



2007 RV Southern Surveyor program

voyageplan SS05-2007

Exploring and characterising marine ecosystems of the NW Region

Characterising the benthic biogeography of the deep continental shelf and slope in Australia's "North Western Region", with emphasis on the processes maintaining (and threatening) biodiversity, and support for implementing the NW Regional Marine Plan and Commonwealth Marine Protected Areas.

Itinerary

Leg 1:

Depart Dampier 1900 hrs Thursday 7th June 2007

Arrive Broome 0800 hrs Thursday 21st June 2007

Leg 2

Depart Broome 1000 hrs Thursday 21st June 2007

Arrive Broome 1700 hrs Tuesday 26th June 2007

Leg 3

Depart Broome 2200 hrs Tuesday 26th June 2007

Arrive Darwin 0800 hrs Saturday 7th July 2007

Principal Investigators

Dr Alan Williams (Chief Scientist, Legs 1 &2)

Mr Rudy Kloser (Chief Scientist, Leg 3), Dr Nic Bax

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Scientific Objectives

Our overall aims are to provide data on the distribution of deep seabed habitats and fauna that are amenable to scientific hypothesis testing, can be immediately applied to marine resource management processes, and that enable strategic development of tools and techniques for understanding the processes that maintain deep sea biodiversity. This work will support the process of NWR Estate inventory and management performance assessment by providing *interpreted* benthic habitat maps, faunal inventories, distribution maps and conservation values. Data will be collected at scientific reference sites from potential MPA areas that can be re-visited for monitoring purposes in the future. Sampling along environmental gradients (geographic range and depth) in this section of Australia's coast will also provide the opportunity to evaluate biogeographic hypotheses. Further refinement of predictive methods for identifying seabed habitat types, initially developed in temperate and cool-temperate environments, will be enabled by data collection from this tropical location in Australia.

We intend to highlight the importance of this underlying science as a modern "Voyage of Discovery" given the likely significance of the findings in terms of Australia's biodiversity and its biogeography and evolution, and the public's curiosity about remote deep-sea environments and unusual animals. We expect significant discoveries of new faunas comparable to those made in the 1980-1990s by Museum Victoria and CSIRO on the southeastern Australian slope and seamounts (Koslow and Gowlett-Holmes 1998; Koslow et al 2001; O'Hara and Poore 2000; Poore et al 1993, Richer de Forges et al 2000) and by the Western Australian Museum and CSIRO on the North West shelf (Ward and Rainer 1988).

Sampling will be targeted at nested spatial scales of habitat – terrains of sediment and rocky substrata comprising features (canyons, seamounts and sediments terraces of the continental slope), within depth zones, across latitude/ longitude – to determine how biodiversity is distributed at particular scales. At the highest level, samples are allocated to enable comparison of the provincial benthic bioregions off northwest coast of Western Australia. To the extent possible, sampling will target sites that may become candidate sites for MPAs, or are already conserved – e.g. deep waters around the Rowley Shoals, or suited to the establishment of scientific reference sites, and that will demonstrate the different outcomes from alternative conservations strategies.

The project will be planned, implemented and delivered by a team of scientists from CSIRO Marine and Atmospheric Research and a consortium of Australia's museums, with input from international taxonomic experts.

The overarching project will address five primary objectives:

- 1) Test hypotheses on the evolution and biogeography of Australia's biodiversity relating to species composition, distribution patterns and taxonomic surrogacy, and whether or not the NWR may be a biodiversity hotspot (cf Ward and Rainer, 1988).
- 2) Test the use of fine and broad scale spatial patterns of biodiversity in determining the physical (and possibly biological) processes maintaining species boundaries.

- 3) Collect and identify biological specimens from major benthic invertebrate taxa (including Cnidaria, Echinodermata and Decapoda) and fishes for the BarCode of Life program.
- 4) Document the benthic biodiversity in areas of high topographic complexity that could form the focus of future MPA areas in the North West Region (NWR).
- 5) Validate, and permit refinement of, a marine bioregionalisation of the NWR during the development of the NW Regional Marine Plan by the National Oceans Office (NOO)

Voyage Objectives

At depths of 100 m, 200 m, 400 m, 700 m and 1000 m on transects in focus areas, and at 'standard' 100 m and 400 m sites spaced at approximately 60 n.m. intervals, sampling will:

1. Generate swath acoustic maps of seabed terrains with the Simrad EM300 multibeam sonar in target areas on the deep continental shelf and continental slope seabed (~150-1500 m) to pre-stratify for biological sampling and provide greater context for physical and photographic samples.
2. Ground-truth representative slope terrains with photographic imagery using the CMAR deep towed camera platform to identify the types and distributions of habitats and provide a set of target sample sites in each target area.
3. Collect a standard set of biological and physical samples with a sediment grab and epibenthic sleds at each site to ground-truth data from remote methods.
4. Coarse-sort, photograph and preserve benthic fauna as the basis for providing a biological inventory for each site and area at increasing levels of resolution:
 - an 'at sea' composition of large fauna based on sorting to the finest taxonomic level possible
 - an 'immediate post-cruise' species-level identification of some taxonomic groups of large invertebrates selected on the basis of taxonomic tractability, available expertise, and information content
 - a mid-term (18 month) refinement of the species-level identifications of other large taxa; and
 - a 'longer term lab-based' extraction from sediment samples and determination of micro-invertebrates on a taxon by taxon basis, together with a 'longer term genetic-based' identification of up to major benthic phyla as part of the Barcode of Life program
5. Collect fishes with a commercial-sized fish trawl during Leg 2, in corresponding depths to invertebrate samples, at a small number of selected locations north of Broome.

Voyage Track

Sampling along the continental shelf (100 m isobath) and upper slope (~400 m isobath) and additional cross-depth transects between Dampier and a point NNW of Broome where deep water is restricted by shallow shelf; from here a 'shortest-route' transit to Darwin (Figure 1).

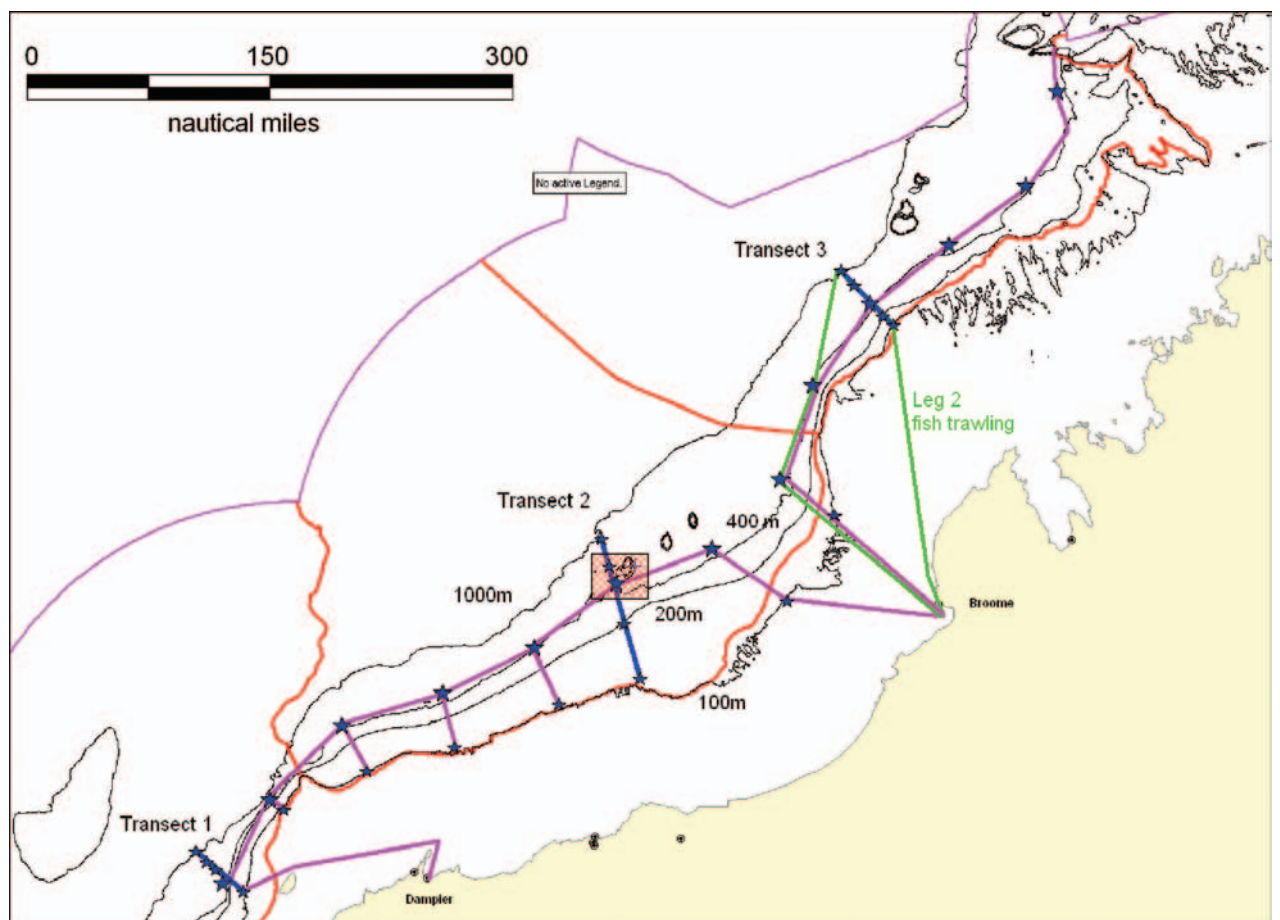


Figure 1: Map showing vessel track with sampling sites (stars) and 3 transects. Sampling is at 100 m and 400 m depth, with additional sites at 200 m, 700 m and 1000 m on transects. Leg 1, Dampier to Broome; Leg 2 (fish trawling), Broome-Broome; Leg 3, Broome-Darwin.

Time Estimates

	Activity	Unit	Days
Leg 1			
Dampier to Broome	'Standard sites' (100 & 400 m)	5	3.3
	Transects	2	4.0
	Steaming	1,135 nm	4.7
	Port period/ bad weather		1.2
Sub-total			13.2
Leg 2			
Broome to Broome	Fish trawling		4.0
	Steaming	490 nm	2.0
	Port period/ bad weather		0.3
Sub-total			6.3
Leg 3			
Broome to Darwin	'Standard sites' (100 & 400 m)	5	3.3
	Transects	1	2.0
	Steaming	900 nm	3.8
	Port period/ bad weather		1.4
Sub-total			10.5
Total			30

Maximum planned numbers of sites and samples

Total sites

10 'standard' @ 100 m x soft = 10
 10 'standard' @ 400 m x soft = 10
 3 transects x 5 soft sites = 15
 3 transects x 5 hard sites = 15
 Additional targets x 9 = 9

Total samples

Camera transects: 20 'standard sites' + 15 transect sites + <9 targets = ~44
 CTD: 20 'standard sites' + 15 transect sites = 35
 Sediment grab: 2 x 20 'standard sites' + 15 transect sites (duplicates) = 70
 Beam trawl: 20 'standard sites' + 15 transect sites = 35
 Sherman sled: 9 transect sites + ~9 targets = ~18
 Fish trawls : 4 days x 4 trawls + additional sites along transit = ~18

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 mobiles at footprint)
- 3DGPS (for accurate heading, pitch and roll)
- Meteorological Data (temp, humidity, wind speed & dir, barometric pressure)
- Endeavour Navigation package
- Simrad EK 500 sounder (12, 38 and 120KHz)
- Simrad EM300 multibeam swath mapper
- TOPAS sub-bottom profiler
- Sea Surface Temperature and Salinity
- Sea Surface Fluorescence
- ADCP
- Lowered ADCP
- Smith-McIntyre grabs (2)
- Rock dredges (2)
- Woods Hole sleds (2)
- CTD (Seabird SBE 911 plus)
- Wet and Dry Laboratory Spaces
- Photo/Preservation Lab
- Walk-in Freezer
- Laboratory Fridges and Freezer
- UNIX Computers, Personal Computers
- Trawl winches with 4,500m 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)
- Sonardyne tracking system
- Scanmar net monitoring system (for use with benthic sled)

User Equipment

- Sleds (Sherman and Beam)
- Biological sample preservation chemicals (alcohol and formaldehyde)
- Dewar with liquid nitrogen
- Towed camera systems

Personnel List

Leg 1

Alan Williams	CMAR	Chief Scientist
Bruce Barker	CMAR	Watch Leader/ Camera systems
Matt Sherlock	CMAR	Camera systems
Mark Lewis	CMAR	Gear operations
Hiski Kippo	CMAR	NF Computing support
Cameron Buchanan	GA	NF Swath mapping
Peter Dunn	CMAR	NF electronics support
Karen Gowlett-Holmes	CMAR	Invertebrate taxonomy coordination
Gary Poore	MV	Invertebrate taxonomy
Kate Attwood	AM	Invertebrate taxonomy
Corey Wisson	WAM	Invertebrate taxonomy
Oliver Gomez	WAM	Invertebrate taxonomy
David Staples	MV	Invertebrate taxonomy/ Sediment processing
Martin Gomon	MV	Fish taxonomy

Leg 2

Alan Williams	CMAR	Chief Scientist
Bruce Barker	CMAR	Watch Leader/ Camera systems
Mark Lewis	CMAR	Gear operations
Hiski Kippo	CMAR	NF Computing support
Cameron Buchanan	GA	NF Swath mapping
Lindsay MacDonald	CMAR	NF electronics support
Karen Gowlett-Holmes	CMAR	Invertebrate taxonomy/ sediment processing
Alastair Graham	CMAR	Fish taxonomy
John Pogonoski	CMAR	Fish taxonomy
Melody Puckridge	CMAR	Fish taxonomy (genetics)
Martin Gomon	MV	Fish taxonomy
Dianne Bray	MV	Fish taxonomy

Leg 3

Rudy Kloser	CMAR	Chief Scientist
Bruce Barker	CMAR	Watch Leader/ Camera systems
Jeff Cordell	CMAR	Camera systems
Mark Lewis	CMAR	Gear operations
Hiski Kippo	CMAR	NF Computing support
Cameron Buchanan	GA	NF Swath mapping
Lindsay MacDonald	CMAR	NF electronics support
Karen Gowlett-Holmes	CMAR	Invertebrate taxonomy coordination
Peter Davie	QM	Invertebrate taxonomy
Anna McCullum	MV	Invertebrate taxonomy
Shirley Slack-Smith	WAM	Invertebrate taxonomy
Joanna Brown	MV	Invertebrate taxonomy
Robin Wilson	MV	Invertebrate taxonomy/ sediment processing
Dianne Bray	MV	Fish taxonomy

Note: CMAR, CSIRO Marine and Atmospheric Research; GA, Geoscience Australia; MV, Museum Victoria; WAM, Western Australian Museum; AM, Australian Museum; QM, Queensland Museum

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