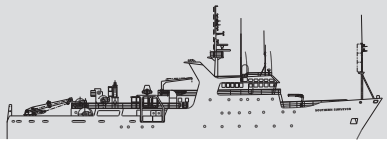


MARINE
NATIONAL FACILITY

2010 program

RV *Southern Surveyor*

voyageplan
SS01-2010 TRANSIT

Leeuwin Current – Australian National Network in Marine Science Student Training Voyage

Itinerary

LEG 1
Depart Hobart 1800 h Monday 29 March 2010
Arrive Fremantle 1000 h, Wednesday 7 April, 2010

LEG 2
Depart Fremantle 1600 h, Wednesday 7 April 2010
Arrive Broome 0800 h Tuesday 13 April 2010

Principal Investigators

Tom Trull, Professor, University of Tasmania
(Chief Scientist, Leg 1) Tom.Trull@utas.edu.au

Anya Waite, Professor, The University of Western Australia
(Chief Scientist, Leg 2) Anya.Waite@uwa.edu.au

CSIRO

Scientific Objectives

The primary objective is to train Australian undergraduate and postgraduate students in ship-based marine science. This objective will be pursued by guiding them to undertake a survey of the Leeuwin Current, starting from its extension into the Southern Ocean and continuing upstream towards its tropical origins off northwest Australia.

The scientific objectives are to:

1) identify plankton within the Leeuwin Current, and thus its role in connecting Indian and Southern Ocean populations

2) investigate physical and biogeochemical gradients underlying these biological patterns.

Leg 1 will also measure chemicals from seafloor hydrocarbon seeps in the Great Australian Bight (piggy-back project led by Xiubin Qi).

Leg 2 will also obtain video images and sediment grab samples from the West Australian Shelf (piggy-back project led by Rudy Kloser).

Voyage Objectives (in priority order)

1. Follow along as much of the Leeuwin Current (LC) as time allows (see Figure 1).

Initial time estimates suggest this will be limited to waters west of Port Lincoln, SA. The tentative plan is to transit directly from Hobart to the shelf edge in this region. Station work will begin as soon as the LC is encountered, and the subsequent selection of stations will also seek to maximize sampling hydrocarbon seeps (X. Qi piggy-back project-Figure 2).

2. Monitor the underway seawater supply for:
i) pCO2 and O2/Ar ratios (B. Tilbrook installed systems)
ii) temperature, salinity, fluorescence (MNF installed systems)
iii) beam attenuation (transmissometer to be installed by T. Trull with MNF support)
iv) hydrocarbons (stripper/multi-sensor system to be installed by Xiubin Qi)

Sample the underway supply up to 12 times per day for:

i) dissolved nutrients – phosphate, nitrate, silicate for analysis by MNF hydrochemist

ii) particulate organic carbon

iii) chlorophyll analyses

iv) size-fractionated plankton samples

3. Deploy the 24-bottle CTD rosette up to 2 times per day to 1000 meters, with sensors for:

i) oxygen, fluorescence and transmission (MNF installed sensors)

ii) Isus nitrate sensor (K. Wild-Allen sensor for testing prior to use on later voyage led by P. Thompson). THIS SENSOR IS LIMITED TO 1000m DEPTH.

iii) hydrocarbons (sensor system to be installed by Xiubin Qi).

Sample the Niskin bottles for:

i) dissolved nutrients – phosphate, nitrate, silicate for analysis by MNF hydrochemist

ii) particulate organic carbon – for onboard filtration, and land based analysis

iii) chlorophyll analyses – for onboard filtration and analysis by fluorometry

iv) phytoplankton identification by onboard flow cytometry and photo-microscopy

At least one of the daily CTD stations will reach to 1000 m in the LC core and will include 5 sampling depths within the euphotic zone, for a minimum of 10 sampling depths. The second will be placed as required for teaching and/or examing any eddies or oceanographic features of interest.

4. Deploy a hand-towed plankton net at each CTD station for plankton identification by photo-microscopy.

5. Deploy a Continuous Plankton Recorder (CPR) on a non-conducting cable from the trawl-deck A-Frame to be towed between each CTD station for collection of plankton samples.

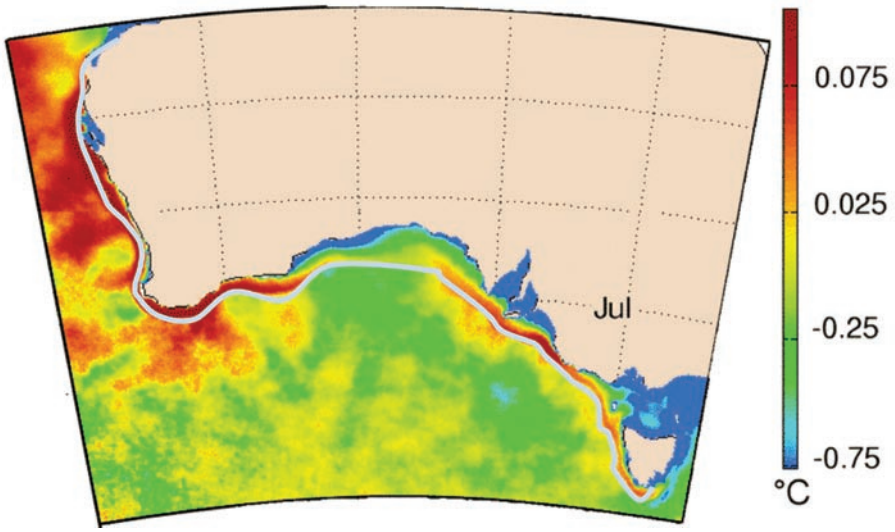
6. Deploy expendable bathythermographs (XBTs) to determine mixed layer depth, at intervals between the CTD stations chosen by reference to the underway and remote sensor measurements.

7. On LEG 1 only: as a replacement for SeaSoar, deploy a CTD as a towed body, equipped with a fluorometer for hydrocarbon detection (Xiubin Qi piggy-back project). Focus is on the hydrocarbon seep area C.

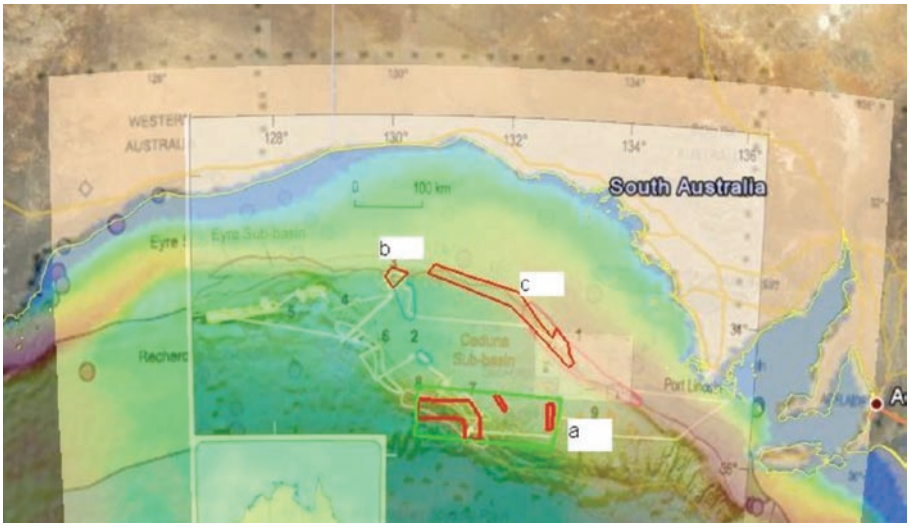
8. On LEG 2 only: operate the Swath mapper and deploy video/ sediment sampler (R. Kloser piggy-back project).

Voyage Track

The plan is to follow the Leeuwin Current as closely as possible, as shown by the grey line drawn over the SST anomaly map of its location in July, when it is most readily apparent, Figure 1:.



The limited shiptime means this will not be fully possible, especially given the need to also undertake the piggy-back projects. For the LEG 1 hydrocarbon seep sampling there are 3 regions of interest, marked a,b,c in the following Figure 2:



Voyage track (continued)

For LEG 1, to address the X. Qi piggy-back objectives and fit the time constraints, the voyage track will be modified to ***at most*** transit directly from Hobart to the region of the Leeuwin Current south of Port Lincoln, South Australia, and then to proceed west upstream in the current to sample hydrocarbon seep region C, before continuing westward across the GAB to the shelf-break off Esperance and then on into Freemantle. This is achievable at 10 knots, but limits station time to just 7 hours for the voyage. If transit is very rapid leaving Hobart, more rapid than 10 knots, this passage via Seep Site C will be pursued. If not, we will refocus on Seep Site A, and if there is further delay, we will skip all Seep Sites and transit directly for the Shelf-Break off Esperance. Times for these options are shown in the table below.

LEG 1 Time Estimates

	d (nm)	**s (kt)**	**time (h)**
Time Available from 18:00 29 March to 10:00 7 April			**208**
Direct Transit Hobart to Freemantle	1800	10	180
via Esperance Shelf-Break	1870	10	187
via Seep Site A (western-most) and Esperance Shelf-Break	1940	10	194
via Seep Site C and Esperance Shelf-Break	2010	10	201
Additional Time – As available within allocated 208 hours			
Minimum of 2 to maximum of 7 stations of duration 2.5 hr consisting of: *i) recovery of continuous plankton recorder – 0.3hr* *ii) CTD to 1000m – 1.5 hr* *iii) hand net haul – 0.3 hr* *iv) relaunch continuous plankton recorder – 0.3 hr* *Minimum of 4 to maximum of 12 hr* *Tow-yowing of CTD at 4 knots*			
Mobilisation/demobilisation in Freemantle *This time NOT included within 208 hours of LEG 1.*			*6*
Total Time			**208**

* At 10 knots, the direct transit would require 121 hours, and limits station time to 15 hours.

Piggy-back Projects

LEG 1: Dr. Xiubin Qi: Testing and validation of a hydrocarbon sensor array

Scientific Objective: To gather information regarding the composition of the waters and subsequent behaviours of the sensor array as a baseline for future studies. The opportunity to sample areas of potentially higher hydrocarbon concentration due to commercial oil operations is of particular interest for the development of this array, as we examine the possibility of differentiating true petroleum seeps from those caused by human activities.

Voyage Objective: The voyage provides an opportunity to test our array as a useful orientation for CSIRO project staff with no prior experience in performing such measurements in the working environment of a research vessel.

Logistics of this project:
i) sensors mounted on CTD
ii) sensors mounted to sample underway seawater supply
iii) 5L of MilliQ water for preparing standards and maintaining sensors
iv) a fume cupboard for liquid-liquid extractions
v) cold storage for ~100, 1L sample bottles

Hydrocarbon sensor system

Stowed system for shipping:

- 1 palletised load dimensions to Australian pallet standard (1165 x 1165 mm)
- Load packing height 1100 mm
- Load weight approximately 160 kg

Vessel requirements:

Water pump deployment:

- Davit or crane with minimum working height not exceeding 10 m from water level
- Davit or crane ideally situated towards the rear of the vessel (max load 40 kg)
- Operation on opposite side to the bilges
- 31.75 mm (1 ¼ inch) heavy duty tubing to be routed to tank
- Power 200-240V, 50/60 Hz, 0.58 kW, 2.5A @ 200V

Sensor tank operation:

- Abaft next to accommodation, can be operated in enclosed area (e.g. wet lab) or on deck.
- Minimum working footprint 1600 mm x 2100 mm (3.36 m2)
- Height 1650 mm
- Securing points required on deck to prevent movement of equipment
- 31.75 mm (1 ¼ inch) hose for water disposal required to run over side at deck level
- Chemicals: 5 litres of class 6.1 chemical (Dichloromethane), 5 litres of class 3 chemical (Ethanol or Acetone), fresh water required for wash down
- Cabling to internal data acquisition area and for GPS unit
- Dry stowage for empty boxes 1 x Australian standard pallet (1165 x 1165 mm)
- Power provided from data acquisition unit

Data acquisition:

- Internal accommodation no more than 15 m from sensor tank
- Minimum working footprint 1500 mm x 1500 mm (2.25 m2)
- Working area to include bench or table and chair
- Data cabling access from deck area
- 220-240 V, 50/60 Hz power

LEG 2 Piggy-back Project:

Dr. R. Kloser: National upper slope seabed multi-beam mapping and ecological interpretation.

Scientific Objective: to develop a categorisation of the physical attributes of the slope in a framework that has high relevance to biodiversity.

Voyage Objective: Using transit voyage time on the Marine National Facility vessel map the upper-slope and mid-slope seabed focusing on the 100 m to 1500 m depth range and regions important for regional marine planning, biodiversity and conservation assessments and fisheries habitat mapping.

Logistics for this project: The proposed ship track for this project is very close to the track proposed for the core training voyage (Fig. 1).

Video/Sediment Sampling System Requirements:
System Details to be provided by Rudy Kloser

Southern Surveyor Equipment

1. Swath mapping capacity is important to satisfy the scientific objectives of the LEG 1 Qi piggy-back and LEG 2. Kloster piggy-back projects.

2. CTD-24 bottle Niskin system with sensors for:
   i) oxygen, fluorescence and transmission (MNF installed sensors)
   ii) Isus nitrate sensor (K. Wild-Allen sensor for testing prior to use on later voyage led by P. Thompson). THIS SENSOR IS LIMITED TO 1000m DEPTH.
   iii) hydrocarbons (sensor system to be installed by Xiubin Qi).

3. Underway clean seawater supply for:
   i) MNF thermosalinograph and fluorometer
   ii) Tilbrook pCO2 and O2/Ar instruments
   iii) Trull beam transmissometer
   iv) LEG 1 Qi piggy-back hydrocarbon stripper/sensor system

4. XBT deployment system and 1 case XBTs from MNF (additional XBTs will be provided A. Thresher)

5. 2x20L carboys of Milli-Q water for equipment washing for core project and LEG 1 Qi piggy-back.

6. Towed body winch and cable for deployment of Continuous Plankton Recorder from trawl deck A-Frame.

User Equipment

Equipment on both LEGS:

1. Trull (Hosie) – Continuous Plankton Recorder
2. Trull – Laminar flow bench and laboratory oven for POC sample handling
3. Trull (Tilbrook) EIMS O2/Ar system
4. Trull – Wetlabs C-Star transmissometer to log underway seawater supply
5. Waite (Thompson) – flow cytometer
6. Waite – hand net
7. Waite – photomicroscopy system
8. Waite – plankton filtration system for underway seawater supply
9. Trull (Wild-Allen) – ISUS nitrate sensor to be mounted on CTD

Equipment only on LEG 1:

1. Xiubin Qi hydrocarbon stripper/sensor system mounted on CTD
2. Xiubin Qi hydrocarbon stripper/sensor system sampling underway seawater supply

Equipment only on LEG 2:

1. Rudy Kloser Video/Sediment Grab system

Special Requests

1. Fitting of sensors to CTD by MNF staff - as described above.
2. Installation of systems sampling the underway seawater supply – as described above.
3. Patience and willingness by the MNF and Ship personnel to assist with the student training exercises – specifically to make time to describe and guide tours of the ship systems for the students, including:

i) bridge systems and vessel operation

ii) engine room operations

iii) plumbing of underway seawater supply

iv) deck operations

Personnel List

LEG 1

Drew Mills	CMAR	MNF Electronics Support/Voyage Manager
Lindsay Pender	CMAR	MNF Computing Support
Peter Hughes	CMAR	MNF Hydrochemistry
David McLeod	CMAR	CPR
Tom Trull	UTas	Chief Scientist
Harriet Patterson	UTas	Scientist
Fanny de Bussarolles	UWA	Student
Vicki Hamilton	UTAS	Student
Simone Niedermueller	UWA	Student
William Feeney	JCU	Student
James Robinson	UTAS	Student
Ben Davis	JCU	Student
Roger Stevens	UTAS	Student
Xiubin Qi	CSIRO E&M	Scientist
Emma Crooke	CSIRO E&M	Scientist

LEG 2

Peter Dunn	CMAR	MNF Electronics Support/Voyage Manager
Lindsay Pender	CMAR	MNF Computing Support
Peter Hughes	CMAR	MNF Hydrochemistry
Bernadette Heaney	CMAR	MNF Swath Mapping
Anya Waite	UWA	Chief Scientist
Harriet Patterson	UTas	Scientist
Murray Bower	JCU	Student
Stephen Ban	JCU	Student
Nicolas Nalgoo	UWA	Student
Amy Newman	UWA	Student
Morena Mills	JCU	Student
Sally Whatmough	JCU	Student
Choo Poh Leem	JCU	Student
Rudy Kloser	CSIRO	Scientist
Jeff Cordell	CSIRO	BOAGS support

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

Tom Trull
LEG 1 Chief Scientist

Anya Waite
LEG 2 Chief Scientist