MINISTRY OF AGRICULTURE, FISHERIES AND FOOD
FISHERIES LABORATORY, LOWESTOFT, SUFFOLK NR33 0HT

1991 RESEARCH VESSEL PROGRAMME

REPORT: RV CIROLANA: CRUISE 2
(PROVISIONAL: Not to be quoted without prior reference to the author)

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DURATION: Departed Lowestoft 1000h 1 February 1991
Docked Lowestoft 1800h 25 February 1991
All times are Greenwich Mean Time

LOCALITY: Southern North Sea, Channel, Irish Sea

AIMS:

1. Collect and process surface water samples from the Southern North Sea and Channel, for Sb-125, Ru-106, Cs-137 and Tc-99, as part of a MAST project. (ACA5, COGEMA).

2. Collect and analyse surface water samples for nutrients, and collect surface sediment for organic micro-contaminants, from the S North Sea. (BGC2, North Sea Task Force).

3. Study the particle and colloidal associations of Pu, Am and Th radionuclides in Irish Sea seawater using a variety of innovative techniques. (ACB8, ACA5, UCD, AUN).

4. Continue to study the speciation of Pu in the waters and sediments of the western Irish Sea. (UCD).

5. Collect and process surface water samples from the eastern Irish Sea to determine the concentrations of the naturally-occurring radionuclides Th-230, Th-234, U-238, Po-210 and Ra-226, to assess the impact of discharges from BNF Springfields and the Marchon plant at Whitehaven. (ACB4).

6. Assess the effectiveness of the benthos, in particular *Amphiura filiformis*, at mediating the transfer of dissolved and particulate forms across the sediment-water interface. (ACB1).

7. Investigate the effect of combined wave and current stresses on cohesive sediment resuspension and transport. (ACB6, COSEDS Group).

8. Complete the study of the behaviour of C-14 in the eastern Irish Sea. (ACBA, SURRC).

NARRATIVE:

CIROLANA sailed from Lowestoft at 1000h on 1 February 1991. A grid of stations was worked during the period 1-4 February, for radionuclide and nutrients analysis with a series of transects towards the Dutch and French coasts intersecting the near-shore front. A high pressure region persisted throughout this period, with light winds and sub-zero temperatures during the night. Sediment was collected from two NSTF sites for organic micro-contaminant analysis. A series of cross-Channel transects was worked from the South Goodwin to Cherbourg on the 4-5 February, for radionuclide and nutrient analysis. CIROLANA docked at Cherbourg at 0900h on the 6th, to exchange scientists, gear and large volume water samples. Following a reception on board, hosted by COGEMA, CIROLANA sailed at 1230h, completing the collection of surface water samples in the Channel en route to the Irish Sea. Nutrient samples were taken north of Milford Haven for the Northern Seas Action Programme (NORSAP) whilst steaming to the next main working area off Sellafield. The first large volume (750l) water sample for Pu ultra-filtration and speciation was collected on the 8th. A grid of sites close to the Marchon (phosphagypsum) outfall was sampled on the 9th for Po-210. Further ultra-filtration samples were taken en route to the western Irish Sea where a series of Reineck cores was collected, on the 10th, from the mud basin for radionuclide analysis at UCD. Following the disembarkation of an injured crew member off Whitehaven, on the morning of the 11th, large volume water samples were taken from the eastern and western Irish Sea, during the period 11th-14th, for ultrafiltration, Pu speciation and natural radionuclide analysis. Transects were run parallel and normal to the coast close to the mouth of the Ribble Estuary. A combined operation with CIROLANA and the ship's Searider took place on the 15th, collecting surface water samples for nutrients and Ra-226 in Saltom Bay - including the immediate vicinity of the Marchon discharge. CIROLANA docked in Workington at midday on the 16th, for a further exchange of scientific staff and equipment, and sailed at 1300h the following day.

A series of Day grabs was collected on the 17th, for faunal analysis, prior to the first test deployment of the Tetrapod, for 14 hours overnight on the 17/18th off the mouth of the Duddon. Two current meter rigs were laid on the 18th, with POL Bottom Pressure Sensors dropped within 200 metres of both rigs. Water samples taken from the Ribble Estuary by Lancaster University, and loaded in Workington, were processed for Th-234 analysis. Several QUISSET samples of bottom water were taken for the determination of in-situ settling velocities. A second test deployment of the Tetrapod took place overnight for 12 hours on the 18/19th, off Workington, to test the compass telemetry. On completion a third current meter rig was laid off St Bees. Further sampling by Day grab, for faunal and pore-water analysis, was completed prior to an attempted rendezvous, off St Bees, with Lady Zigoney, carrying a five-strong film crew from Channel 4 ('Dispatches' current affairs programme). Conditions were judged to choppy to make a safe transfer of personnel and equipment. It had been intended to film the collection and processing of samples for radionuclide analysis in relation to the Marchon and Sellafield discharges. A Calvert core was taken for pore-water and CR-39 analysis. Persistent south-westerly winds prevented a further short-term Tetrapod deployment. Water and sediment sampling continued on the 20th prior to the laying of the Tetrapod and attendant guard buoys (1 was a full current meter rig) during the afternoon for a two month deployment (pick-up on CIR 4/91). Four scientists were put ashore on the 21st off Whitehaven. A number of Calvert and Reineck cores were taken for pore-water and faunal analysis. Two large volume surface water samples were collected from north of the Isle of Man on the morning of the 22nd for C-14 before anchoring in Ramsey Bay to complete certain analyses in relative comfort. CIROLANA commenced the return leg on the afternoon of the 22nd, making slow progress into a southwesterly gale. Lands End was rounded at about 0800h on the 24th where a large volume water sample was taken and processed

for Pu analysis. Several surface water samples were collected for nutrients analysis along the British side of the Channel, and for Cs analysis off the coast of Essex and Suffolk, before docking in Lowestoft at 1800h on the 25th.

RESULTS:

1. Surface seawater was collected from 56 sites in the southern North Sea and Channel and chemically processed for the analysis of Tc-99, Sb-125, Ru-106 and Cs-137, at Lowestoft and COGEMA. Additional samples were taken for Cs-137 and returned to Lowestoft. Radiometric determinations will be completed in the laboratory. Mapping the distribution of these radionuclides, primarily derived from the La Hague discharges, will provide an excellent means of modelling the transfer of contaminants in this region.

2. Nutrient (nitrate, phosphate & silicate) determinations were made on 56 surface water samples in the southern North Sea and Channel. These included 6 North Sea Task Force sites, at 2 of which 6 Day grab samples were taken for micro-organic contaminant analysis. Experiments were conducted: to assess the difference, if any, in collecting water with over-the-side pumps or the 'new' ship's seawater supply; and, to assess the effectiveness of mercuric chloride in the preservation of nutrient samples. Additional nutrient samples were collected, and preserved, from within the Irish Sea for the NORSAP Programme.

3. Large volume (750l) surface and bottom water samples were taken from 2 sites close to Sellafield and size-fractionated using 0.45 μm, 3 K Dalton and 1 K Dalton ultra-filtration, crossflow membranes. Aliquots (totals, permeates and retentates) were taken for analysis, with initial chemical separations being carried out for the determination of total Pu, Pu(IV), Pu(VI), Am, Np, Tc, Cs and Sr. Craib cores were taken at both sites for ultra-filtration experiments in the laboratory.

   A method intercomparison exercise was conducted (DFR and Agric. Univ. Norway) at both sites using an additional crossflow apparatus with cut-offs at 0.1 μm, 10 K Dalton and 1 K Dalton. The reproducibility of the 2 techniques - and the effects of differing flow rates and membrane types - will be assessed by comparing results for Pu (total, IV and VI), Tc, Cs and Sr.

   Water samples were collected from 2 sites in the eastern and western Irish Sea and passed through 0.45 μm membranes, 10 K Dalton and 3 K Dalton hollow fibre cartridges. The permeates were then passed sequentially through aluminium oxide sorption beds (UCD). An assessment will be made, on the basis of Pu data (total, IV and VI), as to the usefulness of combined physical (U-F) and chemical (A1 oxide) separation techniques.

4. Five Reineck cores were taken in the western Irish Sea, X-rayed and sectioned for Pu and Pb-210 analysis at UCD. Four bottom water samples were processed for Pu speciation.

5. An experiment was conducted to test for a 'memory' effect, on the Pu concentration, by sampling through the Jabsco over-the-side pump and the 'new' ship's seawater supply - this problem had previously been associated with the 'old' seawater supply. Samples were collected off Sellafield and Lands End on the return leg.

6. Eight surface water samples were processed for Th-234 analysis along 2 transects off the Ribble. An additional 5 samples were processed on-board, having been taken from the Ribble by Lancaster University and loaded at Workington. The aim of this work is to assess the influence of the Springfields nuclear fuel fabrication plant.

7. A benthic survey and pore-water analysis was carried out at 3 sites in the eastern Irish Sea to study the effects of *Amphiura filiformis* on sediment-water exchange. Sediment samples were retained for analysis by the CR-39 alpha-track technique. A benthic survey was carried out at a fourth site for PML ('STABLE' site).

8. Surface water was collected from 4 sites for carbon extraction and analysis of C-14. An air sample was obtained off the Cumbrian coast. The analyses will be performed at SURRC, East Kilbride.

9. Two test deployments of the Tetrapod were completed, off the Duddon and in the entrance of the Solway Firth, prior to the laying of the rig off Sellafield for a 2 month period. Three current meter rigs were laid, and at 2 sites a POL bottom pressure sensor was deployed. One of the three guard buoys around the Tetrapod consisted of a current meter mooring.

10. Several surface water samples were collected off the coast of Essex and Suffolk as part of the investigation of the 'caesium anomaly' in this area.

Dr Peter Kershaw
Scientist-in-Charge
7 March 1991

SEEN IN DRAFT: Capt Chapman (Master
Mr J Harper (Fishing Skipper)

INITIALLED: CEP

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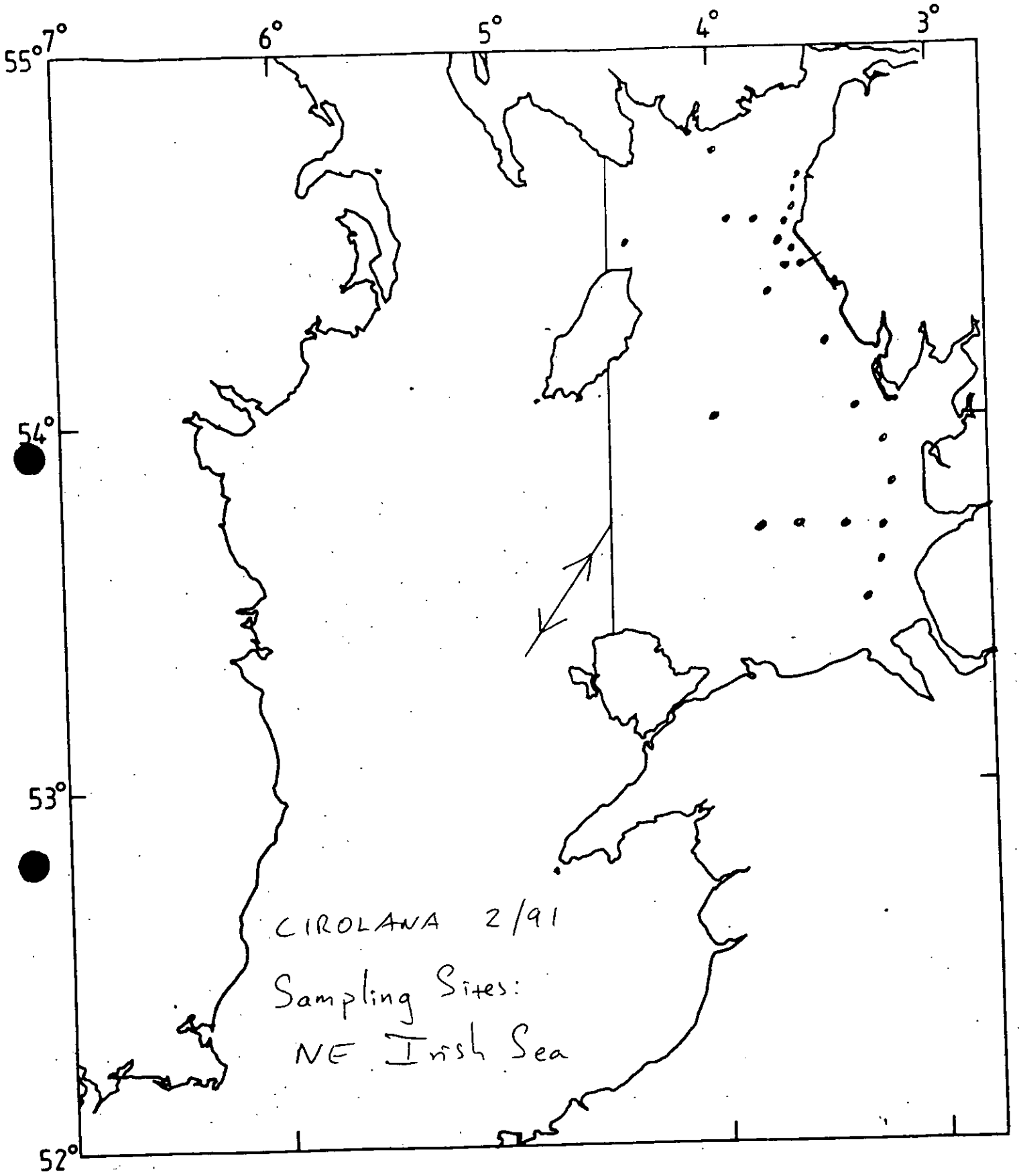
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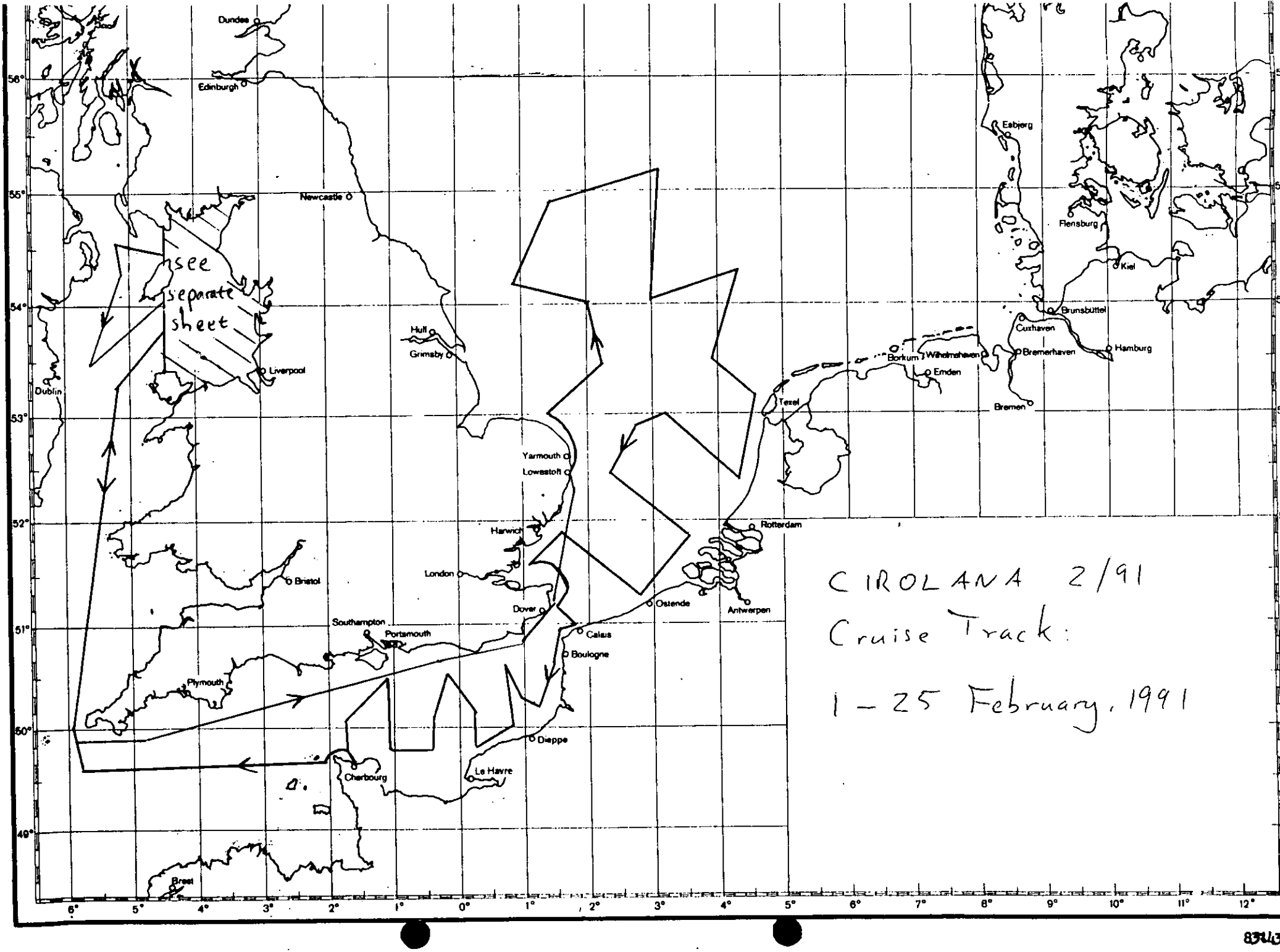
CIROLANA 2/91
Sampling Sites:
NE Irish Sea



CIROLANA 2/91

Cruise Track:

1 – 25 February, 1991