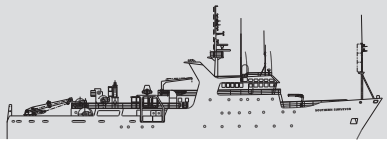

MARINE
NATIONAL FACILITY

2010 program

RV *Southern Surveyor*

voyageplan
SS04-2010

Assessing oceanographic delivery of nutrients to Ningaloo Reef

Part I : Autumn Dynamics

Itinerary

Mobilise Port Hedland 0800 h, May 7th 2010
Depart Port Hedland 1000 h, May 8th 2010
Arrive Fremantle 0800 hrs, Thurs 27 May 2010 and demobilise

Principal Investigator(s)

Professor Anya M. Waite (Chief Scientist)
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CSIRO

Scientific Objectives

Ningaloo Reef is Australia's largest fringing coral reef and the basis of a major tourist industry. Though diverse and delicate, coral reefs (and the controls of their productivity) remain poorly understood. Understanding the interaction of the reef with the surrounding ocean is essential for predicting and managing the impacts of human and climate-induced changes, and therefore for the effective conservation of reefs. This proposal is part of a new initiative aimed at providing a scientific basis for determining the oceanographic distance beyond which industrial developments will not damage a reef's ecological processes. This analysis is essential for maintaining guiding sustainable development in the region. We will determine the seasonal differences in the productivity and delivery of nutrients and particles, by the Leeuwin (LC) and Ningaloo Currents (NC) on the continental shelf off Ningaloo Reef, WA, with special emphasis on identifying coastal upwelling mechanisms driving reef production. This work is part of a 3-year funded ARC project (Waite, Roughan, Pattiaratchi, Kotta) comparing reef-based uptake of nutrients from the surrounding ocean with the shelf oceanography delivering materials to the Ningaloo reef. We have applied for a second voyage in summer 2011/12 to complete the study.

Hypotheses to test:

1. Nutrient enrichment of the Leeuwin Current during autumn (May) is driven by mixed layer deepening as the LC moves south
2. The autumn bloom supported by this nutrient enrichment is the primary driver of production and particle flux to Ningaloo Reef
3. Deep water masses off Ningaloo carry a distinctive alkalinity / pCO_2 signature which may impact the chemistry of waters adjacent to the reef

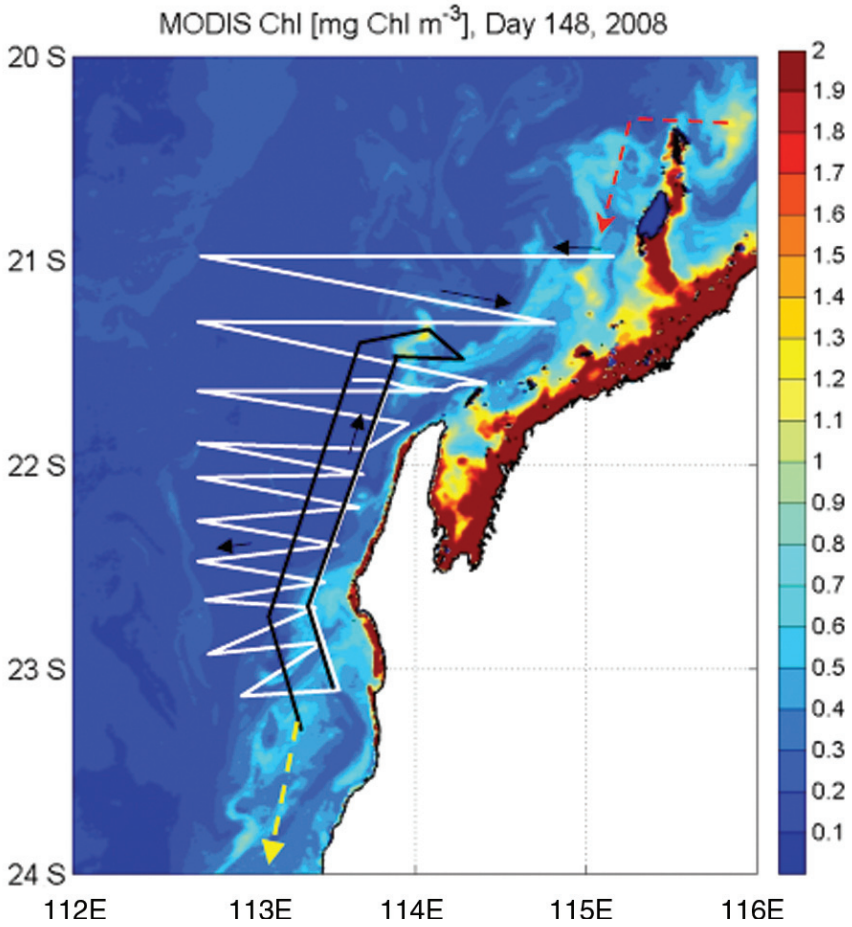
Voyage Objectives

Our recent work has illuminated that Ningaloo Reef filters large volumes of ocean as it concentrates its nutrients (especially nitrogen) from the plankton (Wyatt et al., in press). Changes in oceanic production rates offshore of Ningaloo Reef will therefore likely directly impact reef production, but the mechanisms and transport rates driven by them are unknown.

Expected Outcomes:

1. Snapshot of the physical dynamics of the Leeuwin Current (*and the wind-driven countercurrent the Ningaloo Current, in two contrasting seasons – Part II*)
2. 4 (four) Lagrangian drifter tracks illuminating physics of consolidation point of LC north of Northwest Cape
3. Estimation of the nutrient injections forced by mixed layer deepening
4. Measurements of primary production, nutrient uptake and suspended particle concentrations along the length of Ningaloo Reef (in two seasons – Part II)
5. Estimate of local gradients in ocean acidity signature along the length of the reef

Voyage Track



Red Dash = Transit 1, Port Hedland to Barrow Is.
White = Southward Track, Leg 1, 835 nm
Black = Revisit drifters, Leg 2, 300 nm
Dashed Yellow = Transit 2, Coral Bay to Fremantle

Time Estimates

Total Voyage: **490 h**

Time Estimates:

Transit N to Stn 1:	18 h
CTD & PP Stations:	100 h
Transit Legs 1-2 :	80 h
TowYo :	87 h
Transit S (to Freo):	56 h
TOTAL Time:	486 h

Piggy-back Projects

Bronte Tilbrook, CSIRO: Measurements of pCO2 and alkalinity off Ningaloo. Objectives incorporated into core objectives above.

Southern Surveyor Equipment

- Rosette + CTD
- Other Rosette-mounted instruments: oxygen sensor, turbidity, fluorescence
- Milli-Q water
- Scintillation Counter
- "Tow-yo" System developed by the MNF in lieu of SeaSoar
- Bongo Nets (CSIRO CMAR Floreat)

User Equipment

Manifolds, pumps, fluorometer and other sampling equipment: these will be largely as for SSO3 (Kimberley voyage)

Four SVP Drifters – These drifters are each 20 kg, plastic wrapped and approximately 64 cm in diameter, 41 cm high. (Bureau of Meteorology)

Tilbrook – Alkalinity and pCO2 analytical instrumentation (already on board for the Kimberly Voyage SS03)

Nitrate Analyzer mounted on Rosette (borrowed from CSIRO)

Special Requests

Use of "Tow-yo" system repeatedly throughout the voyage.

SVP Drifters: To deploy, we remove the plastic wrap, pull off the pin or magnet, and toss the drifter in the water. There should be deployment instructions inside the plastic packaging of each drifter.

Personnel List

Anya Waite	UWA	Chief Scientist
Lynnath Beckley	Murdoch University	Deputy Chief Scientist
Vincent Rossi	Toulouse UNSW/UWA	Physical Oceanographer
Christin Sawstrom	UWA	Biological Oceanographer Nutrient Uptake
Megan Saunders	UWA	Biological Oceanographer Primary Production
Judith Meyer	Uni Kiel / UWA	Research Volunteer Filtration, microbial sampling
John Akl	CSIRO	Research Technician Alkalinity, pCO2
Nick Breheny	Murdoch University	Research Technician Zooplankton, Fish Larvae
Lisa Woodward	CMAR	MNF Voyage Manager
Pamela Brodie	CMAR	MNF Computing support
Drew Mills	CMAR	MNF Electronics Support
Peter Hughes	CMAR	MNF Hydrochemistry Support
Dave Terhell	CMAR	MNF hydrochemistry support

As per AMSA requirements for additional berths on Southern Surveyor, the following personnel are designated as System Support Technicians and are required to carry their original AMSA medical and AMSA Certificate of Safety Training on the voyage:

Name	**AMSA Certificate of Safety Training No.**	
Lisa Woodward	MSIC ACM41018	Sea Safety Cert BB01145
Pamela Brodie	MSIC ACM 40518	Sea Safety Cert AS02396
Drew Mills	MSIC ACM 40503	Sea Safety Cert As02348
Peter Hughes	MSIC ACM 41312	sea Safety Cert TBA
Dave Terhell	MSIC ACM 40641	sea safety cert AS02843

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

Anya M. Waite
Chief Scientist