VOYAGE SUMMARY ss2012_t06

Survey of marine debris and phytoplankton activity off Australia’s west coast.

Voyage period: 07/09/2012 to 16/09/2012

Port of departure: Freemantle, Western Australia, Australia

Port of return: Darwin, Northern Territory, Australia

Responsible laboratory: CSIRO Marine and Atmospheric Research, Castray Esplanade, Hobart, TAS 7000 Australia

Chief Scientist(s) Chris Wilcox, CSIRO Marine and Atmospheric Research Division

Owned and operated by CSIRO on behalf of Australia’s Marine National Facility
Scientific Objectives

MARINE DEBRIS SURVEYS
(CHRISS WILCOX,CMAR)
We plan to address the following questions:
1. What is the density of marine debris in the oceanic regions around Australia?
2. What is the composition of marine debris in the regions sampled?
3. What fraction is anthropogenic in origin?

PLANKTON SURVEYS
(DAVE MCLEOD, CMAR)
To collect plankton using a CPR along a transect between Broome and Darwin to improve our understanding of plankton abundance and distribution in the north west area of Australia.

MEASUREMENTS OF NITROGEN FIXATION
(ERIC RAERS, UWA)
Collect physical and biological data using the ship’s conductivity – temperature – depth profiler from the surface and the oxygen minimum feature in the photic zone at stations between Broome and Darwin, particularly targeting eddies where possible.

Voyage Objectives

Voyage objectives will include surface sampling for marine debris using a manta trawl net and visual sampling from observation points on either side of the bridge.

While the ship is on the manta trawl stations, the CTD will be deployed to collect samples at the surface and at the oxygen minimum feature in the photic zone. The water budget for each depth is 30 litres. For manta trawl stations where the CTD is not deployed due to time constraints or other issues, surface samples will be taken from either the surface flow through in the wet lab or using a surface bucket.

The CPR will be deployed continuously between Fremantle and Darwin neuston net tows. The CPR can be deployed at cruising speed whenever suitable for the crew after departure and can be towed continuously for up to 500 nautical miles.

Results

The marine debris surveys reached a successful outcome, with 22 stations sampled over the 10 day voyage. Samples were sorted onboard, with visual identification of potential plastics in the sample. Potential plastic items were then removed from the sample and examined under a microscope for confirmation. Plastic samples from each trawl were independently kept, stored in labelled aluminium foil. The remainder of the trawl samples were put back overboard. Due to the favourable conditions there were 3 sample stations per day in the first portion of the voyage, spaced at 8 hour intervals, which reverted to 2 a day due to loss of science time with low steaming speeds. All sample stations had detectable levels of plastics, with materials ranging from large wrappers to small hard pieces of plastic.

The nitrogen fixation team measured diazathrophs in surface waters using the ships flow through system throughout the voyage. Mesocosms were established on deck to look at daytime and nighttime nitrogen fixation rates, with experiments run throughout the voyage. One CTD cast was taken with sampling at the surface and at the oxygen minimum zone to allow comparison of nitrogen fixation rates at the two depths. There were genetic samples of the microbial community collected by the nitrogen fixation team, which were to be processed at a later time. The team was pleased to find large surface aggregations of their target diazathrophs off the western portion of the Kimberley coastline. The phytoplankton team put the CPR in the water several hours out of Fremantle, and it remained in operation throughout the voyage, with the exception of several short interruptions for change of the silk in the machine. The phytoplankton samples will be processed and subsequently housed in a collection as part of the IMOS program in Australia.
Voyage Narrative
There were no significant equipment failures that affected the science on the transit voyage. There was a minor issue with the CTD winch which caused a slight delay due to the need to respool a portion of the cable. We had significant currents moving against the ship throughout the middle portion of the voyage, which caused some loss of science time. Due to the uncertainty in the amount of time that would ultimately be lost we elected to reduce the number of marine debris sampling stations from three per day (0600, 1400, 2200) to two (0800, 2000). We were able to maintain two sampling stations from that point until arrival in port in Darwin. Weather was largely fair, with minimal seas and little precipitation, allowing smooth operations for the science team and equipment. There was one CTD cast taken, sampling at two depths, at the oxygen minimum and at the surface.

Summary
The transit voyage was very successful. The primary science goal initially had been to collect marine debris samples at two stations each day over a 7 day voyage. Due to necessary repairs during the preceding voyage, the transit was extended to 11 days and sampling for the nitrogen fixation study to have happened on the preceding voyage was added. The flexibility of the ships management team, science team, and crew made the adaptation to the altered plans smooth, resulting in a very successful voyage with all three science teams achieving their sampling goals.
PRINCIPAL INVESTIGATORS

A. Marine Debris: Chris Wilcox, CSIRO Marine and Atmospheric Research, Hobart, TAS 7000, AU

B. Nitrogen Fixation: Eric Rees, University of Western Australia, Crawley, WA 6009, AU

C. Plankton: David McLeod, CSIRO Marine and Atmospheric Research, Hobart, TAS 7000, AU

A red “x” indicates where data was collected.
SUMMARY OF MEASUREMENTS AND SAMPLES TAKEN

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>PI</th>
<th>NO</th>
<th>UNITS</th>
<th>DATA TYPE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>22</td>
<td>Trawls</td>
<td>P01</td>
<td>3 x 0.75 kt manta net trawls at the surface. Only plastic materials recovered retained. No biological data collected.</td>
</tr>
<tr>
<td>2</td>
<td>B</td>
<td>48</td>
<td>Flow through water samples</td>
<td>B02, B71, B72, B08</td>
<td>Water volumes were measured for chlorophyll a and phytoplankton pigment composition, phytoplankton identification, particulate organic carbon and Nitrogen (PON/POC), δ18O</td>
</tr>
<tr>
<td>3</td>
<td>C</td>
<td>Full track</td>
<td>CPR tows</td>
<td>B08</td>
<td>Phytoplankton samples were taken</td>
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CURATION REPORT

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plastic samples retained by PI, no biological material retained. CSIRO Marine and Atmospheric Research. Preserved dry, no long term curation.</td>
</tr>
<tr>
<td>2</td>
<td>Samples retained by PI. University of Western Australia. No long term curation.</td>
</tr>
<tr>
<td>3</td>
<td>Samples retained by PI. Long term curation by IMOS. Contact PI for access. Preservation in formalin.</td>
</tr>
</tbody>
</table>

General ocean area(s): Indian Ocean, Timor Sea.
Activities were conducted along voyage track. No specific areas of focus.
### Scientific Participants

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Role</th>
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</thead>
<tbody>
<tr>
<td>Chris Wilcox</td>
<td>CMAR</td>
<td>Chief Scientist</td>
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<tr>
<td>Ray Cilia</td>
<td>Earthwatch</td>
<td>Marine debris team member</td>
</tr>
<tr>
<td>Peter Hoskin</td>
<td>Earthwatch</td>
<td>Marine debris team member</td>
</tr>
<tr>
<td>Rebecca Hall</td>
<td>Earthwatch</td>
<td>Marine debris team member</td>
</tr>
<tr>
<td>David McLeod</td>
<td>CMAR</td>
<td>Plankton Study Technician</td>
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<tr>
<td>Eric Raes</td>
<td>UWA</td>
<td>Nitrogen study team leader</td>
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<tr>
<td>Allison McInnes</td>
<td>UWA</td>
<td>Nitrogen study team member</td>
</tr>
<tr>
<td>Hannipoula Olsen</td>
<td>UWA/Texas Uni</td>
<td>Nitrogen study team member</td>
</tr>
<tr>
<td>Sascha Frydman</td>
<td>CMAR</td>
<td>MNF Voyage Manager</td>
</tr>
<tr>
<td>Karl Forcey</td>
<td>CMAR</td>
<td>MNF Electronics Support</td>
</tr>
<tr>
<td>Anoosh Sarraf</td>
<td>CMAR</td>
<td>MNF Computing Support</td>
</tr>
</tbody>
</table>

### Marine Crew

<table>
<thead>
<tr>
<th>Name</th>
<th>Role</th>
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</thead>
<tbody>
<tr>
<td>Mike Watson</td>
<td>Master</td>
</tr>
<tr>
<td>John Boyes</td>
<td>Chief Off</td>
</tr>
<tr>
<td>Simon Smeaton</td>
<td>2nd Off</td>
</tr>
<tr>
<td>Mike Yorke-Barber</td>
<td>Chief Eng</td>
</tr>
<tr>
<td>John Edwards</td>
<td>1st Eng</td>
</tr>
<tr>
<td>Bill Bourne</td>
<td>2nd Eng</td>
</tr>
<tr>
<td>Graham McDougall</td>
<td>CIR</td>
</tr>
<tr>
<td>Kel Lewis</td>
<td>IR</td>
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<tr>
<td>Jonathon Lumb</td>
<td>IR</td>
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<tr>
<td>Rod Langham</td>
<td>IR</td>
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<tr>
<td>Nathan Arahanga</td>
<td>IR</td>
</tr>
<tr>
<td>Darcy Chalker</td>
<td>Chief Steward</td>
</tr>
<tr>
<td>Brett Brooker</td>
<td>Chief Cook</td>
</tr>
<tr>
<td>Leon Evans</td>
<td>2nd Cook</td>
</tr>
</tbody>
</table>

**Chris Wilcox**  
*Chief Scientist*
CSR/ROSCOP PARAMETER CODES

M01 Upper air observations
M02 Incident radiation
M05 Occasional standard measurements
M06 Routine standard measurements
M71 Atmospheric chemistry
M90 Other meteorological measurements

PHYSICAL OCEANOGRAPHY

H71 Surface measurements underway (T,S)
H13 Bathythermograph
H09 Water bottle stations
H10 CTD stations
H11 Subsurface measurements underway (T,S)
H72 Thermistor chain
H16 Transparency (eg transmissometer)
H17 Optics (eg underwater light levels)
H73 Geochemical tracers (eg freons)
D01 Current meters
D71 Current profiler (eg ADCP)
D03 Currents measured from ship drift
D04 GEK
D05 Surface drifters/drifting buoys
D06 Neutrally buoyant floats
D09 Sea level (incl. Bottom pressure & inverted echosounder)
D72 Instrumented wave measurements
D90 Other physical oceanographic measurements

CHEMICAL OCEANOGRAPHY

H21 Oxygen
H74 Carbon dioxide
H33 Other dissolved gases
H22 Phosphate
H23 Total - P
H24 Nitrate
H25 Nitrite
H75 Total - N
H76 Ammonia
H26 Silicate
H27 Alkalinity
H28 PH
H30 Trace elements
H31 Radioactivity
H32 Isotopes
H90 Other chemical oceanographic measurements

MARINE CONTAMINANTS/POLLUTION

P01 Suspended matter
P02 Trace metals
P03 Petroleum residues
P04 Chlorinated hydrocarbons
P05 Other dissolved substances
P12 Bottom deposits
P13 Contaminants in organisms
P90 Other contaminant measurements

MARINE BIOLOGY

B01 Primary productivity
B02 Phytoplankton pigments (eg chlorophyll, fluorescence)
B03 Particulate organic matter (inc POC, PON)
B04 Dissolved organic matter (inc DOC)
B71 Biochemical measurements (eg lipids, amino acids)
B72 Sediment traps
B07 Pelagic bacteria/micro-organisms
B16 Benthic bacteria/micro-organisms
B17 Phytobenthos
B18 Zoobenthos
B25 Birds
B26 Mammals & reptiles
B14 Pelagic fish
B19 Demersal fish
B20 Molluscs
B21 Crustaceans
B28 Acoustic reflection on marine organisms
B37 Taggings
B64 Gear research
B65 Exploratory fishing
B90 Other biological/fisheries measurements

MARINE GEOLOGY/GEOPHYSICS

G01 Dredge
G02 Grab
G03 Core - rock
G04 Core - soft bottom
G08 Bottom photography
G71 In-situ seafloor measurement/sampling
G72 Geophysical measurements made at depth
G73 Single-beam echosounding
G74 Multi-beam echosounding
G24 Long/short range side scan sonar
G75 Single channel seismic reflection
G76 Multichannel seismic reflection
G26 Seismic refraction
G27 Gravity measurements
G28 Magnetic measurements
G90 Other geological/geophysical measurements