

**RV Prince Madog 36/10 cruise report**  
**NOC Irish Sea Observatory cruise 72**  
**27 – 30 September**

## **1. CRUISE OBJECTIVES**

### **1.1 At site A, 53° 32' N, 3° 21.8' W (CTD station 1)**

To recover:

- a) A sea bed frame containing a 600 kHz RDI ADCP (measuring mean current profile, pressures and directional waves), SeaBird SBE 16*plus* (with pumped conductivity sensor), digiquartz pressure sensor, a SeaPoint turbidity sensor with wiper, and a SeaBird SBE 16*plus* with an Aanderra oxygen Optode.
  
- b) CEFAS SmartBuoy in a single point mooring. Attached to the mooring wire are SeaBird MicroCat temperature, conductivity loggers at 5 m and 10 m below the surface and temperature miniloggers at 7.5 m and 15 m below the surface. Plus a new WetLabs ACS unit and Wetlabs fluorometer on a frame at 5m.

To deploy:

- a) A sea bed frame containing a 600 kHz RDI ADCP (measuring mean current profile, pressures and directional waves), SeaBird SBE 16*plus* (with pumped conductivity sensor), digiquartz pressure sensor, a SeaPoint turbidity sensor with wiper and SeaBird SBE 16*plus* with an Aanderra oxygen Optode.
  
- b) CEFAS SmartBuoy in a single point mooring. Temperature mini-loggers are attached to the mooring wire at 7.5 m and 15 m below the surface and a SeaBird Microcat temperature and conductivity logger at 10m below the surface. A frame with a WetLabs ACS unit, Wetlabs fluorometer and SeaBird MicoCat is attached at 5m below the surface.

### **1.2 At 'new' site B, 53° 32.3' N, 3° 38.4' W (CTD station 20)**

To recover:

- a) A sea bed frame for a 600 kHz RDI ADCP measuring mean current profile, pressures and directional waves, a SeaBird SBE 16*plus* (with pumped conductivity sensor), digiquartz pressure sensor and a SeaPoint turbidity sensor (fitted with a wiper).
  
- b) A CEFAS SmartBuoy in a single point mooring. Attached to the mooring wire are SeaBird MicroCat temperature, conductivity loggers at 5 m and 10 m below the surface and temperature miniloggers at 7.5 m, 15 m and 20 m below the surface.

### To deploy

- a) A sea bed frame for a 600 kHz RDI ADCP measuring mean current profile, pressures and directional waves, a SeaBird SBE 16*plus* (with pumped conductivity sensor), digiquartz pressure sensor and a SeaPoint turbidity sensor (fitted with a wiper).
- b) A CEFAS SmartBuoy in a single point mooring. Attached to the mooring wire are SeaBird MicroCat temperature, conductivity loggers at 5 m and 10 m below the surface and temperature miniloggers at 7.5 m, 15 m and 20 m below the surface.

### **1.3 CTD and LISST survey**

- To conduct a CTD survey including LISST measurements at 34 sites every five nautical miles covering the eastern Irish Sea to determine the effects of the rivers Dee, Mersey and Ribble on Liverpool Bay. The survey covers the area from the coast of North Wales to a line extending westwards from Blackpool, and from the Lancashire coast to a line extending northwards from Great Ormes Head.
- To obtain calibration samples for salinity, transmittance and suspended sediment at selected stations.
- To obtain near surface and bed water samples for nutrient (nitrate, phosphate, silicate), suspended sediment and chlorophyll-*a* determination. NOC Liverpool has supplied filtering equipment and filters for determining concentrations of suspended sediment and chlorophyll-*a*.
- To obtain surface samples for a Defra pH/Alkalinity study by David Hydes (NOC, at Southampton).
- To test an OSIL YSI CastAway CTD system

### **1.4 Other activities**

- *Sea bed sediment analysis.* To collect sediment samples at each CTD site with a Day grab for Andy Plater (University of Liverpool).
- *Trace metal analysis.* To collect samples for trace metal analysis (for in-situ and laboratory analysis) for Pascal Salaun (University of Liverpool)
- *Zooplankton net hauls:* To collect 10 vertical zooplankton net hauls for CEFAS at Site A

## 2. CRUISE PARTICIPANTS

### *Scientific personnel*

Phil Knight (Principal, NOC)  
John Kenny (NOC)  
Terry Doyle (NOC)  
Ray Edun (NOC)  
Andy Lane (NOC)  
Anne Forbes-Brook (Bangor University)  
Tom Hull (CEFAS)  
Chris Read (CEFAS)  
Pascal Salaun (University of Liverpool)  
Lucy Bricheno (NOC)

### *Ship's officers and crew*

Steve Duckworth (Master)  
David Shaw (Chief Officer)  
Les Black (Chief Engineer)  
Meikle MacKay (2nd Engineer)  
David Leigh (AB)  
Gary Barnes (AB)  
Phil Jones (Bosun)  
Colin Hughes (Cook)

## 3. CRUISE NARRATIVE (all times in GMT)

The RV Prince Madog arrived at Vittoria Wharf, Birkenhead at 02:30 on 27/09/2010. Loading was completed between 02:30 and 03:30.

The Prince Madog left her berth at 23:30 on 27/09/2010. At 23:37 the ships ADCP and underway Enviro systems were switched on. The Madog waited until first light near the Liverpool Bar Light to begin mooring work. Vertical zooplankton net hauls were completed between 05:00- 05:52 on 28/09/2010. Wind speeds during this time were 7-8 ms<sup>-1</sup> from 160°.

A pre-mooring deployment CTD was conducted at 06:07 and calibration samples taken by CEFAS. The ADCP frame at site A was recovered at 06:49 and a new frame deployed at 07:27.

The aerial off the old SmartBuoy was required for the new SmartBuoy deployment. The RV Prince Madog maneuvered alongside the old SmartBuoy. Ropes were attached for stability while the aerial was removed between 7:35-07:40, before the old SmartBuoy was released again. At 08:46, and after attaching the aerial, the new SmartBuoy at site A was released. There were concerns that the ACS system (attached underneath the SmartBuoy) was not recording since there were no signs of activity. An unsuccessful attempt was made to communicate with the ACS prior to deployment. Due to the tide turning and with the requirement to still recover the old SmartBuoy it was decided to deploy the new SmartBuoy even though the ACS did not appear to be sampling.

The SmartBuoy was recovered between 09:05 and 9:40. However, during the procedure of switching winches a rope attaching the ACS part of the mooring to the ship snapped. Fortunately it was still attached at the buoy end.

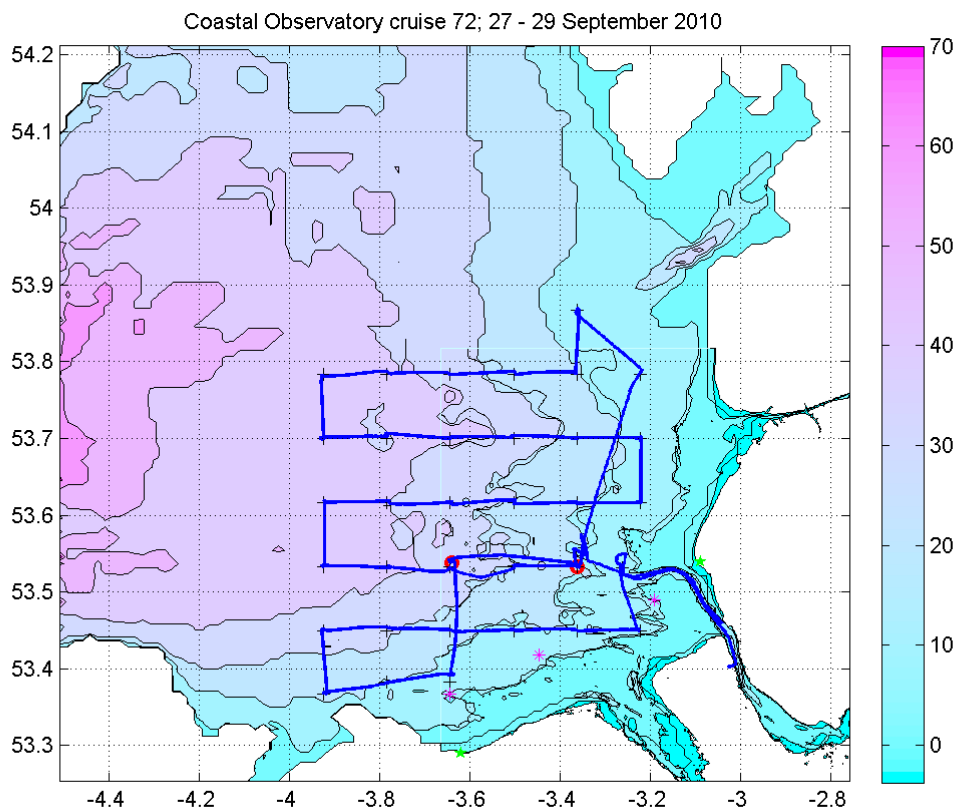
The Madog then headed north to station 4 to start the CTD survey. The grid was sampled

from east-west/west-east (Stations 4, 5, 6, 16, 17, 28, 29, 30, 27, 18, 15, 7, 3, 2, 8, 14, 19, 26, 31, 32, 25, 20, 13, 9 and 20). South-easterly wind (force 3-4, afternoon of 28/09/2010) produced a slight swell, which eased over night.

A pre-deployment CTD cast was recorded at Site B at 07:01 on 29/09/2010. The ADCP frame was released at 07:19. The new ADCP frame was deployed at 07:47. The SmartBuoy was deployed between 08:20 and 08:22. The old SmartBuoy was recovered between 08:32 and 08:51. Winds ranged between 7-9 ms<sup>-1</sup> from the southwest.

After the moorings work at site B and a post-deployment CTD, the CTD survey was recommenced visiting stations 22, 23, 34, 33, 24, 21, 12, 11, 10 and 35. After the last CTD the Prince Madog waited at the entrance of the Mersey before moving down the river for the allocated time slot for the lock, near to mid-night. The ships ADCP and Enviro systems were switched off at 22:59 on 29/09/2010. The Prince Madog was tied up at Vittoria docks by 23:59. Unloading was completed between 07:30 and 09:00 on 30/09/2010.

With favourable conditions a full set of CTD casts were collected and all survey tasks completed. Both the ADCP frame and SmartBuoy at Site A, and the ADCP frame and SmartBuoy at Site B were serviced.



**Coastal Observatory Cruise #72 track**

## 4. MOORINGS

### 4.1 Recovered Instrumentation

#### Site A: Bedframe

Waves ADCP 600 kHz RDI S/N 5806: Memory 1GB

Mode 1: 100 pings every 10 minutes 35 × 1 m bins (2.65–36.65 m above the bed, WN035)

Beam coordinates – speeds, correlation, echo intensity, % good

Sound velocity calculated from temperature, depth and salinity of 32.

Clock set at 08:16:00 on 10/08/2010 : delayed start at 06:00:00 on 11/08/2010

Stopped logging at 08:27:25 on 30/09/2010

Clock drift was 1 minute 33 seconds over the deployment

SeaBird SBE 16plus S/N 4738

Mounted on base of frame with pumped conductivity sensor and SeaPoint turbidity sensor (S/N 10538) taped to roll bar setup for 0–125 FTU range and fitted with wiper.

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

Clock set at 08:49:00 on 10/08/2010: delayed start at 06:00:00 on 11/08/2010.

Stopped logging at 13:34:10 on 30/09/2010

Clock drift was +6 seconds over the deployment

SeaBird SBE 16plus S/N 4490 (RS232) with Aanderaa Optode (S/N 674)

Sample interval 600 s.

Clock set at 09:17:00 on 10/08/2010: delayed start at 06:00:00 on 11/08/2010

Stopped logging at 13:26:05 on 30/09/2010

Clock drift was +7seconds over deployment

The frame was fitted with a fizz link, a spooler with 50 m of rope for recovery of the ballast weight and two Benthos releases:

S/N 72381 (Rx=11.0 kHz, Tx=12.0 kHz, RC=B)

S/N 69676 (Rx=11.5 kHz, Tx=12.0 kHz, RC=C)

#### Site A: SmartBuoy Mooring

SeaBird MicroCat temperature and conductivity recorder S/N 5792

Mounted at 5 m below the surface (on frame with ACS and fluorometer)

Clock set at 15:38:00 on 09/08/10

Delayed start at 06:00:00 on 11/08/2010

Stopped logging at 13:47:10 on 30/09/2010

Clock drift was +49 seconds over the deployment

AC-S S/N 60 at 5m below surface measuring multi-spectral absorption and attenuation (DH4 data logger S/N 140)– attached WetLabs fluorometer S/N 1513

Clock set at 16:38:00 on 09/08/10

Delayed start at 06:00:00 on 11/08/2010

Unplugged from battery on recovery

SeaBird MicroCat temperature and conductivity recorder S/N 5434

Mounted at 10 m below the surface.

Clock set at 10:28:00 on 10/08/10: delayed start at 06:00:00 on 11/08/2010

Stopped logging at 13:57:30 on 30/09/2010

Clock drift was +2 seconds over the deployment

Mini-logger (StarOddi) S/N 2841

Mounted at 7.5 m below the surface. Set to record at 600s intervals.

Delayed start at 06:00:00 on 11/08/2010

Stopped logging at 10:35:20 on 1/10/2010

Clock drift was -6 seconds over the deployment

Mini-logger (StarOddi) S/N 2842

Mounted at 15 m below the surface. Set to record at 600s intervals.

Delayed start at 06:00:00 on 11/08/2010

Stopped logging at 10:45:50 on 1/10/2010

Clock drift was -5 seconds over the deployment

The CEFAS SmartBuoy is fitted with sensors for conductivity, temperature and optical back scatter at 1 m below surface, light sensors at 1 m and 2 m below the surface, a fluorometer (SeaPoint), oxygen sensor (Aanderaa Optode), an in-situ NAS2E nutrient analyzer and a water sampler which obtains samples every fourth day for laboratory analysis (ToxN and silicate) and every eighth day (phytoplankton species, composition and abundance). The conductivity, temperature, optical back scatter and light data are transmitted back to CEFAS via Orbcomm satellite.

The single point mooring was composed of  $\frac{1}{2}$  long link chain, marked by a 1.8 m diameter toroid and anchored by a half tonne clump of scrap chain.

### **Site B: Bedframe**

Waves ADCP 600 kHz RDI S/N 2390: Memory 1.5GB.

Mode 1: 100 pings every 10 minutes.

45 × 1 m bins (2.65–46.65 m above the bed, WN045).

Beam coordinates – speeds, correlation, echo intensity, % good.

Sound velocity calculated from temperature, depth and salinity of 32.

Clock reset at 08:28:00 on 10/08/2010: delayed start at 06:00:00 on 11/08/2010

Stopped logging at 08:31:05 on 30/09/2010

Clock drift was 1 minute 48 seconds over the deployment

SeaBird SBE 16plus S/N 4736 (RS485)

Mounted on base of frame with pumped conductivity sensor and SeaPoint turbidity sensor (S/N 10320) taped to roll bar; setup for 0–125 FTU range and fitted with wiper.

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

Clock reset at 09:02:00 on 10/08/2010: delayed start at 06:00:00 on 11/08/2010.

Stopped logging at 13:38:30 on 30/09/2010

Clock drift was +5 seconds over the deployment

The frame was fitted with a fizz link, a spooler with 50 m of rope for recovery of the ballast weight and two Benthos releases:

S/N 72863 (Rx=13.5 kHz, Tx=12.0 kHz, RC=A)

S/N 71919 (Rx=10.5 kHz, Tx=12.0 kHz, RC=C)

### **Site B: SmartBuoy**

*SmartBuoy B was not serviced on cruise 71. The following instrumentation remains in the water from the previous deployment on 08/07/2010 (Cruise # 70).*

SeaBird MicroCat temperature and conductivity recorder S/N 2506

Mounted at 5 m below the surface

Clock set at 11:56:30 on 06/07/2010: delayed start at 06:00:00 on 07/07/2010.

Stopped logging at 14:04:00 on 30/9/2010

Clock drift was +14 seconds over the deployment

SeaBird MicroCat temperature and conductivity recorder S/N 5791

Mounted at 10 m below the surface

Clock set at 12:08:00 on 06/07/2010: delayed start at 06:00:00 on 07/07/2010.

Stopped logging at 13:52:00 on 30/9/2010

Clock drift was -2 seconds over deployment

Mini-logger (StarOddi) S/N 2840 mounted at 7.5 m below the surface

Set to record at 600 s intervals

Delayed start at 06:00:00 on 07/07/2010

Stopped logging at 10:52:10 on 1/10/2010

Clock drift was -7.5 seconds over the deployment

Mini-logger (StarOddi) S/N 2848 mounted at 15 m below the surface

Set to record at 600 s intervals

Delayed start at 06:00:00 on 07/07/2010

Stopped logging at 10:57:40 on 1/10/2010

Clock drift was -7.5 seconds over the deployment

Mini-logger (StarOddi) S/N 2851 mounted at 20 m below the surface

Set to record at 600 s intervals

Delayed start at 06:00:00 on 07/07/2010 Stopped logging at 11:05:40 on 1/10/2010

Clock drift was -7.5 seconds over the deployment.

The CEFAS SmartBuoy is fitted with sensors for conductivity, temperature and optical back scatter and a fluorometer at 1 m below 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.**

	Latitude (N)	Longitude (W)	Depth (m)	Date	Time (GMT)
<b>ADCP frame (Site A)</b>	53° 32.008	3° 21.481	19.8	28/09/2010	06:49
<b>SmartBuoy (Site A)</b>	53° 31.988	3° 21.683	21.3	28/09/2010	09:05
<b>ADCP frame (Site B)</b>	53° 32.371	3° 38.465	32.0	29/09/2010	07:19
<b>SmartBuoy (Site B)</b>	53° 32.271	3° 38.205	38.1	29/09/2010	08:32

## **4.2 Deployed Instrumentation**

### **Site A: Bedframe**

Waves ADCP 600 kHz RDI S/N 12239: Memory 1GB

Mode 1: 100 pings every 10 minutes 35 × 1 m bins (2.65–36.65 m above the bed, WN035)

Beam coordinates – speeds, correlation, echo intensity, % good

Sound velocity calculated from temperature, depth and salinity of 32.

Clock set at 13:26:15 on 27/09/2010 : delayed start at 06:00:00 on 28/09/2010

SeaBird SBE 16plus S/N 4597

Mounted on base of frame with pumped conductivity sensor and SeaPoint turbidity sensor (S/N 10471) taped to roll bar setup for 0–125 FTU range and fitted with wiper.

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

Clock set at 14:13:00 on 27/09/2010: delayed start at 06:00:00 on 28/09/2010.

SeaBird SBE 16plus S/N 4741 with Aanderaa Optode (S/N 675)

Sample interval 600 s.

Clock set at 13:48:00 on 27/09/2010: delayed start at 06:00:00 on 28/09/2010

The frame was fitted with a fizz link, a spooler with 50 m of rope for recovery of the ballast weight and two Benthos releases:

S/N 70356 (Rx=10.5 kHz, Tx=12.0 kHz, RC=D)

S/N 72382 (Rx=10.0 kHz, Tx=12.0 kHz, RC=A)

### **Site A: SmartBuoy Mooring**

SeaBird MicroCat temperature and conductivity recorder S/N 5790

Mounted at 5 m below the surface (on frame with ACS and fluorometer)

Clock set at 15:38:00 on 27/09/10

Delayed start at 06:00:00 on 28/09/2010

AC-S S/N 56 at 5m below surface measuring multispectral absorption and attenuation (DH4 data logger S/N 119)– attached WetLabs fluorometer S/N 1514

ACS - Clock set at 16:24:00 on 20/09/10

ACS - Delayed start at 06:00:00 on 28/09/2010

Fluorometer - Clock set at 15:19:00 on 20/09/10

Fluorometer - Delayed start at 06:20:00 on 28/09/2010

SeaBird MicroCat temperature and conductivity recorder S/N 4998

Mounted at 10 m below the surface.

Clock set at 15:43:30 on 27/09/10: delayed start at 06:00:00 on 28/09/2010

Mini-logger (StarOddi) S/N 2836

Mounted at 7.5 m below the surface. Set to record at 600s intervals.

Delayed start at 06:00:00 on 28/09/2010

Mini-logger (StarOddi) S/N 2838

Mounted at 15 m below the surface. Set to record at 600s intervals.

Delayed start at 06:00:00 on 28/09/2010



The CEFAS SmartBuoy is fitted with sensors for conductivity, temperature and optical back scatter at 1 m below surface, light sensors at 1 m and 2 m below the surface, a fluorometer (SeaPoint), oxygen sensor (Aanderaa Optode), an in-situ NAS2E nutrient analyzer and a water sampler which obtains samples every fourth day for laboratory analysis (ToxN and silicate) and every eighth day (phytoplankton species, composition and abundance). The conductivity, temperature, optical back scatter and light data are transmitted back to CEFAS via Orbcomm satellite.

The single point mooring was composed 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: Bedframe**

Waves ADCP 600 kHz RDI S/N 5807: Memory 1GB.

Mode 1: 100 pings every 10 minutes.

45 × 1 m bins (2.65–46.65 m above the bed, WN045).

Beam coordinates – speeds, correlation, echo intensity, % good.

Sound velocity calculated from temperature, depth and salinity of 32.

Clock reset at 13:34:00 on 27/09/2010: delayed start at 06:00:00 on 28/09/2010

SeaBird SBE 16plus S/N 4737

Mounted on base of frame with pumped conductivity sensor and SeaPoint turbidity sensor (S/N 10537) taped to roll bar; setup for 0–125 FTU range and fitted with wiper.

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

Clock reset at 14:21:30 on 27/09/2010: delayed start at 06:00:00 on 28/09/2010.

The frame was fitted with a fizz link, a spooler with 50 m of rope for recovery of the ballast weight and two Benthos releases:

S/N 70358 (Rx=11.0 kHz, Tx=12.0 kHz, RC=A)

S/N 71922 (Rx=11.5 kHz, Tx=12.0 kHz, RC=A)

### **Site B: SmartBuoy**

SeaBird MicroCat temperature and conductivity recorder S/N 5433

Mounted at 5 m below the surface

Clock set at 15:26:00 on 27/09/2010: delayed start at 06:00:00 on 28/09/2010.

SeaBird MicroCat temperature and conductivity recorder S/N 4966

Mounted at 10 m below the surface

Clock set at 15:33:50 on 27/09/2010: delayed start at 06:00:00 on 28/09/2010.

Mini-logger (StarOddi) S/N 2843 mounted at 7.5 m below the surface

Set to record at 600 s intervals

Delayed start at 06:00:00 on 28/09/2010

Mini-logger (StarOddi) S/N 2849 mounted at 15 m below the surface

Set to record at 600 s intervals

Delayed start at 06:00:00 on 28/09/2010

Mini-logger (StarOddi) S/N 2852 mounted at 20 m below the surface  
 Set to record at 600 s intervals  
 Delayed start at 06:00:00 on 28/09/2010

The CEFAS SmartBuoy is fitted with sensors for conductivity, temperature and optical back scatter and a fluorometer at 1 m below surface. The single point mooring was composed mainly of  $\frac{1}{2}$  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.**

	<b>Latitude (N)</b>	<b>Longitude (W)</b>	<b>Depth (m)</b>	<b>Date</b>	<b>Time (GMT)</b>
<b>ADCP frame (Site A)</b>	53° 32.021	3° 21.491	20.5	28/09/2010	07:27
<b>SmartBuoy (Site A)</b>	53° 32.009	3° 21.819	21.4	28/09/2010	07:55
<b>ADCP frame (Site B)</b>	53° 32.407	3° 38.495	34.0	29/09/2010	07:47:00
<b>SmartBuoy (Site B)</b>	53° 32.426	3° 38.183	33.6	29/09/2010	08:22:00

## 5. CTD

The SeaBird 911 CTD recorded downwelling PAR light levels, temperature, conductivity, oxygen concentration, transmittance and fluorescence at 24 Hz. The frame was fitted with an altimeter. The CTD temperature data was checked against a SeaBird SBE35 precision thermometer. A Satlantic SUNA nitrate analyzer was fitted to the CTD underneath the frame and its data logged by the SeaBird data logging. A LISST-100X particle sizer with internal logging was also attached to the CTD frame.

Water samples were taken by Anne Forbes-Brook (Bangor University) near the sea bed (3m above bottom) for calibration of the CTD salinity. Water samples were taken from the near surface (1 m) and near bed (3 m above bottom) to determine: suspended sediment load (filtered), chlorophyll-a concentration (filtered), nutrients (nitrate, phosphate, silicate), and ammonia oxidation/nitrification rates. Near surface (1m) samples were also taken for alkalinity (Defra) and for CEFAS calibration (chlorophyll, suspended sediment load, nutrients, salinity). A bottle at 7m was fired for trace metal analysis.

The bottle positions on the rosette were

Near bed:

- Bottle 3 – SPM/chlorophyll
- Bottle 4 – Nutrients
- Bottle 5 – Cefas

Near surface:

Bottle 8 – Trace metals (at approx 7m from surface)  
Bottle 9 – SPM  
Bottle 10 – Nutrients and pH;  
Bottle 11,12 – Cefas

## **6. SURFACE SAMPLING**

The intake of the surface sampling system is located about 3 m below the water line of RV Prince Madog. The parameters recorded every minute by the WS Oceans system are: date, transmittance, hull temperature ( $^{\circ}\text{C}$ ), barometric pressure (mbar), fluorescence, oxygen concentration, turbidity, salinity, conductivity and water temperature ( $^{\circ}\text{C}$ ). A met package measures and records barometric pressure (mbar), solar radiation ( $\text{W m}^{-2}$ ), PAR (photosynthetically active radiation,  $\mu\text{mol m}^{-2} \text{s}^{-1}$ ), air temperature ( $^{\circ}\text{C}$ ), relative humidity, relative wind speed ( $\text{m s}^{-1}$ ), relative wind direction ( $^{\circ}$ ) with zero indicating wind on the bow, minimum air temperature ( $^{\circ}\text{C}$ ), maximum air temperature ( $^{\circ}\text{C}$ ) and wind gust ( $\text{m s}^{-1}$ ).

The ship was fitted with a 300 kHz ADCP set to record current velocity  $25 \times 2$  m bins (bin nearest the surface at 5.1 m depth), every 30 s with 29 pings per ensemble.

Underway data and ship's ADCP data were recorded between 23:37 on 27/09/2010 and 23:59 on 29/09/2010.

## **Acknowledgements**

The assistance of the master, officers and crew of the RV Prince Madog and all scientists is appreciated in ensuring the success of this cruise.

**Table 3. Nominal CTD positions, stations visited and samples taken**

Station	Latitude (N)	Longitude (W)	Trace metals	Sediments & chl-a	Nutrients top+bot	Grab #	CEFAS	pH
1(A)&9	53° 32.0'	3° 21.8'	Yes	Yes	Yes	1	Yes	Yes
2	53° 37.0'	3° 13.4'	Yes	Yes	Yes	15	Yes	Yes
3	53° 42.0'	3° 13.4'	Yes	Yes	Yes	14	No	Yes
4	53° 47.0'	3° 13.4'	Yes	Yes	Yes	2	No	Yes
5	53° 52.0'	3° 21.8'	Yes	Yes	Yes	3	Yes	Yes
6	53° 47.0'	3° 21.8'	Yes	Yes	Yes	4	No	Yes
7	53° 42.0'	3° 21.8'	Yes	Yes	Yes	13	Yes	Yes
8	53° 37.0'	3° 21.8'	No	Yes	Yes	16	No	Yes
10	53° 27.0'	3° 13.4'	Yes	Yes	Yes	34	Yes	Yes
11	53° 27.0'	3° 21.8'	Yes	Yes	Yes	33	No	Yes
12	53° 27.0'	3° 30.2'	Yes	Yes	Yes	32	No	Yes
13	53° 32.0'	3° 30.2'	No	Yes	Yes	24	No	Yes
14	53° 37.0'	3° 30.2'	Yes	Yes	Yes	17	No	Yes
15	53° 42.0'	3° 30.2'	Yes	Yes	Yes	12	No	Yes
16	53° 47.0'	3° 30.2'	Yes	Yes	Yes	5	No	Yes
17	53° 47.0'	3° 38.6'	Yes	Yes	Yes	6	Yes	Yes
18	53° 42.0'	3° 38.6'	No	Yes	Yes	11	No	Yes
19	53° 37.0'	3° 38.6'	Yes	Yes	Yes	18	Yes	Yes
20(B)*	53° 32.3'	3° 38.4'	No	Yes	Yes	23	Yes	Yes
21*	53° 27.0'	3° 38.6'	No	Yes	Yes	31	Yes	Yes
22	53° 23.7'	3° 38.6'	Yes	Yes	Yes	26	No	Yes
23	53° 23.0'	3° 47.0'	No	Yes	Yes	27	No	Yes
24	53° 27.0'	3° 47.0'	Yes	Yes	Yes	30	No	Yes
25	53° 32.0'	3° 47.0'	No	Yes	Yes	22	No	Yes
26	53° 37.0'	3° 47.0'	No	Yes	Yes	19	No	Yes
27	53° 42.0'	3° 47.0'	Yes	Yes	Yes	10	No	Yes
28	53° 47.0'	3° 47.0'	No	Yes	Yes	7	No	Yes
29	53° 47.0'	3° 55.4'	No	Yes	Yes	8	No	Yes
30	53° 42.0'	3° 55.4'	Yes	Yes	Yes	9	Yes	Yes
31	53° 37.0'	3° 55.4'	No	Yes	Yes	20	No	Yes
32	53° 32.0'	3° 55.4'	No	Yes	Yes	21	Yes	Yes
33	53° 27.0'	3° 55.4'	Yes	Yes	Yes	29	No	Yes
34	53° 22.0'	3° 55.4'	Yes	Yes	Yes	28	Yes	Yes
35	53° 32.0'	3° 15.9'	Yes	Yes	Yes	26	No	Yes

\*Before cruise 66 (26/01/2010), Stn 21 was referred to as Site B and Stn 20 was at 53° 32.0' N 3° 38.6' W