RV Prince Madog 05/10 cruise report
POL Coastal Observatory cruise 67
17 March 2010

1. Cruise objectives

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

To recover:

a) A sea bed frame containing a 600kHz RDI ADCP (waves ADCP), Sea-Bird SBE 16+, digiquartz pressure sensor, SeaPoint turbidity sensor with wiper, and a Sea-Bird 16*plus* with an Aanderra oxygen optode.
b) CEFAS SmartBuoy in a single point mooring. Attached to the mooring wire are Sea-Bird MicroCat temperature, conductivity loggers at 5 and 10m below the surface and miniloggers at 7.5 and 15 m below the surface.

To deploy:

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

To collect 10 vertical zooplankton hauls for CEFAS.

At site B 53º 32.3´ N, 3º 38.4´ W (CTD station 20) (new site also referred to as B)

To recover

a) A sea bed frame containing a 600 kHz RDI ADCP, a Sea-Bird SBE 16+, digiquartz pressure sensor and a SeaPoint turbidity sensor fitted with a wiper.

b) A CEFAS SmartBuoy in a single point mooring including a new water sampler for trials. Attached to the mooring wire are Sea-Bird MicroCat temperature, conductivity loggers at 5 and 10m below the surface and miniloggers at 7.5 and 15 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 Sea-Bird SBE 16+ (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 Sea-Bird MicroCat temperature, conductivity loggers at 5m and 10m below the surface and miniloggers at 7.5 and 15 m below the surface.

CTD and LISST survey

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 and suspended sediment at selected stations. To obtain near surface and bed water samples for nutrient (nitrate, phosphate, silicate) and suspended sediment determination. To obtain surface samples for a Defra pH study by David Hydes (NOCS). Collect water samples for trace metal analysis from a selected number of CTD locations (Pascal Salaun, University of Liverpool).

Sediment samples

Collect sediment samples at each CTD site with a Day grab for Andy Plater (University of Liverpool).

2. Cruise personnel

Science crew	Ship's officers and crew
Phil Knight (Principal)	Eric Lloyd (Master)
Ray Edun	Nick Davis (Chief Officer)
Terry Doyle	Gary Barnes
John Kenny	Mike Callaghan
Andy Lane	Tom Roberts
Pascal Salaun (UoLiverpool)	Arfon Williams (Chief Eng.)
Ray Wilton (UoBangor)	Alan Thomson (2nd Eng.)
Dave Pearce (CEFAS)	Terry Gordon (Cook)
Tom Hull (CEFAS)	

3. Cruise Narrative

The ship was loaded during the afternoon of 16 March 2010 at Vittoria Wharf, Birkenhead, Liverpool. Earlier in the day during a compass test in the docks the RV Prince Madog developed a Gyro problem that disabled the Auto-Pilot. This resulted in only being able to steer the ship manually using the ships compass. During the afternoon an electronics engineer examined the Gyro and pronounced that a new part was required (to be sourced by Friday). After consultation with the Master the cruise plan was changed to work one day at

sea; To refurbish the mooring sites and attempt a few CTD stations along the East West line of the mooring sites.

The ship left Liverpool on 17 March 2010 at 09:12, leaving slightly late due to a bridge malfunction at the dock exit. The pCO_2 sensor was not available to use since part of it had been taken away for re-calibration. The ship's underway and ADCP were turned on at 11:08 as the ship passed the Mersey radar tower. The sea state was good with light winds from the SW, and with a fair forecast for the next 12 hours.

All mooring operations were completed at site A by 13:45 on 17 March 2010. A single CTD cast was made prior to instrument recovery and following deployment. No vertical zooplankton hauls were carried out due to time constraints (Moorings at site B had to be refurbished during daylight hours).

Site B was reached at 15:36, however there was no sign of the SmartBuoy. A search to a reported position of a drifting buoy (a few miles to the north of site B) was attempted without any success. All moorings were deployed at the new site B by 16:50 and a post deployment CTD cast made.

The following CTD stations were visited; Stations 1, 13, 20, 25 and 35.

In summary;

- All mooring deployments were successful
- Apart from loss of the SmartBuoy mooring, the other recoveries were successful.
- CTD profiles, water samples and sediment grab samples were collected at five sites.
- Underway, met, pCO2 and ships ADCP data was collected over an East West Line ranging from Station 35 to Station 25.

4 . Moorings

4.1 Recovered instrumentation:

Site A: Bedframe Deployed 09:30 26/1/10
Recovered 12:49 17/3/10

Waves ADCP 600kHz RDI S/N 5807.
Firmware updated to v50.36.
Mode 1: 100 pings every 10 minutes.
35 x 1m bins (2.65-36.65 m above the bed)
Beam coordinates – speeds, correlation, echo intensity, % good.
Sound velocity calculated from temperature, depth and salinity of 32.
Clock set at 10:44:00 on 25/1/2010.
Delayed start at 06:00:00 on 26/1/2010.
Stopped logging at 10:01:50 on 22/3/2010

Clock drift was -1 second over deployment

NOTE: ** Previous cruise report says

S/N 4736 with turbidity sensor S/N 10471
S/N 4737 with Aanderaa optode S/N 675
The following S/N's are written in engineering notes as recovered.

SeaBird 16plus S/N 5309 **** see note above**

Mounted on base of frame with pumped conductivity sensor
Inc. SeaPoint turbidity sensor (S/N 10471) taped to roll bar setup for 0-125 FTU range and fitted with wiper. Sample interval 600s; digiquartz integration time 40s, range 400; pump 0.5s, 1 s delay.
Clock set at 11:04:00 on 25/1/2010.
Delayed start at 06:00:00 on 26/1/2010
Stopped logging at 14:33:55 on 22/3/2010
Clock drift was + 7 seconds over deployment.

Aanderaa optode (S/N 675) on SeaBird 16plus S/N 4741 **** see note above**

Mounted upright on top of frame and (not pumped) conductivity sensor underneath.
Sample interval 600s.
Clock set at 11:30:00 on 25/1/2010.
Delayed start at 06:00:00 on 26/1/2010
Stopped logging at 14:41:00 on 22/3/2010
Clock drift was +6 seconds over deployment.

The frame was fitted with;

a fizz link,
a spooler with 50m of rope for recovery of the ballast weight
two Benthos releases: S/N 72382 (Rx=12kHz, Tx=10kHz, RC=A)
S/N 72381 (Rx=12kHz, Tx=11kHz, RC=B).

Site A: SmartBuoy Mooring Deployed 09:55 26/1/10
Recovered 13:37 17/3/2010

SeaBird microcat temperature and conductivity recorder S/N 2081

Mounted at 5m below the surface.
Clock set at 11:52:00 on 25/1/2010.
Delayed start at 06:00:00 on 26/1/2010.
Stopped logging at 15:08:00 on 22/3/10.
Clock drift was + 4 seconds over deployment.

SeaBird microcat temperature and conductivity recorder S/N 5790

Mounted at 10m below the surface.

Clock set at 12:02:00 on 25/1/2010.
Delayed start at 06:00:00 on 26/1/2010.
Stopped logging at14:57:00 on 22/3/10.
Clock drift was + 17 seconds over deployment.

Mini-logger (StarOddi) S/N 2836

Mounted at 7.5m below the surface.
Set to record at 600s intervals.
Delayed start at 06:00:00 on 26/1/2010.
Stopped logging at 11:05:05 on 23/3/10
Clock drift was + 8 seconds over deployment.

Mini-logger (StarOddi) S/N 2838

Mounted at 15m below the surface.
Set to record at 600s intervals.
Delayed start at 06:00:00 on 26/1/2010.
Stopped logging at 11:07:45 on 23/3/10
Clock drift was +8 seconds over deployment.

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

The Smartbuoy also includes trial experiments;

Six live cages of mussel samples for toxicology analysis.
Silicon sheets for trace chemical analysis.
DGT sampler.
POCIS.

For further information please contact Naomi Greenwood (naomi.greenwood@cefas.co.uk).

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 (new position): Bedframe Deployed 11:35 26/1/10
Recovered 16:04 17/3/2010

Waves ADCP 600kHz RDI S/N 5803.

Firmware updated to v50.36.
Mode 1: 100 pings every 10 minutes.
35 x 1m bins (2.65-36.65 m above the bed)
Beam coordinates – speeds, correlation, echo intensity, % good.

Sound velocity calculated from temperature, depth and salinity of 32.
Clock reset at 10:53:00 on 25/1/2010.
Delayed start at 06:00:00 on 26/1/2010.
Stopped logging at 09:57:30 on 22/3/2010.
Clock drift was 1 minute and 12 seconds over deployment.

SeaBird 16plus S/N 4737

Mounted on base of frame with pumped conductivity sensor
Inc. SeaPoint turbidity sensor (S/N 10537) taped to roll bar; setup for 0-125 FTU range and fitted with wiper.
Sample interval 600s; digiquartz integration time 40s, range 400; pump 0.5s, 1 s delay.
Clock reset at 11:17:00 on 25/1/2010.
Delayed start at 06:00:00 on 26/1/2010
Stopped logging at 14:46:00 on 22/3/2010.
Clock drift was +5 seconds over deployment.

The frame was fitted with a fizz link, a spooler with 50m of rope for recovery of the ballast weight and two Benthos releases; S/N 70358 (Rx=12kHz, Tx=11kHz, RC=A)
S/N 69676 (Rx=12kHz, Tx=11.5kHz, RC=C).

Site B: SmartBuoy Mooring Deployed 13:04 26/1/10
Recovered ** **LOST** **

SeaBird microcat temperature and conductivity recorder S/N 5791 at 5m below the surface. Clock set at 18:58:00 on 25/1/2010. Delayed start at 06:00:00 on 26/1/2010.
SeaBird microcat temperature and conductivity recorder S/N 5793 at 10m below the surface. Clock set at 12:06:00 on 25/1/2010. Delayed start at 06:00:00 on 26/1/2010.
Mini-logger (StarOddi) S/N 2841 @7.5 m below the surface. Set to record at 600s intervals. Delayed start at 06:00:00 on 26/1/2010.
Mini-logger (StarOddi) S/N 2849 @15 m below the surface. Set to record at 600s intervals. Delayed start at 06:00:00 on 26/1/2010.
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The CEFAS SmartBuoy is fitted with sensors for conductivity, temperature and optical back scatter and a fluorometer at 1m below surface. For the purpose of this deployment the Smartbuoy was equipped with a water sampler for trial by CEFAS.
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.

4.2 Deployed instrumentation configuration:

Site A: Bedframe Deployed 13:11 17/3/10 at position **53° 31.959' N, 3° 21.498' W**

Waves ADCP 600kHz RDI S/N 5806

Mode 1: 100 pings every 10 minutes.
35 x 1m bins (2.65-36.65 m above the bed)
Beam coordinates – speeds, correlation, echo intensity, % good.
Sound velocity calculated from temperature, depth and salinity of 32.
Clock set at 12:16:00 on 16/3/2010.
Delayed start at 06:00:00 on 17/3/2010.

SeaBird 16plus S/N 4738

Mounted on base of frame with pumped conductivity sensor
Inc. SeaPoint turbidity sensor (S/N 10538) taped to roll bar setup for 0-125 FTU range and fitted with wiper. Sample interval 600s; digiquartz integration time 40s, range 400; pump 0.5s, 1 s delay.
Clock set at 16:06:30 on 15/3/2010
Delayed start at 06:00:00 on 17/3/2010

Aanderaa optode (S/N 674) on SeaBird 16plus S/N 4490

Mounted upright on top of frame and (not pumped) conductivity sensor underneath.
Sample interval 600s.
Clock set at 12:25:00 on 16/3/2010.
Delayed start at 06:00:00 on 17/3/2010

The frame was fitted with;

a fizz link,
a spooler with 50m of rope for recovery of the ballast weight
two Benthos releases: S/N 71919 (Rx=12kHz, Tx=10.5kHz, RC=C)
S/N 72863 (Rx=12kHz, Tx=13.5kHz, RC=A)

Site A: SmartBuoy Mooring deployed 13:29 17/3/10 **53° 31.942' N, 3° 21.832' W**

SeaBird microcat temperature and conductivity recorder S/N 4966

Mounted at 5m below the surface.
Clock set at 13:21:00 on 16/3/2010.
Delayed start at 06:00:00 on 17/3/2010.

SeaBird microcat temperature and conductivity recorder S/N 5434

Mounted at 10m below the surface.
Clock set at 13:40:00 on 16/3/2010.
Delayed start at 06:00:00 on 17/3/2010.

Mini-logger (StarOddi) S/N 2842

Mounted at 7.5m below the surface.
Set to record at 600s intervals.
Delayed start at 06:00:00 on 17/3/2010.

Mini-logger (StarOddi) S/N 2843

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

Delayed start at 06:00:00 on 17/3/2010.

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

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 (new position): Bedframe deployed 16:30 17/3/10 **53° 32.267' N, 3° 38.533' W**

Waves ADCP 600kHz RDI S/N 2390.

Mode 1: 100 pings every 10 minutes.
35 x 1m bins (2.65-36.65 m above the bed)
Beam coordinates – speeds, correlation, echo intensity, % good.
Sound velocity calculated from temperature, depth and salinity of 32.
Clock reset at 12:09:00 on 16/3/2010.
Delayed start at 06:00:00 on 17/3/2010.

SeaBird 16plus S/N 4736

Mounted on base of frame with pumped conductivity sensor
Inc. SeaPoint turbidity sensor (S/N 10320) taped to roll bar; setup for 0-125 FTU range and fitted with wiper.
Sample interval 600s; digiquartz integration time 40s, range 400; pump 0.5s, 1 s delay.
Clock reset at 15:35:00 on 15/3/2010.
Delayed start at 06:00:00 on 17/3/2010

The frame was fitted with a fizz link, a spooler with 50m of rope for recovery of the ballast weight and two Benthos releases; S/N 72378 (Rx=12kHz, Tx=10.5kHz, RC=A)
S/N 70355 (Rx=12kHz, Tx=10.0kHz, RC=B).

Site B: SmartBuoy Mooring deployed 16:48 17/3/10 **53° 32.339' N, 3° 38.409' W**

SeaBird microcat temperature and conductivity recorder S/N 5792 at 5m below the surface.
Clock set at 13:46:00 on 16/3/2010.
Delayed start at 06:00:00 on 17/3/2010.

SeaBird microcat temperature and conductivity recorder S/N 4998 at 10m below the surface.
Clock set at 13:35:00 on 16/3/2010.
Delayed start at 06:00:00 on 17/3/2010.

Mini-logger (StarOddi) S/N 2844 @7.5 m below the surface.
Set to record at 600s intervals.
Delayed start at 06:00:00 on 17/3/2010.

Mini-logger (StarOddi) S/N 2852 @15 m below the surface.
Set to record at 600s intervals.
Delayed start at 06:00:00 on 17/3/2010.
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The CEFAS SmartBuoy is fitted with sensors for conductivity, temperature and optical back scatter and a fluorometer at 1m 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.

5. CTD

The Sea-Bird 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 Sea-Bird SBE35 precision thermometer. Water samples were taken from a near bed (3mab) bottle for calibration of the CTD salinity data by Anne Hammerstein (University of Bangor). Water samples were taken from the near surface (1m) and near bed (3mab) bottles and filtered to determine suspended sediment load concentration, nutrient concentration, ammonia oxidation/nitrification rate assessment, surface pH (DEFRA) and for CEFAS calibration. A LISST-100X particle sizer with internal logging was attached to the CTD frame. Copies of the Sea-Bird binary files were taken off for processing and calibration at BODC / POL. A LISST-25 particle sizer was fitted to the CTD and its data logged on the Sea-Bird data logging system.

Cast	Station	time	Latitude N	Longitude W
1	1 pre-mooring	Mar 17 2010 12:36	53º 31.906’	03º 20.975'
2	1 post mooring	Mar 17 2010 13:52	53º 32.063’	03º 22.028'
3	13	Mar 17 2010 14:44	53º 31.998'	03º 30.274'
4	20 pre-mooring	Mar 17 2010 15:36	53º 32.341'	03º 38.549'
5	20 post mooring	Mar 17 2010 16:54	53º 32.316'	03º 38.387'
6	20	Mar 17 2010 17:01	53º 32.344'	03º 38.532'
7	25	Mar 17 2010 18:01	53º 31.892'	03º 46.597'
8	35	Mar 17 2010 20:24	53º 32.026'	03º 15.693'

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, Transmittance, Hull Temperature (ºC), Barometric Pressure (mbar), Fluorescence, Oxygen concentration, Turbidity, Salinity and Conductivity sensor water temperature (ºC).

A met package measures and records Barometric pressure (mbar), Solar Radiation (W m^{-2}), PAR (μmols / m^2s), Air Temperature (ºC), Relative Humidity, Relative Wind Speed (ms^{-1}), Relative Wind Direction (º) – zero indicates wind on the bow, Minimum Air Temp (ºC), Maximum Air Temp (ºC) and Wind Gust (ms^{-1}).

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

Underway data and ship's ADCP data were recorded every minute.

All systems were recording from 11:08 17/3/10 and were stopped by 21:30 17/3/10 at the Crosby radar tower.

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