

Prince Madog cruise 10/03
6, 7 March 2003
POL Coastal Observatory cruise 6
REPORT

1. Objectives

1. At 53° 32' N 3° 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 fitted with a 1.2 MHz ADCP, SonTek ADV, LISST-100 and Sontek coherent Doppler on loan.
- c) A CEFAS SmartBuoy in a single point mooring with an Aanderaa temperature and conductivity logger at 10 m below the surface.
- d) A development spar buoy.

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 CEFAS SmartBuoy in a single point mooring with an Aanderaa temperature and conductivity logger at 10 m below the surface.

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. To obtain grab samples of sea bed sediment at selected stations.

2.1 Scientific personnel

R. Proctor
M. Burke
J.D Humphery
J.P. Pugh
A.J. Souza
M.J. Smithson
D. Sivyver (CEFAS)
A. Hammerstein (School of Ocean Sciences)
E. Bray (SOS, 2nd year u/g student)
R. Cooksley (SOS, 2nd year u/g student)

2.2 Ship's officers and crew

A.D. Price (Master)
A. Simmonds (Chief Officer)
A. Williams (Chief Engineer)
P.A. Ryan (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 5 March 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. Omitted to bring 25m of anchor chain for the SmartBuoy, Mike Burke returned to POL to collect it, returning in the evening.

RV Prince Madog left Menai Bridge at 08.15 on 6 March. Progress towards Puffin Island was slow because of shallow water depths (low tide just after springs). Recording of surface sampling was switched on at 09.12, near Puffin Island. 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. Weather sunny, winds SW 4/5, slight swell. The mooring site was reached at 11.20 and a calibration CTD for the recording transmissometer and MicroCat recorded and surface, mid-depth and bottom water samples collected.

The weather was fine and sunny with little wind and the sea state was calm, but the forecast for the next day was less good so every effort was made to complete the mooring work today. The 'mean' ADCP was released at 12.13, inboard by 12.25 and its ballast weight inboard by 12.35. The 'sediments' ADCP was released at 12.56, inboard by 13.07 but with a tangled ballast weight rope. In attempting to recover the ballast weight the tangled rope snapped and the ballast was lost. Both frames were clean of growth, some fine muddy sandy sediment came up on 'mean' adcp. Anenomes and starfish were present on the ballast weight. Since there were now three 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 memory card replaced with a high capacity card, preparatory for its redeployment. The data download to a laptop was commenced (subsequently stopped after download time of 400MB was estimated at 30 hours!). The SmartBuoy was deployed between 14.23 and 14.25. The new 'mean' ADCP was deployed at 14.34. Recovery of the SmartBuoy and anchor chain was between 14.55 and 15.05. Slight damage to the licor brackets and burring of the bottom licor occurred on recovery. The development spar buoy and anchor chain was recovered between 15.38 and 15.40. The rope was tangled around the bottom section. The deck was tidied, completing the mooring work. A grab sample of sea bed sediment was collected at 15.55 but produced only a small sample. A second grab sample at 16.01 was successful. All objectives had been accomplished in an afternoon of intensive activity aided by the benign weather conditions.

The weather forecast was for an imminent (6-12 hours away) Southerly gale, so we pushed on with the CTD survey.

The CTD survey commenced with station 10 at 16.49, followed by stations 2 – 9, 11 – 27. Grab samples were obtained at stations 10, 2-8 (10 samples in all, samples 1 & 2 at station 1, 3 at station 10, 4 at station 2, 5 at station 3, etc., ... 10 at station 8). Water bottle samples were taken at surface and bottom at each station, for salinity calibration and sediment filter samples, except there was no surface filter sample at station 2 because of bottle firing

difficulties. A mid-depth water sample was also taken at station 1/9. Weather forecast was for imminent SW gale force 8 so the furthest offshore stations (28, 29) were skipped. Survey completed with stations 30-34, finishing at 14.42. Surface sampling was switched off at 15:23. RV Prince Madog was alongside at Menai Bridge at 16.15.

All of the mooring objectives were accomplished and 32 out of 34 CTD sites visited (sites 28-29 were missed completely). The area was in general well-mixed vertically, only stations 4, 7, 15, 16 and 18 showed signs of significant stratification. Temperatures varied between 4.94 and 6.86°C and salinities between 30.73 and 33.96.

4. Moorings (times in GMT)

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

a) 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, last ensemble at 10:50 on 6 March 2003.

Aanderaa pressure recorder BPR 445: 10 minute sampling, started 14:30 on 20 January, 2003; first scan at 14.40 20 January, 2003, last scan on 03:21 7 March 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, last scan on 02:50 on 7 March 2003.

SeaBird MicroCat temperature, conductivity recorder (37IM29828-2506 – ID03): 10 minute sampling was started at 10:00 on 23 January 2003, last scan on 00:45 7 March 2003.

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.

b) 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, last ensemble 15:11 on 6 March 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, last scan at 16:00:12 on 6 March 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, last scan at 16:00:12 on 6 March 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, last scan at 17:05:05 on 6 March 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. It was not recovered due to spooler rope snagging, then breaking.

c) 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, last scan on 04:21 on 7 March 2003.

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

Water sampler recovered, collected 43 samples as programmed.

Loggers still working on recovery with very little biofouling, although bottom licor was damaged during recovery.

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 1. Recovered mooring positions and times.

	<u>Latitude</u> (N)	<u>Longitude</u> (W)	<u>Water</u> <u>Depth</u> (m)	<u>Deployment</u> <u>Time</u>	<u>Date</u>	<u>Water</u> <u>Depth</u> (m)	<u>Recovery</u> <u>Time</u>	<u>Date</u>
SmartBuoy	53° 31.982'	3° 22.903'	30	15:43	23/01/03	30	14.55	06/03/03
Mean ADCP	53° 31.968'	3° 21.619'	26	16:18	23/01/03	28	12.25	06/03/03
Waves ADCP	53° 31.905'	3° 21.045'	28	14:48	23/01/03	30	13.07	06/03/03
Trial Spar Buoy	53° 32.014'	3° 21.452'	24	17:36	23/01/03	25	15.40	06/03/03

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 14:00 on 6 March 2003.

Aanderaa pressure recorder BPR 1357: 10 minute sampling, started 12:30 on 26 February, 2003.

25 cm Sea-Tech Transmissometer, ST631, recording in Aanderaa logger (RCM7 11818) fitted with temperature and conductivity sensors: 10 minute sampling, started at 11:00 on 27 February 2003. Air readings at 09:20 & 10:30-11:30 on 6 March and blocked path readings at 09:40 until 10:20 on 6 March.

SeaBird MicroCat temperature, conductivity recorder (37IM29828-2010 – ID01): 10 minute sampling was started at 12:00 on 6 March. The reference depth was set to 25 m.

The frame, D6, was fitted with two Benthos releases, 1B, 7A, and a spooler with 200 m of rope for recovery of the ballast weight.

e) SmartBuoyMooring. Aanderaa current meter RCM7 9631 without fin at 10 m below the surface to log temperature and conductivity: 10 minute samples. Started at 16:40 on 26 February 2003.

The NAS nutrient analyser was fitted to the buoy, calibrated on the 5 March, set running standards at 12:00 6 March, last standard at 14:00 6 March 2003.

Water sampler WMS programmed to start at 00:00 7 March 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 1 tonne clump of scrap chain.

Table 2. Deployed mooring positions and times.

	<u>Latitude</u> (N)	<u>Longitude</u> (W)	<u>Water</u> <u>Depth (m)</u>	<u>Deployment</u>	
				<u>Time</u>	<u>Date</u>
Mean ADCP	53° 31.993'	3° 21.844'	27	14.34	06/03/03
SmartBuoy	53° 32.068'	3° 22.118'	28	14.23	06/03/03

5. CTD

Table 3. Nominal CTD positions.

<u>Site</u>	<u>Latitude</u> (N)	<u>Longitude</u> (W)	<u>Visited on</u> <u>this cruise</u>	<u>Chlorophyll</u> <u>& nutrients</u>
1	53° 32'	3° 21.8'	yes	
2	53° 37'	3° 13.4'	yes	
3	53° 42'	3° 13.4'	yes	
4	53° 47'	3° 13.4'	yes	
5	53° 52'	3° 21.8'	yes	yes
6	53° 47'	3° 21.8'	yes	yes
7	53° 42'	3° 21.8'	yes	yes
8	53° 37'	3° 21.8'	yes	yes
9	53° 32'	3° 21.8'	yes	yes
10	53° 27'	3° 13.4'	yes	
11	53° 27'	3° 21.8'	yes	yes
12	53° 27'	3° 30.2'	yes	
13	53° 32'	3° 30.2'	yes	
14	53° 37'	3° 30.2'	yes	
15	53° 42'	3° 30.2'	yes	

16	53° 47'	3° 30.2'	yes	
17	53° 47'	3° 38.6'	yes	
18	53° 42'	3° 38.6'	yes	
19	53° 37'	3° 38.6'	yes	
20	53° 32'	3° 38.6'	yes	
21	53° 27'	3° 38.6'	yes	
22	53° 23'	3° 38.6'	yes	
23	53° 23'	3° 47.0'	yes	
24	53° 27'	3° 47.0'	yes	
25	53° 32'	3° 47.0'	yes	
26	53° 37'	3° 47.0'	yes	
27	53° 42'	3° 47.0'	yes	
28	53° 47'	3° 47.0'		no
29	53° 47'	3° 55.4'		no
30	53° 42'	3° 55.4'	yes	
31	53° 37'	3° 55.4'	yes	
32	53° 32'	3° 55.4'	yes	
33	53° 27'	3° 55.4'	yes	
34	53° 22'	3° 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. Only surface water samples were filtered after station 24 (lack of filter papers). 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 ($\mu mol s^{-1} m^{-2}$), Air Temperature ($^{\circ}C$), Relative Humidity, Relative Wind Speed ($m s^{-1}$), Relative Wind Direction ($^{\circ}$) – zero indicates wind on the bow, Transmittance, Hull Temperature ($^{\circ}C$), Barometric Pressure (mbar), Fluorescence, Turbidity, Salinity, Minimum Air Temp ($^{\circ}C$), Maximum Air Temp ($^{\circ}C$), Wind Gust ($m s^{-1}$), GPS Time, Latitude, Longitude, Barometric Pressure Minimum (mbar), Barometric Pressure Maximum (mbar), Conductivity sensor water temperature ($^{\circ}C$).

Data were recorded from 09:12 on 6 March at Puffin Island, until 15:23 on 7 March, at Puffin Island. The series is mostly complete, a single gap of 1 hour around 2200 on 6 March. 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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