AMT19 Cruise Report

RRS James Cook JC039

(13 October – 1 December 2009)

Principal Scientist: Andy Rees
Plymouth Marine Laboratory

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Oceans 2025

National Oceanography Centre
NATURAL ENVIRONMENT RESEARCH COUNCIL

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Scientific personnel

Andy Rees
PSO
Plymouth Marine Laboratory

Plymouth Marine Laboratory

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OVOCs

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OVOCs

Chris Galliene
Optics/zooplankton

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Nutrients

Stephanie Sargeant
OVOCs

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P:R

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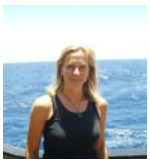
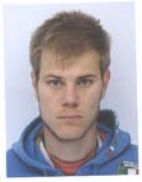
Flow cytometry



Claire Widdecombe
Primary production



Neil Wyatt
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National Oceanography Centre, Southampton

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NMF-SS

Manuela Hartmann
Algal mixotrophy

Sian Herrington
DOP turnover

Ross Holland
Flow cytometry

Dougal Mountifield
NMF-SS

Stuart Painter
Physical oceanography

Paul Provost
NMF-SS (TLO)

Sophie Richier
Metabolic proteins

Libby Ross
SHRIMP/physical oceanography

Neil Sloan
NMF-SS

Mike Zubkov
Microbial activity

University of Warwick

Carolina Grob
Croup specific C fixation

Martin Ostrowski
Picocyanobacteria

Bigelow Laboratory for Ocean Sciences

Emily Lysczkowski
Coccolithophore RS

University of Phillipines

Charissa Ferrera
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University of Washington

Kevin Tempest
Noble gases

Oregon State University

Giorgio Dall'Olmo
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University of Brest

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Cocco biogeography

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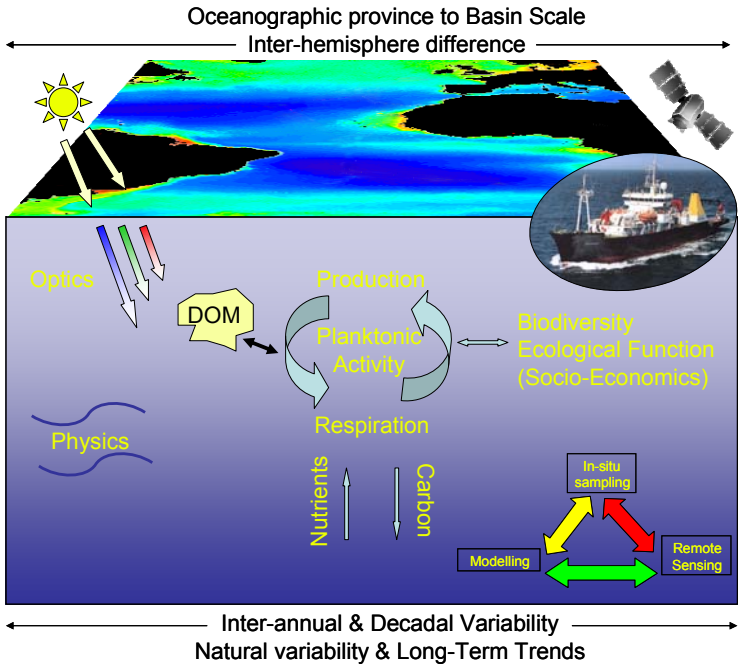
The Atlantic Meridional Transect programme

The Atlantic Meridional Transect – AMT (www.pml.ac.uk/amt) is a multidisciplinary programme which undertakes biological, chemical and physical oceanographic research during an annual voyage between the UK and destinations in the South Atlantic - previously the Falkland Islands and South Africa, and for this cruise Punta Arenas Chile. This transect crosses a range of ecosystems from sub-polar to tropical and from euphotic shelf seas and upwelling systems to oligotrophic mid-ocean gyres.

The programme was established in 1995 and this was the 19th in the series of research cruises which have involved over 200 scientists from 11 countries. AMT has proved to be a long-term multidisciplinary ocean observation programme, which is a platform for national and international scientific collaboration, a training arena for the next generation of oceanographers and an ideal facility for validation of novel technology. AMT continues to contribute to science and policy development including the social and economic understanding of the marine environment and services it delivers.

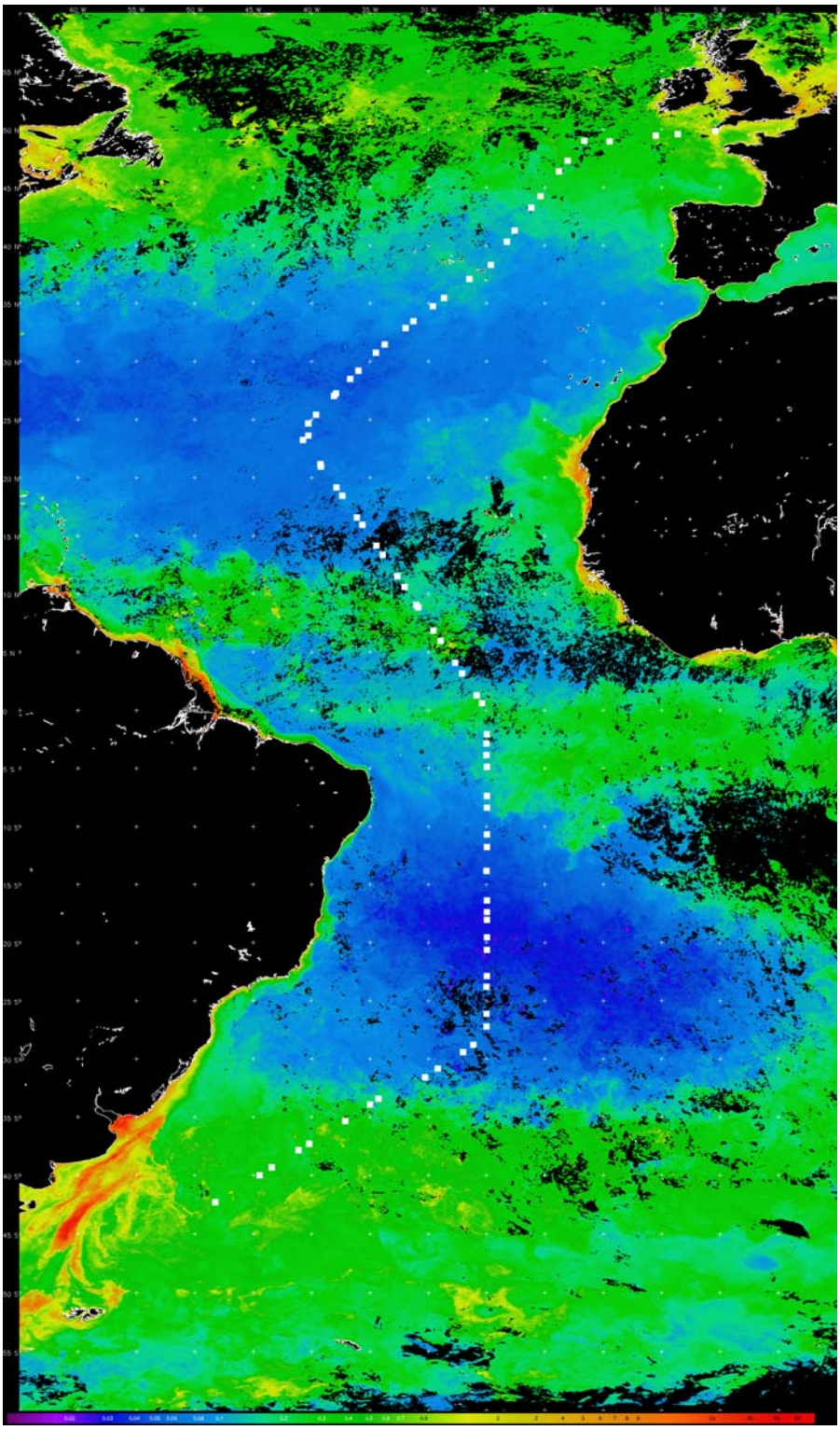
The main deliverable of AMT is an unique time series (1995-2012) of spatially extensive and internally consistent observations on the structure and biogeochemical properties of planktonic ecosystems in the Atlantic Ocean that are required to validate models addressing questions related to the global carbon cycle. Data sets include:

- Vertical CTD profiles and continuous underway data
- Optical characteristics of the water column
- Biogeochemical measurements on water samples including nutrients, pigments, dissolved gases and particulate carbon and nitrogen
- Primary, new production and respiration measurements



Data sets from 1995-2005 are publicly available, with CTD profiles and underway surface time series available online at: www.bodc.ac.uk/projects/uk/amt/ The remaining AMT data sets are available on request to BODC. The Oceans 2025 data policy has been designed to make the data from 2007 onwards available to the Oceans 2025 community 1 year after a cruise and then, after 2 years t the wider scientific community.

AMT19 cruise track



Cruise timetable of events JC039 / JC040

R.V. JAMES COOK

Date	Time (UT)	Event
11/10/09	0830	Author of following report joins vessel in Falmouth Mobilisation for Cruise JC039 already underway
12/10/09	0800	Mobilisation continues
	1330-1500	Familiarisation of Scientists and signing them on
13/10/09	0800	Day begins – preparations to sail
	0930-1000	Emergency and Lifeboat Musters and lectures
	1140	Pilot on board
	1208	All gone and clear of berth
	1231	Pilot disembarks off breakwater
	1254	FULL AWAY on passage 50 04.6N 005 00.9 W
	1315	a/c to 201˚ T Manacles bore 295˚ T x 2.70M
	1348	a/c to 245˚ T Black Head bore 336˚ T x 4.10M
	1430-1500	Cruise Planning Meeting underway
	1530-1624	**Event 1** **039 / 001 CTD (STS) 1 cast outboard 49 49.96 N 005 27.41 W**
	1624-58	Trace metal Fish being deployed.
	1658	Resumed course and speed.
	1830	a/c to 270˚ T 49 42.6N 005 52.6 W
	2050	a/c to 265˚ T 49 43.2N 006 33.9 W
14/10/09	0000	Position Latitude 49 39.7 N Longitude 007 26.1 W
	0434-0524	**Event 2** **039 / 002 CTD (STS) 2 cast outboard 49 34.02 N 008 38.01 W**
	0442-56	**Event 3** **039 / 002 Plankton net 1 cast outboard**
	0524	Resumed course and speed
	1239	Hove To on **Station 039 / 003**
	1243-1325	**Event 4** **039 / 003 CTD (STS) 3 cast to 130 m 49 26.0 N 010 32.0 W**
	1247-1302	**Event 5** **039 / 003 OPTICS rig 1 cast outboard**
	1328	Station complete – set course 260˚ T @ full speed
	1700	Position Latitude 49 18.7 N Longitude 011 27.2 W
15/10/09	0100	Position Latitude 49 03.6 N Longitude 013 34.6 W
	0430	Hove To on **Station 039 / 004**
	0439-0544	**Event 6** **039 / 004 CTD (STS) 4 cast to 500m 48 56.91 N 014 27.59 W**
	0444-0550	**Event 7** **039 / 004 Plankton net 2 (0444) & 3 (0505) cast outboard**
	0623-57	**Event 8** **039 / 004 CTD (STS) 5 cast to 100m 48 56.91 N 014 27.59 W**
	0827-42	**Event 9** **039 / 004 CTD (Ti) 6 cast outboard 48 56.91 N 014 27.59 W**
	0857-1338	Deep Tow weight cast to 4000 metres for testing traction winch inserts
	1414-45	**Event 10** **039 / 005 OPTICS rig 2 cast outboard 48 56.91 N 014 27.59 W**
	1450	Station complete – set course 273˚ T @ best speed.
16/10/09	0132	Hove to on SHRIMP site – awaiting repairs to termination
	0435-0513	**Event 11** **039 / 006 CTD (Ti) 7 cast outboard 49 00.19 N 016 39.89 W**
	0439-0507	**Event 12** **039 / 006 Plankton net 4 cast outboard**
	0538-0640	**Event 13**

		039 / 006 CTD (STS) 8 cast outboard 49 00.21 N 016 39.88 W
	0940-1040	**Event 14**
		039 / 006 CTD (STS) 9 cast outboard 49 00.32 N 016 39.78 W
	1337-1413	**Event 15**
		039 / 006 OPTICS rig 3 cast o/b 49 00.00 N 016 40.00 W
	1419-54	**Event 16**
		039 / 006 OPTICS rig 4 cast o/b 49 00.00 N 016 40.00 W
	1530-1606	Remain hove to on SHRIMP site – still awaiting repairs to termination
	1606	Repairs unsuccessful – Set course 208˚ T @ full speed
17/10/09	0429	Hove To on **Station 039 / 007 -** moving SHRIMP out of the way.
	0459-0536	**Event 17**
		039 / 007 CTD (Ti) 10 cast o/b 47 17.22 N 018 02.51 W
	0503-24	**Event 18**
		039 / 007 Plankton net 5 cast outboard
	0556-0650	**Event 19**
		039 / 007 CTD (STS) 11 cast o/b 47 17.22 N 018 02.51 W
	0602-18	**Event 20**
		039 / 007 Plankton net 6 cast outboard
	0654	Station complete – set course 208˚ T @ best speed
	1332	Hove To on **Station 039 / 008**
	1340-1445	**Event 21**
		039 / 008 CTD (Ti) 12 cast to 500m 46 20.3 N 018 48.1 W
	1341-1409	**Event 22**
		039 / 008 OPTICS rig 5 cast outboard
	1412-43	**Event 23**
		039 / 008 OPTICS rig 6 cast outboard
	1451	Station complete – set course 208˚ T @ best speed
18/10/09	0430	Hove To on **Station 039 / 009**
	0440-0511	**Event 24**
		039 / 009 CTD (Ti) 13 cast o/b 44 14.5 N 020 24.1 W
	0446-0502	**Event 25**
		039 / 009 Plankton net 7 cast outboard
	0540-0626	**Event 26**
		039 / 009 CTD (STS) 14 cast o/b 44 14.7 N 020 24.2 W
	0542-0607	**Event 27**
		039 / 009 Plankton net 8 cast outboard
	0630	Station complete – set course 208˚ T @ best speed
	1331	Hove To on **Station 039 / 010**
	1342-1412	**Event 28**
		039 / 010 OPTICS rig 7 cast outboard 43 12.9 N 021 10.5 W
	1347-1434	**Event 29**
		039 / 010 CTD (Ti) 15 cast to 500m
	1414-39	**Event 30**
		039 / 010 OPTICS rig 8 cast outboard 43 12.9 N 021 10.5 W
	1459-1517	**Event 31**
		039 / 010 11m Long Plankton Net 1 cast outboard
	1530	Station complete – set course 208˚ T @ best speed
19/10/09	0427	Hove To on **Station 039 / 011**
	0444-0524	**Event 32**
		039 / 011 CTD (Ti) 16 cast o/b 41 15.23 N 022 36.25 W
	0448-0504	**Event 33**
		039 / 011 Plankton net 9 cast outboard
	0549-0642	**Event 34**
		039 / 011 CTD (STS) 17 cast o/b 41 15.14 N 022 36.18 W
	0553-0613	**Event 35**
		039 / 011 Plankton net 10 cast outboard
	0650	Station complete – set course 208˚ T @ best speed
	1330	Hove To on **Station 039 / 012**
	1333-1417	**Event 36**

		039 / 012 CTD (Ti) 18 cast to 500m 40 19.4 N 023 16.3 W
	1334-1404	**Event 37**
		039 / 012 OPTICS rig 9 cast outboard
	1408-36	**Event 38**
		039 / 012 OPTICS rig 10 cast outboard
	1439	Station complete – set course 208˚ T @ best speed
20/10/09	0431	Hove To on **Station 039 / 013**
	0438-0522	**Event 39**
		039 / 013 CTD (Ti) 19 cast o/b 38 19.25 N 024 39.93 W
	0447-0502	**Event 40**
		039 / 013 Plankton net 11 cast outboard
	0544-0637	**Event 41**
		039 / 013 CTD (STS) 20 cast o/b 38 19.01 N 024 40.23 W
	0549-0614	**Event 42**
		039 / 013 Plankton net 12 cast outboard
	0642	Station complete – set course 208˚ T @ best speed
	1027	a/c to 236˚ T 37 46.0N 025 03.0 W
	1100	a/c to 260˚ T 37 42.5N 025 09.2 W
	1330	Arrival off Ponta Delgada Port entrance
	1331-1400	Engaged in boat transfer – embarked James Cooper
	1400	Vessel stopped - Commenced repairing deep Tow termination
		Repairs carry on throughout rest of day and night
21/10/09	0645-0718	Vessel engaged in boat transfer – disembarks James Cooper
	0718	Set course 227˚ T @ best speed
	1300	Hove To on **Station 039 / 014**
	1305-32	**Event 43**
		039 / 014 OPTICS rig 11 cast outboard 37 06.1 N 026 29.3 W
	1307-1400	**Event 44**
		039 / 014 CTD (Ti) 21 cast to 500m
	1336-1404	**Event 45**
		039 / 014 OPTICS rig 12 cast outboard
	1414-37	**Event 46**
		039 / 014 11m Long Plankton Net 2 cast outboard
	1438-53	TMS Fish entangled with longline – recovery and disentangle
	1453-1501	TMS Fish re-deployed
	1501	Set course 227˚ T @ best speed
22/10/09	0000	Position Latitude 36 05.3 N Longitude 027 49.6 W
	0200	Clocks retarded I hour to UT-1
	0530	Hove To on **Station 039 / 015**
	0536-0617	**Event 47**
		039 / 015 CTD (Ti) 22 cast o/b 35 27.29 N 028 38.73 W
	0539-0555	**Event 48**
		039 / 015 Plankton net 13 cast outboard
	0638-0729	**Event 49**
		039 / 015 CTD (STS) 23 cast o/b 35 26.98 N 028 38.74 W
	0643-0705	**Event 50**
		039 / 015 Plankton net 14 cast outboard
	0733-48	**Event 51**
		039 / 015 Trichinet 01 cast outboard 35 26.54 N 028 38.75 W
	0750	Station complete – set course 227˚ T @ best speed
	0930-1200	Seismic compressor run up and tested whilst underway
	1357	Hove To on **Station 039 / 016**
	1359-1456	**Event 52**
		039 / 016 CTD (Ti) 24 cast to 500m 34 43.4 N 029 35.3 W
	1400-24	**Event 53**
		039 / 016 OPTICS rig 13 cast outboard
	1428-51	**Event 54**
		039 / 016 OPTICS rig 14 cast outboard
	1458-1514	**Event 55**

		039 / 016 11m Long Plankton Net 3 cast outboard
	1525	Set course 227˚ T @ best speed
	1900	Reduced Speed to 9 knots
		Finding it difficult to maintain 9 knots throughout due to inclement weather
23/10/09	0530	Hove To on **Station 039 / 017**
	0539-0621	**Event 56**
		039 / 017 CTD (Ti) 25 cast o/b 33 25.19 N 031 15.37 W
	0542-57	**Event 57**
		039 / 015 Plankton net 15 cast outboard
	0557	**NET LOST – Rope Parted in heavy swell conditions**
	0641-0728	**Event 58**
		039 / 017 CTD (STS) 26 cast o/b 33 25.15 N 031 15.00 W
	0736	Station complete – set course 227˚ T @ 9 knots
	1358	Hove To on **Station 039 / 018**
	1402-1513	**Event 59**
		039 / 018 CTD (Ti) 27 cast to 500m 32 52.2 N 031 56.7 W
	1444-1515	**Event 60**
		039 / 018 OPTICS rig 15 cast outboard
	1520	Station complete – set course 227˚ T @ 9 knots
24/10/09	0529	Hove To on **Station 039 / 019**
	0537-0613	**Event 61**
		039 / 019 CTD (Ti) 28 cast o/b 31 25.70 N 033 44.19 W
	0542-53	**Event 62**
		039 / 019 Plankton net 16 cast outboard
	0630-0714	**Event 63**
		039 / 019 CTD (STS) 29 cast o/b 31 25.76 N 033 44.25 W
	0635-0700	**Event 64**
		039 / 019 Plankton net 17 cast outboard
	0717-32	**Event 65**
		039 / 019 Trichinet 02 cast outboard 31 25.92 N 033 44.38 W
	0732	Station complete – set course 227˚ T @ 9 knots
	1008	a/c to 220˚ T 31 15.1N 033 56.9 W
	1356	Hove To on **Station 039 / 020**
	1358-1424	**Event 66**
		039 / 020 OPTICS rig 16 cast outboard 30 44.7 N 034 29.0 W
	1359-1458	**Event 67**
		039 / 020 CTD (Ti) 30 cast to 500m
	1428-53	**Event 68**
		039 / 020 OPTICS rig 17 cast outboard
	1500-13	**Event 69**
		039 / 20 Trichinet 03 cast outboard
	1522-40	**Event 70**
		039 / 020 11m Long Plankton Net 4 cast outboard
	1552	Station complete – set course 220˚ T @ 9 knots
25/10/09	0529	Hove To on **Station 039 / 021**
	0533-0612	**Event 71**
		039 / 021 CTD (Ti) 31 cast o/b 29 11.13 N 035 59.35 W
	0538-49	**Event 72**
		039 / 021 Plankton net 18 cast outboard
	0635-0730	**Event 73**
		039 / 021 CTD (STS) 32 cast o/b 29 10.83 N 035 58.98 W
	0639-57	**Event 74**
		039 / 021 Plankton net 19 cast outboard
	0736	Station complete – set course 227˚ T @ 9 knots
	1357	Hove To on **Station 039 / 022**
	1359-1425	**Event 75**
		039 / 022 OPTICS rig 18 cast outboard 28 28.7 N 036 40.8 W
	1400-1500	**Event 76**
		039 / 022 CTD (Ti) 33 cast to 500m

	1430-52	**Event 77**
		039 / 022 OPTICS rig 19 cast outboard
	1500-12	**Event 78**
		039 / 22 Trichnet 04 cast outboard
	1520-37	**Event 79**
		039 / 022 11m Long Plankton Net 5 cast outboard
	1548	Station complete – set course 220˚ T @ 9 knots
26/10/09	0310	Hove To on **Station 039 / 023 (selected SHRIMP site)**
	0534-0612	**Event 80**
		039 / 023 CTD (Ti) 34 cast o/b 27 13.00 N 037 53.01 W
	0537-49	**Event 81**
		039 / 023 Plankton net 20 cast outboard
	0627-0718	**Event 82**
		039 / 023 CTD (STS) 35 cast o/b 27 12.91 N 037 53.23 W
	0632-52	**Event 83**
		039 / 023 Plankton net 21 cast outboard
	0718	Relocating to SHRIMP deployment position
	0742	On SHRIMP deployment position – awaiting deployment
	0828-0952	**Event 84**
		039 / 023 SHRIMP cast o/b – FAILED 27 13.00 N 037 53.00 W
	0952-1013	Inboard for assessment and repairs
	1013-1132	**Event 85**
		039 / 023 SHRIMP cast o/b – FAILED 27 13.00 N 037 53.00 W
	1132-53	Inboard for assessment and eventual abandonment
	1153	Station complete – set course 220˚ T @ 9 knots
	1357	Hove To on **Station 039 / 024**
	1359-1423	**Event 86**
		039 / 024 OPTICS rig 20 cast outboard 27 01.4 N 038 03.2 W
	1400-53	**Event 87**
		039 / 024 CTD (Ti) 36 cast to 500m
	1426-53	**Event 88**
		039 / 024 OPTICS rig 21 cast outboard
	1454-1505	**Event 89**
		039 / 24 Trichnet 05 cast outboard
	1508	Station complete – set course 220˚ T @ 9 knots
27/10/09	0528	Hove To on **Station 039 / 025**
	0536-0614	**Event 90**
		039 / 025 CTD (Ti) 37 cast o/b 25 23.50 N 039 36.07 W
	0540-51	**Event 91**
		039 / 025 Plankton net 22 cast outboard
	0632-0721	**Event 92**
		039 / 025 CTD (STS) 38 cast o/b 25 23.47 N 039 36.25 W
	0635-53	**Event 93**
		039 / 025 Plankton net 23 cast outboard
	0728	Station complete – set course 220˚ T @ 9 knots
	1358	Hove To on **Station 039 / 026**
	1400-26	**Event 94**
		039 / 026 OPTICS rig 22 cast outboard 24 39.1 N 040 17.0 W
	1401-1500	**Event 95**
		039 / 026 CTD (Ti) 39 cast to 500m
	1429-51	**Event 96**
		039 / 026 OPTICS rig 23 cast outboard
	1502-14	**Event 97**
		039 / 26 Trichnet 06 cast outboard
	1521-37	**Event 98**
		039 / 026 11m Long Plankton Net 6 cast outboard
	1549	Station complete – set course 220˚ T @ 9 knots
	2337	**a/c to 147˚ T 23 45.8N 041 05.7 W**
28/10/09	0356	Hove To on **Station 039 / 027**

	0408-0505	**Event 99** **039 / 027 Turbulence Profiler 01 cast o/b 23 13.7 N 040 43.1 W** Profiler recovered and deployed - having problems.
	0526-40	**Event 100 & 101** **039 / 027 Drifter (5988) 01 launched 23 12.9N 040 43.0W**
	0630-0708	**Event 102** **039 / 027 CTD (Ti) 40 cast o/b 23 13.26 N 040 43.08 W**
	0634-48	**Event 103** **039 / 027 Plankton net 24 cast outboard**
	0729-0819	**Event 104** **039 / 027 CTD (STS) 41 cast o/b 23 13.52 N 040 43.17 W**
	0734-53	**Event 105** **039 / 027 Plankton net 25 cast outboard**
	0846	**Drifter 01 recovered**
	0846	Station complete – set course 147˚ T @ 9 knots
	1402	Hove To on **Station 039 / 028**
	1410	CTD Casts aborted due to CTD cable foul in winch room
	1412-34	**Event 106** **039 / 028 OPTICS rig 24 cast outboard 23 35.9 N 040 16.5 W**
	1436-1501	**Event 107** **039 / 028 OPTICS rig 25 cast outboard**
	1504-15	**Event 108** **039 / 28 Trichnet 07 cast outboard**
	1523-33	**Event 109** **039 / 028 11m Long Plankton Net 7 cast outboard**
	1544	Station complete – set course 147˚ T @ 9 knots
29/10/09	0359	Hove To on **Station 039 / 029**
	0407-58	**Event 110** **039 / 029 Turbulence Profiler 02 cast o/b 21 08.0 N 039 14.6 W**
	0515-17	**Event 111** **039 / 029 Drifter (2880) 02 launched 21 07.68N 039 14.42W**
	0600-08	**Event 112** **039 / 029 CTD (Ti) surface 01 cast o/b 21 08.01 N 039 14.52 W**
	0620-0703	**Event 113** **039 / 029 CTD (Ti) 42 cast o/b 21 08.01 N 039 14.52 W**
	0625-38	**Event 114** **039 / 029 Plankton net 26 cast outboard**
	0727-0804	**Event 115** **039 / 029 CTD (Ti) 43 cast o/b 21 07.91 N 039 14.92 W**
	0731-54	**Event 116** **039 / 029 Plankton net 27 cast outboard**
	0807-21	**Event 117** **039 / 29 Trichnet 08 cast outboard**
	0902-07	**Event 118** **039 / 029 CTD (Ti) surface 02 cast o/b 21 07.58 N 039 15.22 W**
	1001-07	**Event 119** **039 / 029 CTD (Ti) surface 03 cast o/b 21 07.26 N 039 15.53 W**
	1056-1109	**Event 120** **039 / 029 Plankton net 28 cast outboard**
	1058-1105	**Event 121** **039 / 029 CTD (Ti) surface 04 cast o/b 21 07.20 N 039 15.87 W**
	1116-27	**Event 122** **039 / 29 Trichnet 09 cast outboard**
	1155-1203	**Event 123** **039 / 029 CTD (Ti) surface 05 cast o/b 21 07.20 N 039 15.77 W**
	1257-1303	**Event 124** **039 / 029 CTD (Ti) surface 06 cast o/b 21 07.20 N 039 16.10 W**
	1357-1403	**Event 125** **039 / 029 CTD (Ti) surface 07 cast o/b 21 07.20 N 039 16.10 W**
	1358-1420	**Event 126** **039 / 029 OPTICS rig 26 cast outboard**

	1421-1503	**Event 127** **039 / 029 CTD (Ti) 44 cast o/b 21 07.20 N 039 16.10 W**
	1423-47	**Event 128** **039 / 029 OPTICS rig 27 cast outboard**
	1502-12	**Event 129** **039 / 29 Trichnet 10 cast outboard**
	1520-33	**Event 130** **039 / 029 11m Long Plankton Net 8 cast outboard**
	1600-07	**Event 131** **039 / 029 CTD (Ti) surface 08 cast o/b 21 07.30 N 039 16.10 W**
	1658-1706	**Event 132** **039 / 029 CTD (Ti) surface 09 cast o/b 21 07.20 N 039 16.80 W**
	1800-06	**Event 133** **039 / 029 CTD (Ti) surface 10 cast o/b 21 07.25 N 039 17.47 W**
	1801-14	**Event 134** **039 / 029 Plankton net 29 cast outboard**
	1820-33	**Event 135** **039 / 29 Trichnet 11 cast outboard**
	1914-2007	**Event 136** **039 / 029 CTD (Ti) 45 cast o/b 21 07.24 N 039 17.58 W**
	2007-2304	Manoeuvring away for grey water tank dump – then returning to site
	2304-18	**Event 137** **039 / 029 Plankton net 30 cast outboard**
	2305-10	**Event 138** **039 / 029 CTD (Ti) surface 11 cast o/b 21 07.45 N 039 18.55 W**
	2324-39	**Event 139** **039 / 29 Trichnet 12 cast outboard**
30/10/09	0159-0205	**Event 140** **039 / 029 CTD (Ti) surface 12 cast o/b 21 08.00 N 039 18.40 W**
	0500-08	**Event 141** **039 / 029 CTD (Ti) surface 13 cast o/b 21 08.00 N 039 18.40 W**
	0601-05	**Event 142** **039 / 029 CTD (Ti) surface 14 cast o/b 21 07.95 N 039 18.42 W**
	0618-33	**Event 143** **039 / 029 Plankton net 31 cast outboard**
	0629-0703	**Event 144** **039 / 029 CTD (Ti) 46 cast o/b 21 07.95 N 039 18.43 W**
	0638-52	**Event 145** **039 / 029 Plankton net 32 cast outboard**
	0709-23	**Event 146** **039 / 29 Trichnet 13 cast outboard**
	0736-0806	**Event 147** **039 / 029 CTD (Ti) 47 cast o/b 21 07.62 N 039 19.00 W**
	0901-04	**Event 148** **039 / 029 CTD (Ti) surface 15 cast o/b 21 07.42 N 039 19.00 W**
	1000-04	**Event 149** **039 / 029 CTD (Ti) surface 16 cast o/b 21 07.42 N 039 19.00 W**
	1101-05	**Event 150** **039 / 029 CTD (Ti) surface 17 cast o/b 21 07.36 N 039 19.04 W**
	1159-1203	**Event 151** **039 / 029 CTD (Ti) surface 18 cast o/b 21 07.26 N 039 19.18 W**
	1205-15	**Drifter (2880) 02 recovered**
	1215	Station complete – set course 147˚ T @ 9 knots
	1359	Hove To on **Station 039 / 030**
	1400-23	**Event 152** **039 / 030 OPTICS rig 28 cast outboard 20 56.2 N 039 10.0 W**
	1401-51	**Event 153** **039 / 030 CTD (Ti) 48 cast to 500m**
	1426-45	**Event 154** **039 / 030 OPTICS rig 29 cast outboard**
	1452-1504	**Event 155**

		039 / 030 Trichnet 14 cast outboard
	1510-22	**Event 156**
		039 / 030 11m Long Plankton Net 9 cast outboard
	1532	Station complete – set course 147˚ T @ 9 knots
	1715-45	Emergency fire drill
31/10/09	0600	Hove To on **Station 039 / 031**
	0602-38	**Event 157**
		039 / 031 CTD (Ti) 49 cast o/b 19 08.64 N 037 51.83 W
	0607-22	**Event 158**
		039 / 031 Plankton net 33 cast outboard
	0658-0748	**Event 159**
		039 / 031 CTD (STS) 50 cast o/b 19 08.64 N 037 51.83 W
	0702-20	**Event 160**
		039 / 031 Plankton net 34 cast outboard
	0756	Station complete – set course 147˚ T @ 9 knots
	1355	Hove To on **Station 039 / 032**
	1357-1418	**Event 161**
		039 / 032 OPTICS rig 30 cast outboard 18 25.1 N 037 21.6 W
	1400-49	**Event 162**
		039 / 032 CTD (Ti) 51 cast to 500m
	1422-51	**Event 163**
		039 / 032 OPTICS rig 31 cast outboard
	1454-1507	**Event 164**
		039 / 032 Trichnet 15 cast outboard
	1515-29	**Event 165**
		039 / 032 11m Long Plankton Net 10 cast outboard
	1538	Station complete – set course 147˚ T @ 9 knots
01/11/09	0628	Hove To on **Station 039 / 033**
	0641-0719	**Event 166**
		039 / 033 CTD (Ti) 52 cast o/b 16 34.14 N 036 05.86 W
	0644-58	**Event 167**
		039 / 033 Plankton net 35 cast outboard
	0737-0828	**Event 168**
		039 / 033 CTD (STS) 53 cast o/b 16 34.36 N 036 05.90 W
	0744-0805	**Event 169**
		039 / 033 Plankton net 36 cast outboard
	0830	Station complete – set course 147˚ T @ 9 knots
	1357	Hove To on **Station 039 / 034**
	1359-1419	**Event 170**
		039 / 034 OPTICS rig 32 cast outboard 15 55.5 N 035 39.7 W
	1400-54	**Event 171**
		039 / 034 CTD (Ti) 54 cast to 500m
	1423-45	**Event 172**
		039 / 034 OPTICS rig 33 cast outboard
	1455-1509	**Event 173**
		039 / 034 Trichnet 16 cast outboard
	1512	Station complete – set course 147˚ T @ best speed
02/11/09	0529	Hove To on **Station 039 / 035**
	0533-0603	**Event 174**
		039 / 035 CTD (Ti) 55 cast o/b 14 09.18 N 034 27.41 W
	0542-55	**Event 175**
		039 / 035 Plankton net 37 cast outboard
	0620-0708	**Event 176**
		039 / 035 CTD (STS) 56 cast o/b 14 09.39 N 034 27.44 W
	0624-45	**Event 177**
		039 / 035 Plankton net 38 cast outboard
	0718	Station complete – set course 147˚ T @ Best Speed
	1356	Hove To on **Station 039 / 036**
	1358-1423	**Event 178**

		039 / 036 OPTICS rig 34 cast outboard 13 20.9 N 033 54.9 W
	1401-54	**Event 179**
		039 / 036 CTD (Ti) 57 cast to 500m
	1427-51	**Event 180**
		039 / 036 OPTICS rig 35 cast outboard
	1456-1509	**Event 181**
		039 / 036 Trichnet 17 cast outboard
	1509-17	Recovering Trace Metal Fish – too many bubbles
	1517	Station complete – set course 147˚ T @ best speed
03/11/09	0528	Hove To on **Station 039 / 037**
	0539-0609	**Event 182**
		039 / 037 CTD (Ti) 58 cast o/b 11 27.96 N 032 38.75 W
	0542-58	**Event 183**
		039 / 037 Plankton net 39 cast outboard
	0625-0709	**Event 184**
		039 / 037 CTD (STS) 59 cast o/b 11 28.09 N 032 38.83 W
	0627-46	**Event 185**
		039 / 037 Plankton net 40 cast outboard
	0718	Station complete – set course 147˚ T @ Best Speed
	1357	Hove To on **Station 039 / 038**
	1359-1417	**Event 186**
		039 / 038 OPTICS rig 36 cast outboard 10 33.8 N 032 02.4 W
	1400-55	**Event 187**
		039 / 038 CTD (Ti) 60 cast to 500m
	1420-38	**Event 188**
		039 / 038 OPTICS rig 37 cast outboard
	1456-1509	**Event 189**
		039 / 038 Trichnet 18 cast outboard
	1518-31	**Event 190**
		039 / 038 11m Long Plankton Net 11 cast outboard
	1542	Station complete – set course 147˚ T @ best speed
04/11/09	0300	Hove To on **Station 039 / 039 – EVENT 191**
	0338	**SHRIMP (01) cast outboard 09 00.90N 031 00.60W**
	0648	SHRIMP 01 cast to 5378 metres 09 00.89N 031 00.59W
	0948	Commenced recovery of SHRIMP 01 09 02.45N 031 00.59W
	1200	SHRIMP 01 inboard - set course 147˚ T @ best speed
	1359	Hove To on **Station 039 / 040**
	1401-22	**Event 192**
		039 / 040 OPTICS rig 38 cast outboard 08 48.3 N 030 52.0 W
	1402-55	**Event 193**
		039 / 040 CTD (Ti) 61 cast to 500m
	1425-46	**Event 194**
		039 / 040 OPTICS rig 39 cast outboard
	1456-1509	**Event 195**
		039 / 040 Trichnet 19 cast outboard
	1512	Station complete – set course 147˚ T @ best speed
05/11/09	0529	Hove To on **Station 039 / 041**
	0537-0611	**Event 196**
		039 / 041 CTD (STS) 62 cast o/b 06 49.90 N 029 32.80 W
	0542-56	**Event 197**
		039 / 041 Plankton net 41 cast outboard
	0629-0709	**Event 198**
		039 / 041 CTD (Ti) 63 cast o/b 06 50.34 N 029 32.64 W
	0632-47	**Event 199**
		039 / 041 Plankton net 42 cast outboard
	0719	Station complete – set course 147˚ T @ Best Speed
	1358	Hove To on **Station 039 / 042**
	1400-24	**Event 200**
		039 / 042 OPTICS rig 40 cast outboard 05 56.9 N 028 57.5 W

	1402-49	**Event 201**
		039 / 042 CTD (Ti) 64 cast to 500m
	1427-49	**Event 202**
		039 / 042 OPTICS rig 41 cast outboard
	1456-1509	**Event 203**
		039 / 042 Trichnet 20 cast outboard
	1516-29	**Event 204**
		039 / 042 11m Long Plankton Net 12 cast outboard
	1540	Station complete – set course 147˚ T @ best speed
06/11/09	0528	Hove To on **Station 039 / 043**
	0534-0612	**Event 205**
		039 / 043 CTD (Ti) 65 cast o/b 04 03.16 N 027 41.66 W
	0539-54	**Event 206**
		039 / 043 Plankton net 43 cast outboard
	0628-0711	**Event 207**
		039 / 043 CTD (STS) 66 cast o/b 04 03.28 N 027 41.64 W
	0632-56	**Event 208**
		039 / 043 Plankton net 44 cast outboard
	0719	Station complete – set course 147˚ T @ Best Speed
	1358	Hove To on **Station 039 / 044**
	1359-1419	**Event 209**
		039 / 044 OPTICS rig 42 cast outboard 03 09.5 N 027 05.9 W
	1400-54	**Event 210**
		039 / 044 CTD (Ti) 67 cast to 500m
	1423-42	**Event 211**
		039 / 044 OPTICS rig 43 cast outboard
	1455-1507	**Event 212**
		039 / 044 Trichnet 21 cast outboard
	1512-28	**Event 213**
		039 / 044 11m Long Plankton Net 13 cast outboard
	1539	Station complete – set course 147˚ T @ best speed
07/11/09	0528	Hove To on **Station 039 / 045**
	0534-0610	**Event 214**
		039 / 045 CTD (Ti) 68 cast o/b 01 16.25 N 025 50.84 W
	0537-52	**Event 215**
		039 / 045 Plankton net 45 cast outboard
	0627-0710	**Event 216**
		039 / 045 CTD (STS) 69 cast o/b 01 16.19 N 025 51.02 W
	0629-49	**Event 217**
		039 / 045 Plankton net 46 cast outboard
	0715	Station complete – set course 147˚ T @ Best Speed
	1225	Hove To on **Station 039 / 046**
	1228-39	**Event 218**
		039 / 046 Plankton net 47 cast outboard 00 36.57 N 025 23.89 W
	1244-1304	**Event 219**
		039 / 046 OPTICS rig 44 cast outboard 00 36.76 N 025 23.74 W
	1307-30	**Event 220**
		039 / 044 OPTICS rig 45 cast outboard
	1330	Station complete – set course 147˚ T @ Best Speed
08/11/09	0705	Hove To on **Station 039 / 047**
	0710-52	**Event 221**
		039 / 047 CTD (Ti) 70 cast o/b 02 02.83 S 024 59.54 W
	0715-27	**Event 222**
		039 / 047 Plankton net 48 cast outboard
	0807-50	**Event 223**
		039 / 047 CTD (STS) 71 cast o/b 02 02.53 S 024 59.27 W
	0811-28	**Event 224**
		039 / 047 Plankton net 49 cast outboard
	0858	Station complete – set course 180˚ T @ Best Speed

	1358	Hove To on **Station 039 / 048**
	1400-21	**Event 225**
		039 / 048 OPTICS rig 46 cast outboard 02 50.8 S 025 00.1 W
	1401-1501	**Event 226**
		039 / 048 CTD (Ti) 72 cast to 500m (fouled by long line (cleared))
	1424-43	**Event 227**
		039 / 048 OPTICS rig 47 cast outboard
	1501	**Relocated due to presence of long line close by**
	1523-27	**Event 228**
		039 / 048 Trichnet 22 cast outboard
		(Truncated due to hydraulic piston leak on crane)
	1527-46	Preparing to launch SHRIMP **EVENT 229**
	1546	**SHRIMP (02) cast outboard 02 52.69S 025 00.25W**
	1821	SHRIMP 02 cast to 5500 metres 02 52.69S 025 00.25W
	2120	Commenced recovery of SHRIMP 02 02 54.07S 024 59.67W
	2343	SHRIMP 02 inboard - set course 180˚ T @ best speed
09/11/09	0528	Hove To on **Station 039 / 049**
	0534-0608	**Event 230**
		039 / 049 CTD (Ti) 73 cast o/b 03 50.47 S 025 00.06 W
	0538-53	**Event 231**
		039 / 049 Plankton net 50 cast outboard
	0623-0704	**Event 232**
		039 / 049 CTD (STS) 74 cast o/b 03 50.28 S 024 59.97 W
	0628-46	**Event 233**
		039 / 049 Plankton net 51 cast outboard
	0714	Station complete – set course 180˚ T @ Best Speed
	1330	Hove To on **Station 039 / 050**
	1332-55	**Event 234**
		039 / 050 OPTICS rig 48 cast outboard 04 51.5 S 025 00.0 W
	1333-1424	**Event 235**
		039 / 050 CTD (Ti) 75 cast to 500m
	1358-1422	**Event 236**
		039 / 050 OPTICS rig 49 cast outboard
	1430-49	**Event 237**
		039 / 050 11m Long Plankton Net 14 cast outboard
	1456	Station complete – set course 180˚ T @ best speed
10/11/09	0530	Hove To on **Station 039 / 051**
	0535-0618	**Event 238**
		039 / 051 CTD (Ti) 76 cast o/b 07 22.05 S 024 59.54 W
	0538-53	**Event 239**
		039 / 051 Plankton net 52 cast outboard
	0632-0720	**Event 240**
		039 / 051 CTD (STS) 77 cast o/b 07 21.69 S 024 59.33 W
	0635-55	**Event 241**
		039 / 051 Plankton net 53 cast outboard
	0727	Station complete – set course 180˚ T @ Best Speed
	1328	Hove To on **Station 039 / 052**
	1329-49	**Event 242**
		039 / 052 OPTICS rig 50 cast outboard 08 22.8 S 024 59.7 W
	1330-1426	**Event 243**
		039 / 052 CTD (Ti) 78 cast to 500m
	1352-1413	**Event 244**
		039 / 052 OPTICS rig 51 cast outboard
	1426-40	**Event 245**
		039 / 052 11m Long Plankton Net 15 cast outboard
	1448	Station complete – set course 180˚ T @ 10 knots
11/11/09	0430	Hove To on **Station 039 / 053**
	0436-0512	**Event 246**
		039 / 053 CTD (Ti) 79 cast o/b 10 39.34 S 024 59.96 W

	0438-55	**Event 247** **039 / 053 Plankton net 54 cast outboard**
	0524-0608	**Event 248** **039 / 053 CTD (STS) 80 cast o/b 10 38.95 S 024 59.82 W**
	0527-46	**Event 249** **039 / 053 Plankton net 55 cast outboard**
	0615	Station complete – set course 180˚ T @ 10 knots
	1258	Hove To on **Station 039 / 054**
	1300-25	**Event 250** **039 / 054 OPTICS rig 52 cast outboard 11 43.5 S 025 00.0 W**
	1301-53	**Event 251** **039 / 054 CTD (Ti) 81 cast to 500m**
	1328-51	**Event 252** **039 / 054 OPTICS rig 53 cast outboard**
	1356-1410	**Event 253** **039 / 054 11m Long Plankton Net 16 cast outboard**
	1417	Station complete – set course 180˚ T @ 10 knots
12/11/09	0258	Hove To on **Station 039 / 055**
	0302-0411	**Event 254** **039 / 055 Turbulence Profiler 03 cast o/b 13 48.9 S 025 00.1 W**
	0411-22	**Event 255** **039 / 055 Drifter 03 launched 13 48.95S 024 58.88W**
	0501-07	**Event 256** **039 / 055 CTD (Ti) surface 19 cast o/b 13 48.83 S 024 58.87 W**
	0517-57	**Event 257** **039 / 055 CTD (Ti) 82 cast o/b 13 48.80 S 024 58.87 W**
	0521-35	**Event 258** **039 / 055 Plankton net 56 cast outboard**
	0625-0701	**Event 259** **039 / 055 CTD (Ti) 83 cast o/b 13 48.83 S 024 59.14 W**
	0627-44	**Event 260** **039 / 055 Plankton net 57 cast outboard**
	0803-08	**Event 261** **039 / 055 CTD (Ti) surface 20 cast o/b 13 49.75 S 025 00.79 W**
	0858-0902	**Event 262** **039 / 055 CTD (Ti) surface 21 cast o/b 13 50.14 S 025 01.36 W**
	0958-1003	**Event 263** **039 / 055 CTD (Ti) surface 22 cast o/b 13 50.51 S 025 01.95 W**
	1056-1101	**Event 264** **039 / 055 CTD (Ti) surface 23 cast o/b 13 50.80 S 025 02.59 W**
	1157-1203	**Event 265** **039 / 055 CTD (Ti) surface 24 cast o/b 13 51.32 S 025 03.25 W**
	1254-1318	**Event 266** **039 / 055 CTD (Ti) surface 25 cast o/b 13 51.32 S 025 03.25 W**
	1255-1315	**Event 267** **039 / 055 OPTICS rig 54 cast outboard 13 51.32 S 025 03.25 W**
	1315-1406	**Event 268** **039 / 055 CTD (Ti) 84 cast to 500m**
	1321-41	**Event 269** **039 / 055 OPTICS rig 55 cast outboard**
	1409-21	**Event 270** **039 / 055 11m Long Plankton Net 17 cast outboard**
	1429-1500	Re-locating to find drift buoy
	1502-08	**Event 271** **039 / 055 CTD (Ti) surface 26 cast o/b 13 53.0 S 025 05.4 W**
	1604-09	**Event 272** **039 / 055 CTD (Ti) surface 27 cast o/b 13 53.11 S 025 05.94 W**
	1702-06	**Event 273** **039 / 055 CTD (Ti) surface 28 cast o/b 13 53.48 S 025 06.10 W**
	1833-1903	**Event 274** **039 / 055 CTD (Ti) 85 cast o/b 13 54.51 S 025 07.07 W**

	1903-2153	Manoeuvring away for grey water tank dump – then returning to site
	2202-06	**Event 275**
		039 / 055 CTD (Ti) surface 29 cast o/b 13 56.68 S 025 08.70 W
13/11/09	0058-0105	**Event 276**
		039 / 055 CTD (Ti) surface 30 cast o/b 13 58.5 S 025 09.3 W
	0400-05	**Event 277**
		039 / 055 CTD (Ti) surface 31 cast o/b 13 59.9 S 025 10.1 W
	0459-0505	**Event 278**
		039 / 055 CTD (Ti) surface 32 cast o/b 14 00.24 S 025 10.30 W
	0519-0602	**Event 279**
		039 / 055 CTD (Ti) 86 cast o/b 14 00.23 S 025 10.31 W
	0520-37	**Event 280**
		039 / 055 Plankton net 58 cast outboard
	0625-0705	**Event 281**
		039 / 055 CTD (Ti) 87 cast o/b 14 00.57 S 025 10.50 W
	0630-45	**Event 282**
		039 / 055 Plankton net 59 cast outboard
	0801-04	**Event 283**
		039 / 055 CTD (Ti) surface 33 cast o/b 14 00.84 S 025 10.66 W
	0857-0901	**Event 284**
		039 / 055 CTD (Ti) surface 34 cast o/b 14 01.13 S 025 11.07 W
	0959-1003	**Event 285**
		039 / 055 CTD (Ti) surface 35 cast o/b 14 01.37 S 025 11.32 W
	1059-1104	**Event 286**
		039 / 055 CTD (Ti) surface 36 cast o/b 14 01.54 S 025 11.66 W
	1104-12	**Drifter 03 recovered**
	1138-1237	**Event 287**
		039 / 055 Turbulence Profiler 04 cast o/b 14 01.4 S 025 10.8 W
	1258-1318	**Event 288**
		039 / 055 OPTICS rig 56 cast outboard 14 01.4 S 025 10.8 W
	1259-1348	**Event 289**
		039 / 055 CTD (Ti) 88 cast to 500m
	1321-42	**Event 290**
		039 / 055 OPTICS rig 57 cast outboard
	1351-1403	**Event 291**
		039 / 055 11m Long Plankton Net 18 cast outboard
	1410	Station complete – set course 180˚ T @ 10 knots
	1615-45	Emergency fire drill 14 37.6S 025 01.6W
14/11/09	0430	Hove To on **Station 039 / 056**
	0443-0519	**Event 292**
		039 / 056 CTD (Ti) 89 cast o/b 16 22.33 S 024 59.87 W
	0447-0503	**Event 293**
		039 / 056 Plankton net 60 cast outboard
	0535-0613	**Event 294**
		039 / 056 CTD (STS) 90 cast o/b 16 21.87 S 024 59.79 W
	0537-56	**Event 295**
		039 / 056 Plankton net 61 cast outboard
	0627	Station complete – set course 180˚ T @ 10 knots
	1035-42	Vessel stopped to test hydro boom then resumed course
	1113-18	Vessel stopped to test hydro boom then resumed course
	1300	Hove To on **Station 039 / 057**
	1300-58	**Event 296**
		039 / 057 CTD (Ti) 91 cast to 500m 17 20.8 S 025 00.0 W
	1303-23	**Event 297**
		039 / 057 OPTICS rig 58 cast outboard
	1326-46	**Event 298**
		039 / 057 OPTICS rig 59 cast outboard
	1400-1413	**Event 299**
		039 / 057 11m Long Plankton Net 19 cast outboard
	1421	Station complete – set course 180˚ T @ 10 knots

	1830	Hove to on SHRIMP station **Station 039 / 058 EVENT 300**
	1840	**SHRIMP (03) cast outboard 18 00.00S 025 00.00W**
	1900	SHRIMP 03 inboard for repairs
	1920	SHRIMP 03 station abandoned - set course 180˚ T @ 10 knots
15/11/09	0429	Hove To on **Station 039 / 059**
	0433-0511	**Event 301**
		039 / 059 CTD (Ti) 92 cast o/b 19 30.00 S 024 59.77 W
	0439-56	**Event 302**
		039 / 059 Plankton net 62 cast outboard
	0527-0612	**Event 303**
		039 / 059 CTD (STS) 93 cast o/b 19 29.87 S 024 59.88 W
	0530-50	**Event 304**
		039 / 059 Plankton net 63 cast outboard
	0615	Station complete – set course 180˚ T @ 10 knots
	1258	Hove To on **Station 039 / 060**
	1259-1321	**Event 305**
		039 / 060 OPTICS rig 60 cast outboard
	1302-57	**Event 306**
		039 / 060 CTD (Ti) 94 cast to 500m 20 35.4 S 025 00.0 W
	1324-57	**Event 307**
		039 / 060 OPTICS rig 61 cast outboard
	1358-1412	**Event 308**
		039 / 060 11m Long Plankton Net 20 cast outboard
	1420-50	Azi thruster housing problems – remain stopped
	1421	All in order - Station complete – set course 180˚ T @ 10 knots
16/11/09	0430	Hove To on **Station 039 / 061**
	0433-0509	**Event 309**
		039 / 061 CTD (Ti) 95 cast o/b 22 51.23 S 024 59.77 W
	0436-50	**Event 310**
		039 / 061 Plankton net 64 cast outboard
	0525-0612	**Event 311**
		039 / 061 CTD (STS) 96 cast o/b 22 51.23 S 024 59.77 W
	0527-43	**Event 312**
		039 / 061 Plankton net 65 cast outboard
	0615	Station complete – set course 180˚ T @ 10 knots
	0857-0954	Stopped for launching MO boat and lifeboat lowering
	0954	Resumed passage
	1259	Hove To on **Station 039 / 062**
	1301-1323	**Event 313**
		039 / 062 OPTICS rig 62 cast outboard
	1302-56	**Event 314**
		039 / 062 CTD (Ti) 97 cast to 500m 23 45.8 S 025 00.1 W
	1326-47	**Event 315**
		039 / 062 OPTICS rig 63 cast outboard
	1356	All in order - Station complete – set course 180˚ T @ 10 knots
17/11/09	0358	Lost GPS signal and heading veered away (see NM072)
	0430	Hove To on **Station 039 / 063**
	0442-0517	**Event 316**
		039 / 063 CTD (Ti) 98 cast o/b 26 06.76 S 025 00.31 W
	0446-0502	**Event 317**
		039 / 063 Plankton net 66 cast outboard
	0534-0617	**Event 318**
		039 / 063 CTD (STS) 99 cast o/b 26 06.64 S 025 00.28 W
	0537-55	**Event 319**
		039 / 063 Plankton net 67 cast outboard
	0625	Station complete – set course 180˚ T @ 10 knots if attainable
	1258	Hove To on **Station 039 / 064**
	1259-1322	**Event 320**
		039 / 064 OPTICS rig 64 cast outboard

	1301-56	**Event 321**
		039 / 064 CTD (Ti) 100 cast to 500m 27 10.1 S 025 00.1 W
	1325-50	**Event 322**
		039 / 064 OPTICS rig 65 cast outboard
	1356	Station complete – set course 180˚ T @ 10 knots if attainable
	1920	a/c to 232˚ T 20 00.0 S 025 00.0 W
18/11/09	0432	Hove To on **Station 039 / 065**
	0438-0517	**Event 323**
		039 / 065 CTD (Ti) 101 cast o/b 28 47.28 S 026 08.47 W
	0442-59	**Event 324**
		039 / 065 Plankton net 68 cast outboard
	0535-0626	**Event 325**
		039 / 065 CTD (STS) 102 cast o/b 28 47.40 S 026 08.17 W
	0538-55	**Event 326**
		039 / 065 Plankton net 69 cast outboard
	0640	Station complete – set course 232˚ T @ 10 knots if attainable
	1259	Hove To on **Station 039 / 066**
	1300-23	**Event 327**
		039 / 066 OPTICS rig 66 cast outboard
	1303-58	**Event 328**
		039 / 066 CTD (Ti) 103 cast to 500m 29 23.4 S 027 02.0 W
	1325-48	**Event 329**
		039 / 066 OPTICS rig 67 cast outboard
	1404-1423	**Event 330**
		039 / 066 Long Plankton Net 21 cast outboard
	1435	Station complete – set course 232˚ T @ 10 knots if attainable
19/11/09	0430	Hove To on **Station 039 / 067**
	0434-0508	**Event 331**
		039 / 067 CTD (Ti) 104 cast o/b 30 50.02 S 029 11.02 W
	0437-54	**Event 332**
		039 / 067 Plankton net 70 cast outboard
	0522-0600	**Event 333**
		039 / 067 CTD (STS) 105 cast o/b 30 50.02 S 029 11.02 W
	0525-44	**Event 334**
		039 / 067 Plankton net 71 cast outboard
	0608	Station complete – set course 232˚ T @ 10 knots if attainable
	1259	Hove To on **Station 039 / 068**
	1300-22	**Event 335**
		039 / 068 OPTICS rig 68 cast outboard
	1302-1406	**Event 336**
		039 / 068 CTD (Ti) 106 cast to 500m 31 32.8 S 030 15.3 W
	1325-46	**Event 337**
		039 / 068 OPTICS rig 69 cast outboard
	1409-24	**Event 338**
		039 / 068 Long Plankton Net 22 cast outboard
	1435	Station complete – set course 232˚ T @ 10 knots if attainable
	1514-1612	CTD Cable veered outboard with weight to sort out scrolling problems
	1612	Resumed course 232˚ T @ best speed attainable
20/11/09	0200	Clocks retarded I hour to UT-1
	0530	Hove To on **Station and assessing conditions**
		32 55.9 S 032 20.3 W
	0536	Station cancelled due to inclement weather - securing deck
	0554	All secured on deck - Resumed course 232˚ T @ best speed
	0854	Weather significantly worsens – ship begins to labour
		Vessel Hove to – To wind and sea 33 00.8 S 032 36.4 W
		Wind NNW'ly @ 40 knots – seas rough to high
	1400	Station cancelled due to inclement weather
	2000	Resumed passage to next station

21/11/09	0532	Hove To on **Station 039 / 069**
	0542-0624	**Event 339**
		039 / 069 CTD (Ti) 107 cast o/b 33 24.59 S 034 15.37 W
	0546-0604	**Event 340**
		039 / 069 Plankton net 72 cast outboard
	0645-0733	**Event 341**
		039 / 069 CTD (STS) 108 cast o/b 33 24.95 S 034 14.88 W
	0649-0711	**Event 342**
		039 / 069 Plankton net 73 cast outboard
	0745	Station complete – set course 231˚ T @ best speed attainable
	1357	Hove To on **Station 039 / 070**
	1401-26	**Event 343**
		039 / 070 OPTICS rig 70 cast outboard
	1402-1502	**Event 344**
		039 / 070 CTD (Ti) 109 cast to 500m 33 53.0 S 034 58.5 W
	1502	Station complete – set course 231˚ T @ best speed attainable
22/11/09	0500	Hove To on **Station 039 / 071**
	0503-08	**Event 345**
		039 / 071 CTD (Ti) surface 37 cast o/b 35 17.93 S 037 06.98 W
	0516-0601	**Event 346**
		039 / 071 CTD (Ti) 110 cast to 500m 35 17.87 S 037 06.81 W
	0520-38	**Event 347**
		039 / 071 Plankton net 74 cast outboard
	0625-0700	**Event 348**
		039 / 071 CTD (Ti) 111 cast to 500m 35 17.68 S 037 06.71 W
	0629-46	**Event 349**
		039 / 071 Plankton net 75 cast outboard
	0700-11	**Event 350**
		039 / 071 Drifter 04 launched 35 17.60S 037 06.65W
	0759-0805	**Event 351**
		039 / 071 CTD (Ti) surface 38 cast o/b 35 17.09 S 037 06.92 W
	0856-0900	**Event 352**
		039 / 071 CTD (Ti) surface 39 cast o/b 35 16.44 S 037 07.50 W
	0959-1003	**Event 353**
		039 / 071 CTD (Ti) surface 40 cast o/b 35 15.90 S 037 08.34 W
	1057-1102	**Event 354**
		039 / 071 CTD (Ti) surface 41 cast o/b 35 15.62 S 037 09.37 W
	1158-1203	**Event 355**
		039 / 071 CTD (Ti) surface 42 cast o/b 35 15.57 S 037 09.30 W
	1300-05	**Event 356**
		039 / 071 CTD (Ti) surface 43 cast o/b 35 15.57 S 037 09.30 W
	1311-1403	**Event 357**
		039 / 071 CTD (Ti) 112 cast to 150m 35 15.50 S 037 11.00 W
	1356-1419	**Event 358**
		039 / 071 OPTICS rig 71 cast outboard 35 15.50 S 037 11.00 W
	1421-44	**Event 359**
		039 / 071 OPTICS rig 72 cast outboard 35 15.50 S 037 11.00 W
	1455-1501	**Event 360**
		039 / 071 CTD (Ti) surface 44 cast o/b 35 15.50 S 037 11.00 W
	1508-23	**Event 361**
		039 / 071 Long Plankton Net 23 cast outboard
	1557-1602	**Event 362**
		039 / 071 CTD (Ti) surface 45 cast o/b 35 16.10 S 037 12.80 W
	1700-06	**Event 363**
		039 / 071 CTD (Ti) surface 46 cast o/b 35 16.29 S 037 12.90 W
	1801-06	**Event 364**
		039 / 071 CTD (Ti) surface 47 cast o/b 35 16.51 S 037 12.90 W
	1931-2004	**Event 365**
		039 / 071 CTD (Ti) 113 cast to 150m 35 16.75 S 037 12.90 W
	2300-04	**Event 366**
		039 / 071 CTD (Ti) surface 48 cast o/b 35 16.95 S 037 12.79 W

23/11/09	0242	Station cancelled due to inclement weather - securing deck Weather significantly worsens – ship begins to labour Vessel Hove to – To wind and sea 35 16.5 S 037 12.2 W Wind ENE'ly @ 40 / 45 knots – seas rough to high LOSS OF DRIFTER
	0925	Resumed course 231˚ T @ best speed attainable
24/11/09	0528	Hove To on **Station 039 / 072**
	0536-0608	**Event 367** **039 / 072 CTD (Ti) 114 cast o/b 37 17.86 S 040 11.37 W**
	0540-55	**Event 368** **039 / 072 Plankton net 76 cast outboard**
	0625-0708	**Event 369** **039 / 072 CTD (STS) 115 cast o/b 37 17.86 S 040 11.37 W**
	0629-50	**Event 370** **039 / 072 Plankton net 77 cast outboard**
	0721	Station complete – set course 231˚ T @ best speed attainable
	1358	Hove To on **Station 039 / 073**
	1359-1423	**Event 371** **039 / 073 OPTICS rig 73 cast outboard**
	1400-47	**Event 372** **039 / 073 CTD (Ti) 116 cast to 500m 37 52.0 S 041 05.5 W**
	1426-50	**Event 373** **039 / 073 OPTICS rig 74 cast outboard**
	1502-18	**Event 374** **039 / 073 Long Plankton Net 24 cast outboard**
	1526	Station complete – set course 231˚ T @ best speed attainable
25/11/09	0528	Hove To on **Station 039 / 074**
	0533-0611	**Event 375** **039 / 074 CTD (Ti) 117 cast o/b 39 18.89 S 043 23.54 W**
	0537-51	**Event 376** **039 / 074 Plankton net 78 cast outboard**
	0626-0710	**Event 377** **039 / 074 CTD (STS) 118 cast o/b 39 18.89 S 043 23.54 W**
	0629-47	**Event 378** **039 / 074 Plankton net 79 cast outboard**
	0718	Station complete – set course 231˚ T @ best speed attainable
	1359	Hove To on **Station 039 / 075**
	1400-23	**Event 379** **039 / 075 OPTICS rig 75 cast outboard**
	1402-55	**Event 380** **039 / 075 CTD (Ti) 119 cast to 500m 39 58.1 S 044 26.6 W**
	1426-49	**Event 381** **039 / 075 OPTICS rig 76 cast outboard**
	1459-1514	**Event 382** **039 / 075 Long Plankton Net 25 cast outboard**
	1516-25	Man Overboard boat launched for drill and test
	1536	**Event 383** **039 / 075 Met Buoy Drifter (01) launched 39 58.83 S 044 26.37 W**
	1537	Station complete – set course 231˚ T @ best speed attainable
26/11/09	0530	Hove To on **Station – Wind NW'ly 35 knots – swell moderate to high** **Station cancelled due to inclement weather conditions**
	0545	set course 231˚ T @ best speed attainable
	0927	**Event 384** **039 / 075 Met Buoy Drifter (02) launched 41 49.5 S 047 29.4 W**
	1357	Hove To on **Station 039 / 076**
	1400-18	**Event 385** **039 / 076 OPTICS rig 77 cast outboard**
	1401-53	**Event 386**

		039 / 076 CTD (Ti) 120 cast to 500m 42 15.0 S 048 13.5 W
	1423-38	**Event 387**
		039 / 076 OPTICS rig 78 cast outboard
	1500	Station complete – set course 231˚ T @ best speed attainable
		Stationary SCIENCE ENDS Set Course 231˚ T for passage to Magellan Straits 42 15.0 S 048 13.5 W
	2300	Position Latitude 42 51.5 S Longitude 049 14.7 W
27/11/09	0300	Clocks retarded I hour to UT-2
	1009	**Event 388**
		039 / 076 Met Buoy Drifter (03) launched 43 55.0 S 051 02.6 W
	1200	Position Latitude 44 07.0 S Longitude 051 23.5 W
28/11/09	0000	Position Latitude 45 26.8 S Longitude 053 44.5 W
	1200	Position Latitude 46 44.0 S Longitude 056 02.7 W
	1847	**039 / 076 Met Buoy Drifter (04) launched 47 29.4 S 057 28.0 W**
29/11/09	0000	Position Latitude 48 02.5 S Longitude 058 33.1 W
	1200	Position Latitude 49 18.6 S Longitude 061 01.7 W
		ALL SCIENCE ENDS
1/12/09 0800 (prov)		ETA Punta Arenas

END OF REPORT

Scientific Reports:

Nutrients

CAROLYN HARRIS
Plymouth Marine Laboratory

Objectives

To investigate the spatial and temporal variations of the micro-molar nutrient species Nitrate, Nitrite, Phosphate, Silicate and Ammonium during the research cruise along the Atlantic Meridional Transect (AMT) cruise track, departing the from Falmouth, UK and sailing through the North Atlantic Gyre (NAG), south to the equator, through the South Atlantic Gyre (SAG), before turning south-west to end the cruise at Punta Arenas, Chile.

Sampling and methodology

Micro-molar nutrient analysis was carried out using a 5 channel (nitrate (Brewer & Riley, 1965), nitrite (Grasshoff,K., 1976), phosphate, silicate (Kirkwood, D.S., 1989) & ammonium (Mantoura, R.F.C. & Woodward, E.M. S., 1983) Bran & Luebbe AAIII segmented flow, colourimetric, auto-analyser. Established, proven analytical protocols were used.

Water samples were taken from a 24 x 20 litre bottle stainless steel framed CTD / Rosette system (Seabird). These were sub-sampled into clean (acid-washed) 60ml HDPE (Nalgene) sample bottles. Subsequent nutrient analysis was complete within 3-4 hours of sampling.

Clean handling techniques were employed to avoid contamination of the samples (particularly the ammonium) and none of the samples were frozen or stored for later analysis.

Time was taken during the cruise to optimise the analyser performance and attempt to analyse some of the nutrients down to nanno-molar concentrations.

CTD samples analysed

A total of 72 vertical profiles were analysed along the axis of the AMT and are listed in the table below, (CTD geographic positions and corrected bottle firing depths being available from the CTD Log.):-

Table 1: AMT19 - Nutrient Analysis - Station & CTD Sampling Summary

Date	Time (GMT)	Ship Stn.	CTD ID	Niskin sampled
14.10.2009	04:40	JCO39_002	CTD_002S	22, 16, 15, 12, 9, 7, 4, 2
14.10.2009	12:35	JCO39_003	CTD_003S	12, 10, 9, 7, 6, 5, 4, 3, 2
15.10.2009	04:30	JCO39_004	CTD_005S	21, 18, 15, 12, 9, 6, 4, 2, 1
16.10.2009	05:45	JCO39_006	CTD_008S	21, 19, 15, 13, 11, 7, 6, 5, 4, 3, 2, 1
17.10.2009	06:00	JCO39_007	CTD_011S	21, 19, 17, 13, 11, 9, 7, 6, 5, 4, 3, 2, 1
17.10.2009	14:00	JCO39_008	CTD_012T	15, 14, 13, 11, 10, 9, 7, 6, 5, 4, 3, 2, 1
18.10.2009	05:45	JCO39_009	CTD_014S	22, 19, 14, 13, 11, 9, 6, 5, 4, 3, 1
18.10.2009	13:50	JCO39_010	CTD_015T	15, 14, 13, 11, 10, 8, 7, 6, 5, 4, 3, 2, 1
19.10.2009	05:50	JCO39_011	CTD_017S	23, 20, 18, 14, 12, 10, 9, 5, 4, 3
19.10.2009	13:30	JCO39_012	CTD_018T	15, 14, 13, 11, 10, 9, 8, 7, 4, 3, 2, 1
20.10.2009	05:30	JCO39_013	CTD_020S	23, 20, 18, 14, 12, 10, 9, 5, 4, 3, 2
21.10.2009	13:00	JCO39_014	CTD_021T	15, 13, 12, 10, 9, 8, 7, 5, 4, 3, 2, 1
22.10.2009	06:40	JCO39_015	CTD_023S	23, 20, 18, 14, 11, 10, 9, 5, 4, 3
22.10.2009	14:00	JCO39_016	CTD_024T	15, 14, 12, 11, 10, 9, 8, 7, 3, 2, 1
23.10.2009	06:40	JCO39_017	CTD_026S	23, 20, 17, 14, 12, 10, 9, 5, 4, 3, 2, 1
23.10.2009	14:15	JCO39_018	CTD_027T	15, 13, 12, 11, 9, 8, 22, 7, 5, 4, 3, 2, 1
24.10.2009	06:30	JCO39_019	CTD_029S	23, 20, 18, 14, 11, 10, 9, 5, 4, 3, 2
24.10.2009	14:00	JCO39_020	CTD_030T	17, 14, 13, 12, 10, 9, 20, 7, 5, 4, 3, 2, 1
25.10.2009	06:40	JCO39_021	CTD_032S	23, 20, 18, 14, 12, 10, 9, 5, 4, 3, 2
25.10.2009	14:00	JCO39_022	CTD_033T	17, 15, 14, 13, 12, 11, 10, 6, 5, 4, 3

26.10.2009	06:30	JCO39_023	CTD_035S	22, 19, 17, 13, 11, 9, 8, 4, 3, 2
26.10.2009	14:00	JCO39_024	CTD_036T	15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5
27.10.2009	06:30	JCO39_025	CTD_038S	23, 20, 18, 14, 12, 10, 9, 5, 4, 3, 2
27.10.2009	14:00	JCO39_026	CTD_039T	15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5
28.10.2009	07:30	JCO39_027	CTD_041S	23, 20, 18, 14, 12, 10, 9, 5, 4, 3, 2
29.10.2009	07:30	JCO39_029	CTD_043T	19, 15, 11, 8, 6, 5, 1
30.10.2009	07:40	JCO39_029	CTD_047T	20, 17, 13, 11, 9, 8, 2, 1
30.10.2009	14:00	JCO39_030	CTD_048T	17, 15, 14, 13, 12, 11, 9, 8, 7
31.10.2009	07:00	JCO39_031	CTD_050S	23, 20, 18, 14, 12, 10, 9, 5, 4, 3
31.10.2009	14:00	JCO39_032	CTD_051T	15, 14, 13, 12, 11, 10, 8, 7, 6, 4
01.11.2009	07:40	JCO39_033	CTD_053S	23, 20, 17, 14, 12, 9, 8, 5, 4, 3, 2
01.11.2009	14:00	JCO39_034	CTD_054T	14, 13, 11, 10, 9, 8, 5, 4, 3, 2, 1
02.11.2009	06:20	JCO39_035	CTD_056S	23, 20, 18, 14, 12, 10, 9, 5, 4, 3, 2
02.11.2009	14:00	JCO39_036	CTD_057T	15, 13, 11, 10, 9, 6, 5, 4, 3, 2, 1
03.11.2009	06:25	JCO39_037	CTD_059S	23, 20, 18, 14, 12, 10, 9, 5, 4, 3, 2
03.11.2009	14:00	JCO39_038	CTD_060T	15, 12, 11, 10, 9, 6, 5, 4, 3, 2, 1
04.11.2009	14:00	JCO39_040	CTD_061T	15, 11, 10, 9, 8, 6, 5, 4, 3, 2, 1
05.11.2009	06:30	JCO39_041	CTD_063S	22, 19, 17, 13, 11, 9, 8, 4, 3, 2
05.11.2009	14:05	JCO39_042	CTD_064T	16, 13, 11, 10, 9, 6, 5, 3, 2, 1
06.11.2009	06:30	JCO39_043	CTD_066S	23, 20, 18, 14, 12, 10, 9, 5, 4, 3, 1
06.11.2009	14:00	JCO39_044	CTD_067T	15, 13, 11, 10, 9, 8, 5, 4, 3, 2, 1
07.11.2009	06:30	JCO39_045	CTD_069S	23, 20, 18, 14, 12, 10, 9, 5, 4, 3, 2
08.11.2009	08:00	JCO39_047	CTD_071S	23, 20, 18, 14, 12, 10, 9, 5, 4, 3, 2
08.11.2009	14:00	JCO39_048	CTD_072T	15, 13, 11, 10, 9, 7, 5, 4, 3, 2, 1
09.11.2009	06:20	JCO39_049	CTD_074S	23, 20, 18, 14, 12, 10, 9, 8, 3, 2
09.11.2009	13:30	JCO39_050	CTD_075T	15, 13, 11, 10, 9, 7, 5, 4, 3, 2, 1
10.11.2009	06:30	JCO39_051	CTD_077S	23, 20, 18, 14, 12, 10, 9, 5, 4, 3, 2
10.11.2009	13:30	JCO39_052	CTD_078T	15, 14, 12, 9, 8, 7, 6, 5, 4, 3, 2
11.11.2009	05:30	JCO39_053	CTD_080S	23, 20, 18, 14, 12, 10, 9, 8, 4, 3, 2
11.11.2009	13:00	JCO39_054	CTD_081T	15, 13, 11, 10, 9, 8, 7, 5, 3, 2, 1
12.11.2009	06:30	JCO39_055	CTD_083T	15, 14, 11, 9, 7, 6, 5, 2, 1
13.11.2009	06:30	JCO39_055	CTD_087T	14, 13, 12, 11, 10, 9, 8, 7, 5, 2, 1
14.11.2009	05:40	JCO39_056	CTD_090S	23, 20, 18, 14, 12, 11, 9, 8, 7, 3, 2
14.11.2009	13:00	JCO39_057	CTD_091T	14, 12, 11, 10, 9, 8, 7, 6, 3, 2, 1
15.11.2009	05:30	JCO39_059	CTD_093S	23, 20, 18, 14, 11, 10, 9, 8, 7, 6, 2
15.11.2009	13:00	JCO39_060	CTD_094T	17, 15, 14, 13, 12, 11, 10, 8, 6
16.11.2009	05:30	JCO39_061	CTD_096S	23, 20, 18, 14, 12, 10, 9, 8, 7, 3, 2
16.11.2009	13:00	JCO39_062	CTD_097T	17, 16, 15, 14, 13, 12, 11, 10, 9, 8, 7
17.11.2009	05:30	JCO39_063	CTD_099S	23, 20, 18, 14, 12, 10, 9, 8, 4, 3, 2
17.11.2009	13:00	JCO39_064	CTD_100T	17, 16, 15, 14, 13, 12, 11, 10, 9, 8, 7
18.11.2009	05:30	JCO39_065	CTD_102S	23, 19, 18, 14, 13, 10, 8, 7, 3, 2
18.11.2009	13:00	JCO39_066	CTD_103T	19, 17, 16, 15, 14, 13, 12, 10, 9, 8, 7
19.11.2009	05:20	JCO39_067	CTD_105S	23, 20, 18, 14, 12, 10, 9, 8, 4, 3, 2
19.11.2009	13:00	JCO39_068	CTD_106T	16, 15, 14, 13, 12, 10, 9, 8, 7, 6
21.11.2009	06:45	JCO39_069	CTD_108S	23, 19, 17, 14, 12, 9, 5, 4, 3, 2
21.11.2009	14:00	JCO39_070	CTD_109T	17, 15, 14, 13, 12, 10, 8, 7, 6, 5
22.11.2009	06:30	JCO39_071	CTD_111T	17, 14, 12, 10, 8, 5, 3, 2, 1
24.11.2009	06:30	JCO39_072	CTD_115S	23, 18, 14, 12, 9, 5, 4, 3, 2
24.11.2009	14:00	JCO39_073	CTD_116T	18, 16, 15, 13, 11, 10, 9, 8, 7, 5, 4
25.11.2009	06:30	JCO39_074	CTD_118S	23, 20, 17, 12, 10, 8, 7, 6, 5, 4, 3, 2
25.11.2009	14:00	JCO39_075	CTD_119T	15, 13, 12, 9, 7, 6, 5, 4, 3, 2, 1
26.11.2009	14:00	JCO39_078	CTD_120T	19, 17, 12, 9, 8, 7, 6, 5, 3, 2, 1

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I would like to thank colleagues and the officers & crew of the RRS James Cook for making the cruise a pleasant and rewarding trip.

In-water and above-surface optics

CHRIS GALLIENNE
Plymouth Marine Laboratory

Aims and objectives

Prior to the cruise, and as part of the SOLAS programme, a coupled atmospheric in-water UV optical model has been developed at PML. The model requires measurements of chlorophyll and CDOM to extrapolate the signal measured in the visible (400 – 700 nm) to the UV (300 – 400 nm). On AMT19 measurements of spectral inherent optical properties were made (using an ac-9) with which to better parameterise the model, and coincidental in-water spectral UV measurements were taken with which to validate the model. The atmospheric component of the model would be validated against the deck measured incident UV measurements.

In addition measurements of phytoplankton physiology have been made using an FRRF. PAR measurements were made to determine the light levels through the water column for the various incubation experiments. Opportunistic measurements of aerosol optical depth have been made for the NASA AERONET project. The optical data (deck and in-water) fit within the wider optical aims of the AMT vis a vis: the characterisation of waters of different optical properties with particular interest in the backscatter signal; the development and validation of optical algorithms within the context of remote sensing; and the description using FRRF of the different phytoplankton physiology.

Methodology

In-water optics

On the optics rig the following instruments were deployed: Wet Labs ac-9; Wet Labs flow cells; Fast Repetition Rate Fluorometer (NMF supplied); Satlantic UV sensor; Seabird SBE19+ CTD; Hobilabs hydroscat 6 – also known as bb6 (see appendix for instrument details).

The optics rig was deployed from crane on the starboard aft quarter of the ship using 180 m of 6 mm dyneema on the deck winch. Profiles were made at or within one hour of local solar noon. Optical protocols state that deployments should be on the sunward side of the ship; this criterion was generally met. The instruments were switched on and the instrument package lowered into the water and kept at the surface for three minutes. The rig was then lowered at a fairly fast rate (0.5 m/s) down to 180 m depth. The upcast is the important part of the deployment and this was carried out at 0.2 m/s.

Upon recovery, data from the instruments was downloaded: hyperterminal was used to download the FRRF; WLHost the ac-9, UV sensor and CTD combination; and Hobilabs software (Hydrosoft 2.72) to download the bb6.

Light depth profiles were calculated daily from the PAR data from the FRRF in order to help inform the choice of depths for CTD bottle firing the following day. The data from the FRRF will be processed using V6 of the Sam Laney (WHOI) Matlab code. This requires the FRRF to be characterised using 0.2 µm filtered water, at each of the gain settings (0, 1, 4, 16, 64, 256) for both the light and dark chambers, in a black bucket. This was done once in the middle of the transect. The primary outputs of the FRRF data stream are the maximum fluorescence (Fm) and the ratio of the variable to maximum fluorescence (Fv/Fm). The final FRRF data product will consist of the phytoplankton physiological parameters binned to 2 m depth resolution.

The ac-9 data will be pre-processed using the Wetlabs WAP (v4.28a) software which essentially extracts the separate data streams from the instrument binary and then merges the different datastreams back into ascii format. The ac9 data need to be corrected for the effects of temperature, salinity and scattering (Zanefeld et al. scheme) which is done using bespoke IDL routines. The ac-9 also needs to have regular field calibrations done by running 0.1 µm filtered milliQ water through a thoroughly cleaned instrument (methanol used to clean optics and tubes). This was done on once and the necessary offsets removed. The final ac-9 product will consist of the spectral ac-9 signal merged with the Satlantic UV-sensor (4 channels); CTD and flow cells.

The bb6 data will be processed in the laboratory as processing requires a further post-cruise calibration and the processed ac9 data for correction purposes.

Atmospheric optics

Surface UV measurements

A Trios Rameses ACC UV sensor was setup high on the ships forward met platform and configured to log hyperspectal UV between 200 and 500 nm at 2.5 nm resolution every 5 minutes through daylight hours. The data can either be kept as hyperspectral (to force e.g. in-water light field models) or integrated over broadband (UV-A and UV-B) ranges (this was done on the cruise using bespoke IDL routines).

Satlantic Hypersas

A Satlantic HyperSAS system was also mounted high on the ships met platform. The instrument has three sensors measuring: i) sea upwelling radiance (angled at 45 degrees downwards); ii) sky downwelling radiance (angled at 45 degrees upwards) and iii) downwelling radiance (pointing vertically). The data is merged with GPS information and data processing for water leaving reflectance will be carried out back at the laboratory.

Microtops sun photometer

A Solar light Co. microtops sunphotometer was opportunistically used to determine the spectral aerosol optical thickness at 340, 440, 675 and 870 nm as part of the NASA AERONET project. The instrument was used throughout the AMT and data processing done by Dr. Sasha Smirnov.

Appendix

Table 1: AMT19 Deployment Log for the Optics Profiling Rig

Date	Station	Latitude	Longitude	Event No.	Weather	In	Out	Event	Comments
14.10.09	JC039003	49° 26.0N	10° 32.0W	5	Sunny	1247	1302	OPTICS001	
15.10.09	JC039005	48° 56.91N	14° 27.59W	10	Sunny	1414	1445	OPTICS002	
16.10.09	JC039006	49° 00.00N	16° 40.00W	15	Overcast	1337	1413	OPTICS 003	
16.10.09	JC039006	49° 00.00N	16° 40.00W	16	Overcast	1419	1545	OPTICS 004	
17.10.09	JC039008	46° 20.3N	18° 48.1W	22	Sunny	1341	1409	OPTICS005	
17.10.09	JC039008	46° 20.3N	18° 48.1W	23	Sunny	1412	1443	OPTICS006	
18.10.09	JC039010	43° 12.9N	21° 10.5W	28	Sun/Cloud	1342	1412	OPTICS007	
18.10.09	JC039010	43° 12.9N	21° 10.5W	30	Sun/Cloud	1414	1439	OPTICS008	
19.10.09	JC039012	40° 19.4N	23° 16.3W	37	Sunny	1334	1404	OPTICS009	
19.10.09	JC039012	40° 19.4N	23° 16.3W	38	Sunny	1408	1436	OPTICS010	
21.10.09	JC03914	37°06.1N	26° 29.3	43	Sunny	1305	1332	OPTICS011	‘a’ flow cell unseated on recovery
21.10.09	JC03914	37°06.1N	26° 29.3	45	Sunny	1336	1404	OPTICS12	
22.10.09	JC03916	34° 43.4N	29° 35.3W	53	Sunny	1359	1424	OPTICS013	
22.10.09	JC03916	34° 43.4N	29° 35.3W	54	Sunny	1428	1451	OPTICS014	
23.10.09	JC03918	32° 52.2N	31° 56.7W	60	Cloudy	1444	1515	OPTICS015	Test after bongo loss - CTD Tube left on.
24.10.09	JC03920	30° 44.7N	34° 29.0W	66	Sunny	1358	1424	OPTICS16	
24.10.09	JC03920	30° 44.7N	34° 29.0W	68	Sunny	1428	1453	OPTICS17	

Date	Station	Latitude	Longitude	Event No.	Weather	In	Out	Event	Comments
25.10.09	JC03922	28° 28.7N	36° 40.8W	75	Sunny	1359	1425	OPTICS18	
25.10.09	JC03922	28° 28.7N	36° 40.8W	77	Sunny	1430	1452	OPTICS19	
26.10.09	JC03924	27° 01.4N	38° 03.2W	86	Sunny	1359	1423	OPTICS20	
26.10.09	JC03924	27° 01.4N	38° 03.2W	88	Sunny	1426	1448	OPTICS21	
27.10.09	JC03926	24° 39.1N	40° 17.0W	94	Sunny	1400	1426	OPTICS022	
27.10.09	JC03926	24° 39.1N	40° 17.0W	96	Sunny	1429	1451	OPTICS023	
28.10.09	JC03928	23° 35.9N	40° 16.5W	106	Sun/Cloud	1412	1434	OPTICS024	
28.10.09	JC03928	23° 36.0N	40° 16.6W	107	Sun/Cloud	1436	1501	OPTICS025	
29.10.09	JC03929	21° 07.2N	39° 16.1W	126	Sun/Cloud	1357	1420	OPTICS026	
29.10.09	JC03929	21° 07.2N	39° 16.1W	128	Sun/Cloud	1423	1447	OPTICS027	
30.10.09	JC03930	20° 56.2N	39° 10.0	152	Sun/Cloud	1400	1423	OPTICS028	
30.10.09	JC03930	20° 56.2N	39° 10.0	154	Sun/Cloud	1426	1445	OPTICS029	
31.10.09	JC03932	18 °25.1N	37° 21.6W	161	Heavy Cloud	1357	1418	OPTICS030	
31.10.09	JC03932	18 °25.1N	37° 21.6W	163	Heavy Cloud	1422	1451	OPTICS031	Came up with bb6 cable disconnected from ac9
01.11.09	JC03934	15° 55.5 N	35° 39.7 W	170	Sunny	1359	1419	OPTICS032	
01.11.09	JC03934	15° 55.5 N	35° 39.7 W	172	Sunny	1423	1445	OPTICS033	
02.11.09	JC03936	13° 20.9 N	33° 54.9 W	178	Heavy Cloud	1358	1423	OPTICS034	
02.11.09	JC03936	13° 20.9 N	33° 54.9 W	180	Heavy Cloud	1427	1451	OPTICS035	
03.11.09	JC03938	10° 33.8 N	32° 02.4 W	186	Heavy Cloud	1359	1417	OPTICS036	

Date	Station	Latitude	Longitude	Event No.	Weather	In	Out	Event	Comments
03.11.09	JC03938	10° 33.8 N	32° 02.4 W	188	Heavy Cloud	1420	1438	OPTICS037	
04.11.09	JC03940	08° 48.3 N	30° 52.0 W	192	Sun/Cloud	1401	1422	OPTICS038	
04.11.09	JC03940	08° 48.3 N	30° 52.0 W	194	Sun/Cloud	1425	1446	OPTICS039	
05.11.09	JC03942	05° 56.9 N	28° 57.5 W	200	Sun/Cloud	1400	1424	OPTICS 040	
05.11.09	JC03942	05° 56.9 N	28° 57.5 W	202	Sun/Cloud	1427	1449	OPTICS 041	
06.11.09	JC03944	03° 09.5 N	27° 05.9 W	209	Heavy Overcast	1359	1419	OPTICS 42	
06.11.09	JC03944	03° 09.5 N	27° 05.9 W	211	Heavy Overcast	1423	1442	OPTICS 43	
07.11.09	JC03946	00° 36.57 N	25° 23.89 W	219	Very Sunny	1244	1304	OPTICS 44	
07.11.09	JC03946	00° 36.57 N	25° 23.89 W	220	Very Sunny	1307	1330	OPTICS 45	
08.11.09	JC03948	02° 50.08 S	25° 00.1 W	225	Sun/Cloud	1400	1421	OPTICS 46	
08.11.09	JC03948	02° 50.08 S	25° 00.1 W	227	Sun/Cloud	1424	1443	OPTICS 47	
09.11.09	JC03950	04° 51.5 S	25.00.0 W	234	Sun/Cloud	1332	1355	OPTICS 48	
09.11.09	JC03950	04° 51.5 S	25.00.0 W	236	Sun/Cloud	1358	1422	OPTICS 49	
10.11.09	JC03952	08° 22.8 S	24° 59.7 W	242	Sun/Cloud	1329	1349	OPTICS 50	
10.11.09	JC03952	08° 22.8 S	24° 59.7 W	244	Sun/Cloud	1352	1413	OPTICS 51	
11.11.09	JC03954	11° 43.5 S	25° 00.00 W	250	Sunny	1300	1325	OPTICS 52	
11.11.09	JC03954	11° 43.5 S	25° 00.00 W	252	Sunny	1328	1351	OPTICS 53	
12.11.09	JC03955	13° 51.32 S	25° 03.25 W	267	Sunny	1254	1318	OPTICS 54	

Date	Station	Latitude	Longitude	Event No.	Weather	In	Out	Event	Comments
12.11.09	JC03955	13° 51.3 S	25° 03.4 W	269	Sunny	1329	1341	OPTICS 55	
13.11.09	JC03955	14° 01.4 S	25° 10.8 W	288	Sunny	1250	1318	OPTICS 56	
13.11.09	JC03955	14° 01.4 S	25° 10.8 W	290	Sunny	1321	1342	OPTICS 57	
14.11.09	JC03957	17° 20.80 S	25° 00.00 W	297	Sunny	1303	1323	OPTICS 58	
14.11.09	JC03957	17° 20.80 S	25° 00.00 W	298	Sunny	1326	1346	OPTICS 059	
15.11.09	JC03960	20° 35.4 S	25° 00.0 W	305	Overcast	1259	1321	OPTICS 60	
15.11.09	JC03960	20° 35.4 S	25° 00.0 W	307	Overcast	1324	1345	OPTICS 61	
16.11.09	JC03962	23° 45.8 S	25° 00.1 W	313	Cloudy	1301	1323	OPTICS 62	
16.11.09	JC03962	23° 45.8 S	25° 00.1 W	315	Cloudy	1326	1347	OPTICS 63	
17.11.09	JC03964	27° 10.1 S	25° 00.1 W	320	Sun/Cloud	1259	1322	OPTICS 64	
17.11.09	JC03964	27° 10.1 S	25° 00.1 W	322	Sun/Cloud	1325	1350	OPTICS 65	
18.11.09	JC03966	29° 23.4 S	27° 02.0 W	327		1300	1323	OPTICS 66	
18.11.09	JC03966	29° 23.4 S	27° 02.0 W	329		1325	1348	OPTICS 67	
19.11.09	JC03968	31° 32.8 S	30° 15.3 W	335		1300	1322	OPTICS 68	
19.11.09	JC03968	31° 32.8 S	30° 15.3 W	337		1325	1346	OPTICS 69	
20.11.09	Station cancelled – bad weather. Optics rig fell over – bent frame & FRRF Bracket – broken battery charge socket. Instruments tested OK								
21.11.09	JC03970	33° 53.0 S	34° 58.5 W	343	Cloudy	1401	1426	OPTICS 70	Test deployment after fall
22.11.09	JC03971	35° 15.51 S	37° 09.30 W	358		1356	1419	OPTICS 71	
22.11.09	JC03971	35° 15.51 S	37° 09.30 W	359		1421	1444	OPTICS 72	

Date	Station	Latitude	Longitude	Event No.	Weather	In	Out	Event	Comments
23.11.09	Station cancelled – bad weather.								
24.11.09	JC03973	37° 52.0 S	41° 05.5 W	371		1359	1423	OPTICS 73	
24.11.09	JC03973	37° 52.0 S	41° 05.5 W	373		1426	1450	OPTICS 74	
25.11.09	JC03975	39° 58.0 S	44° 26.8 W	379		1400	1423	OPTICS 75	
25.11.09	JC03975	39° 58.0 S	44° 26.8 W	381		1426	1449	OPTICS 76	
26.11.09	JC03976	42° 15.0 S	48° 13.5 W	385		1400	1418	OPTICS 77	
26.11.09	JC03976	42° 15.0 S	48° 13.5 W	387		1423	1438	OPTICS 78	

Table 1: Description and serial numbers of instruments used on AMT-18. Highlighting is used to show instruments used as a unit.

Measurement	Instrument	Manufacturer	Model	Serial number	Calibration
In-water UV (305, 320, 340, 380 nm)	UV sensor	Satlantic	507-UV	168	19th Feb 2009 Satlantic; used post cruise calibration (Di168b.cal)
phytoplankton phys.	FRRF	Chelsea	FRRF 1	182042	19th June 2008 Chelsea
PAR	PAR sensor	Chelsea	not known	not known	
Depth	Depth sensor	Druck	not known	not known	
Temperature, Salinity backscatter at 6 wavelengths 442, 488, 550, 620, 671, 852	CTD	SeaBird	SBE19+	19P27903-4180	12th Dec 2001 Seabird 4th April 2007
absorption / attenuation at 412,440, 488,510,532,555,650,676, 715 nm	hydroscat 6 ac-9	Hobilabs Wetlabs	bb6 ac9+	HS020332 ac90265	11th May 2005 Wetlabs
HyperSAS	Radiometer - vertical	Satlantic	OCR-R	258	29th September 2006 - Satlantic
	Radiometer -45	Satlantic	OCR-R	023	29th September 2006 – Satlantic
	Radiometer +45	Satlantic	OCR-R	022	29th September 2006 - Satlantic
Incident UV (200 – 500 nm at 2.5 nm resolution)	Hyperspectral UV sensor	Trios	ACC2 UV	010-05-501F	Manufacturer's original calibration but with not known but regularly calibrated at Goddard.
Aerosol Optical Depth	sunphotometer	SOLAR light co.	microtops II	03759	

Primary production and concentration of chlorophyll a

CLAIRE WIDDICOMBE
Plymouth Marine Laboratory,

Objectives

Integrated size fractionated primary production and chlorophyll a was measured at 38 stations during AMT 19 in order to address and fulfil one of the main deliverables of the Oceans 2025 Theme 10a. Concentration of total chlorophyll a was also measured from the underway non-toxic seawater supply system for greater spatial heterogeneity and calibration purposes. These core measurements contribute to the unique time series of spatially extensive and internally consistent observations on the structure and biogeochemical properties of planktonic ecosystems in the Atlantic Ocean and the methods used are synonymous to those used on previous AMT cruises.

Methods

Primary production

Water samples were collected pre-dawn using the titanium SeaBird CTD rosette sampler. Seawater from six light depths (between 97% and 1%) were collected and sub-sampled into triplicate 75mL clear polycarbonate bottles (and triplicate dark 75mL bottles), inoculated with ca. 10µCi ^{14}C-bicarbonate and incubated in on-deck (simulated in-situ) incubators for ca. 12-14 hours (local dawn to dusk). The incubators were covered with neutral density filters to mimic subsurface irradiance and maintained at in-situ temperature by pumping surface seawater through the incubators and for the deeper light depths a cooler was used to chill the seawater temperature to ±3°C. Experiments were terminated by sequential filtration through 2µm polycarbonate and 0.2µm Supor 200 membrane filters and fumed overnight with HCl prior to analysis onboard using a Packard, Tricarb 2900 liquid scintillation counter.

Chlorophyll a

Size fractionated (2µm and 0.2µm) chlorophyll concentrations were determined using water collected pre-dawn for the primary production experiments. Discrete underway samples (0.2µm) were also collected from the ship's Surf-Met (underway surface and meteorological data collection) flow system approximately 3-4 times daily and calibrated against the TSG fluorometer. Chlorophyll a was measured on-board using a Turner Trilogy fluorometer, calibrated against pure chlorophyll a.

Results

Primary production averaged 386 (±311) mgC m^{-2} d^{-1} during the cruise with the majority of production typically occurring in the 0.2-2µm size fraction (Fig. 1). Surface chlorophyll a concentrations were also highly variable along the AMT transect, averaging 0.16 ±0.28 mg m^{-3}. (Fig. 2) and showed a reasonable calibration against the TSG fluormeter (Fig. 3).

Table 1. Primary production station details

Expt	JD	Date	Time (GMT)	Latitude	Longitude W
1	287	14/10/2009	04:34	49 34.0	008 38.01
2	288	15/10/2009	04:37	48 56.9	014 27.59
3	289	16/10/2009	04:30	49 00.2	016 39.92
4	290	17/10/2009	04:54	47 17.2	018 02.52
5	291	18/10/2009	04:31	44 14.6	020 24.09
6	292	19/10/2009	04:30	41 15.2	022 36.25
7	293	20/10/2009	04:43	38 19.3	024 39.95
8	295	22/10/2009	05:58	35 27.2	028 38.74
9	296	23/10/2009	05:28	33 25.2	031 15.23

Expt	JD	Date	Time (GMT)	Latitude	Longitude W
10	297	24/10/2009	05:29	31 25.7	033 44.21
11	298	25/10/2009	05:27	29 11.2	035 59.34
12	299	26/10/2009	05:29	27 13.0	037 53.06
13	300	27/10/2009	05:28	25 23.5	039 36.05
14	301	28/10/2009	06:26	23 13.3	040 43.08
15	302	29/10/2009	06:15	21 08.0	039 14.52
17	304	31/10/2009	05:57	19 08.6	037 51.80
18	305	01/11/2009	06:28	16 34.1	036 05.85
19	306	02/11/2009	05:28	14 09.2	034 27.41
20	307	03/11/2009	05:29	11 28.0	032 38.76
21	309	05/11/2009	05:29	06 49.8	029 32.80
22	310	06/11/2009	05:29	04 03.2	027 41.66
23	311	07/11/2009	05:25	01 16.2	025 50.80
24	312	08/11/2009	07:04	-02 02.9	024 59.60
25	313	09/11/2009	05:28	-03 50.5	025 00.08
26	314	10/11/2009	05:28	-07 22.1	024 59.5
27	315	11/11/2009	04:30	-10 39.4	025 00.00
28	316	12/11/2009	05:14	-13 48.8	024 58.90
29	318	14/11/2009	04:39	-16 22.3	024 59.79
30	319	15/11/2009	04:29	-19 30.1	024 59.70
31	320	16/11/2009	04:28	-22 51.2	024 59.77
32	321	17/11/2009	04:36	-26 06.8	025 00.31
33	322	18/11/2009	04:31	-28 47.3	026 08.52
34	323	19/11/2009	04:29	-30 50.0	029 11.02
35	325	21/11/2009	04:36	-33 24.5	034 15.48
36	326	22/11/2009	05:15	-35 17.9	037 06.82
37	328	24/11/2009	05:28	-37 17.9	040 11.37
38	329	25/11/2009	05:27	-39 18.9	043 23.50

Figure 1.

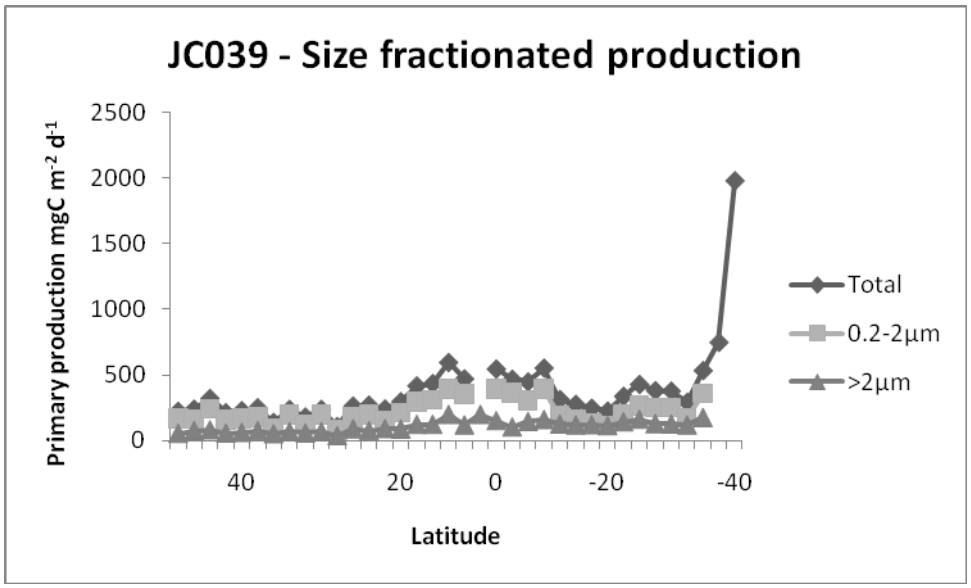


Figure 2.

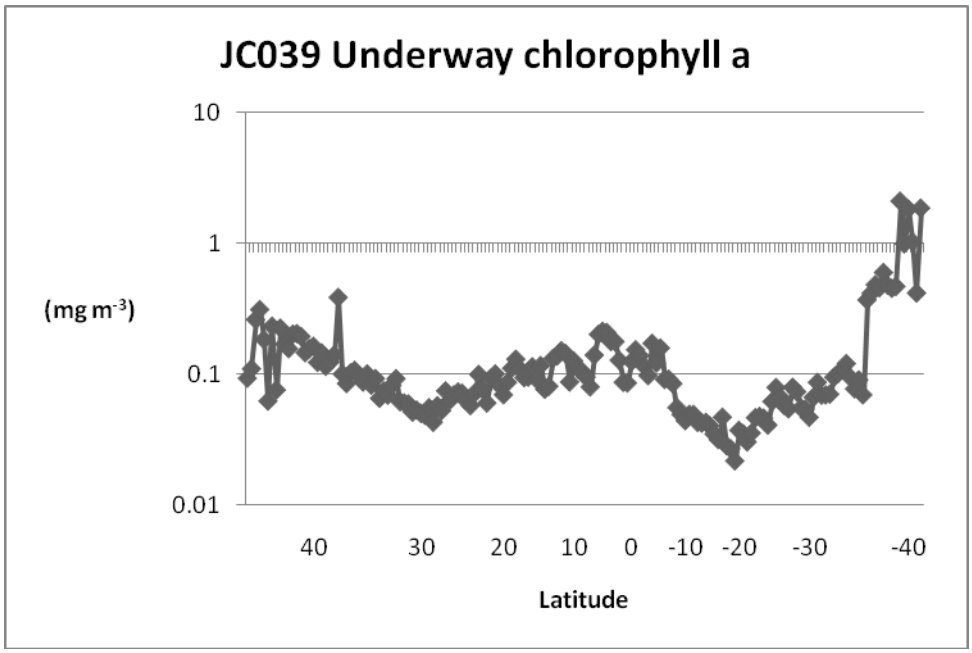
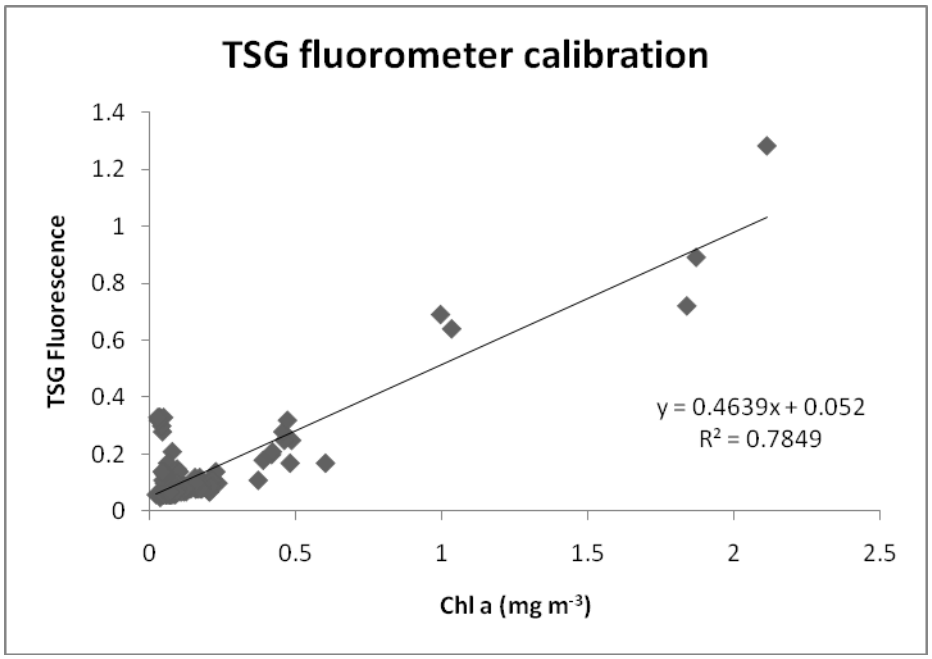


Figure 3



Dissolved oxygen

JOHN STEPHENS[1] AND KEVIN TEMPEST[2]
Plymouth Marine Laboratory[1] and University Of Washington[2]

Background

Dissolved oxygen (O_2) in seawater is produced by photosynthesis and consumed by respiration and photochemical reactions in the surface waters. Equilibrium between dissolved O_2 in seawater and O_2 in the atmosphere is maintained through air-sea gas exchange. Previous work on the AMT programme has shown that gross community respiration may at times exceed production of O_2 integrated over the euphotic zone (Robinson *et al*., 2002; Serret *et al*., 2001). Several cruises have shown that this result is not consistent in either space or time suggesting transient net heterotrophy in the open ocean. The net trophic state of the oceans (autotrophic vs. heterotrophic) ultimately determines whether they act as a source or a sink for atmospheric carbon dioxide. Understanding the dynamics of O_2 is therefore necessary in order to improve biogeochemical models and associated climate change predictions. The AMT programme presents an ideal opportunity to study the biogeochemical interactions between photosynthesis and respiration on the dynamics of dissolved O_2 across diverse marine biomes. The aims of this work are:-

1. To quantify gross community production and respiration of O_2 in surface waters.
2. To calibrate the O_2 sensors on both the ships' depth profilers.

Methods

Dissolved O_2 was determined by automated Winkler titration with photometric end-point detection (Carritt & Carpenter, 1966). The concentration of thiosulphate was calibrated every 3 days. Gross community production and respiration experiments were carried out according to Robinson et al. (2002). In brief, seawater samples were collected daily from the pre-dawn depth profile in 10 L acid-washed carbuoys (6 depths within the euphotic zone). Each carbuoy was sub-sampled into 125 ml glass O_2 bottles which were placed in on-deck incubators for 24 hours. The incubators were covered with neutral density light filters and temperature controlled in order to simulate *in-situ* conditions. Additional sub-samples were taken and fixed at the start of the incubation (T_{ZERO} sub-samples).Light and Dark (aluminium foil wrapped) O_2 bottles were removed after the 24 hour incubation and fixed and analysed for O_2. Each treatment for each depth (T_{ZERO}, Light and Dark) was replicated four times (12 bottles per depth).

Community respiration (CR) was calculated as O_2 consumption in the Dark samples (Dark – T_{ZERO}).
Net community production was calculated as O_2 production in Light samples (Light – Dark).

In total, 29 experiments were carried out for the determination of community production/respiration along the transect and the station summary is listed in Table 1.

Seawater samples were collected daily from both (stainless steel framed and titanium framed) vertical profiling rigs (CTD's) (2-5 depths), fixed and analysed for O_2 for the calibration of their respective O_2 sensors. The station summaries are listed in Table 2.

Results

The CTD calibration data shown in Figs.1a & b show a linear relationship between the O_2 sensors and the titration results for both systems. The data show that the O_2 sensors consistently underestimated the concentration of dissolved O_2. On closer examination however there would appear to be a drift in sensitivity with time and calibration of the sensors on a weekly level rather than the cruise transect in bulk would provide a more accurate representation of dissolved oxygen concentrations.

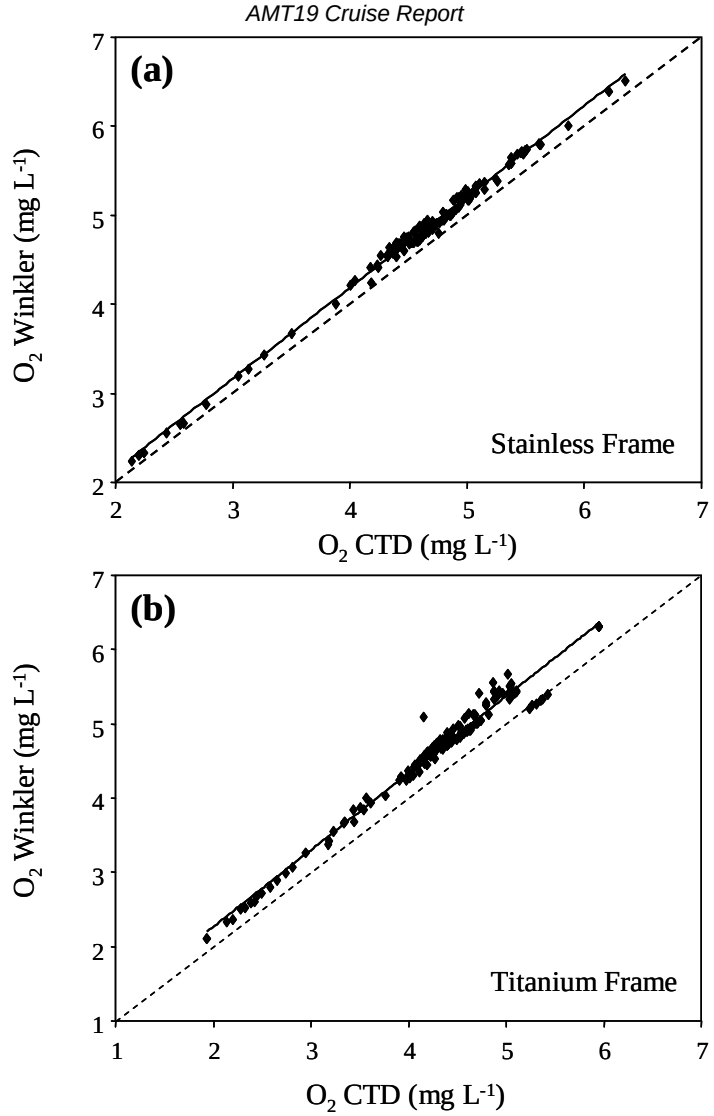


Figure 1: Calibration of O_2 sensors on the Conductivity Temperature Depth profilers during AMT 19 (JC_039). O_2 determined by Winkler titration against sensor data. (a) Stainless Steel Frame, (b) Titanium Frame. The 1:1 line is shown in each case.

Experimental data for the determination of community production/respiration is not yet fully quality controlled and will be subject to further analysis before any inferences or conclusions can be drawn.

Table 2: Station log for samples collected for production/respiration of O_2 during AMT 19 (JC_039). Station geographic location (latitude & longitude) and actual sampled depth (rather than nominal depth) can be obtained from the cruise CTD log.

Date	Time (GMT)	Ship Stn.	CTD ID	Niskin sampled
14.Oct.2009	04:40	JC039_002	CTD_002S	7, 15, 23
15.Oct.2009	04:40	JC039_004	CTD_004S	3, 7, 12, 14, 17, 19
16.Oct.2009	04:40	JC039_005 CTD_007T	5, 6, 8, 12, 13, 14	
17.Oct.2009	05:00	JC039_007	CTD_010T	5, 6, 7, 12, 13, 18
19.Oct.2009	05:00	JC039_011	CTD_016T	1, 6, 7, 8, 10, 11
20.Oct.2009	04:45	JC039_013	CTD_019T	4, 5, 6, 7, 9, 10
22.Oct.2009	05:40	JC039_015	CTD_022T	4, 5, 6, 7, 8, 9
23.Oct.2009	05:40	JC039_017	CTD_025T	4, 5, 6, 7, 8, 18
24.Oct.2009	05:40	JC039_019	CTD_028T	4, 5, 6, 7, 8, 9

Date	Time (GMT)	Ship Stn.	CTD ID	Niskin sampled
26.Oct.2009	05:30	JC039_023	CTD_034T	4, 5, 6, 7, 8, 9
27.Oct.2009	05:35	JC039_025	CTD_037T	4, 5, 6, 7, 8, 9
29.Oct.2009	06:20	JC039_029	CTD_042T	4, 5, 6, 7, 8, 9
31.Oct.2009	06:00	JC039_031	CTD_049T	4, 5, 6, 7, 8, 9
01.Nov.2009	06:40	JC039_033	CTD_052T	4, 5, 6, 7, 8, 9
03.Nov.2009	05:40	JC039_037	CTD_058T	4, 5, 6, 7, 8, 9
05.Nov.2009	05:40	JC039_041	CTD_062T	5, 6, 7, 8, 13, 14
06.Nov.2009	05:30	JC039_043	CTD_065T	4, 5, 6, 7, 8, 13
08.Nov.2010	07:00	JC039_047	CTD_070T	4, 5, 6, 7, 8, 13
09.Nov.2010	05:35	JC039_050	CTD_073T	4, 5, 6, 7, 8, 13
11.Nov.2010	04:40	JC039_053	CTD_079T	4, 5, 6, 7, 8, 13
12.Nov.2010	05:20	JC039_055	CTD_082T	4, 5, 6, 7, 8, 13
14.Nov.2010	04:40	JC039_056	CTD_089T	4, 5, 6, 7, 8, 13
15.Nov.2009	04:30	JC039_059	CTD_092T	4, 5, 6, 7, 8, 13
17.Nov.2009	04:40	JC039_063	CTD_098T	4, 5, 6, 7, 8, 13
18.Nov.2009	04:40	JC039_065	CTD_101T	4, 5, 8, 9, 10, 13
21.Nov.2009	05:40	JC039_069	CTD_107T	4, 7, 8, 9, 10, 13
22.Nov.2009	05:20	JC039_071	CTD_110T	4, 5, 6, 11, 12, 18
24.Nov.2009	05:40	JC039_072	CTD_114T	4, 5, 10, 11, 12, 13
25.Nov.2009	05:40	JC039_074	CTD_117T	4, 5, 6, 11, 12, 13

Table 2: Station log of samples analysed for the calibration of O_2 sensors on the Conductivity Temperature Depth profilers during AMT 19 (JC_039). Station geographic location (latitude & longitude) and actual sampled depth (rather than nominal depth) can be obtained from the cruise CTD log.

Stainless Steel Frame:

Date	Time (GMT)	Ship Stn.	CTD ID	Niskin sampled
17.Oct.2009	06:00	JC039_007	CTD_011S	2, 5, 8, 16, 20
18.Oct.2009	05:40	JC039_009	CTD_014S	3, 4, 8, 13, 16, 21
19.Oct.2009	05:50	JC039_011	CTD_017S	4, 8, 16, 22
20.Oct.2009	05:45	JC039_013	CTD_020S	2, 4, 8, 22, 24
22.Oct.2009	06:40	JC039_015	CTD_023S	4, 8, 16
23.Oct.2009	06:40	JC039_017	CTD_026S	4, 8, 17, 22
24.Oct.2009	06:30	JC039_019	CTD_029S	4, 8, 15, 19, 22
25.Oct.2009	06:40	JC039_021	CTD_032S	4, 8, 17, 19, 22
26.Oct.2009	06:30	JC039_023	CTD_035S	3, 7, 16, 19, 21
27.Oct.2009	06:35	JC039_025	CTD_038S	4, 8, 15, 19, 22
27.Oct.2009	07:30	JC039_027	CTD_041S	4, 8, 17, 22
31.Oct.2009	07:00	JCO39_031	CTD_050S	4, 8, 15, 19, 22
01.Nov.2009	07:40	JCO39_033	CTD_053S	4, 7, 16, 22
02.Nov.2009	06:20	JCO39_035	CTD_056S	1, 4, 8, 19, 21
03.Nov.2009	06:25	JCO39_037	CTD_059S	4, 8, 19, 22
05.Nov.2009	06:30	JCO39_041	CTD_063S	2, 7, 16, 21
06.Nov.2009	06:30	JCO39_043	CTD_066S	3, 8, 15, 22
07.Nov.2009	06:30	JCO39_045	CTD_069S	3, 8, 17, 22
08.Nov.2009	08:00	JCO39_047	CTD_071S	3, 8, 17, 19, 21
09.Nov.2009	06:20	JCO39_050	CTD_074S	3, 7, 17, 19, 21
10.Nov.2009	06:30	JCO39_051	CTD_077S	3, 8, 17, 19, 22
11.Nov.2009	05:30	JCO39_053	CTD_080S	3, 7, 15, 19, 22
14.Nov.2009	05:40	JCO39_056	CTD_090S	5, 8, 16, 19, 22
15.Nov.2009	05:30	JCO39_059	CTD_093S	5, 7, 17, 19, 22
16.Nov.2009	05:30	JCO39_061	CTD_096S	3, 6, 17, 19, 22
17.Nov.2009	05:30	JCO39_063	CTD_099S	3, 7, 19, 22
18.Nov.2009	05:30	JCO39_065	CTD_102S	3, 6, 17, 20, 22
19.Nov.2009	05:20	JCO39_067	CTD_105S	3, 7, 17, 19, 22

Date	Time (GMT)	Ship Stn.	CTD ID	Niskin sampled
21.Nov.2009	06:45	JCO39_069	CTD_108S	3, 8, 16, 18, 22
24.Nov.2009	06:30	JCO39_072	CTD_115S	3, 7, 19, 21
25.Nov.2009	06:30	JCO39_074	CTD_118S	3, 5, 10, 16

Titanium Frame:

Date	Time (GMT)	Ship Stn.	CTD ID	Niskin sampled
17.Oct.2009	13:40	JC039_008	CTD_012T	1, 2, 5, 9, 13, 16
18.Oct.2009	13:45	JC039_010	CTD_015T	1, 10, 13, 16
19.Oct.2009	13:30	JC039_012	CTD_018T	1, 2, 3, 12, 16
21.Oct.2009	13:00	JC039_014	CTD_021T	1, 2, 5, 16
22.Oct.2009	14:00	JC039_016	CTD_024T	1, 2, 7, 13, 16
23.Oct.2009	14:15	JC039_018	CTD_027T	1, 2, 3, 4, 5, 7, 16
24.Oct.2009	14:00	JC039_020	CTD_030T	1, 2, 3, 4, 5, 19
25.Oct.2009	14:00	JC039_022	CTD_033T	2, 3, 4, 19, 20
26.Oct.2009	14:00	JC039_024	CTD_036T	2, 3, 4, 7, 8, 12, 16
27.Oct.2009	14:00	JC039_026	CTD_039T	1, 2, 3, 4, 5
30.Oct.2009	06:30	JC039_028	CTD_046T	4, 5, 6, 7, 8
30.Oct.2009	14:00	JC039_030	CTD_048T	1, 2, 3, 4, 5, 6
31.Oct.2009	14:00	JCO39_032	CTD_051T	1, 2, 3, 5, 6
01.Nov.2009	14:00	JCO39_034	CTD_054T	1, 3, 8, 12, 16
02.Nov.2009	14:00	JCO39_036	CTD_057T	3, 9, 12, 16
03.Nov.2009	14:00	JCO39_038	CTD_060T	3, 9, 13, 16
04.Nov.2009	14:00	JCO39_040	CTD_061T	3, 8, 12, 16
05.Nov.2009	14:05	JCO39_042	CTD_064T	3, 9, 12, 17
06.Nov.2009	14:00	JCO39_044	CTD_067T	3, 8, 12, 16
08.Nov.2009	14:00	JCO39_048	CTD_072T	3, 7, 17
09.Nov.2009	13:30	JCO39_051	CTD_075T	3, 7, 16
10.Nov.2009	13:30	JCO39_052	CTD_078T	4, 6, 16
11.Nov.2009	13:00	JCO39_054	CTD_081T	3, 5, 12, 16
12.Nov.2009	13:20	JCO39_055	CTD_084T	1, 3, 7, 12
14.Nov.2009	13:00	JCO39_057	CTD_091T	19, 20, 21, 22
15.Nov.2009	13:00	JCO39_060	CTD_094T	1, 2, 3, 4, 5
16.Nov.2009	13:00	JCO39_062	CTD_097T	1, 2, 3, 4, 5, 6
17.Nov.2009	13:00	JCO39_064	CTD_100T	1, 2, 3, 4, 5, 6
18.Nov.2009	13:00	JCO39_066	CTD_103T	1, 2, 3, 4, 5, 6
19.Nov.2009	13:00	JCO39_068	CTD_106T	1, 2, 3, 4, 5
21.Nov.2009	14:00	JCO39_070	CTD_109T	1, 2, 3, 4, 5, 6
24.Nov.2009	14:00	JCO39_073	CTD_116T	1, 2, 3, 5, 6
25.Nov.2009	14:00	JCO39_075	CTD_119T	2, 5, 9, 11, 16

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Diel experiment drifter deployments for AMT19

JOHN STEPHENS
Plymouth Marine Laboratory

Method

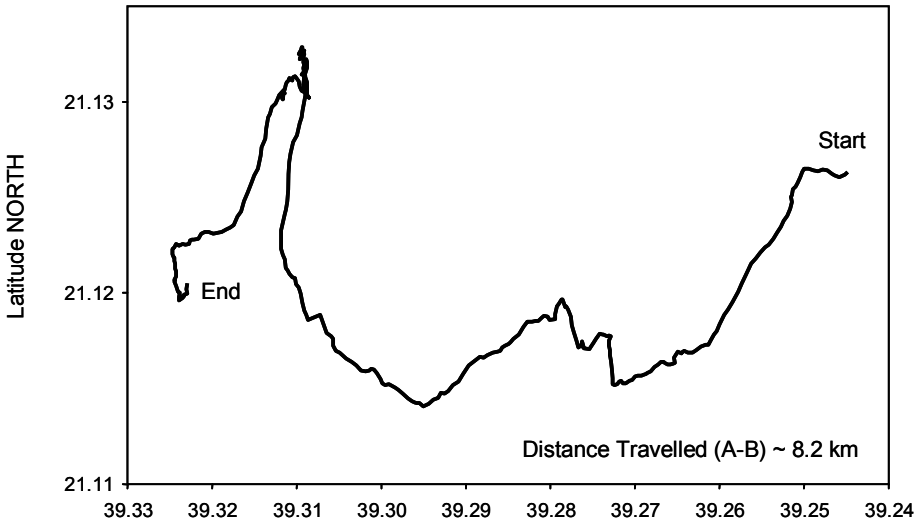
To facilitate a number of diel experiments designed to measure the variability in the concentration and biological turnover of selective oxygenated volatile organic carbon compounds and the requirement to sample the same body of water for up to a 30h period at hourly intervals a drifter buoy (Pacific Gyre, *www.pacificgyre.com*) was deployed at the start of each experiment and followed for the duration of that experiment. The drifter arrangement was a surface buoy with GPS receiving and transmitting hardware attached to an 8m umbilical which in turn was attached to a 2m long x 1m diameter drogue which hung vertically in the water column. This configuration allowed the ship to track the surface water (10m depth) by receiving a radio GPS position from the buoy via a modem interfaced to a PC on the ships' bridge. The buoy position and ships' position (taken from the ships' GPS via the PC) were then interactively plotted in real time enabling the officer of the watch to track the buoy relative to the ship and thus hold station.

Results

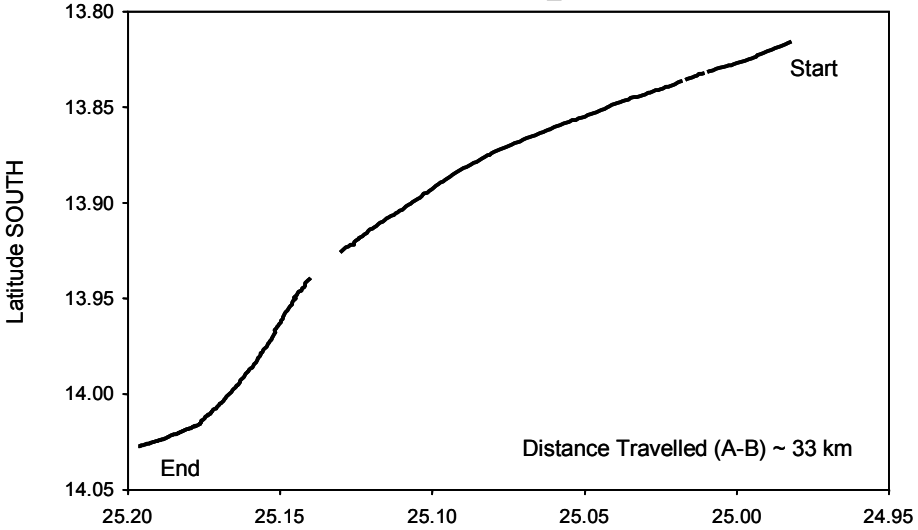
A total of three deployments were undertaken for the periods 29-30th Oct 2009, 11-12th Nov 2009 and 22-23rd Nov 2009. The deployments were successful and relayed buoy positions for the duration of the diel experiments until severe weather necessitated the abandonment of the third experiment and due to deteriorating sea conditions the drifter also.

The figure below shows the buoy tracks for the three experiments and the distances are not for the distance travelled but the direct distance (straight line) between the start and the finish of each drift.

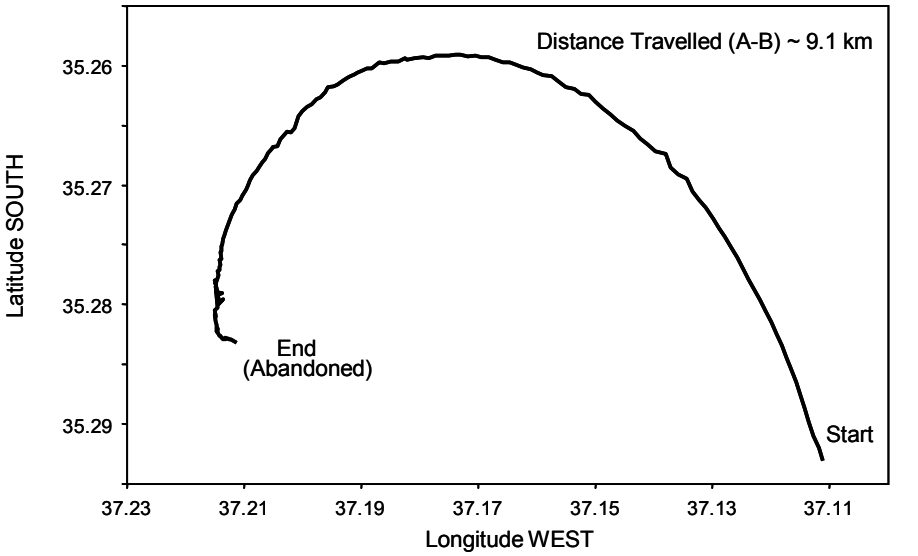
JC039 : Drifter Track for Diel_01 : 29-30 Oct.2009



JC039 : Drifter Track for Diel_02 : 12-13 Nov.2009



JC039 : Drifter Track for Diel_03 : 22-23 Nov.2009



Microbial plankton community abundance, structure and dynamics

GLEN TARRAN[1], MARTIN OSTROWSKI[2], CAROLINA GROB[2], MANUELA HARTMANN[3], SIÂN HERRINGTON[3], ROSS HOLLAND[3] AND MIKE ZUBKOV[3]

[1]*Plymouth Marine Laboratory*
[2]*University of Warwick, Coventry*
[3]*National Oceanography Centre, Southampton*

Aim

To examine abundance, phylogenetic composition, cellular elemental composition and metabolic activities of dominant microbial groups within planktonic communities, inhabiting the euphotic zone of temperate, tropical and equatorial regions of the North and South Atlantic Ocean.

1. Abundance and Composition of Microbial Plankton Communities: flow cytometry and pigment analyses (Tarran, Holland, Zubkov)

Objectives:

- To determine the distribution, abundance and community structure of nano- and picophytoplankton, heterotrophic bacteria and heterotrophic nano- and picoplankton from predawn and solar noon CTD casts by flow cytometry. *AMT core measurement.*
- To determine the distribution, abundance and community structure of planktonic phototrophic and heterotrophic bacteria and protists (flagellates) from high frequency underway sampling from the ship's pumped seawater supply by flow cytometry. *AMT core measurement.*
- Collect and filter seawater samples for the post-cruise quantification of phytoplankton pigments using High Performance Liquid Chromatography (HPLC) from predawn and solar noon CTD casts. *AMT core measurement.*
- To determine community composition of microplankton protist communities (size range 20-200 µm). Trials of newly developed tandem microplankton net and FlowCAM flow cytometer *AMT core measurement development.*

1.1. Phytoplankton community structure and abundance by flow cytometry. *AMT core measurement*

Fresh seawater samples were collected in clean 250 mL polycarbonate bottles from a Seabird CTD system containing a 24 bottle rosette of 10 and 20 L Niskin bottles from predawn and solar noon CTD casts. Samples were stored in a refrigerator and analysed within 1-2 hours of collection. Fresh samples were measured using a Becton Dickinson FACSort flow cytometer which characterised and enumerated *Prochlorococcus* sp. and *Synechococcus* sp. (cyanobacteria), pico-eucaryotes, cryptophytes, coccolithophores and other nanophytoplankton based on their light scattering and autofluorescence properties. The data were immediately stored on disk and will be analysed back in the UK. Table 1.1. summarises the CTD casts sampled and analysed during the cruise.

Samples were drawn from all pre-dawn and noon CTD casts, kept refrigerated and fixed with paraformaldehyde within half an hour of surfacing. Both CTD and Underway samples (see below) were stained with the DNA stain SYBR Green I (Sigma) in order to separate particles in suspension based on DNA content and light scattering properties. Samples were analysed flow cytometrically within 4 hours of surfacing. Each stained sample was run twice through a Becton Dickinson FACSort flow cytometer; once to analyse sub-micron particles and once to analyse particles greater than 1 micron in diameter. Data was saved and will be analysed ashore. Concentrations per ml of Heterotrophic bacteria, Viruses, Protists, Picophytoplankton and Nanophytoplankton will be calculated.

Underway samples were drawn every hour from the ship's non-toxic seawater supply by an automated liquid handling robot (Tecan Miniprep 60, Tecan, Reading, UK). Samples were fixed instantly with paraformaldehyde and analysed flow cytometrically within 8 hours. Underway sampling began at 15:00 on 15/10/09 and was discontinued at 00:00 on 27/11/09.

Table 1.1: CTD casts sampled for phytoplankton, heterotrophic bacteria and heterotrophic flagellate commumity structure & abundance

Date	CTD	Time on deck (GMT)	Lat (N, -S)	Long W	Depths sampled (m).
14-Oct	2	05:23	49.57	8.63	1 5 10 17 20 23 40 50 100 130
14-Oct	3	13:26	49.43	10.53	1 5 10 20 27 40 50 80 100
15-Oct	5	06:57	48.95	14.46	1 5 10 17 23 40 60 80 100
16-Oct	8	06:36	49.00	16.66	1 5 10 17 23 38 60 80 100 125 150 200
17-Oct	11	06:50	47.29	18.04	1 5 10 17 25 45 60 80 100 125 150 175 200
17-Oct	12	13:44	46.34	18.80	1 5 10 20 30 40 50 60 80 100 125 150 200
18-Oct	14	06:27	44.24	20.40	1 15 25 30 50 60 80 100 125 200
18-Oct	15	14:33	43.21	21.18	1 5 10 20 30 40 50 60 80 100 125 150 200
19-Oct	17	06:38	41.25	22.60	1 9 17 30 40 60 70 80 100 125
19-Oct	18	14:16	40.32	23.27	1 5 10 20 30 40 50 60 100 125 150 200
20-Oct	20	06:36	38.32	24.67	1 7 13 25 30 40 57 80 100 125 150 200
21-Oct	21	13:58	37.10	26.49	1 5 10 20 30 40 60 100 125 150 200
22-Oct	23	06:26	35.45	28.65	1 10 17 30 40 55 68 75 100 125
22-Oct	24	14:56	34.72	29.58	1 10 20 40 50 60 80 100 125 150 200
23-Oct	26	06:39	33.42	31.25	1 15 25 45 60 80 105 125 150 175 200
23-Oct	27	15:12	32.87	31.95	1 10 20 40 55 60 80 115 150 175 200
24-Oct	29	07:09	31.43	33.74	1 15 28 50 65 85 115 127 150 175 200
24-Oct	30	14:57	30.75	34.48	1 10 20 40 55 60 80 130 150 175 200
25-Oct	32	07:22	29.18	35.98	1 15 30 50 65 85 115 125 150 175 200
25-Oct	33	14:58	28.48	36.68	1 10 20 40 60 80 100 130 150 175 200
26-Oct	35	07:09	27.22	37.89	1 15 25 45 65 85 110 125 150 175 200
26-Oct	36	14:53	27.02	38.05	1 10 20 40 60 80 100 115 150 175 200
27-Oct	38	07:13	25.39	39.60	1 15 30 50 65 85 115 130 150 175 200
27-Oct	39	14:59	24.65	40.28	1 10 20 40 60 80 100 130 150 175 200
28-Oct	41	08:14	23.23	40.72	1 15 25 45 65 85 110 125 150 175 200
29-Oct	43	08:02	21.13	39.25	1 15 25 45 65 85 110
29-Oct	44	15:03	21.12	39.27	1 10 15 20 40 60 80 90 110 125 150
30-Oct	47	08:05	21.13	39.31	1 25 45 60 75 100 125 150
30-Oct	48	14:50	20.12	39.27	1 10 20 40 60 80 100 125 150 200
31-Oct	50	07:41	19.14	37.86	1 10 20 35 45 60 81 100 125 150 200
31-Oct	51	14:46	18.42	37.36	1 10 20 40 60 78 100 125 150 200
01-Nov	53	08:20	16.57	36.10	1 15 25 45 60 75 100 125 150 175 200
01-Nov	54	14:54	15.93	35.66	1 10 20 40 60 82 100 125 150 175 200
02-Nov	56	07:02	14.15	34.46	1 10 17 30 40 55 68 100 125 150 200
02-Nov	57	14:53	13.35	33.92	1 10 20 40 60 80 100 125 150 175 200
03-Nov	59	07:03	11.47	32.65	1 5 10 17 25 30 42 70 100 150 200
03-Nov	60	14:53	10.56	32.04	1 10 20 40 59 80 100 125 150 200
04-Nov	61	14:53	8.80	30.87	1 10 20 40 60 80 100 125 150 175 200
05-Nov	63	07:07	6.84	29.55	1 7 15 25 30 40 55 75 100 150 200
05-Nov	64	14:53	5.95	28.96	1 10 20 40 60 80 100 125 150 175 200
06-Nov	66	07:07	4.05	27.69	1 15 25 40 55 70 95 110 125 150 200
06-Nov	67	14:53	3.16	27.10	1 10 20 40 60 85 100 125 150 175 200
07-Nov	69	06:25	1.27	25.85	1 10 15 30 40 55 70 100 125 150 200
08-Nov	71	08:07	-2.04	24.99	3 10 20 35 45 60 80 100 125 150 200
08-Nov	72	14:56	-2.85	25.00	1 10 20 40 60 71 100 125 150 175 200
09-Nov	74	07:00	-3.84	25.00	1 15 25 40 55 70 80 95 125 150 200
09-Nov	75	14:21	-4.86	25.00	1 10 20 40 60 85 100 125 150 175 200
10-Nov	77	07:15	-7.36	24.99	1 15 25 45 60 75 100 125 150 175 200

Date	CTD	Time on deck (GMT)	Lat (N, -S)	Long W	Depths sampled (m).
10-Nov	78	14:22	-8.38	25.00	1 10 20 35 40 60 80 100 125 150 175 200
11-Nov	80	06:04	-10.65	25.00	1 15 25 45 60 75 100 125 150 175 200
11-Nov	81	13:51	-11.72	25.00	1 10 20 40 60 80 100 125 150 175 200
12-Nov	83	07:00	-13.81	24.99	1 15 30 55 75 95 140 175 200
12-Nov	84	14:03	-13.86	25.06	1 10 20 40 60 80 100 120 135 150
13-Nov	87	07:02	-14.01	25.18	1 20 30 45 60 80 100 120 145 175 200
13-Nov	88	13:46	-14.02	25.18	1 10 20 40 60 80 100 125 142 175 200
14-Nov	90	06:11	-16.37	25.00	1 20 35 65 75 90 100 120 150 175 200
14-Nov	91	13:55	-17.35	25.00	1 10 20 40 60 80 100 130 158 180 200
15-Nov	93	06:09	-19.50	25.00	1 20 40 70 90 105 120 145 160 175 200
15-Nov	94	13:55	-20.59	25.00	1 20 40 60 80 110 140 165 200
16-Nov	96	06:07	-22.52	25.00	1 20 35 60 80 105 120 140 175 200
16-Nov	97	13:54	-23.76	25.00	1 10 20 40 60 80 100 125 150 175 200
17-Nov	99	06:14	-26.11	25.01	1 20 35 60 85 105 120 140 150 175 200
17-Nov	100	13:54	-27.17	25.00	1 10 20 40 60 80 100 115 130 175 200
18-Nov	102	06:21	-28.79	26.14	1 20 30 45 60 80 115 135 175 200
18-Nov	103	13:56	-29.39	27.03	1 10 20 40 60 90 110 130 150 175 200
19-Nov	105	05:58	-30.83	29.18	1 15 30 55 75 100 115 130 150 175 200
19-Nov	106	14:03	-31.55	30.25	1 10 20 40 60 92 110 130 150 200
21-Nov	108	06:30	-33.41	34.25	2 10 20 35 45 88 100 125 150 200
21-Nov	109	14:57	-33.88	34.97	2 10 20 40 60 82 100 125 150 200
22-Nov	111	05:59	-35.30	37.11	1 5 10 20 30 40 60 100 150 200
22-Nov	112	14:02	-35.26	37.18	3 5 10 20 30 35 50 100 125 150
24-Nov	115	07:02	-37.30	40.19	5 10 15 25 30 38 60 100 150 200
24-Nov	116	14:45	-37.87	41.09	5 10 20 40 60 80 100 125 150 175 200
25-Nov	118	07:08	-39.32	43.39	2 5 10 15 20 30 40 50 75 100 150 200
25-Nov	119	14:53	-39.97	44.45	2 5 10 15 20 40 60 80 100 150 200
26-Nov	120	14:52	-42.25	48.22	5 7 20 28 38 60 80 100 150 175 200

1.2. Sample collection for quantification of phytoplankton pigments using High Performance Liquid Chromatography (HPLC). *AMT core measurement*

Libby Ross from NOC,S conducted the sample collection and filtration for HPLC pigments. Many thanks to Libby for taking on this task.

Fresh seawater samples from 6 light depths (97, 55, 33, 14, 3 and 1% of surface light. 1% was sometimes substituted with deep chlorophyll maximum (DCM)) were collected into 7 L polypropylene carboys covered in black plastic to keep out light. Duplicate 1-2 L samples were decanted into rinsed polypropylene bottles with siphon tubes and inverted into a 6 port vacuum filtration rig at a vacuum of 18-20 inches of mercury. Samples were filtered through 25 mm Advantec® GF75 glass fibre filters and the resulting sample filters were folded into 2 mL opaque brown cryovials (Starlab®), flash frozen in liquid nitrogen and stored at -80^{o}C.

Table 1.2.: summarises the CTD casts sampled during the cruise. Samples will be analysed by HPLC after the cruise.

Table 1.2: CTD casts sampled for phytoplankton pigments.

Date	CTD	Time on deck (gmt)	Lat (n, -s)	Long w	Depths Sampled (m) DCM highlighted	Corresponding % light or dcm (highlighted)	Volume filtered (l)
14-Oct	2	05:23	49.57	8.63	1 5 10 17 23 40	97 55 33 14 7 1	1
14-Oct	3	13:26	49.43	10.53	1 5 10 20 27 40		1
15-Oct	5	06:57	48.95	14.46	1 5 10 17 23 40	97 55 33 14 7 1	1

Date	CTD	Time on deck (gmt)	Lat (n, -s)	Long w	Depths Sampled (m) DCM highlighted	Corresponding % light or dcm (highlighted)	Volume filtered (l)
16-Oct	8	06:36	49.00	16.66	1 5 10 17 23 38	97 55 33 14 7 1	2
17-Oct	11	06:50	47.29	18.04	1 5 10 20 25 45	97 55 33 14 7 1	2
17-Oct	12	13:44	46.34	18.80	1 5 10 20 30 40		2
18-Oct	14	06:27	44.24	20.40	1 8 15 25 30 50	97 55 33 14 7 1	2
18-Oct	15	14:33	43.21	21.18	1 5 10 20 30 50		2
19-Oct	17	06:38	41.25	22.60	1 9 17 30 40 70	97 55 33 14 7 1	2
19-Oct	18	14:16	40.32	23.27	1 5 10 30 40 60		2
20-Oct	20	06:36	38.32	24.67	1 7 13 25 30 57	97 55 33 14 7 1	2
21-Oct	21	13:58	37.10	26.49	1 5 20 30 40 60	97 55 33 14 7 1	2
22-Oct	23	06:26	35.45	28.65	1 10 17 30 40 68	97 55 33 14 7 1	2
22-Oct	24	14:56	34.72	29.58	1 13 20 40 60 100		2
23-Oct	26	06:39	33.42	31.25	1 15 25 45 60 105	97 55 33 14 7 1	2
23-Oct	27	15:12	32.87	31.95	1 10 20 60 80 115		2
24-Oct	29	07:09	31.43	33.74	1 15 28 50 65 115	97 55 33 14 7 1	2
24-Oct	30	14:57	30.75	34.48	1 20 40 60 80 130		2
25-Oct	32	07:22	29.18	35.98	1 15 30 50 65 115	97 55 33 14 7 1	2
25-Oct	33	14:58	28.48	36.68	1 20 40 60 80 130		2
26-Oct	35	07:09	27.22	37.89	1 15 25 45 65 110	97 55 33 14 7 1	2
26-Oct	36	14:53	27.02	38.05	1 10 20 60 80 115		2
27-Oct	38	07:13	25.39	39.60	1 15 30 50 65 115	97 55 33 14 7 1	2
27-Oct	39	14:59	24.65	40.28	1 20 40 60 80 130		2
28-Oct	41	08:14	23.23	40.72	1 15 25 45 65 110	97 55 33 14 7 1	2
29-Oct	43	08:02	21.13	39.25	1 15 25 45 65 110	97 55 33 14 7 1	2
29-Oct	44	15:03	21.12	39.27	1 10 40 60 80 100		2
30-Oct	47	08:05	21.13	39.31	1 25 45 60 100	97 33 14 7 1	2
30-Oct	48	14:50	20.12	39.27	1 20 40 60 80 100		2
31-Oct	50	07:41	19.14	37.86	1 10 20 35 45 81	97 55 33 14 7 1	2
31-Oct	51	14:46	18.42	37.36	1 10 20 40 60 78		2
01-Nov	53	08:20	16.57	36.10	1 15 25 45 60 100	97 55 33 14 7 1	2
01-Nov	54	14:54	15.93	35.66	1 10 20 40 60 82		2
02-Nov	56	07:02	14.15	34.46	1 10 17 30 40 68	97 55 33 14 7 1	2
02-Nov	57	14:53	13.35	33.92	1 10 20 40 60		2
03-Nov	59	07:03	11.47	32.65	1 5 10 17 25 42	97 55 33 14 7 1	2
03-Nov	60	14:53	10.56	32.04	1 10 20 40 59		2
04-Nov	61	14:53	8.80	30.87	1 10 20 40 60		2
05-Nov	63	07:07	6.84	29.55	1 7 15 25 30 55	97 55 33 14 7 1	2
05-Nov	64	14:53	5.95	28.96	1 10 20 40 60		2
06-Nov	66	07:07	4.05	27.69	1 15 25 40 55 95	97 55 33 14 7 1	2
06-Nov	67	14:53	3.16	27.10	1 10 20 40 60 85		2
07-Nov	69	06:25	1.27	25.85	1 10 15 30 40 70	97 55 33 14 7 1	2
08-Nov	71	08:07	-2.04	24.99	3 10 20 35 45 80	97 55 33 14 7 1	2
09-Nov	74	07:00	-3.84	25.00	1 15 25 40 55 95	97 55 33 14 7 1	2
09-Nov	75	14:21	-4.86	25.00	1 10 20 40 60 85		2
10-Nov	77	07:15	-7.36	24.99	1 15 25 45 60 100	97 55 33 14 7 1	2
10-Nov	78	14:22	-8.38	25.00	1 10 20 60 80 100		2
11-Nov	80	06:04	-10.65	25.00	1 15 30 55 75 125	97 55 33 14 7 1	2
11-Nov	81	13:51	-11.72	25.00	1 10 20 60 80 125		2
12-Nov	83	07:00	-13.81	24.99	1 15 30 55 75 140	97 55 33 14 7 1	2
12-Nov	84	14:03	-13.86	25.06	1 20 60 80 120 135		2

Date	CTD	Time on deck (gmt)	Lat (n, -s)	Long w	Depths Sampled (m) DCM highlighted	Corresponding % light or dcm (highlighted)	Volume filtered (l)
13-Nov	87	07:02	-14.01	25.18	1 20 45 60 100 145	97 55 33 14 7 1	2
13-Nov	88	13:46	-14.02	25.18	1 20 40 60 80 142		2
14-Nov	90	06:11	-16.37	25.00	1 20 35 75 90 150	97 55 33 14 7 1	2
14-Nov	91	13:55	-17.35	25.00	1 20 40 60 100 158		2
15-Nov	93	06:09	-19.50	25.00	1 20 40 70 90 120 175	97 55 33 14 7 1	2
15-Nov	94	13:55	-20.59	25.00	1 20 60 80 110 165		2
16-Nov	96	06:07	-22.52	25.00	1 20 35 80 140	97 55 33 7 1	2
16-Nov	97	13:54	-23.76	25.00	1 10 20 60 100 150		2
17-Nov	99	06:14	-26.11	25.01	1 20 35 60 85 140	97 55 33 14 7 1	2
17-Nov	100	13:54	-27.17	25.00	1 10 20 60 100 130		2
18-Nov	102	06:21	-28.79	26.14	1 20 30 60 80 135	97 55 33 14 7 1	2
18-Nov	103	13:56	-29.39	27.03	1 10 20 60 90 130		2
19-Nov	105	05:58	-30.83	29.18	1 15 30 55 75 130	97 55 33 14 7 1	2
19-Nov	106	14:03	-31.55	30.25	1 10 20 40 60 92		2
21-Nov	108	06:30	-33.41	34.25	2 10 20 45 88	97 55 33 7 1	2
21-Nov	109	14:57	-33.88	34.97	2 10 20 40 60 82		2
22-Nov	111	05:59	-35.30	37.11	1 5 10 20 30 40	97 55 33 14 7 1	2
22-Nov	112	14:02	-35.26	37.18	3 5 10 20 30 35		2
24-Nov	115	07:02	-37.30	40.19	5 10 15 25 38		2
24-Nov	116	14:45	-37.87	41.09	5 10 20 40		2
25-Nov	118	07:08	-39.32	43.39	2 5 10 15 20		1-1.37
25-Nov	119	14:53	-39.97	44.45	2 5 10 15 20 40		1
26-Nov	120	14:52	-42.25	48.22	5 7 20 28 38		1

1.3. Characterisation of microplankton communities using net hauls and FlowCAM. *AMT core measurement development.*

A newly developed microplankton net containing a duplicate series of 4 conical nets with mesh sizes 180, 100, 40 and 20 µm was deployed from the aft starboard crane immediately after the solar noon CTDs on a regular basis during the cruise. At each site, duplicate plankton samples were collected on vertical net hauls from 100 m to the surface. 20-40 µm, 40-100 µm and 100-180 µm fractions were collected in their respective cod ends and then analysed on a FlowCAM (Fluid Imaging inc.) with a 300 µm path length flow cell, a 4x microscope objective and a CCD camera operating in trigger mode at a frame grab rate of 7 frames per second. Data files were stored on the FlowCAM computer's hard drive and will be analysed back in the lab. to provide community composition data in the different water masses along the cruise transect. Table 1.3 summarises the dates and times of net hauls.

Table 1.3: Summary of net hauls for microplankton community structure

Date	JC event #	Time on deck GMT	Lat	Lon	Region
18-Oct	31	15:15	43.21	21.18	NT
21-Oct	46	14:34	37.10	26.49	NT
22-Oct	55	15:11	34.72	29.58	NAG
24-Oct	70	15:36	30.75	34.48	NAG
25-Oct	79	15:35	28.48	36.68	NAG
27-Oct	98	15:37	24.65	40.28	NAG
28-Oct	109	15:31	23.23	40.72	NAG
29-Oct	130	15:32	21.12	39.27	NAG
30-Oct	156	15:22	20.12	39.27	NAG
31-Oct	164	15:27	18.42	37.36	EU
03-Nov	190	15:30	10.56	32.04	EU

Date	JC event #	Time on deck GMT	Lat	Lon	Region
05-Nov	204	15:28	5.95	28.96	EU
06-Nov	213	15:26	3.16	27.10	EU
09-Nov	237	14:30	-4.86	25.00	EU
10-Nov	245	14:39	-8.38	25.00	EU/SAG edge
11-Nov	253	14:09	-11.72	25.00	SAG
12-Nov	265	14:21	-13.86	25.06	SAG
13-Nov	291	14:03	-14.02	25.18	SAG
14-Nov	299	14:12	-17.35	25.00	SAG
15-Nov	308	14:11	-20.59	25.00	SAG
18-Nov	330	14:22	-29.39	27.03	SAG, edge
19-Nov	338	14:23	-31.55	30.25	SSTZ, edge
22-Nov	360	15:22	-35.26	37.18	SSTZ
24-Nov	374	15:17	-37.87	41.09	ST
25-Nov	382	15:12	-39.97	44.45	ST

NT, Northern temperate waters, NAG, North Atlantic Gyre, EU, Equatorial Upwelling, SAG, South Atlantic Gyre, SSTZ, Southern Subtropical Zone, ST, Southern temperate waters

2. Factors Affecting Community Structure of Marine Picocyanobacteria (Ostrowski, Grob)

2.1 Determination of the horizontal and vertical distribution of genetically distinct populations of *Prochlorococcus (Pro), Synechococcus (Syn),* pico- and nano-eukaryotes (Peuk).

2.2 Isolation of Syn and Peuk cultures with the aid of enrichments and flow-sorting.

2.3 Metagenomics and transcriptomics of flow-sorted Syn and Peuk populations at selected stations

2.4 Elemental composition of flow-sorted *Syn, Pro* and *Peuk* cells using X-Ray TEM and High Resolution Inductively-Coupled-Plasma Mass Spectrometry (HR ICP-MS)

2.5 Other sampling: The ecological role of parasites in the regulation of eukaryotic pico and-nanophytoplankton (Cecile Lepere, Uinversity of Warwick)

2.1 Distribution of *Pro, Syn* and Peuk

2.1a. Sampling strategy

Bulk community DNA was collected at the 2nd pre-dawn CTD from a range of light depths (97, 55, 14, 7, 3, 1 and 0.1%) (Table 1). Up to 7.5 l vol from each depth was pre-filtered through 100 µm mesh and 10.0 µm polycarbonate (PC) filters while the 5.0µm (PC) and 0.45 µm (Supor) fractions were retained and flash frozen (in liq. N_2) in 2.0 ml of lysis buffer and stored at -80˚C. Additionally, 500 ml samples from 2 depths were fixed with PFA (0.1%w/v, 1h, 4˚C) and concentrated by gentle vacuum filtration onto 0.2 µm membranes and stored at -80˚C for analysis by Fluorescence *in-situ* Hybridisation (FISH) with lineage-specific probes for Peuk.

2.1b. Proposed analyses

DNA will be extracted from filters using established techniques and analysed by a variety of methods in the laboratory. Quantitative estimates of the abundance of Syn and Pro genotypes will be carried out on large-scale libraries (2,000+ clones) using selected multi-locus markers such as *petB* (Mazard et al., in prep.).

The relative abundance of Peuks will be assessed with up to 10 plastidic probes using dotblots and ^{32}P labelled probes. Supporting analyses include construction of clone libraries for 16S/18S ribosomal RNA and internal transcribed spacer (ITS) regions, clone libraries and (t)RFLP analyses of MLSA marker genes (such as *petB*). Estimates of species/ribotype abundance will complement the flow cytometric analsyses of underway and CTD samples (Tarran/Holland) as well as allow for direct comparison with similar data obtained on AMT18 (Ostrowski, unpublished), AMT-15 (Zwirglmaier et al., 2008) and AMT-13 (Johnson et al., 2006). A total of 42 stations were sampled for a total volume of ~1,520 l of seawater filtered.

Table 2.1 Summary of size-fractionated bulk DNA samples. Samples were concentrated from 5.0 -10.0 l of seawater and pre-filtered through 100 µm mesh and 10.0 µm filters. Concentrated samples were retained on 5.0 and 0.45 µm filters and flash frozen.

Event No.	Date	Station	Latitude	Longitude	Depth	Activity	bottles sampled	comments

Event No.	Date	Station	Latitude	Longitude	Depth	Activity	bottles sampled	comments
2	14.10.09	JC039002	49° 34.02N	08° 38.01W	145	CTD002-S	22,17,15,12,9,7	
6	15.10.09	JC039004	48° 56.91N	14° 27.59W	4630	CTD004-S	23,19,16,10,6,7	
8	15.10.09	JC039004	48° 56.91N	14° 27.59W	4630	CTD005-S	23,19,16,13,10,7	
13	16.10.09	JC039006	49° 00.00N	16° 40.00W	4810	CTD008-S	24,20,18/19,14,12,10	
19	17.10.09	JC039007	47° 17.22N	18° 02.51W	4542	CTD011-S	23,19,17,13,11,9	
26	18.10.09	JC039009	44° 14.61N	20° 24.17W	3847	CTD014-S	23,19,14,13,11,9	
34	19.10.09	JC039011	41° 15.23N	22° 36.25	4224	CTD017-S	23,20,18,14,12,9	
41	20.10.09	JC039013	38° 19.14N	24° 40.08W	3400	CTD020-S	23,20,18,14,12,9	
49	22.10.09	JC039015	35° 27.01N	28° 38.74W	3578	CTD023-S	23,20,17,14,10,9	
58	23.10.09	JC039017	33° 25.19N	31° 15.38W	3319	CTD026-S	23,20,18,12,10,8	
63	24.10.09	JC039019	31° 25.71N	33° 44.20N	3911	CTD029-S	23,20,18,14,10,9	
73	25.10.09	JC039021	29° 10.88N	35° 59.05W	4493	CTD032-S	23,20,18,14,10,9	
82	26.10.09	JC039023	27° 13.91N	37° 53.18W	>4000	CTD035-S	22,19,17,13,9,8	
92	27.10.09	JC039025	25° 23.49N	39° 36.14W	4359	CTD038-S	21,20,18,14,10,9	
104	28.10.09	JC039027	23° 13.26N	40° 43.08W	4682	CTD041-S	21,20,18,15,10,9	
113	29.10.09	JC039029	21° 08.01N	39° 14.52W	5512	CTD042-T	20,15,11,8,5,2	
159	31.10.09	JC039031	19° 08.64N	37° 51.83	5238	CTD050-S	21,20,18,14,12,6	
168	01.11.09	JC039033	16° 34.08 N	36°05.85W	5034	CTD053-S	21,18,13,11,10,8	
176	02.11.09	JC039035	14° 09.23 N	34° 27.42 W	5971	CTD056-S	21,18,14,12,10,9	
184	03.11.09	JC039037	11° 28.02 N	32° 38.78 W	5394	CTD059-S	23,18,14,12,10,9	
198	05.11.09	JC039041	06° 50.04 N	29° 32.75 W	4252	CTD063-S	22,18,17,11,9,8	
207	06.11.09	JC039043	04° 03.21 N	27° 41.65 W	4076	CTD066-S	23,20,18,12,10,9	
216	07.11.09	JC039045	01° 16.22 N	25° 50.95 W	3729	CTD069-S	23,20,14,12,10,9	
223	08.11.09	JC039047	02° 02.59 S	24° 59.36 W	4820	CTD071-S	23,20,18,14,10,9,5	
232	09.11.09	JC039049	03° 50.37 S	25° 00.00 W	5417	CTD074-S	23,20,18,14,12,10,9,8	
240	10.11.09	JC039051	07° 21.08 S	24° 59.37 W	5668	CTD077-S	23,20,18,14,12,10,9,5	
294	14.11.09	JC039056	16° 22.01 S	24° 59.81 W	-	CTD090-S	23,18,14,12,11,7	
303	15.11.09	JC039059	19° 29.93 S	24° 59.85 W	-	CTD093-S	23,18,14,12,8,6,1	
311	16.11.09	JC039061	22° 51.23 S	24° 59.77 W	5437	CTD096-S	23,18,14,10,7,3	
318	17.11.09	JC039063	26° 06.08 S	25° 00.32 W	4538	CTD099-S	23,18,12,10,8,4	
325	18.11.09	JC03965	28° 47.38 S	26° 08.23 W	5240	CTD 102-S	23,19,14,13,10,8,7	
333	19.11.09	JC03967	30° 50.02 S	29° 11.02 W	2218	CTD 105-S	23,18,14,12,10,8,4	
248	11.11.09	JC039053	10° 39.05 S	24° 59.85 W	5062	CTD080-S	23,20,18,14,12,10,8,4	
259	12.11.09	JC039055	13° 48.86 S	24° 59.14 W	5264	CTD083-T	15,14,11,9,8,8	
341	21.11.09	JC03969	33° 24.52 S	34° 15.48 W	4296	CTD 108-S	23,21,17,14,12,9,5,7	
348	22.11.09	JC03971	35° 17.26 S	37° 06.74 W	4616	CTD 0111-T	16,10,8,6,3 (16,17)	
	23.11.09	JC039	35˚ 43.81 S	37˚ 47.08	-	UW		5m
369	24.11.09	JC03972	37° 17.86 S	40° 11.37 W	4992	CTD 115-S	23,20,14,12,9,5	
377	25.11.09	JC03974	39° 18.89 S	43° 23.54 W	5106	CTD 118-S	23,18,12,10,8,7	
386	26.11.09	JC03976	42° 15.0 S	48° 13.5 W	5470	CTD 120-T	16,10	8m, 27m
	27.11.09	JC039	44˚ 28.21 S	52˚ 01.00	-	UW^		5m
	28.11.09	JC039	46˚ 59.47 S	56˚ 31.50 W	-	UW-SWAB*		surf
	29.11.09	JC039	49˚ 38.22 S	61˚ 42.49 W	157	UW-SWAB		surf

^UW= Underway sample
*SWAB = Surface Water Acquisition Bucket

Table 2.2. Summary of size-fractionated samples for fluorescent in situ hybridisation. Samples were concentrated from 400 ml of seawater and pre-filtered through a 5.0 µm filter. Samples were fixed with fresh 1.0% PFA for 4 h then concentrated by gentle filtration on 0.45 µm filters dehydrated with a series of ethanol washes, dried and stored at -80˚C.

Event No.	Date	Station	Latitude	Longitude	Depth	IN	OUT	Activity	bottles sampled

Event No.	Date	Station	Latitude	Longitude	Depth	IN	OUT	Activity	bottles sampled
4	14.10.09	JC039003	49°26.0N	10°32.0W	142	1243	1325	CTD003-S	11,6
8	15.10.09	JC039004	48°56.91N	14°27.59W	4630	623	657	CTD005-S	13,7
13	16.10.09	JC039006	49°00.00N	16°40.00W	4810	538	640	CTD008-S	24,10
17	17.10.09	JC039007	47°17.21N	18°02.52	4542	459	536	CTD010-T	
19	17.10.09	JC039007	47°17.22N	18°02.51W	4542	556	650	CTD011-S	23,9
26	18.10.09	JC039009	44°14.61N	20°24.17W	3847	540	626	CTD014-S	23,9
34	19.10.09	JC039011	41°15.23N	22°36.25	4224	549	642	CTD017-S	23
47	22.10.09	JC039015	35°27.30N	28°38.73W	3597	536	517	CTD022-T	
61	24.10.09	JC039019	31°25.68N	33°44.17N	3916	537	613	CTD028-T	12,1
71	25.10.09	JC039021	29°11.17N	35°59.34W	4493	533	612	CTD031-T	12,1
90	27.10.09	JC039025	25°23.50N	39°36.03W	4359	536	614	CTD037-T	12,1
102	28.10.09	JC039027	23°13.25N	40°43.05W	4682	630	708	CTD040-T	11,1
174	02.11.09	JC039035	14°09.10N	34°27.39W		533	603	CTD055-T	16,1
182	03.11.09	JC039037	11°27.93N	32°38.74W	5379	539	609	CTD058-T	16,1
196	05.11.09	JC039041	06°49.78N	29°32.84W	4242	537	611	CTD062-T	10,1
214	07.11.09	JC039045	01°16.26N	25°50.80W	3729	534	610	CTD068-T	11,1
221	08.11.09	JC039047	02°02.86S	24°59.59W	4852	710	752	CTD070-T	9,1
246	11.11.09	JC039053	10°39.42S	24°59.88W	5109	436	512	CTD079-T	12,11,1
257	12.11.09	JC039055	13°48.81S	24°58.88W	5460	517	557	CTD082-T	12,10,1
292	14.11.09	JC039056	16°22.34S	24°59.87W	-	443	519	CTD089-T	12,11,1
301	15.11.09	JC039059	19°30.06S	24°59.73W	-	433	511	CTD092-T	12,1
309	16.11.09	JC039061	22°51.23S	24°59.77W	5440	433	509	CTD095-T	12,4
316	17.11.09	JC039063	26°06.08S	25°00.32W	4538	442	517	CTD098-T	9,1
323	18.11.09	JC039065	28°47.23S	26°08.59W	5240	438	517	CTD 0101-T	11,1
333	19.11.09	JC039067	30°50.02S	29°11.02W	2218	522	600	CTD 105-S	23,18,14,12,10,8,4
339	21.11.09	JC039069	33°24.52S	34°15.48W	4296	542	524	CTD 107-T	12,1
365	22.11.09	JC039071	35°16.75S	37°12.90W	4664	1931	2004	CTD 113-T	
367	24.11.09	JC039072	37°17.84S	40°11.40W	4992	536	608	CTD 114-T	8,1
375	25.11.09	JC039074	39°18.89S	43°23.54W	5106	533	611	CTD 117-T	8,4

2.2. Isolation of Syn, Pro and Peuk cultures with the aid of flow-sorting

Water samples were taken every other day from the surface, the DCM or both to set up picophytoeukaryote cultures (peuks). In most cases cells were first concentrated into 0.8 µm filters by filtering 30 to 40 mL of seawater gravitationally. The filters were then rinsed in water from the same depth or from the DCM previously filtered through 0.2 µm and kept in polystyrene culture flasks or glass tubes at constant temperature (20ºC) and under a 12:12hrs light regime in an incubator. In some cases the water sample was mixed directly with surface or DCM water filtered through 0.2 µm without pre-concentrating the cells. DCM water from the Southern Gyre (CTD35S) was used to sort 50, 100 and 250 large peuk cells and 50 small peuk cells using surface water filtered through 0.2 µm as sheath fluid. DCM water filtered through 0.2 µm was added later on to most of the cultures. Additionally, K/10 or K/100 medium was added to some of the concentrated cells. All cultures were analyzed at the end of the cruise using flow cytometry to confirm the presence of peuk in ~90% of them. Back in the laboratory, these environmental samples will be used to generate unialgal peuk cultures. Novel unialgal cultures will mainly be used to design specific oligonucleotide probes at the class level based on the chloroplast 16S rRNA gene.

2.3. Metagenomics and transcriptomics of Syn and Peuk populations at selected stations

2.3a. Sampling strategy

Seawater was collected from 2 or 3 depths at 9 stations in the oligotrophic Northern and Southern gyres, the equatorial region and at the high-latitude temperate extremities of the cruise (Table 2). Seawater concentrates were collected in Cell Traps (0.22 µm) after size-fractionation (100 µm mesh, 10 µm and 5.0 µm PC filter membranes) from carboys wrapped in black plastic. Additional samples from 2 depths were taken on the diel stations, corresponding to midday, dusk and dawn samples for comparative analyses. Samples for RNA (transcriptomics) were harvested from the first 1.5-2.5 l of filtered sample and flash frozen in Liq. N2 within 15-20

min of beginning the filtration. The flash-freezing of samples was generally achieved within a total of 30 min of the CTD coming on board.

2.3b. Proposed analyses

DNA and RNA will be extracted from flow-sorted populations of Syn, Pro and Peuk and amplified using a commercial kit (after reverse transcription for RNA). Amplified nucleic acids will then be sequenced to a high depth-of coverage using 454 sequencing at a NERC Molecular Genetics Facility.

Table 2.3. Summary of size-fractionated samples for metagenomics and meta-transcriptomics work. Samples were concentrated from 20 l of seawater in duplicate and pre-filtered through 100 µm mesh and 10.0 µm filters. Concentrated samples were extracted in triplicate from 0.22 µm cell traps. The initial concentrates, corresponding to 1.5-2.5 l of seawater, were extracted within 30 min of the CTD coming on board.

Event No.	Date	Station	Latitude	Longitude	Depth	IN	OUT	Activity	bottles sampled
6	15.10.09	JC039004	48° 56.91N	14° 27.59W	4630	439	544	CTD004-S	23,19,16,10,6,7
44	21.10.09	JC039014	37°06.1N	26° 29.3	2692	1307	1400	CTD021-T	24,22,21,14
127	29.10.09	JC039029	21° 07.2N	39° 16.1W	5213	1415	1421	CTD044-T	UW,11,5
136	29.10.09	JC039029	21° 07.24N	39° 17.58W	5495	1914	2007	CTD045-T	UW,19,21,22
147	30.10.09	JC039029	21° 07.95N	39° 18.33W	~4800	736	806	CTD047-T	20,17,7
179	02.11.09	JC039036	13° 20.9 N	33° 54.9 W	5963	1401	1454	CTD057-T	*Bottles
268	12.11.09	JC039055	13° 51.32 S	25° 03.25 W	5264	1315	1406	CTD084-T	22,21,20,19
274	12.11.09	JC039055	13° 54.51 S	25° 07.07 W	5215	1833	1903	CTD085-T	7,6,5,4
321	17.11.09	JC039064	27° 10.1 S	25° 00.1 W	4021	1301	1356	CTD100-T	24,23,22,21
357	22.11.09	JC039071	35° 15.51 S	37° 09.30 W	4655	1311	1403	CTD112-T	24,23,22,21
279	13.11.09	JC039055	14° 00.24 S	25° 10.30 W	5894	519	602	CTD086-T	7,6,2,1, 10

2.4 Elemental composition analysis of flow-sorted *Syn, Pro* and *Peuk* cells using X-Ray TEM and High Resolution Inductively-Coupled-Plasma Mass Spectrometry (HR ICP-MS)

2.4a. Sampling strategy

Seawater was collected from up to 4 depths at 30 stations along the transect at the noon CTD. Up to 10 l was collected in acid-washed polycarbonate carboys shrouded in light-proof plastic and immediately processed. Seawater samples were pre-filtered (100 µm mesh and 10.0 µm PC) and the < 3.0 µm fraction was concentrated in Cell Traps (0.22 µm pore size). All filter-holders, filters and peristaltic pump tubing was saoked in 1.0% trace-clean HCl, rinsed with MilliQ and pre-wahsed with ~ 500 ml of seawater sample. Concentrated cells were extracted at least three times from each trap with the first extraction, corresponding to 3-5l of seawater, after 20-40 min of concentration. Concentrated cells were immediately flash frozen in Liq. N_2 and transferred to -80˚C.

2.4b. Proposed analyses

Micro-elemental composition (S, P, Fe, Zn, Co, Cu, Mo) of flow-sorted Syn, Pro (and Peuk where possible) as well as bulk samples will be determined with an Agilent 7500cx HR-ICPMS instrument equipped with an octopole reaction system (ORS). For the trace metals to be tested the instrument has limits of detection in the low ppb to ppt range, as verified by trace-metal controlled pre-cruise optimisation trials carried out with cyanobacterial cultures. To complement this analysis we will also determine the composition of 'macro' elements (C, N, P, Na, Mg, K, Cl), as well as Fe and other trace metals, in single picocyanobacterial cells using XRay-TEM. This work will provide fundamental knowledge on the trace-metal physiology of members of the picocyanobacterial genera, *Synechococccus* and *Prochlorococcus* and link directly to data obtained from the assesment of community structure (outlined in section 1).

Table 2.4. Summary for elemental composition analysis samples. Replicate samples were concentrated from up to 10l of seawater from 4 light-depths (e.g 97%, 55%, 3.0% and 1.0%) and flash frozen in 1.6 ml aliquots.

Event No.	Date	Station	Latitude	Longitude	Depth	OUT	Activity	bottles sampled	comments

21	17.10.09	JC039008	46°20.3N	18°48.1W	4422	1445	CTD012-T	24,23,22	
29	18.10.09	JC039010	43°12.9N	21°10.5W	4282	1434	CTD015-T	24,23,22,21	
44	21.10.09	JC039014	37°06.1N	26°29.3W	2692	1400	CTD021-T	24,22,21,14	
52	22.10.09	JC039016	34°43.4N	29°35.3W	3540	1456	CTD024-T	24,23,22,21	
59	23.10.09	JC039018	32°52.2N	31°56.7W	3565	1513	CTD027-T	24,23,22,21	
67	24.10.09	JC039020	30°44.7N	34°29.0W	4455	1458	CTD030-T	22,21,11,8	
87	26.10.09	JC039024	27°01.4N	38°03.2W	4804	1453	CTD036-T	23,22,20	
95	27.10.09	JC039026	24°39.1N	40°17.0W	4300	1500	CTD039-T	24,23,22,21	
162	31.10.09	JC039032	18°25.1N	37°21.6W	5748	1449	CTD051-T	24,23,22,21	
171	01.11.09	JC039034	15°55.5N	35°39.7W	4992	1454	CTD054-T	23,22,20,19	10,35,60,82
193	04.11.09	JC039040	08°48.3N	30°52.0W	5373	1455	CTD061-T	24,23,22,20	
201	05.11.09	JC039042	05°56.9N	28°57.5W	3860	1455	CTD064-T	24,14,22,20	
210	06.11.09	JC039044	03°09.5N	27°05.9W	4245	1454	CTD067-T	24,23,22,21	
226	08.11.09	JC039048	02°50.08S	25°00.1W	5433	1501	CTD072-T	23,22,20,19	
235	09.11.09	JC039050	04°51.5S	25.00.0W	5342	1424	CTD075-T	22,21,20,19	
246	11.11.09	JC039053	10°39.42S	24°59.88W	5109	512	CTD079-T	12,11,1	
251	11.11.09	JC039054	11°43.5S	25°00.00W	6225	1353	CTD081-T	24,23,22,21	
257	12.11.09	JC039055	13°48.81S	24°58.88W	5460	557	CTD082-T	12,10,1	
279	13.11.09	JC039055	14°00.24S	25°10.30W	5894	602	CTD086-T	7,6,2,1, 10	
292	14.11.09	JC039056	16°22.34S	24°59.87W	-	519	CTD089-T	12,11,1	
296	14.11.09	JC039057	17°20.80S	25°00.00W	-	1358	CTD091-T	16	surface only
301	15.11.09	JC039059	19°30.06S	24°59.73W	-	511	CTD092-T	12,1	
306	15.11.09	JC039060	20°35.4S	25°00.0W	-	1316	CTD094-T	24,23,22,21	
309	16.11.09	JC039061	22°51.23S	24°59.77W	5440	509	CTD095-T	12,4	
314	16.11.09	JC039062	23°45.8S	25°00.1W	4564	1356	CTD097-T	24,23,22,21	
328	18.11.09	JC039066	29°23.4S	27°02.0W	4879	1358	CTD103-T	24,23	20, 130
336	19.11.09	JC039068	31°32.8S	30°15.3W	3916	1406	CTD106-T	24,23,22,21	
344	21.11.09	JC039070	33°53.0S	34°58.5W	4295	1502	CTD109-T	24,23,22,21	
372	24.11.09	JC039073	37°52.0S	41°05.5W	5042	1447	CTD116-T	24,23,22	
380	25.11.09	JC039075	39°58.0S	44°26.8W	5103	1455	CTD119-T	24,23,22	
386	26.11.09	JC039076	42°15.0S	48°13.5W	5470	1453	CTD120-T	16,10	8m, 27m

2.5 The ecological role of parasites in the regulation of eukaryotic pico and-nanophytoplankton (Cecile Lepere, Unversity of Warwick)

The major aim of this research project (Marie curie fellowship) is to reveal the ecological role of parasites in the regulation of eukaryotic pico and-nanophytoplankton communities in open ocean systems. A number of samples were taken from surface bottles during the latter part of the cruise. Up to 8 l was concentrated using 0.22µm cell traps following pre-fractionation with a 20µm mesh.

3. Dynamics, metabolic activities and phylogenetic composition of dominant microbial groups (Grob, Hartmann, Herrington, Zubkov)

Aim

To assess metabolic activities of dominant prokaryotic and eukaryotic groups within the planktonic communities in the oligotrophic North Atlantic gyre and South Atlantic gyre. To use molecular approaches to identify these groups taxonomically in order to link community composition and function. To measure rates of carbon fixation by microbial groups and to assess the contribution of each group to total carbon fixation.

Objectives

- To estimate turnover rates of dissolved organic nutrients, nitrogen and phosphorus using methionine, leucine, urea, ATP, AMP, UMP and phosphate tracers.
- To estimate carbon fixation rates of dominant phototrophic microbes.

- To collect concentrated seawater samples for molecular analysis of the phylogenetic composition of the groups (flow sorted for rate measurements) using 18S-rDNA clone libraries and fluorescence *in situ* hybridisation (TSA-FISH).

3.1. Estimations of turnover rates and concentrations of dissolved organic nutrients, nitrogen and bioavailable phosphate

Ambient concentrations as well as uptake rates of the amino acids (leucine and methionine), urea, inorganic and organic phosphate by total bacterioplankton were measured using isotopic dilution time-series incubations (Zubkov et al., 2004; Zubkov et al., 2007). Microbial inorganic and organic phosphorus dynamics were determined in the phosphate-depleted North Atlantic gyre (Table 3.1. stations marked with a star) to estimate ambient concentrations and turnover rates of the bioavailable fraction of these nutrients. All seawater samples were processed within an hour of collection. In addition, the relative contributions by dominant groups of microorganisms to the amino acid and phosphate cycle were determined using flow cytometric cell sorting. Moreover, nitrogen uptake in the form of urea was measured at the borderline of the South Atlantic gyre and more productive waters.

Table 3.1: Sampling stations including CTD no., dates, bottle no. and depth. At stations marked with a * ambient concentrations of bioavailable, inorganic phosphate were determined. At stations marked with a ° bioavailable, organic phosphate concentrations were measured. At stations labelled with a $^{+}$ measurements of urea uptake were carried out.

CTD no.	Date	Latitude [°N]	Longitude [°W]	Max. depth	Time [GMT]	Temp. at bottle depth	bottle no.	bottle depth [m]
002 S	14.10.09	49.34	8.38	145	4.58	15.8	11	20
004 S	15.10.09	48.56	14.27	4630	4.30	15.8	10	20
007 T°	16.10.09	49.00	16.39	4810	4.44	15.5	11	20
010 T°	17.10.09	47.17	18.02	4480	5.00	16.1	9-10	20
013 T°	18.10.09	44.14	20.23	3815	4.41	19.2	10-11	20
016 T*°	19.10.09	41.55	22.36	4146	4.45	21.9	13-14, 9	13-14 = surface, 9 = 20m
019 T*°	20.10.09	38.19	24.39	4637	4.40	21.5	12-13	Surface, 20m
021 T*°	21.10.09	37.06	26.29	2692	13.07	21.9	16	surface
022 T*°	22.10.09	35.27	28.38	3597	5.44	23.3	11-12	surface
025 T*°	23.10.09	33.25	31.15	3320	5.40	24.4	11-13	20
028 T*°	24.10.09	31.25	33.44	3916	5.42	25.0	10-12	surface
031 T*°	25.10.09	29.11	35.59	4493	5.33	26.0	10-12	surface
034 T*°	26.10.09	27.13	37.53	4625	5.33	26.5	11-13	surface
037 T*°	27.10.09	25.23	39.36	4359	5.44	27.2	10-12	surface
040 T*°	28.10.09	23.13	40.43	4682	6.38	27.4	10-12	surface
042 T*°	29.10.09	21.80	39.14	5520	6.26	27.4	10-12	surface
045 T	29.10.09	21.07	39.17	5309	19.16	27.4	16	surface
046 T*°	30.10.09	21.79	39.18	4800	6.36	27.4	10-12	surface
049 T*°	31.10.09	19.05	37.51	5238	6.10	27.2	10-12	surface
052 T*°	01.11.09	16.34	36.58	5034	6.46	27.3	10-12	surface
055 T*°	2.11.09	14.09	34.27	6295	5.39	27.1	10-12	surface
058 T*°	3.11.09	11.27	32.38	5379	5.43	27.9	10-12	surface
062 T*°	5.11.09	6.49	29.32	4246	5.36	28.8	9-11	20
065 T*°	6.11.09	4.31	27.41	4047	5.41	28.4	9-11	20
068 T	7.11.09	1.16	25.05	3729	5.40	27.0	8-11	20
070 T	8.11.09	-2.28	24.59	4854	7.18	26.4	9-11	20
073 T°	9.11.09	-3.50	25.09	5425	5.41	26.4	9-11	20
076 T°	10.11.09	-7.22	24.59	5695	5.48	25.6	9-11	20
079 T°	11.11.09	-10.39	24.59	5100	4.44	25.6	9-11	20

CTD no.	Date	Latitude [°N]	Longitude [°W]	Max. depth	Time [GMT]	Temp. at bottle depth	bottle no.	bottle depth [m]
082 T	12.11.09	-13.48	24.58	5462	5.24	25.4	9-11	20
085 T	12.11.09	-13.54	25.07	5462	18.30	25.5	8	20
086 T°	13.11.09	-14.02	25.10	5894	5.25	25.6	8-10	20
089 T	14.11.09	-16.22	24.59	n.d.	4.52	24.6	9-12	20
092 T°	15.11.09	-19.30	24.59	n.d.	4.43	25.2	9-12	20
095 T	16.11.09	-22.51	24.59	5437	4.42	24.8	9-12	20
098 T^+	17.11.09	-26.68	25.03	4571	4.49	24.4	9-11	20
101 T^+	18.11.09	-28.47	26.85	5230	4.47	22.8	11,12	20
104 T	19.11.09	-30.50	29.11	2218	4.51	20.8	11,12	20
107 T^+	21.11.09	-33.24	34.15	4297	5.53	17.9	11,12	20
110 T^+	22.11.09	-35.17	37.68	4618	5.26	16.8	7-9	20
114 T^+	24.11.09	-37.18	40.11	n.d.	5.50	16.1	7-9	20
117 T^+	25.11.09	-39.19	43.24	n.d.	5.48	14.0	7-9	10

3.2. Estimation of carbon fixation rates by dominant microbial groups

Sodium ^{14}C-bicarbonate was used in a series of experiments to trace photosynthetic fixation by microbes. In addition, the relative contributions by dominant groups of microorganisms to the carbon cycle were determined using flow cytometric cell sorting. Seawater samples were incubated for 10h in ambient light conditions, subsequently fixed with paraformaldehyde (PFA, 1% final concentration) and filtered on 0.2µm pore size polycarbonate filter to determine total carbon uptake.

3.3. Collection of eukaryotic and prokaryotic cells for molecular analyses of phylogenetic composition of the dominant groups

In order to understand the contribution of photosynthetic picoeukaryotes (PPEs) to carbon fluxes and the microbial food web, it is necessary to quantify the dominating phylogenetic groups within that cluster. Clone libraries will be constructed using eukarotic 18S rDNA primer pairs as well as prokaryotic 16S rDNA primer pairs targeting specifically chloroplastidic DNA of photosynthetic eukaryotes. This approach will be combined with TSA-FISH to assess the distribution, the abundance and the contribution of specific PPE classes to the total phytoplankton biomass. Moreover, the results of the molecular approach will be compared to those of the tracer experiments.

To determine the variation within the PPE classes, samples were collected at 26 stations (Table 3.1). Two different approaches were used to concentrate microbial cells: (1) 2L of seawater sample were concentrated using a 20µm pore-size mesh, to screen out larger organisms, combined with a Celltrap^{TM} ceramic filtration unit, 1.6ml of this concentrate were fixed with 1% PFA, incubated for 1 hour at 4°C, subsequently flash frozen with liquid and stored at -80°C. (2) 60ml of 1% PFA fixed seawater sample were concentrated on 0.8um polycarbonate filter using a syringe pump at a speed of 2.5mL per minute. Samples were flash frozen immediately after concentration and stored at -80°C.

3.4. Preliminary observations.

Initial scintillation counts were carried out on board the ship (Packard Tri-Carb 3100). Bioassayed concentrations of methionine and leucine ranged between 0.1-0.5 nM and 0.1-1.2 nM, respectively. The estimated turnover of these amino acid molecules ranged between 37-500 and 4-213 hours, respectively. The bioavailable, inorganic phosphate concentrations ranged between 1.0-8 nM and the estimated turnover time for phosphate varied between 2-237 hours. Finally, concentrations of 0.1-4.3 nM and an estimated turnover time of 21-688 hours were measured for organic phosphate. After the cruise, the collected tracer samples of flow sorted cells we be analysed in detail on low background counters due to the sensitivity limitations of the scintillation counters on board. The detailed data set will allow estimation of rates of metabolic activity of bacterioplankton and phytoplankton, as well as production and mortality. Moreover, completion of molecular analysis will enable us to link prokaryotic and eukaryotic community composition and function.

Measurement of selected oxygenated volatile organic compounds (OVOCs) in atmospheric and sea water samples

RACHAEL BEALE
Plymouth Marine Laboratory

Aim

To measure concentrations of selected OVOC compounds in both atmosphere and sea water; specifically methanol, acetaldehyde and acetone. Particular attention to changes in surface water concentrations over the cruise path.

Analysis methods

OVOC by Membrane Inlet (MI) Proton Transfer Reaction / Mass Spectrometry (PTR/MS):
Sea water Analysis;
OVOCs are extracted from sea water samples across a semi-permeable membrane into a supply of clean gas flowing directly into the PTR/MS inlet. PTR/MS is operated in Multiple Ion Detection (MID) mode to analyse the gas for protonated molecular OVOC weights. Calibration is carried out through production of water standards.

Atmospheric OVOC Analysis;
Atmospheric samples are pumped through FEP tubing positioned on the meteorological station. The end of the atmospheric line is connected directly to the inlet of the PTR/MS. Ability to route the sample directly into the instrument or through a catalyst system to obtain a 'system blank'.

Sampling methods

Vertical profiles and surface samples were performed using water collected from stainless steel (s) and titanium (t) CTD rosettes at specified depths. Water was sampled by use of Tygon tubing directly into blacked out glass bottles. Approximately 2L water collected from each depth.

Incubation experiments were also performed using water collected from stainless steel CTD. In this case an entire 20L niskin was assigned to this experiment.

Diel experiments were performed using seawater collected from titanium CTD. Approximately 2L water collected.

Sampling Log for Water Analysis by MI-PTR/MS

Date/Time	Location	Station	Description of Activities
15/10/09 Predawn Cast 2	Lat: 48°56N Long: 14°27W	CTD 004s	OVOC analysis by MI-PTR/MS at 3 depths, surface (97%), 10m (33%) and 40m (1%).
16/10/09 Predawn Cast 2	Lat: 49°00N Long: 16°39W	CTD 008s	OVOC analysis by MI-PTR/MS at 4 depths, surface (97%), 10m (33%), 38m (1%) and 200m.
17/10/09 Predawn Cast 2	Lat: 47°17N Long: 18°02W	CTD 011s	OVOC analysis by MI-PTR/MS at 5 depths, surface (97%), 10m (33%), 20m (14%), 60m (1%) and 200m.
Solar Noon Cast	Lat: 46°20N Long: 18°48W	CTD 012t	OVOC analysis by MI-PTR/MS at surface only.
18/10/09 Predawn Cast 2	Lat: 44°14N Long: 20°24W	CTD 014s	OVOC analysis by MI-PTR/MS at 5 depths, surface (97%), 15m (33%), 25m (14%), 50m (1%) and 200m.
Solar Noon Cast	Lat: 43°12N Long: 21°12W	CTD 015t	OVOC analysis by MI-PTR/MS at surface only.
19/10/09 Predawn Cast 2	Lat: 41°15N Long: 22°36W	CTD 017s	OVOC analysis by MI-PTR/MS at 4 depths, surface (97%), 17m (33%), 30m (14%) and 70m (1%). (NB. 200m niskin failed to fire).
Solar Noon Cast	Lat: 40°19N Long: 23°16W	CTD 018t	OVOC analysis by MI-PTR/MS at surface only.
20/10/09 Predawn Cast 2	Lat: 38°19N Long: 24°40W	CTD 020s	OVOC analysis by MI-PTR/MS at 4 depths, surface (97%), 13m (33%), 25m (14%) and 57m (1%). (NB. 200m niskin failed to fire).

Date/Time	Location	Station	Description of Activities
22/10/09 Predawn Cast 2	Lat: 35°26N Long: 28°38W	CTD 023s	OVOC analysis by MI-PTR/MS at 4 depths, surface (97%), 17m (33%), 30m (14%) and 68m (1%). (NB. 200m niskin failed to fire).
Solar Noon Cast	Lat: 34°43N Long: 29°35W	CTD 024t	OVOC analysis by MI-PTR/MS at surface only.
23/10/09 Predawn Cast 2	Lat: 33°25N Long: 31°15W	CTD 026s	OVOC analysis by MI-PTR/MS at 5 depths, surface (97%), 25m (33%), 45m (14%), 100m (1%) and 200m.
Solar Noon Cast	Lat: 32°52N Long: 31°56W	CTD 027t	OVOC analysis by MI-PTR/MS at surface only.
24/10/09 Solar Noon Cast	Lat: 30°44N Long: 34°29W	CTD 030t	OVOC analysis by MI-PTR/MS at surface only.
25/10/09 Predawn Cast 2	Lat: 29°10N Long: 35°58W	CTD 032s	OVOC analysis by MI-PTR/MS at 5 depths, surface (97%), 30m (33%), 50m (14%), 115m (1%) and 200m.
Solar Noon Cast	Lat: 28°28N Long: 36°40W	CTD 033t	OVOC analysis by MI-PTR/MS at surface only.
26/10/09 Predawn Cast 2	Lat: 27°12N Long: 37°53W	CTD 035s	Photochemical/Biological deck incubation experiment 01; Northern Atlantic Gyre (NAG)(with Jo Dixon, PML) OVOC analysis by MI-PTR/MS, surface water only.
27/10/09 Predawn Cast 2	Lat: 25°23N Long: 39°36W	CTD 038s	OVOC analysis by MI-PTR/MS at surface only.
Solar Noon Cast	Lat: 24°39N Long: 40°17W	CTD 039t	OVOC analysis by MI-PTR/MS at surface only.
28/10/09 Predawn Cast 2 NB. No Solar Noon Cast	Lat: 23°13N Long: 40°43W	CTD 041s	OVOC analysis by MI-PTR/MS at surface only.
29/10/09			30-hour CTD DIEL 01; Northern Atlantic Gyre (NAG): SURFACE WATER ONLY
	21°08N 39°14W	Surf-01	0500
	21°07N 39°14W	CTD042t	0600
	21°07N 39°14W	CTD043t	0700
	21°07N 39°15W	Surf-02	0800
	21°07N 39°15W	Surf-03	0900
	21°07N 39°15W	Surf-04	1000
	21°07N 39°15W	Surf-05	1100
	21°07N 39°16W	Surf-06	1200
	21°07N 39°16W	Surf-07	1300
	21°07N 39°16W	CTD044t	1400
	21°07N 39°16W	Surf-08	1500
	21°07N 39°16W	Surf-09	1600
	21°07N 39°16W	Surf-10	1700
	21°07N 39°17W	CTD045t	1900
	21°07N 39°18W	Surf-11	2200
30/10/09			30-hour CTD DIEL 01; Northern Atlantic Gyre (NAG) cont'. SURFACE WATER ONLY.
		Surf-12	0100
		Surf-13	0400
	21°07N 39°18W	Surf-14	0500
	21°07N 39°18W	CTD046t	0600
	21°07N 39°18W	CTD047t	0700
	21°07N 39°19W	Surf-15	0800
	21°07N 39°19W	Surf-16	0900
	21°07N 39°19W	Surf-17	1000
	21°07N 39°19W	Surf-18	1100
31/10/09 Predawn Cast 2	Lat: 19°08N Long: 37°51W	CTD 050s	OVOC analysis by MI-PTR/MS at 5 depths, surface (97%), 20m (33%), 35m (14%), 80m (1%) and 200m.
Solar Noon Cast	Lat: 18°25N Long: 37°21W	CTD 051t	OVOC analysis by MI-PTR/MS at surface only.
01/11/09	Lat: 16°34N	CTD 053s	OVOC analysis by MI-PTR/MS at 2 depths, surface (97%) and

Date/Time	Location	Station	Description of Activities
Predawn Cast 2	Long: 36°05W		200m.
Solar Noon Cast	Lat: 15°55N Long: 35°39W	CTD 054t	OVOC analysis by MI-PTR/MS at surface only.
02/11/09 Predawn Cast 2	Lat: 14°09N Long: 34°27W	CTD 056s	OVOC analysis by MI-PTR/MS at 5 depths, surface (97%), 17m (33%), 30m (14%), 70m (1%) and 200m.
Solar Noon Cast	Lat: 13°20N Long: 33°54W	CTD 057t	OVOC analysis by MI-PTR/MS at surface only.
03/11/09 Predawn Cast 2	Lat: 11°28N Long: 32°38W	CTD 059s	OVOC analysis by MI-PTR/MS at 5 depths, surface (97%), 10m (33%), 17m (14%), 42m (1%) and 200m.
Solar Noon Cast	Lat: 10°33N Long: 32°02W	CTD 060t	OVOC analysis by MI-PTR/MS at surface only.
04/11/09 Solar Noon Cast	Lat: 08°48N Long: 30°51W	CTD 061t	OVOC analysis by MI-PTR/MS at surface only.
05/11/09 Predawn Cast 2	Lat: 06°50N Long: 29°32W	CTD 063s	Photochemical/Biological deck incubation experiment 02; Equatorial Upwelling (with Jo Dixon, PML) OVOC analysis by MI-PTR/MS, surface water only.
06/11/09 Predawn Cast 2	Lat: 04°03N Long: 27°41W	CTD 066s	OVOC analysis by MI-PTR/MS at 5 depths, surface (97%), 25m (33%), 40m (14%), 95m (1%) and 200m.
Solar Noon Cast	Lat: 03°09N Long: 27°05W	CTD 067t	OVOC analysis by MI-PTR/MS at surface only.
07/11/09 Predawn Cast 2	Lat: 01°16N Long: 25°51W	CTD 069s	OVOC analysis by MI-PTR/MS at 5 depths, surface (97%), 15m (33%), 30m (14%), 70m (1%) and 200m.
08/11/09 Predawn Cast 2	Lat: 02°02S Long: 24°59W	CTD 071s	OVOC analysis by MI-PTR/MS at 2 depths, surface (97%) and 200m.
Solar Noon Cast	Lat: 02°50S Long: 25°00W	CTD 072t	OVOC analysis by MI-PTR/MS at surface only.
09/11/09 Predawn Cast 2	Lat: 03°50S Long: 24°59W	CTD 074s	OVOC analysis by MI-PTR/MS at 5 depths, surface (97%), 25m (33%), 40m (14%), 95m (1%) and 200m.
Solar Noon Cast	Lat: 04°51S Long: 25°00W	CTD 075t	OVOC analysis by MI-PTR/MS at surface only.
10/11/09 Solar Noon Cast	Lat: 08°22S Long: 24°59W	CTD 078t	OVOC analysis by MI-PTR/MS at surface only.
11/11/09 Predawn Cast 2	Lat: 10°38S Long: 24°59W	CTD 080s	OVOC analysis by MI-PTR/MS at 5 depths, surface (97%), 30m (33%), 55m (14%), 125m (1%) and 200m.
Solar Noon Cast	Lat: 11°43S Long: 24°60W	CTD 081t	OVOC analysis by MI-PTR/MS at surface only.
12/11/09			30-hour CTD DIEL 02; Southern Atlantic Gyre (SAG): SURFACE WATER ONLY
	13°49S 24°59W	Surf-19	0500
	13°49S 24°59W	CTD082t	0600
	13°49S 24°59W	CTD083t	0700
	13°49S 25°00W	Surf-20	0800
	13°50S 25°01W	Surf-21	0900
	13°50S 25°02W	Surf-22	1000
	13°50S 25°02W	Surf-23	1100
	13°51S 25°03W	Surf-24	1200
	13°51S 25°03W	Surf-25	1300
	13°51S 25°03W	CTD084t	1400
	13°52S 25°05W	Surf-26	1500
	13°53S 25°06W	Surf-27	1600
	13°53S 25°06W	Surf-28	1700
	13°54S 25°07W	CTD085t	1900
	13°56S 25°08W	Surf-29	2200
13/11/09			30-hour CTD DIEL 02; Southern Atlantic Gyre (SAG) cont'. SURFACE WATER ONLY.
	13°58S 25°09W	Surf-30	0100

Date/Time	Location	Station	Description of Activities
	13°59S 25°10W	Surf-31	0400
	14°00S 25°10W	Surf-32	0500
	14°00S 25°10W	CTD086t	0600
	14°00S 25°10W	CTD087t	0700
	14°00S 25°10W	Surf-33	0800
	14°01S 25°11W	Surf-34	0900
	14°01S 25°11W	Surf-35	1000
	14°01S 25°11W	Surf-36	1100
14/11/09 Predawn Cast 2	Lat: 16°22S Long: 24°59W	CTD 090s	OVOC analysis by MI-PTR/MS at 2 depths, surface (97%) and 200m.
Solar Noon Cast	Lat: 17°20S Long: 24°60W	CTD 091t	OVOC analysis by MI-PTR/MS at surface only.
15/11/09 Predawn Cast 2	Lat: 19°29S Long: 24°60W	CTD 093s	OVOC analysis by MI-PTR/MS at 5 depths, surface (97%), 40m (33%), 70m (14%), 175m (1%) and 200m.
Solar Noon Cast	Lat: 20°35S Long: 25°00W	CTD 094t	OVOC analysis by MI-PTR/MS at surface only.
16/11/09 Predawn Cast 2	Lat: 22°51S Long: 24°59W	CTD 096s	Photochemical/Biological deck Incubation Experiment 03; Southern Atlantic Gyre (SAG) (with Jo Dixon, PML) OVOC analysis by MI-PTR/MS, surface water only.
17/11/09 Predawn Cast 2	Lat: 26°06S Long: 25°00W	CTD 099s	OVOC analysis by MI-PTR/MS at 5 depths, surface (97%), 35m (33%), 60m (14%), 140m (1%) and 200m.
Solar Noon Cast	Lat: 27°10S Long: 25°00W	CTD 100t	OVOC analysis by MI-PTR/MS at surface only.
18/11/09 Predawn Cast 2	Lat: 28°47S Long: 26°08W	CTD 102s	OVOC analysis by MI-PTR/MS at surface only.
Solar Noon Cast	Lat: 29°23S Long: 27°02W	CTD 103t	OVOC analysis by MI-PTR/MS at surface only.
19/11/09 Predawn Cast 2	Lat: 30°50S Long: 29°11W	CTD 105s	OVOC analysis by MI-PTR/MS at 5 depths, surface (97%), 30m (33%), 55m (14%), 130m (1%) and 200m.
Solar Noon Cast	Lat: 31°32S Long: 30°15W	CTD 106t	OVOC analysis by MI-PTR/MS at surface only.
21/11/09 Predawn Cast 2	Lat: 33°25S Long: 34°15W	CTD 108s	OVOC analysis by MI-PTR/MS at surface only.
Solar Noon Cast	Lat: 29°23S Long: 27°02W	CTD 103t	OVOC analysis by MI-PTR/MS at surface only.
22/11/09			30-hour CTD DIEL 03; Southern Temperate Zone: SURFACE WATER ONLY
	35°18S 37°07W	Surf-37	0400
	35°18S 37°07W	CTD110t	0500
	35°18S 37°07W	CTD111t	0600
	35°17S 37°07W	Surf-38	0700
	35°16S 37°08W	Surf-39	0800
	35°16S 37°08W	Surf-40	0900
	35°16S 37°09W	Surf-41	1000
	35°15S 37°10W	Surf-42	1100
	35°15S 37°11W	Surf-43	1200
	35°15S 37°11W	CTD112t	1300
	35°15S 37°11W	Surf-44	1400
	35°16S 37°12W	Surf-45	1500
	35°16S 37°13W	Surf-46	1600
	35°16S 37°13W	Surf-47	1700
	35°17S 37°13W	CTD113t	1900
	35°17S 37°13W	Surf-48	2200
24/11/09 Solar Noon Cast	Lat: 37°52S Long: 41°06W	CTD 116t	OVOC analysis by MI-PTR/MS at 5 depths, surface (97%), 10m (33%), 20m (14%), 40m (1%) and 200m.
25-26/11/09 Predawn Cast 2	Lat: 39°19S Long: 43°24W	CTD 118s	Photochemical/Biological deck Incubation Experiment 04; Southern Temperate Zone (with Jo Dixon, PML)

Date/Time	Location	Station	Description of Activities
			OVOC analysis by MI-PTR/MS, surface water only.

Atmospheric OVOC Sampling Log;

Atmospheric data collected over the following time periods;

START		FINISH	
Date	**Time**	**Date**	**Time**
28/10/2009	21:09	29/10/2009	00:00
29/10/2009	12:40	31/10/2009	09:14
31/10/2009	14:06	31/10/2009	16:00
01/11/2009	10:54	02/11/2009	08:09
02/11/2009	08:12	03/11/2009	10:22
03/11/2009	10:55	04/11/2009	10:00
04/11/2009	18:02	05/11/2009	09:19
06/11/2009	07:42	06/11/2009	12:37
06/11/2009	13:36	06/11/2009	14:22
06/11/2009	15:25	06/11/2009	09:00
08/11/2009	08:48	08/11/2009	16:54
09/11/2009	07:44	10/11/2009	05:40
10/11/2009	13:55	10/11/2009	19:30
11/11/2009	07:45	13/11/2009	22:25
14/11/2009	05:29	15/11/2009	06:30
15/11/2009	16:09	18/11/2009	00:00
18/11/2009	08:53	20/11/2009	07:00

Preliminary Results;

None to report at this stage.

Biogeochemistry of selected oxygenated volatile organic compounds (OVOCs) in the north and south Atlantic Ocean

JOANNA DIXON AND STEPHANIE SARGEANT
Plymouth Marine Laboratory

Objectives

1. To determine the spatio variability in the oxidation rates of methanol, acetaldehyde and acetone throughout the Atlantic Ocean
2. To determine the particulate uptake rates of methanol as a function of microbial productivity throughout the Atlantic Ocean
3. To evaluate the biological turnover rates of methanol, acetone and acetaldehyde
4. To determine the degree of photochemical versus biological production of methanol, acetaldehyde, and acetone in surface waters of the Atlantic Ocean
5. To assess the diel variability of selected OVOC oxidation rates
6. To characterise the biodiversity of methylotrophic bacteria throughout the Atlantic Ocean

Methods

Heterotrophic Bacterial Production (HBP): Incorporation of L-[4,5-^{3}H]Leucine into bacterial protein in seawater samples was determined following the method of Smith and Azam 1992. 1.7 ml seawater samples were inoculated with 25 nM ^{3}H Leucine (6.8 µl) and incubated in the dark at in situ temperature for 1 hr. Samples were terminated with 100 µl TCA (5% final concentration) and incorporated ^{3}H extracted following procedures outlined in Smith & Azam 1992 before being measured by liquid scintillation counting

OVOC oxidation rates: Total oxidation of ^{14}C labelled methanol, acetone and acetaldehyde to $^{14}CO_2$ were determined by pipetting 1 ml samples into 2 ml micro centrifuge tubes and adding 0.5 ml of $SrCl_2.6H_2O$ (1 M), to precipitate the product of the biological oxidation as $Sr^{14}CO_3$, 20 µl of NaOH (1 M), to neutralise the HCl produced from the previous reaction, and 100 µl of Na_2CO_3 (1 M), to ensure adequate pellet formation (Connell et al., 1997; Goodwin et al., 1998). After centrifugation, the supernatant was aspirated, the pellet washed twice with ethanol (70%) and resuspended in 1 ml NaOH solution (pH ~11.7), before addition of Optiphase HiSafe III to create a slurry. The samples were vortex mixed and stored in the dark for >24 h before being analysed on the scintillation counter.

OVOC particulate uptake: Particulate uptake of ^{14}C labelled methanol was determined using ~320 ml samples incubated in the light and dark at in situ temperature for between 4-6 hours. Incubations were terminated by gentle vacuum sequential filtration using 2.0 µm and 0.2 µm filters. The filters were washed twice with filtered seawater before a final rinse with 70% ethanol and dried overnight in a desiccators before the addition of Optiphase HiSafe III scintillation fluid and analysis using a Tricarb 2100 counter.

Biodiversity of Methylotrophic bacteria: Large volume (~10-20 L) seawater samples were filtered through 0.22 µm Sterivex polyethersulfone filters for DNA/RNA collection. Samples were prepared for storage by incubating with 1.6 mL of RNA*later* solution overnight at 4°C, to allow thorough penetration of the tissue, then transfer initially to –80°C, although samples were transported back to the UK at -20^{o}C.

References

Smith, D.C and Azam, F. 1992 Marine Microbial Food webs 6(2): 107-114.
Connell, T.L., Joye, S.B., Miller, L.G., Oremland, R.S., 1997. Environ. Sci. Technol. 31, 1489-1495.
Goodwin, K.D., Schaefer, J.K., Oremland, R.S., 1998.. Appl. Environ. Microbiol. 64 (12), 4629-4636.

Sampling Log

Date/Time	Station	Description of Activities
15/10/09	CTD 4	Heterotrophic bacterial production (HBP) and methanol oxidation (MO) from 3 depths (5, 10, 40m)
16/10/09	CTD 8	HBP (5, 10, 38m)
17/10/09	CTD 11	HBP, MO, particulate methanol uptake (PMU) from 5 depths (5, 10, 20, 60, 200m)
	CTD 12	HBP, MO (5m)
18/10/09	CTD 14	HBP, MO, PMU, AO (Acetone oxidation) from 5 depths (5, 15, 25, 50, 200)
		HBP, MO, AO (5m)
	CTD 15	
19/10/09	CTD 17	HBP, MO & AAO (Acetaldehyde oxidation) from 4 depths (5, 17, 30, 70m)
	CTD 18	HBP, MO, AO & AA (5m)
20/10/09	CTD 20	HBP, MO AO, AAO & PMU from 4 depths (5, 13, 25, 57m)
21/10/09	CTD 21	HBP, MO & AAO from surface only, AAO time series expt
22/10/09	CTD 23	HBP, MO, AO , AAO & PMU from 4 depths (5, 17, 30, 68m)
	CTD 24	HBP, MO, AO & AA (5m), AO time series
23/10/09	CTD 26	HBP, MO, AO , AAO & PMU from 5 depths (5, 25, 45, 105 & 200m)
	CTD 27	HBP, MO, AO & AA (5m)
24/10/09	CTD 29	HBP, MO, AO , AAO & PMU from 5 depths (5, 28, 50, 115 & 200m)
	CTD 30	HBP, MO, AO & AA (5m)
25/10/09	CTD 32	HBP, MO, AO & AAO from 5 depths (5, 30, 50, 115 & 200m)
	CTD 33	HBP, MO, AO & AAO (5m)
26/10/09	CTD 35	Photochemical/Biological deck incubation experiment (1) HBP, MO, AO & AAO (Light/Dark, Poisoned/Live treatments) surface water (5m)
	Near NAG	HBP & MO from 3 depths (5, 25 & 110 m)
	CTD 36	HBP, MO, AO & AAO (5m)
27/10/09	CTD 38	HBP & MO from 4 depths (5, 30, 115 & 200m), AO & AAO 5m only
	CTD 39	HBP & MO from surface (5m)
28/10/09	CTD 41	HBP, MO, AO & AAO from 4 depths (5, 25, 110, & 200m).
29/10/09	Event no	DIEL (1) N Gyre surface (5m)
(CTD dip)	(CTD no)	
05:00 (surf 01)	112	HBP, MO, AO & AAO from each time point (AO & AAO missing from 01:00 & 04:00 h)
06:00	113 (42)	
07:00	115 (43)*	
08:00 (surf 02)	118	*DNA/RNA sterviex samples
09:00 (surf 03)	119	
10:00 (surf 04)	121*	
11:00 (surf 05)	123	
12:00 (surf 06)	124	
13:00 (surf 07)	125*	
14:00	127 (44)	
15:00 (surf 08)	131	
16:00 (surf 09)	132*	
17:00 (surf 10)	133	
19:00	136* (45)	
22:00 (surf 11)	138*	
01:00 (surf 12)	140*	
04:00 (surf 13)	141*	
05:00 (surf 14)	142	
06:00	144 (46)	
07:00	147* (47)	
08:00 (surf 15)	148	

Date/Time	Station	Description of Activities
09:00 (surf 16)	149	
10:00 (surf 17)	150*	
11:00 (surf 18)	151	
31/10/09	CTD 50	HBP, MO, AO, AAO from 5 depths (5, 20, 35, 80 & 200m).
	CTD 51	HBP, MO, AO, AAO from surface (5m)
01/11/09	CTD 53	HBP, MO, AO, AAO from surface only (5m)
	CTD 54	HBP, MO, AO, AAO from surface only (5m)
02/11/09	CTD 56	HBP, MO, AO & AAO from 5 depths (5, 17, 30, 70 & 200m)
	CTD 57	HBP, MO, AO, AAO from surface only (5m)
03/11/09	CTD 59	HBP, MO, AO, AAO & PMU from 5 depths (5, 10, 17, 42, 200m)
	CTD 60	HBP, MO, AO & AAO from surface (5m)
04/11/09	CTD 61	HBP, MO, AO & AAO from surface (5m)
05/11/09	CTD 63	Photochemical/Biological deck incubation experiment (2) HBP, MO, AO & AAO (Light/Dark, Poisoned/Live treatments) surface water (5m)
	Equatorial upwelling	HBP, MO, AO & AAO from surface (5m)
	CTD 64	HBP, MO, AO & AAO (5m)
06/11/09	CTD 66	HBP, MO, AO, AAO & PMU from 5 depths (5, 25, 40, 95, 200m)
	CTD 67	HBP, MO, AO & AAO (5m)
07/11/09	CTD 69	HBP, MO, AO, AAO from 5 depths (5, 15, 30, 70, 200m)
09/11/09	CTD 74	HBP, MO, AO, AAO & PMU from 5 depths (5, 25, 40, 95, 200m)
	CTD 75	HBP, MO, AO & AAO (5m)
10/11/09	CTD 77	HBP, MO, AO, AAO & PMU from 5 depths (5, 25, 45, 100, 200m)
	CTD 78	HBP, MO, AO & AAO (5m)
11/11/09	CTD 80	HBP, MO, AO, AAO & PMU from 5 depths (5, 30, 55, 125, 200m)
	CTD 81	HBP, MO, AO & AAO (5m)
12/11/09	Event no	DIEL (2) S Gyre surface (5m)
(CTD dip)	(CTD no)	
05:00 (surf 19)	256	HBP, MO, AO & AAO from each time point
06:00	257 (82)	
07:00	259 (83)*	*DNA/RNA sterviex samples
08:00 (surf 20)	261	
09:00 (surf 21)	262	
10:00 (surf 22)	263*	
11:00 (surf 23)	264	
12:00 (surf 24)	265	
13:00 (surf 25)	266*	
14:00	268 (84)	
15:00 (surf 26)	271	
16:00 (surf 27)	272*	
17:00 (surf 28)	273	
19:00	274 (85)*	
22:00 (surf 29)	275*	
01:00 (surf 30)	276*	
04:00 (surf 31)	277*	
05:00 (surf 32)	278	
06:00	279 (86)	
07:00	281 (87)*	
08:00 (surf 33)	283	
09:00 (surf 34)	284	
10:00 (surf 35)	285	
11:00 (surf 36)	286*	
15/11/09	CTD 93	HBP, MO, AO, AAO & PMU from 5 depths (5, 40, 70, 175, 200m)
	CTD 94	HBP, MO, AO & AAO (5m)
16/11/09	CTD 96	Photochemical/Biological deck incubation experiment (3) HBP, MO, AO & AAO

Date/Time	Station	Description of Activities
		(Light/Dark, Poisoned/Live treatments) surface water (5m)
	~SAG	HBP & MO at 4 depth (5m, 33%, 1% & 200m)
	CTD 97	HBP, MO from surface (5m)
17/11/09	CTD 99	HBP, MO from 5 depths (5, 35, 60, 140, 200m)
18/11/09	CTD 102	HBP, MO, AO, AAO from surface only (5m)
	CTD103	HBP, MO, AO, AAO from surface only (5m)
19/11/09	CTD 105	HBP, MO, AO, AAO & PMU from 5 depths (5, 40, 70, 175, 200m)
	CTD 106	HBP, MO, AO, AAO from surface only (5m)
21/11/09	CTD 108	HBP, MO, AO, AAO from surface only (5m)
	CTD 109	HBP, MO, AO, AAO from surface only (5m)
22/11/09	Event no	DIEL (3) Southern Temperate Region surface (5m)
(CTD dip)	(CTD no)	
04:00 (surf 37)	345	MO, AO & AAO from each time point
05:00	346 (110)	HBP @ 04:00, 07:00, 10:00, 13:00, 16:00, 19:00 & 22:00 only due to substrate shortage
06:00	348 (111)	
07:00 (surf 38)	351*	
08:00 (surf 39)	352	*DNA/RNA sterviex samples
09:00 (surf 40)	353	
10:00 (surf 41)	354*	Cancelled after 22:00 sampling due to weather
11:00 (surf 42)	355	
12:00 (surf 43)	356	
13:00	357 (112)*	
14:00 (surf 44)	360	
15:00 (surf 45)	362	
16:00 (surf 46)	363*	
17:00 (surf 47)	364	
19:00	365 (113)*	
22:00 (surf 48)	366*	
24/11/09	CTD 115	MO, AO & AAO from 5 depths (5, 10, 15, 38, 200m)
	CTD 116	MO, AO, AAO from surface only (5m)
25/11/09	CTD 118	Photochemical/Biological deck incubation experiment (4) HBP, MO, AO & AAO (Light/Dark, Poisoned/Live treatments & antibiotic treatments) surface water (5m)
	Southern Temperate Region	MO at 4 depths (5m, 33%, 1% & 200m)
		MO from surface (5m)
	CTD 119	

In addition DNA/RNA sterivex samples were taken routinely at between 3-4 depths from the pre-dawn CTD casts (typically @ 97%, 33% & 1% incident PAR equivalent depths, and 200m) and from the surface (5m) at the solar noon CTD cast.

Nitrogen fixation, iron distributions and climate impacts in the Atlantic Ocean

NEIL WYATT
Plymouth Marine Laboratory

Main aim

To contribute data to the national database on rates of N_2 fixation and Fe distribution in the euphotic zone of the Atlantic. To collect samples to determine the distribution of cobalt throughout the AMT. To investigate how climate change (Ocean Acidification) will impact on nitrogen fixation, primary production and Fe speciation in Atlantic waters. To generate a profile of seawater pH within the upper 200 m of the Atlantic Ocean.

1. The distribution of iron and cobalt in the Atlantic Ocean using flow injection

Objectives

Collect seawater for the post cruise quantification of the distribution of iron and cobalt within the upper 200 m of the Atlantic Ocean from pre-dawn CTD casts using trace metal clean techniques.

1.1 Sampling strategy for seawater iron and cobalt determination

Fresh seawater samples were collected from 6 depths pre-dawn using 6 pre-cleaned niskin bottles and the titanium Seabird CTD system. All bottles were transferred immediately to a trace metal clean facility. Samples were taken within 2 hours of collection for total dissolvable iron in trace metal clean bottles using clean handling techniques. Filtered (0.45, 0.2 µl S-bran filter capsule) samples were also taken for dissolved iron and dissolved cobalt. All samples were acidified with ultra pure hydrochloric acid within 20 minutes of collection, stored securely and the collection data recorded. All samples will be analysed back in the UK by flow injection. Table 1.1 summarises the CTD casts sampled during the cruise.

2. Determination of the rates of nitrogen fixation using stable isotope mass spectrometry

Objectives

To determine the rates of N_2 fixation at different depths within the upper 200 m based upon specific light penetration levels.

2.1 Sampling strategy, incubation and filtration for N_2 determination

Fresh seawater samples were collected from four light depths (97, 33, 20 and 1% of surface light) pre-dawn using 6 pre-cleaned niskin bottles and the titanium Seabird CTD system. All bottles were transferred immediately to a trace metal clean facility. Samples were decanted into trace metal clean 1 L polycarbonate bottles covered in black bags to eradicate light. Triplicate samples were collected at each depth and spiked with 1 ml of 15N stable isotope before being placed in their respective incubations on deck and covered with the appropriate light screen. Incubations lasted 24 hours from dawn until dawn the following day. Samples were then filtered through 25 mm Whatman GF/F glass microfiber filters and the resulting sample filter oven dried at 60^{o}C for 24 hours. The analysis will be by mass spectrometry and conducted back in the UK. Table 1.1 summarises the CTD casts sampled for N_2 fixation.

3. Seawater pH determination by spectrophotometry using *m*-cresol purple.

Objectives

To determine the distribution of seawater pH within the upper 200 m of the Atlantic Ocean using spectrophotometric methods and the indicator dye *m*-cresol purple.

3.1 Sampling strategy and analysis for pH seawater measurement

Fresh seawater samples were collected from 6 depths pre-dawn using 6 pre-cleaned niskin bottles and the titanium Seabird CTD system. All bottles were transferred immediately to a trace metal clean facility. From these bottles 250 ml samples were collected in borosilicate glass bottles prior to any other seawater collection. This ensured minimal CO_2 exchange. Samples were sealed with caps and parafilm and left in a black bag to equilibrate to ambient lab temperature next to the spectrophotometer. Analysis was conducted within 2 hours of collection according to the methods described by Dickson et al. (2007) (**Dickson, A.G., Sabine, C.L. and Christian, J.R. (Eds.) 2007. *Guide to best practices for ocean CO_2 measurements*. PICES Special Publication 3, 191 pp.**). Table 1.1 summarises the CTD casts sampled for pH determination during the cruise.

4. The effects of carbonate system perturbation on nitrogen fixation, primary production and Fe speciation in Atlantic waters.

Objectives

To use the techniques described in section 1 to assess the impact of climate change (ocean acidification) on iron speciation, the techniques described in section 2 to assess the impact on diazotroph activity at select light penetration levels (97 and 20 % of surface light) and finally the impact on phytoplankton primary production at the same light levels. Ocean acidification was replicated by the addition of acid and bicarbonate.

4.1 Sampling strategy

Fresh seawater samples were collected from 2 light depths (97 and 20 % of surface light) from the noon cast using 6 (3 bottles at each depth) pre-cleaned niskin bottles and the titanium Seabird CTD system. All bottles were transferred immediately to a trace metal clean facility. Table 1.1 summarises the CTD casts sampled for carbonate system manipulations during the cruise.

4.2 Iron concentration and speciation

Samples were collected for ambient iron concentrations with a separate 250 ml volume filtered through a 0.45, 0.2 µl S-bran filter capsule for iron speciation analysis. Total dissolvable and dissolved iron concentration will be determined by flow injection whilst iron speciation will be determined by competitive ligand exchange cathodic stripping voltammetry (CLE-CSV), all back in the UK.

4.3 Seawater carbonate system

250 ml samples were taken prior to any other collection for pH and total alkalinity (TA) determination to provide the ambient carbonate system at each depth. TA samples were fixed immediately with 125 µl mercuric chloride, sealed with caps and parafilm and stored in a cool, dark container. Analysis for TA will be conducted back in the UK. pH samples were analysed as described in section 3.

4.4 Nitrogen fixation and CO_2 perturbation

2 L samples were taken from homogenized seawater from 3 niskin bottles at the two depths stated according to the procedure outlined in section 2. Prior to the start of the 24 hour incubation period (dawn the following day) each bottle had its carbonate system perturbed to that which represented a seawater pCO_2 of 750 p.p.m. by the addition of hydrochloric acid and sodium bicarbonate. The perturbation required to reach this target was calculated using the CO2SYS software (Pierrot, D. E. Lewis,and D. W. R. Wallace. 2006. *MS Excel Program Developed for CO_2 System Calculations*. ORNL/CDIAC-105a. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tennessee), the ambient pH of the collected seawater and a temperature/salinity relationship used to determine total alkalinity. Each bottle was left to acclimatise to the perturbation in the respective incubators until the addition of the 15N spike pre-dawn the following day. Rates of N_2 fixation under these perturbed conditions will be determined as described in section 2.

4.5 Primary production

60 ml samples were taken from seawater incubations that had their carbonate system manipulated according to section 4.4 and had been acclimatized for at least 12 hours. In addition, triplicate samples at each light depth received a 1 nM iron addition at the same time as acidification. Triplicate samples at each depth were labelled with 14C and incubated at the respective light levels until dusk. Each sample was then passed through a 2 µm and 0.2 µm filter to size fraction the rate of primary production. Each sample filter was fumed overnight with hydrochloric acid to remove inorganic carbon before receiving 3 ml of scintillation fluid. The scintillation count was performed onboard and the data recorded to file.

Table 1.1 CTD casts sampled for iron and cobalt analysis, pH, nitrogen fixation and CO2 perturbation experiments.

	pH	Iron and Cobalt			N2 Fixation	CO2 perturbations	
CTD		**TdFe**	**dFe**	**dCo**	**-**	**N2 fix**	**PP**
007T	*	*	*	*			
008T	*						
012T	*	*	*	*			
013T					*		
016T	*	*	*	*			
019T	*				*		
021T	*	*	*	*			
022T	*	*	*	*	*		
025T	*	*	*	*	*		

	pH	Iron and Cobalt			N2 Fixation	CO2 perturbations	
CTD		**TdFe**	**dFe**	**dCo**	**-**	**N2 fix**	**PP**
029T					*		
028T		*	*	*			
031T	*	*	*	*	*		
034T		*	*	*			
040T	*	*	*	*			
044T	*	*	*		*	*	
052T		*	*	*			
055T	*	*	*	*			
057T	*	*	*				
058T	*	*	*	*			
060T	*	*	*				
065T		*	*	*			
068T	*	*	*	*			
073T	*	*	*	*			
076T		*	*	*			
079T	*	*	*				*
095T		*	*				
098T	*	*	*	*			*
101T	*	*	*	*			
104T		*	*	*			
107T	*	*	*	*			
114T	*	*	*	*			

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Measuring the rate of NH_4^+ oxidation by isotope dilution of $^{15}NO_2^-$ in the oligotrophic gyres of the Atlantic Ocean

CHARISSA M. FERRERA[2], ANDREW P. REES[1], DARREN R. CLARK[1],

[1]Plymouth Marine Laboratory, Prospect Place, Plymouth PL1 3DH, United Kingdom
[2]The Marine Science Institute, University of the Philippines, Diliman, Quezon City 1101, Philippines; Partnership for the Observation of Global Oceans-Scientific Committee on Oceanic Research (POGO-SCOR) 2009 Fellow

Objectives

It has been demonstrated that nitrification occurs throughout the photic zone of the Atlantic Ocean (Clark et al., 2008). An interesting feature was that higher rates of nitrification were associated with the centers of oligotrophic gyres of the North and South Atlantic, especially for the 1% sPAR depth. In this study we aim to reexamine this feature by increasing the number of depths around the bottom of the photic zone at which measurements are made, focusing only on the first step of nitrification – NH_4^+ oxidation.

Methods

A total of 33 stations along a transect from Falmouth, UK to Punta Arenas, Chile were sampled for NH_4^+ oxidation. Samples were collected during the second pre-dawn cast of the CTD-rosette system (Seabird). Details of sampling stations and sampling depths are presented in Table 1. About 4 liters of samples were obtained each at three depths dictated by the pre-determined light intensities measured as a percentage of the incident light at the surface – 14% sPAR, 1% sPAR and 1%-50m sPAR. One liter of sample is filtered for ambient PON and the sub-sample was used to measure ambient NO_2^- concentration. A ^{15}N spike is added to the remaining 3 L of sample. The volume of the spike is guided by the ambient NO_2^- readings from the nutrient autoanalyzer. A 1 L incubation bottle is filled with spiked seawater and placed in a deck incubator for ~10 hours during day light. The rest is filtered and used to determine 'pre-incubation' ^{15}N enrichment and NO_2^- concentration. At the end of the deck incubation, the sample is filtered and the seawater is used to measure 'post-incubation' enrichment and NO_2^- concentration. The process of determination of NO_2^- concentration is the same for the ambient, pre-incubation and post-incubation and is based on the formation of sudan-1 from NO_2^-. After an 8-hour incubation in the laboratory, sudan-1 generated from samples were acidified and collected using solid phase extraction onto C18 column catridges. Sample catridges were kept frozen at ~20°C until GC-MS analysis in PML using the method by Clark et al. (2007). NH_4^+ oxidation rate is calculated from the rate at which the enrichment of the $^{15}NO_2^-$ pool dilutes.

References

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Table 1. Details of sampling stations and sampling depths

Station ID	CTD No.	Latitude	Longitude	Date	Time IN (GMT)	Time OUT (GMT)	Sampling Depths		
							14% sPAR	1% sPAR	1%-50m sPAR
JC039-006	CTD008–S	49°00.00N	16°40.00W	16.10.09	0538	0640	No sample	38m	No sample
JC039-007	CTD011-S	47°17.22N	18°02.51W	17.10.09	0556	0650	No sample	45m	No sample
JC039-009	CTD014-S	44°14.61N	20°24.17W	18.10.09	0540	0626	No sample	50m	100m
JC039-011	CTD017-S	41°15.23N	22°36.25W	19.10.09	0549	0642	30m	70m	125m
JC039-015	CTD023-S	35°27.01N	28°38.74W	22.10.09	0638	0729	30m	68m	125m

Station ID	CTD No.	Latitude	Longitude	Date	Time IN (GMT)	Time OUT (GMT)	Sampling Depths		
							14% sPAR	1% sPAR	1%-50m sPAR
JC039-017	CTD026-S	33°25.19N	31°15.38W	23.10.09	0641	0728	45m	105m	150m
JC039-019	CTD29-S	31°25.71N	33°44.20W	24.10.09	0630	0714	50m	115m	175m
JC039-021	CTD032-S	29°10.88N	35°59.05W	25.10.09	0635	0730	50m	115m	175m
JC039-023	CTD035-S	27°13.91N	37°53.18W	26.10.09	0627	0718	45m	110m	175m
JC039-025	CTD038-S	25°23.49N	39°36.14W	27.10.09	0632	0721	50m	115m	175m
JC039-027	CTD041-S	23°13.26N	40°43.08W	28.10.09	0729	0819	45m	110m	175m
JC039-029	CTD043-T	21°07.91N	39°14.91W	29.10.09	0727	0804	45m	110m	No sample
JC039-029	CTD047-T	21°07.95N	39°18.33W	30.10.09	0736	0806	45m	100m	No sample
JC039-031	CTD050-S	19°08.64N	37°51.83W	31.10.09	0658	0748	35m	80m	125m
JC039-035	CTD056-S	14°09.23N	34°27.42W	02.11.09	0620	0708	30m	70m	125m
JC039-037	CTD059-S	11°28.02N	32°38.78W	03.11.09	0625	0709	17m	42m	100m
JC039-041	CTD063-S	06°50.04N	29°32.75W	05.11.09	0629	0709	25m	55m	100m
JC039-043	CTD066-S	04°03.21N	27°41.65W	06.11.09	0628	0711	40m	95m	150m
JC039-045	CTD069-S	01°16.22N	25°50.95W	07.11.09	0627	0710	30m	70m	125m
JC039-047	CTD071-S	02°02.59S	24°59.36W	08.11.09	0807	0850	35m	80m	125m
JC039-049	CTD074-S	03°50.37S	25°00.00W	09.11.09	0623	0704	40m	95m	150m
JC039-051	CTD077-S	07°21.08S	24°59.37W	10.11.09	0632	0720	45m	100m	150m
JC039-053	CTD080-S	10°39.05S	24°59.85W	11.11.09	0524	0608	55m	125m	150m
JC039-055	CTD083-T	13°48.86S	24°59.14W	12.11.09	0625	0701	No sample	140m	200m
JC039-056	CTD090-S	16°22.01S	24°59.81W	14.11.09	0535	0613	65m	150m	200m
JC039-059	CTD093-S	19°29.93S	24°59.85W	15.11.09	0527	0612	70m	175m	200m
JC039-061	CTD096-S	22°51.23S	24°59.77W	16.11.09	0525	0612	60m	140m	200m
JC039-063	CTD099-S	26°06.08S	25°00.32W	17.11.09	0534	0617	60m	140m	200m
JC039-065	CTD102-S	28°47.38S	26°08.23W	18.11.09	0535	0626	60m	135m	200m
JC039-067	CTD105-S	30°50.02S	29°11.02W	19.11.09	0522	0600	55m	130m	175m
JC039-069	CTD108-S	33°24.52S	34°15.48W	21.11.09	0645	0733	35m	88m	125m
JC039-072	CTD115-S	37°17.86S	40°11.37W	24.11.09	0625	0708	15m	38m	100m
JC039-074	CTD118-S	39°18.89S	43°23.54W	25.11.09	0626	0710	surface	15m	75m

$\delta^{13}C$ of Particulate Organic Matter and Dissolved Inorganic Carbon

JODI N YOUNG

Department of Earth Sciences, Oxford University, Oxford, OX1 3PR

Objectives

The objective was to examine variation in isotopic fractionation of carbon in surface water between Particulate Organic Carbon (POC) and Dissolved Inorganic Carbon (DIC) across the broad latitudinal range afforded by the AMT transect. Pairs of sampled were collected to enable this; filtered bulk organic samples for analysis of $\delta^{13}C$ in POC and sea water samples for analysis of $\delta^{13}C$ in DIC.

Methods

A set of about 140 POC and 96 DIC samples was collected, including 'blank' samples duplicate samples to test the result reproducibility. Between 5 and 10 l of near-surface water from the ship's non-toxic seawater supply or niskin bottles was collected in a carboy during the pre-dawn and noon station. The DIC samples were collected using a 50 ml disposable syringe and poured through a 0.2 □m disposable filter into an $HgCl_2$ pre-poisoned, 30ml amber boston round bottle. The bottle was sealed with no air space and stored in the dark at room temperature.

The $\delta^{13}C$ samples were filtered under vacuum through pre-combusted 47 mm, 0.7 □m GF/F membranes using a pre-combusted glass filtration unit. Different size fractions were collected by prefiltering through 53um mesh or 3um filter or no filter. The filters, filtration unit and the carboy were systematically rinsed with HCL and milliQ water between each sample to remove any inorganic carbon. At the end of the filtration, the filters were rinsed with milliQ water to remove Cl^- ions. They were then put onto a piece of pre-combusted aluminium foil, and dried for at least 12 hours at 60□C. The foil was closed, labelled and the sample store at RT. The blank samples were just filters rinsed with HCL, then milliQ water and dried before storage.

Coccolithophore biogeography

JODI N YOUNG
Department of Earth Sciences, Oxford University, Oxford, OX1 3PR

Background

Coccolithophores are a prominent component of the open ocean phytoplankton. They typically dominate the eukaryotic phytoplankton within the oceanic gyres, but occur throughout the Atlantic. In addition to their role as primary producers they are the most important single contributors to pelagic carbonate sedimentation. Consequently they are of great interest to geologists and biogeochemists as well as marine biologists and have been the subject of extensive multidisciplinary research (e.g. Thierstein &Young 2004, de Vargas et al. 2007). This combined with their relatively well-established taxonomy (Young et al. 2003) makes them an ideal group for monitoring the response of phytoplankton to global change.

The AMT project provides an uniquely suitable platform for conducting this type of research since: (1) The sampling through the Atlantic is ideal for mapping out the large scale biogeography of coccolithophores; (2) the chemical and physical oceanographic analyses undertaken during AMT cruises provide the full suite of environmental data needed to interpret assemblage data; (3) lower resolution studies of coccolithophore assemblages have been undertaken by different research groups throughout the history of AMT research; (4) complimentary analyses of other aspects of coccolithophore biology are being routinely undertaken by the research team of Barney Balch;.(5) the long term nature of the AMT project allows for repeat sampling in the future.

Objectives

1. To carry out high resolution analysis of nannofossil assemblages from AMT19, including particularly detailed sampling through the water column. This will be used to (1) Refine understanding of coccolithophore biogeography through the Atlantic; (2) Analyse patchiness and predictability of this representative group of phytoplankton; (3) Provide reliable autecological data for most coccolithophore species. 2. Collect medium resolution set of samples using the COD-FISH protocol to allow DNA probe studies of distribution of specific taxonomic groups, and when specific or generic level probes are available to identify life cycle phases. 4. To collect a set of environmental DNA samples from across the AMT transect for clone library study of haptophyte diversity.

Collaborators

The collecting was undertaken in collaboration with Dr Jeremy Young and Dr Martine Couapel from Palaeontology Department, The Natural History Museum, London SW7 5BD who will be analysing the samples. COD-FISH and environmental DNA samples will be carried out as a collaboration also with research group of Colomban de Vargas (SB Roscoff)

Sampling for coccolithophore assemblage analysis

Filter samples for coccolithophore assemblage analysis were collected from the pre-dawn (second cast). Typically samples of ca 5l were taken from 6 depths through a 53um mesh. This usually included six light level determined depths (97%, 33%, 14%, 1% and 2 below the DCM). 2L filtered onto 47mm cellulose nitrate 1um for light microscope (LM) analysis and 2L filtered onto 47mm polycarbonate 1um for scanning electron microscope (SEM) analysis. Filters were oven dried directly after filtration and were archived in millipore petrislides for subsequent study.

Summary: In total around 210 filters for SEM and 210 filters for LM were taken.

Sampling for COD-FISH analysis

COD-FISH is a modification of Fluorescence In-Situ Hybridisation (FISH) method using nonacidic buffers (Frada et al. 2006). It allows cross-polarised light identification of coccolithophores to be combined with fluorescent labelling of cells by DNA probes. Study of these filters will be conducted in collaboration with the research team of Colomban de Vargas (Station Biologique de Roscoff) who has developed a range of probes for different coccolithophore groups.

COD-FISH samples were usually collected at 2 depths from pre-dawn cast 2 every 3 days. Altogether 30 samples were recover from 15 different stations along the transect. Water samples were pre-filtered through a 53µmmesh then a precise volume of seawater (between 0.5 to 1 l) was fixed using 1 or 0.1% PFA according to the oceanic region, and incubated in the dark for at least 1hr. The preparation was then gently mixed and filtered through a 25 mm 0.22 µm anodisc membrane filter using a low vacuum pressure. At the end of the filtration, the filter was rinsed in a series of increasing purity ethanol baths. The filter was dried at room temperature, then stored in a petrislide dish, and frozen at -80□C.

Environmental DNA samples

Molecular genetic studies of microplankton have traditionally been limited to species available in culture, which for oceanic groups such as coccolithophores is a very limited sampling of total diversity. Increasingly the alternative approach of analysing DNA diversity from bulk samples is being used to circumvent this bottleneck. We have been collaborating with the research team of Colomban de Vargas (Station Biologique de Roscoff) in application of this methodology to study of coccolithophore diversity through parallel study of morphological and molecular diversity of selected samples (Hui et al. in prep). Some of the collected bulk DNA samples will also be used by David Bass (NHM, Zoology Dept.) for a multi-library DNA environmental PCR survey of Cercozoa.

Bulk DNA samples were usually collected from the surface and the DCM at pre-dawn cast 1. Altogether 90 samples were recover from 45 stations along the transect. Seawater was pre-filtered through a 53 □m mesh during recovery from Niskin bottles into a 15l plastic carboy. A sterile vented filter unit SterivexTM-GV 0.22□m was then connected with silicone tubing to a peristaltic pump, using gloves and put into the carboy. This arrangement with the filtration unit immersed in the sample was used to eliminate potential leaks at connections. 10 l had been filtered. The filter unit was then removed from the water but kept connected to the pump for 30min to dry out. Subsequently, 2 ml of buffer solution was injected into the filter unit with a micropipette. Finally the filter unit was sealed with parafilm and frozen at -20°C.

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Date	Lat	Long	Stat	Cast	DNA	Microscope	DIC	POC	Cod-fish
14-Oct-09	49°34.02N	08°38.01W	JC039002	CTD002 S	2	6	2	4	
	49°34.02N	08°38.01W	JC039002	underway				1	
15-Oct-09	48°56.91N	14°27.59W	JC039004	CTD004 t	2				
	48°56.91N	14°27.59W	JC039004	underway			1	1	
	48°56.91N	14°27.59W	JC039004	CTD005 S		6	1		2
16-Oct-09	49°00.00N	16°40.00W	JC039006	CTD007 T	2				
	49°00.00N	16°40.00W	JC039006	underway			1	1	

Date	Lat	Long	Stat	Cast	DNA	Microscope	DIC	POC	Cod-fish
	49°00.00N	16°40.00W	JC039006	CTD008S		6			
17-Oct-09	47°17.21N	18°02.52	JC039007	CTD010 T	2		1	1	
	47°17.21N	18°02.52	JC039007	underway			1	1	
	47°17.22N	18°02.51W	JC039007	CTD011S		6			2
18-Oct-09	44°14.50N	20°24.01W	JC039009	CTD013 T	2				
	44°14.50N	20°24.01W	JC039009	underway			1	1	
	44°14.61N	20°24.17W	JC039009	CTD014S		6			
19-Oct-09	44°14.50N	20°24.01W	JC039011	CTD016 t	2				
	44°14.50N	20°24.01W	JC039011	underway			1	2	
	44°14.50N	20°24.01W	JC039011	CTD017S	2	6	1	1	
20-Oct-09	38°19.29N	24°39.91W	JC03913	CTD019t	2				
	38°19.29N	24°39.91W	JC03913	underway			1	1	
	38°19.14N	24°40.08W	JC03913	CTD020S		6			2
22-Oct-09	35°27.30N	28°38.73W	JC03915	CTD022T	2				
	35°27.30N	28°38.73W	JC03915	underway			1	2	
	35°27.01N	28°38.74W	JC03915	CTD023S		6	1	1	
22-Oct-09	34°43.4N	29°35.3W	JC03916	CTD024T	2			1	
	34°43.4N	29°35.3W	JC03916	underway					
23-Oct-09	33°25.19N	31°15.38W	JC03917	CTD025T	2				
	33°25.19N	31°15.38W	JC03917	underway			1	1	
	33°25.19N	31°15.38W	JC03917	CTD026S		6			2
24-Oct-09	31°25.68N	33°44.17N	JC03919	CTD028T	2				
	31°25.68N	33°44.17N	JC03919	underway			1	1	
	31°25.71N	33°44.20N	JC03919	CTD029S		6			
25-Oct-09	29°11.17N	35°59.34W	JC03921	CTD031T	2				
	29°11.17N	35°59.34W	JC03921	underway			1	1	
	29°10.88N	35°59.05W	JC03921	CTD032S		6	1	1	
	28°28.7N	36°40.8W	JC03922	CTD033T	2		1	1	
	28°28.7N	36°40.8W	JC03922	underway			1	1	
26-Oct-09	27°13.00N	37°53.00W	JC03923	CTD034T	2				
	27°13.00N	37°53.00W	JC03923	underway			1	1	
	27°13.91N	37°53.18W	JC03925	CTD035S		6			2
27-Oct-09	25°23.50N	39°36.03W	JC03925	CTD037T	2				
	25°23.50N	39°36.03W	JC03925	underway			1	1	
	25°23.49N	39°36.14W	JC03925	CTD038S		6			
28-Oct-09	23°13.25N	40°43.05W	JC03927	CTD040T	2				
	23°13.25N	40°43.05W	JC03927	underway			1	1	
	23°13.26N	40°43.08W	JC03927	CTD041S		6			
29-Oct-09	21°08.01N	39°14.52W	JC039029	CTD042T	2				
	21°08.01N	39°14.52W	JC039029	underway			1	1	
	21°07.91N	39°14.91W	JC039029	CTD043 T		4	1	1	
	21°07.2N	39°16.1W	JC039029	CTD044T				1	
30-Oct-09	21°07.95N	39°18.43W	JC03929	CTD046T	2				
	21°07.95N	39°18.43W	JC03929	underway			1	1	

Date	Lat	Long	Stat	Cast	DNA	Microscope	DIC	POC	Cod-fish
	21°07.95N	39°18.33W	JC03929	CTD047T		6			2
31-Oct-09	19°08.64N	37°51.83	JC03931	CTD049T	2				
	19°08.64N	37°51.83	JC03931	underway			1	1	
	19°08.64N	37°51.83	JC03931	CTD050S		6			
01-Nov-09	1634.24N	365.87W	JC03933	CTD052T	2				
	1634.24N	365.87W	JC03933	underway			1	1	
	16°34.08N	36°05.85W	JC03933	CTD053 S		6			
02-Nov-09	14°09.10N	34°27.39W	JC03935	CTD055T	2				
	14°09.10N	34°27.39W	JC03935	underway			1	1	
	14°09.23N	34°27.42W	JC03935	CTD056S		6			2
	13°20.9N	33°54.9W	JC03936	CTD057T			1	1	
03-Nov-09	11°27.93N	32°38.74W	JC03937	CTD058T	2				
	11°27.93N	32°38.74W	JC03937	underway			1	1	
	11°28.02N	32°38.78W	JC03937	CTD059S		6			
04-Nov-09	08°48.3N	30°52.0W	JC30040	CTD061T	2		1	2	
	08°48.3N	30°52.0W	JC30040	underway			1	3	
05-Nov-09	06°49.78N	29°32.84W	JC03941	CTD062T	2				
	06°49.78N	29°32.84W	JC03941	underway			1	1	
	06°50.04N	29°32.75W	JC03941	CTD063S		6			2
06-Nov-09	04°03.09N	27°41.67W	JC03943	CTD065T	2	6	1	1	
	03°09.5N	27°05.9W	JC03944	underway			1	2	
	03°09.5N	27°05.9W	JC03944	CTD67T			1	2	
07-Nov-09	01°16.26N	25°50.80W	JC03945	CTD068T	2				
	01°16.26N	25°50.80W	JC03945	underway			1	1	
	01°16.22N	25°50.95W	JC03945	CTD069S		6			
09-Nov-09	02°02.86S	24°59.59W	JC03947	CTD070T	2				
	02°02.86S	24°59.59W	JC03947	underway			1	1	
	02°02.59S	24°59.36W	JC03947	CTD071S		6			2
	02°50.08S	25°00.1W	JC03948	CTD072T	4				
09-Nov-09	03°50.49S	25°00.09W	JC03949	CTD073T	2				
	03°50.49S	25°00.09W	JC03949	underway			1	1	
	03°50.37S	25°00.00W	JC03949	CTD074S		5			
	04°51.5S	25.00.0W	JC03950	underway			1	2	
	04°51.5S	25.00.0W	JC03950	CTD075T			1	2	
10-Nov-09	07°22.10S	24°59.56W	JC03951	CTD076T	2				
	07°22.10S	24°59.56W	JC03951	underway			1	1	
	07°21.08S	24°59.37W	JC03951	CTD077S		6			
11-Nov-09	10°39.42S	24°59.88W	JC03953	CTD079T	2				
	10°39.42S	24°59.88W	JC03953	underway			1	1	
	10°39.05S	24°59.85W	JC03953	CTD080S		6			2
	11°43.5S	25°00.00W	JC03954	underway			1	2	
	11°43.5S	25°00.00W	JC03954	CTD081T			1	2	
12-Nov-09	13°48.81S	24°58.88W	JC03955	CTD082T	2				
	13°48.81S	24°58.88W	JC03955	underway			1	1	

Date	Lat	Long	Stat	Cast	DNA	Microscope	DIC	POC	Cod-fish
	13°48.86S	24°59.14W	JC03955	CTD083T		6	1	1	
	13°51.32S	25°03.25W	JC03955	CTD084T	2		2	2	
13-Nov-09	14°00.24S	25°10.30W	JC03955	CTD086T	2				
	14°00.24S	25°10.30W	JC03955	underway			1	1	
14-Nov-09	16°22.34S	24°59.87W	JC03956	CTD089T	2				
	16°22.34S	24°59.87W	JC03956	underway			1	2	
	16°22.01S	24°59.81W	JC03956	CTD090S		6	1	2	2
15-Nov-09	19°30.06S	24°59.73W	JC03959	CTD092T	2				
	19°30.06S	24°59.73W	JC03959	underway			1	1	
	19°29.93S	24°59.85W	JC03959	CT093S		6	1	1	
	20°35.4S	25°00.0W	JC03960	CTD094T			1	2	
	20°35.4S	25°00.0W	JC03960	underway			1	2	
16-Nov-09	22°51.23S	24°59.77W	JC03961	CTD095T	2				
	22°51.23S	24°59.77W	JC03961	underway			1	1	
	22°51.23S	24°59.77W	JC03961	CTD096S		6			
17-Nov-09	26°06.08S	25°00.32W	JC03963	CTD098T	2		2	6	
	26°06.08S	25°00.32W	JC03963	underway			1	1	
	26°06.08S	25°00.32W	JC03963	CTD099S		5			2
	26°06.08S	25°00.32W	JC03963	underway			1	1	
18-Nov-09	28°47.38S	26°08.23W	JC03965	CTD101T	2				
	28°47.38S	26°08.23W	JC03965	underway			1	1	
	28°47.38S	26°08.23W	JC03965	CTD102S		6			
19-Nov-09	31°32.80S	30°15.28W	JC03968	underway			1	1	
20-Nov-09	32°48.75S	32°45.32W	na	underway			1	3	
21-Nov-09	33°24.68S	34°15.26W	JC03969	CTD107T	2				
	33°24.68S	34°15.26W	JC03969	underway			1	2	
	33°24.68S	34°15.26W	JC03969	CTD108S		6	1	2	2
	30°53.03S	34°58.48W	JC03970	CTD109T	2				
	30°53.03S	34°58.48W	JC03970	underway			1	1	
22-Nov 09	35°17.68S	37°06.70W	JC03971	CTD110T	2				
	35°17.68S	37°06.70W	JC03971	underway			1	1	
	35°17.68S	37°06.70W	JC03971	CTD111T		6			
	35°17.93S	37°06.89W	JC03971	CTD112T			1	2	
	35°17.93S	37°06.89W	JC03971	underway			1	2	
23/11/2009	35°38.09S	37°41.57W	na	underway			1	3	
24/11/2009	37°17.85S	40°11.37W	JC03972	CTD114T	2				
	37°17.85S	40°11.37W	JC03972	underway			1	1	
	37°17.85S	40°11.37W	JC03972	CTD115S		6			2
	37°51.95S	41°5.46W	JC03973	underway			1	3	
	37°51.95S	41°5.46W	JC03973	CTD116T			1	3	
25/11/2009	39°28.89S	43°23.54W	JC03974	underway			1	2	
	39°28.89S	43°23.54W	JC03974	CTD117T	2		1	2	
	39°28.89S	43°23.54W	JC03974	CTD118S		6			
26/11/2009	42°14.95S	48°13.46W	JC03976	CTD120T			1	3	

Date	Lat	Long	Stat	Cast	DNA	Microscope	DIC	POC	Cod-fish
	42°14.95S	48°13.46W	JC03976	underway			1	3	
27/11/2009	44°23.49S	51°52.97W	na	underway			1	1	
28/11/2009	46°58.78S	56°29.43W	na	underway			1	3	

Atmospheric inputs: chemical, physical and biological composition; role of bioaerosols in the iron biogeochemical cycle at the ocean atmosphere interface

MARIE CHEIZE

Laboratoire des sciences de l'Environnement MARrin (LEMAR), European Institute for Marine Studies, Brest

Staff for post cruise analyses

Marie Cheize: Laboratoire des sciences de l'Environnement MARrin (LEMAR), European Institute for Marine Studies, Brest.

Alex Baker: University of East Anglia, Norwich.

Karine Desboeufs : Laboratoire Interuniversitaire des Systèmes Atmosphériques (LISA), Paris.

Anne-Claire Baudoux: Laboratoire des sciences de l'Environnement MARrin (LEMAR), European Institute for Marine Studies, Brest.

Eva Bucciarelli: Laboratoire des sciences de l'Environnement MARrin (LEMAR), European Institute for Marine Studies, Brest.

Géraldine Sarthou: Laboratoire des sciences de l'Environnement MARrin (LEMAR), European Institute for Marine Studies, Brest.

Main aim

1. To study the biological, chemical and physical composition of aerosols (dry and wet) in the Atlantic open Ocean subject to contrasting atmospheric inputs.
2. To determine the role of bioaerosols (bacteria and viruses) in the iron biogeochemical cycle at the ocean-atmosphere interface.

General remark 1: All aerosol samplers were located in the same area on the upper deck of the ship to avoid contamination from marine aerosols. In addition collectors were placed as far as possible from the cheminy of the ship to avoid smoke contamination from the ship.

General remark 2: Flow was recorded during all sampling periods. Position of the ship, GMT time and meteorological informations (air temperature, pressure and humidity, wind speed and direction) were reported at the beginning and at the end of all sampling periods.

A. Biological, chemical and physical composition of dry aerosols:

Objectives:

- Collect dry aerosols on filters to determine, in post cruise analyses, their biological, physical and chemical composition. (Marie Cheize, LEMAR, Brest.; Alex Baker, UEA, Norwich.)
- Collect bioaerosols in liquid medium in order to culture and identify atmospheric bacteria and viruses in a post cruise laboratory work. (Marie Cheize, LEMAR, Brest)

Dry aerosol sample collection on filters:

- Dry aerosols were collected on filters (Whatman filter paper 41/20,3cm*25,4cm) on two cascade impactors in order to analyze the Major Ion (MI) composition and the Trace Metal (TM) concentration. By contrast filters used for MI, TM filters were pre-acid washed.
- Dry aerosols were also collected to determine their iron organic speciation. Filters were acid washed and pre-combusted before use.
- In order to couple chemical and physical approach of atmospheric inputs, dry aerosols were also collected on polycarbonate filters (Isopore menbrane filter 0.4µm-47mm). The air was collected through a low volume pump.
- Finally, dry aerosols were also collected through another low volume pump, on PTFE filters using teflon cassette to collect bioaerosols. Teflon cassette and PTFE filters were autoclaved before use.

All filters manipulations (loading and unloading) were executed under a laminar flow hood. During the cruise, the total sampling time for each filter were at least 15 hours and no more than 48 hours. An exceptional sampling time

(only 8 hours sampling) was applied to polycarbonate filters during dust events. After sampling, filters were placed inside plastic bags and transfered to -20°C.

MI and TM filters will be analysed at the University of East Anglia by Alex Baker. Filters for organic speciation and bioaerosols presence will be analysed at the European Institute for Marine studies in Brest by Marie Cheize.

Tables 1 to 5 summarise dry aerosol filters sampled and stored during the cruise for post cruise analyses.

Table 1: Details of dry aerosols samples collected for MI analyses during AMT19

Sample Number	Date	Start Sampling (GMT)	Lat (N,-S) Start Sampling	Long Start Sampling	Date	End Sampling (GMT)	Lat (N,-S) End Sampling	Long. End Sampling
AMT19-I-01	13/10/2009	13:30	FALMOUTH		14/10/2009	14:13	49°24.25'	10°42.15'
AMT19-I-02	14/10/2009	14:54	49°24.02'	10°42.15'	15/10/2009	14:00	48°56.99'	14°27.59'
AMT19-I-03	15/10/2009	14:15	48°56.99'	14°27.59'	16/10/2009	16:15	48°55.97'	16°43.69'
AMT19-I-04	16/10/2009	16:30	48°55.97'	16°43.69'	17/10/2009	15:40	46°11.04'	18°55.28'
AMT19-I-05	17/10/2009	16:10	46°04.53'	18°59.99'	18/10/2009	13:41	43°12.85'	21°10.50'
AMT19-I-06	18/10/2009	15:59	43°09.30'	21°12.90'	19/10/2009	13:30	40°19.39'	23°16.31'
AMT19-I-07	19/10/2009	16:18	40°06.22'	23°25.32'	20/10/2009	13:57	37°43.53'	25°38.84'
AMT19-I-08	20/10/2009	17:35	37°41.89'	25°39.01'	21/10/2009	15:00	37°06.07'	26°29.31'
AMT19-I-09	21/10/2009	15:57	37°00.64'	26°36.44'	22/10/2009	15:40	34°38.40'	29°41.87'
AMT19-I-10	22/10/2009	16:15	34°30.37'	29°50.10'	23/10/2009	16:55	32°43.56'	32°07.41'
AMT19-I-11	23/10/2009	18:00	32°36.76'	32°16.06'	24/10/2009	14:58	30°44.70'	34°29.04'
AMT19-I-12	24/10/2009	16:00	30°44.07'	34°29.04'	25/10/2009	14:18	28°28.72'	36°40.74'
AMT19-I-13	25/10/2009	16:17	28°25.65'	36°43.33'	26/10/2009	14:34	27°01.37'	38°03.19'
AMT19-I-14	26/10/2009	16:00	26°55.50'	38°09.55'	27/10/2009	14:00	24°39.11'	40°16.99'
AMT19-I-15	27/10/2009	16:30	24°34.51'	40°21.15'	28/10/2009	14:15	22°35.95'	40°16.62'
AMT19-I-16	28/10/2009	16:20	22°30.48'	40°12.64'	29/10/2009	14:30	21°07.19'	39°16.11'
AMT19-I-17	30/10/2009	15:50	20°54.41'	39°08.08'	31/10/2009	15:14	18°25.00'	37°21.00'
AMT19-I-18	31/10/2009	17:34	18°10.36'	37°11.52'	01/11/2009	17:52	15°35.00'	35°26.00'
AMT19-I-19	01/11/2009	19:29	15°23.00'	35°17.05'	02/11/2009	16:16	13°13.00'	33°49.00'
AMT19-I-20	02/11/2009	17:48	13°01.50'	33°41.51'	03/11/2009	17:33	10°19.00'	31°53.00'
AMT19-I-21	03/11/2009	19:49	10°01.42'	31°40.42'	04/11/2009	17:50	08°26.00'	30°37.00'
AMT19-I-22	04/11/2009	18:35	08°15.90'	30°30.31'	06/11/2009	17:27	02°53.79'	26°55.46'
AMT19-I-23	06/11/2009	18:38	02°43.09'	26°48.63'	08/11/2009	14:55	02°52.64'	25°00.25'
AMT19-I-24	09/11/2009	8:38	-04°04.39'	25°00.06'	10/11/2009	09:38	-07°43.55'	24°59.86'
AMT19-I-25	10/11/2009	10:37	-07°53.97'	21°59.83'	11/11/2009	09:01	-11°04.00'	25°00.00'
AMT19-I-26	12/11/2009	6:24	-13°48.86'	24°59.14'	13/11/2009	13:12	-14°01.39'	25°10.79'
AMT19-I-27	15/11/2009	8:12	-19°49.16'	24°59.94'	16/11/2009	14:20	-23°49.16'	25°00.06'
AMT19-I-28	16/11/2009	19:30	-24°43.76'	24°59.74'	18/11/2009	06:21	-28°47.42'	26°08.13'
AMT19-I-29	18/11/2009	10:15	-29°07.60'	26°38.87'	19/11/2009	06:54	-30°54.08'	29°17.50'
AMT19-I-30	19/11/2009	15:27	-31°35.85'	30°19.81'	21/11/2009	07:35	-33°26.28'	34°15.96'
AMT19-I-31	21/11/2009	10:42	-33°42.50'	34°42.40'	22/11/2009	11:42	-35°15.48'	37°10.12'
AMT19-I-32	22/11/2009	14:03	-35°15.48'	37°11.05'	23/11/2009	10:07	-35°09.19'	37°05.33'
AMT19-I-33	24/11/2009	9:31	-37°29.49'	40°29.94'	25/11/2009	16:42	-40°06.36'	44°39.12'

Table 2: Details of dry aerosols samples collected for TM analyses during the AMT19

Sample Number	Date	Start Sampling (GMT)	Lat (N,-S) Start Sampling	Long Start Sampling	Date	End Sampling (GMT)	Lat (N,-S) End Sampling	Long. End Sampling
AMT19-M-01	13/10/2009	13:30	FALMOUTH		14/10/2009	14:13	49°24.25'	10°42.15'
AMT19-M-02	14/10/2009	14:54	49°24.02'	10°42.15'	15/10/2009	14:00	48°56.99'	14°27.59'
AMT19-M-03	15/10/2009	14:15	48°56.99'	14°27.59'	16/10/2009	16:15	48°55.97'	16°43.69'
AMT19-M-04	16/10/2009	16:30	48°55.97'	16°43.69'	17/10/2009	15:40	46°11.04'	18°55.28'
AMT19-M-05	17/10/2009	16:10	46°04.53'	18°59.99'	18/10/2009	13:41	43°12.85'	21°10.50'
AMT19-M-06	18/10/2009	15:59	43°09.30'	21°12.90'	19/10/2009	13:30	40°19.39'	23°16.31'
AMT19-M-07	19/10/2009	16:18	40°06.22'	23°25.32'	20/10/2009	13:57	37°43.53'	25°38.84'
AMT19-M-08	20/10/2009	17:35	37°41.89'	25°39.01'	21/10/2009	15:00	37°06.07'	26°29.31'
AMT19-M-09	21/10/2009	15:57	37°00.64'	26°36.44'	22/10/2009	15:40	34°38.40'	29°41.87'
AMT19-M-10	22/10/2009	16:15	34°30.37'	29°50.10'	23/10/2009	16:55	32°43.56'	32°07.41'
AMT19-M-11	23/10/2009	18:00	32°36.76'	32°16.06'	24/10/2009	14:58	30°44.70'	34°29.04'
AMT19-M-12	24/10/2009	16:00	30°44.07'	34°29.04'	25/10/2009	14:18	28°28.72'	36°40.74'
AMT19-M-13	25/10/2009	16:17	28°25.65'	36°43.33'	26/10/2009	14:34	27°01.37'	38°03.19'
AMT19-M-14	26/10/2009	16:00	26°55.50'	38°09.55'	27/10/2009	14:00	24°39.11'	40°16.99'
AMT19-M-15	27/10/2009	16:30	24°34.51'	40°21.15'	28/10/2009	14:15	22°35.95'	40°16.62'
AMT19-M-16	28/10/2009	16:20	22°30.48'	40°12.64'	29/10/2009	14:30	21°07.19'	39°16.11'
AMT19-M-17	30/10/2009	15:50	20°54.41'	39°08.08'	31/10/2009	15:14	18°25.00'	37°21.00'
AMT19-M-18	31/10/2009	17:34	18°10.36'	37°11.52'	01/11/2009	17:52	15°35.00'	35°26.00'
AMT19-M-19	01/11/2009	19:29	15°23.00'	35°17.05'	02/11/2009	16:16	13°13.00'	33°49.00'
AMT19-M-20	02/11/2009	17:48	13°01.50'	33°41.51'	03/11/2009	17:33	10°19.00'	31°53.00'
AMT19-M-21	03/11/2009	19:49	10°01.42'	31°40.42'	04/11/2009	17:50	08°26.00'	30°37.00'
AMT19-M-22	04/11/2009	18:35	08°15.90'	30°30.31'	06/11/2009	17:27	02°53.79'	26°55.46'
AMT19-M-23	06/11/2009	18:38	02°43.09'	26°48.63'	08/11/2009	14:55	02°52.64'	25°00.25'
AMT19-M-24	09/11/2009	8:38	-04°04.39'	25°00.06'	10/11/2009	09:38	-07°43.55'	24°59.86'
AMT19-M-25	10/11/2009	10:37	-07°53.97'	21°59.83'	11/11/2009	09:01	-11°04.00'	25°00.00'
AMT19-M-26	12/11/2009	6:24	-13°48.86'	24°59.14'	13/11/2009	13:12	-14°01.39'	25°10.79'
AMT19-M-27	15/11/2009	8:12	-19°49.16'	24°59.94'	16/11/2009	14:20	-23°49.16'	25°00.06'
AMT19-M-28	16/11/2009	19:30	-24°43.76'	24°59.74'	18/11/2009	06:21	-28°47.42'	26°08.13'
AMT19-M-29	18/11/2009	10:15	-29°07.60'	26°38.87'	19/11/2009	06:54	-30°54.08'	29°17.50'
AMT19-M-30	19/11/2009	15:27	-31°35.85'	30°19.81'	21/11/2009	07:35	-33°26.28'	34°15.96'
AMT19-M-31	21/11/2009	10:42	-33°42.50'	34°42.40'	22/11/2009	11:42	-35°15.48'	37°10.12'
AMT19-M-32	22/11/2009	14:03	-35°15.48'	37°11.05'	23/11/2009	10:07	-35°09.19'	37°05.33'
AMT19-M-33	24/11/2009	9:31	-37°29.49'	40°29.94'	25/11/2009	16:42	-40°06.36'	44°39.12'

Table 3: Details of dry aerosols samples collected for iron organic speciation analyses during AMT19

Sample Number	Date	Start Sampling (GMT)	Lat (N,-S) Start Sampling	Long Start Sampling	Date	End Sampling (GMT)	Lat (N,-S) End Sampling	Long. End Sampling
AMT19-S-01	13/10/2009	13:30	FALMOUTH		14/10/2009	14:13	49°24.25'	10°42.15'
AMT19-S-02	14/10/2009	14:54	49°24.02'	10°42.15'	15/10/2009	14:00	48°56.99'	14°27.59'
AMT19-S-03	15/10/2009	14:15	48°56.99'	14°27.59'	16/10/2009	16:15	48°55.97'	16°43.69'
AMT19-S-05	17/10/2009	16:10	46°04.53'	18°59.99'	18/10/2009	13:41	43°12.85'	21°10.50'
AMT19-S-06	18/10/2009	15:59	43°09.30'	21°12.90'	19/10/2009	13:30	40°19.39'	23°16.31'
AMT19-S-07	19/10/2009	16:18	40°06.22'	23°25.32'	20/10/2009	13:57	37°43.53'	25°38.84'
AMT19-S-08	20/10/2009	17:35	37°41.89'	25°39.01'	21/10/2009	15:00	37°06.07'	26°29.31'
AMT19-S-09	21/10/2009	15:57	37°00.64'	26°36.44'	22/10/2009	15:40	34°38.40'	29°41.87'
AMT19-S-10	22/10/2009	16:15	34°30.37'	29°50.10'	23/10/2009	16:55	32°43.56'	32°07.41'
AMT19-S-12	24/10/2009	16:00	30°44.07'	34°29.04'	25/10/2009	14:18	28°28.72'	36°40.74'
AMT19-S-13	25/10/2009	16:17	28°25.65'	36°43.33'	26/10/2009	14:34	27°01.37'	38°03.19'
AMT19-S-14	26/10/2009	16:00	26°55.50'	38°09.55'	27/10/2009	14:00	24°39.11'	40°16.99'
AMT19-S-15	27/10/2009	16:30	24°34.51'	40°21.15'	28/10/2009	14:15	22°35.95'	40°16.62'
AMT19-S-16	28/10/2009	16:20	22°30.48'	40°12.64'	30/10/2009	15:11	20°56.23'	39°09.90'
AMT19-S-17	30/10/2009	15:50	20°54.41'	39°08.08'	01/11/2009	17:52	15°35.00'	35°26.00'
AMT19-S-18	01/11/2009	19:29	15°23.00'	35°17.05'	03/11/2009	17:33	10°19.00'	31°53.00'
AMT19-S-19	03/11/2009	19:49	10°01.42'	31°40.42'	06/11/2009	17:27	02°53.79'	26°55.46'
AMT19-S-20	06/11/2009	18:38	02°43.09'	26°48.63'	08/11/2009	14:55	-02°52.64'	25°00.25'
AMT19-S-21	09/11/2009	8:38	-04°04.39'	25°00.06'	11/11/2009	09:01	-11°04.00'	25°00.00'
AMT19-S-22	12/11/2009	6:24	-13°48.86'	24°59.14'	15/11/2009	06:16	-19°29.78'	24°58.98'
AMT19-S-23	15/11/2009	8:12	-19°49.16'	24°59.94'	16/11/2009	14:20	-23°49.16'	25°00.06'
AMT19-S-24	16/11/2009	19:30	-24°43.76'	24°59.74'	19/11/2009	06:54	-30°54.08'	29°17.50'
AMT19-S-25	19/11/2009	15:27	-31°35.85'	30°19.81'	21/11/2009	07:35	-33°26.28'	34°15.96'
AMT19-S-26	21/11/2009	10:42	-33°42.50'	34°42.40'	23/11/2009	10:07	-35°09.19'	37°05.33'
AMT19-S-27	24/11/2009	9:31	-37°29.49'	40°29.94'	25/11/2009	16:42	-40°06.36'	44°39.12'

Table 4: Details of dry aerosols samples collected on polycarbonate filters during the AMT19

Sample Number	Date	Start Sampling (GMT)	Lat (N,-S) Start Sampling	Long Start Sampling	Date	End Sampling (GMT)	Lat (N,-S) End Sampling	Long. End Sampling
AMT19-L-01	13/10/2009	15:50	FALMOUTH		14/10/2009	14:13	49°24.25'	10°42.15'
AMT19-L-02	14/10/2009	14:54	49°24.02'	10°42.15'	15/10/2009	14:00	48°56.99'	14°27.59'
AMT19-L-03	15/10/2009	16:09	48°56.99'	14°27.59'	16/10/2009	16:30	48°55.97'	16°43.69'
AMT19-L-04	16/10/2009	16:45	48°55.97'	16°43.69'	17/10/2009	15:40	46°11.04'	18°55.28'
AMT19-L-05	17/10/2009	16:00	46°04.53'	18°59.99'	18/10/2009	13:41	43°12.85'	21°10.50'
AMT19-L-06	18/10/2009	15:59	43°09.30'	21°12.90'	19/10/2009	13:30	40°19.39'	23°16.31'
AMT19-L-07	19/10/2009	16:18	40°06.22'	23°25.32'	20/10/2009	13:57	37°43.53'	25°38.84'
AMT19-L-08	20/10/2009	17:35	37°41.89'	25°39.01'	21/10/2009	15:00	37°06.07'	26°29.31'
AMT19-L-09	21/10/2009	15:57	37°00.64'	26°36.44'	22/10/2009	15:40	34°38.40'	29°41.87'
AMT19-L-10	22/10/2009	16:15	34°30.37'	29°50.10'	23/10/2009	16:55	32°43.56'	32°07.41'
AMT19-L-11	23/10/2009	18:00	32°36.76'	32°16.06'	24/10/2009	14:58	30°44.70'	34°29.04'
AMT19-L-12	24/10/2009	16:00	30°44.07'	34°29.04'	25/10/2009	14:18	28°28.72'	36°40.74'
AMT19-L-13	25/10/2009	16:17	28°25.65'	36°43.33'	26/10/2009	14:34	27°01.37'	38°03.19'
AMT19-L-14	26/10/2009	16:00	26°55.50'	38°09.55'	27/10/2009	14:00	24°39.11'	40°16.99'
AMT19-L-15	28/10/2009	7:50	23°13.51'	40°43.16'	28/10/2009	14:15	22°35.95'	40°16.62'
AMT19-L-16	28/10/2009	16:20	22°30.48'	40°12.64'	29/10/2009	14:30	21°07.19'	39°16.11'
AMT19-L-17	30/10/2009	15:50	20°54.41'	39°08.08'	31/10/2009	15:14	18°25.00'	37°21.00'
AMT19-L-18	31/10/2009	17:34	18°10.36'	37°11.52'	01/11/2009	17:52	15°35.00'	35°26.00'
AMT19-L-19	01/11/2009	19:29	15°23.00'	35°17.05'	02/11/2009	07:32	14°08.00'	34°26.00'
AMT19-L-20	02/11/2009	10:25	13°47.00'	34°12.00'	02/11/2009	16:16	13°13.00'	33°49.00'
AMT19-L-21	02/11/2009	17:48	13°01.50'	33°41.51'	03/11/2009	07:59	11°23.00'	32°35.00'
AMT19-L-22	03/11/2009	09:43	11°09.53'	32°26.38'	03/11/2009	17:33	10°19.00'	31°53.00'
AMT19-L-23	03/11/2009	19:49	10°01.42'	31°40.42'	04/11/2009	10:18	09°02.50'	31°00.59'
AMT19-L-24	04/11/2009	18:35	08°15.90'	30°30.31'	06/11/2009	17:27	02°53.79'	26°55.46'
AMT19-L-25	06/11/2009	18:38	02°43.09'	26°48.63'	08/11/2009	14:55	-02°52.64'	25°00.25'
AMT19-L-27	09/11/2009	8:38	-04°04.39'	25°00.06'	10/11/2009	09:38	-07°43.55'	24°59.86'
AMT19-L-28	10/11/2009	10:37	-07°53.97'	21°59.83'	11/11/2009	15:28	-11°55.26'	24°59.88'
AMT19-L-29	12/11/2009	6:24	-13°48.86'	24°59.14'	13/11/2009	13:12	-14°01.39'	25°10.79'
AMT19-L-30	15/11/2009	8:12	-19°49.16'	24°59.94'	16/11/2009	14:20	-23°49.16'	25°00.06'
AMT19-L-31	16/11/2009	19:30	-24°43.76'	24°59.74'	18/11/2009	06:21	-28°47.42'	26°08.13'
AMT19-L-32	18/11/2009	10:15	-29°07.60'	26°38.87'	19/11/2009	06:54	-30°54.08'	29°17.50'
AMT19-L-33	19/11/2009	15:27	-31°35.85'	30°19.81'	21/11/2009	07:35	-33°26.28'	34°15.96'
AMT19-L-34	21/11/2009	10:42	-33°42.50'	34°42.40'	22/11/2009	11:42	-35°15.48'	37°10.12'
AMT19-L-35	22/11/2009	14:03	-35°15.48'	37°11.05'	23/11/2009	10:07	-35°09.19'	37°05.33'

Table 5: Details of dry aerosols samples collected on PTFE filters during the AMT19

Sample number	Date	Start Sampling (GMT)	Lat (N,-S) Start Sampling	Long Start Sampling	End Sampling (GMT)	Lat (N,-S) End Sampling	Long End Sampling
PTFE I	29/10/2009	16:47	21°07.24'	39°16.73'	22:03	21°10.14'	39°20.14'
PTFE II	01/11/2009	09:28	16°28.00'	36°02.00'	17:52	15°35.00'	35°26.00'
PTFE III	02/11/2009 to 03/11/2009	16:16	13°13.00'	33°49.00'	07:59	11°23.00'	32°35.00'
PTFE IV	03/11/2009 to 04/11/2009	19:49	10°01.42'	31°40.42'	10:18	09°02.50'	31°00.59'
PTFE V	10/11/2009	09:38	-07°43.55'	24°59.86'	17:11	-08°47.58'	24°59.87'
PTFE VI	12/11/2009	14:30	-13°51.00'	25°03.00'	22:27	-13°56.96'	25°09.07'

B. Bioaerosol sample collection :

Sampling protocol

Bioaerosols were collected using a glass impinger SKC BioSampler® connected to a Biolite Air Sampling Pump® (-4,5 inHg). The impinger was prepared using respectively detergent, hot water, ethanol 70% and sterilized MilliQ water bathes. Between each bath, the material was rinced with sterilized MilliQ water boiled up in a microwave. Then, the impinger was filled with 20 mL of autoclaved glycerol/water 50/50 (v/v).

All impinger manipulations were executed under a laminar flow hood.

The sampling period fluctuates between 5 and 10 hours according to meteorologic conditions. When air temperature was raised, the impinger vial was covered with aluminium paper to prevent the sample from lost of glycerol and UV damage.

In parallel, three open petri dishes were fixed around the impinger to collect bioaerosols. Three media were available : Zobell (as sea water medium), R2A (poor medium) and TSA (rich medium).

General Remark 3: Glycerol used to sample and store bacteria for culture was autoclaved before the cruise. Formaldehyde was filtered before use with sterile seringue and sterile 0.22 µm filters.

Sample treatment
After sampling period, glycerol containing bioaerosols was divided for post cruise analyses into:

- Bacteria culture (17% autoclaved glycerol)
- Bacteria and viruses count (fixed with 2% formaldehyde)
- Viruses diversity (fixed with 2% formaldehyde)
- Viruses infected cells (fixed with 2% formaldehyde)
- Then, samples were stored at 4°C between 15 and 30 min before being flash frozen in liquid nitrogen and stored at -80°C.
- In order to look at the bacteria diversity, ~ 5 mL of sample was diluted with sterile MilliQ water (autoclaved and filtered on sterile filters 0.02 µm Anotop). Then, sample was filtered on autoclaved polycarbonate filters (0.22µm; 25mm).

Within 1-2 hours of collection, all samples were stored at -80°C.

Samples from the impinger will all be treated at the LEMAR by Marie Cheize and Anne-Claire Baudoux.

Table 6 summarises impinger bioaerosols samples associated with petri dishes samples collected during the cruise for post cruise analyses.

Table 6: Details of dry aerosols samples collected with the glass impinger during the AMT19

Sample Number	Date	Start Sampling (GMT)	Lat (N,-S) Start Sampling	Long Start Sampling	End Sampling (GMT)	Lat (N,-S) End Sampling	Long. End Sampling
IMP1	15/10/2009	06:15	48°56.91'	14°27.60'	14:00	48°56.99'	14°27.59'
IMP2	17/10/2009	07:45	47°05.97'	18°12.20'	15:40	46°11.04'	18°55.28'
IMP3	19/10/2009	06:40	41°15.16'	22°36.20'	15:10	40°19.40'	23°16.32'
IMP4	20/10/2009	10:18	37°46.25'	25°02.86'	17:35	37°41.89'	25°39.09'
IMP5	22/10/2009	07:45	35°24.77'	28°41.59'	16:15	34°30.37'	29°50.10'
IMP6	24/10/2009	08:15	31°21.89'	33°49.28'	16:00	30°44.70'	34°29.00'
IMP7	26/10/2009	08:00	27°10.00'	37°53.00'	16:00	26°55.50'	38°09.55'
IMP8	28/10/2009	07:49	23°13.51'	40°43.16'	16:20	22°30.48'	40°12.64'
IMP9	29/10/2009	08:30	21°07.90'	39°14.88'	14:30	21°07.19'	39°16.11'
IMP10	31/10/2009 to 01/11/2009	17:34	18°10.36'	37°11.52'	07:34	16°34.00'	36°05.00'
IMP11	01/11/2009 to 02/11/2009	19:29	15°23.00'	35°17.05'	07:32	14°08.00'	34°26.00'
IMP12	02/11/2009	10:25	13°47.00'	34°12.00'	16:16	13°13.00'	33°49.00'
IMP13	03/11/2009	07:59	11°23.00'	32°35.00'	17:33	10°19.00'	31°53.00'
IMP15	09/11/2009	08:38	04°04.39'	25°00.06'	16:07	05°02.84'	24°59.91'
IMP16	11/11/2009	06:57	10°44.52'	25°00.02'	15:28	11°55.26'	24°59.88'
IMP17	12/11/2009	06:24	13°48.86'	24°59.14'	14:30	13°51.00'	25°03.00'
IMP18	15/11/2009	06:16	-19°29.78'	24°59.98'	14:29	-20°36.06'	24°59.75'
IMP19	16/11/2009	06:21	-22°51.23'	24°59.76'	14:20	-23°49.16'	25°00.06'
IMP20	18/11/2009	06:21	-28°47.42'	26°08.13'	14:32	-29°23.63'	27°01.90'
IMP21	19/11/2009	06:54	-30°54.08'	29°17.50'	15:27	-31°30.85'	30°19.81'
IMP22	21/11/2009	07:35	-33°25.13'	34°14.61'	15:15	-33°53.01'	34°58.47'
IMP23	22/11/2009	11:42	-35°15.48'	37°10.12'	16:45	-35°16.55'	37°12.89'
IMP24	24/11/2009	09:31	-37°29.49'	40°29.94'	Sampler broken		

C. Chemical and biological composition of wet aerosols: Rainwater sample collection.

Objectives:

- Collect rainwater to determine, in post cruise analyses, Anions (A), Cations (C) and Dissolved Organic Carbon (DOC) concentrations, (Karine DesBoeufs, LISA, Paris.)

- Collect rainwater to determine, in post cruise analyses, the organic speciation of iron and the total concentration of iron in these inputs. (Marie Cheize, LEMAR, Brest)
- Collect bioaerosols from rainwater in order to culture and identify atmospheric bacteria and viruses in post cruise laboratory work. (Marie Cheize, Anne-Claire Baudoux, Eva Bucciarelli and Géraldine Sarthou, LEMAR, Brest.)

1. Anions, Cations and Dissolved Organic Carbon rainwater sample collections:

Sampling protocol

The collector used during the cruise to collect rainwater (see objective 1) is described in Figure 1 below.

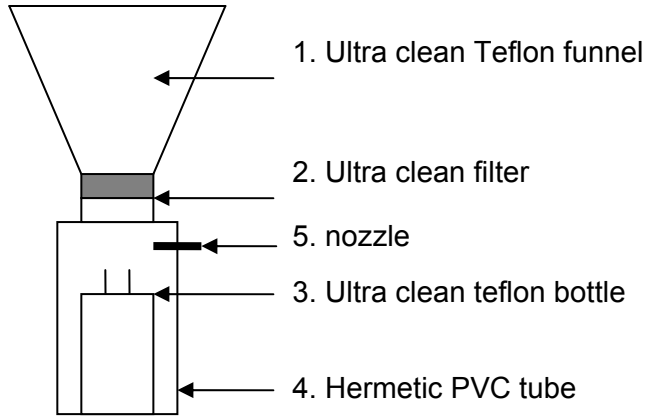

Figure 1: Simplified representation of A, C and DOC rainwater collector.

The four parts of rainwater collectors had to be assembled in ultra clean conditions in the clean container in order to prevent contamination. Before the rain event, the collector just assembled was fixed on the upper deck of the ship and covered by two plastic bags. When it started to rain these plastic bags were removed. After few minutes of rain sampling, a manual pump was connected to the nozzle in order to start the filtration of the rain.

After the rainwater event, the funnel was recovered by plastic bags and the level of rainwater was marked before treatment. The pH was also measured.

Sample treatment:
Rainwater was then divided into three bottles:

- 125mL teflon bottle pre-acidified for C.
- 60mL teflon bottle for A.
- 50 mL glass bottle for DOC.

DOC and A samples were stored at -20°C. The filter, C sample and the sampling bottle of 500mL were stored at ambiant temperature in the deck laboratory.

Samples will be analysed by Karine DesBoeufs at the LISA in Paris.

2. Iron speciation and bioaerosols in rainwater:

Sampling protocole

The second collector was designed and prepared to sample rain in ultra clean and sterile conditions as it is described in Figure 2.

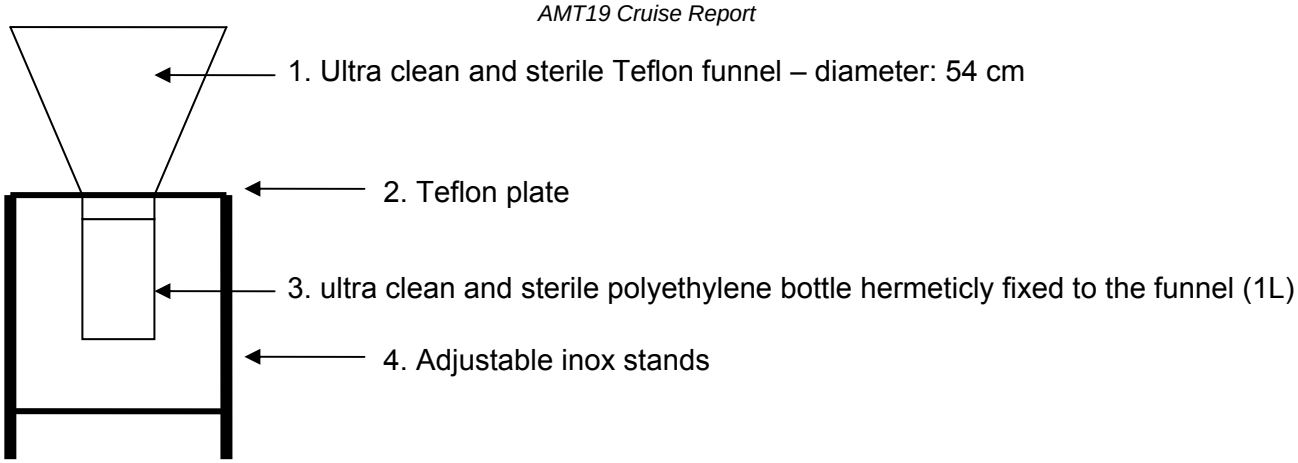

Figure 2: Simplified representation of bioaerosols and iron organic speciation rainwater collector.

The Teflon funnel was cleaned before and between each rainwater event with 10% (v/v) HCl diluted with sterile MilliQ water.

Blanks were sampled when the collector was placed on the upper deck at the beginning of the rain event. Samples collected were divised for further microbiological and iron organic speciation analyses.

Sample treatment for microbiological analyses:
Samples were divided exactly as described in part "A.2. sample treatment". In addition rainwater was also spread out (100µL) on petri dishes (same media used in part A.2.2). Petri dishes were put in a dark box at room temperature. When bacteria presence was observed, they were isolated in autoclaved glycerol 17% (final concentration) under laminar flow hood. Approximately 20 morphotypes were identified by eyes and isolated from petri dishes. Duplicates were sampled if possible.

Sample treatment for iron organic speciation analyses:
Rainwater was sampled to determine:

- the total concentration of iron in 60mL ultra-clean teflon bottles. Before storage at room temperature, samples were acidified with 1 per 1000 (v/v) HCl ultra pure under a laminar flow hood in the clean container.
- the iron organic speciation: rainwater was divided into ultra clean teflon bottles of 125 or 500 mL and stored at -20°C according to the volume collected.

Table 7 summarize rainwater sampled and stored during the cruise for post cruise analyses.

Table 7: Details of rainwater event sampled during the AMT19

Sample Number	Date	Start Sampling (GMT)	Lat (N,-S) Start Sampling	Long Start Sampling	End Sampling (GMT)	Lat (N,-S) End Sampling	Long End Sampling
RW I	23/10/2009	09:20	33°16.37'	31°25.80'	09:53	33°13.31'	31°29.78'
RW II	31/10/2009	08:19	19°06.33'	37°50.52'	09:02	19°00.48'	37°46.53'
RW III	31/10/2009	09:02	19°00.48'	37°46.53'	10:51	18°47.14'	37°36.87'
RW IV	04/11/2009	10:18	09°02.50'	31°00.59'	11:15	08°48.29'	30°51.98'
RW V	05/11/2009	10:30	06°23.24'	29°15.42'	11:19	06°17.36'	29°11.10'
RW VB	05/11/2009	11:19	06°17.36'	29°11.10'	11:40	06°14.69'	29°09.10'
RW VC	05/11/2009	11:40	06°14.69'	29°09.10'	12:16	06°09.93'	29°05.76'
RW VD	05/11/2009	12:16	06°09.93'	29°05.76'	20:02	05°20.23'	28°33.06'
RW VI	16/11/2009	15:30	-24°00.02'	24°59.98'	19:30	-24°43.76'	24°59.74'
RW VIII A	22/11/2009	18:41	-35°16.55'	37°12.89'	21:30	-35°16.53'	37°12.25'
RW VIII B	22/11/2009	21:30	-35°16.53'	37°12.25'	00:19	-35°17.24'	37°12.96'
RW VIII C	22/11/2009 au 23/11/2009	00:19	-35°17.24'	37°12.96'	10:07	35°09.19'	37°05.33'

C. Biological and chemical behaviour of dry and wet inputs in Seawater:

Objective:
Collect surface seawater samples in order to better understand, in post cruise analyses, the behaviour of bioaerosols and the behaviour of iron organic speciation coming from atmospheric inputs at the Ocean-Atmosphere interface. (Marie Cheize, Anne-Claire Baudoux, Eva Bucciarelli and Géraldine Sarthou, LEMAR, Brest.)

1. Seawater sample collection to understand the behaviour of bioaerosols in seawater:

Sampling protocol
Surface seawater were collected while the impinger was running. For rainning event, seawater samples were also collected if the CTD was deployed enough closed to the event. Seawater was sampled in a 2L polycarbonate bottle cleaned between each sampling session with HCl 10%.

Sample treatment
Samples were divided as described in part “A.2. sample treatment” except for bacteria diversity: 500mL of seawater instead of 15mL was filtered on autoclaved polycarbonate filters (0,22µm; 47mm) to look at the bacteria diversity.

After 1-2 hours of collection, all samples are stored at -80°C.

2. Seawater sample collection for iron organic speciation behaviour in seawater:

Sampling protocol
During rainwater and dust events seawater surface was also collected to measure the iron organic speciation.

Ultra cleanned teflon bottles of 125mL, and 500mL were used for sampling seawater surface in ultra clean conditions from a titanium rosette bottles in the clean container.

Sample treatment
Samples were stored at -20°C and will be analysed by Marie Cheize at the LEMAR, Brest by Cathodic Stripping Voltammetry.

Table 8 summarize surface seawater sampled and stored during the cruise for post cruise analyses.

Table 8: Details of surface seawater sampled during the AMT 19

Date	Station JC039	CTD number	Start Sampling (GMT)	Lat (N,-S)	Long.	correspond to
15/10/2009		005	07:15	48°56.91'	14°27.60'	IMP1
17/10/2009	006	underway	07:05	47°15.80'	18°02.75'	IMP2
17/10/2009	007	underway	13:32	46°20.32'	18°48.11'	IMP2
19/10/2009	011	017	07:15	41°15.16'	22°36.19'	IMP3
19/10/2009	012	018	14:18	40°19.40'	23°16.32'	IMP3
22/10/2009	015	023	07:01	35°26.84'	02°28.74'	IMP5
22/10/2009	016	024	15:00	34°43.41'	29°35.33'	IMP5
23/10/2009	018	027	15:14	32°52.24'	31°56.74'	RW I
24/10/2009	019	029	08:15	31°21.89'	33°49.28'	IMP6
24/10/2009	020	030	14:58	30°44.70'	34°29.04'	IMP6
26/10/2009	023	035	07:17	27°13.00'	37°53.00'	IMP7
26/10/2009	024	036	15:19	27°00.60'	38°04.48'	IMP7
28/10/2009	027	041	07:49	23°13.51'	40°43.16'	IMP8
29/10/2009	029	043	08:15	21°07.94'	39°14.87'	IMP9 &PTFE I
29/10/2009	029	044	15:27	21°08.00'	39°14.53'	IMP9 &PTFE I
31/10/2009	031	050	07:03	19°08.63'	37°51.82'	RW II
31/10/2009	FISH	FISH	08:41	19°03.66'	37°48.65'	RW II
31/10/2009	032	051	14:05	18°26.53'	37°22.41'	RW II
01/11/2009	033	053	08:30	16°34.30'	36°05.90'	IMP10 & PTFE II
01/11/2009	034	054	14:54	15°55.55'	35°39.67'	IMP10 & PTFE II
02/11/2009	035	056	07:07	14°09.38'	34°27.44'	IMP11
02/11/2009	036	057	14:50	13°20.88'	33°54.90'	IMP12 & PTFE III
03/11/2009	037	059	07:03	11°28.13'	32°38.86'	IMP13 & PTFE IV
03/11/2009	038	060	14:40	10°33.75'	32°02.43'	IMP 13 & PTFE IV
04/11/2009	040	061	14:40	08°48.29'	30°51.98'	RWIV
05/11/2009	041	063	07:10	06°50.51'	29°32.57'	IMP14
05/11/2009	042	064	14:11	05°56.92'	28°57.46'	RW V
09/11/2009	050	075	13:40	04°51.56'	25°00.02'	IMP15
10/11/2009	051	077	07:22	07°21.51'	24°59.21'	PTFE V
10/11/2009	052	078	14:22	08°22.80'	24°59.75'	PTFE V
11/11/2009	053	080	06:26	10°39.03'	24°59.84'	IMP16
11/11/2009	054	081	13:51	01°14.34'	24°59.78'	IMP 16
12/11/2009	055	083	07:09	13°48.75'	24°59.13'	IMP17 & PTFE VI
12/11/2009	055	084	14:11	13°51.35'	25°03.44'	IMP17 & PTFE VI
12/11/2009	055	085	18:53	13°54.50'	25°07.06'	IMP17 & PTFE VI
15/11/2009	059	093	06:30	-19°29.78'	24°59.98'	IMP18
15/11/2009	060	094	13:54	-20°35.42'	25°00.03'	IMP18
16/11/2009	061	096	06:21	-22°51.23'	24°59.76'	IMP19 & RW VI
16/11/2009	062	097	13:54	-23°45.77'	25°00.14'	IMP19 & RW VI
18/11/2009	065	102	06:21	-28°47.42'	26°08.13'	IMP20
18/11/2009	066	103	13:59	-29°23.54'	27°02.07'	IMP20
19/11/2009	067	105	06:30	-30°50.19'	29°11.57'	IMP21
19/11/2009	068	106	14:22	-31°32.87'	30°15.42'	IMP22
21/11/2009	069	108	07:30	-33°25.12'	34°14.66'	IMP23
21/11/2009	070	109	15:15	-33°53.01'	34°58.47'	IMP24

C. Preliminary observations:

Dry aerosols: dust event

Presence of dust was observed on filters beetwen the 31st of October 2009 and the 3rd of November 2009. This observation was in adequation with the measurement of the Maritime Aeronet Network used on the ship during the cruise (orange point on figure 3).

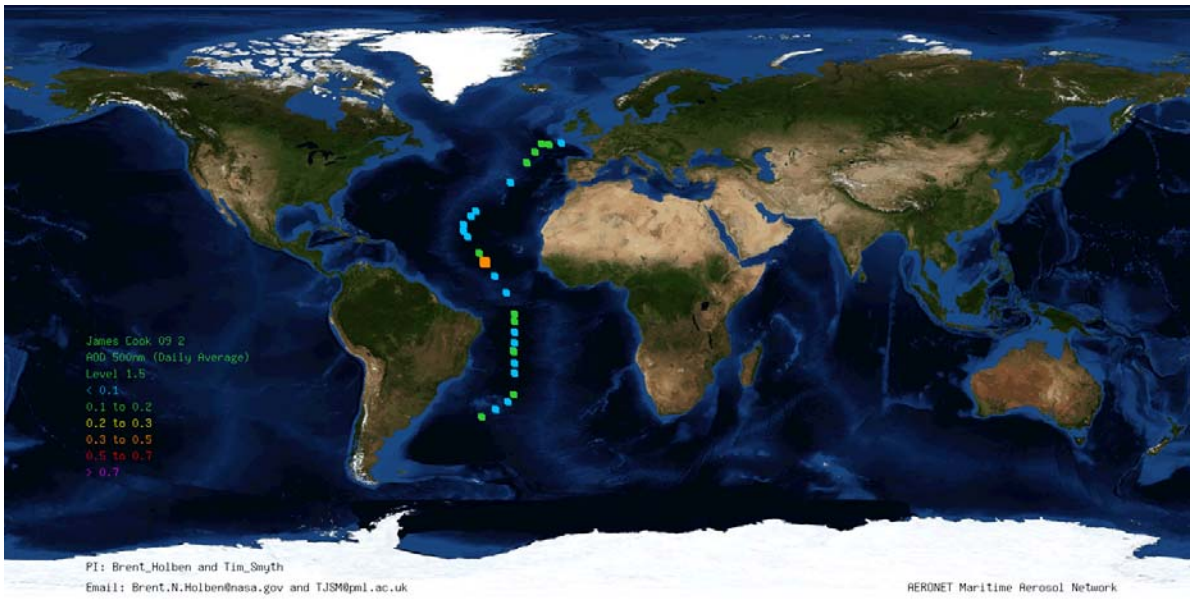

Figure 3: Maritime Aeronet Network

Filters analyses should confirm this saharan event.

Wet aerosol: rainwater

Atmospheric bacteria were isolated from different rain events. The presence of bacteria on petri dishes was only observed in light rainwater event. No bacterium was observed on petri dishes after strong rain event. This does not exclude bacteria presence in this kind of rain event, media used could not be adapted to their metabolism requirements. Additional media will be used during post experiments at the laboratory.

Primary production and key metabolic proteins in marine microbial communities/nitrogen fixation in *Trichodesmium* sp.

SOPHIE RICHIER
National Oceanography Centre, Southampton

1. Introduction

The diversity of marine microbial communities is poorly understood, however, microbial processes catalyze biochemical cycles on global scales. Despite this diversity the proteins that perform the chemistry of these reactions are highly conserved.

Primary production in the ocean is usually quantified through basic methods in oceanography (e.g. chlorophyll content, photosynthetic efficiency (Fv/Fm), satellite pictures). We propose here to investigate the photosynthetic process at a physiological and molecular level in order to better understand the role of nutrients availability on photosynthetic activity. Quantification of both key metabolic genes and related proteins in samples taken on the Atlantic Meridinal transect AMT, will provide such information.

In parallel, the fixation of nitrogen in the well-known cyanobacteria *Trichodesmium* sp. will be follow geographically and on a dial cycle at a molecular level including proteins and genes expression.

2. Methods

2.1- Sampling for proteins and RNA

Water samples were collected from the titanium CTD and underway (Table 1).

From the CTD, samples were collected from the surface and deep chlorophyll maximum (DCM). In the absence of a DCM, water samples were taken from the bottom of the mixed layer depth. For protein samples a volume of water ranging from 1L to 4L (depending on biomass in seawater) was filtered in quadruplicate for 1-2 hour through GF/F filters (0.7 µm, 25mm, Whatman). The filters were then snap-frozen in liquid nitrogen and stored at -80^{o}C. Filters will be used for protein extractions on return to the NOCS.

For RNA/DNA samples, water was collected from underway non-toxic disposal simultaneously to the CTD. Different filters were used depending on the aim of the study and the request from collaborators.

Water was filtered on :

- polycarbonate membrane (0.2 µm, 47 mm) for 30 min (Julie Laroche, IFM Geomar Germany)
- sterivex column for 60 min (Bess Ward, Priceton, USA)
- sterivex column for 40-50 min and snap frozen (NOCS)
- cell trap 2X 60 min (NOCS) back up.
-

2.2 Active chlorophyll fluorescence measurements (FRR and FIRe fluorometry)

Active chlorophyll*a* fluorescence is a non-invasive method of probing phytoplankton photophysiology by providing information on the functioning of photosystem II within the photosynthetic apparatus (Kolber et al. 1998; Suggett et al. 2005). Changes in biophysical parameters measured by active fluorescence techniques can then be used to infer the factors influencing phytoplankton growth *in situ*, including nutrient and light availability/stress (e.g. Greene et al. 1994). During AMT19 two active chlorophyll fluorometers were employed in a variety of modes including; continuous underway measurements and analysis of discrete samples from CTDs and UW. Instruments used for active fluorescence measurements were the FAST*tracka*^{TM} I Fast Repetition Rate (FRR) fluorometer, manufactured by Chelsea Technologies Group (CTG)(UK) and the Fluorescence Induction and Relaxation (FIRe) fluorometer, manufactured by SATLANTIC (Canada).

A CTG FAST*tracka*™ I FRRf was connected to the ships non-toxic supply within the bottle annex in order to monitor the physiological state of photosystem II (PSII) within the surface phytoplankton population throughout the study area. The instrument was run in auto-ranging mode. Saturation of variable chlorophyll fluorescence was performed using 100 flashlets of 1.1µs duration with a 2.8µs repetition rate. Subsequent relaxation of fluorescence was monitored using flashlets provided at 98.8µs spacing, giving a total relaxation protocol length of

around 2ms. The data were stored internally on the instrument and downloaded throughout AMT19 (Table 2). Instrument optics were cleaned daily as fouling of optics has previously been observed if left uncleaned for 2-3 days (Moore, D321a). A total of 29 files were collected. Data will be analyzed using custom software in a Matlab™ environment.

On a daily basis, chlorophyll$_a$ fluorescence was followed on a depth profile from 150 m up to the surface with the FIRe instrument (see Table 1)

2.2- Nitrogen fixation and *Trichodesmium* sp. Collection

A 50 µm mesh net was deployed around the equator (see Table 3) (31°25'74N/33°44'23 - 0°36'76N/25°23'73 W). It was towed at 5 m for 10 min. The net content was collected in a small white bucket, and colonies were picked up with squeezing pipettes and immediately dried on GF/F filters by a hand vacuum pump and snap frozen in liquid nitrogen.

3. Proposed analyses

All the analyses will be performed back to the laboratory. Briefly, proteins will be extracted, quantified and analysed on Western blot. Conserved antibodies against key proteins part of the photosystem I and II of the whole microbial community will be applied and the signal quantified. In parallel, RNA will be extracted and qPCR run in order to follow, transcripts of targets simultaneously.

Date	Station	Time (GMT)	CTD	Latitude	Longitude	Depths sampled (m)
14/10/2009	JC039002	4:30 AM	CTD002S	49°34' N	38°00 W	40 (DCM), 23,17,10,5,0,
14/10/2009	JC039003	12:50 PM	CTD003S	49°25' 98 N	10°31.66' W	DCM, 0, UW1
15/10/2009	JC039004	4:30 AM	CTD 004S	48°56' 91 N	14°27 60 W	(40) DCM, 0, UW2
		6:15 AM	CTD005S			40 (DCM, 23, 17, 10, 5, 0
16/10/2009	JC039006	5:56 AM	CTD 007.T	49°00 17 N	16°39 91 W	38 (DCM), 0, UW3
		7:30 AM	CTD 008 S			38, 23, 17, 10, 5, 0
17/10/2009	JC039007	4:30 AM	CTD 010T	47°17 22 N	18°02 51 W	DCM(56 m), 0 , UW4
			CTD 011S			45,25,20,10,5
	JC039008		CTD 012T	46°20 32 N	18°48 11 W	0, UW5
18/10/2009	JC039009	4:30 AM	CTD 013T	44°14 56 N	20°24 11 W	55 (DCM), surface, UW6
			CTD 014S			50,30,25,15,8,0
	JC039010	14:00				UW7
19/10/2009	JC039011	5:17:14 AM	CTD 016T	41°15 16 W	22°36 19 W	DCM (60), 0, UW8
			CTD 017S			70,40,30,17,9,0
	JC039012	1:45 PM	CTD 018 T	40°19 39 N	23°16 31 W	DCM, 0, UW9
20/10/2009	JC03913	05:19:31	CTD 019T	38°19 15	24°40 07	53 (DCM), 0, UW10
			CTD 020S			57,40,30,25,13,7,0
		2:22 PM		37°41 95 N	25° 38 54 W	DCM (53), 0, UW6
21/10/2009	JC039014	8:20 AM	CTD021T	37°06 09 N	26°29 26 W	DCM (60), 0, UW11
22/10/2009	JC039015	5:45 AM	CTD022T	35° 26 85 N	28° 38 74 w	DCM (75 m), 0, UW12
			CTD023S			68,55,40,30,17,10
	JC039016	1:46:39 PM	CTD024T	34°43.41 N	29°35.33 W	DCM (100), 0, UW13
23/10/2009	JC039017	6:20 AM	CTD025S	33°25 16N	31°15 11W	DCM (100 m), 0, UW14
			CTD026S			105,80,60,45,25,15,9,0
	JC039018	2:06:17 PM	CTD027T	32°52 24 N	31°56 74 W	DCM, 0, UW15
24/10/2009	JC039019	6:15:58 AM	CTD028T	31°25 74 N	33°44 23 W	DCM (110), 0, UW16
			CTD029S			115, 85,65,50,28,15,0
	JC019020	2:30 AM	CTD030T	30°44 69 N	34°29 04 W	DCM(110),0, UW17
25/10/2009	JC039021	6:18:06 AM	CTD031T	29°10°88 N	35°59°05 W	DCM (115), 0, UW18
			CTD032S			115, 85,65,50,28,15,0
	JC039022	2:11 PM	CTD033T	28°28 72 N	36°40 76 W	DCM (115), 0, UW19
26/10/2009	JC039023	6:35:12 AM	CTD034T	27°12 89	37°53 21	DCM (110m),0 , UW20
			CTD035S			110,85,65,45,25,15
	JC039024	2:19:05 PM	CTD036T	27°01 37 N	38°03 19 W	DCM (115),0
27/10/2009	JC039025	06:40:09	CTD037T	25°23 47 N	39°36 18 W	DCM (115),0, UW21
			CTD038S			115, 85,65,50,30,15,0
	JC039026	1:41:04 PM	CTD039T	24°40 32 N	40°15 82 W	DCM, 0, UW22
28/10/2009	JC039027	6:22:19 AM	CTD040T	23°13 25 N	40°43 08 W	DCM (115), 0, UW23
			CTD041 S			110,85,65,45,25,15,0
	JC039028		**CTD cancelled**	22°35 96 N	40°16 41 W	UW24
29/10/2009	JC039029	6:39:55 AM	CTD042T	21°08 00 N	39°14 53 W	DCM (110),0, UW25
			CTD43T			110, 85,45,25,15,0
		11:15 AM	CTD Surface 4			0, UW26
		3:27 PM	CTD044T			0, UW27
		7:31:31 PM	CTD45T			DCM, 0, UW28
		10:00 PM	CTD Surface X			0, UW29
		6:30:53 AM	CTD047T			DCM (100 m),0, UW30
			CTD048T			100,75,60,45,25
31/10/2009	JC039031	7:03:38 AM	CTD049T	19°08 63 N	37°51 82 W	DCM, 0, UW31
			CTD050S			80,60,45,35,20,10,0,
	JC039032		CTD051T	18°26 53 N	37°22 41 W	DCM, 0, UW32
01/11/2009	JC039033	7:48:33 AM	CTD052T	16°34 30 N	36°05 90 W	DCM (100),0, UW33
			CTD053S			100,75,60,45,25,15,0
	JC039034	14:34	CTD054T	15°55 55 N	35°39 67 W	DCM (100),0, UW34
02/11/2009	JC039035	06:39:58	CTD055T	14°09 37 N	34°27 44 W	DCM (70),0, UW35
			CTD056S			70,55,40,30,17,10,0
	JC039036		CTD057T	13°21 07 N	33°54 97 W	DCM,0, UW36
03/11/2009	JC039037	06:15	CTD058T	11°28 13N	32°38 86	DCM(42),0, UW37
		07:03	CTD059S			150,DCM (42),30,25,17,10,5,0
	JC039038	14:17:12	CTD060T	10°33 75 N	32°02 42 W	DCM (60), 0, UW38
04/11/2009	JC039040	14:15:12	CTD061T	08°48 29 N	30°51°98 W	no sampling
05/11/2009	JC039041	06:09:14	CTD062T	06°50 03 N	29°32 75 W	DCM (50),0, UW39
			CTD063S			150, DCM (55),40,30,25,15,7,0
	JC039042	13:52:52	CTD064T	05°57 04 N	28°57 61 W	DCM (60),0, UW40
06/11/2009	JC039043	06:15	CTD065T	04°03 26 N	27°41 64 W	DCM (95),0, UW41
			CTD066S			150,DCM(95),70,55,40,25,15,0
	JC039044	14:16:49	CTD067T	03°09 44 N	27°05 85 W	DCM, 0, UW42
07/11/2009	JC039045	06:12:17	CTD 068T	01°16 23 N	25°50 90 W	DCM (75),0, UW43
			CTD069S			70,55,40,30,15,10,0,

08/11/2009	JC039047	07:31:33	CTD070T	02°02 77 S	24°59 52 W	DCM (75),0, UW44
			CTD071S			150,80,60,45,35,20,10,0,
	JC039048	13:54:27	CTD072T	02°50 76 S	25°00 06 W	DCM,0, UW45
09/11/2009	JC039049	06:12:47	CTD073T	03°50 40S	25°00 08 W	DCM (95),0, UW46
			CTD074S			150,95,70,55,40,25,15,0
		13:40	CTD075T	04°51 56 S	25°00 02 W	DCM,0, UW47
11/11/2009	JC039053	05:26:39	CTD079T	10°39 03 S	24°59 84 W	DCM (125),0, UW48
			CTD080S			150, DCM (125),95,75,55,30,15,0
	JC039054	12:56:30	CTD081T	11°43 45 S	24°59 78 W	DCM (125),0, UW49
12/11/2009	JC039055	05:56:45	CTD082T	13°48 71 S	24°58 87 W	DCM (140),0, UW50
			CTD083T			140,75,55,30,15,0
		09:57:31	CTDS22			0, UW51
		14:11:26	CTD084T			DCM (125),0, UW52
		18:53:44	CTD085T	13°54 50 S	25°07 06 W	DCM (135),0, UW53
		21:54:20		13°56 68 S	25°08 69 W	0, UW54
		05:56:33	CTD086T	14°00 23 S	25°10 30 W	DCM (145),0, UW55
			CTD087T			145,100,60,45,20,0
14/11/2009	JC039056	05:09:27	CTD089T	16°22 18 S	24°59 84 W	DCM (150),0, UW56
			CTD090S			150,90,75,65,35,20,0
	JC039057	13:54:54	CTD091T	17° 20 81 S	24°59 96 W	DCM (158),0, UW57
15/11/2009	JC039059	05:47:35	CTD092T	19°29 85 S	24°59 91 W	DCM (175),0, UW58
			CTD093S			175,120,90,70,40,20,0
	JC039060	13:57:51	CTD094T	20° 35 42 S	25°00 03 W	DCM (165),0, UW59
16/11/2009	JC039061	05:34:11	CTD095T	22°51 23 S	24°59 71 W	DCM (150),0, UW60
			CTD096S			140,105,80,60,35,20,0
18/11/2009	JC039065	05:12:42	CTD101T	28°47.32' S	26°08.38' W	DCM (135),0, UW61
			CTD102S			135,100,80,60,30,20,0
	JC039066		CTD103T			DCM (130),0, UW62
19/11/2009	JC039067	05:21:59	CTD104T	30°50.02' S	29°11.03' W	DCM (130),0, UW63
			CTD105S			130,100,75,55,30,15,0
	JC039068	13:03:14	CTD106T	31°32.80' S	30°15.27' W	DCM,0, UW64
21/11/2009	JC039069	06:46:02	CTD 107T	33°24. 87' S	34°14.99' W	DCM (80),0, UW65
			CTD108S			88,45,35,20,10,0
	JC039070	15:01:36	CTD109T	33°53.01' S	34°58.47' W	DCM (88),0, UW67
22/11/2009	JC039071	06:29:43	CTD110T	35°17'73 S	37°06. 72' W	DCM (45),0, UW68
			CTD111T			40,30,20,10,5,0
		11:06:11		35°15.60' S	13°09.37' W	0, UW69
		14:04	CTD112T	35°15.48' S	37°11. 04' W	DCM (35),0, UW70
		20:10:02	CTD113T	35°16.75' S	37°12.90' W	DCM(38),0, UW71
		22:57:40		35°16.94' S	37°12.79' W	0, UW72
24/11/2009	JC039072	06:15:11	CTD114T	37°17.85' S	40°11.37' W	DCM (33),0, UW73
			CTD115S			38,30,25,15,10,0
	JC039073	14:36:23	CTD116T	37°51.96' S	41°05.46' W	DCM, 0, UW74
25/112009	JC039074	06:15	CTD117T	39°18.90' S	43°23.54' W	DCM(15),0, UW75
			CTD118S			20,DCM (15),10,5,0
	JC039075	14:57:15	CTD119T	39°58.16' S	44°26.13' W	DCM (13),0, UW76
26/11/2009	JC039078	14:37:54	CTD120T	42° 14.94' S	48°13.86' W	DCM (21),0,UW77

Table 1: Sampling for proteins and RNA/DNA from CTD and UW

UW	Date	Station	Time (GMT)	Latitude	Longitude
UW1	14/10/2009	JC039003	12:23:22	49°25' 98 N	10°31.66' W
UW2	16/10/2009	JC039007			
UW3	17/10/12009	JC039008	13:10	46°20 32 N	18°48 11 W
UW4	19/10/2009	JC039012	12:53:35	40°23.56' N	23°13.17' W
UW5					
UW6	20/10/2009	JC039013	14:22	37°41.95' N	25°38.54' W
UW7	22/10/2009	JC039016	13:46:39	34°43.41' N	29°35.33 W
UW8	23/10/2009	JC039018	14:06:17	32°52.24'N	31°56.74'W
UW9	24/10/2009	JC039020	16:28:44	30°41.13'N	34°32.77'W
UW10	27/10/2009	JC039026	13:41:04	24°40.32'N	40°15.82'W
UW11	28/10/2009	JC039028	13:43:44	22°37.16' N	40°17.20'W
UW12	29/10/2009	JC039029	14:19:50	20°56.17' N	39°10.03'W
UW13	31/10/2009	JC039032	13:37:52	18°26.53' N	37°22.41'W
UW14	02/11/2009	JC039036	13:49:45	13°21.07'N	33°54.97'W
UW15	04/11/2009	JC039040	14:15:12	08°48.29' N	30°51.98'W
UW16	05/11/2009	JC039042	14:11	05°56.92'N	28°57.46'W
UW17	06/11/2009	JC039044	13:43:57	03°10.70'N	27°06.64'W
UW18	08/11/2009	JC039048	13:54:27	02°50.76'S	25°00.06'W
UW19	09/11/2009	JC039050	13:40	04°51.56'S	25°00.02'W
UW20	10/11/2009	JC039052	13:27:31	08°22.80'S	24°59.75'W
UW21	11/11/2009	JC039054	12:56:30	11°43.45'S	24°59.78'W
UW20bis	14/11/2009	JC039057	13:54:54	17°20.81'S	24°59.76'W
UW21bis	15/11/2009	JC039060	13:57:51	20°35.42'S	25°00.03'W
UW23	17/11/2009	JC039064	12:32:29	27°07.04'S	24°59.92'W
UW24	20/11/2009	JC039068	13:03:14	31°32.80'S	30°15.27'W
UW25	21/11/2009	JC039070	15:01:36	33°53.01'S	34°58.47'W
UW26	23/11/2009	-	13:16:05	35°29.76'S	37°33.12'W
UW27	25/11/2009	JC039075	14:57:15	39°58.16'S	44°26.13'W
UW28	26/11/2009	JC039078	14:37:54	42°14.94'S	48°13.86'W
UW29	28/11/2009	-	15:09:54	47°05.66'S	56°42.30'W

Table 2: A CTG FASTtracka™ I FRRf files downloads.

Plankton net	Date	Station	CTD Time	Position	
PN1	24/10/2009	JC039019	06:15:58	31°25.74' N	33°44.23' W
PN2	25/10/2009	JC039021	06:18	29°10.88 N	35°59.05' W
PN3		JC039022	15:00	28°28.72' N	36°40.76' W
PN4	26/10/2009	JC039024	15:00	27°01.37' N	38°03.19' W
PN5	27/10/2009	JC039026	15:00	24°40.32' N	40°15.82' W
PN6	28/10/2009	JC039028	15:05	22°35.96' N	40°16.41' W
PN7	29/10/2009	JC039029	07:00	21°08.00' N	39°14.53' W
PN8			11:00		
PN9			15:00		
PN10			17:59		
PN11			22:00		
PN12	31/10/2009	JC039032	14:00	18°26.53' N	37°22.41'W
PN13	01/11/2009	JC039033	14:00	15°55.55' N	35°39.67' W
PN14	02/11/2009	JC039036	14:00	13°21.07' N	33°54.97' W
PN15	03/11/2009	JC039038	14:00	10°33.75'N	32°02.42' W
PN16	04/11/2009	JC039040	14:00	08°48.29' N	30°51.98' W
PN17	05/11/2009	JC039042	14:00	05°57.04'N	28°57.61'W
PN18	06/11/2009	JC039044	14:00	03°09.44' N	27°05.85' W
PN19	07/11/2009	JC039046	14:00	00°36.76' N	25°23.73'W

Table 3: Plankton net deployments

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A proposal for refinement of the MODIS calcite algorithm and Cal/Val activities towards assembly of earth system data records

EMILY LYCZKOWSKI AND BARNEY BALCH
Bigelow Laboratory for Ocean Sciences

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Cruise Objectives

1. Collection of CTD and underway (approximately every 3 hrs) samples for analysis of particulate organic carbon (POC), particulate inorganic carbon (PIC), coccolith enumeration and biogenic silica concentration (BSi). The purpose of these samples was to provide an assessment of the inorganic and organic particle concentrations in surface water, provide indices of community composition, and analytical means to calibrate satellite PIC algorithms.

2. Operation of an along-track flow-through system from the ship's non-toxic seawater system to characterize the fine-scale hydrographic and bio-optical variability of the various water masses for satellite development of the NASA PIC algorithm.

3.Water-leaving radiance measurements in the visible and near infra red taken from the ship's meteorological platform, for characterizing the particulate content of the seawater and to provide sea-truth data for NASA's MODIS-Terra and Aqua satellite-based radiance measurements.

UW sampling

Discrete underway samples were collected from the ship's Surf-Met (underway surface and meteorological data collection) flow system in the CTD hanger lab 3 times per day (every 3-4 hours, spaced around stations). Samples for POC, PIC, BSi, and coccolith enumeration were obtained along with chlorophyll samples taken for fluorometer calibration (UW chlorophylls measured by Claire Widdecombe, Plymouth Marine Lab, UK). PIC samples were collected on 0.4 µm polycarbonate filters, rinsed with potassium tetraborate buffer and stored in metal free centrifuge tubes. These will be analyzed by ICPOES for particulate calcium. Coccolith and cell counts are collected on Millipore HA (nitrocellulose) filters, rinsed with potassium tetraborate buffer, frozen at 20ºC, dried, then mounted onto slides using Norland Optical Adhesive. They will later be enumerated by birefringence microscopy. Biogenic silica (BSi) samples were filtered onto 0.4 µm polycarbonate filters, dried in clean centrifuge tubes, and will be analyzed following the protocol of Brzezinski and Nelson (1989). POC samples were filtered onto pre-combusted glass fiber filters and the organic carbon content will later be analyzed using a Perkin-Elmer CHN analyzer.

CTD sampling

During the pre-dawn CTD (second cast of the day) six light depths (1%, 7%, 14%, 33%, 55%, 97%) and two deeper (down to 200m) depths were analyzed for POC, PIC, BSi, and coccolith enumeration as described above. Six depths (DMC and several depths above and below) were also analyzed from the local noon CTD each day.

Flow-through bio-optical system

This system operates semi-continuously with water from the ships non-toxic sea water supply flowing at a rate of 4 liters per minute. Every 5-7 minutes temperature and salinity are measured (with a SeaBird sensor), chlorophyll fluorescence (WETLabs Wet star), total backscattering at 532nm (bb_{tot}; WETLabs ECO-VSF), acidified backscattering (bb_{acid}; backscattering of the seawater suspension after the pH has been lowered to dissolve calcite and aragonite), and acid labile backscattering (bb'; the difference between the bb_{tot} and bb_{acid}). A WETLabs ac-9 is used to measure absorption and attenuation at 9 visible wavelengths (412, 440, 488, 510, 555, 630, 650, 676, and 715 nm) (every 2 minutes) and absorption and attenuation at the same wavelengths after the water was routed through a serially-mounted 1 µm poresize, then 0.2µm poresize filter (during the intervening 2 minute segments).

Above-Water Radiance Measurements

In order to check the PIC algorithm performance, free of atmospheric error, total upwelling radiance, downwelling sky radiance and total downwelling irradiance were measured from the meteorological platform of the *RRS James Cook* using a Satlantic SeaWiFS Aircraft Simulator (MicroSAS). The same wavelengths are measured with the MicroSAS as used in the 2-band and 3-band PIC algorithms (except the IR bands which are not needed for the

implementation of the ship-derived, three-band algorithm because there is negligible atmospheric correction when measurements are made from ship).

The system consists of a down-looking ocean radiance sensor and an up-looking sky-viewing radiance sensor, both mounted on the platform. The water-viewing radiance detector was set to view the ocean surface at 40° from nadir and the sky-viewing radiance sensor was set to view the sky 40° from zenith (used in the correction for Fresnel reflectance) as recommended by Mueller et al. (2003b). The downwelling irradiance sensor was mounted far enough forward and aloft so as to minimize any shading from the ship's superstructure. Data from these sensors will be used to calculate spectral normalized water-leaving radiance (after filtering out white-caps and high pitch/roll anomalies) for comparison to the satellite estimates of normalized water-leaving radiance.

Sensors were rinsed regularly with Milli-Q water in order to remove salt deposits and any dust. The water radiance sensor was able to view over an azimuth range of ~180° across the ship's heading with no contamination from the ship's deck or wake. The direction of the sensor was adjusted constantly to view the water 120° from the sun's azimuth, to minimize sun glint. This was done using a computer-based system that calculated the sun's azimuth angle relative to the ship's heading and elevation constantly. The system used the ship's gyro-compass to determine the heading of the ship. Depending on the ship's course, the computer controlled a stepping motor that turned the sensors to the proper viewing angle. Protocols for operation and calibration were performed according to Mueller (Mueller et al. 2003a; Mueller et al. 2003b; Mueller et al. 2003c). Data were collected between about 1000 and 1900 GMT when the sun was above 20º elevation. Post-cruise, the 16Hz data will be filtered to remove as much residual white cap and glint as possible (we accept the lowest 5% of the data). Calibrations with 10% reflectance plaque were performed during the cruise in order to assess the status of the radiometric calibrations. A factory calibration of the radiometers was performed before the cruise and also will be done immediately after the cruise.

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Underway Sample Log: A list of samples taken from the ships non-toxic flowing seawater system.

"y" indicates that a sample was taken at that site. POC: Particulate organic carbon, PIC: particulate inorganic carbon, CC: cell count/coccolith enumeration, BiSi: biogenic silica

Date	Time GMT	Calendar day	Uw identifier	Decimal latitude (N, -S)	Decimal longitude (-W)	Sample #	POC?	PIC?	CC?	BiSi?
14/10/2009	04:30	287	AA	49.4843	-9.9052	9	y	y	y	y
14/10/2009	17:20	287	AB	49.1809	-10.3259	16	y	y	y	y
15/10/2009	19:00	288	AC	48.9720	-15.4962	25	y	y	y	y
15/10/2009	22:15	288	AD	48.9855	-16.1080	26	y	y	y	y
16/10/2009	20:00	289	AE	48.4873	-17.1491	35	y	y	y	y
17/10/2009	20:09	290	AF	45.5208	-19.4248	50	y	y	y	y
18/10/2009	10:18	291	AG	43.6845	-20.8312	59	y	y	y	y
18/10/2009	20:59	291	AH	42.3698	-21.8053	66	y	y	y	y
19/10/2009	10:07	292	AI	40.7953	-22.9202	75	y	y	y	y
19/10/2009	19:46	292	AJ	39.5978	-23.7841	82	y	y	y	y

Date	Time GMT	Calendar day	Uw identifier	Decimal latitude (N, -S)	Decimal longitude (-W)	Sample #	POC?	PIC?	CC?	BiSi?
20/10/2009	00:30	293	AK	38.9053	-24.2668	83	y	y	y	y
20/10/2009	10:20	293	AL	37.7817	-25.0383	92	y	y	y	y
20/10/2009	20:10	293	AM	37.6980	-25.6503	93	y	y	y	y
21/10/2009	20:01	294	AN	36.5458	-27.2275	100	y	y	y	y
22/10/2009	00:00	295	AO	36.0972	-27.8147	101	y	y	y	y
22/10/2009	11:28	295	AP	35.0130	-29.2205	110	y	y	y	y
22/10/2009	20:45	295	AQ	34.1978	-30.3427	117	y	y	y	y
23/10/2009	00:30	296	AR	33.8107	-30.7565	118	y	y	y	y
23/10/2009	11:11	296	AS	33.1123	-31.6458	127	y	y	y	y
23/10/2009	20:33	296	AT	32.3393	-32.6082	134	y	y	y	y
24/10/2009	01:20	297	AU	31.8469	-33.2408	135	y	y	y	y
24/10/2009	11:18	297	AV	31.0357	-34.1913	144	y	y	y	y
24/10/2009	20:31	297	AW	30.5197	-34.9991	151	y	y	y	y
25/10/2009	01:05	298	AX	29.6796	-35.5194	152	y	y	y	y
25/10/2009	11:46	298	AY	28.7255	-36.4507	161	y	y	y	y
26/10/2009	00:55	299	AZ	27.4395	-37.6732	168	y	y	y	y
26/10/2009	20:59	299	BA	26.3614	-38.6923	183	y	y	y	y
27/10/2009	01:10	300	BB	25.8564	-39.1526	184	y	y	y	y
27/10/2009	11:20	300	BC	24.9427	-40.0115	193	y	y	y	y
28/10/2009	01:40	301	BD	23.4875	-40.9031	200	y	y	y	y
28/10/2009	11:30	301	BE	22.9017	-40.4918	209	y	y	y	y
28/10/2009	20:15	301	BF	22.1120	-39.9294	210	y	y	y	y
29/10/2009	01:05	302	BG	21.5580	-39.2523	211	y	y	y	y
30/10/2009	20:39	303	BH	20.3133	-38.6702	224	y	y	y	y
31/10/2009	01:05	304	BI	0.0000	0.0000	225	y	y	y	y
31/10/2009	11:38	304	BJ	18.6949	-37.5507	234	y	y	y	y
31/10/2009	20:15	304	BK	17.8390	-36.9617	241	y	y	y	y
01/11/2009	01:15	305	BL	17.2004	-36.5322	242	y	y	y	y
01/11/2009	11:13	305	BM	16.2598	-35.8828	251	y	y	y	y
01/11/2009	20:22	305	BN	15.2794	-35.2192	258	y	y	y	y
02/11/2009	01:40	306	BO	14.6092	-34.7721	259	y	y	y	y
02/11/2009	11:39	306	BP	13.6312	-34.1060	268	y	y	y	y
02/11/2009	20:07	306	BQ	12.7163	-33.4907	275	y	y	y	y
03/11/2009	11:26	307	BR	10.9058	-32.2724	284	y	y	y	y
03/11/2009	20:14	307	BS	9.9627	-31.6361	291	y	y	y	y
04/11/2009	01:05	308	BT	9.2754	-31.1840	292	y	y	y	y
04/11/2009	07:43	308	BU	9.0235	-31.0098	293	y	y	y	y
04/11/2009	20:14	308	BV	8.1185	-30.4041	300	y	y	y	y
05/11/2009	12:55	309	BW	7.4684	-29.9739	301	y	y	y	y
05/11/2009	11:00	309	BX	6.3292	-29.2147	310	y	y	y	y
05/11/2009	20:18	309	BY	5.2998	-28.5285	317	y	y	y	y
06/11/2009	01:30	310	BZ	4.5558	-28.0250	318	y	y	y	y
06/11/2009	11:13	310	CA	3.5388	-27.3498	327	y	y	y	y
06/11/2009	20:07	310	CB	2.5342	-26.6890	334	y	y	y	y
07/11/2009	10:30	311	CC	0.0000	-25.5667	343	y	y	y	y
07/11/2009	16:09	311	CD	0.0000	-25.1752	344	y	y	y	y
07/11/2009	22:17	311	CE	0.0000	-25.0029	345	y	y	y	y
09/11/2009	09:55	313	CF	-4.2813	-25.0005	368	y	y	y	y
09/11/2009	19:15	313	CG	-5.6063	-25.0002	375	y	y	y	y

Date	Time GMT	Calendar day	Uw identifier	Decimal latitude (N, -S)	Decimal longitude (-W)	Sample #	POC?	PIC?	CC?	BiSi?
10/11/2009	00:17	314	CH	-6.4833	-25.0013	376	y	y	y	y
10/11/2009	10:26	314	CI	-7.8692	-24.9971	385	y	y	y	y
10/11/2009	19:03	314	CJ	-9.1043	-24.9960	392	y	y	y	y
10/11/2009	23:12	314	CK	-9.7982	-24.9995	393	y	y	y	y
11/11/2009	09:22	315	CL	-11.1357	-25.0000	402	y	y	y	y
11/11/2009	18:22	315	CM	-12.3953	-25.0062	409	y	y	y	y
11/11/2009	22:26	315	CN	-13.0713	-24.9968	410	y	y	y	y
13/11/2009	18:18	317	CO	-14.6798	-25.0251	417	y	y	y	y
13/11/2009	23:13	317	CP	-15.5093	-25.0022	418	y	y	y	y
14/11/2009	09:10	318	CQ	-16.7882	-24.9957	427	y	y	y	y
14/11/2009	18:28	318	CR	-18.0003	-25.0000	434	y	y	y	y
14/11/2009	22:34	318	CS	-18.5335	-24.9982	435	y	y	y	y
15/11/2009	09:38	319	CT	-20.0492	-24.9989	442	y	y	y	y
15/11/2009	18:54	319	CU	-21.2743	-24.9977	449	y	y	y	y
15/11/2009	22:19	319	CV	-21.8440	-24.9988	450	y	y	y	y
16/11/2009	10:18	320	CW	-23.3138	-25.0037	459	y	y	y	y
16/11/2009	18:03	320	CX	-24.4437	-24.9953	466	y	y	y	y
17/11/2009	09:28	321	CY	-26.6165	-24.9970	473	y	y	y	y
17/11/2009	18:04	321	CZ	-27.7938	-25.0005	480	y	y	y	y
17/11/2009	22:29	321	DA	-28.2790	-25.4025	481	y	y	y	y
18/11/2009	09:29	322	DB	-29.0498	-26.5333	490	y	y	y	y
18/11/2009	18:27	322	DC	-29.7720	-27.6153	497	y	y	y	y
18/11/2009	22:32	322	DD	-30.2292	-28.2807	498	y	y	y	y
19/11/2009	09:21	323	DE	-31.1650	-29.6753	505	y	y	y	y
19/11/2009	18:55	323	DF	-31.8756	-30.7410	507	y	y	y	y
19/11/2009	22:23	323	DG	-32.2165	-31.2703	508	y	y	y	y
20/11/2009	06:35	324	DH	-32.9498	-32.4025	509	y	y	y	y
20/11/2009	14:05	324	DI	-32.8172	-32.7528	510	y	y	y	y
21/11/2009	00:25	325	DJ	-32.9567	-33.6000	511	y	y	y	y
21/11/2009	10:54	325	DK	-33.6470	-34.6100	520	y	y	y	y
21/11/2009	19:10	325	DL	-34.2862	-35.5778	527	y	y	y	y
22/11/2009	00:06	326	DM	-34.8127	-36.3712	528	y	y	y	y
23/11/2009	14:01	327	DN	-35.5938	-37.6540	536	y	y	y	y
23/11/2009	18:56	327	DO	-36.1410	-38.4058	537	y	y	y	y
23/11/2009	23:33	327	DP	-36.6573	-39.2050	538	y	y	y	y
24/11/2009	10:30	328	DQ	-37.5815	-40.6408	547	y	y	y	y
24/11/2009	19:25	328	DR	-38.2510	-41.6855	554	y	y	y	y
24/11/2009	23:07	328	DS	-38.6300	-42.2953	555	y	y	y	y
25/11/2009	10:34	329	DT	-39.6390	-43.9123	562	y	y	y	y
25/11/2009	19:28	329	DU	-40.4028	-45.1460	569	y	y	y	y
25/11/2009	23:53	329	DV	-40.8870	-45.9458	570	y	y	y	y
26/11/2009	06:26	330	DW	-41.5273	-47.0489	571	y	y	y	y
26/11/2009	10:32	330	DX	-41.9253	-47.6690	572	y	y	y	y
26/11/2009	19:32	330	DY	-42.5953	-48.7978	579	y	y	y	y
26/11/2009	23:12	330	DZ	-42.8742	-49.2697	580	y	y	y	y
27/11/2009	08:18	331	EA	-43.7170	-50.7023	581	y	y	y	y
27/11/2009	12:25	331	EB	-44.1600	-51.4748	582	y	y	y	y
27/11/2009	16:30	331	EC	-44.6162	-52.2708	583	y	y	y	y

CTD Sample Log: A list of depths sampled for each measurement from AMT19 CTDs

"y" indicates that a sample was taken. POC: Particulate organic carbon, PIC: particulate inorganic carbon, CC: cell count/coccolith enumeration, BiSi: biogenic silica

Date	Time GMT	Calendar day	Uw identifier	Decimal latitude (N, -S)	Decimal longitude (-W)	Sample #	POC?	PIC?	CC?	BiSi?	Date
14/10/2009	04:30	287	2	49.5670	-8.6335	1	100	y	y	y	y
14/10/2009	04:30	287	2	49.5670	-8.6335	2	50	y	y	y	y
14/10/2009	04:30	287	2	49.5670	-8.6335	3	40	y	y	y	y
14/10/2009	04:30	287	2	49.5670	-8.6335	4	23	y	y	y	y
14/10/2009	04:30	287	2	49.5670	-8.6335	5	17	y	y	y	y
14/10/2009	04:30	287	2	49.5670	-8.6335	6	10	y	y	y	y
14/10/2009	04:30	287	2	49.5670	-8.6335	7	2	y	y	y	y
14/10/2009	04:30	287	2	49.5670	-8.6335	8	0	y	y	y	y
14/10/2009	12:30	287	3	49.4335	-10.5339	10	40		y		y
14/10/2009	12:30	287	3	49.4335	-10.5339	11	27		y		y
14/10/2009	12:30	287	3	49.4335	-10.5339	12	20		y		y
14/10/2009	12:30	287	3	49.4335	-10.5339	13	10		y		y
14/10/2009	12:30	287	3	49.4335	-10.5339	14	5		y		y
14/10/2009	12:30	287	3	49.4335	-10.5339	15	0	y	y	y	y
15/10/2009	05:50	288	5	48.9485	-14.4600	17	80	y	y	y	y
15/10/2009	05:50	288	5	48.9485	-14.4600	18	60	y	y	y	y
15/10/2009	05:50	288	5	48.9485	-14.4600	19	40	y	y	y	y
15/10/2009	05:50	288	5	48.9485	-14.4600	20	23	y	y	y	y
15/10/2009	05:50	288	5	48.9485	-14.4600	21	17	y	y	y	y
15/10/2009	05:50	288	5	48.9485	-14.4600	22	10	y	y	y	y
15/10/2009	05:50	288	5	48.9485	-14.4600	23	5	y	y	y	y
15/10/2009	05:50	288	5	48.9485	-14.4600	24	0	y	y	y	y
16/10/2009	05:38	289	8	49.0037	-16.6649	27	150	y	y	y	y
16/10/2009	05:38	289	8	49.0037	-16.6649	28	80	y	y	y	y
16/10/2009	05:38	289	8	49.0037	-16.6649	29	38	y	y	y	y
16/10/2009	05:38	289	8	49.0037	-16.6649	30	23	y	y	y	y
16/10/2009	05:38	289	8	49.0037	-16.6649	31	17	y	y	y	y
16/10/2009	05:38	289	8	49.0037	-16.6649	32	10	y	y	y	y
16/10/2009	05:38	289	8	49.0037	-16.6649	33	5	y	y	y	y
16/10/2009	05:38	289	8	49.0037	-16.6649	34	0	y	y	y	y
17/10/2009	05:34	290	11	47.2871	-18.0420	36	150	y	y	y	y
17/10/2009	05:34	290	11	47.2871	-18.0420	37	100	y	y	y	y
17/10/2009	05:34	290	11	47.2871	-18.0420	38	45	y	y	y	y
17/10/2009	05:34	290	11	47.2871	-18.0420	39	25	y	y	y	y
17/10/2009	05:34	290	11	47.2871	-18.0420	40	20	y	y	y	y
17/10/2009	05:34	290	11	47.2871	-18.0420	41	10	y	y	y	y
17/10/2009	05:34	290	11	47.2871	-18.0420	42	5	y	y	y	y
17/10/2009	05:34	290	11	47.2871	-18.0420	43	0	y	y	y	y
17/10/2009	13:40	290	12	46.3389	-18.8019	44	150		y		y
17/10/2009	13:40	290	12	46.3389	-18.8019	45	80		y		y
17/10/2009	13:40	290	12	46.3389	-18.8019	46	60		y		y
17/10/2009	13:40	290	12	46.3389	-18.8019	47	40		y		y
17/10/2009	13:40	290	12	46.3389	-18.8019	48	20		y		y
17/10/2009	13:40	290	12	46.3389	-18.8019	49	0	y	y	y	y
18/10/2009	05:40	291	14	44.2435	-20.4029	51	125	y	y	y	y
18/10/2009	05:40	291	14	44.2435	-20.4029	52	80	y	y	y	y
18/10/2009	05:40	291	14	44.2435	-20.4029	53	50	y	y	y	y
18/10/2009	05:40	291	14	44.2435	-20.4029	54	30	y	y	y	y
18/10/2009	05:40	291	14	44.2435	-20.4029	55	25	y	y	y	y
18/10/2009	05:40	291	14	44.2435	-20.4029	56	15	y	y	y	y
18/10/2009	05:40	291	14	44.2435	-20.4029	57	8	y	y	y	y
18/10/2009	05:40	291	14	44.2435	-20.4029	58	0	y	y	y	y
18/10/2009	13:39	291	15	43.2143	-21.1750	60	200		y		y
18/10/2009	13:39	291	15	43.2143	-21.1750	61	125		y		y
18/10/2009	13:39	291	15	43.2143	-21.1750	62	80		y		y

Date	Time GMT	Calendar day	Uw identifier	Decimal latitude (N, -S)	Decimal longitude (-W)	Sample #	POC?	PIC?	CC?	BiSi?	Date
18/10/2009	13:39	291	15	43.2143	-21.1750	63	50		y		y
18/10/2009	13:39	291	15	43.2143	-21.1750	64	20		y		y
18/10/2009	13:39	291	15	43.2143	-21.1750	65	0	y	y	y	y
19/10/2009	05:49	292	17	41.2527	-22.6034	67	125	y	y	y	y
19/10/2009	05:49	292	17	41.2527	-22.6034	68	100	y	y	y	y
19/10/2009	05:49	292	17	41.2527	-22.6034	69	70	y	y	y	y
19/10/2009	05:49	292	17	41.2527	-22.6034	70	40	y	y	y	y
19/10/2009	05:49	292	17	41.2527	-22.6034	71	30	y	y	y	y
19/10/2009	05:49	292	17	41.2527	-22.6034	72	17	y	y	y	y
19/10/2009	05:49	292	17	41.2527	-22.6034	73	9	y	y	y	y
19/10/2009	05:49	292	17	41.2527	-22.6034	74	0	y	y	y	y
19/10/2009	13:32	292	18	40.3233	-23.2721	76	200		y		y
19/10/2009	13:32	292	18	40.3233	-23.2721	77	100		y		y
19/10/2009	13:32	292	18	40.3233	-23.2721	78	60		y		y
19/10/2009	13:32	292	18	40.3233	-23.2721	79	30		y		y
19/10/2009	13:32	292	18	40.3233	-23.2721	80	10		y		y
19/10/2009	13:32	292	18	40.3233	-23.2721	81	0	y	y	y	y
20/10/2009	05:46	293	20	38.3190	-24.6681	84	125	y	y	y	y
20/10/2009	05:46	293	20	38.3190	-24.6681	85	80	y	y	y	y
20/10/2009	05:46	293	20	38.3190	-24.6681	86	57	y	y	y	y
20/10/2009	05:46	293	20	38.3190	-24.6681	87	30	y	y	y	y
20/10/2009	05:46	293	20	38.3190	-24.6681	88	25	y	y	y	y
20/10/2009	05:46	293	20	38.3190	-24.6681	89	13	y	y	y	y
20/10/2009	05:46	293	20	38.3190	-24.6681	90	7	y	y	y	y
20/10/2009	05:46	293	20	38.3190	-24.6681	91	0	y	y	y	y
21/10/2009	12:52	294	21	37.1015	-26.4877	94	200		y		y
21/10/2009	12:52	294	21	37.1015	-26.4877	95	80		y		y
21/10/2009	12:52	294	21	37.1015	-26.4877	96	60		y		y
21/10/2009	12:52	294	21	37.1015	-26.4877	97	30		y		y
21/10/2009	12:52	294	21	37.1015	-26.4877	98	10		y		y
21/10/2009	12:52	294	21	37.1015	-26.4877	99	0	y	y	y	y
22/10/2009	06:26	295	23	35.4496	-28.6458	102	125	y	y	y	y
22/10/2009	06:26	295	23	35.4496	-28.6458	103	75	y	y	y	y
22/10/2009	06:26	295	23	35.4496	-28.6458	104	68	y	y	y	y
22/10/2009	06:26	295	23	35.4496	-28.6458	105	35	y	y	y	y
22/10/2009	06:26	295	23	35.4496	-28.6458	106	40	y	y	y	y
22/10/2009	06:26	295	23	35.4496	-28.6458	107	30	y	y	y	y
22/10/2009	06:26	295	23	35.4496	-28.6458	108	17	y	y	y	y
22/10/2009	06:26	295	23	35.4496	-28.6458	109	0	y	y	y	y
22/10/2009	13:51	295	24	34.7236	-29.5890	111	200		y		y
22/10/2009	13:51	295	24	34.7236	-29.5890	112	100		y		y
22/10/2009	13:51	295	24	34.7236	-29.5890	113	80		y		y
22/10/2009	13:51	295	24	34.7236	-29.5890	114	50		y		y
22/10/2009	13:51	295	24	34.7236	-29.5890	115	20		y		y
22/10/2009	13:51	295	24	34.7236	-29.5890	116	0	y	y	y	y
23/10/2009	06:17	296	26	33.4192	-31.2517	119	200	y	y	y	y
23/10/2009	06:17	296	26	33.4192	-31.2517	120	105	y	y	y	y
23/10/2009	06:17	296	26	33.4192	-31.2517	121	80	y	y	y	y
23/10/2009	06:17	296	26	33.4192	-31.2517	122	60	y	y	y	y
23/10/2009	06:17	296	26	33.4192	-31.2517	123	45	y	y	y	y
23/10/2009	06:17	296	26	33.4192	-31.2517	124	25	y	y	y	y
23/10/2009	06:17	296	26	33.4192	-31.2517	125	15	y	y	y	y
23/10/2009	06:17	296	26	33.4192	-31.2517	126	0	y	y	y	y
23/10/2009	13:52	296	27	32.8707	-31.9458	128	200		y		y
23/10/2009	13:52	296	27	32.8707	-31.9458	129	150		y		y
23/10/2009	13:52	296	27	32.8707	-31.9458	130	115		y		y
23/10/2009	13:52	296	27	32.8707	-31.9458	131	60		y		y
23/10/2009	13:52	296	27	32.8707	-31.9458	132	40		y		y
23/10/2009	13:52	296	27	32.8707	-31.9458	133	0	y	y	y	y
24/10/2009	06:28	297	29	31.4292	-33.7372	136	200	y	y	y	y

Date	Time GMT	Calendar day	Uw identifier	Decimal latitude (N, -S)	Decimal longitude (-W)	Sample #	POC?	PIC?	CC?	BiSi?	Date
24/10/2009	06:28	297	29	31.4292	-33.7372	137	150	y	y	y	y
24/10/2009	06:28	297	29	31.4292	-33.7372	138	115	y	y	y	y
24/10/2009	06:28	297	29	31.4292	-33.7372	139	69	y	y	y	y
24/10/2009	06:28	297	29	31.4292	-33.7372	140	50	y	y	y	y
24/10/2009	06:28	297	29	31.4292	-33.7372	141	28	y	y	y	y
24/10/2009	06:28	297	29	31.4292	-33.7372	142	15	y	y	y	y
24/10/2009	06:28	297	29	31.4292	-33.7372	143	0	y	y	y	y
24/10/2009	13:59	297	30	30.7450	-34.4841	145	200		y		y
24/10/2009	13:59	297	30	30.7450	-34.4841	146	150		y		y
24/10/2009	13:59	297	30	30.7450	-34.4841	147	130		y		y
24/10/2009	13:59	297	30	30.7450	-34.4841	148	80		y		y
24/10/2009	13:59	297	30	30.7450	-34.4841	149	40		y		y
24/10/2009	13:59	297	30	30.7450	-34.4841	150	0	y	y	y	y
25/10/2009	06:34	298	32	29.1807	-35.9836	153	175		y	y	y
25/10/2009	06:34	298	32	29.1807	-35.9836	154	150	y	y	y	y
25/10/2009	06:34	298	32	29.1807	-35.9836	155	115	y	y	y	y
25/10/2009	06:34	298	32	29.1807	-35.9836	156	65	y	y	y	y
25/10/2009	06:34	298	32	29.1807	-35.9836	157	50	y	y	y	y
25/10/2009	06:34	298	32	29.1807	-35.9836	158	30	y	y	y	y
25/10/2009	06:34	298	32	29.1807	-35.9836	159	15		y	y	y
25/10/2009	06:34	298	32	29.1807	-35.9836	160	0	y	y	y	y
25/10/2009	14:01	298	33	28.4788	-36.6794	162	200		y		y
25/10/2009	14:01	298	33	28.4788	-36.6794	163	150		y		y
25/10/2009	14:01	298	33	28.4788	-36.6794	164	130		y		y
25/10/2009	14:01	298	33	28.4788	-36.6794	165	80		y		y
25/10/2009	14:01	298	33	28.4788	-36.6794	166	40		y		y
25/10/2009	14:01	298	33	28.4788	-36.6794	167	0	y	y	y	y
26/10/2009	06:27	299	35	27.2145	-37.8877	169	175		y	y	y
26/10/2009	06:27	299	35	27.2145	-37.8877	170	150	y	y	y	y
26/10/2009	06:27	299	35	27.2145	-37.8877	171	110	y	y	y	y
26/10/2009	06:27	299	35	27.2145	-37.8877	172	65	y	y	y	y
26/10/2009	06:27	299	35	27.2145	-37.8877	173	45	y	y	y	y
26/10/2009	06:27	299	35	27.2145	-37.8877	174	25	y	y	y	y
26/10/2009	06:27	299	35	27.2145	-37.8877	175	15		y	y	y
26/10/2009	06:27	299	35	27.2145	-37.8877	176	0	y	y	y	y
26/10/2009	13:48	299	36	27.0229	-38.0533	177	200		y		y
26/10/2009	13:48	299	36	27.0229	-38.0533	178	150		y		y
26/10/2009	13:48	299	36	27.0229	-38.0533	179	115		y		y
26/10/2009	13:48	299	36	27.0229	-38.0533	180	60		y		y
26/10/2009	13:48	299	36	27.0229	-38.0533	181	20		y		y
26/10/2009	13:48	299	36	27.0229	-38.0533	182	0	y	y	y	y
27/10/2009	06:30	300	38	25.3911	-39.6050	185	200		y	y	y
27/10/2009	06:30	300	38	25.3911	-39.6050	186	150	y	y	y	y
27/10/2009	06:30	300	38	25.3911	-39.6050	187	115	y	y	y	y
27/10/2009	06:30	300	38	25.3911	-39.6050	188	65	y	y	y	y
27/10/2009	06:30	300	38	25.3911	-39.6050	189	50	y	y	y	y
27/10/2009	06:30	300	38	25.3911	-39.6050	190	30	y	y	y	y
27/10/2009	06:30	300	38	25.3911	-39.6050	191	15		y	y	y
27/10/2009	06:30	300	38	25.3911	-39.6050	192	0	y	y	y	y
27/10/2009	14:03	300	39	24.6519	-40.2833	194	200		y		y
27/10/2009	14:03	300	39	24.6519	-40.2833	195	150		y		y
27/10/2009	14:03	300	39	24.6519	-40.2833	196	130		y		y
27/10/2009	14:03	300	39	24.6519	-40.2833	197	180		y		y
27/10/2009	14:03	300	39	24.6519	-40.2833	198	40		y		y
27/10/2009	14:03	300	39	24.6519	-40.2833	199	0	y	y	y	y
28/10/2009	07:32	301	41	23.2253	-40.7194	201	200		y	y	y
28/10/2009	07:32	301	41	23.2253	-40.7194	202	150	y	y	y	y
28/10/2009	07:32	301	41	23.2253	-40.7194	203	110	y	y	y	y
28/10/2009	07:32	301	41	23.2253	-40.7194	204	85	y	y	y	y
28/10/2009	07:32	301	41	23.2253	-40.7194	205	45	y	y	y	y

Date	Time GMT	Calendar day	Uw identifier	Decimal latitude (N, -S)	Decimal longitude (-W)	Sample #	POC?	PIC?	CC?	BiSi?	Date
28/10/2009	07:32	301	41	23.2253	-40.7194	206	25	y	y	y	y
28/10/2009	07:32	301	41	23.2253	-40.7194	207	15		y	y	y
28/10/2009	07:32	301	41	23.2253	-40.7194	208	0	y	y	y	y
29/10/2009	07:28	302	43	21.1320	-39.2486	212	110	y	y	y	y
29/10/2009	07:28	302	43	21.1320	-39.2486	213	65	y	y	y	y
29/10/2009	07:28	302	43	21.1320	-39.2486	214	45	y	y	y	y
29/10/2009	07:28	302	43	21.1320	-39.2486	215	25	y	y	y	y
29/10/2009	07:28	302	43	21.1320	-39.2486	216	15		y	y	y
29/10/2009	07:28	302	43	21.1320	-39.2486	217	0	y	y	y	y
30/10/2009	14:02	303	48	20.9363	-39.1673	218	200		y		y
30/10/2009	14:02	303	48	20.9363	-39.1673	219	150		y		y
30/10/2009	14:02	303	48	20.9363	-39.1673	220	100		y		y
30/10/2009	14:02	303	48	20.9363	-39.1673	221	40		y		y
30/10/2009	14:02	303	48	20.9363	-39.1673	222	20		y		y
30/10/2009	14:02	303	48	20.9363	-39.1673	223	0	y	y	y	y
31/10/2009	06:57	304	50	19.1440	-37.8639	226	200		y	y	y
31/10/2009	06:57	304	50	19.1440	-37.8639	227	150	y	y	y	y
31/10/2009	06:57	304	50	19.1440	-37.8639	228	80	y	y	y	y
31/10/2009	06:57	304	50	19.1440	-37.8639	229	45	y	y	y	y
31/10/2009	06:57	304	50	19.1440	-37.8639	230	35	y	y	y	y
31/10/2009	06:57	304	50	19.1440	-37.8639	231	20	y	y	y	y
31/10/2009	06:57	304	50	19.1440	-37.8639	232	10		y	y	y
31/10/2009	06:57	304	50	19.1440	-37.8639	233	0	y	y	y	y
31/10/2009	13:59	304	51	18.4184	-37.3592	235	200		y		y
31/10/2009	13:59	304	51	18.4184	-37.3592	236	150		y		y
31/10/2009	13:59	304	51	18.4184	-37.3592	237	100		y		y
31/10/2009	13:59	304	51	18.4184	-37.3592	238	78		y		y
31/10/2009	13:59	304	51	18.4184	-37.3592	239	40		y		y
31/10/2009	13:59	304	51	18.4184	-37.3592	240	0	y	y	y	y
01/11/2009	07:37	305	53	16.5710	-36.0979	243	200		y	y	y
01/11/2009	07:37	305	53	16.5710	-36.0979	244	150	y	y	y	y
01/11/2009	07:37	305	53	16.5710	-36.0979	245	100	y	y	y	y
01/11/2009	07:37	305	53	16.5710	-36.0979	246	60	y	y	y	y
01/11/2009	07:37	305	53	16.5710	-36.0979	247	45	y	y	y	y
01/11/2009	07:37	305	53	16.5710	-36.0979	248	25	y	y	y	y
01/11/2009	07:37	305	53	16.5710	-36.0979	249	15		y	y	y
01/11/2009	07:37	305	53	16.5710	-36.0979	250	0	y	y	y	y
01/11/2009	14:00	305	54	15.9258	-35.6610	252	200		y		y
01/11/2009	14:00	305	54	15.9258	-35.6610	253	100		y		y
01/11/2009	14:00	305	54	15.9258	-35.6610	254	80		y		y
01/11/2009	14:00	305	54	15.9258	-35.6610	255	40		y		y
01/11/2009	14:00	305	54	15.9258	-35.6610	256	20		y		y
01/11/2009	14:00	305	54	15.9258	-35.6610	257	0	y	y	y	y
02/11/2009	06:21	306	56	14.1565	-34.4574	260	200		y	y	y
02/11/2009	06:21	306	56	14.1565	-34.4574	261	100	y	y	y	y
02/11/2009	06:21	306	56	14.1565	-34.4574	262	70	y	y	y	y
02/11/2009	06:21	306	56	14.1565	-34.4574	263	40	y	y	y	y
02/11/2009	06:21	306	56	14.1565	-34.4574	264	30	y	y	y	y
02/11/2009	06:21	306	56	14.1565	-34.4574	265	17	y	y	y	y
02/11/2009	06:21	306	56	14.1565	-34.4574	266	10		y	y	y
02/11/2009	06:21	306	56	14.1565	-34.4574	267	0	y	y	y	y
02/11/2009	14:01	306	57	13.3481	-33.9151	269	200		y		y
02/11/2009	14:01	306	57	13.3481	-33.9151	270	150		y		y
02/11/2009	14:01	306	57	13.3481	-33.9151	271	100		y		y
02/11/2009	14:01	306	57	13.3481	-33.9151	272	64		y		y
02/11/2009	14:01	306	57	13.3481	-33.9151	273	20		y		y
02/11/2009	14:01	306	57	13.3481	-33.9151	274	0	y	y	y	y
03/11/2009	06:25	307	59	11.4679	-32.6470	276	200		y	y	y
03/11/2009	06:25	307	59	11.4679	-32.6470	277	100	y	y	y	y
03/11/2009	06:25	307	59	11.4679	-32.6470	278	42	y	y	y	y

Date	Time GMT	Calendar day	Uw identifier	Decimal latitude (N, -S)	Decimal longitude (-W)	Sample #	POC?	PIC?	CC?	BiSi?	Date
03/11/2009	06:25	307	59	11.4679	-32.6470	279	25	y	y	y	y
03/11/2009	06:25	307	59	11.4679	-32.6470	280	17	y	y	y	y
03/11/2009	06:25	307	59	11.4679	-32.6470	281	10	y	y	y	y
03/11/2009	06:25	307	59	11.4679	-32.6470	282	5		y	y	y
03/11/2009	06:25	307	59	11.4679	-32.6470	283	0	y	y	y	y
03/11/2009	14:01	307	60	10.5625	-32.0405	285	200		y		y
03/11/2009	14:01	307	60	10.5625	-32.0405	286	100		y		y
03/11/2009	14:01	307	60	10.5625	-32.0405	287	60		y		y
03/11/2009	14:01	307	60	10.5625	-32.0405	288	40		y		y
03/11/2009	14:01	307	60	10.5625	-32.0405	289	20		y		y
03/11/2009	14:01	307	60	10.5625	-32.0405	290	0	y	y	y	y
04/11/2009	14:02	308	61	8.8046	-30.8669	294	200		y		y
04/11/2009	14:02	308	61	8.8046	-30.8669	295	100		y		y
04/11/2009	14:02	308	61	8.8046	-30.8669	296	60		y		y
04/11/2009	14:02	308	61	8.8046	-30.8669	297	40		y		y
04/11/2009	14:02	308	61	8.8046	-30.8669	298	20		y		y
04/11/2009	14:02	308	61	8.8046	-30.8669	299	0	y	y	y	y
05/11/2009	06:28	309	63	6.8385	-29.5442	302	150		y	y	y
05/11/2009	06:28	309	63	6.8385	-29.5442	303	100	y	y	y	y
05/11/2009	06:28	309	63	6.8385	-29.5442	304	55	y	y	y	y
05/11/2009	06:28	309	63	6.8385	-29.5442	305	30	y	y	y	y
05/11/2009	06:28	309	63	6.8385	-29.5442	306	25	y	y	y	y
05/11/2009	06:28	309	63	6.8385	-29.5442	307	15	y	y	y	y
05/11/2009	06:28	309	63	6.8385	-29.5442	308	7		y	y	y
05/11/2009	06:28	309	63	6.8385	-29.5442	309	0	y	y	y	y
05/11/2009	14:02	309	64	5.9487	-28.9577	311	200		y		y
05/11/2009	14:02	309	64	5.9487	-28.9577	312	100		y		y
05/11/2009	14:02	309	64	5.9487	-28.9577	313	80		y		y
05/11/2009	14:02	309	64	5.9487	-28.9577	314	40		y		y
05/11/2009	14:02	309	64	5.9487	-28.9577	315	10		y		y
05/11/2009	14:02	309	64	5.9487	-28.9577	316	0	y	y	y	y
06/11/2009	06:29	310	66	4.0540	-27.6941	319	150		y	y	y
06/11/2009	06:29	310	66	4.0540	-27.6941	320	110	y	y	y	y
06/11/2009	06:29	310	66	4.0540	-27.6941	321	95	y	y	y	y
06/11/2009	06:29	310	66	4.0540	-27.6941	322	55	y	y	y	y
06/11/2009	06:29	310	66	4.0540	-27.6941	323	40	y	y	y	y
06/11/2009	06:29	310	66	4.0540	-27.6941	324	25	y	y	y	y
06/11/2009	06:29	310	66	4.0540	-27.6941	325	15		y	y	y
06/11/2009	06:29	310	66	4.0540	-27.6941	326	0	y	y	y	y
06/11/2009	14:01	310	67	3.1589	-27.0979	328	200		y		y
06/11/2009	14:01	310	67	3.1589	-27.0979	329	100		y		y
06/11/2009	14:01	310	67	3.1589	-27.0979	330	85		y		y
06/11/2009	14:01	310	67	3.1589	-27.0979	331	40		y		y
06/11/2009	14:01	310	67	3.1589	-27.0979	332	20		y		y
06/11/2009	14:01	310	67	3.1589	-27.0979	333	0	y	y	y	y
07/11/2009	06:25	311	69	1.2696	-25.8511	335	200		y	y	y
07/11/2009	06:25	311	69	1.2696	-25.8511	336	100	y	y	y	y
07/11/2009	06:25	311	69	1.2696	-25.8511	337	70	y	y	y	y
07/11/2009	06:25	311	69	1.2696	-25.8511	338	40	y	y	y	y
07/11/2009	06:25	311	69	1.2696	-25.8511	339	30	y	y	y	y
07/11/2009	06:25	311	69	1.2696	-25.8511	340	15	y	y	y	y
07/11/2009	06:25	311	69	1.2696	-25.8511	341	10		y	y	y
07/11/2009	06:25	311	69	1.2696	-25.8511	342	0	y	y	y	y
08/11/2009	08:07	312	71	-2.0478	-24.9898	346	200		y	y	y
08/11/2009	08:07	312	71	-2.0478	-24.9898	347	125	y	y	y	y
08/11/2009	08:07	312	71	-2.0478	-24.9898	348	80	y	y	y	y
08/11/2009	08:07	312	71	-2.0478	-24.9898	349	45	y	y	y	y
08/11/2009	08:07	312	71	-2.0478	-24.9898	350	35	y	y	y	y
08/11/2009	08:07	312	71	-2.0478	-24.9898	351	20	y	y	y	y
08/11/2009	08:07	312	71	-2.0478	-24.9898	352	10		y	y	y

Date	Time GMT	Calendar day	Uw identifier	Decimal latitude (N, -S)	Decimal longitude (-W)	Sample #	POC?	PIC?	CC?	BiSi?	Date
08/11/2009	08:07	312	71	-2.0478	-24.9898	353	0	y	y	y	y
08/11/2009	14:01	312	72	-2.8472	-25.0013	354	200		y		y
08/11/2009	14:01	312	72	-2.8472	-25.0013	355	125		y		y
08/11/2009	14:01	312	72	-2.8472	-25.0013	356	71		y		y
08/11/2009	14:01	312	72	-2.8472	-25.0013	357	40		y		y
08/11/2009	14:01	312	72	-2.8472	-25.0013	358	20		y		y
08/11/2009	14:01	312	72	-2.8472	-25.0013	359	0	y	y	y	y
09/11/2009	06:23	313	74	-3.8391	-24.9995	360	200		y	y	y
09/11/2009	06:23	313	74	-3.8391	-24.9995	361	150	y	y	y	y
09/11/2009	06:23	313	74	-3.8391	-24.9995	362	95	y	y	y	y
09/11/2009	06:23	313	74	-3.8391	-24.9995	363	55	y	y	y	y
09/11/2009	06:23	313	74	-3.8391	-24.9995	364	40	y	y	y	y
09/11/2009	06:23	313	74	-3.8391	-24.9995	365	25	y	y	y	y
09/11/2009	06:23	313	74	-3.8391	-24.9995	366	15		y	y	y
09/11/2009	06:23	313	74	-3.8391	-24.9995	367	0	y	y	y	y
09/11/2009	13:33	313	75	-4.8592	-25.0004	369	200		y		y
09/11/2009	13:33	313	75	-4.8592	-25.0004	370	125		y		y
09/11/2009	13:33	313	75	-4.8592	-25.0004	371	85		y		y
09/11/2009	13:33	313	75	-4.8592	-25.0004	372	40		y		y
09/11/2009	13:33	313	75	-4.8592	-25.0004	373	20		y		y
09/11/2009	13:33	313	75	-4.8592	-25.0004	374	0	y	y	y	y
10/11/2009	06:32	314	77	-7.3626	-24.9892	377	200		y	y	y
10/11/2009	06:32	314	77	-7.3626	-24.9892	378	125	y	y	y	y
10/11/2009	06:32	314	77	-7.3626	-24.9892	379	100	y	y	y	y
10/11/2009	06:32	314	77	-7.3626	-24.9892	380	60	y	y	y	y
10/11/2009	06:32	314	77	-7.3626	-24.9892	381	45	y	y	y	y
10/11/2009	06:32	314	77	-7.3626	-24.9892	382	25	y	y	y	y
10/11/2009	06:32	314	77	-7.3626	-24.9892	383	15		y	y	y
10/11/2009	06:32	314	77	-7.3626	-24.9892	384	0	y	y	y	y
10/11/2009	13:31	314	78	-8.3800	-24.9960	386	200		y		y
10/11/2009	13:31	314	78	-8.3800	-24.9960	387	150		y		y
10/11/2009	13:31	314	78	-8.3800	-24.9960	388	100		y		y
10/11/2009	13:31	314	78	-8.3800	-24.9960	389	60		y		y
10/11/2009	13:31	314	78	-8.3800	-24.9960	390	20		y		y
10/11/2009	13:31	314	78	-8.3800	-24.9960	391	0	y	y	y	y
11/11/2009	05:25	315	80	-10.6484	-24.9966	394	200		y	y	y
11/11/2009	05:25	315	80	-10.6484	-24.9966	395	150	y	y	y	y
11/11/2009	05:25	315	80	-10.6484	-24.9966	396	125	y	y	y	y
11/11/2009	05:25	315	80	-10.6484	-24.9966	397	75	y	y	y	y
11/11/2009	05:25	315	80	-10.6484	-24.9966	398	55	y	y	y	y
11/11/2009	05:25	315	80	-10.6484	-24.9966	399	30	y	y	y	y
11/11/2009	05:25	315	80	-10.6484	-24.9966	400	15		y	y	y
11/11/2009	05:25	315	80	-10.6484	-24.9966	401	0	y	y	y	y
11/11/2009	13:01	315	81	-11.7243	-24.9999	403	200		y		y
11/11/2009	13:01	315	81	-11.7243	-24.9999	404	150		y		y
11/11/2009	13:01	315	81	-11.7243	-24.9999	405	125		y		y
11/11/2009	13:01	315	81	-11.7243	-24.9999	406	60		y		y
11/11/2009	13:01	315	81	-11.7243	-24.9999	407	20		y		y
11/11/2009	13:01	315	81	-11.7243	-24.9999	408	0	y	y	y	y
12/11/2009	06:25	316	83	-13.8143	-24.9857	411	175	y	y	y	y
12/11/2009	06:25	316	83	-13.8143	-24.9857	412	140	y	y	y	y
12/11/2009	06:25	316	83	-13.8143	-24.9857	413	75	y	y	y	y
12/11/2009	06:25	316	83	-13.8143	-24.9857	414	55	y	y	y	y
12/11/2009	06:25	316	83	-13.8143	-24.9857	415	30	y	y	y	y
12/11/2009	06:25	316	83	-13.8143	-24.9857	416	0	y	y	y	y
14/11/2009	05:36	318	90	-16.3646	-24.9965	419	200		y	y	y
14/11/2009	05:36	318	90	-16.3646	-24.9965	420	175	y	y	y	y
14/11/2009	05:36	318	90	-16.3646	-24.9965	421	150	y	y	y	y
14/11/2009	05:36	318	90	-16.3646	-24.9965	422	90	y	y	y	y
14/11/2009	05:36	318	90	-16.3646	-24.9965	423	75	y	y	y	y

Date	Time GMT	Calendar day	Uw identifier	Decimal latitude (N, -S)	Decimal longitude (-W)	Sample #	POC?	PIC?	CC?	BiSi?	Date
14/11/2009	05:36	318	90	-16.3646	-24.9965	424	35	y	y	y	y
14/11/2009	05:36	318	90	-16.3646	-24.9965	425	20		y	y	y
14/11/2009	05:36	318	90	-16.3646	-24.9965	426	0	y	y	y	y
14/11/2009	13:03	318	91	-17.3469	-24.9993	428	200		y		y
14/11/2009	13:03	318	91	-17.3469	-24.9993	429	158		y		y
14/11/2009	13:03	318	91	-17.3469	-24.9993	430	100		y		y
14/11/2009	13:03	318	91	-17.3469	-24.9993	431	60		y		y
14/11/2009	13:03	318	91	-17.3469	-24.9993	432	20		y		y
14/11/2009	13:03	318	91	-17.3469	-24.9993	433	0	y	y	y	y
15/11/2009	05:27	319	93	-19.4976	-24.9986	436	200	y	y	y	y
15/11/2009	05:27	319	93	-19.4976	-24.9986	437	175	y	y	y	y
15/11/2009	05:27	319	93	-19.4976	-24.9986	438	90	y	y	y	y
15/11/2009	05:27	319	93	-19.4976	-24.9986	439	70	y	y	y	y
15/11/2009	05:27	319	93	-19.4976	-24.9986	440	40	y	y	y	y
15/11/2009	05:27	319	93	-19.4976	-24.9986	441	0	y	y	y	y
15/11/2009	13:03	319	94	-20.5902	-25.0003	443	200		y		y
15/11/2009	13:03	319	94	-20.5902	-25.0003	444	165		y		y
15/11/2009	13:03	319	94	-20.5902	-25.0003	445	110		y		y
15/11/2009	13:03	319	94	-20.5902	-25.0003	446	80		y		y
15/11/2009	13:03	319	94	-20.5902	-25.0003	447	20		y		y
15/11/2009	13:03	319	94	-20.5902	-25.0003	448	0	y	y	y	y
16/11/2009	05:26	320	96	-22.8539	-24.9961	451	200		y	y	y
16/11/2009	05:26	320	96	-22.8539	-24.9961	452	175	y	y	y	y
16/11/2009	05:26	320	96	-22.8539	-24.9961	453	140	y	y	y	y
16/11/2009	05:26	320	96	-22.8539	-24.9961	454	80	y	y	y	y
16/11/2009	05:26	320	96	-22.8539	-24.9961	455	60	y	y	y	y
16/11/2009	05:26	320	96	-22.8539	-24.9961	456	35	y	y	y	y
16/11/2009	05:26	320	96	-22.8539	-24.9961	457	20		y	y	y
16/11/2009	05:26	320	96	-22.8539	-24.9961	458	0	y	y	y	y
16/11/2009	13:02	320	97	-23.7629	-25.0023	460	200		y		y
16/11/2009	13:02	320	97	-23.7629	-25.0023	461	150		y		y
16/11/2009	13:02	320	97	-23.7629	-25.0023	462	100		y		y
16/11/2009	13:02	320	97	-23.7629	-25.0023	463	60		y		y
16/11/2009	13:02	320	97	-23.7629	-25.0023	464	20		y		y
16/11/2009	13:02	320	97	-23.7629	-25.0023	465	0	y	y	y	y
17/11/2009	05:34	321	99	-26.1113	-25.0049	467	175	y	y	y	y
17/11/2009	05:34	321	99	-26.1113	-25.0049	468	140	y	y	y	y
17/11/2009	05:34	321	99	-26.1113	-25.0049	469	85	y	y	y	y
17/11/2009	05:34	321	99	-26.1113	-25.0049	470	60	y	y	y	y
17/11/2009	05:34	321	99	-26.1113	-25.0049	471	35	y	y	y	y
17/11/2009	05:34	321	99	-26.1113	-25.0049	472	0	y	y	y	y
17/11/2009	13:01	321	100	-27.1686	-25.0013	474	200		y		y
17/11/2009	13:01	321	100	-27.1686	-25.0013	475	130		y		y
17/11/2009	13:01	321	100	-27.1686	-25.0013	476	100		y		y
17/11/2009	13:01	321	100	-27.1686	-25.0013	477	60		y		y
17/11/2009	13:01	321	100	-27.1686	-25.0013	478	20		y		y
17/11/2009	13:01	321	100	-27.1686	-25.0013	479	0	y	y	y	y
18/11/2009	05:35	322	102	-28.7901	-26.1361	482	200		y	y	y
18/11/2009	05:35	322	102	-28.7901	-26.1361	483	175	y	y	y	y
18/11/2009	05:35	322	102	-28.7901	-26.1361	484	135	y	y	y	y
18/11/2009	05:35	322	102	-28.7901	-26.1361	485	80	y	y	y	y
18/11/2009	05:35	322	102	-28.7901	-26.1361	486	60	y	y	y	y
18/11/2009	05:35	322	102	-28.7901	-26.1361	487	30	y	y	y	y
18/11/2009	05:35	322	102	-28.7901	-26.1361	488	20		y	y	y
18/11/2009	05:35	322	102	-28.7901	-26.1361	489	0	y	y	y	y
18/11/2009	13:03	322	103	-29.3905	-27.0355	491	200		y		y
18/11/2009	13:03	322	103	-29.3905	-27.0355	492	130		y		y
18/11/2009	13:03	322	103	-29.3905	-27.0355	493	90		y		y
18/11/2009	13:03	322	103	-29.3905	-27.0355	494	60		y		y
18/11/2009	13:03	322	103	-29.3905	-27.0355	495	20		y		y

Date	Time GMT	Calendar day	Uw identifier	Decimal latitude (N, -S)	Decimal longitude (-W)	Sample #	POC?	PIC?	CC?	BiSi?	Date
18/11/2009	13:03	322	103	-29.3905	-27.0355	496	0	y	y	y	y
19/11/2009	05:22	323	105	-30.8338	-29.1837	499	175	y	y	y	y
19/11/2009	05:22	323	105	-30.8338	-29.1837	500	130	y	y	y	y
19/11/2009	05:22	323	105	-30.8338	-29.1837	501	75	y	y	y	y
19/11/2009	05:22	323	105	-30.8338	-29.1837	502	55	y	y	y	y
19/11/2009	05:22	323	105	-30.8338	-29.1837	503	30	y	y	y	y
19/11/2009	05:22	323	105	-30.8338	-29.1837	504	0	y	y	y	y
19/11/2009	13:02	323	106	-31.5468	-30.2545	506	0	y	y	y	y
21/11/2009	06:46	325	108	-33.4146	-34.2499	512	200		y	y	y
21/11/2009	06:46	325	108	-33.4146	-34.2499	513	125	y	y	y	y
21/11/2009	06:46	325	108	-33.4146	-34.2499	514	88	y	y	y	y
21/11/2009	06:46	325	108	-33.4146	-34.2499	515	45	y	y	y	y
21/11/2009	06:46	325	108	-33.4146	-34.2499	516	35	y	y	y	y
21/11/2009	06:46	325	108	-33.4146	-34.2499	517	20	y	y	y	y
21/11/2009	06:46	325	108	-33.4146	-34.2499	518	10		y	y	y
21/11/2009	06:46	325	108	-33.4146	-34.2499	519	0	y	y	y	y
21/11/2009	14:03	325	109	-33.8838	-34.9747	521	200		y		y
21/11/2009	14:03	325	109	-33.8838	-34.9747	522	125		y		y
21/11/2009	14:03	325	109	-33.8838	-34.9747	523	82		y		y
21/11/2009	14:03	325	109	-33.8838	-34.9747	524	60		y		y
21/11/2009	14:03	325	109	-33.8838	-34.9747	525	20		y		y
21/11/2009	14:03	325	109	-33.8838	-34.9747	526	0	y	y	y	y
22/11/2009	06:26	326	111	-35.2950	-37.1119	529	200		y	y	y
22/11/2009	06:26	326	111	-35.2950	-37.1119	530	100	y	y	y	y
22/11/2009	06:26	326	111	-35.2950	-37.1119	531	40	y	y	y	y
22/11/2009	06:26	326	111	-35.2950	-37.1119	532	30	y	y	y	y
22/11/2009	06:26	326	111	-35.2950	-37.1119	533	20	y	y	y	y
22/11/2009	06:26	326	111	-35.2950	-37.1119	534	10	y	y	y	y
22/11/2009	06:26	326	111	-35.2950	-37.1119	535	0	y	y	y	y
24/11/2009	06:25	328	115	-37.2976	-40.1895	539	200		y	y	y
24/11/2009	06:25	328	115	-37.2976	-40.1895	540	100	y	y	y	y
24/11/2009	06:25	328	115	-37.2976	-40.1895	541	60	y	y	y	y
24/11/2009	06:25	328	115	-37.2976	-40.1895	542	38	y	y	y	y
24/11/2009	06:25	328	115	-37.2976	-40.1895	543	25	y	y	y	y
24/11/2009	06:25	328	115	-37.2976	-40.1895	544	15	y	y	y	y
24/11/2009	06:25	328	115	-37.2976	-40.1895	545	10		y	y	y
24/11/2009	06:25	328	115	-37.2976	-40.1895	546	0	y	y	y	y
24/11/2009	14:01	328	116	-37.8661	-41.0911	548	200		y		y
24/11/2009	14:01	328	116	-37.8661	-41.0911	549	125		y		y
24/11/2009	14:01	328	116	-37.8661	-41.0911	550	80		y		y
24/11/2009	14:01	328	116	-37.8661	-41.0911	551	40		y		y
24/11/2009	14:01	328	116	-37.8661	-41.0911	552	20		y		y
24/11/2009	14:01	328	116	-37.8661	-41.0911	553	0	y	y	y	y
25/11/2009	06:26	329	118	-39.3150	-43.3923	556	100	y	y	y	y
25/11/2009	06:26	329	118	-39.3150	-43.3923	557	75	y	y	y	y
25/11/2009	06:26	329	118	-39.3150	-43.3923	558	30	y	y	y	y
25/11/2009	06:26	329	118	-39.3150	-43.3923	559	15	y	y	y	y
25/11/2009	06:26	329	118	-39.3150	-43.3923	560	10	y	y	y	y
25/11/2009	06:26	329	118	-39.3150	-43.3923	561	0	y	y	y	y
25/11/2009	14:03	329	119	-39.9674	-44.4451	563	200		y		y
25/11/2009	14:03	329	119	-39.9674	-44.4451	564	100		y		y
25/11/2009	14:03	329	119	-39.9674	-44.4451	565	60		y		y
25/11/2009	14:03	329	119	-39.9674	-44.4451	566	40		y		y
25/11/2009	14:03	329	119	-39.9674	-44.4451	567	15		y		y
25/11/2009	14:03	329	119	-39.9674	-44.4451	568	0	y	y	y	y
26/11/2009	14:02	330	120	-42.2494	-48.2252	573	200		y		y
26/11/2009	14:02	330	120	-42.2494	-48.2252	574	100		y		y
26/11/2009	14:02	330	120	-42.2494	-48.2252	575	38		y		y
26/11/2009	14:02	330	120	-42.2494	-48.2252	576	20		y		y
26/11/2009	14:02	330	120	-42.2494	-48.2252	577	7		y		y

Date	Time GMT	Calendar day	Uw identifier	Decimal latitude (N, -S)	Decimal longitude (-W)	Sample #	POC?	PIC?	CC?	BiSi?	Date
26/11/2009	14:02	330	120	-42.2494	-48.2252	578	0	y	y	y	y

Optics

GEORGE DALL'OLMO
Oregon State University

Rationale

The particulate beam-attenuation coefficient (cp) is an optical property that is sensitive to particles in the phytoplankton size range and can thus be used to derive information about phytoplankton carbon biomass. Unfortunately cp cannot be retrieved from space. Only the particulate back-scattering coefficient (bbp) can be estimated by satellite sensors, but theory suggests that bbp is sensitive to particles considerably smaller than those influencing cp. Nevertheless, we have shown a consistent correlation between in-situ surface measurements of cp and bbp in the Equatorial Pacific and during the North Atlantic bloom. Other researchers have documented a similar relationship in the South Pacific Gyre. The main objective of the proposed research activity is to assess the extent to which the relationship between particulate backscattering and beam-attenuation coefficients in the Atlantic Ocean varies with respect to other oceanic regions. The quantification of the relationship between bbp and cp is important because it will allow us to derive estimates of phytoplankton carbon biomass from space and thus to improve our current estimates of global net-primary productivity.

Another important objective of our study will be the evaluation of the relationship between the chlorophyll-to-particulate-backscattering ratio (Chl:bbp) and phytoplankton size. Chl:bbp has been proposed as a way to remove the biomass dependence from satellite-derived Chl and to reveal global fields of phytoplankton physiology. However, the intracellular concentration of chlorophyll varies in phytoplankton as a function of cell size. Thus, to be able to extract information of phytoplankton physiology from Chl:bbp, it is first necessary to account for its size-dependence. We plan on studying the relationship between Chl:bbp and phytoplankton size as measured by flow-cytometric analysis.

Measurements and methodology

Flow-through measurements:

Variable	Instrument	Comments	Reference
Particulate backscattering coefficient	WetLabs ECO-BB3 (470, 526, 595, 660 nm)	One instrument operated in flow-through mode, the other mounted on optics cage (see Gallienne's report).	Dall'Olmo et al., 2009
Particulate beam-attenuation and absorption coefficients	WetLabs AC9	Operated after failure of ACs.	Dall'Olmo et al., 2009
Particulate beam-attenuation and absorption coefficients	WetLabs ACs	C-tube failed after 10 days.	Dall'Olmo et al., 2009
Particulate beam attenuation coefficient	WetLabs C-star (532, 650 nm)	-	Dall'Olmo et al., 2009
Volume scattering function	Sequoia Scientific LISST-100X	The instrument appears to have insufficient sensitivity for open ocean waters.	-
Fast repetition rate fluorometer	Custom made instrument	-	Behrenfeld et al., 2006

Discrete measurements:

Variable	Volume filtered	Filter type	Reference
Phytoplankton pigments (HPLC)	2-4 L	Whatman GF/F	Van Heukelem et al., 2001
POC, PON	2,1,0.5 L plus blank	Combusted Whatman GF/F	Behrenfeld and Boss, 2006

In addition, discrete samples were measured in a BD FACScan flow cytometer equipped with a 100mW 473 nm and a 300mW 671 nm lasers. Data on forward scatter and red fluorescence excided by the 671 nm laser will be converted into size and cellular chlorophyll-a estimates by means of laboratory calibrations on cultured cells.

The table below reports date, time (GMT), latitude and longitude (decimal degrees) of the stations at which samples for flow cytometry, HPLC and CHN analyses were collected. In the HPLC column, "yes(D)" indicates that duplicate samples were collected.

Sample ID	Date	Time	Lon	Lat	Flow cytometry	HPLC	CHN
F1	10/17/09	14:22	-18.80	46.34		yes	yes
F2	10/17/09	21:35	-19.60	45.31		yes	yes
F3	10/18/09	19:16	-21.60	42.63		yes(D)	yes
F4	10/19/09	8:46	-22.78	40.99		yes	yes
F5	10/19/09	20:11	-23.82	39.54		yes	yes
F6	10/21/09	20:19	-27.27	36.52		yes(D)	yes
F7	10/22/09	7:19	-28.65	35.45			
F8	10/22/09	14:40	-29.59	34.72	yes	yes	
F9	10/22/09	19:45	-30.18	34.28	yes	yes	yes
F10	10/23/09	8:15	-31.30	33.38	yes	yes	yes
F11	10/23/09	20:28	-32.60	32.35	yes	yes	yes
F12	10/24/09	7:10	-33.74	31.43	yes	yes	yes
F13	10/24/09	11:07	-34.17	31.06	yes	yes	yes
F14	10/24/09	15:16	-34.48	30.75	yes		
F15	10/24/09	19:55	-34.93	30.29	yes	yes	yes
F16	10/25/09	6:52	-35.98	29.18	yes		
F17	10/25/09	11:21	-36.40	28.77		yes(D)	yes
F18	10/25/09	15:30	-36.68	28.48	yes		
F19	10/25/09	20:36	-37.20	27.94		yes	yes
F20	10/26/09	7:21	-37.89	27.21	yes		
F21	10/26/09	14:28	-38.05	27.02	yes	yes	yes
F22	10/26/09	20:40	-38.66	26.40	yes	yes	yes
F23	10/27/09	7:25	-39.61	25.39	yes		
F24	10/27/09	13:54	-40.28	24.65	yes	yes	yes
F25	10/28/09	7:31	-40.72	23.23	yes	yes	yes
F26	10/28/09	20:37	-39.89	22.06		yes	yes
F27	10/29/09	7:19	-39.25	21.13	yes	yes	yes
F28	10/30/09	8:15	-39.31	21.13	yes	yes	yes
F29	10/30/09	15:21	-39.16	20.94	yes		
F30	10/30/09	22:17	-38.52	20.10		yes	yes
F31	10/31/09	9:39	-37.72	18.94		yes(D)	yes
F32	10/31/09	20:17	-36.96	17.84		yes	yes
F33	11/01/09	21:14	-35.14	15.17		yes	yes
F34	11/02/09	15:14	-33.92	13.35		yes	yes
F35	11/02/09	20:21	-33.47	12.68		yes	yes
F36	11/03/09	11:18	-32.28	10.93		yes	yes
F37	11/03/09	14:44	-32.04	10.56		yes	yes
F38	11/03/09	20:14	-31.64	9.96		yes	yes
F39	11/04/09	14:34	-30.86	8.81		yes(D)	yes
F40	11/04/09	20:13	-30.40	8.12		yes	yes
F41	11/05/09	14:32	-28.96	5.95		yes	yes
F42	11/05/09	20:18	-28.53	5.30	yes	yes	yes
F43	11/06/09	7:18	-27.69	4.05	yes	yes	yes
F44	11/06/09	15:38	-27.10	3.16	yes		
F45	11/06/09	20:18	-26.67	2.51	yes	yes	yes
F46	11/07/09	7:15	-25.85	1.27	yes		
F47	11/07/09	16:27	-25.15	0.22		yes	yes
F48	11/07/09	20:36	-25.00	0.39		yes	yes

Sample ID	Date	Time	Lon	Lat	Flow cytometry	HPLC	CHN
F49	11/08/09	7:32	-24.99	-1.95	yes		
F50	11/08/09	15:27	-25.00	-1.12		yes	yes
F51	11/08/09	20:24	-25.00	-1.11	yes	yes	
F52	11/09/09	7:19	-25.00	-2.16	yes		
F53	11/09/09	9:57	-25.00	-3.71		yes	yes
F54	11/09/09	16:35	-25.00	-4.87		yes	yes
F55	11/09/09	20:16	-25.00	-4.22	yes	yes	
F56	11/09/09	23:16	-25.00	-5.69	yes	yes	yes
F57	11/10/09	7:07	-24.99	-6.64	yes	yes	
F58	11/10/09	14:19	-25.00	-7.62		yes(D)	yes
F59	11/10/09	17:25	-25.00	-7.18		yes	yes
F60	11/10/09	20:57	-25.00	-8.58	yes	yes	yes
F61	11/11/09	5:59	-25.00	-9.35	yes	yes	yes
F62	11/11/09	10:24	-25.00	-10.69		yes	
F63	11/11/09	16:13	-25.00	-11.97		yes	yes
F64	11/11/09	19:45	-25.00	-11.38	yes		
F65	11/11/09	21:56	-25.00	-11.01	yes	yes	yes
F66	11/12/09	14:30	-25.06	-12.14		yes(D)	yes
F67	11/13/09	18:14	-25.03	-13.33		yes	yes
F68	11/13/09	20:35	-25.01	-14.94	yes		
F69	11/14/09	6:10	-25.00	-15.64	yes	yes	
F70	11/14/09	13:32	-25.00	-16.65		yes(D)	yes
F71	11/14/09	20:30	-25.00	-17.82	yes	yes	yes
F72	11/15/09	6:05	-25.00	-18.50	yes	yes	
F73	11/15/09	16:10	-25.00	-19.18		yes	yes
F74	11/16/09	19:56	-24.99	-20.55	yes	yes	yes
F75	11/16/09	6:07	-25.00	-21.15	yes	yes	
F76	11/16/09	13:40	-25.00	-22.24		yes	yes
F77	11/16/09	16:49	-25.00	-23.77		yes(D)	yes
F78	11/16/09	20:46	-25.00	-23.09	yes	yes	yes
F79	11/17/09	6:09	-25.00	-25.89	yes	yes	
F80	11/17/09	16:26	-25.00	-26.46		yes	yes
F81	11/17/09	20:49	-25.19	-27.87	yes	yes	yes
F82	11/18/09	6:09	-26.14	-27.21	yes	yes	
F83	11/18/09	13:36	-27.03	-28.61		yes(D)	yes
F84	11/18/09	20:22	-27.92	-28.01	yes	yes	yes
F85	11/19/09	5:58	-29.18	-29.17	yes	yes	
F86	11/19/09	13:55	-30.25	-30.45		yes(D)	yes
F87	11/19/09	20:18	-30.96	-31.99	yes	yes	yes
F88	11/20/09	6:27	-32.39	-31.06	yes	yes	
F89	11/20/09	14:15	-32.76	-31.19		yes(D)	yes
F90	11/20/09	20:47	-32.10	-31.37	yes	yes	yes
F91	11/21/09	7:23	-34.25	-32.58	yes	yes	
F92	11/21/09	14:10	-34.97	-32.12		yes(D)	yes
F93	11/21/09	20:51	-35.85	-33.53	yes	yes	yes
F94	11/22/09	6:50	-37.11	-34.71		yes	
F95	11/23/09	9:42	-37.02	-34.90	yes	yes	yes
F96	11/23/09	13:58	-37.65	-34.41		yes	
F97	11/23/09	17:17	-38.12	-34.03		yes(D)	
F98	11/23/09	21:34	-38.85	-35.57	yes	yes	yes
F99	11/24/09	6:55	-40.19	-36.70	yes	yes(D)	
F100	11/24/09	14:37	-41.09	-36.13		yes	yes

Sample ID	Date	Time	Lon	Lat	Flow cytometry	HPLC	CHN
F101	11/24/09	21:18	-42.00	-37.56	yes	yes	yes
F102	11/25/09	0:00	-43.39	-38.69	yes	yes(D)	
F103	11/25/09	14:31	-44.44	-38.03		yes	yes
F104	11/26/09	10:11	-47.61	-40.11		yes	yes
F105	11/26/09	14:33	-48.23	-41.75		yes(D)	
F106	11/26/09	20:53	-48.98	-41.30		yes	yes

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Diapycnal mixing and bubble mediated air-sea gas exchange estimated from inert gas (Ar, Kr, N_2) saturation

KEVIN TEMPEST
University of Washington, Seattle

Introduction and purpose

Samples of inert gases (Ar, Kr, N_2) were taken in the thermocline (158 samples, ~150-500m, 5-6 depths per cast sampled, ~15-40 degrees latitude in N. and S. Atlantic) and in the mixed layer (148 samples, ~10m, daily to twice daily, cruise duration) in order to better understand the Ocean physics of diapycnal mixing and bubble mediated air-sea gas exchange. Measuring oxygen concentration concurrent to the mixed layer samples furthermore provides a means to estimate net productivity in the mixed layer.

Diapycnal mixing: While diapycnal mixing is important for physical and biogeochemical processes, the rate of tracer mixing has not been adequately quantified. Due to the non-linear thermodynamic relationship of noble gas saturation to temperature, the saturation state increases due to mixing between water masses along the water mass trajectory. In the subtropical thermocline, on a transect between the isopycnal outcrop and the interior of the gyre, the increase in saturation state ($\delta_C = [C]-[C]_{sat}$) of an inert gas C should be proportional to the second derivative of the solubility of that inert gas, the diapycnal diffusivity (κ), and the thermal stratification squared (Ito et al., 2007). The increase in saturation state should be proportional to the integrated effect of diapycnal mixing. For the subtropical gyres, the timescale of ventilation is on the order of decades.

Bubble mediated air-sea gas exchange: Another goal of sampling for inert gases is to gain a better understanding of bubble mediated air-sea gas exchange. Two main bubble mechanisms, injection and exchange, impact the saturation state of gases in the mixed layer. Injection occurs when bubbles complete collapse, thereby injecting gas into the mixed layer at atmospheric ratios and favorably increasing the saturation state of less soluble gases. Exchange occurs when bubbles are submerged and subjected to hydrostatic pressure but do not collapse. Using three inert gases (Ar, N_2, and Kr in this case) it is possible to constrain the ratio of gas flux from injection and exchange (V_{inj}/V_{ex}) (Hamme and Emerson, 2002).

Net Productivity: The thermodynamic solubility-temperature relationships of argon and oxygen are very similar. Therefore, argon is a suitable tracer for the contribution of physical processes to the saturation state of oxygen in the well-ventilated mixed layer. By subtracting the contribution of physical processes to the saturation state of oxygen, the net productivity (photosynthesis-respiration) can be estimated.

DIC-13: Samples were collected from the mixed layer (~10m) for Dr. Paul Quay, Univeristy of Washington and will be analyzed by his Stable Isotope lab upon return.

Methods

Oxygen samples were taken in triplicate, using designated PML oxygen flasks, for each Niskin sampled for inert gases: two samples prior to inert gases sampling and one sample following. The oxygen sampling allows for quality control of the data and indicates if gas exchange has occurred during the sampling. Oxygen concentrations were determined by the Winkler method and incorporated into the CTD sensor calibration using the same set-up and calculations detailed by John Stephens in his cruise report on dissolved oxygen. For the purposes of our calculations, independent calibrations using KIO_3 from the Emerson lab at the University of Washington were run before each set of titrations.

Dissolved inert gas samples were collected into evacuated 150-200 mL glass flasks hand-blown at the University of Washington. The flasks have been modified to contain long necks separating the atmosphere and the sample chamber with double o-rings. The flask necks and attached tygon tubing are initially filled with CO_2 to the second (bottom) o-ring before the introducion of seawater, providing a buffer between the atmosphere and the water entering the sample chamber. After checking for bubbles and forcing them out of the tubing by gentle shaking and tapping, water is allowed to enter the sampling chamber while maintaining at least 4-6 inches buffer zone of water in the tubing. The sample chamber is filled between half and two-thirds full. After sampling a full cast, the flask necks are dried, filled with CO_2, and capped. Upon return to the University of Washington, the equilibrated headspace gas will be spiked with ^{36}Ar and frozen into a stainless steel finger immersed in liquid helium. Gas concentrations will be determined by mass spectrometry based on $^{36}Ar/^{40}Ar$, O_2/Ar, N_2/Ar ratios. The Ar/Kr ratio of samples will be determined using a similar method, but the gas will be collected and purified on a separate gas-collection line and measured on a different MS instrument.

Mixed layer samples were collected at approximately 10m at least once a day. For mixed layer samples, two oxygen, nitrogen, argon (ONAr) and two krypton, argon (Kr/Ar) samples were taken for each Niskin sampled, for a total of 4 dissolved gas samples per Niskin. Mixed layer samples were primarily, but not exclusively, collected from the pre-dawn stainless steel casts. Samples for diapycnal mixing were taken at 4-6 depths in the thermocline (150m-450m) ranging from σ_θ of approximately 26.3-26.8 kg m^{-3} in order to bracket the potential density layer of interest (~26.6 in the N. Atlantic and 26.5 in the S. Atlantic). Each profile in the thermocline consisted of two dissolved gas samples per depth, with entire profiles dedicated either to ONAr or Kr/Ar samples. All samples for diapycnal mixing were collected from the titanium frame during the mid-day casts. Potential densities selected were based upon the ventilation region and volume transport of water masses from literature for both the N. Atlantic (Sarmiento, 1983) and the S. Atlantic (Provost et al., 1999). Profile depths were guided by 1994 World Ocean Atlas monthly data for October and November accessible online at the IRI/LDEO Climate Data Library (http://iridl.ldeo.columbia.edu/SOURCES/.LEVITUS94/).

Results

Oxygen results have been incorporated into the CTD sensor calibration. Please refer to the cruise summary for Dissolved oxygen.

Sampling Plan

Table 1: Location and depth of thermocline samples taken on AMT-19

CTD	Lat	Lon	Depths (m)	Niskins	Sample For
027T	32.871	-31.946	250, 225,200,175,150	1,2,3,4,5	ONAr
030T	30.745	-34.483	275,250,225,200,175,150	19,1,2,3,4,5	Kr/Ar
033T	28.479	-36.680	400,350,250,200,175	19,20,2,3,4	ONAr
036T	27.023	-38.053	330,290,250	2,3,4	Kr/Ar
039T	24.652	-40.283	390,340,300,260,200	1,2,3,4,5	ONAr
048T	20.937	-39.167	360,320,290,260,230,200	1,2,3,4,5,6	ONAr
051T	18.418	-37.359	250,225,200,175,150	1,2,3,5,6	Kr/Ar
091T	-17.347	-25.000	360,320,290,260	19,20,21,22	ONAr
094T	-20.588	-25.000	370,350,330,305,280	1,2,3,4,5	Kr/Ar
097T	-23.763	-25.002	380,350,330,310,290,260	1,2,3,4,5,6	ONAr
100T	-27.168	-25.001	460,420,390,360,330,300	1,2,3,4,5,6	ONAr
103T	-29.390	-26.335	450,410,370,330,290,250	1,2,3,4,5,6	Kr/Ar
106T	-31.547	-30.253	420,370,330,390,240	1,2,3,4,5	ONAr
109T	-33.883	-34.975	360,320,280,240,200,150	1,2,3,4,5,6	Kr/Ar
116T	-37.867	-41.09	250,225,200,175,150	1,2,3,5,6	ONAr

Table 2: Location of mixed layer dissolved gas samples (~10m; 3x oxygen, 2x ONAr, 2x Kr/Ar, DIC-13); locations where only DIC-13 was sampled are shown in columns 5 and 6.

CTD	Niskin	CTD	Niskin	DIC-13 Only	
003S	8	064T	12	CTD	Niskin
008S	20	067T	12	004S	18
012T	12	071S	19	011S	18
015T	12	074S	19	017S	19
018T	12	077S	19	023S	19
020S	19	080S	19	026S	19
024T	13	083T	13	041S	19
029S	19	090S	19	053S	19
032S	19	093S	19	063S	18
035S	18	096S	19	066S	19
038S	19	099S	19	069S	15
045T	13	102S	20	072T	12
050S	19	105S	19	075T	12
054T	12	108S	18	078T	13

056S	19	111T	13	081T	12
057T	12	115S	19	091T	12
059S	19	118S	16		
060T	13	119T	11		
061T	12	120T	15		

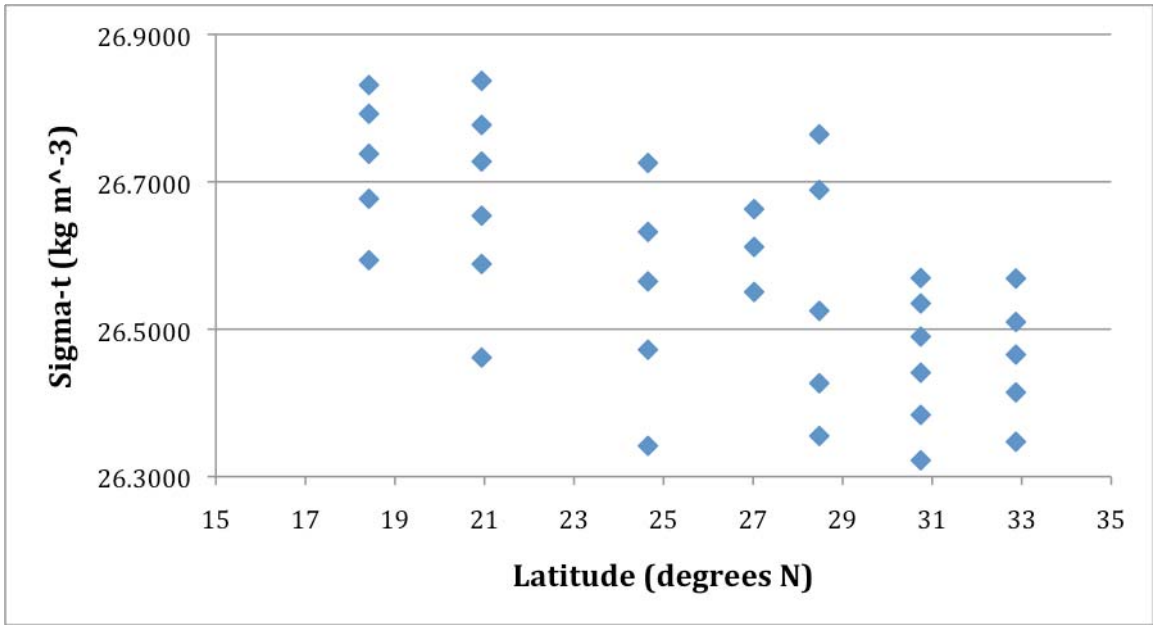

Figure 1: Profile of potential densities sampled in the N. Atlantic thermocline

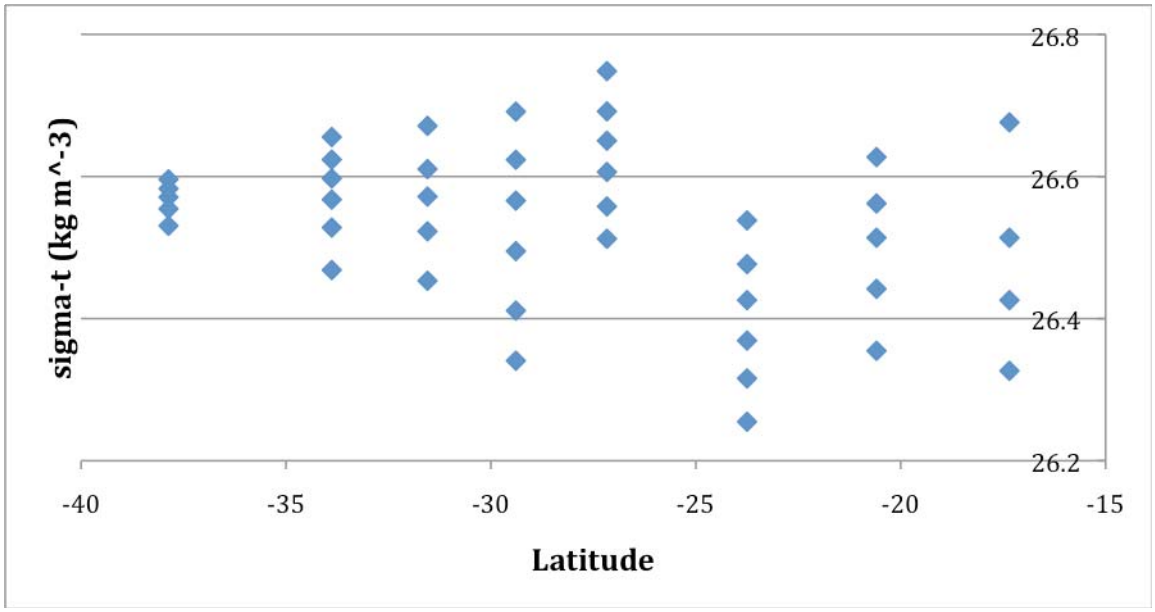

Figure 2: Profile of potential densities sampled in the S. Atlantic thermocline

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Seafloor High Resolution Imaging Platform (SHRIMP)

LIBBY ROSS AND CHRIS BARNARD
National Oceanography Centre, Southamptom

Scientific rationale

The deep sea is aphotic and therefore aphotosynthetic, the fauna that exist there rely entirely upon the fall of material from the euphotic zone as their only source of food. Sinking phytoplankton, zooplankton fecal pellets and marine snow are all important food sources to the deep sea benthos (Turner 2002). Energy limitation is thought to be the most important factor controlling deep sea communities (Smith et al 2008) so that two regions underlying areas of different productivity (quantity, seasonality or quality) are expected to have very different faunas, whilst two regions underlying similar areas of productivity, even those separated by thousands of kilometres, would be expected to have similar faunas .Whilst the main aims of the AMT cruises involve the biology and chemistry of the photic zone, the cruise track, from Falmouth, UK to Punta Arenas, Chile offers a unique opportunity to investigate the organisms on the sea floor over a wide range of biogeochemical settings. In addition, much of the abyssal sea floor has not been sampled. The North Atlantic and North Pacific are relatively well studied but very little data exists for the tropical and South Atlantic. Underwater photography and video of the deep sea floor allow the analysis of the epibenthic megafauna (organisms large enough to be seen on photographs) plus the tracks, trails and burrows of other large fauna. The aim of the cruise was to deploy SHRIMP (Seafloor High Resolution IMaging Platform) six times, three times in the northern hemisphere one highly eutrophic site, one oligotrophic site and one productive but aseasonal site and the same, in mirror image, in the southern hemisphere (see planned site list below, actual sites are given in the summary table. The target depth was 4800m in order to make data comparable with well studied abyssal time series sites such as the PAP (NE Atlantic) and Station M (NE Pacific) but with variable and often uncertain bathymetry anything within the depth range 4500m-5500m was deemed acceptable.

Planned SHRIMP sites:

1. SHRIMP 1: Lat: 48°50'N Long: 016°30'W
   PAP site, productive
   Longhurst province: 4 – NADR – N.Atlantic Drift Province
2. SHRIMP 2: Lat: 27°30'N Long: 038°30'W
   West of the canaries within NAG, oligotrophic
   Longhurst province: Border of 6 & 18 – NASW/NASE N.Atlantic Subtropical Gyral Province West/East
3. SHRIMP 3: Lat: 09°00'N Long: 031°00'W
   South west of Cape Verdes, within effects of African upwelling
   Longhurst province: 8- WTRA- Western Tropical Atlantic Province
4. SHRIMP 4: Lat: 03°30'S Long: 025°00'W
   Just below African upwelling
   Longhurst province: 8-WTRA- Western Tropical Atlantic Province
5. SHRIMP 5: Lat: 18°00'S Long: 025°00'W
   Northern Brazil basin, within SAG, very close to SAG waypoint
   Longhurst province: 10-SATL- S.Atlantic Gyral Province
6. SHRIMP 6: Lat: 45°00S Long 045°00'W
   Argentine basin, productive
   Longhurst province: 80/81- SSTC/SANT- S.Subtropical Convergence Province/ Sub Antarctic Province

Actual SHRIMP sites sometimes varied from the latitudes and longitudes given above for logistical reasons. Actual positions are given in the summary table below. A number of problems arose during the cruise and as a result there were only two successful dives. Below are the details of each dive, both technical and scientific.

Table 1. Position of SHRIMP sites

Dive No	Date	Station No	Latitude	Longitude	Depth	Time on bottom	No Stills	Fauna
1	16.10.2009	N/A	49°00'N	16°40'W	N/A	N/A	N/A	/A
2	26.10.2009	JC03923	27°12'N	37°53'W	N/A	N/A	N/A	N/A

Dive No	Date	Station No	Latitude	Longitude	Depth	Time on bottom	No Stills	Fauna
3	04.11.2009	JC03939	09°00'N	31°00'W	5373m	3 hours	324	Styracaster sea stars, stalked sponge, echiurans, anemone (2 species), squat lobster, holothurians (only from tracks)
4	08.11.2009	JC03948	02°52'S	25°00'W	5456m	3 hours	344	Brisingid sea stars, holothurians (Peniagone? 2 or more species), polychaetes, xenophyophores, echiurans
5	14.11.2009	JC03958	18°00'S	25°00'W	N/A	N/A	N/A	N/A
6	Abandoned	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Wire Tests

Prior to shrimp being deployed there was the requirement to perform wire tests following the re machining work of the inserts on the Traction winch. During this test the Termination bottle that was attached prior to the cruise was pulled and the Deep Tow had to be re terminated.

Several attempts at re terminating the fibre optic were performed however several issues were prevalent. Mainly that when the fibre was put back in the bottle the fibre would become bent slightly as there is not enough space inside the bottle. This then caused the fibre to break and the termination would need to be redone.

Dive 1

Science

There was no data collected at this site. See details below.

Technical

The PAP Site deployment was lost due to the failure of the termination. The termination was working when out of the bottle however with the bend that had been put into it was causing it to fail and the signal was attenuating too much for the comms to work. After a few tests the dive was abandoned and the decision was made to head for the Azores and for James Cooper to come out with glue for the fibre optic connections, which had been an issue in terminating the fibre previously.

In the Azores, James re terminated the fibre several times and finally was able to successfully close the termination bottle and use the termination as was. During the time that James was on board an issue was found with the multiplexer where all of the RS232 lights would stay on when shrimp was powered up. This was believed to be caused by us powering the Shrimp up with Dirty Power as there are no clean supply sockets nearby. Later this was proved not be the case.

Shrimp was powered up and down in order to write some software to make the camera take automated shots at a fixed interval. When it came to dive 2 Shrimp was tested on Deck and found to be working.

Dive 2

Science

There was no data collected at this site. See details below.

Technical

The wire was brought down from the hanger top, secured within the vehicle frame and deployed around 08:25 GMT.

Shrimp was held at 50 meters and powered up. All systems with the exception of the CTD came up immediately. We discovered that SeaTerm had to be started first otherwise the Shrimp 2009 software would block the port. This was overcome quickly.

Shrimp continued its descent after all power ups were completed and at 899 Meters the winch was stopped as all cameras had gone dead. At this time the Top Side Mux had a Link ready light and all RS232 Receive lights were on permanently. Attempts to power cycle the vehicle (Including the vehicle Mux) and also the Top side mux failed to resolve the situation and Shrimp was recovered to the deck.

Shrimp was then brought up on HV on deck and was all working immediately.

Shrimp was then redeployed and at 666 meters the same thing happened with the mux. All RS232 Receive Lights fully illuminated and also a Link Ready light enabled. This time we were able to recover the shrimp by leaving her

powered down in the water for around 10 minutes as well as the top side Mux. Once all was repowered the system responded once more and we continued down. at 930 Meters shrimp had lost all communications and in this case the Top Side Mux Link Ready light was not illuminated, neither were the RS232 receive lights.

Shrimp was recovered to deck and the ship continued on the AMT Transect.

Dive 3

Science

This site was notably covered in Lebenspurren – the burrows and tracks of organisms that cannot actually be seen in photographs themselves. Particularly common were asteroid feeding marks, likely to be caused by species of the genus Styracaster (based on the morphology of the feeding mark and the presence of Styracaster at this site as seen in stills), Echiuran spoke burros with associated gashed mounds. Large tracks were evident throughout the dive, stills show that some are likely to be associated with large holothurians. Stalked sponges (hexactinellid?) were relatively common as were small sea pens and crinoids. In some cases epizoanthid anemones were associated with stalked sponges. Squat lobsters were also present. The swimming sea cucumber Enypniastes eximia was also noted in the water column, visible in photos but not in stills. Early in the dive SHRIMP appeared to become entangled in a long line and a squid, probably attached to the long line obscured site for a little while. The long line occasionally comes into shot on the IMENCO and Bowtech cameras.

Technical

The decision was made to put the cable in place above the gantry prior to the dive to save time. Prior to this it was decided to do a power up as a test. This test failed. It was not possible to turn any of the camera's on that were controlled by the PC Inside shrimp. The problem was thought to be a problem with the mux initially as there had been several with the issue in the Azores and the lab cable.

This assumption was incorrect and on inspecting the mux tube the mux could be seen to be decoding messages from top side mux.

The Power tube was then opened and PC powered up. The PC was working fine and the problem was traced to a loose ribbon cable attaching to the PC Digital IO Card.

Shrimp was successfully deployed at 04:25 the next morning with all systems working. During the descent the Shrimp tripped the GFI twice and returned very quickly. Quickly enough that on the first trip the CTD did not power down. It is thought that this was due to connectors sealing under pressure. The dive continued and Shrimp successfully reached the bottom. There were 3:30 minutes of bottom time and then Shrimp returned to the surface.

The only issue encountered other than the small trips were that one of the lasers could not be seen. The Crosshair laser, although functional, was quite dim and could not be seen on the seabed.

Dive 4

Science

At this site very large lebenspurren such as the broad track marks and very large echiuran spoke burrows appeared to be less abundant than at the previous site, although smaller tracks and burrows were still very common. At this side 'circle scriber' polychaetes were abundant. Brisingid sea stars (Freyella?) were also relatively abundant. Small white/transparent sea cucumbers were found, sometimes 'swimming' in the water column a few metres off the sea bed, and sometimes on the seabed itself. These are thought to be from the genus Peniagone. Another species was also present, possibly another Peniagone or other Elpidiad sea cucumber. 'Reticulammina' type xenophyophores were also present as were 2 species of anemone. An oil drum was also noted.

Technical

Following Dive 3 the lasers were swapped and the Crosshair laser moved to the front of shrimp and front moved to the rear.

Shrimp was deployed at 15:40 GMT and recovered at 00:00 GMT.

This dive was the most successful with no shrimp issues what so ever. Total depth achieved was around 5500m.

Dive 5

Science

There was no data collected at this site. See details below.

Technical

Pre dive tests were completed and Shrimp was deployed at around 18:30 GMT. Shrimp was taken to 100m for power up and also allow the winch driver to hand over from deck control to lab control at the same time to save on handover time.

The top side mux Link Ready light failed to come on. Shrimp was powered down several times and then eventually recovered to deck. When shrimp was recovered and powered up on deck it became obvious that the imenco flash light was not on. This was normally the case that a faint light came from the flash.

Power was checked to be entering the transformer and exiting it.

The problem first pointed to power and so the Power tube was opened first and taken to the lab. All power supplies appeared to be functioning as they should and the PC was also working. The Power tube was placed back into the vehicle and the mux tube was extracted. On opening the Mux tube water came out once the secondary O ring seal on the pressure case was passed. As the metal end cap came completely out of the pressure case a mass of water came out of the tube.

It was then clear that the mux pressure case had flooded and that there was nothing more that could be done. Shrimp's Mux had been imursed in water and there was also a circuit board that had melted in some areas from the water contact while power was applied.

The Mux was thoroughly washed in MiliQ and allowed to dry. The Mux did not appear to have any damage. The Power supply for the mux was tested and was working. However once reconnected to the mux it no longer worked. It would appear that the mux was completely dead and that it had taken its power supply with it.

Dive 6

Science

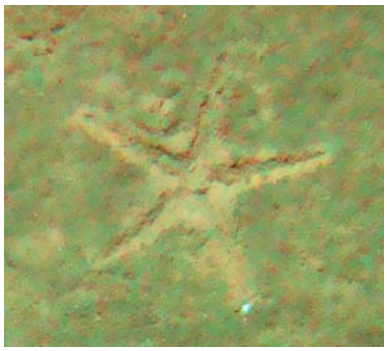
There was no data collected at this site. See details below.

Technical

Scientific dive 6 was completely aborted and under agreement with the PS for AMT there was some pressure tests performed on the Mux pressure case (minus electronics) to ensure the pressure case was still sound for the following cruise without causing any damage to new electronics that would be transferred out.

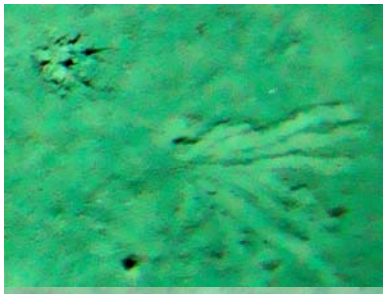
Data Analysis

Video and/or stills will be analysed by Libby Ross. A random subsample of photographs from each dive will be used to identify individual organisms as accurately as possible (to the smallest possible taxonomic unit). This will be used to calculate the abundance and diversity of megafauna (organisms visible in photographs) and lebenspurren (visible tracks and burrows) at each station and relate this to information on energy availability to the community (based on information on primary productivity).



00860 star mark

Asteroid (Styracaster) feeding mark



00892 spoke

Echiuran spoke burrow, plus associated gashed mound (see below)

00892 star

Probably Styracaster

00970 galatheid

Just in the image a squat lobster

00970 sponge

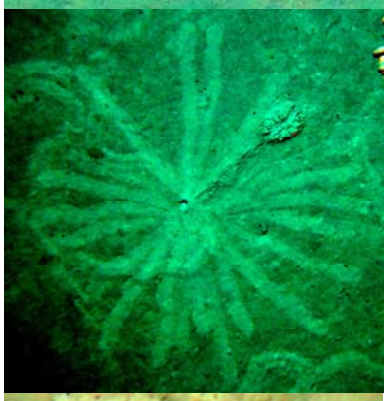
Stalked sponge (probably hexactinellid) next to it may be a small stalked crinoid

01035 sponge and epizoites

Another stalked sponge (probably hexactinellid) with epizoites, including obvious epizoanthid anemone

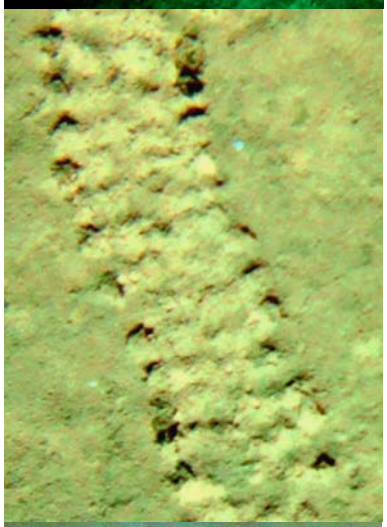
01044 pennatulid

Small sea pen



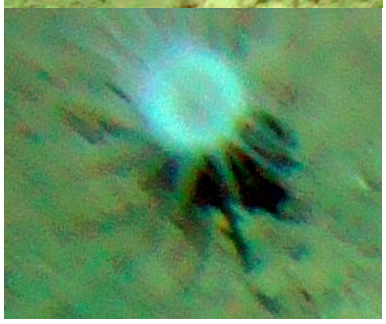
01047 spoke

Very nice Echiuran spoke burrow with associated gashed mound (and gash mark leading to burrow opening). Echiuran proboscis 'licks' the spokes, body of the worm is said to lie below the gashed mound - gash supposed to form as the worm's body expands when the proboscis is retracted - this latter part is probably not true



01062 holothurian trackway

Track mark, probably large holothurian



01178 anemone

Probably same as anemone below

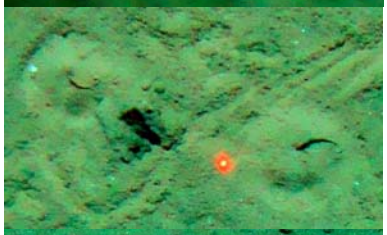
01178 circle-scriber

A fairly famous trace - know as a “circle scriber”, probably a tube dwelling polychaete

They seem to be pretty common at these sites

01195 brisingid

Brisingind, Freyella?



01195 circle scribers

01235 holothurian b

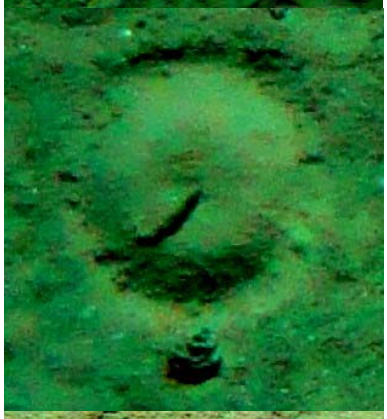
Dave says Peniagone (diaphana)

01303 anemone b

Second type of anemone, best guess is an Edwardsiella-type (but might just be a cerianthid)

01314 brisingid

Freyella?

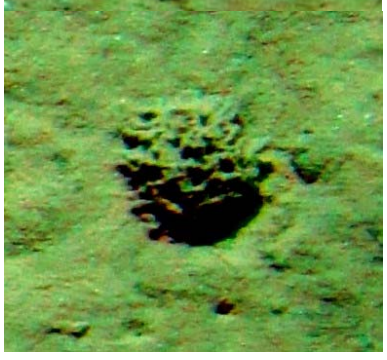


01314 circle-scriber

01326 anemone

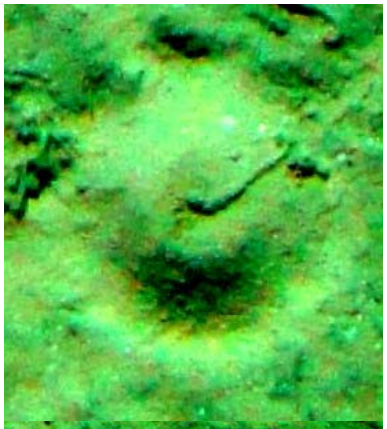
May have some associated fauna around its column, but can't see enough

01326 circle-scriber



01326 xeno

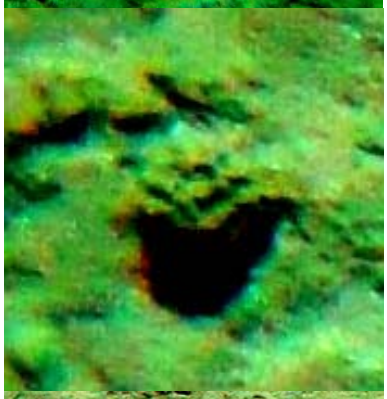
'Reticulammina' type xenophyophore (giant protozoan) - this would be a pretty deep record for it (Pers. comm. Andy Gooday)



01383 circle-scriber

01383 holothurian b

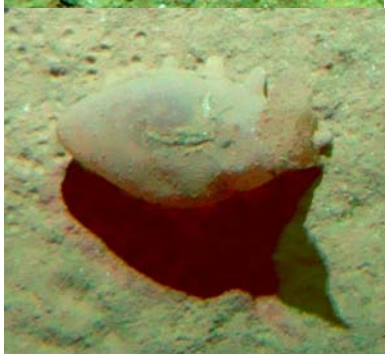
Peniagone (diaphana?)



01383 xeno

01456 holo b

Peniagone (diaphana?)



01485 holothurian a

Another elpidiid (possibly a diff species of Peniagone)

Computing and Instrumentation Report

For further information on this report please contact:

Chris Barnard
342/11 National Marine Facilities
National Oceanography Centre
Waterfront Campus
Southampton SO14 3ZH
+44(2380) 596283
E-mail: cvb@noc.soton.ac.uk

Ifremer TECHSAS System

The Ifremer TECHSAS system is the primary data logger for all navigation, surfmet and winch data. The TECHSAS software is installed on an industrial based system with a high level of redundancy. The operating system is Red Hat Enterprise Linux Edition Release 3.3. The system itself logs data on to a RAID 1 disk mirror and also logs to the backup logger. The TECHSAS interface displays the status of all incoming data streams and provides alerts if the incoming data is lost. The ability exists to broadcast live data across the network via NMEA and XML.

The storage method used for data storage is NetCDF (binary which is a self describing file and is OS independent) and also pseudo-NMEA (ASCII). The Data used for processing is a record on the Level C of the time stamped NMEA output from TECHSAS.

The TECHSAS data logging system was used to log the following instruments:

1. Applanix POSMV System (Converted to RVS Format as posmvpos, posmvatt, posmvsat)
2. Applanix POSMV System Heading (gyropmv)
3. Kongsberg Seatex DPS-116 (Converted to RVS Format as dps116p and dps116s)
4. Chernikeef EM speed log (converted to RVS format as log_chf)
5. Skipper EM Speed Log (converted to RVS Format as log_skip)
6. Ships Gyrocompass (converted to RVS format as gyronmea)
7. Simrad EA600 Precision Echo Sounder (Converted to RVS Format as ea600)
8. NMFD Surface-water and Meteorology instrument suite (Converted to RVS as sm_surf, sm_met and sm_light)
9. ASHTECH ADU-5 Altitude Detection Unit Converted to RVS Format as adu5pat and adu5pos)
10. NMFSS Cable Logging and Monitoring (Converted to RVS as winch)
11. Surface and Meteorological Sampling System (SURFMET) in files met, light and surf.
12. MicroG LaCoste AirSeaII Gravitymeter (airseaii)

Techsas NetCDF to RVS Data Conversion

During this cruise there is no reliance upon the data provided by TECHSAS, however it has been included on the data archive in the standard rvs form using a piece of software used to make it compatible with the RVS ASCII data structure.

An in house application was used to handle the conversion of NetCDF files to the RVS format. This was then parsed back to the data file and was processed as normal. These 2 new applications being ncvars and nclistit.

These new binaries require to environment variables in order to function:

$NCBASE – the base for the NetCDF binaries system, set to /rvs/def9

$NCRAWBASE – the base for the raw data files, set to /rvs/pro_data/TECHSAS/D321/NetCDF

The existing $PATH variable must also include the path to the NC binaries, the path /rvs/def9/bin was appended to the $PATH variable.

All Techsas data file names are in the format of YYYYMMDD-HHMMSS-name-type.category with the data/timestamp being the time the file was created by Techsas.

The files were each processed in the following way for this cruise:

nclistit 20060813-000001-gyro-GYRO.gyr - | titsil Gyronmea -

This output gyro data from TECHSAS in the listit output format that is then read in by the titsil application.

Data Processing

Applanix POSMV System

The Ships primary GPS System for scientific data and also part of the Dynamic Positioning system is the Applanix POSMV. The POSMV includes an inertial measurement unit capable of providing heading pitch and roll data to the bridge, logged by the TECHSAS system and displayed in the main lab. The POSMV data is also used by the ADCP systems in order to account for ships motion.

The Applanix IMU is located at the ships centre point and is used as reference for all offsets for instruments on board the RRS James Cook The GPS antenna positions are held within the POSMV and the GPS position is corrected for the position of the MRU and so the GPS position that is recorded is the position of the MRU itself.

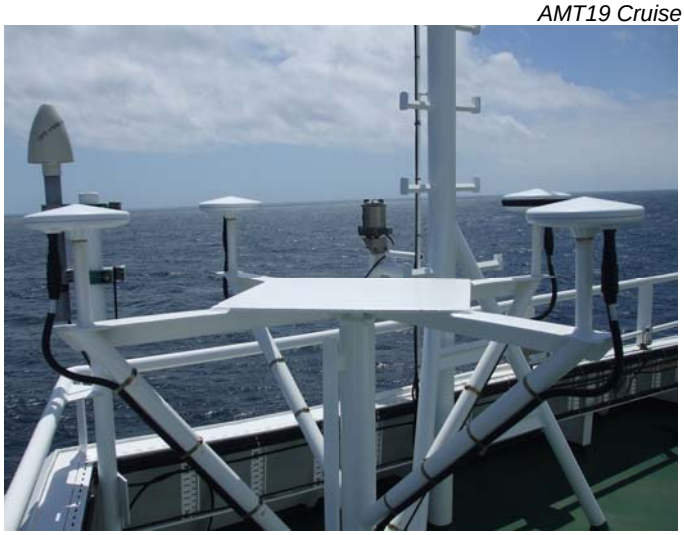
System Specifications

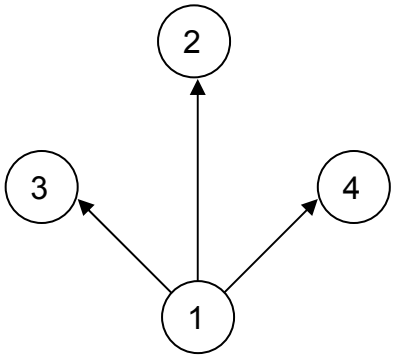
	Specification (With Differential Correction	During GPS Outages
Roll, Pitch Accuracy	0.02 º (1 sigma with GPS or DGPS	0.02 º
Heave Accuracy	5cm or 5% whichever is greater for periods of 20 seconds or less	5cm or 5% whichever is greater for wave periods of 20 seconds or less
Heading Accuracy	0.02 º with 2m antenna baseline	Drift less than 1 º per hour (negligible for outages < 60 seconds)
Position Accuracy	0.5 – 2m (1 sigma) dependant on differential correction quality	Ddegredation 2.5m (1 sigma for outages < 30s) <6m (1 sigma for outages < 60s)
Velocity Accuracy	0.03 m/s horzontal	

Magellan Ashtech ADU-5

This is a four antenna GPS system that can produce attitude data from the relative positions of each antenna and is used to correct the VMADCP for ship motion. The antenna array is located on the port side of the ships monkey island. The ADU-5 system worked reliably throughout the cruise with some gaps that are quite usual with this system due to the amount of calculations necessary and the roll of the ship causing bad satellite communication. No Large data gaps are present. The ADU-5 forms part of the bestnav system which is an assembly of multiple GPS signals including the gyronmea and emlog stream in order to calculate the best possible position, speed heading pitch and roll of the ship.

The ADU was damaged on a previous cruise and was recalibrated prior to JC039 the relative offsets are indicated below.





The ADU5 Platform on the Starboard Side. Black surrounded Antenna indicates AFT. This is the primary antenna which sits behind all 3 other antennas.

ADU5 Offsets with reference to Antenna 1 (used internally by ADU5 for HPR Calculations

Vector	X(Right Positive)	Y(Forward Positive)	Z(Up Positive)
1-2	0.000	1.208	0.008
1-3	-0.601	0.607	-0.016
1-4	0.596	0.607	0.022

Antenna Position on James Cook From MRU (0,0,0)

Antenna	X (Positive Starboard)	Y (Positive Forward)	Z (Positive Up)
1	9.265	1.541	19.416
2	10.463	1.537	19.419
3	9.863	0.932	19.426
4	9.870	2.138	19.419

SeaTex DPS 116

This DPS116 is a GPS system that was installed primarily as a backup for the POSMV to provide information for the ships DP system for ships use which we now receive an output from. The Seatex is only configured to output a single GPGGA message which we record on the TECHSAS System.

The DPS 116 is located at the top of the ships Main mast.

Seatex Seapath 200

This system was installed as an additional system to the bridge which we also take a network UDP feed from. Due to an issue in the programming of the Seapath code we are only able to record 1 message from the Seapath despite it outputting multiple messages. This is due to a fault which causes the seapath to output all NMEA Messages in one large UDP Packet rather than the standard form which involves sending multiple messages.

Due to this there are not many variables logged on TECHSAS for this instrument.

Ship's Gyrocompass

The Gyronmea is a file that receives its data from the Ships gyro compass located in the Bridge Electronics Space. There are two such Gyros on the bridge and we are able to use either one of them as a source of heading. The selected Gyro is logged by the TECHSAS system and is used as part of the bestnav calculation.

Chernikeef EM log

The Chernikeef EM log is a 2-axis electromagnetic water speed log. It measures both longitudinal (forward-aft) and transverse (port – starboard) ships water sped.

The EM log system was not showing the correct data following the last calibration attempt. The system has been highly unreliable since its installation within the ship and continues to be an ongoing issue that we are attempting to get support from the manufacturer for, however they are not so forth coming. The Chernikeef Log requires either a calibration or a good clean as it was reading 3Knots under at maximum speed. The points seem accurate based on the previous calibration and so it is possible that it could be either. Until an inspection is done it will not be obvious which it is.

Skipper Doppler Log

The Skipper Doppler log is the ship fitted speed indicator mainly used by the bridge. It was repeated to the science systems due to the failure of the Chernikeef log to produce reasonable data for the first year and a half of the ships operation. The Skipper is continually logged as it provides good data quality and is a good comparison with the Chernikeef system.

Simrad EA600 Precision Echo Sounder (PES)

The EA600 Precision Echo Sounder is the ships primary depth readout. The EA600 output is passed to TECHSAS and also to the green display screens in the main lab. The EA600 is mounted on the port drop keel.

The EA600 had several issues during the cruise where it would loose network connection between the PC and its Transceiver unit which controls, powers and interprets the return signals from the transducer. Kongsberg were contacted and after several days of the the unit falling over it was recommended to us that we upgrade the software which in turn featured a GPT Firmware update. This update failed and the Transceiver PIC was damaged. The GPT could not be used again.

The EA500 was then used for general echo sounding but was not recorded.

SURFMET System

This is the NMFD surface water and meteorology instrument suite. The surface water component consists of a flow through system with a pumped pickup at approx 5m depth. TSG flow is approx 18 litres per minute whilst fluorometer and transmissometer flow is approx 1.5 l/min. Flow to instruments is degassed using a debubbler with 24 l/min inflow and 10/l min waste flow.

The meteorology component consists of a suite of sensors mounted on the foremast at a height of approx 16.4m above the waterline. Parameters measured are wind speed and direction, air temperature, humidity and atmospheric pressure. There is also a pair of optical sensors mounted on gimbals on each side of the ship. These measure total irradiance (TIR) and photo-synthetically active radiation (PAR).

The NON Toxic System ran throughout the cruise with exception to a clean required during the cruise and also it had to be turned off to fix a leak in a tap that was flooding someone's cabin.

Surfmet Logging of all items except the SBE started at : 09 286 12:36

The TSG System was turned on at 09 290 08:11

The system was turned off at 09 333 13:41

Salinity samples were taken throughout the cruise. The regression of the Discrete samples shows that there are quite a few issues with the sampled bottles being mostly a lot higher than the TSG Samples. I believe this is due to contamination from previous samples that were in the bottle having dried out into the bottles and them not being rinse properly.

Normally the regression for the TSG is not as accurate as the CTD regression. I believe this may be due to the sampling point being a bit far away from the TSG itself and I am recommending that it be moved in order to improve the accuracy of the salinity samples taken.

Salinity samples were only ignored if the residual was over +/-55mPSU from the TSG value.

The regression performed on the data shows that there is a substantial linear offset which can be applied to the data to correct it for this offset.

The Dataset SBECOR.txt in the Cruise Report Folder has the corrected salinity value from the regression in the Excel Spread Sheet.

$y = 1x + 0.0306$
$R^2 = 0.99985$

Using a program called Nudge I have updated the Salinity data in SBECOR.txt to remove the offset.

CASIX PCO_2 System

This system is an autonomous pCO_2 system developed by PML and Dartcom. I advise that you contact Nick Hardman-Mountford at PML for information. The system was run at the same time as the Surfmet system. The System was cleaned on a weekly basis in order to remove fouling from the system as per the manual.

The PCO_2 was cleaned weekly throughout the cruise on every Friday.

The First Friday a quick clean was done. Followed by a Full clean to remove the discoloration within the equilibrator. A Quick clean was done every week following.

There were several faults with the system due to leaks and Standard 3 was turned off due to this issue. Several checks were done for leaks however none could be found.

Data Storage

Data was backed up on a Raid 1 pair from the ADCP's, CTD's, FRRF, LADCP's, ISW and also some scientists also had storage areas on the data drive. This was then backed up nightly using tapes on an alternating routine.

Data Backups at the end of the cruise were burned to DVD's.

3 x CTD DVD containing CTD RAW and PROC, FRRF, LADCP, MSS-90L and CTD Salts.

2 x ADCP 150Khz DVD's

2 x ADCP 75Khz DVD's

1 x TECHSAS NetCDF Disks

3 x RVS Streams Disks containing raw RVS data for the ships GPS, SURFMET, Winch, Gyro's and MRU.

NMF – Sea Systems

CTD/FRRF/LADCP, Autosal & MSS-90L Profiler Operations

DOUGAL MOUNTIFIELD
Sensors & Moorings Group, National Marine Facilities, National Oceanography Centre, Southampton

1. CTD Operations

A total of 168 CTD casts were completed during the cruise. 120 casts were conventional profiling casts with water sampling, and 48 casts were surface sampling during the 3 30hr diel stations, at ~5m with bottles fired from the 11+ front panel. Hence no data was acquired for cast IDs CTD-SURFxx.

Both a stainless steel and a titanium CTD system were used. The titanium frame was normally deployed daily at ~0430 and ~1300 ship time, however there were some additional profiling casts during the diel stations. The SS frame was normally deployed daily at ~0530 ship time. CTD cast numbers were of the form CTDxxxs for SS casts and CTDxxxt for titanium, where xxx was the cast number.

A total of 82 titanium and 38 stainless steel profiles were completed. There were no major operational issues with the CTD suites during the cruise. However there were some issues with fluorimeter drop- outs on the two main CTD fluorimeters during upcasts. These were diagnosed as having worn bulkhead connectors, and are to be returned for service and calibration post-cruise. The primary (frame mounted) conductivity sensor on the titanium frame also failed on cast 109 and was replaced with a spare. 578 salinity samples were taken as 289 pairs of replicates.

An LADCP profile was obtained from each of the 82 titanium CTD casts. For the stainless steel frame there is no slave data for cast CTD004s as the script file was sent at 115200 baud in error. There is also no master or slave data for casts CTD014s and CTD090s as the master script file was not sent in error. Hence there are 36 master and 35 slave LADCP profiles from the stainless steel frame. The LADCP data from cast CTD027t was inadvertently not included in the main cruise archive, this file and the associated log file will be supplied separately to the PI and to BODC after the cruise.

1.1 24-way Stainless Steel CTD Frame

The stainless steel frame configuration was as follows:

- • Sea-Bird 9/11 *plus* CTD system with fin-mounted secondary sensors
- • Sea-Bird SBE-32 24 way rosette pylon on NMF 24 way frame
- • 24 by 20L custom OTE external spring water samplers
- • Sea-Bird SBE-43 oxygen Sensor
- • Chelsea MKIII Aquatracka fluorometer
- • Chelsea MKII Alphatracka 25cm path transmissometer
- • Wetlabs BBRTD 660nm backscatter sensor
- • PML 2PI PAR sensors (UWIRR and DWIRR)
- • NMF LADCP pressure-case battery pack
- • RD Instruments Workhorse 300 KHz lowered ADCP (upward and downward-looking master-slave configuration)
- • Benthos PSA-916T 200kHz altimeter
- • Chelsea Fasttracka Fast Repetition Rate Fluorimeter (FRRF) with associated battery pack, pressure and PAR sensor.

For the 20l bottles, the pressure sensor was located 20cm below the bottom of the water samplers, and 131cm below the top of the water samplers. The 20l niskins are 111cm in height between end-cap seals.

1.2 24-way Stainless Steel CTD Frame Instrument Configuration

The Sea-Bird CTD configuration for the stainless steel frame was as follows:

- SBE 9 *plus* Underwater unit s/n 09P-19817-0528
- Frequency 0—SBE 3P Temperature Sensor s/n 03P-4116 (primary)
- Frequency 1—SBE 4C Conductivity Sensor s/n 04C-2580 (primary)
- Frequency 2—Digiquartz Temperature Compensated Pressure Sensor s/n 73299
- Frequency 3—SBE 3P Temperature Sensor s/n 03P-2919 (secondary – fin mounted)
- Frequency 4—SBE 4C Conductivity Sensor s/n 04C-2450 (secondary – fin mounted)
- SBE 5T Submersible Pump s/n 05T-3609 (primary)
- SBE 5T Submersible Pump s/n 05T-3085 (secondary – fin mounted)
- SBE 32 Carousel 24 Position Pylon s/n 32-19817-0243
- SBE 11 *plus* Deck Unit s/n 11P-34173-0676 Main Unit with Powertecnique UPS s/n?
- SBE 11 *plus* Deck Unit s/n 11P-24680-0589 Spare Unit

The auxiliary A/D output channels were configured as below (due to incorrectly labelled Y-cables V2/3 and V6/7 usages are transposed from historically used channels):

- V0 --- SBE 43 Oxygen s/n 43-0862 (primary duct - 9+ mounted)
- V1 --- Unused – obsolete oxygen temperature
- V2 --- Chelsea MKIII Aquatracka Fluorometer s/n 088244
- V3 --- Benthos PSA-916T Altimeter s/n 41302
- V4 --- 2PI PAR (DWIRR) s/n PML10
- V5 --- 2PI PAR (UWIRR) s/n PML9
- V6 --- Wetlabs BBRTD backscatter s/n 182
- V7 --- Chelsea MKII Alphatracka 25cm path Transmissometer s/n 07-6075-001

The additional self-logging instruments were configured as follows:

- RDI Workhorse 300 KHz Lowered ADCP (down-looking master configuration) s/n 12920
- RDI Workhorse 300 KHz Lowered ADCP (up-looking slave configuration) s/n 4275

The LADCP was powered by the NMF battery pack WH002. Battery pack WH005 was also available as a spare, but was not used.

Stainless Steel CTD Seasave Configuration

Date: 10/14/2009

Instrument configuration file: C:\Program Files\Sea-Bird\SeasaveV7\JC039\0528SS.con

Configuration report for SBE 911plus/917plus CTD

Frequency channels suppressed : 0
Voltage words suppressed : 0
Computer interface : RS-232C
Scans to average : 1
NMEA position data added : Yes
NMEA depth data added : No
NMEA time added : No
NMEA device connected to : deck unit
Surface PAR voltage added : No
Scan time added : Yes

1) Frequency 0, Temperature

Serial number : 4116
Calibrated on : 15 September 2009
G : 4.42620661e-003
H : 6.84911159e-004
I : 2.47884077e-005
J : 2.08871587e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

2) Frequency 1, Conductivity

Serial number : 2580
Calibrated on : 10 September 2009
G : -1.03555819e+001
H : 1.52305177e+000
I : 6.34116122e-006
J : 8.63727710e-005
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

3) Frequency 2, Pressure, Digiquartz with TC

Serial number : 73299
Calibrated on : 18 April 2008
C1 : -5.087539e+004
C2 : 2.199664e-002
C3 : 1.589010e-002
D1 : 3.721700e-002
D2 : 0.000000e+000
T1 : 3.011152e+001
T2 : -2.857091e-004
T3 : 4.528990e-006
T4 : -5.484500e-011
T5 : 0.000000e+000
Slope : 0.99983000
Offset : -1.48410
AD590M : 1.282870e-002
AD590B : -9.075590e+000

4) Frequency 3, Temperature, 2

Serial number : 2919
Calibrated on : 25 June 2009
G : 4.31704129e-003
H : 6.44598156e-004
I : 2.29342982e-005
J : 2.16500407e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

5) Frequency 4, Conductivity, 2

Serial number : 2450
Calibrated on : 25 June 2009
G : -1.02038154e+001
H : 1.62601162e+000
I : -1.77216444e-003
J : 2.26880157e-004
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

6) A/D voltage 0, Oxygen, SBE 43

Serial number : 0862
Calibrated on : 10 March 2009
Equation : Sea-Bird
Soc : 4.36200e-001
Offset : -4.99200e-001
A : -1.09340e-003
B : 9.78700e-005

C : -2.32650e-006
E : 3.60000e-002
Tau20 : 1.37000e+000
D1 : 1.92630e-004
D2 : -4.64800e-002
H1 : -3.30000e-002
H2 : 5.00000e+003
H3 : 1.45000e+003

7) A/D voltage 1, Free

8) A/D voltage 2, Fluorometer, Chelsea Aqua 3

Serial number : 088244
Calibrated on : 10 June 2008
VB : 0.222400
V1 : 2.140200
Vacetone : 0.320500
Scale factor : 1.000000
Slope : 1.000000
Offset : 0.000000

9) A/D voltage 3, Altimeter

Serial number : 41302
Calibrated on : 20 April 2007
Scale factor : 15.000
Offset : 0.000

10) A/D voltage 4, PAR/Irradiance, Biospherical/Licor

Serial number : 10
Calibrated on : 14 April 2008
M : 0.49292500
B : 1.01139400
Calibration constant : 100000000000.00000000
Multiplier : 0.99990000
Offset : 0.00000000

11) A/D voltage 5, PAR/Irradiance, Biospherical/Licor, 2

Serial number : 09
Calibrated on : 21 June 2008
M : 0.49602600
B : 1.03304500
Calibration constant : 100000000000.00000000
Multiplier : 0.99990000
Offset : 0.00000000

12) A/D voltage 6, User Polynomial

Serial number : 182
Calibrated on : 20 June 2007
Sensor name : Wetlabs BBRTD
A0 : -0.00003532
A1 : 0.00301900
A2 : 0.00000000
A3 : 0.00000000

13) A/D voltage 7, Transmissometer, Chelsea/Seatech/Wetlab CStar

Serial number : 07-6075-001
Calibrated on : 18 October 2007
M : 23.8781
B : -0.2388
Path length : 0.250

1.2 24-way Titanium CTD Frame

The titanium frame configuration was as follows:

- Sea-Bird 9/11 *plus* Titanium CTD system with fin-mounted secondary sensors
- Sea-Bird SBE-32 Titanium 24 way rosette pylon on NMF 24 way frame
- 24 by 10L custom OTE trace-metal free external spring water samplers

- Sea-Bird SBE-43 oxygen Sensor
- Chelsea MKIII Aquatracka fluorometer
- Chelsea MKII Alphatracka 25cm path transmissometer
- Wetlabs BBRTD 660nm backscatter sensor
- PML Titanium 2PI PAR sensors (UWIRR and DWIRR)
- NMF Titanium LADCP pressure-case battery pack
- RD Instruments Titanium Workhorse 300 KHz lowered ADCP (downward-looking configuration)
- Tritech PA-200 Altimeter

For the 10l Trace-Metal Free bottles, the pressure sensor was located 34cm below the bottom of the water samplers, and 121cm below the top of the water samplers. The 10l niskins are 87cm in height between end-cap seals.

1.2 24-way Titanium CTD Frame Instrument Configuration

The Sea-Bird CTD configuration for the titanium frame was as follows:

- SBE 9 *plus* Underwater unit s/n 09P-39607-0803(T)
- Frequency 0—SBE 3P Temperature Sensor s/n 03P-4593(T) (primary)
- Frequency 1—SBE 4C Conductivity Sensor s/n 04C-3272(T) (primary)
- Frequency 2—Digiquartz Temperature Compensated Pressure Sensor s/n 93896
- Frequency 3—SBE 3P Temperature Sensor s/n 03P-2729 (secondary – fin mounted)
- Frequency 4—SBE 4C Conductivity Sensor s/n 04C-2858 (secondary – fin mounted)
- SBE 5T Submersible Pump s/n 05T-3090 (primary)
- SBE 5T Submersible Pump s/n 05T-3088 (secondary – fin mounted)
- SBE 32 Carousel 24 Position Pylon s/n 32-24680-0346(T)
- SBE 11 *plus* Deck Unit s/n 11P-34173-0676 Main Unit with Powertecnique UPS
- SBE 11 *plus* Deck Unit s/n 11P-24680-0589 Spare Unit

The auxiliary A/D output channels were configured as below (due to incorrectly labelled Y-cables V2/3 and V6/7 usages are transposed from historically used channels):

- V0 --- SBE 43 Oxygen s/n 43-0363 (primary duct - 9+ mounted)
- V1 --- Unused – obsolete oxygen temperature
- V2 --- Chelsea MKIII Aquatracka Fluorometer s/n 088163
- V3 --- Tritech PA-200 Altimeter s/n 6196.112522
- V4 --- 2PI PAR Titanium (DWIRR) s/n 02
- V5 --- 2PI PAR Titanium (UWIRR) s/n 03
- V6 --- Wetlabs BBRTD backscatter s/n 167
- V7 --- Chelsea MKII Alphatracka 25cm path Transmissometer s/n 161-2642-002

The additional self-logging instruments were configured as follows:

- RDI Workhorse 300 KHz Lowered ADCP (down-looking master configuration) s/n 10607(T)

The LADCP was powered by the NMF titanium battery pack WH006T.

Titanium CTD Seasave Configuration

Date: 11/30/2009

Instrument configuration file: C:\Program Files\Sea-Bird\SeasaveV7\JC039\0803Ti.con

Configuration report for SBE 911plus/917plus CTD

Frequency channels suppressed : 0
Voltage words suppressed : 0
Computer interface : RS-232C
Scans to average : 1
NMEA position data added : No
NMEA depth data added : No
NMEA time added : No
Surface PAR voltage added : No
Scan time added : Yes

1) Frequency 0, Temperature

Serial number : 4593
Calibrated on : 13 May 2009
G : 4.35403312e-003
H : 6.44521221e-004
I : 2.17487721e-005
J : 1.75371783e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

2) Frequency 1, Conductivity

Serial number : 3272
Calibrated on : 8 May 2009
G : -1.00975339e+001
H : 1.31198238e+000
I : 1.10268739e-003
J : -2.11166589e-005
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

3) Frequency 2, Pressure, Digiquartz with TC

Serial number : 93896
Calibrated on : 27 May 2008
C1 : -8.331332e+004
C2 : -3.281962e-001
C3 : 2.216060e-002
D1 : 2.906000e-002
D2 : 0.000000e+000
T1 : 3.005232e+001
T2 : -3.843669e-004
T3 : 4.436390e-006
T4 : 0.000000e+000
T5 : 0.000000e+000
Slope : 0.99999000
Offset : -1.39810
AD590M : 1.289250e-002
AD590B : -8.106440e+000

4) Frequency 3, Temperature, 2

Serial number : 2729
Calibrated on : 24 June 2009
G : 4.35537828e-003
H : 6.42165594e-004
I : 2.35810545e-005
J : 2.31730680e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

5) Frequency 4, Conductivity, 2

Serial number : 2858
Calibrated on : 25 June 2009
G : -1.06517898e+001
H : 1.49633490e+000
I : 9.25650766e-004

J : 2.01755698e-005
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

6) A/D voltage 0, Oxygen, SBE 43

Serial number : 0363
Calibrated on : 19 February 2009
Equation : Sea-Bird
Soc : 3.24300e-001
Offset : -6.45200e-001
A : -1.74890e-003
B : 1.44090e-004
C : -3.18240e-006
E : 3.60000e-002
Tau20 : 1.65000e+000
D1 : 1.92630e-004
D2 : -4.64800e-002
H1 : -3.30000e-002
H2 : 5.00000e+003
H3 : 1.45000e+003

7) A/D voltage 1, Free

8) A/D voltage 2, Altimeter

Serial number : 6196.112522
Calibrated on : 1 February 2006
Scale factor : 15.000
Offset : 0.000

9) A/D voltage 3, Fluorometer, Chelsea Aqua 3

Serial number : 88-2960-163
Calibrated on : 20 March 2008
VB : 0.076200
V1 : 1.972220
Vacetone : 0.125600
Scale factor : 1.000000
Slope : 1.000000
Offset : 0.000000

10) A/D voltage 4, PAR/Irradiance, Biospherical/Licor

Serial number : 02
Calibrated on : 12 January 2007
M : 0.48810000
B : 1.05020000
Calibration constant : 100000000000.00000000
Multiplier : 1.00000000
Offset : 0.00000000

11) A/D voltage 5, PAR/Irradiance, Biospherical/Licor, 2

Serial number : 03
Calibrated on : 14 March 2008
M : 0.49395100
B : 1.07795600
Calibration constant : 100000000000.00000000
Multiplier : 0.99990000
Offset : 0.00000000

12) A/D voltage 6, User Polynomial

Serial number : 167
Calibrated on : 13 May 2008
Sensor name : Wetlabs BBRTD
A0 : -0.00040222
A1 : 0.00338000
A2 : 0.00000000
A3 : 0.00000000

13) A/D voltage 7, Transmissometer, Chelsea/Seatech/Wetlab CStar

Serial number : 161-2642-002
Calibrated on : 4 September 1996

M : 23.1142
B : -0.6241
Path length : 0.250

1.2 24-way CTD Frame Deployment Notes

Sensor changes

For the first titanium cast (CTD006t) the primary and secondary temperature and conductivity sensors were transposed due to a cabling error. The CTD006t con file was edited to swap the primary and secondary channels, but the seabird processing software does not allow you to have different sensor serial numbers between the .hex data file and the .con file. Hence the temperature and conductivity serial numbers in CTD006t.con are not as deployed, but the calibration coefficients are. The cabling error was resolved prior to CTD007t. See comments on rough log sheets for clarification.

From the edited CTD006t.con:

1) Frequency 0, Temperature

Serial number : 4593
Calibrated on : 24 June 2009
G : 4.35537828e-003
H : 6.42165594e-004
I : 2.35810545e-005
J : 2.31730680e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

2) Frequency 1, Conductivity

Serial number : 3272
Calibrated on : 25 June 2009
G : -1.06517898e+001
H : 1.49633490e+000
I : 9.25650766e-004
J : 2.01755698e-005
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

4) Frequency 3, Temperature, 2

Serial number : 2729
Calibrated on : 13 May 2009
G : 4.35403312e-003
H : 6.44521221e-004
I : 2.17487721e-005
J : 1.75371783e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

5) Frequency 4, Conductivity, 2

Serial number : 2858
Calibrated on : 8 May 2009
G : -1.00975339e+001
H : 1.31198238e+000
I : 1.10268739e-003
J : -2.11166589e-005
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

During cast CTD026s the fluorimeter on the stainless frame started going to 0V intermittently on the upcast. The problem deteriorated on the following cast (CTD029s) so the cable between the fluorimeter and the Y-cable was replaced. The subsequent cast (CTD032s) showed no problems with the fluorimeter.

However the problem later returned and the fluorimeter went to 0V as soon as the CTD was submerged on cast CTD038s. There was insufficient time to deal with this issue until after the NAG diel station when the Y-cable was

replaced prior to cast CTD050s. The signal was good on deck but once again deteriorated as soon as the CTD was submerged.

Fluorimeter s/n 088244 was replaced with s/n 09-7117-001 prior to the next cast (CTD053s), and no more problems were experienced. It is suspected that 088244 has a worn bulkhead connector and will be serviced after the cruise.

From 0528SS.con from CTD053s:

8) A/D voltage 2, Fluorometer, Chelsea Aqua 3

Serial number : 09-7117-001
Calibrated on : 10 June 2009
VB : 0.136400
V1 : 2.078500
Vacetone : 0.146690
Scale factor : 1.000000
Slope : 1.000000
Offset : 0.000000

During cast CTD061t the fluorimeter on the titanium frame started to exhibit the same problem as experienced on the stainless steel frame. As before, first the fluorimeter cable, then the Y-cable was replaced, but the problem remained. When the Y-cable was replaced prior to cast CTD068t, the altimeter and fluorimeter were on transposed channels. A new con file was created to resolve this for that cast, and the cabling swapped around to use the original con file for CTD070t onwards.

From the edited CTD068t.con:

8) A/D voltage 2, Fluorometer, Chelsea Aqua 3

Serial number : 88-2960-163
Calibrated on : 20 March 2008
VB : 0.076200
V1 : 1.972220
Vacetone : 0.125600
Scale factor : 1.000000
Slope : 1.000000
Offset : 0.000000

9) A/D voltage 3, Altimeter

Serial number : 6196.112522
Calibrated on : 1 February 2006
Scale factor : 15.000
Offset : 0.000

It was noticed than on 200m casts with the titanium frame that the problem did not occur. On the deeper 500m casts it was an issue. Hence the fluorimeters were swapped between the stainless steel and titanium frames prior to casts CTD092t/093s. Hence from this point on, 09-7117-001 was fitted to the titanium frame and 88-2960-163 was fitted to the stainless steel frame. This solution resulted in good fluorescence data for the remainder of the cruise. Fluorimeter s/n 88-2960-163 will be returned along with s/n 088244 post-cruise for replacement of the bulkhead connector and calibration.

From 0803Ti.con for CTD092t on:

9) A/D voltage 3, Fluorometer, Chelsea Aqua 3

Serial number : 09-7117-001
Calibrated on : 10 June 2009
VB : 0.136400
V1 : 2.078500
Vacetone : 0.146690
Scale factor : 1.000000
Slope : 1.000000
Offset : 0.000000

From 0528SS.con for CTD093s on:

8) A/D voltage 2, Fluorometer, Chelsea Aqua 3

Serial number : 088163
Calibrated on : 20 March 2008
VB : 0.076200
V1 : 1.972200

Vacetone : 0.125600
Scale factor : 1.000000
Slope : 1.000000
Offset : 0.000000

The primary conductivity on the titanium frame suddenly shifted ~12mS/cm low at ~410m during the downcast of a 500m cast. This offset increased to ~15mS/cm in the warmer surface water at the end of the cast. No visual sign of fouling was observed. Due to the imminent 30hr diel station, sensor s/n 04c-3272 was replaced with s/n 3567 prior to cast CTD110t. Please note that oxygen concentration will need to be calculated using secondary temperature and salinity data for this cast.

From 0803Ti.con from CTD110t on:

2) Frequency 1, Conductivity

Serial number : 3567
Calibrated on : 5 May 2009
G : -1.04193607e+001
H : 1.25347531e+000
I : -1.56176059e-003
J : 1.57355898e-004
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

Deployment Comments

The traction winch damaged CTD wire due to outhaulers been left off during deployment of the 1300 titanium CTD on 28/11/2009 (day 301). This resulted in the first and only re-termination of the CTD wire during the cruise and resulted in the loss of one station. CTD operations recommenced with the pre-dawn cast on the 29/11/2009 (day 302).

During recovery of CTD090s a hydraulic hose failed for the hydroboom telescope ram. The stainless steel CTD had to be landed on deck instead of the wetlab. A temporary repair was completed by the Deck Engineer to allow the following day's noon CTD to continue without delay. Subsequently the Deck Engineer completed a full repair prior to the next pre-dawn cast. Hence no delays were incurred.

Two stations were cancelled at the southern end of the transect due to heavy weather. The final CTD deployment (CTD120t) was in very marginal swell conditions. There was a lot of package heave and the quality of data from this cast will suffer as a result. During the upcast there was significant slack wire generated to prevent bottle stops shallower than ~60m. Hence all shallower bottles were fired 'on the fly' without stopping.

Both primary and secondary T-C sensors from the titanium frame and the secondary T-C sensors from the stainless steel frame were returned post-cruise for calibration. Conductivity sensor 04c-3567 will not be calibrated as it is a new sensor with no use prior to this cruise, and it only had a few deployments at the end of the cruise.

During the later part of the cruise the EA600 12kHz echo sounder started becoming unreliable with communications being lost with the transceiver unit. As the CTD was only being used for shallow deployments in deep water, this was not a big problem as far as CTD operations go, but did result in the loss of soundings for several stations.

Eventually after a recommended software update by the manufacturer, the EA600 became completely non-functional. The old EA500 10kHz unit from Charles Darwin was subsequently used with no problems, but this data was not logged electronically.

Further Documentation

A sensor information sheet 'JC039 Sensor Information.doc' and calibration & instrument history sheets were included in the main cruise archive in electronic format (Adobe Acrobat & Microsoft Word). Original copies of all log sheets were supplied to the PSO in addition to the copies that NMF will retain. Scanned copies of the CTD and LADCP rough log sheets will be supplied to BODC by NMF.

1. Salinometry

Two Guildline Autosal 8400B salinometers were available for use having serial numbers 65764 and 68426. Unit s/n 65764 was used for all samples with unit s/n 68426 being reserved as a spare.

The main salinometer was located in the Constant Temperature (C.T.) lab and operated at 21°C bath temperature in 19-21°C ambient lab temperature. Problems with temperature stability were frequently encountered at the start of the cruise. The temperature in the CT lab was sometimes varying by 10°C. A clear area was established around the CT temperature sensor, a fan was installed at deck-head height to circulate air around the lab, and the deadlights were closed to prevent solar heat gains. Subequently the lab temperature stability was of the order of +/-1 degree.

However, problems were still encountered with the stability of the Autosal. Both heater lamps were removed for inspection and were found to be very aged even though the unit had been serviced by OSIL prior to the cruise. Both lamps were replaced, and then no more stability issues were experienced. Replacement lamps for the 8400B to replace the spares have been requested for the next cruise.

The CTD and underway samples were taken by the science party and run using the OSIL PC by the NMF technicians. NMF technicians also tabulated the salinity data from the Autosal to create a regression for CTD data. This is included as an annex to this report.

2. RDI Workhorse LADCP Configuration

Three main command files were used during the cruise:

Downlooking Master Workhorse 300 kHz Aluminium Pressure Case WHM_JC039.CMD	**Uplooking Slave Workhorse 300 kHz Aluminium Pressure Case WHM_JC039.CMD**	**Downlooking Master Workhorse 300 kHz Titanium Pressure Case WHM_JC039.CMD**
PS0	PS0	PS0
CR1	CR1	CR1
CF11101	CF11101	CF11101
EA00000	EA00000	EA00000
EB00000	EB00000	EB00000
ED00000	ED00000	ED00000
ES35	ES35	ES35
EX11111	EX11111	EX11111
EZ0011111	EZ0011111	EZ0011111
TE00:00:01.00	TE00:00:01.00	TE00:00:01.00
TP00:01.00	TP00:01.00	TP00:01.00
WM15	WM15	WM15
LD111100000	LD111100000	LD111100000
LF0500	LF0500	LF0500
LN016	LN016	LN016
LP00001	LP00001	LP00001
LS1000	LS1000	LS1000
LV250	LV250	LV250
LJ1	LJ1	LJ1
LW1	LW1	LW1
LZ30,220	LZ30,220	LZ30,220
SM1	SM2	SM1
SA001	SA001	SA001
SW05000	ST0	SW05000
CK	CK	CK
CS	CS	CS

Deployment Comments

The LADCP's were operated by NMF technicians.

Prior to each deployment the BBtalk terminal session was logged to a file named with the format CTDxxxm.txt for the down-looking master, CTDxxxs.txt for the up-looking slave (both for the stainless steel frame) and CTDxxxt.txt for the down-looking titanium CTD, where xxx was the CTD cast number.

Then the following commands were sent:

CB411 – to change baud rate to 9600 for sending the command file
PS0 – to provide an additional check of serial number (also in the command file)
TS? – time set, offset from GPS clock noted and time reset if greater than a few seconds.
RS? – to check flashcard space and re ErAse if necessary
PA and PT200 – pre-deployment and built in self tests
About 10 minutes before the CTD was deployed the command files were sent and BBtalk file logging stopped. Deployment and end of pinging times were recorded on the rough log sheets.

After pinging was stopped, the number of deployments in the recorder was queried with RA? And the most recent file downloaded in the default RDI-xxx.000 name format. The file was then renamed to the form CTDxxxm/s/t.000. All filenames were noted on the rough log sheets.

The battery was fully charged at 58V until it was drawing 100mA between each cast. Every 15-20 casts the battery was vented.

3. Fast Repetition Rate Fluorimeter (FRRF)

CTG FRRF s/n 182043 was deployed on the stainless steel CTD frame along with associated battery pack, PAR sensor and 500m rated pressure sensor. The instrument configuration was as follows:

ATTRIBUTE DATA LOCATED

FLASH
extended speed
2.0
100ns
speed = 200 ns
20 Mbtyes

Detected Flash Card: 20 MB
Flash card manufacturer = Generic
Flash card type = Flash
Flash card size = 20 Mbytes
Flash card attribute memory size = 0
Flash card speed = 200 ns

CHELSEA INSTRUMENTS LTD (C) 1997 - 2000
FASTtracka
Fast Repetition Rate Fluorometer Code - Ver 1.18
FPGA Code - Ver 0.1

==========
System Setup
==========

Fast Repetition Rate Fluorometer - Ver 1.18
FPGA Version - Ver 0.1
Instrument ID - Ser 182043
Flashcard Size - 20 MB
AutoAcquire is ENABLED

Sat Nov 28 12:50:59 2009
System Battery Voltage = 14.47 V
System Current = 0.139 A
Electronics Temp = 8.01 Deg C

A: Set Date and Time
B: Boot protocol slot number - 1
C: AutoAcquire is ENABLED
D: REF Amplifier offset (counts)- 117
E: PMT Amplifier offset (counts)- 125
F: Reserved
G: Reserved
H: F0 analog output scale maximum - 1.000000
I: FM analog output scale maximum - 1.000000
J: PMT calibration threshhold is - 200 counts
K: Ref calibration threshhold is - 200 counts
L: Set PMT gain constants
M: Check PMT calibration
X: Reset to Safe values

==========
Run Menu
==========

1. Discrete Acquire
2. Programmed Acquire
3. View/Edit Current Protocol
4. Save Protocol
5. Restore Protocol

0. to Return:

**** Boot Protocol = 1 ****

6. 65535 Acquisitions

7. 16 Flash sequences per acquisition
8. 100 Saturation flashes per sequence
9. 4 Saturation flash duration (in instrument units)
A. 0 Saturation interflash delay (in instrument units)
B. DISABLED Relaxation flashes
C. 20 Relaxation flashes per sequence
D. 4 Relaxation flash duration (in instrument units)
E. 120 Relaxation interflash delay (in instrument units)
F. 30 ms Sleeptime between acquisition pairs
G. 16 PMT Gain in Autoranging Mode
H. DISABLED Analog Output
I. DISABLED Desktop (verbose) Mode
J. ACTIVE Light Chamber (A)
K. ACTIVE Dark Chamber (B)
L. ENABLED Logging mode to internal flashcard
M: 80 Upper Limit Autoranging Threshold value
N: 20 Lower Limit Autoranging Threshold value

FRRF data was downloaded using binary xmodem terminal sessions with filenames of the form CTDxxxs_frrf.bin, where xxx was the CTD cast number. After downloading, the data was reduced using FRF.exe using the cal file DF182043.20090724.txt. The reduced data files are of the form CTDxxxs_frrf.csv. The calibration and software disk was included in the cruise archive in the cals subfolder of the FRRF data folder.

An FRRF profile was obtained from each of the 38 stainless steel CTD casts, but the flashcard on the FRRF ran out of space on cast CTD035s, hence a full FRRF profile was not obtained for this cast.

4. ISW MSS-90L Microstructure Turbulence Profiler

The MSS-90L system was used opportunistically at both the NAG and SAG sites. The winch was mounted on the rail in the starboard quarter, and the deckbox and computer in the deck workshop. A total of 18 casts were completed over 4 deployments. The first two deployments suffered from a non-functioning shear 2 channel, which took a lot of effort to resolve. The third deployment resulted in good data. The fourth and final deployment captured some interesting structure between 150 and 250m, but unfortunately the temperature sensor cover was not removed and hence the temperature data will be compromised.

Start of aborted NAG 30hr Diel Station on 28/10/2009 ~23 deg 13'N / 040 deg 43'W
0.7kts with both props turning. SH2 not functioning. SH1 – 6001 / SH2 – 6091

Cast Number	Start Time	End Time	Max Depth
1	04:15:00	04:18:35	150m
2	04:24:30	04:26:15	150m
3	04:32:03	04:37:15	150m
4	04:42:37	04:46:41	150m
5	04:53:18	04:55:28	150m

Start of proper NAG 30hr Diel Station on 29/10/2009 ~ 21 deg 8'N / 039 deg 14'W
0.9kts with stbd prop disabled. SH2 intermittently started working, so recoveries logged as well. Initally went to 250m to respool low-tension cable on winch, then to 200m then 150m to see if SH2 problem was pressure related. SH1 - 6001 / SH2 – 6091

Cast Number	Start Time	End Time	Max Depth
1	04:16:00	04:20:00	150m (continued to 250m to respool winch)
2	04:30:30	04:36:00	200m
2 (recovery)	04:36:00	04:40:00	200m
3 (including recovery)	04:43:47	04:50:00 (04:57:00)	150m

Start of SAG 30hr Diel Station on 12/11/2009 ~13 deg 39'S / 025 deg 0'W
0.9kts with stbd prop disabled. SH2 sensor (6091) fitted as SH1 for diagnostics, 6001 replaced with 6090 in SH2 position as 6001 seemed to be low sensitivity, crushed internal wiring between SH2 head amp and main board replaced, SH2 head amp had lots of dry solder joints, all accessible joints reworked. Both shear probes now working. SH1 - 6091 / SH2 – 6090. All inboard 0408.

Cast Number	Start Time	End Time	Max Depth
1	03:05:45	03:10:00	150m
2	03:16:15	03:20:45	150m
3	03:26:50	03:31:00	150m
4	03:37:10	03:41:30	150m
5	03:47:22	03:51:50	150m
6	03:57:50	04:02:10	150m

End of SAG 30hr Diel Station on 13/11/2009 ~14 deg 2'S / 025 deg 12'W
0.9kts with stbd prop disabled. Both shear probes still working. Interesting structure near bottom of first cast at 150m, so final three casts continued to 250m. Temp probe cover inadvertently left on for this deployment, so temperature data suspect. SH1 - 6091 / SH2 – 6090.

AMT19 Cruise Report

Cast Number	Start Time	End Time	Max Depth
1	11:41:40	~11:46	150m
2	11:51:12	~12:00	250m
3	12:05:44	~12:13	250m
4	12:21:10	~12:29	250m

Mechanical report

NEIL SLOAN
Base Engineering.

NMFU 200 206-2 Chemistry Container

- A/C Failed after 5 weeks due to A/C control module Breaking. No serviceable Spare to repair A/C. Signs of water ingress on circuit board.

NMFU 200 222-6 Cook Chemistry Container

- Initial A/C problem but was track down to be a low flow on the cooling.
- A/C has been temperamental through out the cruise it will trip the high pressure switch. And once reset will work again fine.
- Window's leak when there was heavy rain.
- Inner lobby door handle broke off. Was repaired, but new handled needed.

NMFU 200 224-7 Cook RN Container

- A/C failed due to under rated relay in switch board. A/C was fixed by bypassing the relay and hard wiring straight into the break.
- Strip light failed to work.
- Main door handle broke off. Was repaired, but new handled needed.

NMFU 200 207-8 RN Container

- A/C was heavily icing up. Refrigeration gas checked, there was sufficient and air flow was good. The temperature control module was temperamental. Would not go to set temperature and would display different temp. In need of replacement temperature control module. This may also help with the icing problem.

NMFU 200 205-7 RN Container

- A/C would become heavily iced up, preventing cooled air to be blown into the container. The problem was overcome by turning the unit of when the container was not in use allowing the unit to de-ice.

LN2-03 YELLOW

- Dewar tank gauge stop working about 3 weeks into the cruise. The pipe's that feed the gauge where check for blocks but where clear.
- Dewar feed gauges would not hold set pressure. Replacement fitted which solved the problem.

LN2-01 BLUE

- LN2 was started and left to produce for 36 hours. At this the point was still reading 0, so the dewar was check for liquid nitrogen, to make sure the gauge was not in fault. All filters where changed in the filter bank, but this did not rectify the problem. CP415 charcoal filter was replaced to no effect. The cold head was then inspected; on removal there was a sound of a metal object rattling around inside the cold head. On disassembly a screw was found loose at the bottom of the piston chamber. This had come loose from the piston. The damaged caused by the screw was to the bottom end of the piston and the copper element. The cold head was rebuilt and placed back in the system. Subsequently the LN2 has generated liquid nitrogen satisfactorily.

MILLIPORE water system

- MILLI-Q started to come up with alarm saying FLOW AUTO STOP. So after trying the procedures written down in the manual to rectify the problem the Q-POD was changed the problem still occurred. The main MILLI-Q system was changed for spare. Problem then went away, but then the Q-POD would not always dispense. The Q-POD needed resetting regularly (by pulling the lead out). Millipore technical service was contacted and they gave advice, which also did not help to rectify the problem. See attached email.

- During bad weather the Q-POD dispensing nozzle was dislodged and fell into a bucket of water, which had been left full bellow it. This damaged the switch inside the nozzle preventing the unit working. Both Q-Pods were taken apart and the original Q-POD Nozzle attached to the replacement Q-POD Base. This worked although the flow would not stop when the button on the dispenser was pressed. The system now has to be turned into standby to stop dispensing of MILLI-Q water.

SR3 Slip Ring Winch

- Slight leak to control block lever.

2T Danfoss GP Winch

- All worked well.

Heila HLM25 deck mounted HYAB crane "SuperCrane"

- One word "super"!

AMT19 Event Log

Event No.	Date	Station	Latitude	Longitude	Depth (m)	Time IN (GMT)	Time OUT (GMT)	Activity	Comments
1	13.10.09	JC039001	49°49.96N	05°27.41W	84	1600	1624	CTD001 - S	SHAKEDOWN
2	14.10.09	JC039002	49°34.02N	08°38.01W	145	0434	0524	CTD002 – S	
3	14.10.09	JC039002	49°34.02N	08°38.01W	145	0442	0456	NET001	
4	14.10.09	JC039003	49°26.0N	10°32.0W	142	1243	1325	CTD003 – S	
5	14.10.09	JC039003	49°26.0N	10°32.0W	142	1247	1302	OPTICS001	
15.10.09 0200 CLOCKS RETARDED 1 HOUR TO Z									
6	15.10.09	JC039004	48°56.91N	14°27.59W	4630	0439	0544	CTD004 – S	
7	15.10.09	JC039004	48°56.91N	14°27.59W	4630	0444	0550	NET002	
7a	15.10.09	JC039004	48°56.91N	14°27.59W	4630	0505	0550	NET003	
8	15.10.09	JC039004	48°56.91N	14°27.59W	4630	0623	0657	CTD005 - S	
9	15.10.09	JC039004	48°56.91N	14°27.59W	4629	0827	0842	CTD006 – T	
15.10.09 0857 – 1338 DeepTow Winch Trial									
10	15.10.09	JC039005	48°56.91N	14°27.59W	4629	1414	1445	OPTICS002	
16.10.09 0132 On Station in prep. for Shrimp deployment abandoned 1606									
11	16.10.09	JC039006	49°00.00N	16°40.00W	4808	0435	0513	CTD007 – T	PAP Site
12	16.10.09	JC039006	49°00.00N	16°40.00W	4808	0439	0507	NET004	
13	16.10.09	JC039006	49°00.00N	16°40.00W	4810	0538	0640	CTD008 – S	
14	16.10.09	JC039006	49°00.00N	16°40.00W	4810	0940	1010	CTD009 – S	
15	16.10.09	JC039006	49°00.00N	16°40.00W	4810	1337	1413	OPTICS 003	
16	16.10.09	JC039006	49°00.00N	16°40.00W	4810	1419	1545	OPTICS 004	
17	17.10.09	JC039007	47°17.21N	18°02.52	4542	0459	0536	CTD010 - T	
18	17.10.09	JC039007	47°17.22N	18°02.51W	4542	0503	0524	NET005	
19	17.10.09	JC039007	47°17.22N	18°02.51W	4542	0556	0650	CTD011-S	
20	17.10.09	JC039007	47°17.22N	18°02.51W	4542	0602	0618	NET006	
21	17.10.09	JC039008	46°20.3N	18°48.1W	4422	1341	1445	CTD012-T	
22	17.10.09	JC039008	46°20.3N	18°48.1W	4422	1341	1409	OPTICS005	
23	17.10.09	JC039008	46°20.3N	18°48.1W	4422	1412	1443	OPTICS006	
24	18.10.09	JC039009	44°14.50N	20°24.01W	3847	0440	0511	CTD013-T	
25	18.10.09	JC039009	44°14.53N	20°24.06W	3847	0446	0502	NET007	

Event No.	Date	Station	Latitude	Longitude	Depth (m)	Time IN (GMT)	Time OUT (GMT)	Activity	Comments
26	18.10.09	JC039009	44°14.61N	20°24.17W	3847	0540	0626	CTD014-S	
27	18.10.09	JC039009	44°14.62N	20°24.18W	3847	0542	0607	NET008	
28	18.10.09	JC039010	43°12.9N	21°10.5W	4282	1342	1412	OPTICS007	
29	18.10.09	JC039010	43°12.9N	21°10.5W	4282	1347	1434	CTD015-T	
30	18.10.09	JC039010	43°12.9N	21°10.5W	4282	1414	1439	OPTICS008	
31	18.10.09	JC039010	43°12.9N	21°10.5W	4282	1459	1517	11MNET001	
32	19.10.09	JC039011	41°15.23N	22°36.25	4146	0444	0524	CTD016-T	
33	19.10.09	JC039011	41°15.23N	22°36.25	4146	0448	0504	NET009	
34	19.10.09	JC039011	41°15.23N	22°36.25	4224	0549	0642	CTD017-S	
35	19.10.09	JC039011	41°15.23N	22°36.25	4224	0553	0613	NET010	
36	19.10.09	JC039012	40°19.4N	23°16.3W	4037	1333	1417	CTD018-T	
37	19.10.09	JC039012	40°19.4N	23°16.3W	4037	1334	1404	OPTICS009	
38	19.10.09	JC039012	40°19.4N	23°16.3W	4037	1408	1436	OPTICS010	
39	20.10.09	JC039013	38°19.29N	24°39.91W	3400	0438	0522	CTD019-T	
40	20.10.09	JC039013	38°19.27N	24°40.00W	3400	0447	0502	NET011	
41	20.10.09	JC039013	38°19.14N	24°40.08W	3400	0544	0637	CTD020-S	
42	20.10.09	JC039013	38°19.13N	24°40.09W	3400	0549	0614	NET012	
20.10.09 1330 Arrival off Ponta Delgada Port entrance 21.10.09 0718 Leave Ponta Delgada; Set course 227˚ T									
43	21.10.09	JC03914	37°06.1N	26°29.3	2692	1305	1332	OPTICS011	
44	21.10.09	JC03914	37°06.1N	26°29.3	2692	1307	1400	CTD021-T	
45	21.10.09	JC03914	37°06.1N	26°29.3	2692	1336	1404	OPTICS12	
46	21.10.09	JC03914	37°06.1N	26°29.3	2692	1414	1437	11MNET002	
22.10.09 0200 CLOCKS RETARDED 1 HOUR TO Z-1									
47	22.10.09	JC03915	35°27.30N	28°38.73W	3597	0536	0517	CTD022-T	
48	22.10.09	JC03915	35°27.29N	28°38.74W	3597	0539	0455	NET013	
49	22.10.09	JC03915	35°27.01N	28°38.74W	3578	0638	0729	CTD023-S	
50	22.10.09	JC03915	35°26.98N	28°38.74W	3578	0643	0705	NET014	
51	22.10.09	JC03915	35°26.76N	28°38.74W	3578	0733	0748	TRICHNET01	
52	22.10.09	JC03916	34°43.4N	29°35.3W	3540	1359	1456	CTD024T	
53	22.10.09	JC03916	34°43.4N	29°35.3W	3540	1359	1424	OPTICS013	
54	22.10.09	JC03916	34°43.4N	29°35.3W	3540	1428	1451	OPTICS014	

Event No.	Date	Station	Latitude	Longitude	Depth (m)	Time IN (GMT)	Time OUT (GMT)	Activity	Comments
55	22.10.09	JC03916	34°43.4N	29°35.3W	3540	1458	1514	11MNET03	
Ships speed to 9 knots max until 15°N in order to maximise station occupation in N gyre.									
56	23.10.09	JC03917	33°25.19N	31°15.38W	3319	0539	0621	CTD025-T	
57	23.10.09	JC03917	33°25.19N	31°15.37W	3319	0542	0557	NET015	NET LOST – ROPE PARTED
58	23.10.09	JC03917	33°25.19N	31°15.38W	3319	0641	0728	CTD026-S	
59	23.10.09	JC03918	32°52.2N	31°56.7W	3565	1413	1513	CTD027-T	
60	23.10.09	JC03918	32°52.2N	31°56.7W	3565	1444	1515	OPTICS015	
61	24.10.09	JC03919	31°25.68N	33°44.17N	3916	0537	0613	CTD028-T	
62	24.10.09	JC03919	31°25.70N	33°44.19N	3916	0542	0553	NET016	
63	24.10.09	JC03919	31°25.71N	33°44.20N	3911	0630	0714	CTD29-S	
64	24.10.09	JC03919	31°25.76N	33°44.24N	3916	0635	0700	NET017	
65	24.10.09	JC03919	31°25.82N	33°44.29N	3916	0717	0732	TRICHNET02	
66	24.10.09	JC03920	30°44.7N	34°29.0W	4455	1358	1424	OPTICS16	
67	24.10.09	JC03920	30°44.7N	34°29.0W	4455	1359	1458	CTD030-T	
68	24.10.09	JC03920	30°44.7N	34°29.0W	4455	1428	1453	OPTICS17	
69	24.10.09	JC03920	30°44.7N	34°29.0W	4455	1500	1513	TRICHNET03	
70	24.10.09	JC03920	30°44.7N	34°29.0W	4455	1522	1540	11MNET04	
71	25.10.09	JC03921	29°11.17N	35°59.34W	4493	0533	0612	CTDO31-T	
72	25.10.09	JC03921	29°11.13N	35°59.30W	4493	0538	0549	NET018	
73	25.10.09	JC03921	29°10.88N	35°59.05W	4493	0635	0730	CTD032-S	
74	25.10.09	JC03921	29°10.88N	35°59.05W	4493	0639	0657	NET019	
75	25.10.09	JC03922	28°28.7N	36°40.8W	4450	1359	1425	OPTICS18	
76	25.10.09	JC03922	28°28.7N	36°40.8W	4450	1400	1500	CTD033-T	
77	25.10.09	JC03922	28°28.7N	36°40.8W	4450	1430	1452	OPTICS19	
78	25.10.09	JC03922	28°28.7N	36°40.8W	4450	1500	1512	TRICHNET04	
79	25.10.09	JC03922	28°28.7N	36°40.8W	4450	1520	1537	11MNET05	
80	26.10.09	JC03923	27°13.00N	37°53.00W	>4000	0534	0612	CTD034-T	
81	26.10.09	JC03923	27°12.97N	37°53.18W	>4000	0537	0549	NET020	
82	26.10.09	JC03923	27°13.91N	37°53.18W	>4000	0627	0718	CTD035-S	
83	26.10.09	JC03923	27°12.87N	37°53.19W	>4000	0632	0652	NET021	
84	26.10.09	JC03923	27°13.00N	37°53.00W	>4000	0742	0828	SHRIMP	SHRIMP INTEMITTENT FAULT. ABANDONED

Event No.	Date	Station	Latitude	Longitude	Depth (m)	Time IN (GMT)	Time OUT (GMT)	Activity	Comments
85	26.10.09	JC03923	27°13.00N	37°53.00W	>4000	1013	1153	SHRIMP	STATION ABANDONED
86	26.10.09	JC03924	27°01.4N	38°03.2W	4804	1359	1423	OPTICS20	
87	26.10.09	JC03924	27°01.4N	38°03.2W	4804	1400	1453	CTD0036-T	
88	26.10.09	JC03924	27°01.4N	38°03.2W	4804	1426	1448	OPTICS21	
89	26.10.09	JC03924	27°01.4N	38°03.2W	4804	1454	1505	TRICHNET05	
90	27.10.09	JC03925	25°23.50N	39°36.03W	4359	0536	0614	CTD0037-T	
91	27.10.09	JC03925	25°23.50N	39°36.03W	4359	0540	0551	NET022	
92	27.10.09	JC03925	25°23.49N	39°36.14W	4359	0632	0721	CTD0038-S	
93	27.10.09	JC03925	25°23.48N	39°36.15W	4359	0635	0653	NET023	
94	27.10.09	JC03926	24°39.1N	40°17.0W	4300	1400	1426	OPTICS022	
95	27.10.09	JC03926	24°39.1N	40°17.0W	4300	1401	1500	CTD0039	
96	27.10.09	JC03926	24°39.1N	40°17.0W	4300	1429	1451	OPTICS023	
97	27.10.09	JC03926	24°39.1N	40°17.0W	4300	1502	1514	TRICHNET06	Lot of Trichodesmium
98	27.10.09	JC03926	24°39.1N	40°17.0W	4300	1521	1537	11MNET06	
28.10.09 0300 DIEL STATION 01									
99	28.10.09	JC03927	23°13.7N	40°43.1W	4682	0356	0505	TURBULENCE PROBE	FAULTY SHEAR PROBE.
100	28.10.09	JC03927	23°12.90N	40°43.05W	4682	0526	0530	DEPLOY DRIFTER	LIGHT DAMAGED AND NO GPS SIGNAL ON DEPLOYMENT. RECOVER.
101	28.10.09	JC03927	23°12.870N	40°43.08W	4682	0537	0846	DEPLOY DRIFTER	
102	28.10.09	JC03927	23°13.25N	40°43.05W	4682	0630	0708	CTD0040-T	
103	28.10.09	JC03927	23°13.25N	40°43.08W	4682	0634	0640	NET024	
104	28.10.09	JC03927	23°13.26N	40°43.08W	4682	0729	0819	CTD0041-S	
105	28.10.09	JC03927	23°13.52N	40°43.17W	4682	0734	0753	NET025	
HUGE AMOUNT OF BUBBLES IN TM-FISH SUPPLY, WHICH COULD NOT BE CLEARED. CRITICAL TO SAMPLING PROTOCOL OF OVOC DIEL CYCLE. STATION ABANDONDED.									
28.10.09 1402 ON STATION. CTD CABLE DAMAGED IN WINCH ROOM. ABANDON CTD FOR RE-TERMINATION OF CABLE									
106	28.10.09	JC03928	23°35.9N	40°16.5W	>4000	1412	1434	OPTICS024	
107	28.10.09	JC03928	23°36.0N	40°16.6W	>4000	1436	1501	OPTICS025	
108	28.10.09	JC03928	23°36.0N	40°16.6W	>4000	1504	1515	TRICHNET07	
109	28.10.09	JC03928	23°36.0N	40°16.6W	>4000	1523	1533	11MNET07	
29.10.09 0359 DIEL STATION 01 – SECOND ATTEMPT. OVOC SAMPLING FROM CTD									
110	29.10.09	JC03929	21°08.2N	39°14.8W	5512	0407	0458	TURBULENCE PROBE	SHEAR PROBE STILL FAULTY
111	29.10.09	JC03929	21°07.70N	39°14.43	5512	0515		DEPLOY DRIFTER	

Event No.	Date	Station	Latitude	Longitude	Depth (m)	Time IN (GMT)	Time OUT (GMT)	Activity	Comments
112	29.10.09	JC03929	21°08.01N	39°14.52W	5512	0600	0608	CTD-SURF01	CTDs SURFXX ONLY TO 5M FOR WATER COLLECTION. NO DATA FILES
113	29.10.09	JC03929	21°08.01N	39°14.52W	5512	0620	0703	CTD0042-T	
114	29.10.09	JC03929	21°08.01N	39°14.52W	5512	0625	0638	NET026	
115	29.10.09	JC03929	21°07.91N	39°14.91W	5213	0727	0804	CTD0O43-T	
116	29.10.09	JC03929	21°07.91N	39°14.92W	5213	0731	0754	NET027	
117	29.10.09	JC03929	21°07.98N	39°14.82W	5213	0807	0821	TRICHNET08	
118	29.10.09	JC03929	21°07.58N	39°15.22W	5213	0902	0907	CTD-SURF02	
119	29.10.09	JC03929	21°07.26N	39°15.53W	5213	1001	1007	CTD-SURF03	
120	29.10.09	JC03929	21°07.2N	39°15.81W	5213	1056	1109	NET028	
121	29.10.09	JC03929	21°07.2N	39°15.81W	5213	1058	1103	CTD-SURF04	
122	29.10.09	JC03929	21°07.2N	39°15.81W	5213	1116	1127	TRICHNET09	
123	29.10.09	JC03929	21°07.2N	39°15.77W	5213	1155	1203	CTD-SURF05	
124	29.10.09	JC03929	21°07.2N	39°16.1W	5213	1257	1303	CTD-SURF06	
125	29.10.09	JC03929	21°07.2N	39°16.1W	5213	1357	1403	CTD-SURF07	
126	29.10.09	JC03929	21°07.2N	39°16.1W	5213	1357	1420	OPTICS026	
127	29.10.09	JC03929	21°07.2N	39°16.1W	5213	1415	1421	CTD044-T	
128	29.10.09	JC03929	21°07.2N	39°16.1W	5495	1423	1447	OPTICS028	
129	29.10.09	JC03929	21°07.2N	39°16.1W	5495	1502	1512	TRICHNET10	
130	29.10.09	JC03929	21°07.2N	39°16.1W	5495	1520	1533	11MNET08	
131	29.10.09	JC03929	21°07.32N	39°16.1W	5495	1600	1607	CTD-SURF08	
132	29.10.09	JC03929	21°07. 2N	39°16.8W	5495	1658	1706	CTD-SURF09	
133	29.10.09	JC03929	21°07.25N	39°17.47W	5495	1800	1806	CTD-SURF10	
134	29.10.09	JC03929	21°07.25N	39°17.47W	5495	1800	1814	NET029	
135	29.10.09	JC03929	21°07.25N	39°17.45W	5495	1820	1833	TRICHNET11	
136	29.10.09	JC03929	21°07.24N	39°17.58W	5495	1914	2007	CTD045-T	
137	29.10.09	JC03929	21°07.45N	39°18.55W	5230	2304	2318	NET030	
138	29.10.09	JC03929	21°07.45N	39°18.55W	5230	2305	2310	CTD-SURF11	
139	29.10.09	JC03929	21°07.45N	39°18.55W	5230	2324	2339	TRICHNET12	
140	30.10.09	JC03929	21°08.0N	39°18.4W	5230	0159	0205	CTD-SURF12	
141	30.10.09	JC03929	21°08.0N	39°18.4W	5230	0500	0508	CTD-SURF13	
142	30.10.09	JC03929	21°07.95N	39°18.43W	5230	0601	0605	CTD-SURF14	

Event No.	Date	Station	Latitude	Longitude	Depth (m)	Time IN (GMT)	Time OUT (GMT)	Activity	Comments
143	30.10.09	JC03929	21°07.95N	39°18.43W	5230	0618	0633	NET031	
144	30.10.09	JC03929	21°07.95N	39°18.43W	~4800	0629	0703	CTD0046-T	
145	30.10.09	JC03929	21°07.95N	39°18.43W	~4800	0638	0652	NET032	
146	30.10.09	JC03929	21°07.95N	39°18.43W	~4800	0709	0723	TRICHNET13	
147	30.10.09	JC03929	21°07.95N	39°18.33W	~4800	0736	0806	CTD0047-T	
148	30.10.09	JC03929	21°07.42N	39°18.00W	~4800	0901	0904	CTD-SURF15	
149	30.10.09	JC03929	21°07.42N	39°19.00W	~4800	1000	1004	CTD-SURF16	
150	30.10.09	JC03929	21°07.36N	39°19.04W	~4800	1101	1105	CTD-SURF17	
151	30.10.09	JC03929	21°07.26N	39°19.04W	~4800	1159	1203	CTD-SURF18	
30.10.09 1115 – RECOVER DRIFTER, DEPART DIEL STATION 1									
152	30.10.09	JC03930	20°56.2N	39°10.0		1400	1423	OPTICS028	
153	30.10.09	JC03930	20°56.2N	39°10.0		1415	1451	CTD0048-T	
154	30.10.09	JC03930	20°56.2N	39°10.0		1426	1445	OPTICS029	
155	30.10.09	JC03930	20°56.2N	39°10.0		1452	1504	TRICHNET14	
156	30.10.09	JC03930	20°56.2N	39°10.0		1510	1522	11MNET09	
157	31.10.09	JC03931	19°08.64N	37°51.83	5238	0602	0638	CTD0049-T	
158	31.10.09	JC03931	19°08.64N	37°51.83	5238	0607	0622	NET033	
159	31.10.09	JC03931	19°08.64N	37°51.83	5238	0658	0748	CTD0050-S	
160	31.10.09	JC03931	19°08.64N	37°51.83	5238	0702	0720	NET034	
161	31.10.09	JC03932	18 °25.1N	37°21.6W	5748	1357	1418	OPTICS030	
162	31.10.09	JC03932	18 °25.1N	37°21.6W	5748	1400	1449	CTD0051-T	
163	31.10.09	JC03932	18 °25.1N	37°21.6W	5748	1422	1451	OPTICS031	
164	31.10.09	JC03932	18 °25.1N	37°21.6W	5748	1454	1507	TRICHNET15	
165	31.10.09	JC03932	18 °25.1N	37°21.6W	5748	1515	1529	11MNET10	
166	01.11.09	JC03933	16°34.08N	36°05.85W	5034	0641	0717	CTD052-T	
167	01.11.09	JC03933	16°34.08 N	36°05.86W	5034	0644	0658	NET35	
168	01.11.09	JC03933	16°34.08 N	36°05.85W	5034	0737	0828	CTD0053-S	
169	01.11.09	JC03933	16°34.08 N	36°05.85W	5034	0744	0805	NET36	
170	01.11.09	JC03934	15°55.5 N	35°39.7 W	4992	1359	1419	OPTICS032	
171	01.11.09	JC03934	15°55.5 N	35°39.7 W	4992	1400	1454	CTD0054-T	
172	01.11.09	JC03934	15°55.5 N	35°39.7 W	4992	1423	1445	OPTICS033	

Event No.	Date	Station	Latitude	Longitude	Depth (m)	Time IN (GMT)	Time OUT (GMT)	Activity	Comments
173	01.11.09	JC03934	15°55.5 N	35°39.7 W	4992	1455	1509	TRICHNET 16	
174	02.11.09	JC03935	14°09.10 N	34°27.39 W		0533	0603	CTD0055-T	
175	02.11.09	JC03935	14°09.14 N	34°27.40 W		0542	0555	NET37	
176	02.11.09	JC03935	14°09.23 N	34°27.42 W	5971	0620	0708	CTD0056-S	
177	02.11.09	JC03935	14°09.30 N	34°27.43 W	5971	0624	0645	NET38	
178	02.11.09	JC03936	13°20.9 N	33°54.9 W	5963	1358	1423	OPTICS034	
179	02.11.09	JC03936	13°20.9 N	33°54.9 W	5963	1401	1454	CTD0057-T	
180	02.11.09	JC03936	13°20.9 N	33°54.9 W	5963	1427	1451	OPTICS035	
181	02.11.09	JC03936	13°20.9 N	33°54.9 W	5963	1456	1509	TRICHNET 17	
182	03.11.09	JC03937	11°27.93 N	32°38.74 W	5379	0539	0609	CTD0058-T	
183	03.11.09	JC03937	11°27.94 N	32°38.74 W	5379	0542	0558	NET39	
184	03.11.09	JC03937	11°28.02 N	32°38.78 W	5394	0625	0709	CTD0059-S	
185	03.11.09	JC03937	11°28.02 N	32°38.78 W	5394	0627	0646	NET40	
186	03.11.09	JC03938	10°33.8 N	32°02.4 W	5132	1359	1417	OPTICS036	
187	03.11.09	JC03938	10°33.8 N	32°02.4 W	5132	1400	1455	CTD0060-T	
188	03.11.09	JC03938	10°33.8 N	32°02.4 W	5132	1420	1438	OPTICS037	
189	03.11.09	JC03938	10°33.8 N	32°02.4 W	5132	1456	1509	TRICHNET18	
190	03.11.09	JC03938	10°33.8 N	32°02.4 W	5132	1518	1531	11MNET11	
191	04.11.09	JC03939	09°00.9 N	31°00.6 W	5378	0338	1100	SHRIMP1	
192	04.11.09	JC03940	08°48.3 N	30°52.0 W	5373	1401	1422	OPTICS038	
193	04.11.09	JC03940	08°48.3 N	30°52.0 W	5373	1402	1455	CTD0061-T	
194	04.11.09	JC03940	08°48.3 N	30°52.0 W	5373	1425	1446	OPTICS039	
195	04.11.09	JC03940	08°48.3 N	30°52.0 W	5373	1509	1512	TRICHNET 19	
196	05.11.09	JC03941	06°49.78 N	29°32.84 W	4242	0537	0611	CTD 0062-T	
197	05.11.09	JC03941	06°49.81 N	29°32.83 W	4242	0542	0556	NET 041	
198	05.11.09	JC03941	06°50.04 N	29°32.75 W	4252	0629	0709	CTD 0063-S	
199	05.11.09	JC03941	06°50.23 N	29°32.67 W	4252	0632	0647	NET 042	
200	05.11.09	JC03942	05°56.9 N	28°57.5 W	3860	1400	1424	OPTICS 040	
201	05.11.09	JC03942	05°56.9 N	28°57.5 W	3860	1402	1455	CTD 0064-T	
202	05.11.09	JC03942	05°56.9 N	28°57.5 W	3860	1427	1449	OPTICS 041	
203	05.11.09	JC03942	05°56.9 N	28°57.5 W	3860	1456	1509	TRICHNET 20	

Event No.	Date	Station	Latitude	Longitude	Depth (m)	Time IN (GMT)	Time OUT (GMT)	Activity	Comments
204	05.11.09	JC03942	05°56.9 N	28°57.5 W	3860	1516	1529	11MNET 12	
205	06.11.09	JC03943	04°03.09 N	27°41.67 W	4053	0534	0612	CTD 0065-T	
206	06.11.09	JC03943	04°03.11 N	27°41.67 W	4053	0539	0554	NET 043	
207	06.11.09	JC03943	04°03.21 N	27°41.65 W	4076	0628	0711	CTD 0066-S	
208	06.11.09	JC03943	04°03.09 N	27°41.67 W	4076	0632	0656	NET 044	
209	06.11.09	JC03944	03°09.5 N	27°05.9 W	4245	1359	1419	OPTICS 42	
210	06.11.09	JC03944	03°09.5 N	27°05.9 W	4245	1400	1454	CTD 0067-T	
211	06.11.09	JC03944	03°09.5 N	27°05.9 W	4245	1423	1442	OPTICS 43	
212	06.11.09	JC03944	03°09.5 N	27°05.9 W	4245	1455	1507	TRICHNET 21	
213	06.11.09	JC03944	03°09.5 N	27°05.9 W	4245	1512	1528	11MNET 13	
214	07.11.09	JC03945	01°16.26 N	25°50.80 W	3729	0534	0610	CTD 0068-T	
215	07.11.09	JC03945	01°16.26 N	25°50.80 W	3729	0537	0552	NET 045	
216	07.11.09	JC03945	01°16.22 N	25°50.95 W	3729	0627	0710	CTD 0069-S	
217	07.11.09	JC03945	01°16.22 N	25°50.95 W	3729	0629	0649	NET 046	
218	07.11.09	JC03946	00°36.57 N	25°23.89 W		1226	1239	NET 047	TRICHNET????
219	07.11.09	JC03946	00°36.57 N	25°23.89 W		1244	1304	OPTICS 44	
220	07.11.09	JC03946	00°36.57 N	25°23.89 W		1307	1330	OPTICS 45	
Crossed Equator at 0° 00.00, 24° 59.93 W – 1810 (z) 07.11.09									
221	08.11.09	JC03947	02°02.86 S	24°59.59 W	4852	0710	0752	CTD 0070-T	
222	08.11.09	JC03947	02°02.86 S	24°59.59 W	4852	0715	0727	NET 048	
223	08.11.09	JC03947	02°02.59 S	24°59.36 W	4820	0807	0850	CTD 0071-S	
224	08.11.09	JC03947	02°02.58 S	24°59.34 W	4820	0811	0828	NET 049	
225	08.11.09	JC03948	02°50.08 S	25°00.1 W	5433	1400	1421	OPTICS 46	
226	08.11.09	JC03948	02°50.08 S	25°00.1 W	5433	1401	1501	CTD 0072-T	LONG-LINE ATTACHED TO CTD – RELOCATE STATION
227	08.11.09	JC03948	02°50.08 S	25°00.1 W	5433	1424	1443	OPTICS 47	
228	08.11.09	JC03948	02°52.68 S	25°00.25 W	5433	1523	1527	TRICHNET 22	ABORTED. LEAK TO PISTON ON CRANE
229	08.11.09	JC03948	02°50.08 S	25°00.1 W	5433	1546	2343	SHRIMP 2	
230	09.11.09	JC03949	03°50.49 S	25°00.09 W	5426	0534	0608	CTD 0073-T	
231	09.11.09	JC03949	03°50.49 S	25°00.09 W	5426	0538	0553	NET 050	
232	09.11.09	JC03949	03°50.37 S	25°00.00 W	5417	0623	0704	CTD 0074-S	
233	09.11.09	JC03949	03°50.49 S	25°00.09 W	5417	0628	0646	NET 051	

Event No.	Date	Station	Latitude	Longitude	Depth (m)	Time IN (GMT)	Time OUT (GMT)	Activity	Comments
234	09.11.09	JC03950	04°51.5 S	25.00.0 W	5342	1332	1355	OPTICS 48	
235	09.11.09	JC03950	04°51.5 S	25.00.0 W	5342	1333	1424	CTD 0075-T	
236	09.11.09	JC03950	04°51.5 S	25.00.0 W	5342	1358	1422	OPTICS 49	
237	09.11.09	JC03950	04°51.5 S	25.00.0 W	5342	1430	1449	11MNET 14	
238	10.11.09	JC03951	07°22.10 S	24°59.56 W	5700	0535	0618	CTD 0076-T	
239	10.11.09	JC03951	07°22.10 S	24°59.55 W	5700	0538	0553	NET 052	
240	10.11.09	JC03951	07°21.08 S	24°59.37 W	5668	0632	0720	CTD 0077-S	
241	10.11.09	JC03951	07°21.74 S	24°59.35 W	5668	0635	0655	NET 053	
242	10.11.09	JC03952	08°22.8 S	24°59.7 W	5690	1329	1349	OPTICS 50	
243	10.11.09	JC03952	08°22.8 S	24°59.7 W	5690	1330	1426	CTD 0078-T	
244	10.11.09	JC03952	08°22.8 S	24°59.7 W	5690	1352	1413	OPTICS 51	
245	10.11.09	JC03952	08°22.8 S	24°59.7 W	5690	1426	1440	11MNET 15	
11.11.09 0300 CLOCKS ADVANCED BY 1 HOUR TO GMT									
246	11.11.09	JC03953	10°39.42 S	24°59.88 W	5109	0436	0512	CTD 0079-T	
247	11.11.09	JC03953	10°39.27 S	24°59.94 W	5109	0438	0455	NET 54	
248	11.11.09	JC03953	10°39.05 S	24°59.85 W	5062	0524	0608	CTD 0080-S	
249	11.11.09	JC03953	10°39.42 S	24°59.88 W	5062	0527	0546	NET 55	
250	11.11.09	JC03954	11°43.5 S	25°00.00 W	6225	1300	1325	OPTICS 52	
251	11.11.09	JC03954	11°43.5 S	25°00.00 W	6225	1301	1353	CTD 0081-T	
252	11.11.09	JC03954	11°43.5 S	25°00.00 W	6225	1328	1351	OPTICS 53	
253	11.11.09	JC03954	11°43.5 S	25°00.00 W	6225	1356	1410	11MNET 16	
12.11.09 0258 DIEL STATION 02 – OVOC SAMPLING FROM CTD									
254	12.11.09	JC03955	13°48.9 S	25°00.1 W	5460	0302	0411	TURBULENCE PROFILER	
255	12.11.09	JC03955	13°48.95 S	24°58.88 W	5460	0422		DRIFTER BUOY DEPLOYED	
256	12.11.09	JC03955	13°48.84 S	24°58.88 W	5460	0501	0507	CTDSURF-19	
257	12.11.09	JC03955	13°48.81 S	24°58.88 W	5460	0517	0557	CTD 0082-T	
258	12.11.09	JC03955	13°48.80 S	24°58.87 W	5460	0521	0535	NET 56	
259	12.11.09	JC03955	13°48.86 S	24°59.14 W	5264	0625	0701	CTD 0083-T	
260	12.11.09	JC03955	13°48.85 S	24°59.14 W	5264	0627	0644	NET 57	
261	12.11.09	JC03955	13°49.75 S	25°00.79 W	5264	0803	0808	CTDSURF-20	

Event No.	Date	Station	Latitude	Longitude	Depth (m)	Time IN (GMT)	Time OUT (GMT)	Activity	Comments
262	12.11.09	JC03955	13°50.14 S	25°01.36 W	5264	0858	0902	CTDSURF-21	
263	12.11.09	JC03955	13°50.51 S	25°01.95 W	5264	0958	1003	CTDSURF-22	
264	12.11.09	JC03955	13°50.80 S	25°02.59 W	5264	1056	1101	CTDSURF-23	
265	12.11.09	JC03955	13°51.32 S	25°03.25 W	5264	1157	1203	CTDSURF-24	
266	12.11.09	JC03955	13°51.32 S	25°03.25 W	5264	1254	1301	CTDSURF-25	
267	12.11.09	JC03955	13°51.32 S	25°03.25 W	5264	1254	1318	OPTICS 54	
268	12.11.09	JC03955	13°51.32 S	25°03.25 W	5264	1315	1406	CTD 0084-T	
269	12.11.09	JC03955	13°51.3 S	25°03.4 W	5215	1329	1341	OPTICS 55	
270	12.11.09	JC03955	13°51.32 S	25°03.25 W	5215	1409	1421	11MNET 17	
271	12.11.09	JC03955	13°53.0 S	25°05.4 W	5215	1502	1508	CTDSURF-26	
272	12.11.09	JC03955	13°53.11 S	25°05.94 W	5215	1604	1609	CTDSURF-27	
273	12.11.09	JC03955	13°53.48 S	25°06.10 W	5215	1702	1706	CTDSURF-28	
274	12.11.09	JC03955	13°54.51 S	25°07.07 W	5215	1833	1903	CTD 0085-T	
275	12.11.09	JC03955	13°56.68 S	25°08.70 W	5215	2202	2206	CTDSURF-29	
276	13.11.09	JC03955	13°58.5 S	25°09.30 W	5215	0058	0105	CTDSURF-30	
277	13.11.09	JC03955	13°59.9 S	26°10.1 W	5215	0400	0405	CTDSURF-31	
278	13.11.09	JC03955	14°00.24 S	25°10.30 W	5215	0459	0505	CTDSURF-32	
279	13.11.09	JC03955	14°00.24 S	25°10.30 W	5894	0519	0602	CTD 0086-T	
280	13.11.09	JC03955	14°00.24 S	25°10.30 W	5894	0520	0537	NET 058	
281	13.11.09	JC03955	14°00.57 S	25°10.50 W	5135	0625	0705	CTD 0087-T	
282	13.11.09	JC03955	14°00.57 S	25°10.50 W	5135	0630	0645	NET 059	
283	13.11.09	JC03955	14°00.84 S	25°10.66 W	5135	0801	0804	CTDSURF-33	
284	13.11.09	JC03955	14°01.13 S	25°11.07 W	5135	0857	0901	CTDSURF-34	
285	13.11.09	JC03955	14 °01.39 S	25°11.32 W	5135	0959	1003	CTDSURF-35	
286	13.11.09	JC03955	14°01.54 S	25°11.66 W	5135	1059	1104	CTDSURF-36	
13.11.09 1112 – RECOVER DRIFTER, END OF DIEL EXPERIMENT									
287	13.11.09	JC03955	14°01.64 S	25°11.72 W	5135	1138	1237	TURBULENCE PROFILER	
288	13.11.09	JC03955	14°01.4 S	25°10.8 W	5135	1250	1318	OPTICS 56	
289	13.11.09	JC03955	14°01.4 S	25°10.8 W	5135	1259	1348	CTD 0088-T	
290	13.11.09	JC03955	14°01.4 S	25°10.8 W	5135	1321	1342	OPTICS 57	
291	13.11.09	JC03955	14°01.4 S	25°10.8 W	5135	1351	1403	11MNET 18	

Event No.	Date	Station	Latitude	Longitude	Depth (m)	Time IN (GMT)	Time OUT (GMT)	Activity	Comments
292	14.11.09	JC03956	16°22.34 S	24°59.87 W	-	0443	0519	CTD 0089-T	ECHO SOUNDER NOT WORKING
293	14.11.09	JC03956	16°22.33 S	24°59.87 W	-	0447	0503	NET 060	
294	14.11.09	JC03956	16°22.01 S	24°59.81 W	-	0535	0613	CTD 0090-S	
295	14.11.09	JC03956	16°21.99 S	24°59.81 W	-	0537	0556	NET 061	
296	14.11.09	JC03957	17°20.80 S	25°00.00 W	-	1302	1358	CTD 0091-T	
297	14.11.09	JC03957	17°20.80 S	25°00.00 W	-	1303	1323	OPTICS 58	
298	14.11.09	JC03957	17°20.80 S	25°00.00 W	-	1326	1346	OPTICS 059	
299	14.11.09	JC03957	17°20.80 S	25°00.00 W	-	1400	1413	11MNET 19	
300	14.11.09	JC03958	18°00.00 S	25°00.00 W	-	1830	1920	SHRIMP	NOT WORKING – STN ABANDONEND
301	15.11.09	JC03959	19°30.06 S	24°59.73 W	-	0433	0511	CTD 0092-T	
302	15.11.09	JC03959	19°30.03 S	24°59.74 W	-	0439	0456	NET 062	
303	15.11.09	JC03959	19°29.93 S	24°59.85 W	-	0527	0612	CTD 0093-S	
304	15.11.09	JC03959	19°29.92 S	24°59.86 W	-	0530	0550	NET 063	
305	15.11.09	JC03960	20°35.4 S	25°00.0 W	-	1259	1321	OPTICS 60	
306	15.11.09	JC03960	20°35.4 S	25°00.0 W	-	1302	1316	CTD 0094-T	
307	15.11.09	JC03960	20°35.4 S	25°00.0 W	-	1324	1345	OPTICS 61	
308	15.11.09	JC03960	20°35.4 S	25°00.0 W	-	1358	1412	11MNET 20	
309	16.11.09	JC03961	22°51.23 S	24°59.77 W	5440	0433	0509	CTD 0095-T	
310	16.11.09	JC03961	22°51.23 S	24°59.77 W	5440	0436	0450	NET 064	
311	16.11.09	JC03961	22°51.23 S	24°59.77 W	5437	0525	0612	CTD 0096-S	
312	16.11.09	JC03961	22°51.23 S	24°59.77 W	5437	0527	0543	NET 065	
313	16.11.09	JC03962	23°45.8 S	25°00.1 W	4564	1301	1323	OPTICS 62	
314	16.11.09	JC03962	23°45.8 S	25°00.1 W	4564	1302	1356	CTD 0097-T	
315	16.11.09	JC03962	23°45.8 S	25°00.1 W	4564	1326	1347	OPTICS 63	
316	17.11.09	JC03963	26°06.08 S	25°00.32 W	4538	0442	0517	CTD 0098-T	
317	17.11.09	JC03963	26°06.78 S	25°00.31 W	4538	0446	0502	NET 066	
318	17.11.09	JC03963	26°06.08 S	25°00.32 W	4538	0534	0617	CTD 0099-S	
319	17.11.09	JC03963	26°06.08 S	25°00.32 W	4568	0537	0555	NET 067	
320	17.11.09	JC03964	27°10.1 S	25°00.1 W	4021	1259	1322	OPTICS 64	
321	17.11.09	JC03964	27°10.1 S	25°00.1 W	4021	1301	1356	CTD 0100-T	
322	17.11.09	JC03964	27°10.1 S	25°00.1 W	4021	1325	1350	OPTICS 65	

Event No.	Date	Station	Latitude	Longitude	Depth (m)	Time IN (GMT)	Time OUT (GMT)	Activity	Comments
Southern Turn, alter course – 232°									
323	18.11.09	JC03965	28°47.23 S	26°08.59 W	5240	0438	0517	CTD 0101-T	
324	18.11.09	JC03965	28°47.23 S	26°08.59 W	5240	0442	0459	NET 068	
325	18.11.09	JC03965	28°47.38 S	26°08.23 W	5240	0535	0626	CTD 102-S	
326	18.11.09	JC03965	28°47.23 S	26°08.59 W	5240	0538	0555	NET 069	
327	18.11.09	JC03966	29°23.4 S	27°02.0 W	4879	1300	1323	OPTICS 66	
328	18.11.09	JC03966	29°23.4 S	27°02.0 W	4879	1303	1358	CTD 103-T	
329	18.11.09	JC03966	29°23.4 S	27°02.0 W	4879	1325	1348	OPTICS 67	
330	18.11.09	JC03966	29°23.8 S	27°02.0 W	4879	1404	1423	11MNET 21	
331	19.11.09	JC03967	30°50.02 S	29°11.02 W	2218	0434	0508	CTD 104-T	
332	19.11.09	JC03967	30°50.02 S	29°11.02 W	2218	0437	0454	NET 070	
333	19.11.09	JC03967	30°50.02 S	29°11.02 W	2218	0522	0600	CTD 105-S	
334	19.11.09	JC03967	30°50.02 S	29°11.02 W	2218	0525	0544	NET 071	
335	19.11.09	JC03968	31°32.8 S	30°15.3 W	3916	1300	1322	OPTICS 68	
336	19.11.09	JC03968	31°32.8 S	30°15.3 W	3916	1302	1406	CTD 106-T	
337	19.11.09	JC03968	31°32.8 S	30°15.3 W	3916	1325	1346	OPTICS 69	
338	19.11.09	JC03968	31°32.8 S	30°15.3 W	3916	1409	1424	11MNET 22	
20.11.09 - CLOCKS RETARDED 1 HOUR TO Z-1 – STATIONS ABANDONED DUE TO WEATHER. WIND IN EXCESS OF 35 KNTS, STEEP SWELL									
339	21.11.09	JC03969	33°24.52 S	34°15.48 W	4296	0542	0524	CTD 107-T	
340	21.11.09	JC03969	33°24.54 S	34°15.44 W	4296	0446	0504	NET 072	
341	21.11.09	JC03969	33°24.52 S	34°15.48 W	4296	0645	0733	CTD 108-S	
342	21.11.09	JC03969	33°24.52 S	34°15.48 W	4296	0649	0711	NET 073	
343	21.11.09	JC03970	33°53.0 S	34°58.5 W	4295	1401	1426	OPTICS 70	
344	21.11.09	JC03970	33°53.0 S	34°58.5 W	4295	1402	1502	CTD 109-T	
22.11.09 0503 DIEL STATION 03 – OVOC SAMPLING FROM CTD									
345	22.11.09	JC03971	35°17.93 S	37°06.89 W	4618	0503	0508	CTDSURF 37	
346	22.11.09	JC03971	35°17.93 S	37°06.89 W	4618	0516	0601	CTD 0110-T	
347	22.11.09	JC03971	35°17.93 S	37°06.89 W	4618	0520	0538	NET 074	
348	22.11.09	JC03971	35°17.26 S	37°06.74 W	4616	0625	0700	CTD 0111-T	
349	22.11.09	JC03971	35°17.26 S	37°06.74 W	4616	0629	0646	NET 075	
350	22.11.09	JC03971	35°17.60 S	37°06.65 W	4616	0711		DRIFTER BUOY DEPLOYED	

Event No.	Date	Station	Latitude	Longitude	Depth (m)	Time IN (GMT)	Time OUT (GMT)	Activity	Comments
351	22.11.09	JC03971	35°17.09 S	37°06.92 W	4616	0759	0805	CTDSURF 38	
352	22.11.09	JC03971	35°16.45 S	37°07.49 W	4616	0856	0900	CTDSURF 39	
353	22.11.09	JC03971	35°15.9 S	37°08.34 W	4616	0959	1003	CTDSURF 40	
354	22.11.09	JC03971	35°15.62 S	37°09.33 W	4616	1057	1102	CTDSURF 41	
355	22.11.09	JC03971	35°15.51 S	37°09.30 W	4616	1158	1203	CTDSURF 42	
356	22.11.09	JC03971	35°15.51 S	37°09.30 W	4616	1300	1305	CTDSURF 43	
357	22.11.09	JC03971	35°15.51 S	37°09.30 W	4655	1311	1403	CTD 112-T	
358	22.11.09	JC03971	35°15.51 S	37°09.30 W	4655	1356	1419	OPTICS 71	
359	22.11.09	JC03971	35°15.51 S	37°09.30 W	4655	1421	1444	OPTICS 72	
360	22.11.09	JC03971	35°15.51 S	37°09.30 W	4655	1455	1501	CTDSURF 44	
361	22.11.09	JC03971	35°15.51 S	37°09.30 W	4655	1508	1523	11MNET 23	
362	22.11.09	JC03971	35°16.1 S	37°12.80 W	4655	1557	1602	CTDSURF 45	
363	22.11.09	JC03971	35°16.29 S	37°12.90 W	4655	1700	1706	CTDSURF 46	
364	22.11.09	JC03971	35°16.51 S	37°12.90 W	4655	1801	1806	CTDSURF 47	
365	22.11.09	JC03971	35°16.75 S	37°12.90 W	4664	1931	2004	CTD 113-T	
366	22.11.09	JC03971	35°16.95 S	37°12.79 W	4664	2300	2304	CTDSURF 48	
23.11.09 HOVE TO DUE TO ADVERSE WEATHER. DIEL 03 STATION ABANDONED – DRIFTER BUOY LOST									
367	24.11.09	JC03972	37°17.84 S	40°11.40 W	4992	0536	0608	CTD 114-T	
368	24.11.09	JC03972	37°17.85 S	40°11.37 W	4992	0540	0555	NET 076	
369	24.11.09	JC03972	37°17.86 S	40°11.37 W	4992	0625	0708	CTD 115-S	
370	24.11.09	JC03972	37°17.86 S	40°11.37 W	4992	0629	0650	NET 077	
371	24.11.09	JC03973	37°52.0 S	41°05.5 W	5042	1359	1423	OPTICS 73	
372	24.11.09	JC03973	37°52.0 S	41°05.5 W	5042	1400	1447	CTD 116-T	
373	24.11.09	JC03973	37°52.0 S	41°05.5 W	5042	1426	1450	OPTICS 074	
374	24.11.09	JC03973	37°52.0 S	41°05.5 W	5042	1502	1518	11MNET 24	
375	25.11.09	JC03974	39°18.89 S	43°23.54 W	5106	0533	0611	CTD 117-T	
376	25.11.09	JC03974	39°18.89 S	43°23.54 W	5106	0537	0551	NET 078	
377	25.11.09	JC03974	39°18.89 S	43°23.54 W	5106	0626	0710	CTD 118-S	
378	25.11.09	JC03974	39°18.89 S	43°23.54 W	5106	0629	0647	NET 079	
379	25.11.09	JC03975	39°58.0 S	44°26.8 W	5103	1400	1423	OPTICS 75	
380	25.11.09	JC03975	39°58.0 S	44°26.8 W	5103	1402	1455	CTD 119-T	

Event No.	Date	Station	Latitude	Longitude	Depth (m)	Time IN (GMT)	Time OUT (GMT)	Activity	Comments
381	25.11.09	JC03975	39°58.0 S	44°26.8 W	5103	1426	1449	OPTICS 76	
382	25.11.09	JC03975	39°58.0 S	44°26.8 W	5103	1459	1514	11MNET 25	
383	25.11.09	-	39°58.83 S	44°26.37 W	5103	1536		MET OFFICE DRIFTER#1	IRIDIUM16 300034012545450
26.11.09, 0530 STATION CANCELLED DUE TO ADVERSE CONDITIONS									
384	26.11.09	-	41°49.5 S	47°29.4 W		0927		MET OFFICE DRIFTER#2	IRIDIUM24 300034012694660
385	26.11.09	JC03976	42°15.0 S	48°13.5 W	5470	1400	1418	OPTICS 77	
386	26.11.09	JC03976	42°15.0 S	48°13.5 W	5470	1400	1453	CTD 120-T	
387	26.11.09	JC03976	42°15.0 S	48°13.5 W	5470	1423	1438	OPTICS 78	
END OF STATION WORK									
27.11.09 0300 – CLOCKS RETARDED 1 HOUR TO Z-2									
388	27.11.09	-	43°55.0 S	51°02.6 W		1009		MET OFFICE DRIFTER#3	IRIDIUM22 300034012693760
389	28.11.09	-	47°29.4 S	57°28.0W		1847		MET OFFICE DRIFTER#4	IRIDIUM27 300034012696760

Acknowledgements

There were many achievements made during AMT-19: First AMT on the James Cook, first AMT into Punta Arenas, longest AMT by time and by distance, first AMT with prolonged occupation (up to 36 hours) of stations and first to deploy a benthic observing system (SHRIMP). Once again the successful completion of this mission was the result of a fantastic team effort which involved all of those on the ship. Captain Roger Chamberlain and all of his crew were exemplary in the support that they provided and our colleagues from NMF-SS as usual were outstanding in their professionalism and fully complemented the effort of the ship's staff in providing a first class ship-board service.

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