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Prince Madog cruise 33/08
POL Coastal Observatory cruise 57
21st – 23rd October 2008

1. Objectives

1. At Site A 53º 32´ N 3º 21.8´ W, (CTD station 1)

To recover
a) A sea bed frame containing a 600kHz ADCP (waves ADCP) to measure the mean current profile, pressures and directional waves, Sea-Bird SBE 16*plus* with pumped conductivity sensor, digiquartz pressure sensor and a SeaPoint turbidity sensor, SonTek ADV and Aanderra oxygen optode.

b) A CEFAS SmartBuoy (with cellulose bags) in a single point mooring. Attached to the mooring wire are SeaBird MicroCat temperature, conductivity loggers at 5 and 10m below the surface and miniloggers at 7.5 and 15 m below the surface.

To deploy
c) an identical bedframe to that which was recovered.
d) an identical CEFAS smartbuoy to that which was recovered with the inclusion of a Wetlabs ACS for trial, positioned in line at 5m depth.

e) Collect 10 vertical zooplankton net hauls (CEFAS).

2. At Site B 53º 27´ N 3º 38.6´ W, (CTD station 21)

To recover
a) A CEFAS SmartBuoy (with cellulose bags) in a single point mooring. Attached to the mooring wire are Sea-Bird MicroCat temperature, conductivity loggers at 5 and 10m below the surface and miniloggers at 7.5 and 15 m below the surface.

b) A sea bed frame with a 600 kHz ADCP (waves ADCP) to measure the mean current profile, pressures and directional waves. A Sea-Bird SBE 16*plus* with pumped conductivity sensor, digiquartz pressure sensor and a SeaPoint turbidity sensor were fitted to the frame.

To deploy
C) an identical bedframe to that which was recovered with the inclusion of a YSI multisensor measuring CTD, O2 and fluorescence for trial.
d) an identical CEFAS smartbuoy to that which was recovered.

3. At site C 53º32.3'N 3º27'W, this deployment is a 'one off' deployment as part of the CObs/Bangor University 'fate of freshwater project' and is due for recovery in December .

deploy:
a) A sea bed frame with a 600 kHz RDI ADCP to measure the mean current profile and pressures. A Sea-Bird SBE 16*plus* with pumped conductivity sensor, digiquartz pressure sensor.

b) A single point mooring with 6ft toroid surface marker buoy with a Sea-Bird MicroCat temperature and conductivity logger at 5m.

4. To conduct a CTD / LISST survey of 34 sites every 5 miles covering the eastern Irish Sea between the North Wales coast and Blackpool and the Lancashire coast and the Great Orme, to determine the effects of the rivers Dee, Mersey and Ribble on Liverpool Bay. To obtain calibration samples for salinity, transmittance, suspended sediment and for chlorophyll at selected stations. To obtain near surface and bed water samples for nutrient and suspended sediment determination.

5. Collect sediment samples at each of the CTD sites.

6. Collect near surface water samples for Elena Stoica at stations 1, 21 & the most offshore station. Some of these samples are to be 'fixed' using provided formaldehyde solutions and frozen at -20ºC and others left in the fridge.

7. Collect surface water samples for David Hydes (NOC) for TCO_2 and alkalinity determination as part of a UK DEFRA survey.

2.1 Scientific personnel

Matthew Palmer (Principal Scientist)
Elena Stoica (University of Liverpool)
Terry Doyle
John Kenny
Mike Burke
Eleanor Howlett
David Hayward (CEFAS)
Neil Needham (CEFAS)
Anne Hammerstein (School of Ocean Sciences)
Flo Verspecht (School of Ocean Sciences)

2.2 Ship's officers and crew

Steve Duckworth (Master)
David Shaw (Chief Officer)
Les Black (Chief Engineer)
Meikle Mackay (2nd Engineer)
Dave Leigh (A.B.)
Mick Callaghan (Bosun)
David Robinson (A.B.)
Colin Hughes (Cook)

3. Narrative (times in GMT)

All equipment was loaded at Vittoria Docks, Birkenhead on Monday 21st October. Due to bad weather (Mersey bar wavebuoy reported 2.7m waves, Hilbre Island reported force 5/6) the sailing time was postponed until 0600 22nd October when more favourable weather and sea

state were expected.

RV Prince Madog left Alfred Lock Birkenhead at 0700 on 22nd October 2008. The ship's surface monitoring, pCO_2 system and ADCP were switched on at 0726 at the Mersey radar tower. On reaching site A at 0848 recovery of instrumentation was deemed hazardous due to 2m waves and force 5+ winds. Site C was reached at 0920. Due to the more simple requirements of the operation at site C, the ADCP frame was deployed at 0946 and the single point mooring deployed at 1021. Site A was reached by 1100 but conditions were deemed unsatisfactory for recovery, deployment or CTD operation.

Weather and sea state improved sufficiently for a CTD cast at site A at 1450 with water samples taken. Recovery of the site A ADCP lander was completed by 1534 and the replacement frame deployed at 1632. Conditions did not improve sufficiently for deployment of the Smartbuoy mooring and there was insufficient light to attempt site B recovery/deployment. A post deployment CTD cast was made at 1732.

During the brief lull in weather, CTD casts were made along the east-west transect from station 10 to 33. Attempts to complete a second transect were abandoned due to deteriorating weather conditions and the decision was made to return to port at 2325. Conditions were never suitable for sediment grab samples to be made.

The surface monitoring, pCO_2 system and ADCP were switched off at 0354, 23rd October 2008 at the Mersey radar tower. The ship was inside Alfred lock, Birkenhead at 0500.

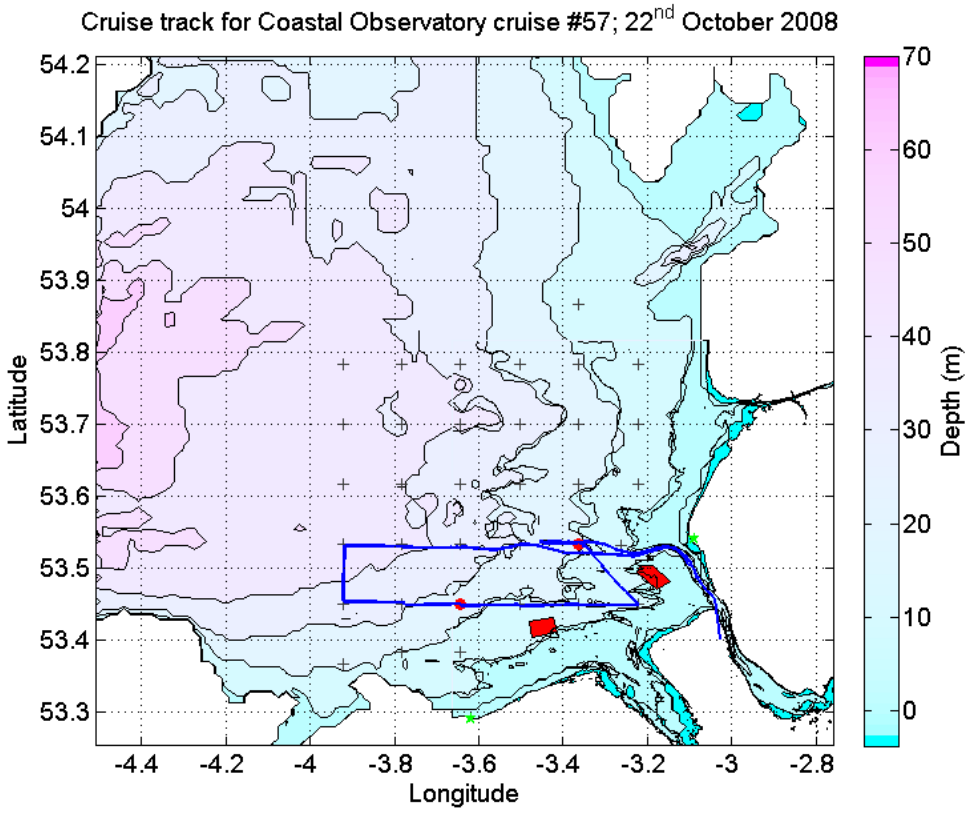

Figure 1. Cruise track is indicated by the blue solid line. Mooring positions are indicated by red dots, active wind farms by red polygons.

4. Moorings (times in GMT)

4.1 The set up of the recovered instruments was as follows:

Site A

a) Waves ADCP 600 kHz RDI 5803
Mode 1: 100 pings every 10 minutes (velocity standard deviation 0.007 m s^{-1}).
35 x 1 m bins (2.65 – 36.65 m above the bed).
Beam co-ordinates - speeds, correlation, echo intensity, % good.
Sound velocity calculated from temperature, depth and salinity of 32.
Clock reset at 15:47:00 on 9 September 2008.
Logging set to start at 17:00 on 9 September 2008.
Recovery at 15:34 on 22/11/08
Logging stopped at 14:59:03 on 22/10/08. Note the logging stopped during recovery. It is suspected the separation of the frame resulted in the battery cable being unplugged.

Sea-Bird 16plus S/N 5309 (RS232) on base of frame with pumped conductivity sensor underneath. Sample interval 600s. SeaPoint turbidity sensor (S/N 10471) taped to roll bar; set up for 0 - 125 FTU range. Sample interval 600 s; digiquartz integration time 40 s, range 400; pump 0.5s, 1 s delay. Aanderaa optode S/N 674. Clock reset at 15:08 on 9 September 2008. Logging set to start at 08:00 on 10 September 2008.
Recovery at 15:34 on 22/11/08
Stopped logging at 10:12:03 on 05/11/08, 17 days lost due to suspected lack of battery power.

SonTek ADV (Acoustic Doppler Velocimeter); ADV Logger G527; head A983.
Distance from center of three prong head on ADV transmitter to deck was 1.390m (i.e. above sea bed). Red prong aligned to ADCP beam 3. Sample rate 16Hz; burst interval 3600s; samples in each burst 19200; burst length 1200s. Time reset to 17:18:00 on 9 September 2008, logging set to start at 08:00:00 on 10 September 2008.
Recovery at 15:34 on 22/11/08
Stopped logging at 15:00:12 on 07/11/08, 15 days lost due to suspected lack of battery power.

The frame was fitted with a fizz link, a spooler with 50m of rope for recovery of the ballast weight and two Benthos releases s/n 71922 (Rx 11.5 kHz, Tx 12.0 kHz, release A) and s/n 72858 (Rx 14.5 kHz, Tx 12.0 kHz, release A).

Table 1. Recovered mooring positions and times.

	Latitude (N)	Longitude (W)	Water Depth (m)	Deployed Time	Deployed Date
ADCP frame (Site A)	53º 32.116´	3º 21.575´	25.0	15:34	22/10/08

4.2 The set up of the deployed instruments was as follows:

Site A

b) Waves ADCP 600 kHz RDI 5807
Mode 1: 100 pings every 10 minutes (velocity standard deviation 0.007 m s^{-1}).
35 x 1 m bins (2.65 – 36.65 m above the bed).
Beam co-ordinates - speeds, correlation, echo intensity, % good.
Sound velocity calculated from temperature, depth and salinity of 32.

Clock reset at 15:39:00 on 21/10/08.
Logging set to start at 06:00 on 22/10/08.

Sea-Bird 16plus S/N 4736 on base of frame with pumped conductivity sensor underneath. Sample interval 600s. SeaPoint turbidity sensor (S/N 10471) taped to roll bar; set up for 0 - 125 FTU range. Sample interval 600 s; digiquartz integration time 40 s, range 400; pump 0.5s, 1 s delay. Clock reset at 18:22 on 20/10/08. Logging set to start at 12:00 on 21/10/08.

Sea-Bird 16plus S/N 4490 on base of frame to provide power and logging for optode. Sample interval 600 s; digiquartz integration time 40 s, range 400; pump 0.5s, 1 s delay. Aanderaa optode S/N 674. Clock reset at 18:25 on 20/10//08. Logging set to start at 12:00 on 21/10/08.

SonTek ADV (Acoustic Doppler Velocimeter); ADV Logger G527; head A983.
Distance from center of three prong head on ADV transmitter to deck was 1.31m (i.e. above sea bed). Red prong aligned to ADCP beam 3. Sample rate 16Hz; burst interval 3600s; samples in each burst 19200; burst length 1200s. Time reset to 15:45 on 21/10/08, logging set to start at 06:00:00 on 22/10/08.

The frame was fitted with a fizz link, a spooler with 50m of rope for recovery of the ballast weight and two Benthos releases s/n 70356 (Rx 10.5 kHz, Tx 12.0 kHz, release D) and s/n 71909 (Rx 10.0 kHz, Tx 12.0 kHz, release C).

Site C
c) Waves ADCP 600 kHz RDI 2390
Mode 1: 100 pings every 10 minutes (velocity standard deviation 0.007 m s^{-1}).
35 x 1 m bins (2.65 – 36.65 m above the bed).
Beam co-ordinates - speeds, correlation, echo intensity, % good.
Sound velocity calculated from temperature, depth and salinity of 32.
Clock reset at 15:51:00 on 21/10/08.
Logging set to start at 06:00 on 22/10/08.

Sea-Bird 16plus S/N 4738 on base of frame with pumped conductivity sensor underneath. Sample interval 600s. Clock reset at 18:15 on 20/10/08. Logging set to start at 12:00 on 21/10/08.

The frame was fitted with a fizz link, a spooler with 50m of rope for recovery of the ballast weight and two Benthos releases s/n 67670 (Rx 12.0 kHz, Tx 11.5 kHz, release B) and s/n 70358 (Rx 11.0 kHz, Tx 12.0 kHz, release A).

Table 2. Deployed mooring positions and times.

	Latitude (N)	Longitude (W)	Water Depth (m)	Deployed Time	Deployed Date
ADCP frame (Site A)	53º 32.068´	3º 21.351´	25.4	16:32	22/10/08
ADCP frame (Site C)	53º 32.199´	3º 27.074´	31.1	09:46	22/10/08
SmartBuoy (Site C)	53º 32.254´	3º 27.022´	31.1	10:21	22/10/08

5. CTD survey:

The Sea-Bird 911 CTD recorded downwelling PAR light levels, temperature, conductivity, 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 Hammerstein (SOS). Water samples were taken from the near surface (1m) and near bed (3mab) bottles and filtered to determine suspended sediment load concentration, nutrient concentration, ammonia oxidation/nitrification rate assessment, surface pH (DEFRA) and for CEFAS calibration. A LISST-100X particle sizer with internal logging was attached to the CTD frame. Copies of the Sea-Bird binary files were taken off for processing and calibration at BODC / POL. A LISST-25 particle sizer was fitted to the CTD and its data logged on the Sea-Bird data logging system.

Table 3: CTD and sample information
SPM = suspended particulate matter, S/B = surface/bottom, UoL = University of Liverpool

CTD Number	Station	Time	Latitude (N)	Longitude (W)	Water depth (m)	SPM bottle number S/B	Cefas bottle no. S/B	UoL Nutrients bottle no. S/B	DEFRApH bottle no. (S)	UoL Biological surface samples
001	1	22/10/08 1450	53º32.143	3º21.957	24.7	8/3	9/4	10/2	11	5
003	10	22/10/08 1732	53º26.962	3º13.322	18.5	8/3	9/no	10/2	11	
005	11	22/10/08 1821	53º26.988	3º21.720	19.7	8/3	9/no	10/2	11	
006	12	22/10/08 1903	53º26.898	3º30.274	19.5	8/3	--	10/2	11	
007	21	22/10/08 1943	53º26.941	3º38.623	25.6	8/3	9/no	10/2	11	4
008	24	22/10/08 2023	53º27.020	3º46.698	30.8	8/3	--	10/2	11	
009	33	22/10/08 2109	53º27.332	3º55.373	36.9	8/3	--	10/2	11	4&9

6. Surface sampling

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, Transmissance, Hull Temperature (ºC), Barometric Pressure (mbar), Fluorescence, Turbidity, Salinity, Conductivity sensor water temperature (ºC). Sea surface temperature, salinity and transmittance were calibrated against the CTD by BODC. In addition a pCO_2 sensor is incorporated into the surface sampling system.

Met package measures and records Barometric pressure (mbar), Solar Radiation (W m^{-2}), PAR (µmols / m^2s), Air Temperature (ºC), Relative Humidity, Relative Wind Speed (m s^{-1}), Relative Wind Direction (º) – zero indicates wind on the bow, Minimum Air Temp (ºC), Maximum Air Temp (ºC), Wind Gust (m s^{-1}). **** Wind spd/dir not working ****

Underway data, pCO_2 and ships ADCP data were recorded every minute. The ship was fitted with a 300 kHz ADCP set to record 25 x 2m bins, the bin nearest the surface was at 5.1 m depth, every 30 seconds with 29 pings / ensemble. The systems were switched on at 0726 on 22nd October 2008 on passing the Mersey radar tower. The ADCP, underway and pCO_2 systems were switched off at 0354, 23rd October 2008 on passing the Mersey radar tower.

7. Summary:

The majority of objectives were not achieved due to bad weather. The change of de/mobilising location from Menai Bridge to Birkenhead did prove useful in utilizing what was a very narrow window of operation within bad weather due to the shorter travel time to the main mooring site. This resulted in successful deployment of 3 moorings and 9 CTD casts with the collection of water samples for 4 different groups.

Acknowledgements

The assistance of the master, officers, and crew is appreciated in ensuring the success of this cruise.