

Prince Madog cruise 25/05
POL Coastal Observatory cruise 28
13 – 14 July 2005

1. Objectives

1. At 53° 32' N 3° 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.
- b) A CEFAS SmartBuoy in a single point mooring with a Sea-Bird MicroCAT temperature, conductivity logger at 5m below the surface and an Aanderaa temperature and conductivity logger at 10 m 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 an SonTek ADV.

d) A CEFAS SmartBuoy in a single point mooring with a Sea-Bird MicroCAT temperature, conductivity logger at 5m below the surface and an Aanderaa temperature and conductivity logger at 10 m below the surface.

e) A sea bed frame for a Aanderaa RDCP600 (waves ADCP) to measure current profile, referenced from the sea-bed, surface and enhanced surface and one estimated surface values

2. At 53° 27' N 3° 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. The frame was fitted with a SonTek ADV.

b) A CEFAS SmartBuoy in a single point mooring with a Sea-Bird MicroCAT temperature, conductivity logger at 5m below the surface and an Aanderaa temperature and conductivity logger at 10 m 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

d) A CEFAS SmartBuoy in a single point mooring with a Sea-Bird MicroCAT temperature, conductivity logger at 5m below the surface and an Aanderaa temperature and conductivity logger at 10 m below the surface.

3. 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.
4. Collect 10 vertical net hauls at mooring site A.
5. To collect water sample for Stan van den Berg from underway sampling system from north-east corner of the CTD grid.

The plan was to complete mooring operations at site A on Wednesday afternoon followed by CTD measurements during the night. On Thursday mooring operations at site B would start at 07:00, followed by completion of the CTD grid.

2.1 Scientific personnel

Phil Knight (Principal)
Mike Burke
Chris Balfour
Mike Smithson
John Kenny
Stuart Cutchey (CEFAS)
Olga Andres (CEFAS)
Berit Lunde Heltne (Aanderaa)
Anne Hammerstein (School of Ocean Sciences)

2.2 Ship's officers and crew

Richard Morris (Master)
Andy Wallis (Chief Officer)
A.V. Williams (Chief Engineer)
K. Wilde (Second Engineer)
Tommy Roberts (A.B.)
Bob Munn (A.B.)
Dave Williams (A.B.)
E. P. Pritchard (Cook)

3. Narrative (times in GMT)

The SmartBuoy toroid, anchor chain clumps, two sea-bed frames and instrumentation were loaded onto RV Prince Madog on the afternoon of 12 July 2005. 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 06:00 on 13 July. See Figure 1 for the cruise track. Recording of surface sampling and the ship's ADCP were started at 07:04, near Puffin Island.

Figure 1. Cruise track.

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 3644; battery case 3240.

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 1 Gbyte PCMCIA memory; hourly wave recording enabled.

Clock reset at 13:40:00 on 14 June 2005; delayed start 07:00:00 on 15 June 2005.

Stopped at 21:24 on 13 July 2005. Clock is 28s fast.

Sea-Bird 16*plus* S/N 4597 on base of frame with pumped conductivity sensor underneath.

SeaPoint turbidity sensor: S/N 10471 taped to roll bar.

Sample interval 600 s; diquartz integration time 40 s; range 400.

1 s delay before sampling, pump on for 0.5 s before sampling.

Clock set at 13:41:00 on 14 June 2005; delayed start at 10:00:00 on 15 June 2005.

Stopped at 21:52:00 on 13 July 2005. Clock is 5s fast.

Calibration on CTD: Sample interval 5 minutes, Start time 22:50:00 on 13 July 2005 on Cast (CTD no.) 14 at Station 12. Cast at 22:59:00 on 13 July 2005.

The frame D1 was fitted with two Benthos releases 70358 – Rx 11.0 kHz, Tx 12.0 kHz, enable C, release D and 72382 – Rx 10.0 kHz, Tx 11.0 kHz, enable D, release A both with a fizz link, and a spooler with 200m of rope for recovery of the ballast weight.

b) SmartBuoy Mooring.

Sea-Bird MicroCAT temperature and conductivity recorder, Serial number 2081 (id=#02), at 5 m below the surface. 10 minute samples.

Clock set at 14:24:20 on 14 June 2005. Delayed start 10:00:00 on 15 June 2005.

Stopped at 23:48:00 on 13 July 2005. Clock is 3s slow. Samples 4115.

Aanderaa current meter RCM8 10526 / DSU 8125 without fin at 10 m below the surface to log temperature (low temperature setting) and conductivity: 10 minute samples.

Started at 15:10:00 on 14 June 2005.

Stopped at 00:13:00 on 14 July 2005. 25572 words. Battery 8.38V. Clock is 10s slow.

The CEFAS SmartBuoy is fitted with two surface CTDS, light sensors at 1 and 2 m below the surface, a water sampler which obtains water samples once per day for laboratory nutrient (nitrate, nitrite, phosphate) determination and an in situ NAS2E nutrient analyser. The CTD and light data are transmitted back to CEFAS via Orbcomm.

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.

Site B

a) Site B. Waves ADCP 600 kHz RDI 2391. Battery case 3235.
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 13:54:00 on 14 June 2005; delayed start 07:00:00 on 15 June 2005.
Stopped at 09:16 on 14 July 2005. Clock 1 minute 8 s fast.

SonTek ADV (Acoustic Doppler Velocimeter)

ADV Sensor head A640

ADV Logger G321

Started 06:00:00 15 June 2005, Sample rate 16Hz, Burst interval 3600s, Samples in each burst is 19200, Burst length is 1200s.

Stopped at 14:30 on 14 July 2005.

Sea-Bird *16plus* S/N 4737 on base of frame with pumped conductivity sensor underneath.

SeaPoint turbidity sensor: S/N 10489 taped to roll bar.

Sample interval 600 s; diquartz integration time 40 s; range 400.

1 s delay before sampling, pump on for 0.5 s before sampling.

Clock set at 13:55:20 on 14 June 2005; delayed start at 10:00:00 on 15 June 2005.

Stopped at 10:39:00 on 14 July 2005. Clock is 4s fast.

Calibration on CTD: Sample interval 5 minutes, Start time 10:25:00 on 14 July 2005 on Cast (CTD no.) 28 at Station 12. Cast at 10:30:00 on 14 July 2005.

The frame D5 was fitted with two Benthos releases 71919 – Rx 10.5 kHz, Tx 11.0 kHz, enable B, release C and 71922 – Rx 11.5 kHz, Tx 11.0 kHz, enable D, release A both with a fizz link, and a spooler with 200m of rope for recovery of the ballast weight.

b) SmartBuoy Mooring.

Sea-Bird MicroCAT temperature, conductivity and pressure recorder Serial number 2506 (id=#03) at 5 m below the surface. 10 minute samples.

Clock set at 14:19:00 on 14 June 2005. Delayed start 10:00:00 on 15 June 2005.

Stopped at 11:57:00 on 14 July 2005. Clock is 5s fast.

Aanderaa current meter RCM7 9959 / DSU 8123 without fin at 10 m below the surface to log temperature (low temperature setting) and conductivity: 10 minute samples.

Started at 15:10:00 on 14 June 2005. Stopped at 12:20:00 on 14 July 2005. Clock is 22s fast.

The CEFAS SmartBuoy is fitted with a surface CTD (including turbidity and fluorescence sensors) and a water sampler which obtains water samples once per day for laboratory nutrient (nitrate, nitrite, phosphate) determination.

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 1. Recovered mooring positions and times.

	<u>Latitude</u> (N)	<u>Longitude</u> (W)	<u>Water</u> <u>Depth</u> (m)	<u>Recovery</u> <u>Time</u>	<u>Date</u>
Waves ADCP (Site A)	53° 31.992'	3° 21.469'	20.8	10:14	13/07/05
SmartBuoy (Site A)	53° 32.028'	3° 21.620'	23.8	12:19	13/07/05
Waves ADCP (Site B)	53° 27.229'	3° 38.887'	25.0	06:13	14/07/05
Smart Buoy (Site B)	53° 27.076'	3° 38.936'	25.6	07:23	14/07/05

4.2 The set up of the deployed 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.

Fitted with a pressure sensor and 1 Gbyte PCMCIA memory; hourly wave recording enabled.

Clock reset at 14:46:30 on 12 July 2005; delayed start 07:00:00 on 13 July 2005.

Sea-Bird 16*plus* S/N 4738 on base of frame with pumped conductivity sensor underneath.

SeaPoint turbidity sensor: S/N 10490 taped to roll bar. Set up to range up to 125 FTU.

Sample interval 600 s

Clock set at 15:00:00 on 12 July 2005; delayed start at 11:00:00 on 13 July 2005.

SonTek ADV (Acoustic Doppler Velocimeter)

ADV Sensor head A638

ADV Logger G365

Started 11:00:00 13 July 2005, Sample rate 16Hz, Burst interval 3600s, Samples in each burst is 19200, Burst length is 1200s.

The frame D4 was fitted with two Benthos releases 72858 – Rx 14.5 kHz, Tx 11.0 kHz, enable B, release G and 72863 – Rx 13.5 kHz, Tx 11.0 kHz, enable B, release G both with a fizz link, and a spooler with 200m of rope for recovery of the ballast weight.

b) SmartBuoy Mooring.

Sea-Bird MicroCAT temperature, conductivity and pressure recorder Serial number 2991 at 5 m below the surface. 10 minute samples.

Clock set at 15:16:00 on 12 July 2005. Delayed start 11:00:00 on 13 July 2005.

Aanderaa current meter RCM7 11814 / DSU 8122 without fin at 10 m below the surface to log temperature (low temperature setting) and conductivity: 10 minute samples.

Started at 15:50:00 on 12 July 2005. Clock set at 15:40:00 on 12 July 2005.

The CEFAS SmartBuoy is fitted with two surface CTDS, light sensors at 1 and 2 m below the surface, a water sampler which obtains water samples once per day for laboratory nutrient (nitrate, nitrite, phosphate) determination and an in situ NAS2E nutrient analyser. The CTD and light data are transmitted back to CEFAS via Orbcomm.

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.

c) Aanderaa RDCP 600 kHz ADCP, Serial No. 0005

Started at 13:00 on 13 July 2005.

Setup was carried out for Column 1, 2, 3, 5 Aanderaa profiles. Setup to do 250 pings in 10 minute intervals.

Column1: Cell size 2m, Overlap 50%, Number of cells 30, cells are instrument referred.

Column2: Cell size 2m, Overlap 50%, Number of cells 20, cells are surface referred.

Column3: Cell size 2m, Overlap 80%, Number of cells 20, cells are surface referred.

Column5: Surface cell.

The frame D2 was fitted with two Benthos releases 70355 – Rx 10.0 kHz, Tx 12.0 kHz, enable C, release D and (serial number uncertain) – Rx 11.0 kHz, Tx 10.5 kHz, enable D, release D (uncertain on the previous two codes) both with a fizz link, and a spooler with 200m of rope for recovery of the ballast weight.

Site B

a) Site B. Waves ADCP 600 kHz RDI 5806.

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 15:46 on 12 July 2005; delayed start 06:00:00 on 14 July 2005.

Sea-Bird 16*plus* S/N 4736 on base of frame with pumped conductivity sensor underneath.

SeaPoint turbidity sensor: S/N 10320 taped to roll bar.

Sample interval 600 s;

Clock set at 14:30:00 on 12 July 2005; delayed start at 11:00:00 on 13 July 2005.

The frame D6 was fitted with two Benthos releases 70354 – Rx 13.0 kHz, Tx 12.0 kHz, enable C, release D and (serial number uncertain) – Rx 11.5 kHz, Tx 12.0 kHz, enable F, release D both with a fizz link, and a spooler with 200m of rope for recovery of the ballast weight.

b) SmartBuoy Mooring.

Sea-Bird MicroCAT temperature and conductivity recorder, Serial number 2010, at 5 m below the surface. 10 minute samples.

Clock set at 15:25:00 on 12 July 2005. Delayed start 11:00:00 on 13 July 2005.

Aanderaa current meter RCM7 9631 / DSU 8117 without fin at 10 m below the surface to log temperature (low temperature setting) and conductivity: 10 minute samples.

Clock set at 16:45:00 on 12 July 2005. Started at 15:50:00 on 12 July 2005.

The CEFAS SmartBuoy is fitted with a surface CTD (including turbidity and fluorescence sensors) and a water sampler which obtains water samples once per day for laboratory nutrient (nitrate, nitrite, phosphate) determination.

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.

	<u>Latitude</u> (N)	<u>Longitude</u> (W)	<u>Water</u> <u>Depth</u> (m)	<u>Deployed</u> <u>Time</u>	<u>Date</u>
Waves ADCP (site A)	53° 32.013'	3° 21.434'	21.2	10:50	13/07/05
SmartBuoy (site A)	53° 32.077'	3° 21.918'	23.1	12:12	13/07/05
Aanderaa ADCP (site A)	53° 32.042'	3° 22.138'	23.5	11:48	13/07/05
Waves ADCP (Site B)	53° 27.221'	3° 38.837'	26.8	06:55	14/07/05
Smart Buoy (Site B)	53° 27.200'	3° 38.528'	25.3	07:13	14/07/05

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. 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 SOC (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.

<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>	<u>Suspended</u> <u>Sediments/</u> <u>nutrients</u>
1	53° 32'	3° 21.8'	yes	yes	yes
2	53° 37'	3° 13.4'	yes		yes
3	53° 42'	3° 13.4'	yes		yes
4	53° 47'	3° 13.4'	yes		yes
5	53° 52'	3° 21.8'	yes	yes	yes

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

Note: * No suspended sediment filtering from station 25-34

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

<u>CTD</u> <u>no</u>	<u>Site</u>	<u>Nuts</u> T/ B	Nominal positions.		<u>Water</u> <u>depth</u> (m)	<u>Temp</u> (deg) T / B	<u>Salinity</u> T / B
			<u>Latitude</u> (N)	<u>Longitude</u> (W)			
2	1	1/ 2	53° 32'	3° 21.8'	25	19.4 / 16.0	32.2 / 32.4
3	10	*3/ 6	53° 27'	3° 13.4'	19	19.1 / 17.6	31.4 / 31.8
4	35	7/ 8	53° 31.9'	3° 15.9'	16	18.8 / 16.7	31.8 / 32.2
5	2	9/10	53° 37'	3° 13.4'	15	18.4 / 18.3	32.3 / 32.3
6	3	11/12	53° 42'	3° 13.4'	19	17.6 / 18.0	32.4 / 32.4
7	4	13/14	53° 47'	3° 13.4'	18	18.0 / 17.5	32.5 / 32.5
8	5	15/16	53° 52'	3° 21.8'	15	17.5 / 17.5	32.5 / 32.5
9	6	17/18	53° 47'	3° 21.8'	19	17.7 / 16.5	32.5 / 32.5
10	7	19/20	53° 42'	3° 21.8'	23	18.3 / 15.2	32.2 / 32.7
11	8	21/22	53° 37'	3° 21.8'	24	18.6 / 15.6	32.2 / 32.6
12	9	23/24	53° 32'	3° 21.8'	22	19.0 / 16.1	31.7 / 32.4
13	11	25/26	53° 27'	3° 21.8'	16	17.5 / 16.8	32.0 / 32.2
14	12	27/28	53° 27'	3° 30.2'	17	17.0 / 16.6	32.2 / 32.6
15	13	29/30	53° 32'	3° 30.2'	31	18.7 / 15.4	31.9 / 32.8
16	14	31/32	53° 37'	3° 30.2'	32	18.7 / 14.8	32.4 / 33.0
17	15	33/34	53° 42'	3° 30.2'	38	19.2 / 14.2	32.4 / 33.3
18	16	23/24	53° 47'	3° 30.2'	27	17.7 / 15.0	32.5 / 32.8
19	17	37/38	53° 47'	3° 38.6'	37	18.4 / 14.1	32.5 / 33.2
20	18	39/40	53° 42'	3° 38.6'	42	18.9 / 14.1	32.4 / 33.2
21	19	41/42	53° 37'	3° 38.6'	35	16.5 / 14.4	33.1 / 33.5
22	20	43/44	53° 32'	3° 38.6'	37	14.7 / 14.5	33.5 / 33.5
23	21	45/46	53° 27'	3° 38.6'	26	16.0 / 15.7	33.2 / 33.3
25	22	47/48	53° 23'	3° 38.6'	13	17.5 / 17.5	32.4 / 32.5
26	23	49/50	53° 23'	3° 47.0'	18	18.0 / 16.4	32.7 / 33.0
27	24	51/52	53° 27'	3° 47.0'	30	15.8 / 15.1	33.2 / 33.4
28	25	53/54	53° 32'	3° 47.0'	41	15.4 / 14.6	33.6 / 33.5
29	26	55/56	53° 37'	3° 47.0'	39	16.9 / 14.3	33.3 / 33.4
30	27	57/58	53° 42'	3° 47.0'	40	18.5 / 14.0	32.6 / 33.3
31	28	59/60	53° 47'	3° 47.0'	41	18.7 / 13.9	32.5 / 33.5
32	29	61/62	53° 47'	3° 55.4'	41	19.1 / 13.9	32.5 / 33.5
33	30	63/64	53° 42'	3° 55.4'	43	17.8 / 14.0	32.9 / 33.5
34	31	65/66	53° 37'	3° 55.4'	47	16.9 / 14.0	33.4 / 33.7
35	32	67/68	53° 32'	3° 55.4'	48	14.4 / 13.9	33.8 / 33.9
36	33	69/70	53° 27'	3° 55.4'	41	14.4 / 14.2	33.8 / 33.8
37	34	71/72	53° 22'	3° 55.4'	25	16.0 / 15.8	33.4 / 33.9

Note: * Bottle labelled no. 4 was broken. In order to keep the sequence of odd for top bottle and even for bottom bottle, the bottle labelled no. 5 was ignored.

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 ($\mu\text{mols / m}^2\text{s}$), Air Temperature ($^{\circ}\text{C}$), Relative Humidity, Relative Wind Speed (m s^{-1}), Relative Wind Direction ($^{\circ}$) – zero indicates wind on the bow, Transmittance, Hull Temperature ($^{\circ}\text{C}$), Barometric Pressure (mbar), Fluorescence, Turbidity, Salinity, Minimum Air Temp ($^{\circ}\text{C}$), Maximum Air Temp ($^{\circ}\text{C}$), Wind Gust (m s^{-1}), GPS Time, Latitude, Longitude, Barometric Pressure Minimum (mbar), Barometric Pressure Maximum (mbar), Conductivity sensor water temperature ($^{\circ}\text{C}$). Sea surface temperature, salinity and transmittance were calibrated against the CTD by BODC.

Data were recorded every minute from 07:04 on 13 July until 17:44 on 14 July 2005 starting and ending at Puffin Island. 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. Data were recorded from 07:04 on 13 July until 17:34 on 14 July 2005 starting and ending at Puffin Island.

Acknowledgements

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