Australia's Marine National Facility

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

CSIRO

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Scientific Objectives

MARINE DEBRIS SURVEYS (CHRIS 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 RAES, 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.

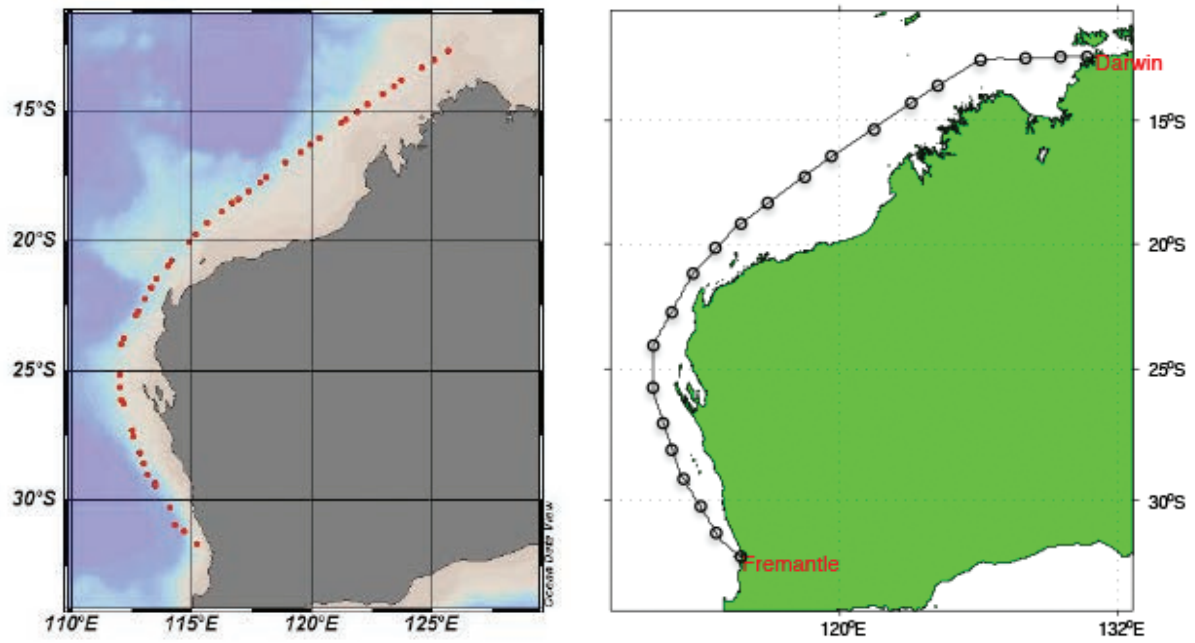
While the ship is on the manta trawl stations, the CTD will be deploy to collect samples at the surface and at the oxygen minimum feature in the photic zone. The water budget for each depth is 30 litres. For manta trawl stations where the CTD is not deployed due to time constraints or other issues, surface 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 diazathrophsdiazothrophs 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.



Nitrogen fixation sampling stations (left) and debris sampling locations (right) along cruise track.

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 preceeding voyage, the transit was extended to 11 days and sampling for the nitrogen fixation study to have happened on the preceeding 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.

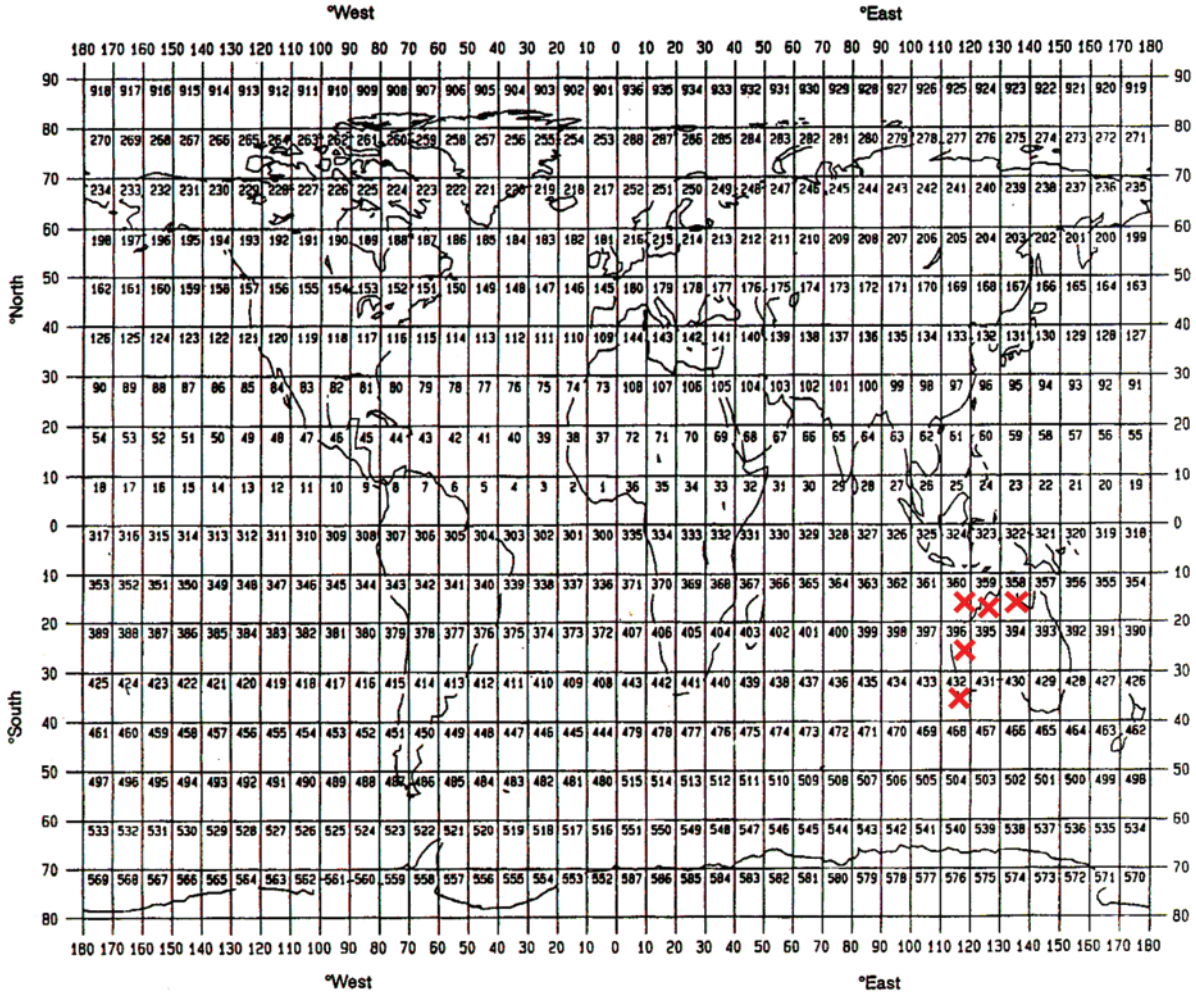
PRINCIPAL INVESTIGATORS

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.

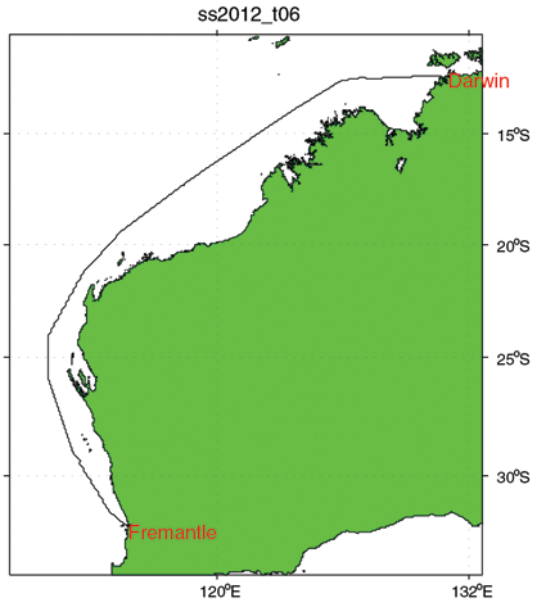


SUMMARY OF MEASUREMENTS AND SAMPLES TAKEN

ITEM NO.	PI	NO	UNITS	DATA TYPE	DESCRIPTION
1	A	22	Trawls	P01	3 x 0.75 kt manta net trawls at the surface. Only plastic materials recovered retained. No biological data collected.
2	B	48	Flow through water saples	B02, B71, B72, B08	Water volumes were measured for chlorophyll a and phytoplankton pigment composition, phytoplankton identification, particulate organic carbon and Nitrogen (PON/POC), δO18
3	C	Full track	CPR tows	B08	Phytoplankton samples were taken

CURATION REPORT

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



General ocean area(s):
Indian Ocean, Timor Sea.

Activities were conducted along voyage track. No specific areas of focus.

PERSONNEL LIST

Scientific Participants

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

Marine Crew

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

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
B01	Primary productivity
B02	Phytoplankton pigments (eg chlorophyll, fluorescence)
B71	Particulate organic matter (inc POC, PON)
B06	Dissolved organic matter (inc DOC)
B72	Biochemical measurements (eg lipids, amino acids)
B73	Sediment traps
B08	Phytoplankton
B09	Zooplankton
B03	Seston
B10	Neuston
B11	Nekton
B13	Eggs & larvae
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