs, Wednesday 17 August 2005

Principal Investigators

- Dr Alan Williams (Chief Scientist, Leg 1)
- Mr Rudy Kloster (Chief Scientist, Leg 2)
- Dr Nic Bax

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CSIRO

Scientific Objectives

The aims of the project are: 1) to apply targeted field-based observation to develop, test, refine and validate multiple use management frameworks developed for the SW Region as part of Regional Marine Planning under Australia's Oceans Policy, and 2) explore and characterise marine ecosystems of the SW Region.

Ecosystem-based, integrated regional marine planning for the Australian marine environment depends 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 technical and methodological issues to investigate before a multibeam-based, optimised method for predictive and reliable habitat assessment is fully developed. This voyage provides that opportunity.

Swath acoustic maps made in real time at sea using data from the Simrad EM300 multibeam will be used to target samples with the towed, high-resolution video system and sediment grabs during this survey. A follow up survey in November/ December 2005 (SS10/2005), run on a reciprocal course and visiting all survey sites, will collect the biological and additional physical samples (consolidated substrata) using benthic sleds. A particular focus of methods refinement will be to increase the types of data processed at sea (e.g. multibeam backscatter) and to increase the quantitative data acquired at sea (e.g. from video and digital still underwater images).

Our sampling will be at nested within spatial scales of habitat – by latitude, depth, and in features including canyons where sediment and rocky substrata will be sampled – to determine how biodiversity is distributed at particular scales. Overall, the allocation of samples will consider the structure of the benthic bioregions off the west and southwest coasts of Western Australia: the Northwest Province, Central Western Transition Zone, Central Western Province, South-western Transition Zone and Southern Province. To the extent possible, sampling will target sites that may become candidate sites for MPAs, or suited to the establishment of scientific reference sites, and that will demonstrate the different outcomes from alternative conservations strategies.

A primary focus of the survey will be the program of sampling using benthic sleds to collect benthic invertebrate epifauna and infauna. There will be an emphasis of taxonomic effort on taxa that can be worked up to named species within 12 months

(enabling comparison to pre-existing data); taxa that will be highly informative to biogeographic analysis (e.g. with limited dispersal mechanisms); taxa amenable to CO1 gene analysis "Bar-coding"; and commercial species. Surrogate-based metrics of biodiversity will be investigated based on morphotypes, and there will be a focus on those taxa amenable to monitoring (e.g. by non-destructive photographic sampling for MPA performance assessment). We plan that biological sampling for this objective will be undertaken primarily during the second survey for this project, SS10/2005, in November/ December 2005, but it is likely that some samples will be collected on this survey.

The survey program (two voyages) will address four primary objectives:

- 1) test hypotheses on the evolution and biogeography of Australia's biodiversity, in particular relating to species composition, distribution patterns and taxonomic surrogacy
- 2) validate and refine CSIRO's optimised methodology for mapping deep water benthic ecosystems on the western continental margin and in sub-tropical locations to enhance its application to natural resource management at a national scale
- 3) document the benthic biodiversity and identify areas of high conservation values in the context of Commonwealth MPA declaration
- 4) validate, and permit refinement of, a marine bioregionalisation during the development of the SW Regional Marine Plan by the National Oceans Office

Voyage Objectives

At depths of 100 m, 200 m, 400 m and ~1000 m, and possibly a deeper site, in each survey area, sampling will:

1. Generate multibeam acoustic maps (bathymetry, texture, slope and backscatter) with the Simrad EM300 multibeam of sample sites and an immediately adjacent area of seabed.
2. Collect physical and photographic ground-truth samples with a grab and the CMR deep towed camera platform to classify and test predictions of seabed habitat types based on acoustic data.
3. Collect phytoplankton and data on water mass structure at ~ 1 degree intervals to quantify the latitudinal gradients in phytoplankton species in relation to water masses, and enable a biogeographic description for Australia's west coast.

Secondary objectives:

4. Collect data to validate ocean colour measurements.
5. Collect water column acoustic backscatter at multiple frequencies

Voyage Track

Upper slope (400 m isobath) between transects and focus survey areas, Dampier to Fremantle, and Fremantle to Fremantle via Albany (see Figure 1).

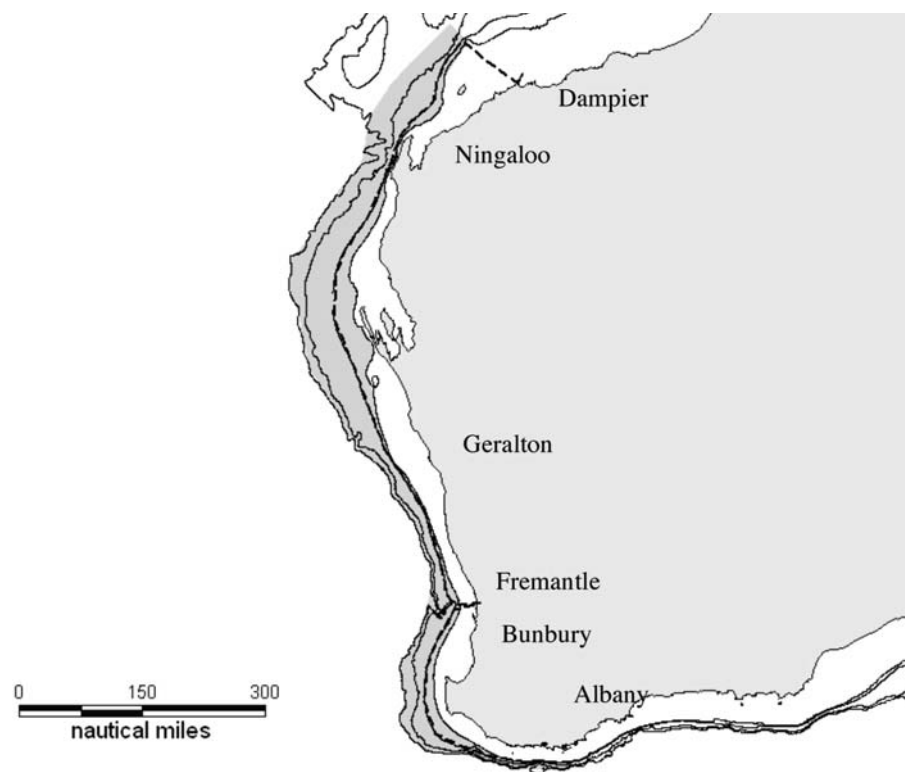


Figure 1: SS07/2005 “area of interest”: the outer continental shelf, upper and mid-continental slope (greyed area) between Dampier to Albany. Sampling will be on cross-shelf transects (~100 to 1000 m depth) and at selected study sites (~100 to 1500 m depth). Individual samples will be targeted at different bottom types within key features of interest, with transects stratified by the three benthic biogeographic provinces (Northwest, Central Western and Southern Provinces).

Time Estimates

Sampling strategy for SS07/2005	Distance or area	Time
Leg 1	(nm)	(days)
Dampier to Fremantle Staff transfer at Fremantle (Day 14)	940	14
Sub-total (days)		14
Leg 2		
Fremantle to Fremantle via Albany region Staff departure at Fremantle (Day 28)	755	14
Total (days)		28

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)
- 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

- CMAR deep towed video system and winch
- 35 mm Photosea camera system, cage frame, 'Skipper sounder' and transducer
- Sonardyne tracking system
- Multifrequency acoustic pod on SS pole
- Sleds (Sherman and Beam)
- Biological sample preservation chemicals (alcohol and formaldehyde)
- Dewar with liquid nitrogen
- Acoustics half container (used for video operations)

Personnel List

Staff changeover is in Fremantle on August 3/ 4.

Leg 1 Alan Williams – CMAR, Chief Scientist
Franziska Althaus – CMAR, Video processing
Nic Bax – CMAR, Spatial data management
Bruce Barker – CMAR, Camera systems
Pamela Brodie – CMAR, Data manager/ ADCP
Karen Gowlett-Holmes – CMAR, Invertebrate taxonomy
Rick Smith – CMAR, Swath mapping
Mark Lewis – CMAR, Gear operations
Matt Sherlock – CMAR, Camera systems
Alix Post – GA, Geoscience
Cameron Buchanan – GA, Swath mapping
Bob Beattie – CMAR, Voyage Manager/computing support/SST
Lindsay MacDonald – CMAR, NF electronics support
Neale Johnston – CMAR, NF Hydrochemistry/SST
Lee Panton – CMAR, System Support Technician

Leg 2 Rudy Kloser – CMAR, Chief Scientist
Franziska Althaus – CMAR, Video processing
Bruce Barker – CMAR, Camera systems
Pamela Brodie – CMAR, Data manager/ ADCP
Jeff Cordell – CMAR, Camera systems
Piers Dunstan – CMAR, Spatial data management
Karen Gowlett-Holmes – CMAR, Invertebrate taxonomy
Mark Lewis – CMAR, Gear operations
Gordon Keith – CMAR, Swath mapping
Alix Post – GA, Geoscience
Cameron Buchanan – GA, Swath mapping
Bob Beattie – CMAR, Voyage Manager/computing support/SST
Neale Johnston – CMAR, NF Hydrochemistry/SST
Peter Dunn – CMAR, NF electronics support
Lucy Potts – CSIRO, Communications

Note: System Support Technicians (SST) are nominated as per AMSA requirements for additional berths on vessel. (CMAR, CSIRO Marine and Atmospheric Research; GA, Geoscience Australia)

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

Alan Williams/ Rudy Kloser
Chief Scientists