

# Post Survey Report

**Vessel Name:** Celtic Voyager

**Call Sign:** EIQN

**Type of Vessel:** Research Vessel

**Cruise Name:** Environmental Survey of Coastal and Shelf Waters – Winter nutrients

**Cruise Code:** CV11020

**Start Date:** 29/01/2011

**End Date:** 10/02/2011 am

**Port of Dept:** Dublin Port

**Port of Return:** Galway

## Responsible Organisation

**Name:** Marine Environment & Food Safety Services, Marine Institute

**Address:** Rinvilla, Oranmore, Co. Galway

# 1. Introduction & Rationale

The 2011 survey builds on the MI Winter Nutrients Survey that ran from 1990 to 2009. The survey evolved during this time period with respect to parameters and sampling strategy. The 2011 survey was further expanded to collect multidisciplinary information on physics, chemistry (nutrients, DO, carbonate parameters, salinity) and biology (benthic macroinvertebrates, winter phytoplankton baseline) of these waters. This contributes to data collection needs of various statutory drivers (esp WFD Dir 2000/60/EC) as well as providing a research dataset on status and changing conditions (trends and variations) for key environmental variables. It is envisaged that alternating SouthAbout /NorthAbout annual surveys would extend this dataset to all Irish coastal waters.

## 2. Objectives

**A) Winter Nutrients Survey:** The survey aims to fulfil Ireland's requirements under the Joint Assessment and Monitoring Programme (JAMP) of the 1992 'Oslo Paris Convention for the Protection of the North East Atlantic' (OSPAR). This requires the answering of 3 key questions:

1. What is the spatial distribution of nutrients in Irish coastal waters?
2. Are nutrient concentrations changing over time (trends)?
3. Are nutrient concentrations significantly elevated (>50%) above salinity related and/or regionally specific background levels?
4. Provide data for coastal water bodies to contribute towards assigning an ecological status in accordance with the requirements of the

Establishing status and trends in coastal and inshore waters requires that we know what the 'background levels' are for Atlantic waters and waters entering the Irish Sea.

As weather down time frequently disrupts coverage of Winter Surveys in a vessel of the size of the Celtic Voyager the sampling plan assigns a priority ranking to the station.

**B) Collect sediment samples for assessment of hazardous substances in the marine environment:**

- obtain sediment samples to be used for trend analysis (Dublin Bay & Irish Sea) for organic and inorganic hazardous substances (OSPAR, WFD).
- Additional sediments are also collected in support of Seachange research project on the integrated chemical and biological monitoring of contaminants

**C) Conduct Water Framework Directive monitoring (Dir 2000/60/EC) and provide supporting information for the implementation of the Natura Directives (Habitats Directive 92/43/EEC).**

- Collect samples to provide data to contribute to classification of WFD (client EPA) ecological status of selected water bodies for physico-chemical (nutrients, chlorophyll & DO) and benthic macro-invertebrate ecological quality elements in a select number of waterbodies.
- Using benthic invertebrates and associated sediment information (Particulate Size Analysis) the survey will be able to provide additional habitat distribution data (ground truth data) for a variety of Natura sites along the Eastern and Southeastern Seaboard.

D) *Collect samples for measuring carbonate system parameters (DIC, TA,  $pCO_{2calc}$  and  $pH_{calc}$  in coastal waters to contribute to baseline dataset for these variables.*

### 3. Personnel

#### Scientific complement

**Role:** Chief Scientist

**Name:** Evin McGovern (EMcG)

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#### Scientific Complement

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**Name:** Brendan McHugh (BMcH)

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**Name:** Francis O'Beirn (FOB) (28<sup>th</sup> Jan – 2<sup>nd</sup> Feb)

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**Address:** Marine Institute, Rinville, Oranmore, Galway, Ireland

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**Name:** Triona McGrath (TMcG)

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**Name:** Brian Boyle (BB)

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**Crew:** 6 crew. **Master** Philip Baugh

**Tech support:** Gordon Furey

### 4. Methods & Protocol

#### 4.1. Equipment Listing

4.1.1. CTD Profiler and Rosette Sampler

**Make:** Seabird SBE 911

**Model:** SBE 911plus

**Sampling Protocols** - CTD deployed at designated stations and times. Data collected from temperature, conductivity and pressure sensors. Water

samples were collected at most stations from the maximum depth reached and surface (~ 3 metres).

Also deployed on frame was Wetlabs fluorometer, transmissometer, DO Sensor (see sect 5)

4.1.2. Fluorometer

**Make:** Wetlabs

**Model:**

**Sampling Protocols** - OSS fluorometer deployed on CTD frame

4.1.3. Transmissometer

**Make:**

**Model:**

**Sampling Protocols** - Deployed on CTD frame

4.1.4. DO sensor

**Make:** Seabird

**Model:** SBE-35

**Sampling Protocols** - Deployed on CTD frame

4.1.5. On board Seawater Pump

**Make:**

**Model:**

**Sampling Protocols:** The seawater pump was used to collect surface water at approximately X stations.

4.1.6. Data were also generated by underway fluorometer, onboard ADCP and MDM 400.

4.1.7. Reineck Box Corer

**Make:** Reineck

**Model:**

**Sampling Protocols:** Sediment samples were taken in the following locations: 2 stations in Dublin Bay and 1 station in the north Irish Sea. X stations were sampled in Cork Harbour. Surface sediment was transferred into glass and plastic bottles for organic and inorganic analysis respectively.

4.1.8 Day grab sampler

**Make:**

**Model:**

**Sampling Protocols:** sampling of sediments and benthic infauna

4.1.9 Shipek sediment grab sampler

**Make:** Shipek

**Model:**

**Sampling Protocols:** sampling of sediments and benthic infauna

**Equipment brought on board by scientific complement**

4.1.10 DO Analysis – Titrino

Sampling protocols: See 4.2

4.1.11 Portasal salinometer

Sampling Protocols: See 4.2

## 4.2. On-board processing

### ***Sediment Samples:***

Surface sediment was split between glass (solvent washed) and plastic jars (acid washed) and frozen immediately after collection.

### ***Water Samples:***

At all stations The following were collected from each water sample:

1. Samples for accurate salinity measurement: Unfiltered glass bottle stored at room temperature for salinity analysis. X% analysed on board while weatherbound. However, temperature fluctuation and vessel movement did not enable a sufficiently stability of reading for analysis at sea.
2. 2 x 50 ml PP tubes filled with water filtered through a 0.45µ cellulose acetate filter and frozen immediately after collection.
3. DIC/TA samples collected for Triona McGrath at designated stations. Samples preserved with mercuric chloride (ref protocol)
4. DO samples: Collected immediately from Niskin bottles avoiding bubbles and fixed immediately on collection. Samples were analysed on board (ref protocol). DO samples were collected and fixed immediately and analysed generally within 1 day of collection.

### ***Benthic Sediment Samples:***

Sediment samples: At all benthic stations (n=47 of 55) where a suitable sediments could be sampled, a subsample of sediments (100-200g) was taken for Particle Size Analysis (PSA) and Loss on Ignition (LOI). The samples were labelled and stored in plastic zip-loc bags and frozen.

Macroinvertebrate samples: sufficient sediment (>2.5L) was retained at n=47 stations and retained for faunal analysis. These samples comprised single Day grab samples or a composite of 3 Shipek grab samples. Upon retrieval all sediment (pooled in case of Shipek samples) were washed on a 1mm mesh sieve. All faunal and residue (e.g. sediment and shell matter) were retained and stored in a plastic container and fixed with V:V 4% neutral buffered formalin.

## 4.3. Equipment Issues

4.3.1 Problem with CTD on first cast although had tested ok on board. On board tech support Gordon Furey traced the problem to a broken part which he effected repairs on. No other problems with CTD over the rest of the survey.

4.3.2 The (new) seawater intake pump gave-up. Chief engineer switched to the backup pump (without the backup this would have been disastrous for the survey).

4.3.3 Data viz screen was lost for a ~day (Mon 7/2/11) which meant going to bridge to get location details. Following communications between crew and head office this was repaired. No depth reading was available via this system at any stage of the survey. Otherwise underway instrumentation and data acquisition worked satisfactorily throughout survey.

4.3.4 N.B. A new fridge has been installed in the wet laboratory area a welcome addition. This fridge was used for storing DO samples and DIC/TA samples during the survey. However, the shelves require a rail or basket system to retain samples. Even more critically there is no catch on the door. Although we used boxes to ensure samples didn't slide around inside the fridge, on one occasion the ship broached and one door opened dumping the entire contents of one side onto the floor of wet lab.

Approximately 25% of DIC/TIC samples were lost. As DO samples were mostly analysed on board only a small number of DO samples were lost. In addition to the inconvenience of losing samples, there is a clear safety issue here, due to the risk of being hit by samples and subsequent risk of broken glass. *A catch needs to be fitted and internal baskets/ railings need to be installed as a matter of urgency.*

4.3.5. The Day grab utilised presented problem in retaining samples. In mixed sediments there is always the risk of gravel 'wedging' the jaws of the grab open and the sample being lost upon retrieval. This is an acceptable part of sampling and second or third attempts were taken to retrieve an adequate sample- this occurred on numerous occasions (Table 1). For Days 1 and 2 the sampler performed adequately and retained samples efficiently with little wash-out. However, on Day 3 of the survey sampling was attempted at a number of locations on the southeast coast that were obviously rocky. As a consequence the jaws of the grab become misaligned and no amount of persuasion would correct this error. Therefore, even in the absence of foreign material in the mouth of the grab the samples still washed out rendering the grab ineffective. The grab used was not robust enough. A number of other samplers were trialled subsequent to this and the Shipek grab was determined to be the most efficient, primarily because of its ease of deployment and retrieval and also the sample could efficiently be transferred to the autosiever. Note: there is no easy way to extract sediment from the Van Veen grab and transfer it to the sieve.

*Table 1. Benthic sampling summary table.*

<b>Sample code</b>	<b>Site depth</b>	<b>Sediment type</b>	<b>Fauna</b>	<b>PSA</b>	<b>Sample Depth</b>	<b>Photo</b>	<b>Notes</b>
CV1102-SWIS-BG1	12.6	(clean) sand	y	y	10	y	Day Grab
CV1102-SWIS-BG2	16.75	mixed muddy sand	y	y	8	y	Day Grab
CV1102-SWIS-BG3	21.8	mixed muddy sand	y	y	7	y	Day Grab
CV1102-SWIS-BG4	19.9	mixed sediment, cobbles, mud and epifauna	y	y	5	y	Day Grab
CV1102-SWIS-BG5	18.6	mixed sediment, cobbles, mud and epifauna	y	y	9	y	Day Grab
CV1102-SWIS-BG6	24	mixed shelly sands	y	y	7	y	Day Grab
CV1102-SWIS-BG7	13.5	mixed muddy sand, eifauna	y	y	6	y	Day Grab - 3rd attempts
CV1102-SWIS-BG8	10	cobble and sand and mud mix	y	n	n	n	Day Grab
CV1102-SWIS-BG9	9.5	rock (crinoids, brittlestars, dead man's fingers)	n	n	n	n	Day Grab -3 attempts
CV1102-SWIS-BG10	8.9	coarse shelly material and cobbles	y	y	n	y	Day Grab
CV1102-SWIS-BG11	13.5	coarse shelly material and cobbles	y	y	n	y	Day Grab
CV1102-SWIS-BG12	-	maerl, shell and pebble	y	y	9	y	Day Grab
CV1102-SWIS-BG13	11.5	coarse cobble and sand	y	y	4	y	Day Grab
CV1102-SWIS-BG14	8.8	mixed mud sand and cobble	y	y	n	y	Day Grab
CV1102-SWIS-BG15	9.3	cobble and sand and mud mix	y	y	n	y	Day Grab
CV1102-SWIS-BG16	7.9	rock	n	n	n	n	Day grab -2 attempts
CV1102-SWIS-BG17	8.5	rock	n	n	n	n	Day Grab - 2 attempts
CV1102-SWIS-BG18	8.7	rock	n	n	n	n	Day Grab - 3 attempts
CV1102-SWIS-BG19	9.3	rock	n	n	n	n	Day Grab
CV1102-SWIS-BG20	8.4	rock	n	n	n	n	Day Grab
CV1102-SWIS-BG45	13	sand (mussel seed)	y	y	-	y	Day grab
CV1102-SWIS-BG43	12.3	cobble sand and shell hash	y	y	-	y	Shipek x 3
CV1102-SWIS-BG42	6.6	sand (tagellus)	y	y	-	y	Day grab
CV1102-SWIS-BG44	13.4	rock	n	n	-	n	Day grab
CV1102-SWIS-BG41	3.4	sand (cockle)	y	y	-	y	Day Grab
CV1102-SWIS-BG40	3	sand	y	y	-	y	Day grab
CV1102-SWIS-BG38	3	sand	y	y	-	y	van veen
CV1102-SWIS-BG37	4.4	coarse sand	y	y	-	y	Shipek x 3
CV1102-SWIS-BG36	7.3	clean sand and shell	y	y	-	y	Shipek x 3
CV1102-SWIS-BG35	7	clean sand and shell	y	y	-	y	Shipek x 3
CV1102-SWIS-BG34	6.5	clean sand	y	y	-	y	Shipek x 3

<b>Sample code</b>	<b>Site depth</b>	<b>Sediment type</b>	<b>Fauna</b>	<b>PSA</b>	<b>Sample Depth</b>	<b>Photo</b>	<b>Notes</b>
CV1102-SWIS-BG33	7.1	fine sand	y	y	-	y	Shipek x 3
CV1102-SWIS-BG32	11	medium sand with some mud	y	y	-	y	Shipek x 3
CV1102-SWIS-BG31	10.1	Coarse sand	y	y	-	y	Shipek x 3
CV1102-SWIS-BG30	10.2	fine sand and some mud - very good seed mussels	y	y	-	y	Shipek x 3
CV1102-SWIS-BG29	10.2	coarse sand and shell	y	y	-	y	Shipek x 3
CV1102-SWIS-BG28	14.3	coarse gravel bottom	y	y	-	y	Shipek x 3
CV1102-SWIS-BG27	17.5	mixed (rock, gravel, sand and mud)	y	y	-	y	Shipek x 3
CV1102-SWIS-BG26	14.5	sand and gravel	y	y	-	y	Shipek x 3
CV1102-SWIS-BG25	13.5	mixed (gravel, sand and mud)	y	y	-	y	Shipek x 3
CV1102-SWIS-BG24	10	fine sand and shell	y	y	-	y	Shipek x 3
CV1102-SWIS-BG23	11.9	clean fine sand	y	y	-	y	Shipek x 3
CV1102-SWIS-BG22	13.3	sand with shell	y	y	-	y	Shipek x 3
CV1102-SWIS-BG21	13.6	clean sand and shell	y	y	-	y	Shipek x 3
CV1102-WAT-BG2	20.5	clean medium sand	y	y	full	y	Shipek x 3
CV1102-WAT-BG1	21	Fine sand (v compact)	y	y	v small	n	Shipek x 3
CV1102-WAT-BG7	18	Fine sand (v compact)	y	y	v. small	n	Shipek x 3
CV1102-WAT-BG6	16.5	medium sand	y	y	full	y	Shipek x 3
CV1102-WAT-BG5	12.3	v. fine compact sand	y	y	v. small	n	Shipek x 3
CV1102-WAT-BG3	8.7	gravel and sand	y	y	full	y	Shipek x 3
CV1102-WAT-BG10	8.7	fine sand	y	y	full	y	Shipek x 3
CV1102-WAT-BG8	10.7	fine sand	y	y	full	y	Shipek x 3
CV1102-WAT-BG4	10.3	v. fine compact sand	y	y	small	n	Shipek x 3
CV1102-WAT-BG9	9	fine sand	y	y	full	y	Shipek x 3



## 5. Narrative

Due to poor weather for much of the survey 4.5 of total 12 days planned actual seetime were lost (37.5%). Weather dictated the vessel tying up in Waterford City for 18 hrs and in Cork City for ~90 hours. Prioritisation of remaining time and ongoing poor weather meant that no offshore transects were completed beyond Carnsore to St. David's head (UK) with the exception of some stations off the Shannon estuary.

**Winter Nutrients:** Given the time constraints good coverage was obtained for the Irish Sea and of coastal samples elsewhere. 85% of priority 1 and 2 samples for winter nutrients were achieved. 163 samples were collected in 31 WFD water bodies (Table 2 & Figure 1)

*Table 2: Winter nutrients sampling: planned vs actual*

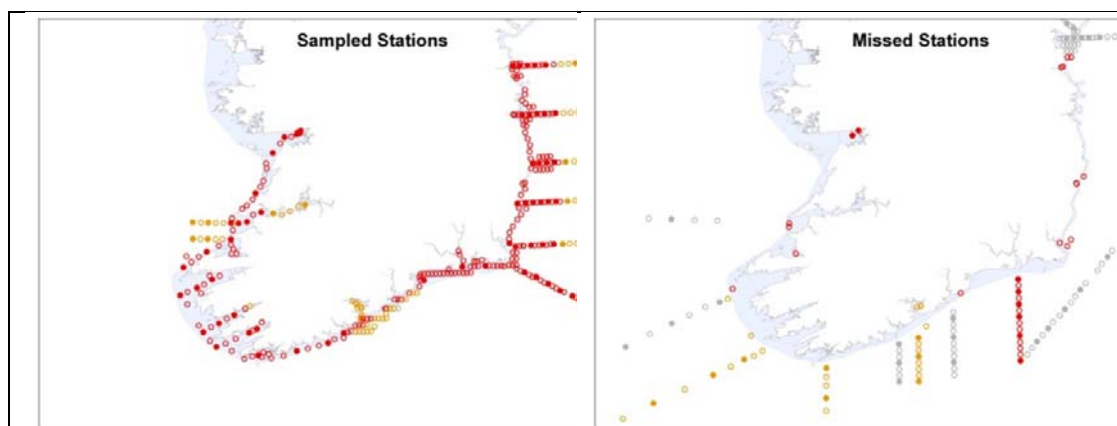
Type	Status	Samples	%
Priority 1	Planned	279	88.9
	Actual	248	
Priority 2	Planned	85	69.4
	Actual	59	
Priority 3	Planned	76	3.95
	Actual	3	
All	Planned	440	70.5
	Actual	310	

Type	Status	Samples	%
Underway	planned	325	72.0
	actual	234	
CTD	planned	115	66.1
	actual	76	

Surface samples for dissolved nutrients and accurate salinity were taken and all underway stations sampled and surface and bottom waters were sampled for CTD stations. DO samples were also collected at CTD stations and analysed on board (Winkler). Conductivity, temperature, DO and turbidity profiles were taken at CTD stations

Samples for chlorophyll analysis were taken at 15 stations.

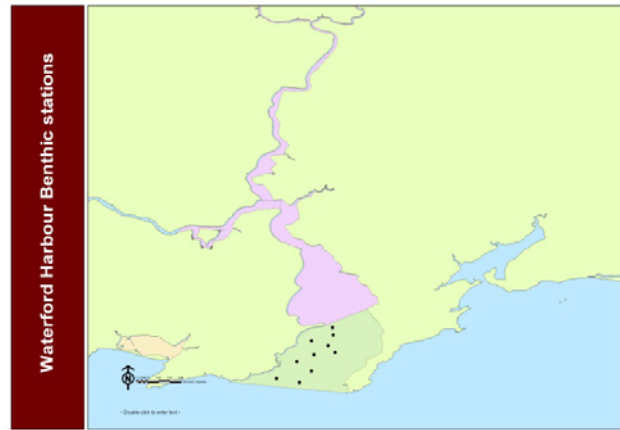


*Figure 2: Stations sampled for winter nutrients and stations not sampled (red = priority 1; orange = priority 2; grey priority 3)*

**Benthic fauna:** Benthic fauna was sampled in two water bodies in the Southwest Irish Sea (South Western Irish Sea (Killiney Bay) and Southwestern Irish Sea Figure 2) and in Waterford Harbour (Figure 3). All priority sites were sampled. Sampling of secondary priority benthic sites in the Barrow-Nore-Suir estuary was discussed with the Master but was considered unfeasible due to time, lighting and navigational constraints.



*Figure 2- Southwest Irish Sea waterbodies*



*Figure 3 –Waterford Harbour*

**Sediment samples were collected for hazardous substances analysis** in Dublin Bay (2) and North Irish Sea (1) – trend stations. Additional sediment samples were collected in Cork Harbour (7) to support Seachange project on Integrated monitoring

**DIC/TA Samples** were collected during transects in the Irish Sea (Dublin Bay, Arklow) and on the west coast (mouth of the Shannon)

See appendices for detailed narrative and map

## 6. Preliminary Findings

Await sample analysis for results. Data will be available via Marine Institute data request system ([www.marine.ie](http://www.marine.ie))

## 7. Conclusions & Recommendations

*Effective completion of the cruise objectives.*

The survey was very successful despite poor weather, 85% priority 1 & 2 stations were completed and 100% of sediment stations were completed. Benthic sampling was completed for all the priority areas targeted. Additional DIC/TA samples

*Weather Downtime:* 37.5% of planned seetime was lost due to inclement weater

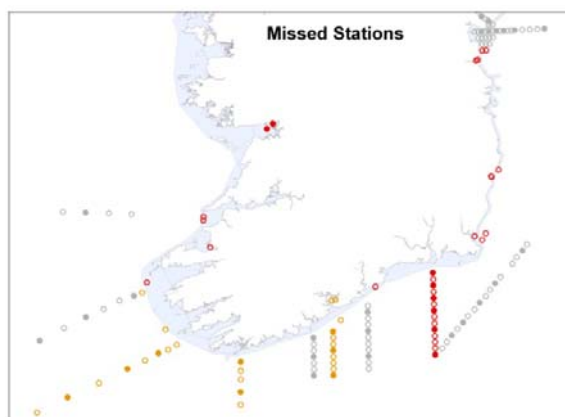
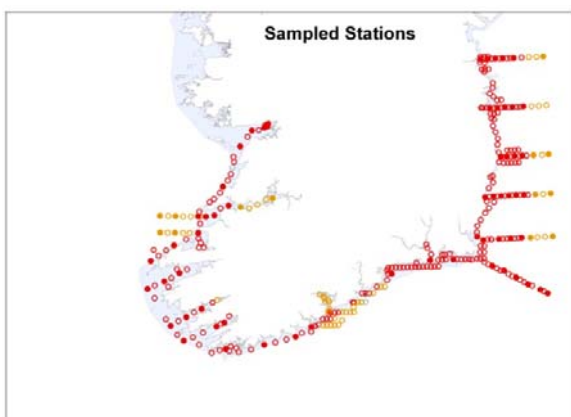
The fridge in the wet laboratory requires a safety lock installed as a matter of priority.

The scientific team would like to commend the master and the crew for their exemplary support and advice and over the course of this survey.

## Appendix 1 (page 1 of 2) – Survey Statistics

Type	Status	Samples	%
Priority 1	planned	279	88.9
	actual	248	
Priority 2	planned	85	69.4
	actual	59	
Priority 3	planned	76	3.95
	actual	3	
All	planned	440	70.5
	actual	310	

Type	Status	Samples	%
Underway	planned	325	72.0
	actual	234	
CTD	planned	115	66.1
	actual	76	



WFD Area	Samples
Aran Islands, Galway Bay, Connemara (HAs 29;31)	1
Barrow Suir Nore Estuary	2
Cork Harbour	3
Corrib Estuary	1
Courtmacsherry Bay	1
Dublin Bay	1
Dungarvan Harbour	1
Eastern Celtic Sea (HAs 13;17)	28
Inner Galway Bay North	3
Liffey Estuary Lower	3
Lough Mahon	3
Lower Shannon Estuary	5
Lower Suir Estuary (Little Island - Cheekpoint)	1
Mouth of the Shannon (HAs 23;27)	6
Northwestern Irish Sea (HA 08)	6
Outer Bantry Bay	4
Outer Cork Harbour	2
Outer Dingle Bay	4
Outer Galway Bay	2
Outer Kenmare River	5
Outer Tralee Bay	5
Roaring Water Bay	5
Shannon Plume (HAs 27;28)	10
South Western Atlantic Seaboard (HAs 21;22)	12
Southwestern Atlantic Seaboard (HA 23)	7
Southwestern Irish Sea - Brittas Bay (HA 10)	1
Southwestern Irish Sea - Killiney Bay (HA10)	8
Southwestern Irish Sea (HAs 11;12)	8
Waterford Harbour	1
Western Celtic Sea (HAs 18;19;20)	23
Youghal Bay	1
<b>Total</b>	<b>163</b>

SWD Area	Samples
Balbriggan/Skerries	3
Kenmare River/Sneem/Ardgroom	4
Malahide	2
Waterford Harbour (Cheekpoint/Arthurstown/Creedan Head)	2
<b>Total</b>	<b>11</b>

## Appendix 2: Survey Narrative

Scientific complement joined vessel Fri 28/1/2011 @ Sir John Rogerson's Quay Dublin Port

Embarked Sat 29/1/2011 1000 to time with East Link Bridge Lift

- Problem with CTD at first station (57) once put in water .
- Picked up DBSed 002 & 003 while Gordon fixed CTD (a plastic ring broken so temporary fix effected that should last survey. Picked up CTD stations 57 & 59 and header north to collect coastal stations
- Transect off Drogheda. Unable to get to Boyne estuary samples without pilot

Sun 30/1/2011

- 0100 – pump for seawater intake went (apparently new pump). Finbarr switched to spare
- Worked west along Dublin Transect
- 0730 commenced coastal Benthic stations in S Irish Sea and commenced Wicklow transect; 1300 ceased benthic sampling (18 stations visited).
- 1200 given poor forecast decision taken to head south picking up outer CTD and to track back on St David's Head to Carnsore transect before collecting final 2 Irish sea transects and coastal stations. Weather good. Water column fully mixed at all stations

Mon 31/1/2011

- Working down outer 3 stations of transects in S Irish Sea.
- 3am Problem in engine room with hose. Engines stopped to effect repairs. ~1.5 hrs before underway again
- Approx 7am Transect of St David's Head towards Rosslare (including DIC)
- 1300 working up coast to pick up inshore stations.
- 1400 start Benthic Grabs. Problem with MaxSea – all stations disappeared. Stopped to fix and upload –wait approx 30 mins while Gordon sorted. 2230 – benthic sampling ceased (24 stations sampled)
- DO samples analysed on board
- Worked up coast to get coastal stations and grabs until late evening. Skipped station 96 as would have added extra hour at least to get up and back (around banks)

Tues 1/2/2011

- Last two transects in Irish Sea (S Arklow and Rosslare) completed in deteriorating weather conditions. Worked around to Waterford Harbour. Picked up as many of inshore/coastal stations as possible before sw gales forecast
- Worked into Waterford Harbour nutrient stations. Added 2 additional nutrient steamover stations in the River Suir (either side of great Island)
- 1900 commenced benthic sampling in outer Waterford Harbour. Ceased at 2100 ((10 stations sampled).
- Arrived on berth Waterford Quay late mon (ca 2300)

Wed 2/2/2011

- Gales. Decision taken to wait until lunch time to review forecast. Reviewed at lunch time and pushed for a 1700 departure to take advantage of short westerly backing and slight decrease in wind speed forecast in hope of getting as far as Cork Harbour
- Francis O'Beirn left ship having completed his priority stations
- Departed Waterford at 1700 and tracked inner stations along S Coast. Weather precluded Waterford transect.

Thurs 3/2/2011

- Continued along track towards Cork alongshore. Picked off as many of the stations outside Cork Harbour before going into harbor. Cut it very fine with deteriorating weather conditions (Force 8 – 11).
- Worked up Cork Harbour and added CTD in Cork Harbour proper 465
- Tied up at Albert Quay 1330
- CS and Master reviewed the forecast. Stong gales to Storm force winds forecast until sat 5/2/11 and outlook beyond not especially encouraging. EMcG BMcH reviewed options with master for using the time to

collect sediment samples in the harbour for research project. Equipment not available (& weather not suitable) for a small boat survey. Decided to consider sat using box core on route from harbor

Fri 4/2/2011

- 0900 CS and master reviewed forecast. Gale/storm force for today. Outlook poor showing south coast subject to strong southerly winds from Sun am to Mon gales. Decision taken to review Sat am

Sat 5/2/2011 – Sun 6/2/2011

- Decision taken to depart Mon am and continue with coastal stations, dropping transects due to continued weather remaining on south coast

Mon 7/2/11

- 7am Departed Albert Quay
- Sampled sediments for Sea Change project (Brendan McHugh) as made way from Harbour using Reineck Box core. Wasn't possible to get sediments in outer stations –coarse sand/rock
- Problem with readings on MDM underway system meant that we needed to go to bridge to get lat longs. Jason emailed office. Fixed during the day.
- Heavy Swell made for slow progress.
- Missed chlorophyll at 286
- Rounded Mizen Head between 2200 and 2300

Tues 8/2/11

- 0000hrs Bantry bay
- Pm Kenmare River. Slow progress to avoid fishing gear. Pots etc
- 1700 open sea. Still rough. Plan of action discussed with Master to see us home for Thurs am

Wed 9/2/11

- AM Working Dingle Bay. Had to move station 386 into Valentia Harbour
- Station 400 moved south of Great Blasket Island
- Still a heavy swell outside the bays
- Tralee Bay sampled 477 dropped too shallow. 476 move towards Harbour (N) and CTD taken for chlorophyll
- Sufficient time available to sample full transect off Shannon. DIC included in CTDs directly off Shannon – Heavy swell remains
- 1750 outer Shannon estuary – crossing bar the vessel broached with much stuff dislodged in the Wet lab (&Kitchen & dry lab etc). Fridge LHS door opened and about 10 DIC samples and a few DO samples (only those taken today) were lost. Remaining salvaged and lab cleaned up. Seems to have been a freak wave at an v unexpected moment as swell had died down in shelter of outer estuary. Will do sample inventory on shore and see what was lost. Main concern is glass on floor

Thurs 10/2/11

- Entered Galway Docks in fog at 0915. Demobbed immediately. All complement and gear off vessel by 1030