Prince Madog cruise 23/03
26, 27 May 2003
POL Coastal Observatory cruise 8
REPORT

1. Objectives

1. At 53º 32´ N 3º 21.8´ W, half a mile west of the Mersey Bar Light Vessel –

To recover
a) A sea bed frame for a 600 kHz ADCP to measure the mean current profile, pressures and directional waves. A pressure recorder, a transmissometer / conductivity / temperature logger and a SeaBird MicroCat are fitted to the frame.
b) A sea bed frame for a 1.2 MHz ADCP to measure fast sample current profiles and pressures.
c) A CEFAS SmartBuoy in a single point mooring with an Aanderaa temperature and conductivity logger at 10 m below the surface.
d) A CEFAS wave buoy.
e) A trial spar buoy mooring

To deploy
f) A sea bed frame for a 600 kHz ADCP to measure the mean current profile, pressures and directional waves. A pressure recorder, a transmissometer / conductivity / temperature logger and a SeaBird MicroCat are also fitted to the frame.
g) A CEFAS SmartBuoy in a single point mooring with an Aanderaa temperature and conductivity logger at 10 m below the surface.
h) A CEFAS wave buoy (recovered at d).

2. To conduct a CTD / LISST survey of 34 stations 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 suspended sediment at all stations and for chlorophyll at selected stations.

3. To obtain grab samples at stations 23 -34 for University of Lancaster.

2.1 Scientific personnel

M.J. Howarth
M. Burke
J.D Humphery
A.J. Souza
M.J. Smithson
D. Pearce (CEFAS)
S. Cutchey (CEFAS)
A. Hammerstein (School of Ocean Sciences)
A. Camps (School of Ocean Sciences)
S. Missias (School of Ocean Sciences)

2.2 Ship's officers and crew

A.D. Price (Master)
I. Bosworth (Chief Officer)
A. Williams (Chief Engineer)
N. Holmes (Second Engineer)
T. Roberts (Bosun)
D.D. Williams (A.B.)
D. Lloyd Jones (A.B.)
E. Pritchard (Cook)

3. Narrative (times in GMT)

The SmartBuoy and mooring, sea-bed frame and instrumentation were loaded onto RV Prince Madog at Menai Bridge on the afternoon of 25 May 2003. (The SmartBuoy toroid was rolled down the walkway.) The ADCP frame was set up on the afterdeck and the tower fitted to the SmartBuoy toroid.

RV Prince Madog left Menai Bridge at 07.15 on 26 May and recording of surface sampling and the ship's ADCP switched on at 08.10, near Puffin Island, section 6. The sea was calm with weak winds, often less than 1 m s^{-1}.

Piling operations for the North Hoyle wind farm were passed on the way to the mooring site, 53º 32´ N 3º 21.8´ W, which was reached at 10.50. A calibration CTD was carried out for the transmissometer and MicroCat due to be deployed on the ADCP frame. The wave buoy was recovered between 11.26 and 11.38, pulling in the rubbercord by hand.

A release on the mean ADCP frame was fired at 12.05 after the ship had been manoeuvred over the frame. Since the ADCP did not surface sweeping was organised. The frame was caught on the first pass, surfacing at 12.33. It was recovered at 12.50, without the ballast weight, since the spooler line had parted, but with the spooler case. (When the data from the ADCP were downloaded the record was found to be short, from 16 – 29 April only). The release on the second, fast sample, ADCP frame was fired at 13.05 and again the frame did not appear. The first pass of the sweep caught a boat's anchor and the second the frame. It and its ballast weight were all inboard by 14.05. Inspection of the ADCP frames indicated that in both cases the spoolers had not been correctly fitted.

The Coastal Observatory ADCP was deployed at 14.27 and the SmartBuoy between 14.44 and 14.50. The preceding SmartBuoy was recovered between 15.00 and 15.11. The wave buoy was redeployed between 15.42 and 15.46 – the buoy had been serviced and its Argos telemetry system replaced with an Orbcomm system. The trial spar buoy was recovered by 16.03 – during the mooring operations it was noticed that this buoy had been used as a tether for some divers.

A CTD profile was recorded at 16.25 and the CTD survey then started with station 10, followed by 2 – 9 and 11 – 31, finishing at 14:00 on 27 May. Grab samples were also obtained at stations 23 – 31. Time having run out, a course was now set for the Mersey Bar Light and Birkenhead, due to lock in at 18:00. Underway sampling was stopped at 17:43, in the River Mersey. The reason for the visit to Birkenhead docks was to pick up STABLE, for deployment off Holyhead for another POL project, and at the same time the SmartBuoy

mooring was unloaded. One more Coastal Observatory CTD was recorded on the way to the Holyhead site, at site 33 at 11:08 on 28 May. The region was in general stratified in temperature, by up to 2ºC, and salinity, by up to 1, with higher chlorophyll levels and more turbid water near the bed. The south-west corner was well-mixed. Temperatures were in the range 10.4 – 13.5ºC, the warmest closest to the English coast and salinities from 31.3 to 34.1.

All of the mooring objectives were achieved; 32 out of 34 CTD sites visited and 9 out of 12 grab samples obtained, in excellent weather – calm seas and very light winds.

4. Moorings (times in GMT)

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

a) Mean 600 kHz RDI ADCP, 2391; battery case 3036.
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).
Earth co-ordinates - speeds, correlation, echo intensity, % good.
Sound velocity calculated from temperature, depth and salinity of 32.
Fitted with a pressure sensor and 512Mb of memory; hourly wave recording enabled.
Started at 13:30 on 16 April 2003; the clock had not been reset and was 66 s fast.
The last scan was recorded at 19.30 on 29 April, 2003. Further data were lost because of a fault within the ADCP indicating the memory was full when it wasn't. The clock was 140 s fast on 26 May, 2003 (it had not been reset before the deployment).

Aanderaa pressure recorder BPR 445 / DSU 3995: 10 minute sampling, started 14:40 on 9 April, 2003. The last scan was at 14:50:59 on 27 May, 2003; 34864 words were recorded.

25 cm Sea-Tech Transmissometer, ST557, recording in Aanderaa logger (RCM 11820 / DSU 8122) fitted with temperature and conductivity sensors: 10 minute sampling, started at 15:40 on 9 April; switched at 08:45 on 16 April. Air readings at 09:35 on 16 April and blocked path readings from 09:06 on 16 April 2003. CTD calibration between 10:42 and 11:05 on 16 April. The last scan was at 02:10:32 on 27 May, 2003; 41286 words were recorded.

SeaBird MicroCat temperature, conductivity, pressure recorder (37IM29828-2506 – ID03): 10 minute sampling was started at 12:00 on 16 April 2003. The last scan was at 13:40 on 26 May, 2003; 5771 scans were recorded. The clock was 15 seconds fast. The post deployment calibration was carried out at station 11, between 23:55 on 26 May and 00:28:41 on 27 May, set on 10 s sampling.

The frame, D4, was fitted with two Benthos releases, 3A, 5A, and a spooler with 200 m of rope for recovery of the ballast weight.

b) 1.2 MHz RDI ADCP, 0572, with Battery cases 254 and 068 and 1 Gbyte memory.
Mode 12, 10 subpings, sampled at 1 Hz.
10 x 1 m bins.
Beam co-ordinates - speeds, echo intensity.
The first sample was at 08:00 on 16 April 2003 and the last at 12:07:14 on 27 May, 2003

The frame, D1, was fitted with two Benthos releases, 4A, 4B, and a spooler with 200 m of rope for recovery of the ballast weight

c) SmartBuoy mooring. Aanderaa current meter RCM7 9959 / DSU 3925 without fin at 10 m below the surface to log temperature and conductivity: 10 minute samples.
Started at 15:10 on 9 April, 2003; the last reading was at 06:01 on 27 May, 2003; 52587 words were recorded. The data looked ok until 03:30 on 23 May; thereafter corrupted.

The single point mooring was composed mainly of ½" long link chain, marked by a 1.8 m diameter toroid and anchored by a 0.5 tonne clump of scrap chain.

Table 1. Recovered mooring positions and times, in 2003.

	Latitude (N)	Longitude (W)	Water Depth (m)	Deployment Time	Deployment Date	Water Depth (m)	Recovery Time	Recovery Date
Wave buoy	53º 32.026´	3º 22.295´			02/02		11:26	26/05
SmartBuoy	53º 32.276´	3º 22.309´	20	15:22	16/04	20	15:00	26/05
Mean ADCP	53º 32.199´	3º 22.279´	23	13:38	16/04		12:05	26/05
Spar	53º 32.224´	3º 21.807´	20	15:58	16/04		15:57	26/05
Fast ADCP	53º 32.046´	3º 21.391´	26	12:22	16/04	20	13:05	26/05

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

f) Mean ADCP 600 kHz RDI 2390; battery case 0250
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 2 x 256 Mb memory; hourly wave recording enabled.
Clock reset at 15:03 on 25 May; ADCP delayed start at 06:00 on 26 May, 2003.

Aanderaa pressure recorder BPR 1357 / DSU 9103: 10 minute sampling. Clock reset at 14:40; started 14:50 on 25 May; first scan at 14:50:50 on 25 May, 2003.

25 cm Sea-Tech Transmissometer, ST556, recording in Aanderaa logger (RCM7 11814 / DSU 9107) fitted with temperature (low range) and conductivity sensors: 10 minute sampling. Clock reset at 15:30; started at 15:40 on 25 May. Air readings at 07:40 – 08:00 on 26 May; blocked path readings at 08:10 – 08:40 on 26 May. CTD calibration sample 11:10 26 May.

SeaBird MicroCat temperature, conductivity recorder (37IM29828-2081 – ID02). The reference depth was set to 25 m. Clock reset at 16:00 on 25 May.
Pre-deployment calibration: 10 second sampling started at 10:45 on 26 May for CTD 1.
10 minute sampling started at 12:00 on 26 May, 2003.

The frame, D2, was fitted with two Benthos releases, 8A, 7A, and a spooler with 200 m of rope for recovery of the ballast weight.

g) SmartBuoy mooring. Aanderaa current meter RCM7 9631 / DSU 8118 without fin at 10 m below the surface to log temperature (low range) and conductivity: 10 minute samples.

Clock reset at 15:17; started at 15:20 on 25 May, 2003.

The single point mooring was composed mainly of ½" long link chain, marked by a 1.8 m diameter toroid and anchored by a 0.5 tonne clump of scrap chain.

h) A CEFAS directional wave buoy, fitted with an Orbcomm transmitter.

Table 2. Deployed mooring positions and times, in 2003.

	Latitude (N)	Longitude (W)	Water Depth (m)	Deployment Time	Deployment Date
SmartBuoy	53º 32.406′	3º 22.469′	19.6	15:50	26/05/03
Mean ADCP	53º 32.229′	3º 22.004′	20	14:27	26/05/03
Wave Buoy	53º 32.151′	3º 21.356′	20.5	15:46	26/05/03

5. CTD

Table 3. Nominal CTD positions.

Site	Latitude (N)	Longitude (W)	Visited on this cruise	Chlorophyll & nutrients	Grab sample
1	53º 32′	3º 21.8′	yes	yes	
2	53º 37′	3º 13.4′	yes		
3	53º 42′	3º 13.4′	yes		
4	53º 47′	3º 13.4′	yes		
5	53º 52′	3º 21.8′	yes	yes	
6	53º 47′	3º 21.8′	yes	yes	
7	53º 42′	3º 21.8′	yes	yes	
8	53º 37′	3º 21.8′	yes	yes	
9	53º 32′	3º 21.8′	yes	yes	
10	53º 27′	3º 13.4′	yes		
11	53º 27′	3º 21.8′	yes	yes	
12	53º 27′	3º 30.2′	yes		
13	53º 32′	3º 30.2′	yes		
14	53º 37′	3º 30.2′	yes		
15	53º 42′	3º 30.2′	yes		
16	53º 47′	3º 30.2′	yes		
17	53º 47′	3º 38.6′	yes		
18	53º 42′	3º 38.6′	yes		
19	53º 37′	3º 38.6′	yes		
20	53º 32′	3º 38.6′	yes		
21	53º 27′	3º 38.6′	yes		
22	53º 23′	3º 38.6′	yes		
23	53º 23′	3º 47.0′	yes		yes
24	53º 27′	3º 47.0′	yes		yes
25	53º 32′	3º 47.0′	yes		yes
26	53º 37′	3º 47.0′	yes		yes
27	53º 42′	3º 47.0′	yes		yes
28	53º 47′	3º 47.0′	yes		yes
29	53º 47′	3º 55.4′	yes		yes

Site	Latitude (N)	Longitude (W)	Visited on this cruise	Chlorophyll & nutrients	Grab sample
30	53º 42	3º 55.4′	yes		yes
31	53º 37′	3º 55.4′	yes		yes
32	53º 32′	3º 55.4′	no		
33	53º 27′	3º 55.4′	yes		
34	53º 22′	3º 55.4′	no		

The Sea-Bird 911 CTD recorded temperature, conductivity, transmittance and fluorescence at 24 Hz. The altimeter fitted to the frame was unreliable. Up to three water bottles were fired near the bed and one or two near the surface. Near bed and near surface water samples were filtered for suspended sediment determination by the School of Ocean Sciences. The other near bed bottle was used for reversing thermometer readings and a water sample for salinity determination back at the School of Ocean Sciences. Water samples from the second near surface bottle were filtered for chlorophyll and suspended sediment determination at CEFAS, and some filtrate was preserved with mercuric chloride for nutrient determination. A LISST-25 particle sizer was fitted to the CTD and its data logged on the Sea-Bird data logging system. Copies of the Sea-Bird binary files were taken off for processing at BODC / POL.

Since the Simrad echo-sounder was not working, depths were obtained from the ship's ADCP readout on the bridge; the navigation echo sounder being switched off to avoid possible interference with the ADCP. As a consequence of the problem with the Simrad, there was also no position readout in the main laboratory – position's were obtained from the surface monitoring readout in the computer laboratory.

Seabed samples were obtained for Lancaster University with a Shipek grab deployed on the main winch, from stations 23 - 31.

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 (μ E m^{-2} s^{-1}), 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).

Data were recorded from 08:10 on 26 May, at 053° 19.405' N 004° 01.756' W, until 17:43 on 27 May, at 053° 26.601' N 003° 01.881' W. The time channel was noisey. 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 28 pings / ensemble.

Acknowledgements
The assistance of the Captain, officers, bosun, and crew contributed greatly to the success of the cruise.