

Cruise report PHiXT3 23rd -26th July 2009

Cruise Report:

Cruise ID: PHiXT3

Ship: RV Prince Madog

Master: Capt. Eric Lloyd

Location: Liverpool Bay, Eastern Irish Sea.

Cruise dates: 23rd -26th July 2009

Scientific personnel:

Emmer Litt (PSO, PML/UoBangor)

Anouska Bailey (UoLiverpool)

Anne Hammerstain (UoBangor)

Peter Hughes (UoBangor)

Lucy Abram (UoLiverpool)

Claire Mahaffey (UoLiverpool)

Angela Honey (UoBangor)

Andy Price (UoBangor)

Pascal Salaun (UoLiverpool)

Zaoshun Bi (UoLiverpool)

Project description:

PHiXT: nutrient PatHways from carbon fluX through the Trophic cascade

This cruise was the third of five multidisciplinary cruises during 2009/10 involving scientists from POL, PML and the Universities of Liverpool and Bangor. The majority of work was centred around water samples collected during 25 hour CTD stations at two sites; coastal location (53° 30.5' N, 3° 24'W, 29m) which is just SW of the main mooring site of POL's Irish Sea Observatory, and an offshore site 30 (53° 42'N, 3° 55.4' W, 44m). The preference was for work to be conducted whilst at anchor, thus permitting safe concurrent deployment of the CTD

The aims of the cruises are to provide data for a variety of individual projects;

1. "Temporal variability of CO₂ flux estimates in contrasting shelf sea regimes" and the "CARBON-OPS NERC KT Project" - Emmer Litt, CASIX PhD Project.
2. "How does pulsed stratification alter coastal primary and secondary production? A case study in Liverpool Bay". NERC SOFI PhD project – Anouska Bailey
3. Detection and speciation of metals and metalloids in Liverpool Bay. Pascal Salaun

Schedule:

To conduct 25 hour long surveys at,

1. A near-shore station, 53° 30.5' N, 3° 24' W.
2. An off-shore station, 53° 42'N, 3° 55.4' W.

Each survey consisted of;

- Hourly CTD profiles and discrete water sample collection at a variety of depths.

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- Short series of CTD profiles from 2NM west to 2NM east of coastal site with 2NM resolution.

Narrative (GMT):

23rd July 2009:

All equipment was loaded onto the ship by 13:00. The ship left Menai Bridge at 14:00, destination offshore site. At Puffin Island (14:40) the ships ADCP, flowthrough and pCO₂ systems were turned on. The ship was arrived at 17:05 but could not anchor and therefore held position around (53° 42'N, 3° 55.4' W) in 38.7m of water. The CTD survey commenced at 17:07, following which 25 further CTD profiles were made on the hour until 24/07/09 18:00.

24th & 25th July 2009:

Arrived at coastal site and anchored close to site A at 20:33 (53° 30.62' N, 3° 22.99' W) in 19.5m of water. The CTD survey commenced at 21:00. At 22:00 the CTD was at full extension of safety on the wire and thus a dip was not made, samples were taken from the flow through system instead, following which 23 further CTD profiles were made on the hour until 25/07/09 22:00. Following recovery of the ships anchor, CTD profiles and water samples were taken at 2NM east (23:02), at the coastal site (23:40), and 2NM west (00:14).

26th July 2009:

00:23 Steamed back to Menai Bridge. ADCP, flow through and pCO₂ stopped logging at 03:58 at Puffin Island.

Samples collected and contact:

Appendix A: Nutrient, zooplankton and phytoplankton samples – Claire Mahaffey (UoLiverpool) Claire.Mahaffey@liverpool.ac.uk & Anouska Bailey (UoLiverpool) Anouska.Bailey@liverpool.ac.uk

Appendix B: Measurements of As(III), Sb(III), Mn²⁺, Zn, Cu and Hg. Pascal Salaun (UoLiverpool) Pascal.Salaun@liverpool.ac.uk

Appendix C: Ships underway measurements – Emmer Litt (PML/UoBangor) emmtta@pml.ac.uk

Appendix D: CTD profiles – Emmer Litt (PML/UoBangor) emmtta@pml.ac.uk

Appendix A:

Size-fractionated chlorophyll *a* – fixed volumes of seawater are filtered through 0.2µm, 2µm, and 10µm polycarbonate filters under low vacuum pressures. The filters are stored frozen at -80°C until analysis in the laboratory where chlorophyll *a* is extracted from the filter by sonicating the filter in 5ml 90% acetone for 10 minutes. Fluorometric analysis of the raw extract as well as the extract post-acidification allows for correction for phaeopigments.

Nutrients – sea water samples are stored in 125ml polycarbonate bottles (acid-washed and triple-rinsed with sample water) prior to analysis with Quattro nutrient analyser onboard.

Dissolved organic carbon (DOC) – seawater samples are filtered through combusted GF/F filters in a glass filter assembly. 20ml of filtrate is pipette into an acid-washed, combusted glass vial pre-filled with 50µl 50% (v/v) hydrochloric acid. Samples are stored in laboratory refrigerator for analysis on Shimadzu TOC-V.

Bacterial abundance – 50 ml of seawater from designated Niskin is emptied into a sterile centrifuge tube pre-filled with formaldehyde (final concentration 2%). Samples are stored in cold room before DAPI staining and enumeration under epifluorescence microscope.

Phytoplankton and microzooplankton abundance – 100ml of seawater is measured into amber glass jar pre-filled with acid Lugol's solution (final concentration 2%) and stored in cold-room. Abundances, biovolumes, and community composition are measured under inverted microscope.

Particulate organic nutrients – fixed volumes of seawater are filtered through combusted GF/F (PC/PN), combusted acid-washed GF/F (PP) or 0.8µm polycarbonate (PSi) and the filters frozen prior to analysis in laboratory.

Net community production - estimated by determining the change in dissolved oxygen concentration in seawater samples in 125 ml glass bottles stored under a 16:8 hour light: dark cycle ('light') or in the dark over a 24-hour incubation period in comparison to a Tzero O₂ concentration. Net community production (µmol O₂ l⁻¹ day⁻¹) is calculated by subtracting the mean Tzero oxygen concentration from the mean O₂ concentration in the 'light' bottles.

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PHiXT 3 Stn 1: Nutrient and phyto/zooplankton samples; 24-25 Jul 09

Time	Chlorophyll a	Dissolved nutrients	DOC	Bacterial abundance	Phytoplankton abundance/ ID	Microzooplankton abundance/ ID	Particulate C/N	Particulate P	Particulate Si
22:00	Y	Y	Y						
23:00	Y	Y	Y						
00:00	Y	Y	Y						
01:00	Y	Y	Y						
02:00	Y	Y	Y	Y	Y	Y	Y	Y	Y
03:00	Y	Y	Y						
04:00	Y	Y	Y	Y	Y	Y	Y	Y	Y
05:00	Y	Y	Y						
06:00	Y	Y	Y						
07:00	Y	Y	Y						
08:00	Y	Y	Y	Y	Y	Y	Y	Y	Y
09:00	Y	Y	Y						
10:00	Y	Y	Y						
11:00	Y	Y	Y						
12:00	Y	Y	Y	Y	Y	Y	Y		
13:00	Y	Y	Y						
14:00	Y	Y	Y					Y	Y
15:00	Y	Y	Y	Y	Y	Y	Y		Y
16:00	Y	Y	Y						
17:00	Y	Y	Y					Y	Y
18:00	Y	Y	Y	Y	Y	Y	Y		Y
19:00	Y	Y	Y						
20:00	Y	Y	Y					Y	Y
21:00	Y	Y	Y	Y	Y	Y	Y		
22:00	Y	Y	Y					Y	
23:00	Y	Y	Y					Y	Y

NOTE 1: Shaded samples taken from flowthrough system (surface only) as no CTD cast due to currents

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PHiXT 3 Stn 30: Nutrient and phyto/zooplankton samples; 23-24 Jul 09

Time	Chlorophyll a	Dissolved nutrients	DOC	Bacterial abundance	Phytoplankton abundance/ ID	Microzooplankton abundance/ ID	Particulate C/N	Particulate P	Particulate Si	NCP
18:00	Y	Y	Y							
19:00	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
20:00	Y	Y	Y							
21:00	Y	Y	Y							
22:00	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
23:00	Y	Y	Y							
00:00	Y	Y	Y							
01:00	Y	Y	Y	Y	Y	Y	Y	Y	Y	
02:00	Y	Y	Y							
03:00	Y	Y	Y							
04:00	Y	Y	Y	Y	Y	Y	Y	Y	Y	
05:00	Y	Y	Y							
06:00	Y	Y	Y							
07:00	Y	Y	Y	Y	Y	Y	Y	Y	Y	
08:00	Y	Y	Y							
09:00	Y	Y	Y							
10:00	Y	Y	Y	Y	Y	Y	Y	Y	Y	
11:00	Y	Y	Y							
12:00	Y	Y	Y							
13:00	Y	Y	Y	Y	Y	Y	Y	Y	Y	
14:00	Y	Y	Y							
15:00	Y	Y	Y							
16:00	Y	Y	Y	Y	Y	Y	Y	Y	Y	
17:00	Y	Y	Y							
18:00	Y	Y	Y							
19:00	Y	Y	Y	Y	Y	Y	Y	Y	Y	

NOTE 1: NCP (=Net Community Production) oxygen incubations for 24 hours - light, dark, and Tzero.

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Appendix B:

Bottom and surface samples for inorganic As(III), Sb(III), As(V), Sb(V), As total (inorganic + organic), Sb total (inorganic+organic), Cu total, Mn²⁺, Hg total and Zn²⁺. Every Hour at both offshore and coastal station.

Appendix C: Ship's underway measurements:

The intake for the surface sampling system is located underneath RV Prince Madog, at about 3 m below sea level. The parameters recorded every minute by the WS Oceans system are: Date, Transmittance, Hull Temperature (°C), Barometric Pressure (mbar), Fluorescence, Oxygen concentration, Turbidity, Salinity, Conductivity sensor water temperature (°C). Sea surface temperature, salinity and transmittance were calibrated against the CTD by BODC. In addition a pCO₂ sensor is incorporated into the surface sampling system. Met package measures and records Barometric pressure (mbar), Solar Radiation (W m⁻²), PAR (μmols / m²s), Air Temperature (°C), Relative Humidity, Relative Wind Speed (m s⁻¹), Relative Wind Direction (°) – zero indicates wind on the bow, Minimum Air Temp (°C), Maximum Air Temp (°C), Wind Gust (m s⁻¹). Underway data, pCO₂ and ships ADCP data were recorded every minute. The ship was fitted with a 300 kHz ADCP set to record 50 x 1m bins, every 30 seconds with 24 pings / ensemble. The systems ran continually beyond Puffin Island between 23/7/09 14:40 and 26/7/09 03:58.

Appendix D:

The Sea-Bird 911 CTD recorded downwelling PAR light levels, temperature, conductivity, oxygen concentration, transmittance and fluorescence at 24 Hz. The frame was fitted with an altimeter. The CTD temperature data was checked against a Sea-Bird SBE35 precision thermometer. Water samples were taken from a near bed (3mab) bottle for calibration of the CTD salinity data by Anne Forbes-Brook (University of Bangor). A LISST-100X particle sizer with internal logging was attached to the CTD frame. A LISST-25 particle sizer was fitted to the CTD and its data logged on the Sea-Bird data logging system.

CTD log:

Cast sequence	Cast ID	time	Latitude (N)	Longitude (W)
001	3off-1	July 23 2009 17:07	53deg 41.763'	03deg 55.890'
002	3off-2	July 23 2009 18:02	53deg 42.397'	03deg 55.683'
003	3off-3	July 23 2009 19:02	53deg 42.200'	03deg 55.048'
004	3off-4	July 23 2009 20:01	53deg 42.264'	03deg 54.220'
005	3off-5	July 23 2009 21:00	53deg 42.145'	03deg 55.557'
006	3off-6	July 23 2009 22:00	53deg 42.166'	03deg 55.163'
007	3off-7	July 23 2009 23:05	53deg 42.320'	03deg 54.814'
008	3off-8	July 24 2009 00:04	53deg 42.029'	03deg 55.357'
009	3off-9	July 24 2009 01:04	53deg 42.104'	03deg 55.514'
010	3off-10	July 24 2009 02:02	53deg 42.068'	03deg 55.835'
011	3off-11	July 24 2009 03:04	53deg 42.085'	03deg 55.781'
012	3off-12	July 24 2009 04:01	53deg 42.034'	03deg 55.662'

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013	3off-13	July 24 2009 05:00	53deg 42.006'	03deg 55.580'
014	3off-14	July 24 2009 06:00	53deg 42.159'	03deg 54.331'
015	3off-15	July 24 2009 07:04	53deg 42.554'	03deg 55.432'
016	3off-16	July 24 2009 08:00	53deg 42.069'	03deg 55.043'
017	3off-17	July 24 2009 09:00	53deg 42.998'	03deg 54.833'
018	3off-18	July 24 2009 10:00	53deg 42.003'	03deg 55.027'
019	3off-19	July 24 2009 11:04	53deg 42.109'	03deg 55.213'
020	3off-20	July 24 2009 12:03	53deg 42.093'	03deg 55.330'
021	3off-21	July 24 2009 13:03	53deg 41.991'	03deg 55.431'
022	3off-22	July 24 2009 14:04	53deg 42.068'	03deg 55.571'
023	3off-23	July 24 2009 15:00	53deg 42.020'	03deg 55.527'
024	3off-24	July 24 2009 16:01	53deg 42.032'	03deg 54.676'
025	3off-25	July 24 2009 17:05	53deg 42.033'	03deg 55.715'
026	3off-26	July 24 2009 18:00	53deg 42.052'	03deg 55.219'
027	3in-1	July 24 2009 21:00	53deg 30.619'	03deg 22.992'
028	3in-2	July 24 2009 23:04	53deg 30.610'	03deg 23.000'
029	3in-3	July 25 2009 00:04	53deg 30.609'	03deg 23.002'
030	3in-4	July 25 2009 01:00	53deg 30.606'	03deg 23.008'
031	Pascal	July 25 2009 02:03	53deg 30.630'	03deg 23.120'
032	3in-5	July 25 2009 03:02	53deg 30.631'	03deg 23.124'
033	3in-6	July 25 2009 04:04	53deg 30.652'	03deg 23.142'
034	3in-7	July 25 2009 05:02	53deg 30.661'	03deg 23.154'
035	3in-8	July 25 2009 06:00	53deg 30.669'	03deg 23.145'
036	3in-9	July 25 2009 07:00	53deg 30.651'	03deg 23.175'
037	3in-10	July 25 2009 08:00	53deg 30.653'	03deg 23.170'
038	3in-11	July 25 2009 09:00	53deg 30.661'	03deg 23.080'
039	3in-12	July 25 2009 10:00	53deg 30.648'	03deg 23.017'
040	3in-13	July 25 2009 11:03	53deg 30.636'	03deg 22.994'
041	3in-14	July 25 2009 12:02	53deg 30.639'	03deg 23.001'
042	3in-15	July 25 2009 13:00	53deg 30.625'	03deg 23.012'
043	3in-16	July 25 2009 14:01	53deg 30.636'	03deg 23.081'
044	3in-17	July 25 2009 15:01	53deg 30.652'	03deg 23.104'
045	3in-18	July 25 2009 16:02	53deg 30.650'	03deg 23.148'
046	3in-19	July 25 2009 17:00	53deg 30.653'	03deg 23.152'
047	3in-20	July 25 2009 18:00	53deg 30.656'	03deg 23.158'
048	3in-21	July 25 2009 19:00	53deg 30.667'	03deg 23.140'
049	3in-22	July 25 2009 20:00	53deg 30.677'	03deg 23.114'
050	3in-23	July 25 2009 21:00	53deg 30.681'	03deg 23.036'
051	3in-24	July 25 2009 22:00	53deg 30.623'	03deg 22.998'
052	TR3	July 25 2009 23:02	53deg 30.593'	03deg 19.562'
053	TR2	July 25 2009 23:40	53deg 30.686'	03deg 23.122'
054	TR1	July 26 2009 00:14	53deg 30.594'	03deg 26.435'

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Acknowledgements:

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