Prince Madog cruise 04/06
POL Coastal Observatory cruise 33
6-7 February 2006

1. Objectives

1. At 53º 32´ N 3º 21.8´ W, half a mile west of the Mersey Bar Light Vessel (site A)
To recover
a) A sea bed frame for 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. The frame is fitted with a SonTek ADV.
b) A CEFAS SmartBuoy (with cellulose bags) in a single point mooring with a Sea-Bird MicroCAT temperature, conductivity logger at 5m below the surface.

To deploy
c) A sea bed frame for 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. The frame is fitted with a SonTek ADV.
d) A CEFAS SmartBuoy in a single point mooring with a Sea-Bird MicroCAT temperature, conductivity logger at 5m below the surface.

2. At 53º 27´ N 3º 38.6´ W (site 21, second site, B)
To recover
a) A sea bed frame for 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.
b) A CEFAS SmartBuoy (with cellulose bags) in a single point mooring with a Sea-Bird MicroCAT temperature, conductivity logger at 5m below the surface and a CEFAS CTD in a frame at 10 m below the surface.
c) A sea bed frame for 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. In addition, an acoustic modem with a 1.2 MHz ADCP, to measure the current profile, was fitted to link up with the telemetry system.

To deploy
c) A sea bed frame for 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. In addition, an acoustic modem with a 1.2 MHz ADCP, to measure the current profile, was fitted to link up with the telemetry system.
d) A CEFAS SmartBuoy in a single point mooring with a Sea-Bird MicroCAT temperature, conductivity logger at 5m below the surface and Liverpool University trace metal probe.

3. To conduct a CTD / LISST and trace metal 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.

4. Collect 5 bentic ecology grab samples at sites A and B.

2.1 Scientific personnel

Alejandro Souza (Principal)
John Kenny
Emlin Jones
Richard Cooke
Jo Foden (CEFAS)
Dave Sivyer (CEFAS)
Anne Hammerstein (School of Ocean Sciences)
Vladimir Krivtsov (School of Ocean Sciences)
Conrad Chapman (Liverpool University)
Catherine Scott (Liverpool University)

2.2 Ship's officers and crew

Adrian Simonds (Master)
Andy Wallis (Chief Officer)
A. V Williams (Chief Engineer)
Kevin Wild (Second Engineer)
Tommy Roberts (Bosun)
Dave D. Williams (A.B.)
Dave O. Williams (A.B.)
Eifion (Avion) Pritchard (Cook)

3. Narrative (times in GMT)

The SmartBuoy toroid, anchor chain clumps, three sea-bed frames and instrumentation were loaded onto RV Prince Madog on the afternoon of 5 February 2005, about 3 hours after low water. The SmartBuoy toroid was rolled down the walkway. The ADCP frames and instruments were set up on the afterdeck, and the tower and instruments fitted to the SmartBuoy toroid

RV Prince Madog left Menai Bridge at 07:45 on 6 February; see Figure 1 for the cruise track. Recording of surface sampling and the ship's ADCP were started at 08:35, near Puffin Island. The flow through wasn't set up properly so it had to be restarted at 8:55.

We started the CTD grid at 9:06, from the southernmost point, station 34 and then we carried out stations 23, 22. We arrived at site 12 at 11:17 where we proceed to do a CTD and then to deploy a fast sampling ADCP with SBE-16 and OBS for the Dee experiment at 11:31 53º 26.979'N 3º 30.158' W at depth of 16.5m. We then proceed to station 21 (mooring site B) at 12:09 a CTD was carried out and then we deployed the telemetry ADCP frame out at 12:20 53º26.906'N 3º38.278'W at a depth of 23.7m. This followed the deployment of the smart buoy at 53º 26.891'N 3º 38.424' W at a depth of 23.5m.

We then proceed to recover the other SmartBuoy at this station located at 53º 26.992'N 3º 38.424'W and a depth of 24.4, the SmartBuoy was grappled at 12:52 and on board by 12:55, followed by the subsurface cage at 12:57 and the chain clumps up by 13:05. An attempt to recover the ADCP was carried out at 13:15, but it did not surfaced. We reposition again and fire it by 13:35 and the ADCP surfaced at 13:39. 13:46 the ADCP was on board, note that the frame and two of the ADCP transducers were covered with fish eggs.

The ballast frame followed at 13:53. We position to recover the telemetry frame at 14:10, fire it but it did not come up we triggered it again at about 14:15 and the ADCP surfaced by 14:23. The telemetry ADCP was on board at 14:35 and the bed frame followed at 14:39. A series of 6 grabs one for sediments were carried out from 15:23 at 53º 27.025N 3º 38.468W and finished at 15:40.

We then proceed to continue the CTD grid towards the west doing stations 21, 24, 33. Then we started a north-south path scanning the CTD grid. We expected to recover moorings at Site A at about 9:30 AM, but the weather had turn by then. We had another go at about 13:30 and be tried backing to the smart buoy. Conditions were too severe to attempt recovery so this was aborted and we move south out of the shipping channel to await to come into Vittoria Docks.

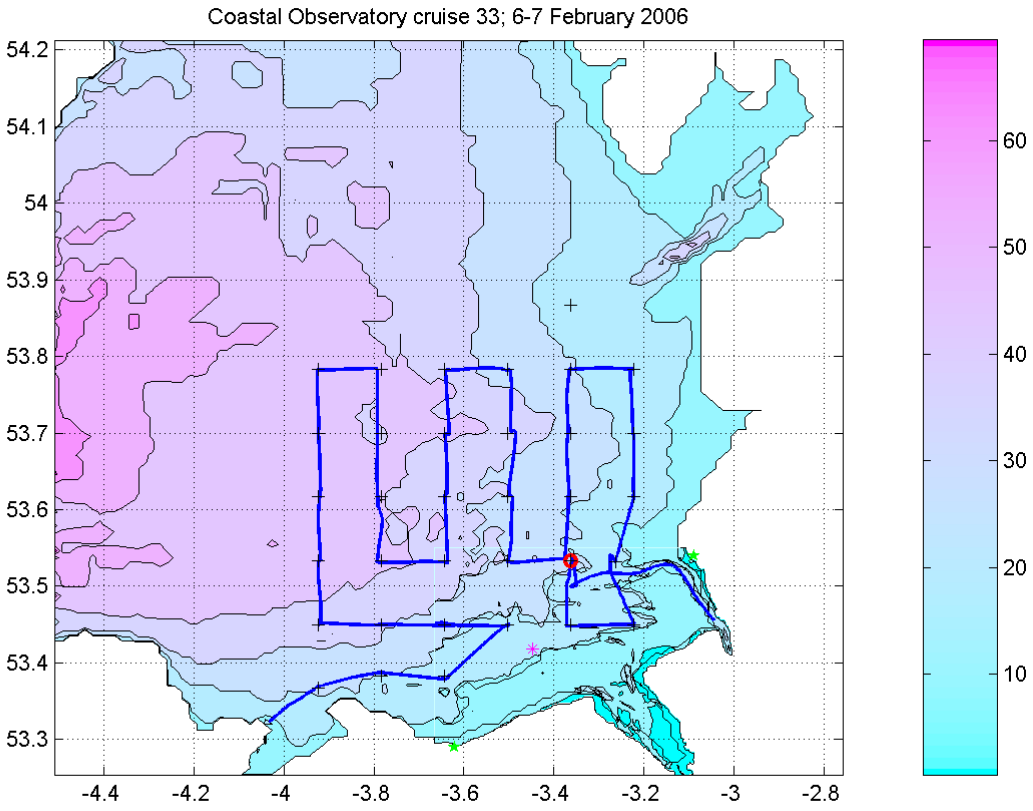

Figure 1. Cruise track.

4. Moorings (times in GMT)

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

Site A
Nothing recovered.

Site B
a) Site B. 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.
Fitted with a pressure sensor and 1Gbyte PCMCIA memory; hourly wave recording enabled.
Clock reset at 18:07:00 on 13 December 2005; delayed start 12:00:00 on 15 December 2005.
(Note: called Site A in ADCP file)

Sea-Bird 16*plus* S/N 4738 on base of frame with pumped conductivity sensor underneath.
SeaPoint turbidity sensor: S/N 10320 taped to roll bar; set up for 0 - 25 FTU range (No cable available to set to 0-125 FTU range). Sample interval 600 s;
Clock set at 11:11:00 on 13 December; delayed start at 12:00:00 on 14 December 2005.

b)Telemetry ADCP 1.2MHz RDI 6489

LinkQuest modem (serial number 8604)

The frame D1 was fitted with two Benthos releases (serial number 72850) – Rx 11.5 kHz, Tx 12.0 kHz, release C and (serial number 71904) – Rx 10.0 kHz, Tx 12.0 kHz, release C both with a fizz link, and a spooler with 200m of rope for recovery of the ballast weight.

c) Smart Buoy Recovered.

Table 1. Recovered mooring positions and times.

	Latitude (N)	Longitude (W)	Water Depth (m)	Recovery Time	Date
Waves ADCP (Site A)	Not recovered				
SmartBuoy (Site A)	Not recovered				
Waves ADCP (Site B)	53º 27.003'	3º 38.437'		13:46	06/02/06
Waves ADCP+Tel (Site B)				14:35	06/02/06
Smart Buoy (Site B)	53º 26.992'	3º 38.424'	24.4	12:57	06/02/06

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

Site A
a) Waves ADCP Not deployed
b) Smart Buoy Not deployed

Site B
c) Site B. 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.
Fitted with a pressure sensor and 1Gbyte PCMCIA memory; hourly wave recording enabled.
Clock reset at 18:36:00 on 2 February 2006; delayed start 08:00:00 on 6 February 2006.

Sea-Bird 16*plus* S/N 4737 on base of frame with pumped conductivity sensor underneath. SeaPoint turbidity sensor: S/N 10489 taped to roll bar; set up for 0-125 FTU range. Sample interval 600 s;
Clock set at 17:14:00 on 5 February; delayed start at 11:00:00 on 6 February 2006.

Telemetry ADCP 1.2MHz RDI 0572

LinkQuest modem (serial number 8602)

The frame was fitted with two Benthos releases (serial number 72858) – Rx 14.5 kHz, Tx 12.0 kHz, release A and (serial number 72863) – Rx 13.5 kHz, Tx 12.0 kHz, release A both with a fizz link, and a spooler with 200m of rope for recovery of the ballast weight.

d) SmartBuoy Mooring
No POL equipment was attached to this mooring.

The CEFAS SmartBuoy is fitted with a surface CTD (including turbidity and fluorescence sensors). A CTD with turbidity sensor was fitted in a cage at 10 m below the surface.

The single point mooring was composed mainly of ½" long link chain, marked by a 1.8 m diameter toroid and anchored by a half tonne clump of scrap chain

Table 2. Deployed mooring positions and times.

	Latitude (N)	Longitude (W)	Water Depth (m)	Deployment Time	Date
Wave+Tel ADCPs (Site B)	53º 26.88'	3º 38.34'	23.6	12:30	06/02/06
Smart Buoy (Site B)	53º 26.89'	3º 38.36'	24.1	12:39	06/02/06

5. CTD

The Sea-Bird 911 CTD recorded downwelling PAR light levels (CEFAS light sensor), temperature, conductivity, transmittance, oxygen (no calibration samples) and fluorescence at 24 Hz. The frame was fitted with an altimeter, which was not totally reliable, so that measurements were taken to within an estimated 3 m above the bed. The rosette will take twelve 10 l water bottles although the capacity is reduced by one (for the LISST-25) and by two to accommodate a bottle with reversing thermometers. Two water bottles were fired near bed and two near the surface, when needed. One of the near bed bottles was fitted with two electronic thermometers to check the CTD temperature data. Water samples were taken from this bottle for calibration of the CTD salinity data. (At the CEFAS stations, see below, this bottle was fired near the surface). Water samples were taken from the near surface and near bed bottles and frozen for nutrient analysis by NOC (nitrate, phosphate, silicate), and also were filtered to determine suspended sediment load and calibrate the CTD transmissometer, by the School of Ocean Sciences. Water samples from the second near surface bottle from stations 1, 5 – 9 and 11 were filtered for chlorophyll and suspended sediment determination and some filtrate was preserved with mercuric chloride for nutrient determination by CEFAS. A LISST-25 particle sizer was fitted to the CTD and its data logged on the Sea-Bird data logging system. A LISST-100 particle sizer with internal logging was also attached to the CTD frame and its data periodically downloaded for analysis by SOS. Copies of the Sea-Bird binary files were taken off for processing and calibration at BODC / POL.

Table 3. Nominal CTD positions.

Site	Latitude (N)	Longitude (W)	Visited on this cruise	Chlorophyll & nutrients	Suspended **Sediments** /nutrients	Trace metals
1	53º 32′	3º 21.8′	no			
2	53º 37′	3º 13.4′	yes		yes	yes

3	53º 42′	3º 13.4′	yes		yes	yes
4	53º 47′	3º 13.4′	yes		yes	yes
5	53º 52′	3º 21.8′	no			
6	53º 47′	3º 21.8′	yes	yes	yes	yes
7	53º 42′	3º 21.8′	yes	yes	yes	yes
8	53º 37′	3º 21.8′	yes	yes	yes	yes
9	53º 32′	3º 21.8′	yes	yes	yes	yes
10	53º 27′	3º 13.4′	yes		yes	yes
11	53º 27′	3º 21.8′	yes	yes	yes	yes
12	53º 27′	3º 30.2′	yes		yes	yes
13	53º 32′	3º 30.2′	yes		yes	yes
14	53º 37′	3º 30.2′	yes		yes	yes
15	53º 42′	3º 30.2′	yes		yes	yes
16	53º 47′	3º 30.2′	yes		yes	yes
17	53º 47′	3º 38.6′	yes		yes	yes
18	53º 42′	3º 38.6′	yes		yes	yes
19	53º 37′	3º 38.6′	yes		yes	yes
20	53º 32′	3º 38.6′	yes		yes	yes
21	53º 27′	3º 38.6′	yes		yes	yes
22	53º 23′	3º 38.6′	yes		yes	yes
23	53º 23′	3º 47.0′	yes		yes	yes
24	53º 27′	3º 47.0′	yes		yes	yes
25	53º 32′	3º 47.0′	yes		yes	yes
26	53º 37′	3º 47.0′	yes		yes	yes
27	53º 42′	3º 47.0′	yes		yes	yes
28	53º 47′	3º 47.0′	yes		yes	yes
29	53º 47′	3º 55.4′	yes		yes	yes
30	53º 42	3º 55.4′	yes		yes	yes
31	53º 37′	3º 55.4′	yes		yes	yes
32	53º 32′	3º 55.4′	yes		yes	yes
33	53º 27′	3º 55.4′	yes		yes	yes
34	53º 22′	3º 55.4′	yes		yes	yes
35	53º 32′	3º 15.9′	yes		yes	yes

Table 4. Surface and bottom parameters from CTD, noted in log book.

CTD no	Site	Nuts	Nominal positions. Latitude (N)	Longitude (W)	Water depth (m)	Temp (deg)	Salinity
		T/ B				T / B	T / B
1	34	37/38	53º 22′	3º 55.4′	23	6.2 / 6.4	32.9 / 32.9
2	23	67/72?	53º 23′	3º 47.0′	17	6.0 / 6.3	32.7 / 32.9
3	22	55/46	53º 23′	3º 38.6′	11	5.6 / 5.6	32.6 / 32.6
4	12	59/40	53º 27′	3º 30.2′	16	6.4 / 6.4	32.9 / 32.9
5	21	51/44	53º 27′	3º 38.6′	23	6.4 / 6.5	33.1 / 33.1
6	24	45/42	53º 27′	3º 47.0′	35	7.4 / 7.4	33.6 / 33.6
7	33	39/48	53º 27′	3º 55.4′	40	8.0 / 8.0	33.9 / 33.9
8	32	65/66	53º 32 ′	3º 55.4′	48	8.4 / 8.4	34.0 / 34.0
9	31	69/62	53º 37′	3º 55.4′	44	8.3 / 8.3	34.0 / 34.0
10	30	53/54	53º 42	3º 55.4′	43	8.1 / 8.1	33.9 / 33.9
11	29	43/70?	53º 47′	3º 55.4′	43	7.6 / 8.1	33.5 / 33.7
12	28	71/60	53º 47′	3º 47.0′	43	6.4 / 7.7	32.5 / 33.7
13	27	63/56	53º 42′	3º 47.0′	43	6.7 / 7.7	32.7 / 32.7
14	26	89/64	53º 37′	3º 47.0′	42	7.6 / 8.0	not noted
15	25	51/52	53º 32′	3º 47.0′	43	7.8 / 7.8	33.8 / 33.5
16	20	50/41	53º 32′	3º 38.6′	33	7.2 / 7.5	33.4 / 33.5
17	19	61/58	53º 37′	3º 38.6′	30	7.2 / 7.4	33.4 / 33.5
18	18	47/57	53º 42′	3º 38.6′	39	6.7 / 7.4	32.7 / 33.5
19	17	45/62	53º 47′	3º 38.6′	35	6.8 / 7.0	32.9 / 32.8
20	16	35/36	53º 47′	3º 30.2′	27	6.0 / 6.7	32.1 / 32.6
21	15	43/66	53º 42′	3º 30.2′	-	6.3 / 7.3	33.1 / 33.2
22	14	67/52	53º 37′	3º 30.2′	34	6.9 / 6.8	33.0 / 33.0
23	13	60/48	53º 32′	3º 30.2′	33	6.9 / 6.9	33.0 / 33.0
24	9	53/54	53º 32′	3º 21.8′	27	6.6 / 6.6	32.7 / 32.7
25	8	37/54	53º 37′	3º 21.8′	29	7.0 / 7.0	33.1 / 33.1
26	7	59/38	53º 42′	3º 21.8′	26	6.5 / 6.5	32.5 / 32.5
27	6	58/19	53º 47′	3º 21.8′	22	5.8 / 6.0	31.8 / 32.0
28	4	51/56	53º 47′	3º 13.4′	18	5.5 / 5.5	31.6 / 31.7
29	3	69/44	53º 42′	3º 13.4′	18	5.5 / 5.5	31.5 / 31.5
30	2	71/70	53º 37′	3º 13.4′	13	5.5 / 5.5	31.5 / 31.4
31	35	65/46	53º 31.9′	3º 15.9′	12	6.9 / 6.6	31.3 / 31.3
32	10	49/40	53º 27′	3º 13.4′	14	5.7 / 5.7	32.0 / 31.8
33	11	41/42	53º 27′	3º 21.8′	16	6.2 / 6.2	32.4 / 32.4

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, 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, Transmissance, Hull Temperature (ºC), Barometric Pressure (mbar), Fluorescence, Turbidity, Salinity, Minimum Air Temp (ºC), Maximum Air Temp (ºC), Wind Gust (m s^{-1}), GPS Time, Latitude, Longitude, Barometric Pressure Minimum (mbar), Barometric Pressure Maximum (mbar), Conductivity sensor water temperature (ºC). Sea surface temperature, salinity and transmittance were calibrated against the CTD by BODC.

Data were recorded every minute. Copies of the data were taken off the ship as an Excel file, along with a copy of the ship's navigation data.

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.

Acknowledgements
The assistance of the master, officers, and crew contributed greatly to the success and safety of the cruise.