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

1982 RESEARCH VESSEL PROGRAMME

REPORT: RV CIROLANA : CRUISE 5

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

STAFF:

B R Harvey (SIC)
M B Lovett
P J Kershaw
I A Huggins
D J Swift
D C Denoon
Miss S Gerrell
Miss L Thurston
R J Pentreath/T Doddington (Exchanged at Isle of Man)
P Gueguenlat CEA Cherbourg (Disembarked at Cherbourg)
J O'Grady NEB Dublin (Embarked at Fishguard)

DURATION:

Left Grimsby 0800 h 14 May
Arrived Grimsby 0400 h 3 June

LOCALITY:

English Channel, Irish Sea, North Scottish Coast

AIMS:

1. To study the distribution of Np and Tc in seawater around the British coast and to obtain samples of suspended particulate matter to enable Kd's to be determined for both elements at selected sites.

2. To carry out speciation studies on Pu, Am, Cm, Np and Tc in seawater with particular emphasis on comparing results from the Cap de la Hague and Windscale areas.

3. To collect a small number of samples for radiocaesium analysis for Mr Jefferies in selected areas. Samples will also be collected by the observer from the Nuclear Energy Board, Dublin, chiefly in the Western Irish Sea.

4. To obtain samples for radioantimony and Pu analysis in the southern North Sea and English Channel for the Commissariat a l'Energie Atomique, Republique Francaise.

5. To sample plankton in the Cap de la Hague and Windscale areas for radionuclide analysis.

6. To obtain core samples at a number of stations in the Irish Sea for comparability studies.

7. To squeeze out the interstitial water from core sections at selected sites so that the physico-chemical conditions and the transuranic element concentrations may be compared.

8. To investigate bioturbation in Irish Sea sediments by separating and identifying the burrowing animal population in the cores collected.

NARRATIVE:

CIROLANA sailed at 0800 h on 14 May and proceeded south towards the English Channel. On the way a number of surface water samples were taken for analysis of caesium and salinity and the French observer (P Gueguenïat) collected water samples for the analysis of radioantimony. After passing through the Straits of Dover the ship turned south to the French coast where water sampling continued in a line from east to west across the Bay of the Seine. During the afternoon of 15 May samples of plankton were collected by tin-tow net for subsequent analysis of radionuclides. Off Cap de la Hague a number of water samples were collected within the area bounded by the Channel Islands and the French coast and at one of the stations nearest to the discharge from the la Hague nuclear reprocessing plant, large water samples were collected to enable speciation of plutonium, americium and possibly curium to be studied. In this area, the French observer carried out his own study of plutonium for comparative purposes. Plankton samples were also collected during the afternoon. The ship docked at Cherbourg at 0800 h on 17 May to off-load samples of water, plankton and concentrates of radioantimony and plutonium. The French observer also left the ship at this point.

After the completion of some minor repairs to the steering gear CIROLANA sailed again at 1430 h setting a westerly course. Collection of surface water samples continued at intervals of 1° longitude to a position 49.5° N 7.0° W where, at midday 18 May, large water samples (3 x 200 l + 1 x 100 l) were collected. (Approximately N. Atlantic fallout level radionuclide concentrations). The ship then set course for the Irish Sea, further plankton sampling being carried out during the afternoon. With the weather remaining calm the scheduled programme of water sampling was completed in Cardigan Bay on 19 May. The Irish observer, John O'Grady of the Nuclear Energy Board at Dublin (NEB), joined the ship by launch at 0830 on 20 May and the ship then proceeded towards Tuskar Rock at the south eastern tip of Ireland. Sediment cores were taken at eight positions off the east coast of Ireland from Tuskar Rock to St John's Point, and surface water samples for radiocaesium analysis were also taken in the same area. During this phase of the work which continued into 21 May a fault developed in the bow propeller and with wind strength increasing, attempts to obtain cores at two standard stations (54° 14.5' N 5° 14' W and 54° 14.5' N 4° 55.5' W) had to be abandoned. It was decided therefore to proceed overnight to the east of the Isle of Man where on 22 May speciation studies for Np and Tc and analysis for radiocaesium were carried out on water samples collected in a line from 54° 16.7' N 4° 5.8' W to 54° 24.1' N 3° 33.3' W. From this point the discharged radioactive waste from the Sellafield outfall was followed northward using the gamma probe (housed in a 200 litre barrel on board). At the point of highest activity, 800 litres of water were collected for Pu and Am speciation studies and further samples were collected for Np and Tc speciation studies. Plankton was collected in this area during the afternoon and as the ship returned towards the Isle of Man during the evening, cores were obtained from two standard stations. An exchange of scientific staff was carried out at 0825 on 23 May using a small boat from Douglas. Repairs to the bow propeller were now complete and CIROLANA returned to the vicinity of Windscale where for the next four days detailed studies were carried out at a small number of selected sites. A number of box and gravity cores were collected for a detailed assessment of sediment accumulation and subsequent disturbance (particularly bioturbation) using biological observations, X-ray radiography, radiochemical analyses of core profiles and magnetic fabric analysis (IOS Taunton). At two sites 54° 21.9' N 3° 40.8' W and 54° 24.6' N 3° 34.5' W interstitial water was squeezed from sediment cores for an investigation of Pu speciation. At the second of these sites sufficient interstitial water was collected to attempt similar measurements for Np as well. Supporting measurements of physico-chemical conditions were also made at each site. On 28 May a number of sediment cores and water

samples were collected in Liverpool Bay and during the morning of 29 May a concerted effort was made to obtain further specimens of burrowing animals from sediments in the eastern Irish Sea mud patch for the assessment of the extent of bioturbation. The remainder of the day was spent collecting water samples to the north of St Bees Head and along the Scottish coast. Further plankton sampling was carried out from a point just south west of Balcary Point towards Wigtown Bay before the ship set course for the western Isle of Man area to make a second attempt to obtain cores at the two standard stations where the attempt had to be abandoned on 21 May. At the most easterly of the two stations, interstitial waters were extracted and analysed (though not for transuranic elements).

Before leaving the eastern Irish Sea area it had been decided to forego sampling for transuranic elements around the Orkney and Shetland Islands so that additional time could be made available for the completion of important coring and bioturbation work in the Irish Sea. The return journey was therefore re-scheduled via the Pentland Firth with further water sampling being carried out from the North Channel through the west coast Scottish Isles round to Rattray Bay. On 31 May some time was spent coring in the north Minch and after completion of the coring work the opportunity was taken to undertake towing trials with the Endico 3 ft V-fin (intended for use with the towed gamma-probe). Samples of water and plankton were obtained off Dounreay on 1 June and after passing through the Pentland Firth in perfect weather conditions a final sample of water for transuranic element analysis was collected off Rattray Head before CIROLANA completed her passage to Grimsby where she docked at 0400 on 3 June.

RESULTS:

1. Twenty 100 litre samples of seawater were collected around the British coast and chemically treated to remove Np. At six of these stations Np IV and Np V species were collected separately. A similar number of 50 litre samples were collected and treated to remove Tc which was also separated into higher and lower oxidation states. Final analytical separation and radiometric assay will be carried out back at the laboratory. Suspended particulate matter will also be analysed for these elements to provide further Kd values.

2. Thirty 200 litre samples were collected for speciation studies of Pu and Am in seawater. $Fe(OH)_3$ was used to coprecipitate these elements and if sufficient Cm is present analytical data will also be obtained for this element.

3. Samples of seawater were collected for radiocaesium analysis which along with samples collected for salinity measurements will be used for comparison with Tc and transuranic element results. A small number of samples were collected specifically for Mr Jefferies throughout the cruise and twenty-two duplicate Cs samples were taken for NEB, these being chiefly in the western Irish Sea. All Cs samples were processed on board using ASG or KCFC cartridges to remove the Cs as appropriate to the sampling area.

4. Twenty 200 litresamples for radioantimony analysis were taken by the French observer. Preconcentration using MnO_2 precipitation was used given about 5 litre samples of slurry for further treatment at the Laboratoire de Radio-ecologie. A small number of samples for Pu speciation studies were also collected near Cap de la Hague for analysis at the French laboratory.

5. Plankton samples for radionuclide analysis were collected from the Bay of the Seine, off Cap de la Hague, southwest of the Scilly Isles, south of St Bees Head southwest of Balcary Point and in the Dounreay area. At each site a 25 litre sample of seawater was collected for comparative radionuclide analysis (chiefly fission products).

6. Irish Sea bottom sediments were sampled at 30 stations using grabs, box corers and gravity corers depending both on the nature of the sea bed and the type of sample required. Duplicate grab and box samples were collected for MAFF and NEB at eight stations in Irish waters (plus 4 in other areas) for radiochemical analysis. A gravity corer on loan from IOS (Taunton) was successfully used to collect 4 x 2 metre cores (off the Cumbria coast, west of the Isle of Man and in the Minches). Analyses for mineralogical, chemical and physical properties will be made and suitable samples will be subjected to magnetic fabric analysis (IOS Taunton/Southampton University) to provide an independent (of radiochemical methods) estimate of post-depositional disturbance. Eleven box cores provided minimally disturbed samples of the upper 40 cm of the sea bed and will be used for X-radiographic and radiochemical analyses in conjunction with biological observations made at the time of collection to assess the extent of bioturbation. Gravity cores were taken and sectioned at seven standard stations for later analysis and eight homogenized bulk sediment samples were collected for use in laboratory desorption experiments. In addition to bottom deposits ten samples of suspended particulate matter were taken in the eastern Irish Sea for autoradiography work.

7. Nearly 30 additional cores were taken for the analysis of interstitial water at four sites. The interstitial fluid was expelled by squeezing in a compressed-air operated rig. Measurements of Eh and pH were made and samples were analysed for nitrite and ferrous iron immediately. Other samples were retained for phosphate, nitrate, silicate, total iron and manganese analysis. At two stations near Windscale separations for higher and lower oxidation states of transuranic elements were carried out. These will need further separation and final analysis back at the laboratory.

8. As part of the study of bioturbation in Irish Sea sediments samples taken by box corer were examined for burrowing organisms. Those present were identified and recorded (28 stations). Samples of burrow linings and faeces where present were also kept for radionuclide analysis. The Echinoid worm Amalosoma eddystonease was found at a number of stations and samples were preserved for further study. Other animals found were Callianassa subterranea (crustacea), Chaetopterus variopedatus, Notoreastus latericeus and Glycera convoluta (Annelida), Echinocardium cardatum, Ophuira texturata and Amphuira filiformes (Echinodermata).

9. In addition to the specified aims of the cruise a continuous record of the gamma activity as seen by the probe in the 200 litre flow-through barrel was obtained and use was made of this equipment to locate the peak of the activity discharged from the Sellafield pipe so as to obtain a high level sample for transuranic speciation studies. Opportunity was also taken to carry out some towing trials for the Endico 3 feet V-fin in calm conditions in the Minch area. Though the calculations have not yet been completed, results suggest that cable tensions were considerably in excess of manufacturers predictions and a maximum towing speed for the fin was assessed to be 5-8 knots. Further trials are obviously needed for this equipment.

B Harvey
24 June 1982.

SEEN IN DRAFT:

M J W Master
E W P Fishing Skipper

INITIALLED:

H W H

DISTRIBUTION:

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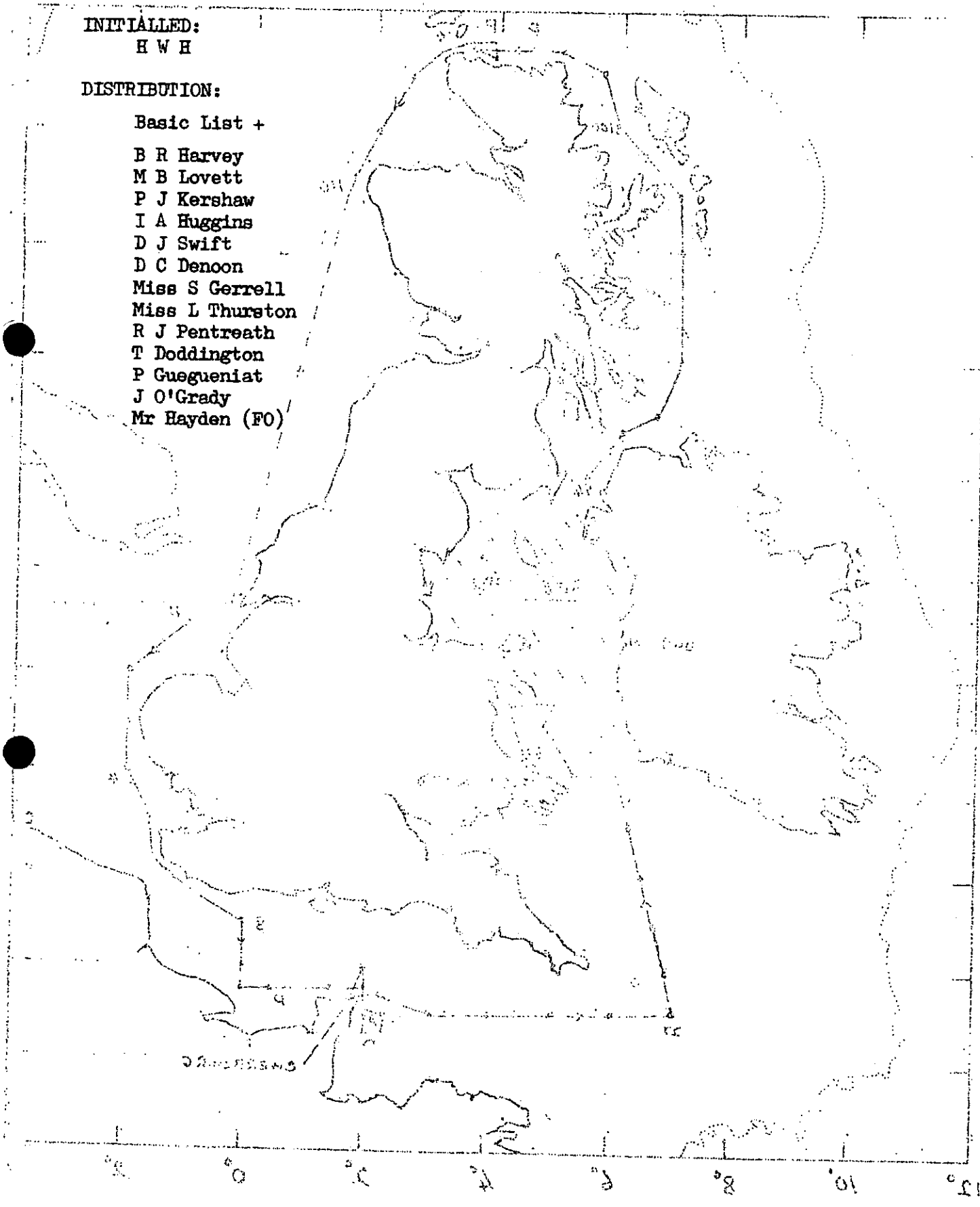
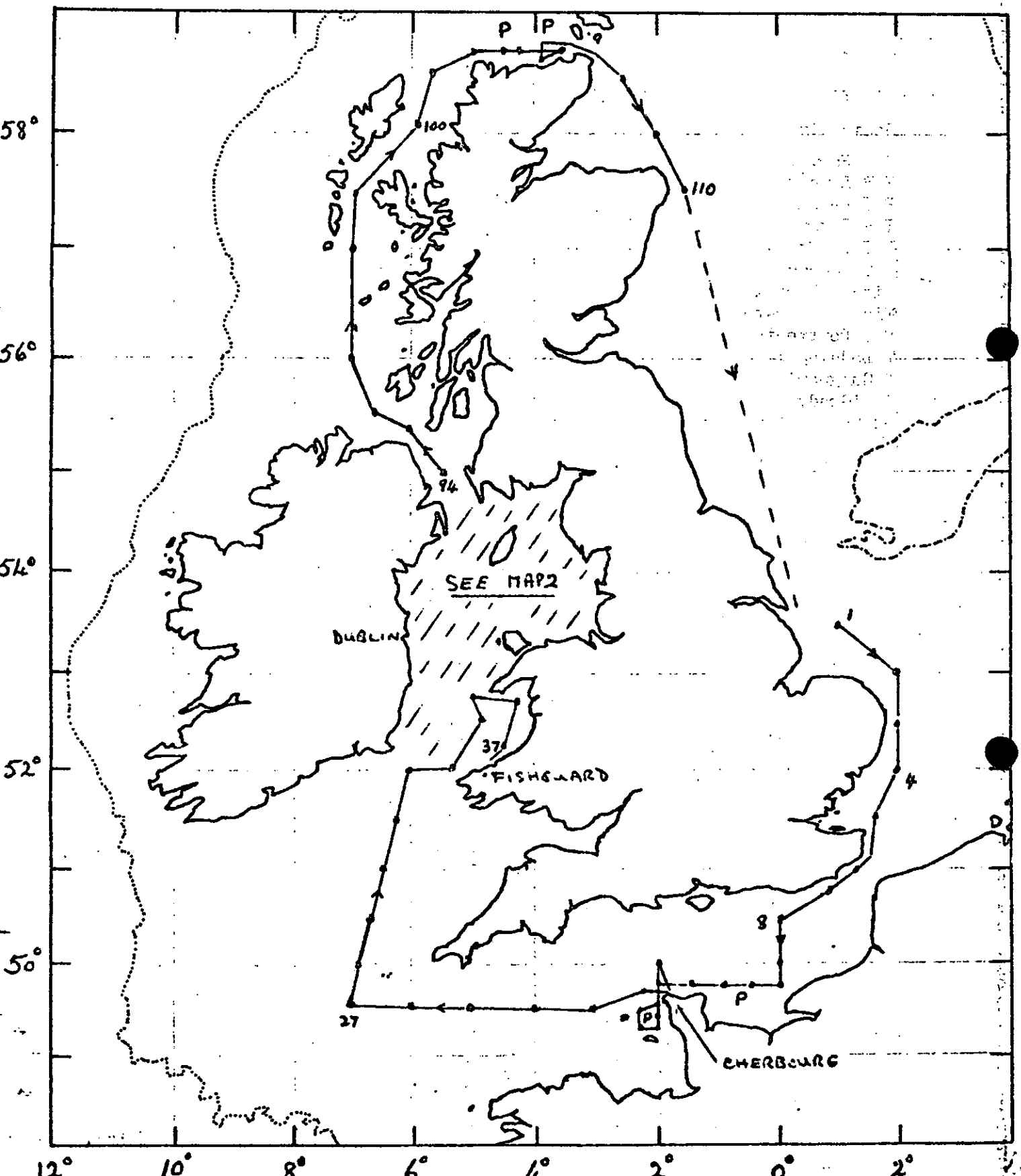
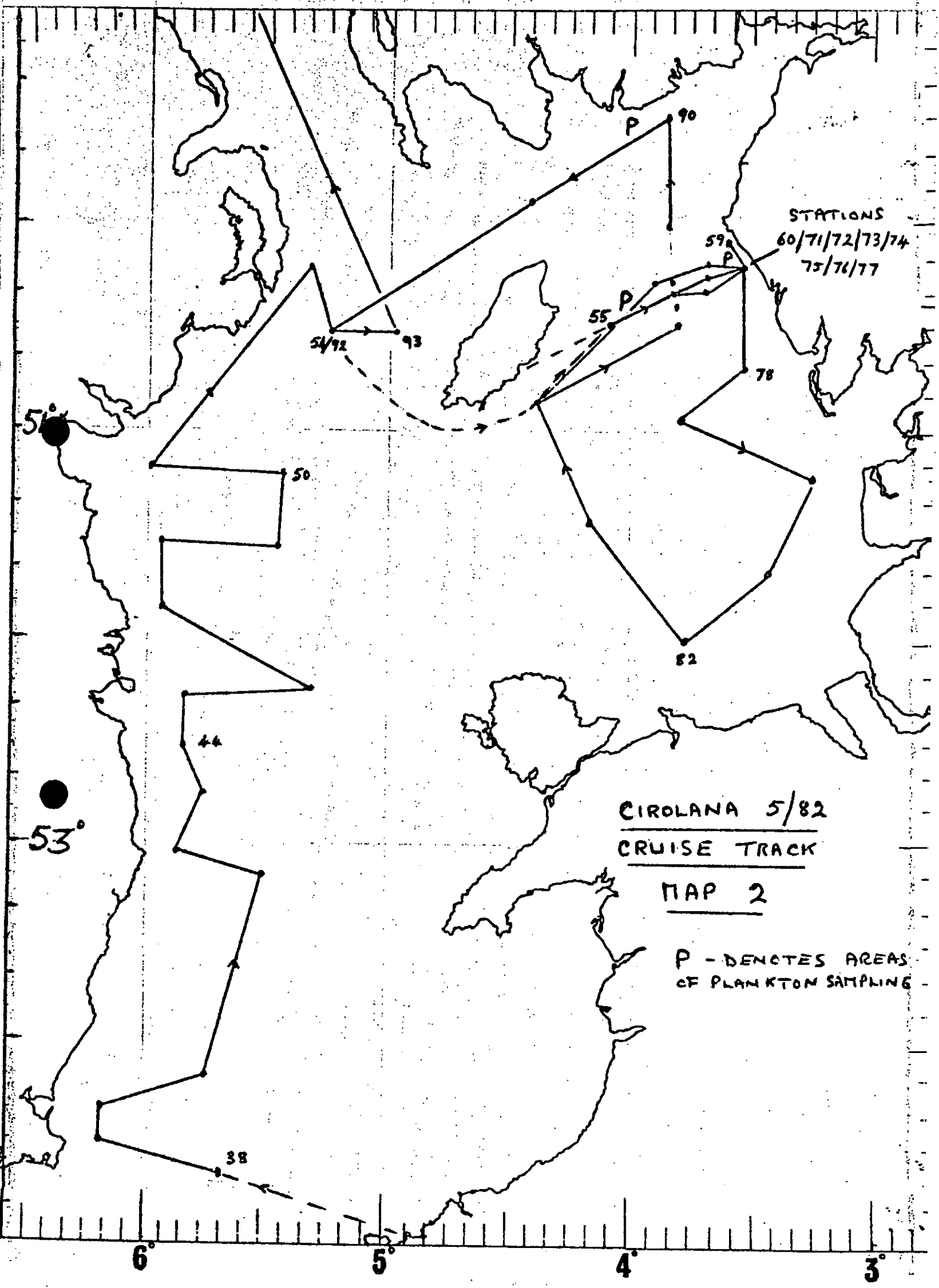
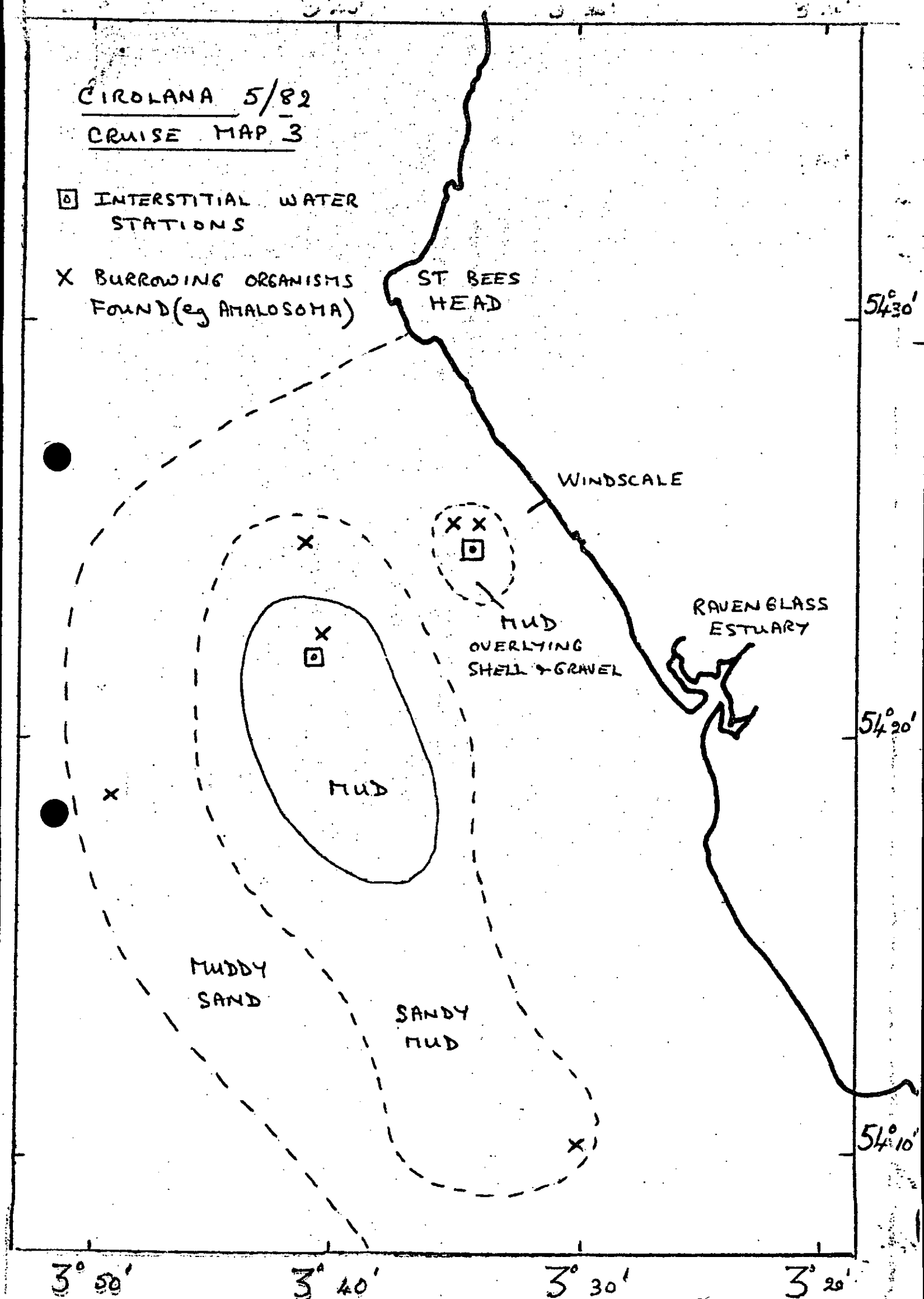


CIROLANA 5/82 CRUISE TRACK MAP I

P DENOTES PLANKTON SAMPLING AREAS.




P
90
STATIONS
60/71/72/73/74
75/76/77
59
P
55
P
54/92
93
78
51°
50
82
44
53°
38
CIROLANA 5/82
CRUISE TRACK
MAP 2
P - DENOTES AREAS
OF PLANKTON SAMPLING
6°
5°
4°
3°


CIROLANA 5/82
CRUISE MAP 3
INTERSTITIAL WATER STATIONS
X BURROWING ORGANISMS FOUND (eg AMALOSOMA)
ST BEES HEAD
WINDSCALE
RAVENGLASS ESTUARY
MUD OVERLYING SHELL + GRAVEL
MUD
MUDDY SAND
SANDY MUD
54° 30'
54° 20'
54° 10'
3° 50'
3° 40'
3° 30'
3° 20'