

## *Voyage Plan*

### **2000 RESEARCH VESSEL PROGRAM VOYAGE SS 01/ 2000 4 APRIL — 21 MAY 2000**

#### **ITINERARY**

##### **LEG 1**

DEPART: HOBART 0900 TUESDAY APRIL 4  
RETURN: EDEN 1500 FRIDAY APRIL 14

##### **LEG 2**

DEPART: EDEN 1100 SATURDAY APRIL 15  
RETURN: HOBART 1500 TUESDAY MAY 2

##### **LEG 3**

DEPART: HOBART 0900 WEDNESDAY MAY 3  
RETURN: HOBART 0900 SUNDAY MAY 21

#### **AREA OF OPERATION**

Tasmanian, Victorian, South Australian and New South Wales coastal and offshore waters bounded by 31°S-44°S and 130°E-151°E.

#### **RESEARCH BACKGROUND**

A spatial framework will form the basis for managing Australia's Marine Jurisdiction (AMJ) as set out in Australia's Oceans Policy. Management goals include ecologically sustainable development of marine-based industries, multiple-use of resources, and conservation and reservation of representative marine ecosystems. The spatial framework currently consists of a suite of hierarchical biophysical regionalisations at provincial- and meso-scales for the continental shelf.

This framework needs to be simplified and refined in a Large Marine Domain (LMD) regionalisation to make it operational. Simplification is the identification of appropriate boundaries for LMDs (that are aggregations of provincial and meso-scale regions). Refinement is the definition of a biophysical substructure within LMDs that represent natural ecological units. The CSIRO Marine Research (CMR) voyage will survey areas within the 'South-eastern LMD' and the Great Australian Bight Marine Park to support this process.

The overall research goals for the voyage are to:

- a) test and refine techniques for mapping and classifying marine

benthic habitats and their biological communities using surrogate variables, and develop protocols for ground-truthing such assessments

b) map habitat and community substructure in key areas

c) sample previously unsurveyed marine habitats and communities to enable extension of the existing regionalisations in this region (principally on the lower continental slope, 1500 - 2000 m)

## **CRUISE PLAN**

### **Leg 1**

From Hobart *Southern Surveyor* will steam to Darcy's Patch off Maria Island, then move on to eastern Bass Strait and complete Leg 1 in the port of Eden in southern NSW (Fig. 1). The overall aim of Leg 1 is to evaluate the 100 KHz Simrad EM 1002 multibeam swath mapping instrument as a tool for classifying seabed type, and to conduct complementary biophysical sampling. Much of the work will be undertaken on the continental shelf (~40-200 m) in eastern Bass Strait and southern NSW where CMR have existing data on the structure and composition of the seabed and its invertebrate and fish communities.

Initially, about one day will be spent in the vicinity of Maria Island off the east coast of Tasmania to complete calibration of the swath mapper and test the new video camera array in deep water (> 200 m). Swath map data will be collected in a narrow cross-shelf transect from near-shore to the upper slope. This will provide a continuous transect to the abyssal plain in conjunction with data taken by the deep swath map instrument used by AGSO on the vessel *L'Atalante* in 1999. The CMR transect will cross an area of seabed used previously for acoustic calibration work. There will be provision to transfer four staff at sea on the evening of April 5 off the Tasmanian east coast. Four staff associated with the swath mapper calibration and deep water camera test will leave the vessel and be replaced by others who will complete Leg 1.

From here the vessel will steam to the key continental shelf sampling sites: the Big Horseshoe canyon neck off Point Hicks in eastern Gippsland, the outer edge of Gabo Reef off Cape Howe, and the Howe Reef complex off Green Cape in southern NSW. Approximately 6 days will be spent using the swath mapper: 3-4 days will be spent mapping the seabed along predetermined transects, and 1-2 days will be used for specific calibration and validation experiments (including tests to determine resolution, repeatability and angular dependence). Transect sampling will include a cross-shelf component from near-shore (~40 m) to beyond the shelf-edge (~400 m) at the Horseshoe and Howe Reef. These transects will target heterogeneous seabed types across a range of depths, as well as providing cross-shelf swaths that will overlap the AGSO swath mapping on the continental slope. The remaining time, 2-3 days, will be spent taking physical and biological ground-truth samples. On Leg 1, this will be mostly the sediment and camera sampling, with the remaining biological sampling and camera work completed during Leg 2 when the biological staff and a second camera technician are on board. A component of the camera work is to

acquire stereo video images to develop photogrammetric methods.

Physical sampling will be with a sediment box corer and rock dredge at predetermined sites, and at sites with contrasting backscatter properties. Sediment samples will be sub-divided to provide undisturbed sections and bulk samples for a range of classification and acoustic reflectivity analyses undertaken by AGSO and CMR. Seabed geomorphology and invertebrate communities will be surveyed at key locations with digital stereo video cameras: target sites will be determined by swath mapping results, and where there are no pre-existing CMR data. The camera will be used in drop-mode and tow-mode as appropriate. Invertebrate communities will be sampled with a benthic sled, and fish communities with a McKenna Market trawl where there are no existing data, or as determined by mapping results. As far as is possible, all sampling gears will be deployed with a Sonadyne beacon to enable exact position fixing.

In addition, the ADCP will be run during transecting and sampling whenever possible to measure water column currents. Dedicated transects will be run across the Horseshoe region where temperature profiles will be measured by expendable XBT sampling. There will be underway sampling of surface water for physical parameters, and for chlorophyll. Twice daily water samples will be taken to calibrate underway chlorophyll measurements and validate Ocean Colour data, and CTD casts will be made at key locations and times to provide calibration data for the acoustic transducers. Data from the single beam EK500 sounder (12, 38 and 120 KHz) and the EchoListener system will be logged whenever possible to compare with the multi-beam backscatter data. Backscatter data from water column micronekton will be logged throughout the survey.

The vessel will steam to the port of Eden on April 14 for re-provisioning and a partial change of the scientific crew.

### **Leg 1 objectives**

To test and refine techniques to map and classify seabed habitat by

1. mapping selected areas of seabed on the continental shelf and upper slope with a multi-beam swath mapper to evaluate its capability for mapping and classifying seabed types based on bathymetric and backscatter data
2. characterising the physical and biological attributes of these areas by ground-truth sampling of sediments, consolidated sediments, invertebrates and fishes with a video camera, box corer, rock dredge, benthic sled and fish trawl (mostly substrate sampling on Leg 1)
3. taking biological and physical samples from areas of the upper-slope previously swath-mapped by AGSO (for the same purpose as described in objectives 1 and 2)
4. acquiring water current and water column profile data for comparison with hydrodynamic climatology, and for calibration of the acoustic transducers
5. acquiring digitised acoustic data from the single-beam EK500 (12, 38 and 120 KHz) and bridge sounders to compare with

multi-beam data from both the EM1002 and EM12

In addition, to

6. acquire underway hydrology data as part of the AOOS, particularly for Ocean Colour validation (applies to entire voyage)

## **Leg 2**

From Eden the vessel will steam back to the nearest of the Leg 1 continental shelf sites (Howe Reef) on April 15 to continue the biophysical sampling. Up to 4 days will be spent completing this part of the program that will be mostly biological and photographic sampling. As before, the ADCP, single beam EK500 sounder and the EchoListener system will log data whenever possible, and there will be underway sampling of surface water and chlorophyll. Twice daily water samples will be taken to calibrate underway chlorophyll measurements and validate Ocean Colour data. When the continental shelf sampling is complete, the vessel will steam southwards to eastern Tasmania to begin a second phase of the survey program.

The aim of the second phase is to ground-truth, evaluate and compare the initial seabed characterisations provided by AGSO swath mapping on the continental slope. Backscatter data from the eastern Tasmanian region were collected with a Simrad EM12 as part of the AUSTREA surveys in 1999 at a depth range beyond the capability of the instrument used by *Southern Surveyor*. The survey area will be on the lower continental slope (~1500-2000 m) (Fig. 1). This depth stratum is intermediate in the depth range sampled by AGSO (~400-5000+ m), at the limit of capability for some of the ground truth samplers on *Southern Surveyor*, and previously unsampled for biological communities by trawl or benthic sled anywhere in the AMJ.

Biophysical sampling will be as described for Leg 1, and will occupy about 11 days. Sampling will be stratified primarily by depth (~1500 m, 1750 m and 2000 m horizons) and substrate type as determined from evaluation of bathymetry and texture in AGSO swath maps. Contrasting substrates will be sediments ('soft' seabed), semi-to well-consolidated sediments ('hard' seabed) and rock outcrop ('rough' seabed). Bathymetric maps show that canyons are numerous and a dominant geomorphological feature of the southeastern continental slope seabed. Fine-scale topographic stratification within canyons will be an additional component of the 'rough' seabed sampling. All gears will be used to samples all sites, except that it will not be possible to trawl on the roughest seabed.

On completion of this phase of sampling the vessel will return to Hobart for re-provisioning and a partial change of the scientific crew on May 2.

## **Leg 2 objectives**

To test and refine techniques for mapping and classifying seabed

habitat by

1. completing the biophysical sampling of shelf areas swath-mapped during Leg 1 (mostly the biological and photographic sampling)
2. evaluating the initial seabed characterisations provided by AGSO swath maps on the continental slope using a Simrad EM12 through a program of ground-truth biophysical sampling.
3. acquiring data to enable comparison of the continental slope seabed characterisations provided by the Simrad EM12 (on the *L'Atalante*) with the single-beam EK500 on *Southern Surveyor*

In addition, to enable the extension of biophysical regionalisation to lower continental slope depths (~1500-2000 m) by

4. collecting and curating benthic invertebrates to provide a biological inventory at various scales of taxonomic resolution
5. collecting and curating demersal fishes to provide a biological inventory at species-level

### Leg 3

From Hobart the vessel will steam to the Great Australian Bight via the outer regions of the continental shelf off Port Macdonnell and Kangaroo Island (Fig. 1). This third phase of sampling will provide swath maps of the seabed beneath a key upwelling area for blue whales (the Bonney Coast off Port Macdonnell), abundance and distribution data for fishes at the northwestern boundary of the South Eastern Large Marine Domain (in the vicinity of Kangaroo Island), and a seabed map with ground-truth biophysical sampling on the continental shelf within the GAB Marine Protected Area (Benthic Protection Zone).

The continental shelf area off Port Macdonnell will be visited only briefly (~12 hours) to swath map the seabed in area that will sampled for water column productivity by the ORV *Franklin* in 2001. On completion of this survey, *Southern Surveyor* will steam to the outer shelf area off Kangaroo Island to commence a 2-day trawl program to sample fishes towards the eastern extent of the Gulfs Province. Their distribution and abundance in this area will be used to refine the existing but provisional northeastern boundary of the southeastern management region- the SE Large Marine Domain. Trawling will be based on a depth-stratified (40, 80 and 120 m) 3-transect design, with samples taken during the day and night. This design will enable direct comparison with biogeographic data taken by CMR from the South East Biotone.

The vessel will then continue westwards to the GAB Marine Protected Area to commence a 7-day survey of the continental shelf seabed and its communities within the boundary of the Benthic Protection Zone. The first five days will be a program of swath mapping and biophysical sampling using the same tools and sampling protocols as Leg 1. The sampling design will be based on a depth stratified transect, targeting areas that have relatively light and heavy historical trawl fishing effort as assessed from maps of trawl effort provided by BRR. Swath

mapping will extend offshore to overlap the area covered by the AGSO mapping from *L'Atalante*. If time permits, limited trawl sampling will be undertaken on a section of the upper to mid- continental slope (200-700 m) to evaluate the distribution and abundance of deep water squalid sharks.

The final 2 days of survey will be undertaking a program of geophysical sampling with AGSO scientists in the GAB Benthic Protected Area. Two AGSO technicians and geophysicist Dr Nadege Rollet, together with Don McKenzie (CMR), will join the *Southern Surveyor* by fishing boat from Fowler's Bay, and four CMR staff will return by this boat.

Swath-mapping shows that the slope to about 3000 m is relatively featureless, but below that it is steeper, faulted, and strongly canyoned. Associated with canyons, and elsewhere in deep water, are huge holes, up to 8 km across and 500 m deep. No such features are known to AGSO elsewhere in the world, and their nature is a complete mystery. AGSO will sample down from 500 m to the abyssal plain at 5300 m, in two modes. From 500 to 2500, there will be 5 stations with sampling every 500 m on an AUSTREA 1 profile. A grab sample for seabed characterisation and a 10m gravity core to investigate long-term changes in sedimentary, water column, and climatic conditions will be taken. In 3000-5000 m water depth there will be 7 stations: five cores at sites determined by swath-mapping and seismic and 3.5 kHz profiles (two as above, three to investigate the sediments in the deep holes) and two dredges to sample old (Cretaceous and Paleogene) detrital sediments.

On completion of this last phase of sampling on about May 16 the vessel will return to Hobart and arrive on May 21.

### **Leg 3 objectives**

To test and refine techniques for mapping and classification of seabed habitat by

1. mapping additional selected areas of seabed from a second biogeographical region of the continental shelf with a multi-beam swath mapper to evaluate its capability for mapping and classifying seabed types based on bathymetric and backscatter data
2. characterising the physical and biological attributes of these areas by ground-truth sampling of sediments, consolidated sediments, invertebrates and fishes with a video camera, box corer, rock dredge, benthic sled and fish trawl
3. characterising the physical attributes of the seabed of the continental slope, rise and abyssal plain by ground-truth sampling of sediments, with a box corer, gravity corer and benthic sled
4. investigate long-term changes in sedimentary, water column, and climatic conditions in the GAB region by sampling old (Cretaceous and Paleogene) detrital sediments with a benthic sled

In addition, provide a taxonomic inventory, with community composition and structure data for demersal fishes and benthic

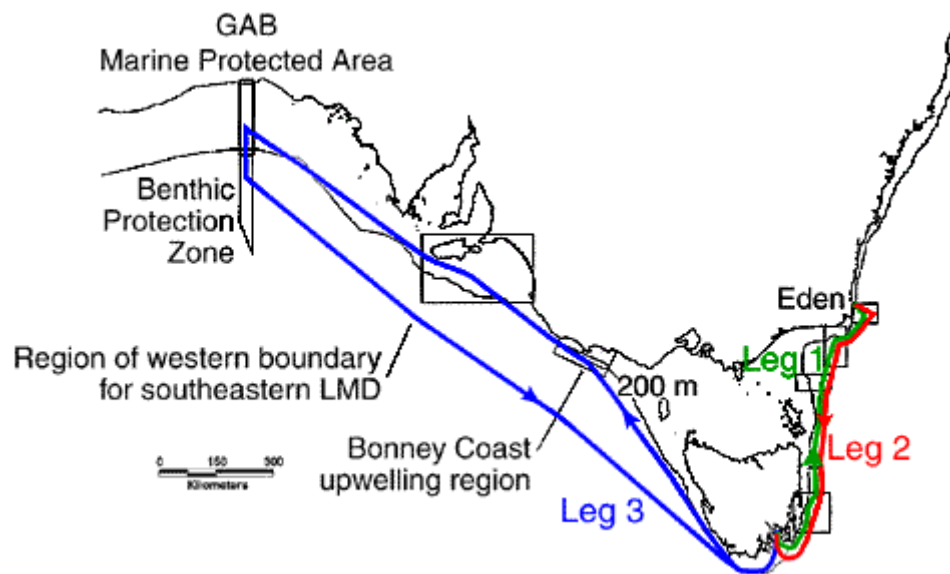
invertebrates, from the GAB MPA (Benthic Protection Zone) by

5. biological sampling with a benthic sled in areas with contrasting histories of relatively light and heavy trawling activity
6. biological sampling with a fish trawl in areas with contrasting histories of relatively light and heavy trawling activity

## APPENDIX 1: PROVISIONAL CRUISE TIME ESTIMATES

Activity time	(Days)
<i>Leg 1</i>	<i>(11)</i>
Steaming	2.5
Calibration of swath mapper and deep camera test	1
Swath mapping and ADCP survey of three shelf areas	3.5
Experimental exploration of swath mapper capability	1-2
Biophysical sampling of sites within survey areas (commence)	2-3
<i>Leg 2</i>	<i>(18)</i>
Steaming/ port time	3
Biophysical sampling of sites within survey areas (complete)	4
Biophysical sampling of slope sites swath mapped by AGSO	11
<i>Leg 3</i>	<i>(19)</i>
Steaming	10
Swath map survey in Bonney Coast upwelling	0.5
Trawl survey at northwestern boundary of southeastern LMD	2
Swath mapping/ biophysical sampling within GAB MPA	4.5
Geoscience sampling of slope sites within GAB MPA	2
TOTAL	48 days

**Figure1: Map showing general sampling areas for voyage SS0100**



[View complete version of SS0100 Voyage Plan](#)