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MINISTRY OF AGRICULTURE, FISHERIES AND FOOD
FISHERIES LABORATORY, LOWESTOFT, SUFFOLK

1994 RESEARCH VESSEL PROGRAMME

REPORT: RV CIROLANA: CRUISE 6
(PROVISIONAL: Not to be quoted without prior reference to the author)

DURATION: Left Lowestoft 1245 h 17 May 1994
Docked Lowestoft 0000 h 03 June 1994
(all times GMT)

LOCATION: Irish Sea

STAFF:

K S Leonard (SIC)	
D McCubbin	
D J Allington	
D C Denoon	
I T McMeekan	
A J Poole	17 - 24 May
A K Young	17 - 24 May
H S Emerson	17 - 24 May
M B Lovett	24 - 30 May
R D Ibbett	24 - 30 May
T Brooks	24 May - 03 June
B Taylor	24 - 30 May
J Merino (Univ. Barcelona)	24 - 30 May
L N Greenwood	30 May - 03 June

AIMS:

1. To study the surface sediment and water concentrations of U, Th, Ra, Po and Pb radionuclides and nutrients in the immediate vicinity of the Marchon outfall and further offshore in the eastern Irish Sea. Part of this work is to be carried out in conjunction with a small charter vessel (AE0115A).

2. To commence a study to investigate the surface sediment and water concentrations of radionuclides from the Ribble estuary (AE0115A).

3. Collection of sediment cores from the Irish Sea and thus enable laboratory experiments to be carried out to evaluate the relative importance of historic and current discharges of radionuclides to the sea from Sellafield (AE0117A).

4. To collect and process surface water from the Irish Sea for the analysis of Tc, Cs, Sb and transuranic radionuclides as part of the Post EARP survey (AE0114A, Nuclear Fission Safety Programme - CEC contract).

5. To collect plankton samples and hence study, in conjunction with aim 4, concentration processes of radionuclides in the primary food chain (AE0117A, Nuclear Fission Safety Programme).

6. Collection of live Plaice from Rye Bay and thus enable laboratory experiments to be carried out to evaluate radiation effects on reproduction (AE0116A).

7. To collect, on behalf of IAEA, a bulk fish sample for world wide distribution as a intercalibration reference sample.

NARRATIVE:

RV CIROLANA sailed from Lowestoft at approximately 1245 h on 17 May following the southern route to the Irish Sea. Surface seawater samples were collected at 8 stations en route in the English Channel (see figure 1) and processed for radionuclide analysis (^{60}Co and ^{99}Tc). Good passage was made with calm weather and the ship arrived off the Scilly Isles at 0600 h on 19 May and a large volume surface water was collected and processed for a blank natural radionuclide determination.

CIROLANA arrived off Whitehaven at 0600 h on Friday 20 May and commenced the Marchon survey extending from the Saltom Bay area (as shown in figure 2), collecting both water and surface sediment samples for natural radionuclide and nutrient analyses (aim 1). During the early morning of 21 May a rendezvous between a charter vessel (LADY EMMA) and CIROLANA took place and two scientists boarded the charter vessel for collection of samples from the inshore stations. CIROLANA continued to collect and process offshore samples. Rendezvous between the two vessels took place on two further occasions during the day to bring inshore samples on board CIROLANA for processing. Both scientists returned to CIROLANA on completion of the charter vessel operations.

On the evening of 21 May the ship proceeded to the mouth of the Solway Estuary and the opportunity was taken to collect a sediment core on behalf of Westlakes Research Institute. Unfortunately a malfunction with the NIOZ corer was identified (an incomplete seal upon sampling) and the station was abandoned. During the early morning of 22 May the remainder of the Marchon survey was completed and CIROLANA then proceeded to the vicinity of the Ribble Estuary to carry out aim 2. Shortly after commencing an offshore CTD transect (8 stations, RT1-8), as close as possible to the mouth of the Ribble estuary (figure 3), the collection of surface and bottom waters was temporarily suspended due to fraying of the CTD cable wire. Whilst repairing the CTD array, the collection of sediment samples was carried out along the same transect.

On the morning of 23 May the ship's searider was deployed, with scientists and crew, to collect four mid-channel samples along the River Ribble (Preston to Lytham) for a suite of natural radionuclides (particulate and dissolved), nutrient, salinity and suspended load analyses. Mini CTD profiles were also recorded to provide information describing the water column structure. Samples were collected on the flood tide within an hour of high tide, along an upstream to the estuary transect. An offshore CTD station (RT4, figure 3) was completed aboard CIROLANA to coincide with work being completed in the River Ribble. On return of the ship's searider, CIROLANA revisited the stations of the offshore transect and completed the CTD sampling (figure 3).

Also during the period 20 - 24 May, as the opportunities arose, fish samples were collected on behalf of IAEA (aim 7). In all, the trawl was shot on 5 occasions off Sellafield, and hauled after a period of between 0.5 - 2 hours. Having successfully completed sample processing (for aims 1 and 2), a transfer of scientists took place during mid-morning of 24 May by the ship's searider from Whitehaven.

CIROLANA then proceeded to St Bees Head to commence a grid of stations in the Irish Sea (aims 3 to 5) as shown in figure 3. These stations were worked for artificial radionuclides, sediment cores and plankton samples during the period 24 - 29 May. In addition to the aims outlined, on two occasions, large volume samples were collected to concentrate dissolved organic carbon from seawater using the ultrafiltration technique. All sample processing was completed and another opportunity was taken to carry out a further trawl (two hours duration) off Sellafield on the morning of 30 May (aim 7). A final transfer of scientists took place during the afternoon at Whitehaven, and at 1500 h CIROLANA proceeded south to Rye Bay. En route surface water samples were again collected off the Scilly Isles on 31 May for artificial radionuclide determinations.

CIROLANA arrived at Rye Bay at 1630 h on 1 June and commenced trawling for male plaice (aim 6). Three trawls (each of 0.5 hours duration) were carried out with little success (a total of 7 male plaice were landed) and further fishing in this area was abandoned. An alternative fishing ground was chosen and at 2100 h the ship proceeded to Smith's Knoll and began fishing at 0830 h on 2 June. A total of 186 male plaice were landed from 10 trawls. CIROLANA docked at Lowestoft at 0000 h on 3 June.

We express our thanks to the Master, the ship's officers and the crew for their high standard of support.

RESULTS

1. Samples of surface water and sediments for natural radionuclide, salinity, nutrient and suspended particulate matter determinations were collected at a total of 68 stations extending from the Saltom Bay area. Preliminary separation of U, Th, Pb and Po radionuclides, and Ra stripping, took place on board. Nutrient samples were filtered and preserved with $HgCl_2$ and suspended load determinations were processed. This programme of work undertaken 24 months after the Albright & Wilson Marchon works ceased processing phosphate ore forms part of a down-run study of the environmental changes in concentrations of natural radionuclides and nutrients as a consequence of this change. Samples have been collected prior to cessation of ore processing and on three previous occasions (at 6 monthly intervals) since cessation.

2. Samples of surface/bottom water (and CTD profiles) and sediments for natural radionuclide, salinity, nutrient and suspended particulate matter determinations were collected at a total of 12 stations from the Ribble area. Preliminary separation of determinands as described in aim 1 were completed on board. The objective of this work was to provide an initial characterisation of the transport of fine sediments and, hence, Springfields derived radionuclides during differing tidal and river flood regimes.

3 Sediment cores were successfully obtained from 9 of the 11 proposed stations. Because of the misalignment of the NIOZ corer, a Day grab was used to collect the 2 sandy sediments. The cores will be used for a programme of experimental laboratory work to assess the impact of current Sellafield discharge practices.

4. Samples of 50 litres x 2 surface seawater were collected from 34 locations in the Irish Sea and passed through ion exchange columns to extract ^{99}Tc and Cs radionuclides. At 15 sites, 50 litres surface seawater samples were collected and ^{125}Sb was extracted by co-precipitation methods. Further radiochemical purification and radiometric assay will take place at the Lowestoft laboratory. The primary purpose of this survey is to establish elevated concentrations for key radionuclides from the new BNF Enhanced Actinide Removal Plant (EARP).

5. Zooplankton (>220 μm) and phytoplankton (>20 μm) samples were collected and initially processed at 15 stations in the Irish Sea. Samples of 50 or 100 litres of surface seawater, collected from identical locations, were subjected to preliminary chemical separation procedures to isolate ^{241}Am, ^{60}Co and the two oxidation states of plutonium. The combined information will provide a basis to assess the concentration processes in the primary food chain.

6. A total of 193 male plaice were successfully landed and returned to the laboratory. Ideally, a total of 250-300 live fish were required.

7. A bulk sample of approximately 200 kg (wet) mixed fish is required, of which a total of 106 kg was obtained from trawls off Sellafield.

K S Leonard (SIC)
04 June 1994

SEEN IN DRAFT

R J (Captain)
M R (Fishing Skipper)

INITIALLED: PGS

DISTRIBUTION:

Basic List +
Staff on cruise
Cumbria Sea Fisheries Committee
North Western and North Wales Sea Fisheries Committee
District Inspector (North Western)
District Inspector (Wales)

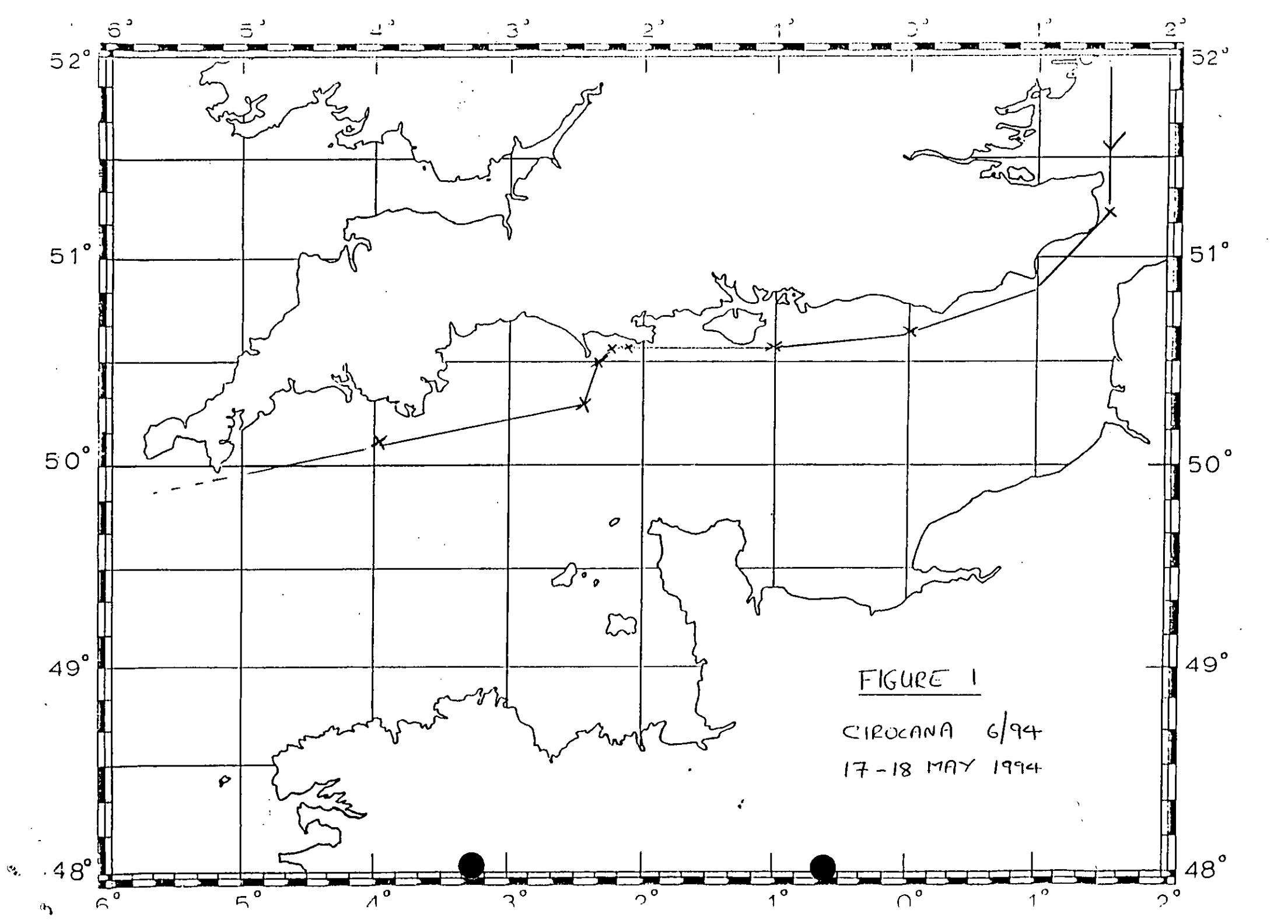
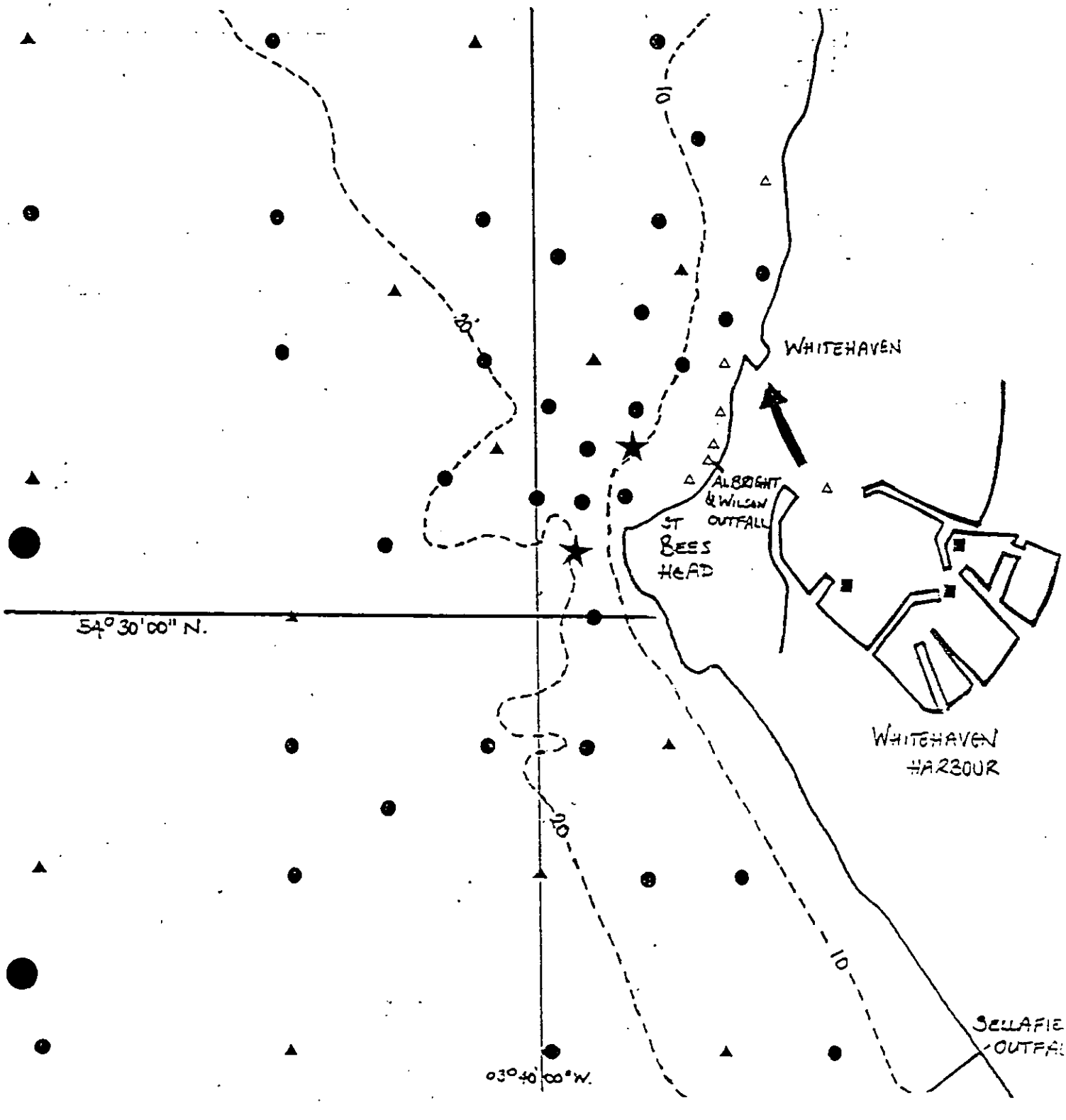


FIGURE 1

CIROCANA 6/94

17-18 MAY 1994

Figure 2. CIRCLANA 6/94 20 - 22 May 1994



★ - Surface waters for Ra, Pb, Po, Th and U radionuclide, nutrient, suspended load and salinity analysis plus sediments for geochemical, grainsize and Ra, Pb, Po, Th and U radionuclide analysis

■ - Sediment samples for geochemical, grainsize and Ra, Pb, Po, Th and U radionuclide analysis

▲ - Surface waters for dissolved ^{226}Ra determination and nutrient, suspended load and salinity analysis and sediments for geochemical, grainsize and Ra, Pb, Po, Th and U radionuclide analysis

△ - Surface waters for dissolved ^{226}Ra determination and nutrient, suspended load and salinity analysis

● - Surface water samples for nutrient, suspended load and salinity analysis

Figure 3

Cirolana 6/94 cruise programme

Irish Sea grid (aims 3-5)+
and Ribble transect (aim 2) ⊗