DEPARTMENT FOR ENVIRONMENT, FOOD AND RURAL AFFAIRS.
CEFAS LOWESTOFT LABORATORY, LOWESTOFT, SUFFOLK, ENGLAND.

2008 RESEARCH VESSEL, PROGRAMME.

REPORT: RV ENDEAVOUR; CRUISE 12/08 B.

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All staff from Weymouth Laboratory unless indicated otherwise.

DURATION:
20th June – 8h July 2008

LOCATION:
Irish Sea, North Sea and English Channel.

AIMS:

1. To collect samples of demersal fish for chemical analysis from the Irish Sea, North Sea and Eastern English Channel in support of the UK Clean Safe Seas Environmental Monitoring Programme.

2. To collect fish samples at CSEMP sites for fish disease and genotoxic markers (e.g. DNA adducts).

3. To collect fish samples at CSEMP sites for biochemical markers (e.g. EROD and bile metabolites analysis).

4. To sample representative CSEMP stations using grab, multicore and beam trawl for trace metal contaminants, sediment particle size analysis, PAHs and benthic fauna.

5. To trial the proposed redesign of the CSEMP in Tyne Tees region. Sediment samples will be collected using a day grab for benthos, trace metals, organics and chlorophyll. Water samples will be collected for nutrients and chlorophyll.

6. To collect water samples at CSEMP stations around England and Wales for the determination of nutrients, chlorophyll and salinity.

7. To note the presence of litter trawled up from the seabed at all CSEMP stations.

8. To collect biota where appropriate for the determination of imposex in support of OSPAR requirements.

All times are BST unless otherwise stated.

NARRATIVE:

Friday 20th June
RV ENDAEVOUR sailed from Falmouth at 20:00hrs and headed west towards Lands End and then towards the Bristol Channel.

Saturday 21st June
RV ENDEAVOUR arrived on station in the Bristol Channel benthos at 8:00hrs. The first station (Benthos stn 87) was sampled using the day grab for PSA, metals, chlA, porosity and organics (6 replicate samples) and micro faunal assemblages (>1mm). The ship then sailed NW arriving at Carmarthen Bay at 13:00 hrs where the Granton trawl was deployed to collect fish for aims 1, 2 and 3 (CSEMP 616). At the mid tow trawl position a Day grab was taken to collect sediment for chemical analysis (biomarker support). A 2m " Simon Jennings" beam trawl was also deployed (5 minutes) for supporting data for the fish disease survey and stomach contents analysis. *RV ENDEAVOUR* then proceeded to complete the benthos sites within the Bristol Channel, sampling Camarthen Bay (Benthos stn 88) and St David's ((Benthos stn 89). Severe weather was then forecast from the SW so the decision was made to steam north, bypassing Cardigan Bay to seek shelter along the North Wales coast at Red Wharf Bay.

Sunday 22nd June
On the morning of 21st June the wind was blowing SW at 50 knots (gusting 60). The shelter from the North Wales coastline wasn't sufficient to permit work, so the Endeavour took shelter in Red Wharf Bay for the whole day.

Monday 23rd June
Overnight the wind abated and fishing commenced with the Granton trawl at 07:20hrs in Red Wharf Bay (CSEMP 776) to collect fish for aims 1, 2 and 3. At the mid tow trawl position the Day grab and 2m beam were also deployed. Samples of mackerel, plaice and whiting were also taken for the analysis of external diseases as

part of the commercial fish assessment programme (aim 2). Work was completed by 11:00hrs and the *RV ENDEAVOUR* then proceeded to Liverpool Bay (CSEMP 715) to repeat the morning sampling. The first trawl lacked dab in any real numbers, so an alternative fishing station (TREND site) was sampled, as had been necessary in the 2006 and 2007 sampling programme. This was completed by 17:30 and *RV ENDEAVOUR* returned to CSEMP 715 to complete the benthos station (aim 4), which consisted of 10-day grabs and a 2m beam conducted within a 200m bullring. Work was completed by 20:00hrs, and the ship then head east towards Burbo Bight (CSEMP 705).

Tuesday 24th June

The Granton trawl was deployed at Burbo Bight Bay (CSEMP 706) to collect fish for aims 1, 2 and 3, and at the mid tow position a Day grab and a 2m beam was deployed. to collect sediment and benthos. Samples of flounder were taken for the analysis of external diseases and fin clips for the flatfish population genetics programme (E3206). Sampling was completed by 11:00hrs and *RV ENDEAVOUR* then proceeded north to Morecambe Bay (CSEMP 796, Fishing Stn 6) to repeat the morning sampling.

Wednesday 25th June

Overnight the ship had steamed to St Bees (CSEMP 769) where fish were sampled with the Granton trawl for aims 1, 2 and 3. Additional dab fin clip samples (1st hundred fish from the external disease survey) were taken as part of the Defra funded flatfish population genetics project (E3206). The sampling was completed by late morning and RV ENDEAVOUR headed south to the CSEMP (805) fishing station where further fish samples were collected for aims 1,2 and 3. Additionally, whiting were sampled for an external disease record. After completing the fishing the Day grab, muliticorer and the 2m beam were deployed to collect sediment and benthos for aim 4 at the CSEMP 805 benthos station. Throughout the day the weather was poor with winds of around 30-40 knots but conditions were acceptable for working.

Thursday 26th June

On the morning of the 26th June *RV ENDEAVOUR* arrived at North Cardigan Bay (CSEMP 649) and deployed the Granton trawl at 09:00hrs to collect fish for aims 1, 2 and 3. Fishing was generally poor with insufficient numbers of dab for sampling. The hauls were dominated by spider crabs and seaweed. No external disease record was taken and only a limited number of samples collected for chemistry (1 x 25; aim1). After two tows the station was abandoned and the ship headed south to Cardigan Bay (CSEMP 655). Fishing at Inner Cardigan Bay was equally poor and only small dab caught. These were sampled for full histopathology in the absence of fish fitting the correct size classes. Additional samples of scallops and spider craps were also sampled for histopathology. *RV ENDEAVOUR* then moved to the CSEMP benthos station and deployed the Day grab and 2m beam, collecting samples of sediment and benthos for aim 4 before returning for one final fishing tow at CSEMP 655 fishing station. Throughout the day the weather was again poor. Insufficient time was available to trawl at the South Cardigan Bay (CSEMP 684) station.

Friday 27th June

Overnight *RV ENDEAVOUR* had sailed to West Lundy (CSEMP 604) where the Granton trawl was deployed to collect fish for aims 1, 2 and 3. Again dab were

present in low numbers and only sufficient to supply samples for chemistry (2 x 25) biomarkers (20) and histopathology (30). External disease records were also noted for hake, haddock and whiting as part of the commercial species disease assessment programme. The station was completed at 13:00 hrs and the ship steamed south.

Saturday 28th June

RV ENDEAVOUR visited Portland to collect equipment, take onboard liquid nitrogen supplies, take off samples and changeover scientific staff and then headed off out Eddystone.

Sunday 29th June

On the morning of 29th June the Granton trawl was deployed to successfully collect fish for aims 1, 2 and 3, and mid tow samples taken with the Day grab and 2m beam trawl at CSEMP station South Eddystone (584). After completing this station by midday the ship steamed into Lyme Bay to complete a further fishing station (CSEMP 534, Inner Lyme Bay). In the evening the ship moved to the CSEMP benthos station (536, Lyme Bay), where a series of 10 grabs were taken using the Day grab, and in addition samples taken using the multicorer and 2m beam.

Monday 30th June

Overnight *RV ENDEAVOUR* had steamed to the Off Newhaven fishing station were samples of fish were successfully collected with the Granton trawl. This work was completed by late morning and the ship sailed eastward to Rye Bay (CSEMP 486) where fish were successfully collected for aims 1,2 and 3. *En route* to Rye Bay the ships ancillary launch was used to pick up a scientist from Sovereign Harbour. Late in the evening as the ship headed through the Dover Straits a series of 10 Day grabs were taken at the CSEMP 484 benthos station off Folkestone. RV ENDEAVOUR then sailed northwards to Thames Outer Gabbard.

Tuesday 1st July

At Thames Gabbard (CSEMP 475) fish were successfully collected for aims 1,2 and 3 and a series of 10 day grabs were taken for benthos, aim 4. During the afternoon *RV ENDEAVOUR* headed north to the Smiths Knoll Trend station. Insufficient fish were caught and the ship moved to an alternative tow at Smiths Knoll Bank. On hauling the net was very heavy and after the trawl doors had been retrieved the net broke away, leaving the headline and ground rope. In the late evening a new net was rigged. This tow had been used over the previous five years without problem.

Wednesday 2nd July

Overnight the ship had steamed north to the Indefatigable Bank (CSEMP 378) and later in the day to the Off Humber (CSEMP 346) fishing stations. Fish were successfully collected with the Granton trawl at each station for aims 1,2 and 3. In the evening a series of 10 Day grabs were taken for benthos for aims 4, together with samples using the multicorer and 2m beam.

Thursday 3rd July

After steaming eastward overnight the ship arrived at the South Dogger station where fish and shellfish were collected for aim 2. Later in the afternoon the ship was in

position on the Central Dogger station (CSEMP 287) where the Granton trawl was deployed and fish successfully collected for aims 1,2 and 3.

Friday 4th July
RV ENDEAVOUR had sailed overnight to the NE Dogger and during the day as the ship sailed south-westerly fish were successfully collected using the Granton trawl at three fishing stations, North East Dogger (CSEMP 283), North Dogger (CSEMP 284) and West Dogger (CSEMP 286). In the evening a series of 10 Day grabs were taken at the WEST Dogger benthos station (CSEMP 285). In the late evening *en route* to the Wash a further series of six Day grabs were taken for aim 5.

Saturday 5th July
During the morning the Granton trawl was deployed at the Inner Wash fishing station (CSEMP 387). On both of two tows the net was full of weed with few fish. Sufficient dab were collected for aim 1 and several crustacean species were collected for aim 2. Later in the morning the ship had moved further into the Wash to the benthos station (Wash, CSEMP 386); here a series of 10 Day grabs were taken. This was completed by midday and *RV ENDEAVOUR* moved north out of the Wash to the Outer Humber fishing station (CSEMP 377). The ground here had damaged the trawl in previous years so the 4m steel beam was deployed but insufficient fish were available to sample. In the late evening, the ship sailed to the Humber benthos station (CSEMP 376) were a series of 5 Day grabs were taken for aim 4.

Sunday 6th July
Overnight *RV ENDEAVOUR* sailed northwards to the Off Flamborough fishing station (CSEMP 344) and fish were successfully collected using the Granton trawl for aims 1,2 and 3. By early evening the ship had steamed to the Tees Bay CSEMP (294) fishing station where fish were collected for all of aims 1,2 and 3. Overnight in the Tees bay area 4 stations were sampled, a series of 6 Day grabs on each, for aim 5.

Monday 7th July
By morning the ship had moved to the north and deployed the Granton trawl at the Amble fishing station (CSEMP 244). Sufficient fish were collected for all of aims 1,2 and 3. In the afternoon further deployments of the Granton trawl were made at the Farne fishing station (CSEMP 243) and sufficient fish sampled for aims 1 and 2. Overnight *RV ENDEAVOUR* collected a series of 6 Day grabs at four station in Tees bay for aim 5.

Tuesday 8th July
RV ENDEAVOUR docked at Hartlepool at 08:30 hr.

Weather; the weather was poor throughout the first week of the cruise with unseasonably strong winds. On day 2 of the cruise the wind was too strong to enable work to proceed and *RV ENDEAVOUR* sheltered from severe gale force winds in Red Wharf Bay. The weather on the second week of the cruise was good

Fishing; the Granton trawl was used for all fishing stations and was deployed on 110 occasions. The target species for the CSEMP programme is the dab and it is clear that

as reported in previous years, the number of trawl deployments required to catch sufficient specimens is increasing. It is notable that this is particularly the case in the Irish Sea fishing stations in Liverpool bay and Cardigan Bay

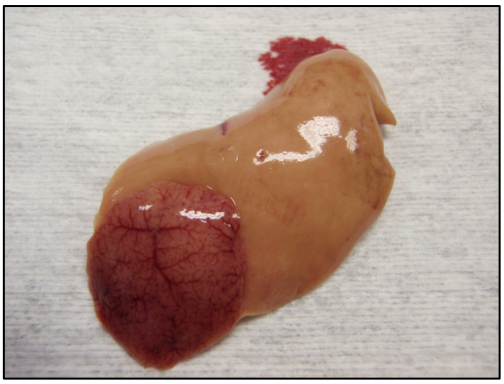
RESULTS

Aim 1. Samples of dab for chemical analysis were collected when caught in sufficient numbers (i.e. 50) and appropriate size at 23 of the 31 CSEMP fishing sites, see appendix 1. At these sites fish were also collected for biological effects and fish disease studies. All samples were frozen and stored at -20 C. for chemical analysis at the Burnham Laboratory. Of the 8 sites missed, 4 were stations not fished because of a lack of time, and 4 were stations where insufficient dab were caught in the time allocated and further fishing effort was required. A long standing fishing station, Liverpool Bay (CSEMP 715), was aborted due to lack of dabs (a trend noted over the past 5 years) and fish for this station were collected from the nearby Trend station

Samples of plaice, five consecutive length stratified groups were collected for trend purposes from Liverpool Bay. There were insufficient numbers and size ranges to collect samples for whiting and cod. Plaice, dab, whiting and cod were not caught at the Smith's Knoll Trend site, nor at any of the alternative tows for this site. All samples were frozen and stored at -20 C. for chemical analysis at the Burnham Laboratory.

Fishing stations introduced into the programme in 2005 and 2006 were West Lundy, South Eddystone, Inner Lyme Bay and Off Newhaven. These stations were fished again this year and fish were successfully obtained for aims 1,2 and 3.

Aim 2.



Large cancerous lesion in Common Dab.

External and internal diseases of dab (*Limanda limanda*) were assessed at the following stations. Figures in parenthesis refer to numbers of dab sampled for histopathology and for external diseases respectively:

Carmarthen Bay (50, 259), Inner Cardigan Bay (30, 0), North Cardigan Bay (20, 0), St Bee's (50, 227), Morecambe Bay (50, 296), Burbo Bight (50, 261), Liverpool Bay (50, 269), Red Wharf Bay (50, 267), West Lundy (20, 0), South of Eddystone (50, 50), Lyme Bay (50, 0), Newhaven (50, 189), Rye Bay (50, 266), Thames Gabbard (50, 0), Smiths Knoll (50, 255), Central Dogger Bank (50, 254), NE Dogger Bank (50, 281), West Dogger Bank (50, 251), North Dogger Bank (50, 252), Off Flamborough (50, 174), Off Humber (50, 0), Indefatigable Bank (50, 270), Amble (50, 0) and Tees Bay (50, 355).

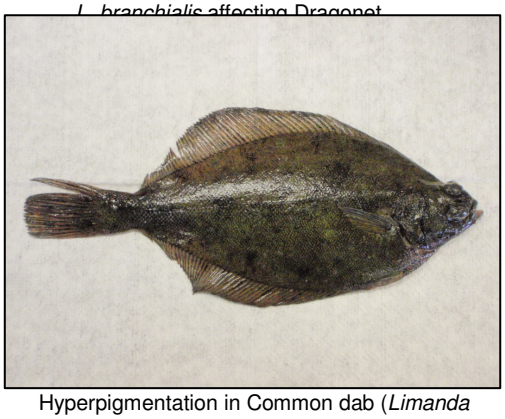
In total, 4656 dab were screened for disease. Where found, samples of liver cancer were removed from those fish examined for external disease and will be further processed for histological diagnosis of lesion type (n= 137). Large tumors were excised and frozen for proteomic and genomic assessment of cancer-specific genes. Furthermore, frozen liver sections were obtained from the majority of fish sampled on the Dogger Bank for Laser capture micro dissection (LCMD). These samples will be used to compare gene expression within pre-neoplastic and neoplastic lesions under the Seedcorn contract, DP195. Fin clips were also collected for population genetic analysis from 100 dab at selected fishing stations in the North Sea, Irish Sea and English Channel. Samples will be processed under the E3206 contract on population genetics of dab at University of Bangor, Wales.

Additional species

External disease assessment was carried out on a number of commercial fish species from the North Sea, Irish Sea and English Channel. Species included Atlantic cod, Plaice, Haddock, Whiting, Hake Mackerel, and Bib. Commercial shellfish and crustacean species were sampled for histological assessment including King scallops, Queen scallops, Brown crab, Norway lobster, European lobster and Spider crab,

L. branchialis affecting Dragonet

Several species were sampled for miscellaneous histology including Atlantic cod, European flounder, Plaice, Dragonet, Dab, Black Bream, Bib, Hake, Megrim, Pink shrimp and Hermit crab. Additional histology samples were obtained from Brown crab, Dab, and European lobster to further enhance the capacity to undertake resin histology. *Hematodinium* sp. Infection was observed at low prevalence in Norway lobsters from the Smiths Knoll site and at higher prevalence in brown crabs from the Wash.



Hyperpigmentation in Common dab (*Limanda limanda*)

A full disease screen of Brown crab (*Cancer pagarus*) of various size ranges (20mm to 140mm carapace width) was carried on samples collected in the Wash. Samples were also taken for histology, molecular biology and TEM.

Electron microscopy

Samples of liver corresponding to each specimen of dab collected for baseline histopathology was preserved for electron microscopy (EM). Individual samples are fully cross-referenced to all histopathology and biomarker specimens and will be selectively analysed at Cefas Weymouth. Additional EM samples were also collected from selected tumor samples. Other miscellaneous samples were also collected and preserved for ultra structural analysis under the scanning and transmission electron

microscope. These included various tissue samples from Dab, Plaice, Common lobster, Brown crab, Spider crab, Hermit Crab, Dragonet, King Scallop, Norwegian lobster and Bib.

Aim 3. Fish tissue was collected from dab at 23 CSEMP locations for biological effects investigations using biomarkers. Sections of dab liver were stored in liquid nitrogen for measurement of EROD activity, analysis of DNA adducts and bile was frozen for PAH analysis. The analysis will be carried out at the Lowestoft / Weymouth Laboratories. In addition, sediments were collected using a Day grab from the mid-tow position of all CSEMP fishing stations. These sediments were frozen at –20 C for targeted chemical analysis in support of the biomarker work programme and in support of the chemical contaminants and fish disease programme (aims 1 and 2).

Aim 4. Ten sediment samples were collected (within a 50m bullring) for the determination of metal and organic contaminants and benthic fauna, from each of 10 CSEMP sites, Cardigan Bay (CSEMP 655se), Liverpool Bay (CSEMP 715se), SE Isle of Man (CSEMP 805se), Lyme Bay (CSEMP 536), Off Folkestone (CSEMP 484), Thames Gabbard (CSEMP 475), Off Humber (CSEMP 345), West Dogger (CSEMP 285), the Wash (CSEMP 386) and Humber (CSEMP 376). Chemical analysis and identification of the benthos will be carried out back at the Burnham Laboratory. In addition, benthos samples were collected at these five sites using a 2-m beam. At the SE Isle of Man, Lyme Bay and Off Humber sites a multicorer was deployed to collect meiofauna for subsequent analysis at the Lowestoft Laboratory.

Aim 5. The proposed CSEMP redesign programme was trialled in the new designated Tees Tyne Regional Sea Area. A series of six Day grabs was collected for macrofauna, meiofuauno, PSA, metals and organics and chlorophyll ‘a’ from each site within a 50m bullring. Sites were randomly selected to include a sample within each ICES rectangle, within and outside of the 12-mile nautical limit. Eight sites were sampled; the remaining sites in the programme will be sampled on the subsequent cruise *RV ENDEAVOUR* 12 C. Samples were processed onboard and preserved for subsequent analysis back at the laboratory. Duplicate water samples were also collected at each of the above stations for nutrient, chlorophyll ‘a’ and salinity.

Aim 6. Water samples were taken through the ships’ clean water supply at 31 CSEMP sites in support of the CSEMP nutrients programme. These consisted of filtered samples for nutrients, preserved for subsequent analysis at the Lowestoft Laboratory and filter papers for the determination of chlorophyll. Water samples were also taken for determination of salinity at the Lowestoft Laboratory.

Aim 7. Litter records were kept for the first two trawl tows at each of the 23 CSEMP fishing stations. Details of type of litter (plastic, fishing, glass, metal etc) were recorded including size and quantity as appropriate. A large proportion of litter is colonised by organisms and information on species type and abundance was also recorded. As observed in previous years, there are sites where litter is more

frequently found e.g. Off Morecombe and Rye Bay. In general the abundance of litter was similar to that found in previous years.

Aim 8. Common and red whelks had been collected opportunistically in previous years for the measurement of imposex (an indicator of exposure to TBT from antifouling paint used on ships). This year very few whelks were caught and were only present in sufficient numbers at Carmarthen Bay and Red Wharf Bay.

Cruise track:

A schematic of the cruise track is given in appendix 2.

Cetacean sightings:

During the ship's passage the following cetaceans were sighted.

27th June 2007, 14:30 hr at ca off West Lundy (51 57.70 N 05 20.91 E)
Six dolphins around the ship for ca 10 minutes.

Noteworthy observations:

The following unusual fish were caught;

Twait Shad, (*Alosa fallax*) all between 42 to 45 cms.
3 at Outer Gabbard (51 09.79 N 05 26.67 E)

Acknowledgements: I would like to acknowledge the active and excellent support and help of the Captain, Fishing Skipper, officers and crew in completing the above programme of work

John Thain (**Scientist In Charge**) - signed
7th July 2008.

SEEN IN DRAFT:

Captain Readman (**Master**) – signed

A Simpson (**Fishing Skipper**) – signed

INITIALLED:

Stuart Rogers (**Contract Leader for CEFAS CSEMP monitoring activities)**

DISTRIBUTION:

Basic list: +

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S Feist
K Bateman
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F Goodsir
R Hicks
E Clarke
A Franklin
A Smith
T Hill
J Bignell
M Green
C Jackson
P Whomersley
S Ware
D Limpenny

APPENDIX 1: CSEMP FISHING STATIONS

Samples taken on cruise CEFAS Endeavour 12 / 08
A total of 110 tows made with the Granton trawl

CSEMP Number	Location	Mid tow Lat. Long.	Dab Sampled
244	Amble	55 16.01 N 01 15.26 W	Y
243	Farne	55 29.71 N 01 07.59 W	Y
283	North East Dogger	55 18.05 N 02 53.82 E	Y
284	North Dogger	55 04.08 N 02 05.40 E	Y
286	West Dogger	54 46.76 N 01 17.69 E	Y
287	Central Dogger	54 30.00 N 02 42.53 E	Y
294	Tees Bay	54 45.25 N 01 08.31 W	Y
344	Off Flamborough	54 14.72 N 00 29.91 E	Y
346	Off Humber	54 03.92 N 01 47.46 E	N
377	Outer Humber	53 19.37 N 00 25.47 E	Y
378	Indefatigable Bank	53 33.40 N 02 04.92 E	Y
387	Inner Wash	53 08.50 N 01 33.30 E	Y
475	Outer Gabbard	52 01.86 N 02 06.57 E	Y
486	Rye Bay	50 46.74 N 00 46.83 E	Y
494	Off Newhaven	50 45.59 N 00 00.00 E	Y
534	Inner Lyme Bay	50 36.86 N 02 55.82 W	Y
584	South Eddystone	50 06.44 N 04 06.06 W	Y
616	West Lundy	51 09.79 N 05 26.67 W	Y
605	Celtic Deep	51 10.29 N 05 43.75 W	N
616	Carmarthen Bay	51 32.82 N 04 35.13 W	Y
649	North Cardigan Bay	52 42.44 N 04 32.29 W	N
654	South Cardigan Bay	52 10.90 N 04 29.87 W	N
656	Inner Cardigan Bay	52 18.00 N 04 16.35 W	N
665	Outer Cardigan Bay	52 23.76 N 04 53.72 W	N
706	Burbo Bight	53 28.24 N 03 20.47 W	Y
715	Liverpool Bay	53 28.32 N 03 41.91 W	N
769	St Bees Head	54 30.71 N 03 47.63 W	Y
776	Red Wharf Bay	53 22.46 N 04 12.84 W	Y
796	Morecambe Bay	53 55.31 N 03 23.23 W	Y
805	SE Isle of Man	54 03.36 N 03 52.47 W	Y
815	Outer Dundrum Bay	54 04.81 N 05 37.29 W	N
Trend	Smith's Knoll	52 48.67 N 02 45.33 E	N
Trend	Alternative Smith' Knoll	52 43.91 N 02 27.51 E	N
Trend	Smith's Knoll Bank	52 46.48 N 02 17.25 E	N
Trend	Liverpool Bay	53 23.76 N 03 37.55 W	Y

APPENDIX 2: Schematic diagram of cruise track

Sailed from Falmouth and Docked at Hartlepool