

**Prince Madog cruise 48/05**  
**POL Coastal Observatory cruise 32**  
**14-15 December 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. 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 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.
- 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.

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
- e) A telemetry toroid for communications with the 1.2MHz ADCP attached to the bottom frame, via acoustic modems, and orbcomm satellites.

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 10 vertical net hauls at mooring site A.

## **2.1 Scientific personnel**

Phil Knight (Principal)  
Mike Burke  
John Kenny  
Mike Smithson  
Chris Balfour  
Naomi Greenwood (CEFAS)  
Neil Needham (CEFAS)  
Anne Hammerstein (School of Ocean Sciences)  
Pascal Salaun (Liverpool University)  
Luis Laglera (Liverpool University)

## **2.2 Ship's officers and crew**

Adrian Simonds (Master)  
Andy Wallis (Chief Officer)  
Goodluck Levi Miebai (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 telemetry and SmartBuoy toroids, anchor chain clumps, two sea-bed frames and instrumentation were loaded onto RV Prince Madog on the morning of 13 December 2005, just after high water. The telemetry and SmartBuoy toroids were rolled down the walkway. The ADCP frames and instruments were set up on the afterdeck, the telemetry toroid built up and instruments fitted, and the tower and instruments fitted to the SmartBuoy toroid

RV Prince Madog left Menai Bridge at 08:00 on 14 December; see Figure 1 for the cruise track. Recording of surface sampling and the ship's ADCP were started at 08:49, near Puffin Island. Due to a bad weather forecast for Thursday and deck logistics, it was decided to deploy the telemetry buoy at site B, together with the ADCP frame earlier than intended. This was carried out between 10:33 and 10:45. The 0-125 FTU cable for the turbidity sensor was not available since it was to be taken from the frame at site A, therefore the 0-25 FTU cable was used instead.

Mooring site A was reached at 12:01 when a CTD profile was recorded. The Wave ADCP was located and released at 12:22, recovered and its ballast weight was on deck by 12:38.

The replacement ADCP was deployed at 12:55. Conditions were reasonable – the wind speed was about 10m/s from the NNW. The SmartBuoy was deployed at 13:12 and the original buoy recovered between 13:24 and 13:33. The deck was tidied, a CTD recorded and ten vertical net hauls for zooplankton (five with 1 m diameter and five with 0.5 m diameter net holders) were undertaken, finishing at 14:52.

The CTD sample grid then commenced, visiting sites 10, 35, 2 – 24 arriving at Station 21 (mooring site B) at 10:00 on 15 December. It was decided not to carry out any moorings work due to worsening weather conditions (large swell and water regularly coming onto the aft deck). The CTD sample grid then re-commenced, visiting sites 25, 32 – 34. The CTD survey was completed at 13:10, the ship's ADCP and surface monitoring system switched off at 13:50 at Puffin Island, and Prince Madog docked at Menai Bridge at 14:35 on 15 December.

The cruise had been hampered by strong winds from the NW and large swell waves. The SmartBuoy and ADCP were not recovered at site B, and the replacement Smartbuoy at site B was not deployed. The CTD grid was completed, except for seven sites (including one abandoned) sites.

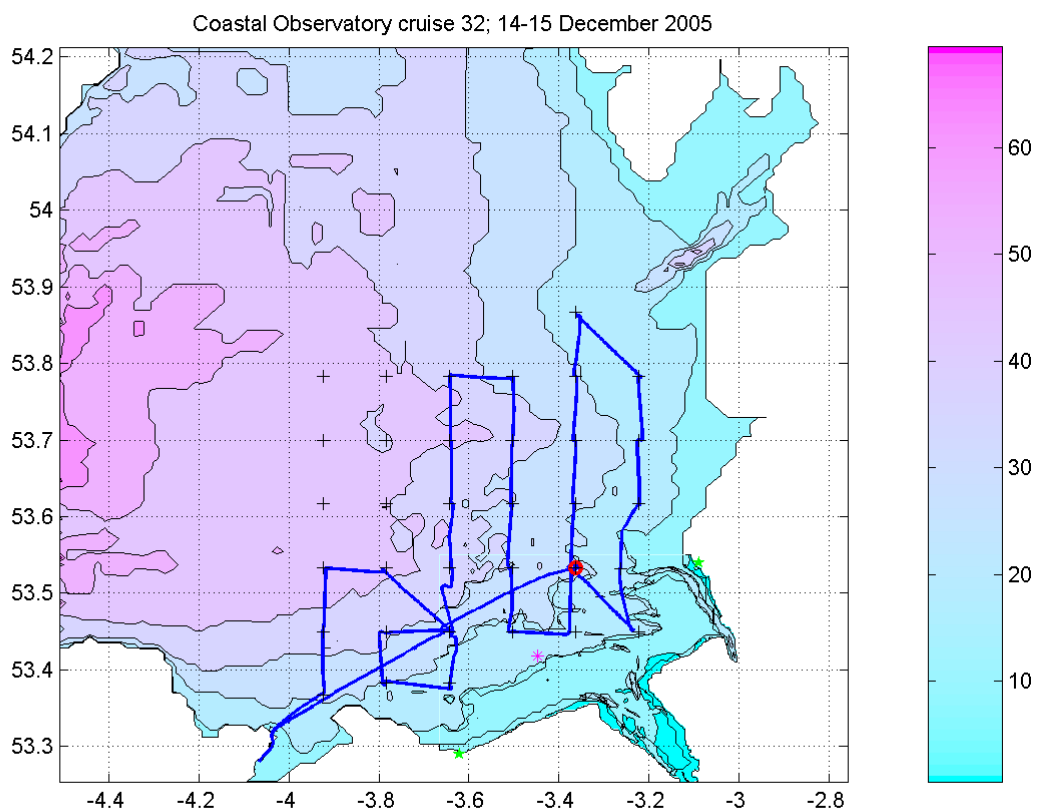


Figure 1. Cruise track.

#### 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 pack 0068

Mode 1: 100 pings every 10 minutes (velocity standard deviation  $0.007 \text{ m s}^{-1}$ ).

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 14:23:00 on 25 October; delayed start 06:00:00 on 26 October 2005; started ok.

Stopped at 22:01:00 14 December. File name N3644, size 229,736kB, processed OK.

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

SeaPoint turbidity sensor: S/N 10471 taped to roll bar; set up for 0 - 125 FTU range.

Sample interval 600 s; digiquartz integration time 40 s, range 400; pump 0.5s, 1 s delay.

Clock set at 14:24:00 on 25 October 2005; delayed start at 11:00:00 on 26 October 2005.

Stopped at 23:58:00 on 14 December 2005. Clock is 7s fast.

Calibration dip, 3 min sampling, delayed start at 01:15:00 on 15 December, attached to CTD (cast) No. 16, Station 14; time in 01:24, stopped at 02:32:00.

SonTek ADV (Acoustic Doppler Velocimeter); ADV Logger G258

Sample rate 16Hz; burst interval 3600s; samples in each burst 19200; burst length 1200s.

Clock reset. Compass orientation changed. Delayed start at 12:00:00 26 October 2005.

ADV G258 + B233H, stopped at 15:36:00 on 15 December 2005.

The frame (no number) was fitted with two Benthos releases 71919 – Rx 10.5 kHz, Tx 12.0 kHz, release C and 70355 – Rx 10.0 kHz, Tx 12.0 kHz, release B 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. Sample interval 600s. Reference pressure 25 dB.

Clock set at 13:36:20 on 25 October 2005. Delayed start 11:00:00 on 26 October 2005.

Stopped at 01:22:00 on 15 December 2005, samples=7143, download OK.

No Aanderaa.

The CEFAS SmartBuoy is fitted with one surface CTD, light sensors at 1 and 2 m below the surface, a water sampler which obtains water samples once per day for laboratory nutrient (TOXN and silicate; no filtration therefore no phosphate) and chlorophyll 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**

c) Site B. Waves ADCP 600 kHz RDI 2391; battery case 3240.

Mode 1: 100 pings every 10 minutes (velocity standard deviation  $0.007 \text{ m s}^{-1}$ ).

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 14:54:00 on 25 October; delayed start 06:00:00 on 26 October 2005; started ok.  
 Not recovered.

Sea-Bird 16*plus* S/N 4597 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; digiquartz integration time 40s, range=400; run pump 0.5s, 1 s delay.  
 Clock set at 14:11:00 on 25 October 2005; delayed start at 11:00:00 on 26 October 2005.  
 Not recovered.

The frame D5 was fitted with two Benthos releases 71922 – Rx 11.5 kHz, Tx 12.0 kHz, release A and 70358 – Rx 11.0 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.

Sea-Bird MicroCAT temperature, conductivity and pressure recorder, serial number 2506 (id#03), at 5 m below the surface. Sample interval 600s. Digiquartz pressure sensor.  
 Clock set at 13:30:00 on 25 October 2005. Delayed start 11:00:00 on 26 October 2005.  
 Not recovered.

No Aanderaa.

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 1. Recovered mooring positions and times.

	<u>Latitude</u> (N)	<u>Longitude</u> (W)	<u>Water</u> <u>Depth</u> (m)	<u>Recovered</u> <u>Time</u>	<u>Date</u>
Waves ADCP (site A)	53° 32.021'	3° 21.439'	23.1	12:22	14/12/05
SmartBuoy (site A)	53° 31.998'	3° 21.722'	23.5	13:24	14/12/05
Waves ADCP (Site B)	Not recovered				
Smart Buoy (Site B)	Not recovered				

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

**Site A**

a) Waves ADCP 600 kHz RDI 5806; battery case 250.  
 Mode 1: 100 pings every 10 minutes (velocity standard deviation 0.007 m s<sup>-1</sup>).  
 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 14:12 on 13 December 2005; delayed start 08:00:00 on 14 December 2005.

Sea-Bird 16*plus* S/N 4736 on base of frame with pumped conductivity sensor underneath.  
SeaPoint turbidity sensor: S/N 10490 taped to roll bar; set up for 0 - 125 FTU range.

Sample interval 600 s.

Clock set at 11:01:00 on 13 December; delayed start at 12:00:00 on 14 December 2005.

SonTek ADV (Acoustic Doppler Velocimeter) – head at 1.7 m above the sea bed pointing up.  
ADV Sensor head A638; ADV Logger G365.

Started 12:00:00 on 14 December.

Sample rate 16Hz; burst interval 3600s; 19200 samples in each burst, lasting 1200s.

The frame D6 was fitted with two Benthos releases 72381 – Rx 11.0 kHz, Tx 12.0 kHz, release B and 69679 – Rx 11.5 kHz, Tx 12.0 kHz, release B, 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 2991 at 5 m below the surface. 10 minute samples.

Clock set at 11:51:00 on 13 December 2005. Delayed start 12:00:00 on 14 December 2005.

No Aanderaa.

The CEFAS SmartBuoy is fitted with a surface CTD, 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

c) Site B. Waves ADCP 600 kHz RDI 5803.

Mode 1: 100 pings every 10 minutes (velocity standard deviation 0.007 m s<sup>-1</sup>).

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.

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.

d) SmartBuoy Mooring.  
Not deployed.

e) Telemetry buoy

The telemetry buoy is fitted with an Orbcomm satellite system and a LinkQuest acoustic modem (serial number 8604).

Table 2. Deployed 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>
Waves ADCP (Site A)	53° 32.052'	3° 21.553'	23.8	12:55	14/12/05
SmartBuoy (Site A)	53° 32.079'	3° 21.616'	22.9	13:13	14/12/05
Waves ADCP+Tel (Site B)	53° 26.997'	3° 39.481'	29.0	10:45	14/12/05
Smart Buoy (Site B)	Not deployed				
Telemetry Buoy(Site B)	53° 26.893'	3° 39.385'	29.5	10:33	14/12/05

## 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. 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.

<u>Site</u>	<u>Latitude (N)</u>	<u>Longitude (W)</u>	<u>Visited on this cruise</u>	<u>Chlorophyll &amp; nutrients</u>	<u>Suspended Sediments▲ /nutrients</u>	<u>Trace metals</u>
1	53° 32'	3° 21.8'	yes	yes	yes	yes
2	53° 37'	3° 13.4'	yes		yes	yes
3	53° 42'	3° 13.4'	yes		yes	yes
4	53° 47'	3° 13.4'	yes		yes	yes
5	53° 52'	3° 21.8'	yes	yes	yes	yes
6	53° 47'	3° 21.8'	yes	yes	yes	yes
7	53° 42'	3° 21.8'	yes	yes	yes	yes
8	53° 37'	3° 21.8'	yes	yes	yes	yes
9	53° 32'	3° 21.8'	yes	yes	yes	
10	53° 27'	3° 13.4'	yes		yes	yes
11	53° 27'	3° 21.8'	yes	yes	yes	yes
12	53° 27'	3° 30.2'	yes		yes	yes
13	53° 32'	3° 30.2'	yes		yes	yes
14	53° 37'	3° 30.2'	yes		yes	yes
15	53° 42'	3° 30.2'	yes		yes	yes
16	53° 47'	3° 30.2'	yes		yes	yes
17	53° 47'	3° 38.6'	yes		yes	yes
18	53° 42'	3° 38.6'	yes		yes	yes
19	53° 37'	3° 38.6'	yes		yes	yes
20	53° 32'	3° 38.6'	yes		yes	yes
21	53° 27'	3° 38.6'	yes	no	yes	yes
22	53° 23'	3° 38.6'	abandoned			
23	53° 23'	3° 47.0'	yes		yes	yes
24	53° 27'	3° 47.0'	yes		yes	yes
25	53° 32'	3° 47.0'	yes		yes	yes
26	53° 37'	3° 47.0'	no			
27	53° 42'	3° 47.0'	no			
28	53° 47'	3° 47.0'	no			
29	53° 47'	3° 55.4'	no			
30	53° 42'	3° 55.4'	no			
31	53° 37'	3° 55.4'	no			
32	53° 32'	3° 55.4'	no			yes
33	53° 27'	3° 55.4'	yes		yes	yes
34	53° 22'	3° 55.4'	yes		yes	yes
35	53° 32'	3° 15.9'	yes		yes	yes

▲ Only surface water was analysed for suspended sediment load due to a shortage of filters (Only 40 filters were available).



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'	22	8.2 / 9.0	31.7 / 32.6
3	10	3/ 4	53° 27'	3° 13.4'	14	7.7 / 7.9	30.8 / 31.2
4	35	5/ 6	53° 31.9'	3° 15.9'	10	7.3 / 7.5	30.1 / 30.2
5	2	7/ 8	53° 37'	3° 13.4'	10	7.1 / 7.7	30.2 / 31.2
6	3	9/10	53° 42'	3° 13.4'	15	7.2 / 7.7	31.0 / 31.6
7	4	11/12	53° 47'	3° 13.4'	16	7.3 / 7.5	31.7 / 32.1
8	5	13/14	53° 52'	3° 21.8'	16	7.9 / 7.9	32.3 / 32.3
9	6	15/16	53° 47'	3° 21.8'	23	7.9 / 7.9	32.4 / 32.4
10	7	17/18	53° 42'	3° 21.8'	28	8.7 / 9.2	32.6 / 33.0
11	8	19/20	53° 37'	3° 21.8'	31	9.1 / 9.1	32.8 / 32.8
12	9	21/22	53° 32'	3° 21.8'	30	9.1 / 9.1	32.8 / 32.8
13	11	23/24	53° 27'	3° 21.8'	21	8.7 / 8.8	32.6 / 32.6
14	12	25/26	53° 27'	3° 30.2'	20	8.9 / 8.9	32.7 / 32.7
15	13	27/28	53° 32'	3° 30.2'	32	9.4 / 9.4	33.0 / 33.1
16	14	29/30	53° 37'	3° 30.2'	32	9.4 / 9.5	33.1 / 33.1
17	15	31/32	53° 42'	3° 30.2'	36	9.4 / 9.6	33.1 / 33.2
18	16	35/36	53° 47'	3° 30.2'	24	8.3 / 8.4	32.6 / 32.6
19	17	37/38	53° 47'	3° 38.6'	33	9.1 / 9.4	33.0 / 33.2
20	18	39/40	53° 42'	3° 38.6'	37	9.4 / 9.8	33.2 / 33.4
21	19	41/42	53° 37'	3° 38.6'	29	9.7 / 9.7	33.3 / 33.3
22	21	43/44	53° 27'	3° 38.6'	24	9.0 / 9.0	32.8 / 32.8
23	22	45/46	53° 23'	3° 38.6'	13	8.0 / 8.0	31.8 / 31.8
24	23	47/48	53° 23'	3° 47.0'	15	8.6 / 8.6	32.3 / 32.3
25	24	49/50	53° 27'	3° 47.0'	33	9.6 / 9.6	33.1 / 33.1
26	25	51/52	53° 32'	3° 47.0'	47	9.9 / 9.9	33.4 / 33.4
27	32	53/54	53° 32'	3° 55.4'	49	10.2 / 10.2	33.6 / 33.6
28	33	55/56	53° 27'	3° 55.4'	39	9.8 / 9.8	33.3 / 33.3
29	34	57/58	53° 22'	3° 55.4'	25	8.7 / 8.9	32.4 / 32.6

## 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 ( $\text{W m}^{-2}$ ), PAR ( $\mu\text{mols / m}^2\text{s}$ ), Air Temperature ( $^{\circ}\text{C}$ ), Relative Humidity, Relative Wind Speed ( $\text{m s}^{-1}$ ), 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 ( $\text{m s}^{-1}$ ), 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 08:49 on 14 December until 13:50 on 15 December 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 08:49 on 14 December until 13:50 on 15 December 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.