SH

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

1979 RESEARCH VESSEL PROGRAMME

REPORT: RV CIROLANA: CRUISE 4

PROVISIONAL: Not to be quoted without prior reference to the author.

STAFF

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DURATION

Left Grimsby 1730 h 11 April
Arrived Grimsby 0830 h 1 May

LOCATION

The waters surrounding the British Isles, especially the Irish Sea and western and northern coastal waters.

AIMS

1. To continue the examination of the distribution of Strontium-90, Caesium-134, Caesium-137, Plutonium-238, Plutonium 239/240 and Americium-241 in British Isles coastal waters.

2. To continue work on determination of the oxidation states of plutonium in seawater.

3. To determine the suspended load in seawater at stations where seawater samples are to be analysed for plutonium.

4. To record the gamma count rate, in a selected energy range, from surface seawater of the Irish Sea and its immediate approaches.

5. To measure the concentrations of Polonium-210 in seawater and in plankton.

6. To collect 5 core samples of the seabed of the north Irish Sea using the Reineck box corer on mud and the Tennant box corer on sand.

7. To measure surface and bottom seawater temperatures at selected stations in the Irish Sea for Mr R J Wood.

NARRATIVE

RV CIROLANA sailed from Grimsby on the afternoon tide of 11 April and proceeded south about to station 26 off the south west of Ireland (see chart) at 50°30'N, 13°W, collecting en route 50 litres of seawater at the surface at 25 stations and at depth at 3 stations. The samples were filtered through 0.22μm membrane filters and processed on board for later analysis of

caesium-134 and caesium-137. At 5 selected stations additional 100 litre samples were taken and filtered and processed on board for later determination of ^{238}Pu, $^{234/240}Pu$ and ^{241}Am in both the "dissolved" and "particulate" fractions. In addition large volume samples were also taken for ANL at 4 stations for the determination, after initial preparation on board, of the amounts of Plutonium IV and Plutonium VI oxidation states in seawater. This work is a continuation of that started on CIROLANA 10/77 and CIROLANA 5/78. Suspended load determinations were also made by passing up to 5 litres of seawater through weighed membrane filters of the same pore size. Surface water was also collected at 4 stations for Strontium-90 determination and at 2 stations for Polonium-210.

At station 26 seawater samples were collected from surface, 100 m, 500 m and 1000 m using the Niskin rosette array, with the TSD cable, off the port quarter. It was anticipated that it should have been possible to obtain there seawater containing radiocaesium, plutonium, americum and radio strontium derived from nuclear weapon test fallout only and free from the influence of the discharges of these radionuclides from the nuclear fuel reprocessing plants at BNFL Windscale and CEA Cap de la Hague. Information on these "fallout" background concentrations in British coastal waters is required in order to be able to compare the distributions of radiocaesium and transuranics in seawater as a function of distance from BNFL Windscale.

The station was completed at 2340 h 14 April and RV CIROLANA then worked a grid of 18 stations, with a similar work content to stations 1-25, off the west and south coasts of Ireland until a programme of work within the Irish Sea commenced at 0030 17 April on a line of 3 stations from Fishguard to Rosslare. Seawater sampling on a 72 station grid (47 stations with depth) (see chart) continued until 1430 h 21 April. All stations were sampled for radiocaesium analysis. 28 stations were sampled for plutonium and americium, 19 for plutonium oxidation states and 14 for radiostrontium. The programme was delayed for a period of about 12 hours because of dense fog on the evening of 18 April and the morning of 19 April.

The gamma probe was run continuously and information on gamma counts, Decca positions, time and water temperature was fed into the FRL data logger. The data were interrogated on board using the Hewlett Packard programme but a print out had to be obtained by outputting paper tape and the use of a standard teletype because the Logabax line printer was not operative.

Attempts to obtain core samples of the sea bed in the immediate vicinity of BNFL Windscale, using the Reineck box corer, were not successful. At the first station a similar fault occurred as on RV CIROLANA 3/79. The stainless steel box was crushed and the supporting flukes broken. The problem appears to be that the swinging arm needs to be straightened, to allow the knife edge to drop to its full extent and pass just below the box instead of hitting it as at present. Samples of sea bed were obtained at two stations using the Tennant box corer which worked very well. Thought should be given to the possibility of increasing the maximum depth of sampling from the present 20 cms to a possible 30-40 cms, and thus replace the more unwieldy Reineck sampler. Surface and bottom temperatures were taken at 22 stations in the Irish Sea for Aim 5, using reversing thermometers and the thermograph was run continuously throughout the cruise.

Before proceeding out of the Irish Sea a sample of zooplankton was collected in the North Channel for the measurement of the naturally occurring polonium-210 to be made as a comparison to the measurement of ^{210}Po in seawater.

A line of 3 stations, from Stranraer to Larne completed the work in the Irish Sea at 1430 h 21 April. RV CIROLANA then worked a grid of 76 stations (26 with depth) of seawater sampling between the North Channel and Orkney-Shetland (see chart) out to and just beyond the shelf edge. At all stations seawater was collected for the measurement of radiocaesium with the objective of estimating the budget of radiocaesium in the water column of this area of ICES Division VIA. The estimate will be compared with that obtained on CIROLANA 5B/78 and with the estimated loss from the Irish Sea, during the same period, in order to establish a residence time of radiocaesium in this sea area. At 10 stations seawater samples were obtained for radiostrontium analyses. The results will be used to establish a $^{137}Cs/^{90}Sr$ concentration distance relationship out of the North Channel to the North Sea and to estimate transit times from the Cumberland coast to the northern North Sea and the latter estimate will be compared with that obtained by the method of using $^{137}Cs/^{134}Cs$. At 18 stations samples were obtained for transuranic analyses and at 13 for plutonium oxidation states in order to examine the relationship of the Plutonium IV and Plutonium VI as a function of time/distance from Windscale. This period of the cruise proceeded normally except for some delay due to worsening weather conditions on the night of 22 April, with an additional delay of about 4 hours whilst repairs were made to a burnt-out coil in the engine room.

The cruise was completed by working a line of 12 stations from Fair Isle to Spurn Head but no planned depth sampling station could be worked because of storm and then gale force wind conditions in Scottish coastal waters. CIROLANA docked at Grimsby at 0830 h 1 May.

RESULTS

All the major aims of the cruise were completed. Of the minor, all were completed except for the collection of three bed cores, using the Reineck corer not obtained on CIROLANA 3/79, and the abandonment of 12 seawater collection stations in the northern North Sea.

Provisional contours of the ^{137}Cs concentrations in seawater of the North Irish Sea, obtained from the gamma probe measurements, were produced on board and demonstrated a similar distribution to that obtained on CIROLANA 5/78 but with a drop in absolute concentrations, reflecting the change in discharge rates from BNFL Windscale. The contours again demonstrated the influence of seawater of lower ^{137}Cs concentrations moving up from the south and turning eastwards to the south of the Isle of Man toward the Cumberland coast between the Windscale pipeline outlet and Walney Island. Maximum concentrations were found less than 3 Km from the discharge point in comparison with the maximum found, on CIROLANA 3/79, off St Bees Head, some 10 Km north.

Minimum bottom water temperature in the Irish Sea were $5.5^{\circ}C$ - $6^{\circ}C$ between the Cumberland coast and the Isle of Man with the maximum temperature of $7.5^{\circ}C$ at the southern entrance. The maximum surface temperatures found were $7.8^{\circ}C$-$8.4^{\circ}C$, south west of the Isle of Man, with a $1.3^{\circ}C$-$1.5^{\circ}C$ reduction for the bottom water temperatures at the same position. Comparison of the surface measurements, at the 22 stations, with those recorded on the thermograph showed a positive bias of about $0.5^{\circ}C$ for the thermograph.

D F Jefferies
22 May 1979

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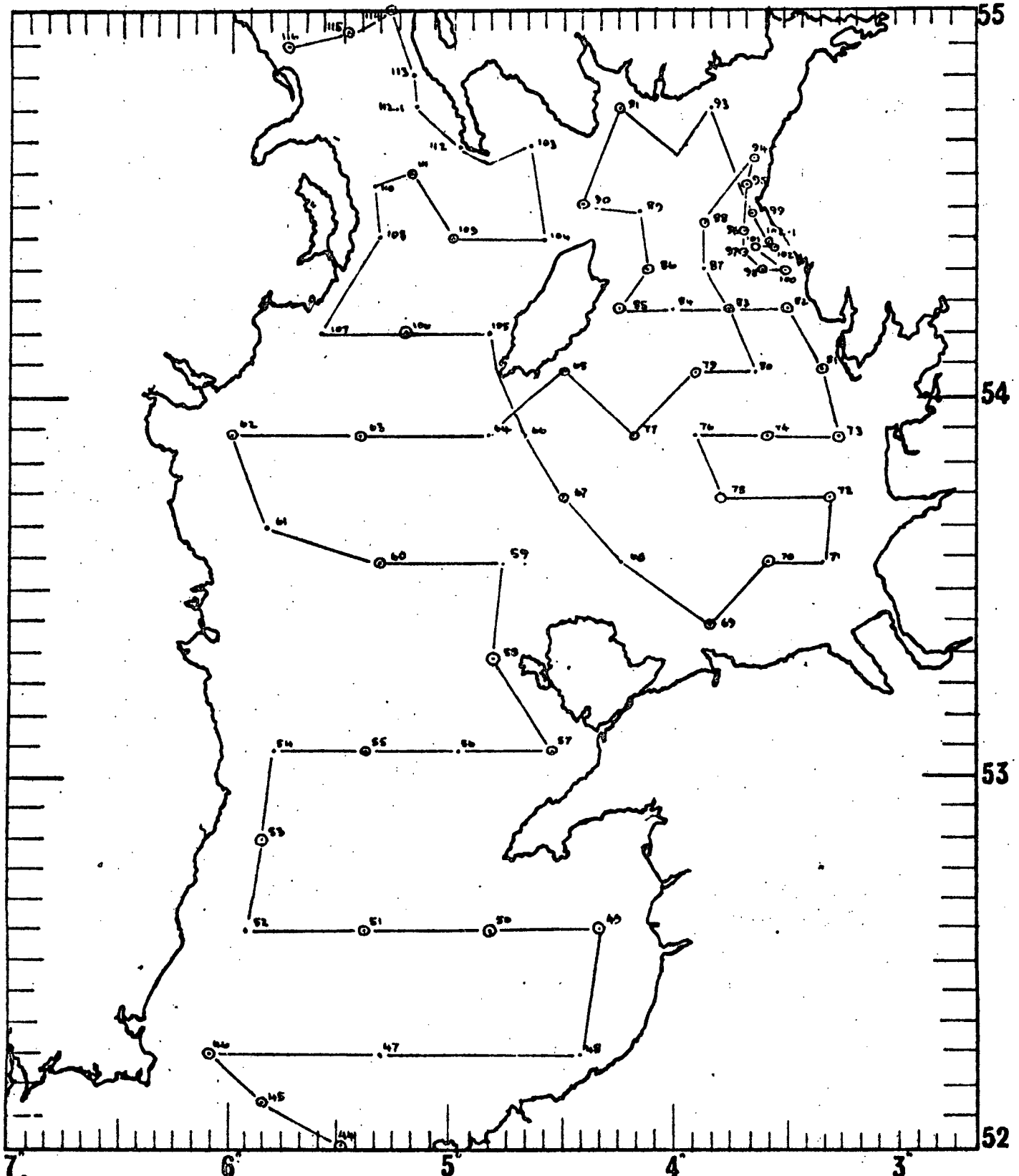
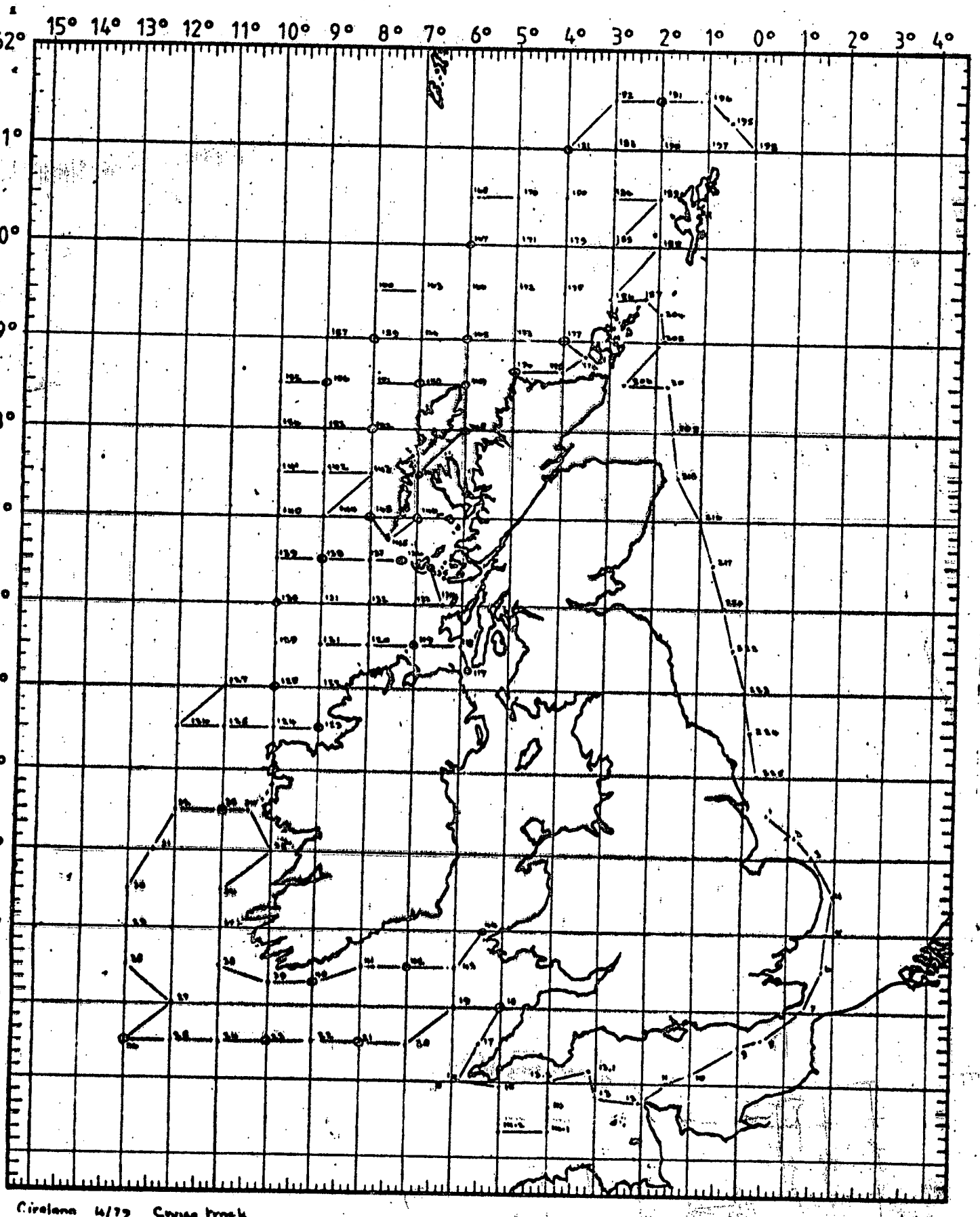


Circolana 4/79 Cruise track.



Circolare 4/79 Course track.