Prince Madog cruise 02/03
23, 24 January 2003
POL Coastal Observatory cruise 5
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 and pressures. A pressure recorder, a transmissometer / conductivity / temperature logger and a SeaBird MicroCat are fitted to the frame.
b) A sea bed frame for a 600 kHz ADCP to measure the mean current profile, pressures and directional waves.
c) A CEFAS SmartBuoy in a single point mooring with an Aanderaa temperature and conductivity logger at 10 m below the surface.

To deploy
d) A sea bed frame for a 600 kHz ADCP to measure the mean current profile and pressures. A pressure recorder, a transmissometer / conductivity / temperature logger and a SeaBird MicroCat are also fitted to the frame (recovery a).
e) A sea bed frame fitted with a 1.2 MHz ADCP, SonTek ADV, LISST-100 and Sontek coherent Doppler on loan.
f) A CEFAS SmartBuoy in a single point mooring with an Aanderaa temperature and conductivity logger at 10 m below the surface.
g) A development spar buoy.

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.

2.1 Scientific personnel

M.J. Howarth
M. Burke
R. Cooke
J.D Humphery
J.P. Pugh
A.J. Souza
A. Reeve (CEFAS)
R. Wilton (School of Ocean Sciences)

2.2 Ship's officers and crew

A.D. Price (Master)
A. Simmonds (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, spar buoy and moorings, sea-bed frames and instrumentation were loaded onto RV Prince Madog on the afternoon of 22 January 2003. (The SmartBuoy toroid was rolled down the walkway.) Both ADCP frames were set up on the afterdeck and the tower fitted to the SmartBuoy toroid. One of the acoustics failed its test - a replacement would be fitted from the acoustics on the frames to be recovered. A phone call from CEFAS informed us that telemetry indicated the wave buoy at the mooring site had come adrift that day and was moving towards the mouth of the Mersey.

RV Prince Madog left Menai Bridge at 08.30 on 23 January. Progress towards Puffin Island was slow because of shallow water depths (low tide just after springs). Recording of surface sampling was switched on at 10.06, near Puffin Island, section 6. The ship's ADCP was still out of action and is unlikely to be serviceable until after dry docking in August 2003, when the windows will be changed. Phone calls from CEFAS informed us that the wave buoy had now come ashore between Hilbre Island and Red Rocks - it was recovered later in the day by POL staff. The mooring site was reached at 12.20 and a calibration CTD for the recording transmissometer and MicroCat recorded. The rosette failed to fire. The nutrient analyser due for deployment on the SmartBuoy was noticed not to be working. When it was opened later in the afternoon there was a nasty smell and the voltage was low, suggesting a terminal power supply failure. The SmartBuoy was, therefore, deployed without a nutrient analyser.

Since the weather was fine and sunny with little wind and the sea state was calm and since the forecast for the next day was less good, every effort was made to complete the mooring work today. The 'waves' ADCP was released at 12.57, inboard by 13.12 and the ballast weight inboard by 31.21. The 'mean' ADCP was released at 13.38, inboard by 13.45 and its ballast weight inboard by 13.57. Both frames were clean of growth, apart from a clump of whelk eggs on one. Some fine muddy sandy sediment came up on the ballast weights. Since there were now four ADCP frames on the deck, as well as the SmartBuoy, some shuffling of the frames was necessary. The 'mean' ADCP was removed from its frame and its data downloaded, preparatory for its redeployment. One set of acoustics was removed from the 'waves' ADCP frame and fitted to the new 'mean' ADCP frame. The 'sediments' ADCP was deployed at 14.48. The SmartBuoy, without the nutrient analyser, was deployed between 15.30 and 15.43. On the way to deploy, it the pellet floats of the wave buoy mooring were spotted so this was now recovered between 15.55 and 16.06. Recovery once again showed the difficulty of handling the rubber cord which has to be pulled in by hand. The top section of the rubber cord was incomplete and looked to have suffered a break through tension. The new 'mean' ADCP was deployed at 16.18. The MicroCat on this frame was attached nearly vertically so that sediment could not collect in it, a postulated reason for poor conductivity measurements on previous deployments. The ballast weights of both ADCP frames were fitted with two extra lead weights since earlier records showed some changes in heading, tilt and roll.

Recovery of the SmartBuoy started at 16.28 but two sections of the bridle rope broke. The buoy was caught a second time and recovered between 16.40 and 16.50. The top ring of the

buoy was bent during the recovery. The deck was tidied and the trial spar buoy deployed between 17.29 and 17.36, completing the mooring work. All objectives had been accomplished in an afternoon of intensive activity aided by the benign weather conditions.

To allow everyone a breather, the CTD survey commenced with station 10 at 18.28, with the rosette now functional, followed by stations 2 – 9, 11 – 18. Station 19 was abandoned without data being recorded because of data communications difficulties between the sensors and the ship, whilst station 18 had not been completed for the same reason. The problem was intermittent since once the CTD was on the deck it disappeared. The water bottles did not fire at stations 7 and 17. The CTD survey was suspended because of these problems and because the sea state was marginal at the furthest offshore stations (winds up to 16 m s^{-1} from the south-west). Surface sampling was relied on for stations 19 - 21. At station 22, inshore and hence relatively sheltered, the CTD was tried, and worked. Therefore the CTD survey concluded with stations 23, 24, 32, 33 and 34, finishing at 13.35 and surface sampling was switched off at 14:29, with the intention of recovering a School of Ocean Sciences ADCP, off Gallows Point. However, since the wind was blowing too strongly, over 15 m s^{-1} from the south-west, along the Menai Strait, for the ship to hold station, recovery was not attempted. RV Prince Madog was alongside at Menai Bridge at 15.00.

All of the mooring objectives were accomplished and 27 out of 34 CTD sites visited (sites 25-31 were missed completely and surface values only obtained from sites 19, 20 and 21). The area was in general well-mixed vertically, only stations 2, 3, 4, 6 and 7 showed signs of significant stratification. Temperatures varied between 5.7 and 7.7ºC and salinities between 30.7 and 33.7.

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 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).
Earth co-ordinates - speeds, correlation, echo intensity, % good.
Sound velocity calculated from temperature, depth and salinity of 32.
Fitted with a pressure sensor.
Started at 19:00 on 11 December 2002, the last scan was at 14:10 on 23 January 2003.

Aanderaa pressure recorder BPR 1357: 10 minute sampling, started 17:10 on 11 December, 2002 The initial time stamp failed to record. The last scan was at 09:51:11 on 28 January 2003; 34633 words were recorded. Unable to check the clock.

25 cm Sea-Tech Transmissometer, ST556, recording in Aanderaa logger (RCM 11818) fitted with temperature and conductivity sensors: 10 minute sampling, started at 18:50 on 11 December. Air readings at 08:30 & 08:40 12 December and blocked path readings from 08:50 – 09:20 12 December. Air readings on the afternoon of 23 January. The last scan was at 12:20:45 on 23 January 2003; 41538 words were recorded; the clock was 64 s slow.

SeaBird MicroCat temperature, conductivity recorder (37IM29828-2010 – ID01): 10 minute sampling was started at 12:00 on 12 December 2002. The reference depth was set to 25 m.

The last scan was at 14:10 on 28 January 2003; 6782 scans were recorded. We were unable to download the data on the ship, possibly because of interference.

The frame, D4, was fitted with two Benthos releases, 7A, 8A, and a spooler with 200 m of rope for recovery of the ballast weight.

b) Waves ADCP; 600 kHz RDI 2390; 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; wave recording enabled.
Started at 05:00 on 12 December 2002; last scan at 01:20 on 24 January 2003; the clock was 70 s slow at 09:15 on 29 January.

The frame, D6, was fitted with two Benthos releases, 1B, 5A, and a spooler with 200 m of rope for recovery of the ballast weight.

c) SmartBuoyMooring. Aanderaa current meter RCM7 9631 without fin at 10 m below the surface to log temperature and conductivity: 10 minute samples.
Started at 18.30 on 11 December 2002. The last scan was at 11:10:48 on 28 January; 41508 words were recorded. The clock was 32 s slow at 11:46 on 28 January.

The single point mooring was composed mainly of ½" long link chain, marked by a 1.8 m diameter toroid and anchored by a 1 tonne clump of scrap chain.

Table 1. Recovered mooring positions and times.

	Latitude (N)	Longitude (W)	Water Depth (m)	Deployment Time	Deployment Date	Water Depth (m)	Recovery Time	Recovery Date
SmartBuoy	53º 31.917′	3º 22.452′	28	16:51	12/12	28	16.28	23/01/03
Mean ADCP	53º 31.995′	3º 21.670′	26	15:30	12/12	28	13.38	23/01/03
Waves ADCP	53º 31.991′	3º 21.352′	23	10:31	13/12	27	12.57	23/01/03

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

d) Mean ADCP 600 kHz RDI 2391; battery case 0254
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.
Started at 16:00 on 23 January 2003.

Aanderaa pressure recorder BPR 445: 10 minute sampling, started 14:30 on 20 January, 2003; first scan at 14.40 20 January, 2003.

25 cm Sea-Tech Transmissometer, ST557, recording in Aanderaa logger (RCM7 11820) fitted with temperature and conductivity sensors: 10 minute sampling, started at 15:10 on 20

January. Air readings at 09:50 & 10:00 on 23 January and blocked path readings at 10:10 & 10:20 on 23 January.

SeaBird MicroCat temperature, conductivity recorder (37IM29828-2506 – ID03): 10 minute sampling was started at 10:00 on 23 January 2003. The reference depth was set to 25 m.

The frame, D1, was fitted with two Benthos releases, 4B, 5A, and a spooler with 200 m of rope for recovery of the ballast weight.

e) Sediments ADCP 1.2 MHz RDI, 3052; battery case 0068; 1 GByte memory.
Mode 12. 10 min burst sampling every 59 minutes 59.98 seconds; 600 one second ensembles of 8 subpings every 60ms.
49 bins of length 0.5 m.
Start time 10:00 on 23 January 2003.

Sontek 5 MHz ADV 252; battery case 250.
10 minute burst sampling every hour; 15000 samples at 25 Hz.
Start time 10:00 on 23 January 2003.
Mounted on a scaffolding pole.

Sontek Pulse-coherent Acoustic Doppler Profiler 33, battery case 107. On loan from OSIL.
30 bins, each of 0.047 m, with a blanking interval of 0.05 m
10 minute burst sampling every hour; 600 samples at 1 Hz.
Start time 10:00 on 23 January 2003.

LISST-100 1109.
5 minute burst sampling every hour, 15 lots of 40 sample averages at 20 s intervals.
Start time 10:00 on 23 January 2003.

The frame, D3, was fitted with two Benthos releases, 4A, 3A, and a spooler with 200 m of rope for recovery of the ballast weight.

f) SmartBuoyMooring. Aanderaa current meter RCM7 9959 without fin at 10 m below the surface to log temperature and conductivity: 10 minute samples.
Started at 14:10 on 20 January 2003.

The NAS nutrient analyser was not fitted to the buoy because of instrument failure.

The single point mooring was composed mainly of ½" long link chain, marked by a 1.8 m diameter toroid and anchored by a 1 tonne clump of scrap chain.

g) A development spar buoy, single point mooring.

Table 2. Deployed mooring positions and times.

	Latitude (N)	Longitude (W)	Water Depth (m)	Deployment Time	Deployment Date
Trial Spar Buoy	53º 31.979′	3º 21.541′	24	17:36	23/01/03
Mean ADCP	53º 32.032′	3º 21.622′	26	16:18	23/01/03
Sediments ADCP	53º 31.962′	3º 21.932′	28	14:48	23/01/03
(Wave Buoy	53º 32.016′	3º 22.449′			02/02/03)[۳]
SmartBuoy	53º 31.994′	3º 22.887′	30	15:43	23/01/03

[۳] The wave buoy was redeployed by the CEFAS research vessel Corystes.

5. CTD

Table 3. Nominal CTD positions.

Site	Latitude (N)	Longitude (W)	Visited on this cruise	Chlorophyll & nutrients
1	53º 32′	3º 21.8′	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	
8	53º 37′	3º 21.8′	yes	yes
9	53º 32′	3º 21.8′	yes	yes
10	53º 27′	3º 13.4′	yes	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′	no	
20	53º 32′	3º 38.6′	no	
21	53º 27′	3º 38.6′	no	
22	53º 23′	3º 38.6′	yes	
23	53º 23′	3º 47.0′	yes	
24	53º 27′	3º 47.0′	yes	
25	53º 32′	3º 47.0′	no	
26	53º 37′	3º 47.0′	no	
27	53º 42′	3º 47.0′	no	
28	53º 47′	3º 47.0′	no	
29	53º 47′	3º 55.4′	no	
30	53º 42	3º 55.4′	no	
31	53º 37′	3º 55.4′	no	
32	53º 32′	3º 55.4′	yes	
33	53º 27′	3º 55.4′	yes	
34	53º 22′	3º 55.4′	yes	

The Sea-Bird 911 CTD recorded temperature, conductivity, transmittance and fluorescence at 24 Hz. Since the frame was fitted with an altimeter measurements were taken to within 2 m above the bed. Two 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. 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 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.

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).

Data were recorded from 10:06 on 23 January, at 053° 19.015' N 004° 02.085' W, until 14:29 on 24 January, at 053° 15.554' N 004° 05.449' W. Unfortunately there were many gaps in the data so that only 31% of possible data points were recorded. Copies of the data were taken off the ship as an Excel file, along with a copy of the ship's navigation data.

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