VOYAGE SUMMARY SS07/2003

Title
Seasonality in Community Structure, Productivity and Energy Flows in the Continental Shelf and Offshore Pelagic Environment off Southwestern Western Australia

Itinerary
Departed Fremantle 1800 hrs, Friday 22 August 2003
Arrived Fremantle 1000 hrs, Saturday 30 August 2003

Principal Investigator
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Scientific Objectives
The scientific objectives were to:

- Investigate the physical, chemical, and biological (phytoplankton, zooplankton and micro-nekton) structure along a transect north of Perth extending from the nearshore (17 m depth) to offshore (1000 m depth);
- Measure processes associated with biological productivity: inshore and offshore;
- Investigate relationships between topography, currents and concentrations of krill in the region of Perth canyon.

Voyage Objectives
The Voyage objective was to occupy stations along a transect north of Perth orthogonal to the coast, with its nearshore station outside Two Rocks. Stations were at the following depths:

- 17 m (coastal) (A);
- 40 m (inner shelf) (B);
- 100 m (outer shelf) (C);
- 300 m (shelf break)(D); and
- 1000 m (offshore-Leeuwin Current) (E)

Each station was to be repeated day and night

At each station the following sampling was to be undertaken:

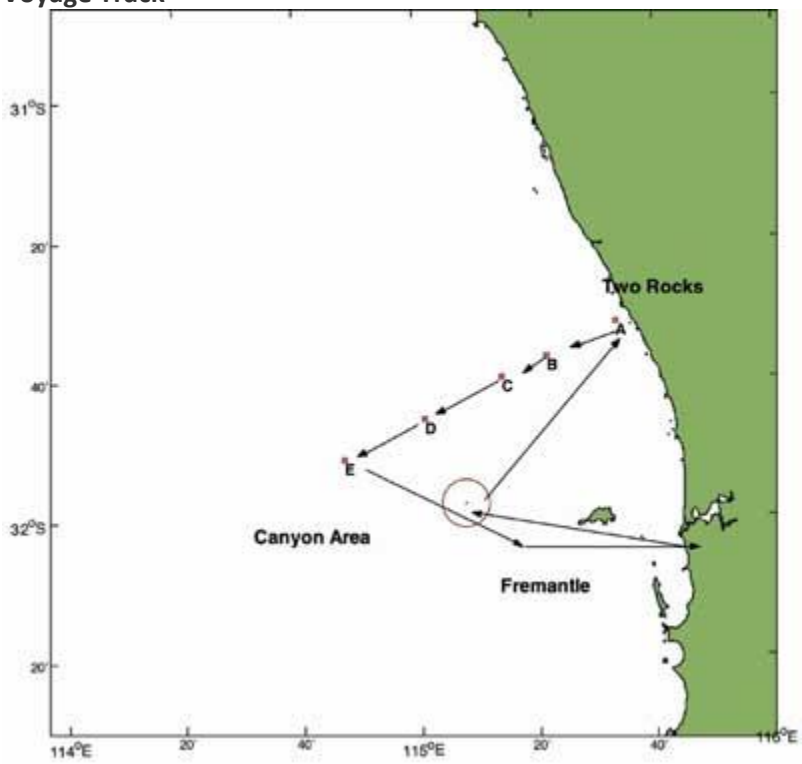
- CTD profiles to measure temperature, salinity, light, chlorophyll, oxygen, and acoustic backscattering (TAPS). (CTD casts were also to be made midway between each full sampling station).

- Rosette casts to collect water for oxygen, nutrients (N, P, Si), salinity, chlorophyll a, photosynthetic pigments, micro-zooplankton and determinations of primary productivity at depths (as available) of: 0 (bucket or sub-surface Niskin), 10, 25, 50, 75, 100 and 150 m depth or near bottom at shallow stations. A sample from the chlorophyll maximum should be substituted for one of the latter depths, depending upon its position.
- Replicated double-oblique Bongo net tows, plus one daytime and one night-time depth stratified tow from near surface to within 5-10 m of bottom or to a maximum of 150 m depth. The depth-stratified tows will cover the following strata: surface, mixed layer above chlorophyll maximum, chlorophyll maximum, and the layer below chlorophyll maximum. Fewer strata may be sampled at station B (40 m depth).
- Replicated day and night midwater trawl tows, vertically stratified at stations greater than 100 m depth.
- Measurements of upwelling and downwelling light irradiance and hyperspectral irradiance through the water column to 30 m depth.

Other sampling included:

- Measurements of primary productivity based on 24-hr 14C incubations, microzooplankton and mesozooplankton grazing at stations A, C and E. Microzooplankton dilution experiments will be carried out at the surface and chlorophyll maximum depths.
- Deploying and retrieving a drifting sediment trap, with satellite tracking buoy, at station E.
- Conducting an acoustic transect across Rottnest Canyon and sampling potential krill layers with stratified net tows on the north flank of the canyon.
- Collecting three replicate box-core or grab samples of the bottom sediments at stations A – D to assess sources of organic matter deposited in the sediments.
- Collecting underway temperature, salinity, and chlorophyll fluorescence between each station. A sample will be obtained at each full station to calibrate the underway fluorescence.

Voyage Track



Results

All stations were occupied and virtually all objectives were achieved. At each station, the CTD was deployed to obtain a water column profile of temperature, salinity, oxygen, and chlorophyll a fluorescence. Water samples were obtained at the selected depths to calibrate the salinity, oxygen and chlorophyll values and to obtain samples for nutrient analyses, as well as to analyze for phytoplankton and microzooplankton species composition from the surface (bucket sample and just below surface, respectively) and chlorophyll maximum. Water samples from near surface were size fractionated for analysis of stable isotopes to trace food web processes.

Leon Majewski (Curtin University) took an irradiance profile at each station.

Replicate tows with a bongo net were carried out day and night at each station to sample macrozooplankton and ichthyoplankton. Fine (100 m m) and coarse mesh (355 m m) nets were used to adequately sample the smaller and larger copepods. A 1m square-framed net was towed at the surface day and night at each station to sample the neuston (near-surface macrozooplankton and micronekton). The neuston community is quite distinct and many interesting specimens were obtained of macro- and megazooplankton and of larval and juvenile fishes.

Stephan Pesant (Centere for Water Research, UWA) undertook measurements of primary production at stations A, C and E, based on 24-hr C-14 incubations. Harriet Paterson (UWA) measured the grazing of phytoplankton by microzooplankton at these stations based on the dilution method, and Joanna Strzelecki (CMR) measured the grazing by macrozooplankton using standard grazing experimental techniques. Ms Strzelecki also measured the feeding by zooplankton on phytoplankton at each station based on measurements of gut fluorescence and also copepod egg production based on 24-hr incubations of individual copepods, using the dominant species at each station. Copepod egg production is a standard means to estimate zooplankton secondary productivity.

Karen Crawley (Edith Cowan University) obtained triplicate sediment samples with a Smith-McIntyre grab at stations A- D to examine sources of organic carbon (e.g. seagrass and macroalgae vs phytoplankton detritus).

An acoustic survey of the canyon was carried out and samples obtained to attempt to identify acoustic deep-scattering layers.

Stephane Pesant also deployed a sediment trap at the outer shelf station (C: 100 m), allowing it to drift for approximately 24 hr to measure the quantity of organic matter sinking below the euphotic zone. The trap was deployed at 70m and was tethered to a freely drifting buoy equipped with Iridium satellite GPS positioning to enable the trap to be re-located. Eight cylindrical traps (60-80mm diameter) were mounted on an aluminium frame. Four replicate traps were used to determine carbon and nitrogen isotope fluxes as well as pigment fluxes and particle composition, i.e. intact plankton, fecal pellets and detritus. The other four traps contained gels that allow video analysis of sinking particles.

Midwater trawl samples were not carried out due to a failure of the Scanmar depth sensors.

Voyage Narrative
Cruise departure was delayed until evening due to 30-40 knot winds that continued through the first day. However weather for the remainder of the voyage was reasonable and did not significantly hamper scientific operations, except for preventing a transfer of personnel at Rottnest Island on the last day.

Cruise operations generally followed a routine, whereby sampling continued over 24 hours at each station, enabling the plankton to be sampled during daylight and night-time hours to assess diurnal variability. Dawn and dusk periods were used to obtain sediment grab samples and, where possible, to steam between stations. Steaming between stations was carried out at reduced speeds (6–8 nm/h) to enable the collection of high-quality acoustic data.

Summary
The Southern Surveyor is a highly seaworthy vessel, providing a stable platform with ample laboratory space and sufficient deck (winch) facilities to collect a wide range of samples and data. Although there were gear shakedown problems, support staff (electronics and computing) worked hard to get them aright and, as stated, virtually all cruise objectives were achieved.

In a relatively brief cruise we were able to sample the physical, chemical and biological environments from the coastal lagoon, across the shelf and over the continental slope in the region of the Leeuwin Current. The cruise will provide our most detailed assessment to date of the plankton communities off southwest Western Australia, their productivity and feeding interactions, and relationships with their physico-chemical environment.

Personnel
Scientific Crew:
Tony Koslow – CMR, Chief Scientist
Nick Mortimer – CMR, Acoustician
Joanna Strzelecki – CMR, Zooplankton
Mark Lewis – CMR, Biologist
Stephan Pesant – UWA, Phytoplankton
Harriet Paterson – UWA, Microzooplankton
Karen Crawley – Edith Cowan Uni, Benthos
Leon Majewski – Curtin Uni, Remote sensing
Lynnath Beckley – Murdoch Uni, Ichthyoplankton
Kate Berry – CMR, Hydrochemistry
Lindsay MacDonald – CMR, Electronics
Miroslaw Ryba – CMR, Computing

Ships' Crew:
Murray Doyle – Master
Roger Pepper – Chief Officer
John Boyes – 2nd Officer
John Morton – Chief Engineer
David Jonker – 1st Engineer
Jim Hickie – 2nd Engineer
Malcolm Mcdougall – Bosun
Graham Mcdougall – I.R.
Tony Hearne – I.R.
Manfred Germann – I.R.
Phillip French – Greaser

David Willcox – Chief Steward
Peter Williams – Chief Cook
Andrew Goss – 2nd Cook

Acknowledgements
The success of this cruise resulted from the hard work and dedication of all scientific and support staff. The considerable effort of Miroslaw Ryba and Lindsay MacDonald should be noted in particular, along with the support from Hobart of Bob Beattie. Special thanks to the Master, Ian Taylor, for his skill, support and unfailing patience in working with the scientists on a demanding cruise; in particular the highly positive and cooperative spirit he maintains between scientists and crew, the key to a successful and harmonious research vessel. The hard work, skill and experience of the mates and crew all contributed to making the cruise a success, and are gratefully acknowledged.

Tony Koslow
Chief Scientist