Prince Madog cruise 41/05
POL Coastal Observatory cruise 31
26 - 27 October 2005

1. Objectives

1. At 53º 32´ N 3º 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 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 53º 27´ N 3º 38.6´ W (site 21, second site, B)
To recover
e) 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.
f) A CEFAS SmartBuoy in a single point mooring with a Sea-Bird MicroCAT temperature, conductivity logger at 5m below the surface.
To deploy
g) 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
h) A CEFAS SmartBuoy 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.

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. To collect sediment samples at each of the 34 sites with a shipek grab.

5. Collect 10 vertical net hauls at mooring site A.

6. To deploy an underwater glider.

Since the weather was uncertain the plan was to deploy the glider at site 26 first, followed by mooring operations at site A on Wednesday afternoon and CTD measurements during the night. On Thursday morning mooring operations at site B would be followed by the completion of the CTD grid.

2.1 Scientific personnel

John Howarth (Principal)
Mike Burke
John Kenny
Mike Smithson
Stewart Cutchey (CEFAS)
Dave Pearce (CEFAS)
Anne Hammerstein (School of Ocean Sciences)
Vladimir Krivtsov (School of Ocean Sciences)
Josh Kohut (Rutgers University)

2.2 Ship's officers and crew

Steve Duckworth (Master)
Dean Atkinson (Chief Officer)
Neil Holmes (Chief Engineer)
Les Black (Second Engineer)
Phil Jones (A.B.)
Bob Cummings (A.B.)
Bob Munn (A.B.)
Mick Downey (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 25 October 2005, after low water. 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. The balance and buoyancy of the glider was checked by deploying it tethered off the pier head landing stage, and altered by removing 100 g.

RV Prince Madog left Menai Bridge at 07:10 on 26 October; see Figure 1 for the cruise track. Recording of surface sampling and the ship's ADCP were started at 08:09, near Puffin Island. The glider deployment site (station 26) was reached at 10:10 and the glider deployed at 53º 37.40´N 3º 47.62´W. The site was chosen to be to the west of the shipping, oil / gas rigs, wind farms and shallow water in Liverpool Bay and far enough north to avoid shipping heading to / from the separation zone off north-west Anglesey. After a successful 15 minute trial, during which a CTD profile was recorded and a grab sample obtained with the shipek gab, the glider was sent on its way toward 53º 48´N 4º 22´W, reporting back to Rutgers University via Iridium initially after an hour. This was successful, so the glider was then set

on 3 hourly reporting. The glider travels on average about 1 km per hour and will therefore take about two days to reach 53º 48´N 4º 22´W, 42 km away. Once there it was instructed to head due west to 53º 48´N 4º 54´W, a distance of 35 km, and shuttle to and fro between these two sites.

Mooring site A was reached at 12:51 when a CTD profile was recorded and a grab sample obtained. The Wave ADCP was located and released at 13:13, recovered and its ballast weight was on deck by 13:31. (The 0-125 FTU cable for the turbidity sensor was removed from this frame and fitted to the frame to be deployed at site B.) The replacement ADCP was deployed at 13:47. Conditions were reasonable – the wind speed was about 30 knots, but from the SSE so that wave activity was low. The SmartBuoy was deployed at 14:16 and the original buoy recovered between 14:25 and 14:37. 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 16:05.

The CTD and grab sample grid then commenced, visiting sites 10, 35, 2 – 21 arriving at Station 21 (mooring site B) at 08:29 on 27 October. There the ADCP frame and ballast weight were recovered between 08:49 and 09:08 followed by the deployment of the replacement ADCP frame at 09:24. The new SmartBuoy, consisting of a surface CTD only, MicroCAT and a trial CTD at 10 m in a cage, was deployed by 09:44 and the old buoy recovered between 10:05 and 10:11. (This mooring had been in the water since 18 August, because rough weather had prevented the turn around of the SmartBuoy at this site on the 16 September visit.) After a second CTD at the site the grid was continued from 22 to 34, missing out 29, but CTDs were not attempted at stations 28 and 32, because of the sea state because both the sites had the longest fetch for a SSE wind and also the wind was increasing in strength. The CTD survey was completed at 19:00, the ship's ADCP and surface monitoring system switched off at 19:34 at Puffin Island and Prince Madog docked at Menai Bridge at 20:18.

The cruise had been very successful considering the time of year and the preceding weather forecasts (although it was fortunate the winds were from the south-east), with all the major objectives met and the CTD grid completed, except for 3 sites.

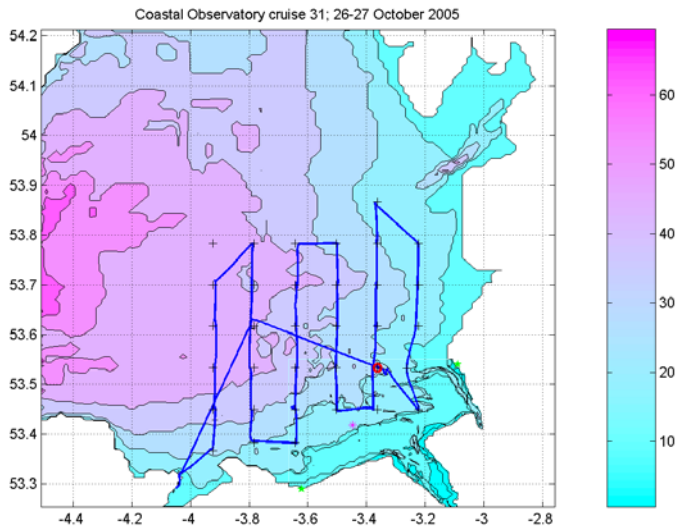

Figure 1. Cruise track.

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 5806; bzttery case 250.
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 13:57 on 14 September 2005; delayed start 08:00:00 on 15 September 2005.
Stopped at 03:16:00 on 27 October 2005.
Two files with record lengths 1,338,295 and 196,621,255 bytes.

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 - 125 FTU range.
Sample interval 600 s.
Clock set at 13:42:00 on 14 September; delayed start at 11:00:00 on 15 September 2005.
Stopped at 18:43:50 on 26 October 2005; clock 2 s slow. Samples 5951.
Reset on 5 min sampling for calibration dip.
Delayed start at 20:20:00 on 26 October; deployed at 20:37:00 on CTD 9 at station 5.

SonTek ADV (Acoustic Doppler Velocimeter) – head at 1.7 m above the sea bed pointing up.
ADV Sensor head A638; ADV Logger G365.
Clock reset at 13:14:10 on 14 September 2005.
Started 11:00:00 15 September 2005. Sample rate 16Hz; burst interval 3600s; 19200 samples in each burst, lasting 1200s.
Data downloaded on 26 October 2005.

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 and conductivity recorder Serial number 2991 at 5 m below the surface. 10 minute samples.
Clock set at 12:48:00 on 14 September 2005. Delayed start 11:00:00 on 15 September 2005.
Stopped at 04:46:30 on 27 October 2005; clock 6s fast. Sample number = 6011.

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

e) Site B. Waves ADCP 600 kHz RDI 5803; battery case 3070.
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 14:44:00 on 14 September 2005; delayed start 10:00:00 on 16 September 2005.
Stopped at 17:04:00 on 27 October 2005.
Record length 191,616 kbytes.

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 14:28:00 on 14 September; delayed start at 10:00:00 on 16 September 2005.
Stopped at 17:54 on 27 October 2005; clock 3 s fast. Record length 5952 samples.

The frame D6 was fitted with two Benthos releases (serial number uncertain) – 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.

f) SmartBuoy Mooring.
Sea-Bird MicroCAT temperature and conductivity recorder, serial number 2081, at 5 m below the surface. 10 minute samples.
Clock set at 16:00:00 on 16 August 2005. Delayed start 10:00:00 on 18 August 2005.
Stopped at 20:08:00 on 27 October 2005; clock 4 s fast; number of samples 10141.

No Aanderaa.

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.

	Latitude (N)	Longitude (W)	Water Depth (m)	Recovery Time	Date
Waves ADCP (Site A)	53º 32.111′	3º 21.519′	22.6	13:13	26/10/05
SmartBuoy (Site A)	53º 32.084′	3º 21.942′	23.8	14:25	26/10/05
Waves ADCP (Site B)	53º 27.314′	3º 38.970′	28.6	08:49	27/10/05
Smart Buoy (Site B)	53º 27.152′	3º 39.026′	27.2	10:05	27/10/05

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

Site A

c) Waves ADCP 600 kHz RDI 3644; battery pack 0068
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 14:23:00 on 25 October; delayed start 06:00:00 on 26 October 2005; started 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.

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.

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.

d) 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.

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

g) Site B. Waves ADCP 600 kHz RDI 2391; 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 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.

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.

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.

h) 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.

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 2. Deployed mooring positions and times.

	Latitude (N)	Longitude (W)	Water Depth (m)	Deployed Time	Deployed Date
Waves ADCP (site A)	53º 32.021´	3º 21.439´	23.1	13:47	26/10/05
SmartBuoy (site A)	53º 31.998´	3º 21.722´	23.5	14:16	26/10/05
Waves ADCP (Site B)	53º 27.004´	3º 38.592´	26.0	09:24	27/10/05
Smart Buoy (Site B)	53º 26.999´	3º 38.446´	25.0	09:44	27/10/05

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.

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

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

CTD no	Site	Nuts	Nominal positions. Latitude (N)	Longitude (W)	Water depth (m)	Temp (deg)	Salinity
		T/ B				T / B	T / B
1	26	1/ 2	53º 37′	3º 47.0′	40	14.2 / 14.2	33.7 / 33.8
3	1	3/ 4	53º 32′	3º 21.8′	24	13.9 / 13.9	32.0 / 33.1
4	10	5/ 6	53º 27′	3º 13.4′	18	12.9 / 13.1	31.7 / 32.2
5	35	7/ 8	53º 31.9′	3º 15.9′	15	13.6 / 13.5	32.7 / 32.7
6	2	9/10	53º 37′	3º 13.4′	15	13.8 / 13.8	33.0 / 33.0
7	3	11/12	53º 42′	3º 13.4′	20	13.7 / 13.7	32.7 / 32.8
8	4	13/14	53º 47′	3º 13.4′	18	13.4 / 13.4	32.2 / 32.2
9	5	15/16	53º 52′	3º 21.8′	17	13.8 / 13.8	33.1 / 33.1
10	6	17/18	53º 47′	3º 21.8′	21	13.9 / 13.9	33.2 / 33.2
11	7	19/20	53º 42′	3º 21.8′	24	14.0 / 14.0	33.2 / 33.3
12	8	21/22	53º 37′	3º 21.8′	21	14.0 / 14.1	33.3 / 33.4
13	9	23/24	53º 32′	3º 21.8′	24	13.7 / 13.8	33.0 / 33.0
14	11	25/26	53º 27′	3º 21.8′	16	13.1 / 13.4	32.1 / 32.7
15	12	27/28	53º 27′	3º 30.2′	17	13.6 / 13.7	32.9 / 33.0
16	13	29/30	53º 32′	3º 30.2′	29	14.0 / 14.0	33.3 / 33.3
17	14	31/32	53º 37′	3º 30.2′	29	14.2 / 14.2	33.5 / 33.6
18	15	33/34	53º 42′	3º 30.2′	37	14.1 / 14.1	33.5 / 33.5
19	16	35/36	53º 47′	3º 30.2′	26	14.0 / 14.0	33.4 / 33.4
20	17	37/38	53º 47′	3º 38.6′	36	14.1 / 14.1	33.8 / 33.8
21	18	39/40	53º 42′	3º 38.6′	41	14.2 / 14.2	33.6 / 33.6
22	19	41/42	53º 37′	3º 38.6′	35	14.2 / 14.2	33.7 / 33.7
24	21	43/44	53º 27′	3º 38.6′	28	14.0 / 14.2	33.3 / 33.6
25	21	45/46	53º 27′	3º 38.6′	28	14.0 / 14.2	33.2 / 33.5
26	22	47/48	53º 23′	3º 38.6′	13	13.6 / 13.7	32.4 / 32.8
27	23	49/50	53º 23′	3º 47.0′	20	13.8 / 14.0	32.5 / 33.3
28	24	51/52	53º 27′	3º 47.0′	31	14.2 / 14.2	33.4 / 33.7
29	25	53/54	53º 32′	3º 47.0′	42	14.3 / 14.2	33.8 / 33.8
30	27	55/56	53º 42′	3º 47.0′	40	14.2 / 14.2	33.8 / 33.8
31	30	57/58	53º 42	3º 55.4′	43	14.1 / 14.1	33.9 / 34.0
32	31	59/60	53º 37′	3º 55.4′	48	14.2 / 14.2	33.9 / 33.9
33	33	61/62	53º 27′	3º 55.4′	40	14.3 / 14.2	33.7 / 33.8
34	34	63/64	53º 22′	3º 55.4′	26	14.1 / 14.1	33.4 / 33.4

Table 5. Grab samples positions

Site	Latitude (N)		Longitude (W)		Water depth (m)
26	53º	37.52′	3º	47.49′	39.8
1	53º	32.29′	3º	22.45′	23.1
10	53º	26.98′	3º	13.41′	17.9
35	53º	31.91′	3º	15.79′	15.2
2	53º	36.69′	3º	13.94′	15.0
3	53º	42.01′	3º	13.55′	19.9
4	53º	46.90′	3º	13.43′	18.4
5	53º	51.79′	3º	22.19′	17.0
6	53º	47.20′	3º	21.89′	21.1
7	53º	41.99′	3º	21.96′	24.3
8	53º	36.87′	3º	22.10′	21.1
11	53º	26.99′	3º	22.68′	16.4
12	53º	26.95′	3º	30.13′	16.6
13	53º	31.85′	3º	30.27′	29.4
14	53º	36.85′	3º	29.93′	28.8
15	53º	41.96′	3º	29.92′	37.2
16	53º	46.83′	3º	29.96′	25.8
17	53º	47.03′	3º	38.38′	36.2
18	53º	42.06′	3º	38.30′	41.3
19	53º	37.15′	3º	38.43′	35.1
20	53º	31.93′	3º	38.26′	36.9
21	53º	27.23′	3º	38.71′	28.3
22	53º	22.83′	3º	38.43′	13.0
23	53º	23.26′	3º	47.52′	19.5
24	53º	26.91′	3º	47.41′	30.7
25	53º	31.84′	3º	47.66′	42.4
27	53º	42.22′	3º	47.41′	40.2
30	53º	42.40′	3º	54.97′	42.5
31	53º	37.62′	3º	55.03′	47.6
32	53º	32.08′	3º	54.96′	47.5
33	53º	27.15′	3º	55.04′	39.5
34	53º	22.32′	3º	55.45′	26.1

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). Sea surface temperature, salinity and transmittance were calibrated against the CTD by BODC.

Data were recorded every minute from 08:10 on 26 October until 19:34 on 27 October 2005 starting and ending at Puffin Island. There was a gap between 05:02 and 05:26 on 27 October. 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 08:09 on 26 October until 19:34 on 27 October 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.