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CENTRE FOR ENVIRONMENT, FISHERIES AND AQUACULTURE SCIENCE, LOWESTOFT, SUFFOLK, ENGLAND

2000 RESEARCH VESSEL PROGRAMME

REPORT: RV CORYSTES: CRUISE 11

STAFF:

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| Dr J Brown | Dr L Fernand |
| Ms J Taylor | Mr B Riches |
| Dr E Young | Mr K Medler |
| Mr E Tinton | Dr K Weston (UEA) |
| Ms H Cannaby (UWB) | |

UWB – University of Wales, Bangor
UEA – University of East Anglia

DURATION: 15 – 31 August

LOCALITY: North Sea

AIMS:

The work is directed toward:

a) A better understanding of the dynamics of the circulation processes of the central North Sea in order to characterise the extent and nature of density driven and seasonal jet-like circulation which acts as a direct and rapid pathway for transport of material. Subsequently, the knowledge will be viewed with respect to concerns that elevated levels of contaminants on the Dogger Bank have originated in the near coastal regions.
b) Improved knowledge of the processes that determine areas of strong phytoplankton production in the vicinity of the Dogger Bank.
c) A resolution of the processes that influence primary productivity and the distribution and behaviour of particulate matter and nutrients in the southern North Sea. In particular, the interaction between UK and Dutch waters.

The main sampling aims of the cruise are:

1. To recover moorings deployed at the Sean Gas Field.
2. To undertake Scanfish and CTD surveys between the East Anglian and Dutch coast to collect information on nutrients, suspended sediment and primary production.
3. To recover four mooring arrays in the vicinity of the Dogger Bank.
4. Recover free-floating satellite tracked buoys deployed to determine the Lagrangian circulation.
5. To undertake Scanfish and CTD surveys to collect information on nutrients and circulation in the vicinity of the Dogger Bank.
6. Conduct experiments to examine the near-bed cross frontal circulation on the Dogger Bank.

NARRATIVE (all times GMT):

RV CORYSTES sailed at 09:30, approximately one hour late as a casual member of the deck crew failed to report for duty. It had been intended to sail to the Dogger Bank for Scanfish work, recovering en route an acoustic buoy deployed by FSM in early June during CORYSTES 8/00 (position 53° 36.30'N 2° 11.35'E). However, a replacement crewman had to be collected during the late evening in Lowestoft. In the interim, the mooring was recovered (15:45 15 August), but the return to Lowestoft effectively meant the loss of 12 hours ship time. Having picked up the crewman, CORYSTES sailed for the centre of the A1221 array (Fig. 1) to undertake a productivity and CTD station (04:00 16 August). Subsequently, two Argos buoys were recovered on the Dogger Bank prior to a Scanfish line (Fig. 4; 5) on the northern flank of the Bank along the line of ADCP moorings (Fig. 3).

The dye release frame was deployed (08:30 17 August) and a CTD performed at the site (Fig. 2; 8). At 15:00 the dye release was triggered acoustically and a near bed Scanfish survey commenced in the vicinity. The following three days were occupied with mapping the evolution of the dye field with respect to the density structure and associated flow field. This work was punctuated by several problems with the Scanfish, including the instrument being dragged briefly along the seabed, fortunately with minimal damage. Overnight (21:00 19 August – 10:00 20 August), during a short period of comparatively poor weather, work was temporally halted when an intermittent fault appeared in the communication with the instrument. At this stage a cure could not be found, nevertheless, it was possible to continue the survey despite continued instrumental problems. However, at 18:00 communications with the instrument became sufficiently troublesome that recovery was necessary. At this point dye tracking was still possible 76 hours after release.

A CTD section was started at 22:00 in order to characterise the nutrient and phytoplankton regime in the vicinity of the dye. On completion (10:00 Monday 21 August) four ADCP moorings on the northern flank of the Dogger were recovered (Fig. 3). However, the marker toroids from the southern two were missing; at 'L' it transpired that the batteries had 'leaked'; and the release system at the northern one failed requiring the instrument to be recovered by dragging. Subsequently, the dye release frame was recovered and CORYSTES sailed to commence recovery of ARGOS buoys at first light (22 August).

The following five days were occupied by Scanfish sections (Fig. 4; 150 – 163)and Argos buoy recoveries, the latter included collecting an instrument from a rig standby vessel. The Scanfish work was possible as Mr Riches and Dr Fernand traced the Scanfish problems to a faulty power supply and effected a temporary repair by rigging an external 12V power supply. On 26 August (22:15) the eastern most Scanfish line of the AE1221 sections was completed after a transect from the Tail End of the Dogger Bank (Fig. 4; 164). Work continued with a series of Scanfish lines (Fig. 4) and CTD's (Fig. 2), the latter to enable quantification of productivity. During daylight hours on 27 August moorings G, D, E, B and A (Fig. 1) were recovered successfully. On the following day the toroid at F was recovered, the rest of the mooring having been trawled several weeks previously. Additionally, the 'Smart' buoy and guard buoy at C were recovered, with the Minipod retrieved the following morning (29 August). Following this a short search was instigated for a sub-surface buoy lost in February. The final Scanfish section was completed at 1629 30 August, whereupon CORYSTES sailed for Lowestoft; docking at 31 August.

RESULTS (Preliminary):

1. All moorings at the Sean Gas field (AE1221 array) were successfully recovered, with the exception of that at F, reported ashore several weeks previously. A provisional inspection of the current meter data suggests a good rate of data return, but full analysis will await return to the laboratory when data is combined with that collected from January onwards. The Smart buoy collected a full data set, both from the NAS nutrient analyser and the water sampler. However, instruments were heavily fouled and interpretation of the ancillary fluorescence, suspended load and conductivity data will require care. The quality of the data from the minipod will be determined ashore with access to the appropriate software. However, care will also be needed when interpreting data from the MOBS as there was significant fouling.
2. All four 'standard' Scanfish sections and the five productivity stations were completed. An initial inspection of the available processed data shows comparatively low levels of suspended sediment, consistent with calm weather. Overall, nutrient and chlorophyll levels were low. A detailed picture will be available when data is fully processed.
3. All four ADCP's deployed during CORYSTES 9a/00 were recovered. However, mooring 'L' failed as the battery pack installed by the manufacturers 'leaked'. Analysis of the data awaits return to the laboratory.
4. Sixteen satellite-tracked drifters had been deployed on the northern flank of the Dogger Bank during CORYSTES 9a/00 in order to monitor the Lagrangian circulation. The trajectories of the drifters were influenced by strong north westerly winds around the 12 July, pushing the instruments south. Following this, those in the vicinity of 50 m contour line on the northern flank of the Dogger Bank moved persistently east with the strong density driven flow associated with the bottom fronts in the region. Those to the north showed little movement, whilst those to the south exhibited a weaker easterly flow. The most easterly instrument reached the region north of Jutland, describing for the first time the path of a density driven flow that apparently extends continuously from the UK coast to the Skaggerak.
5. This objective was met. The mooring section was occupied with CTD's and Scanfish, showing the presence of a strong thermocline and bottom fronts. There was strong near bed phytoplankton production in the vicinity of the bottom fronts, whilst in deeper water there was a 'thin' layer of intense production associated with the thermocline. The production appears to be largely 'fuelled' by the nutrient-rich pool of dense deep water isolated below the summer thermocline following its formation in April/May. The limited series of Scanfish sections provided strong evidence for the movement of fresher water of coastal origin along the northern flank of the Dogger Bank and further east. The flow is consistent with transport in the jet-like circulation associated with the bottom fronts extending offshore from Flamborough Head.
6. This element of the work was particularly successful. The movement and evolution of dye released at the sea bed was tracked for 76 hours before a power supply failure associated with the Scanfish powercom stopped work. Overall, there was a general eastward movement consistent with translation with the general jet-like flow associated with the bottom fronts. In addition, the dye also moved 'up slope' from denser to less dense water, but it also 'climbed' up the pycnocline away from the seabed, following an isopycnal (line of constant density). These observations represent the first direct observations in European waters of the weak cross frontal flows predicted for bottom fronts. The full potential of the data set will be realised when combined with the observations of nutrients

and plankton from the CTD line, the current meter data, larger scale Scanfish data and modelling studies.

The hard work, enthusiasm and good humour of the ships crew and scientific staff made possible the success of the programme.

Juan Brown
(Scientist-in-Charge)
31 August 2000

SEEN IN DRAFT:

A R Williams (Master)
B Salter (Senior Fishing Skipper)

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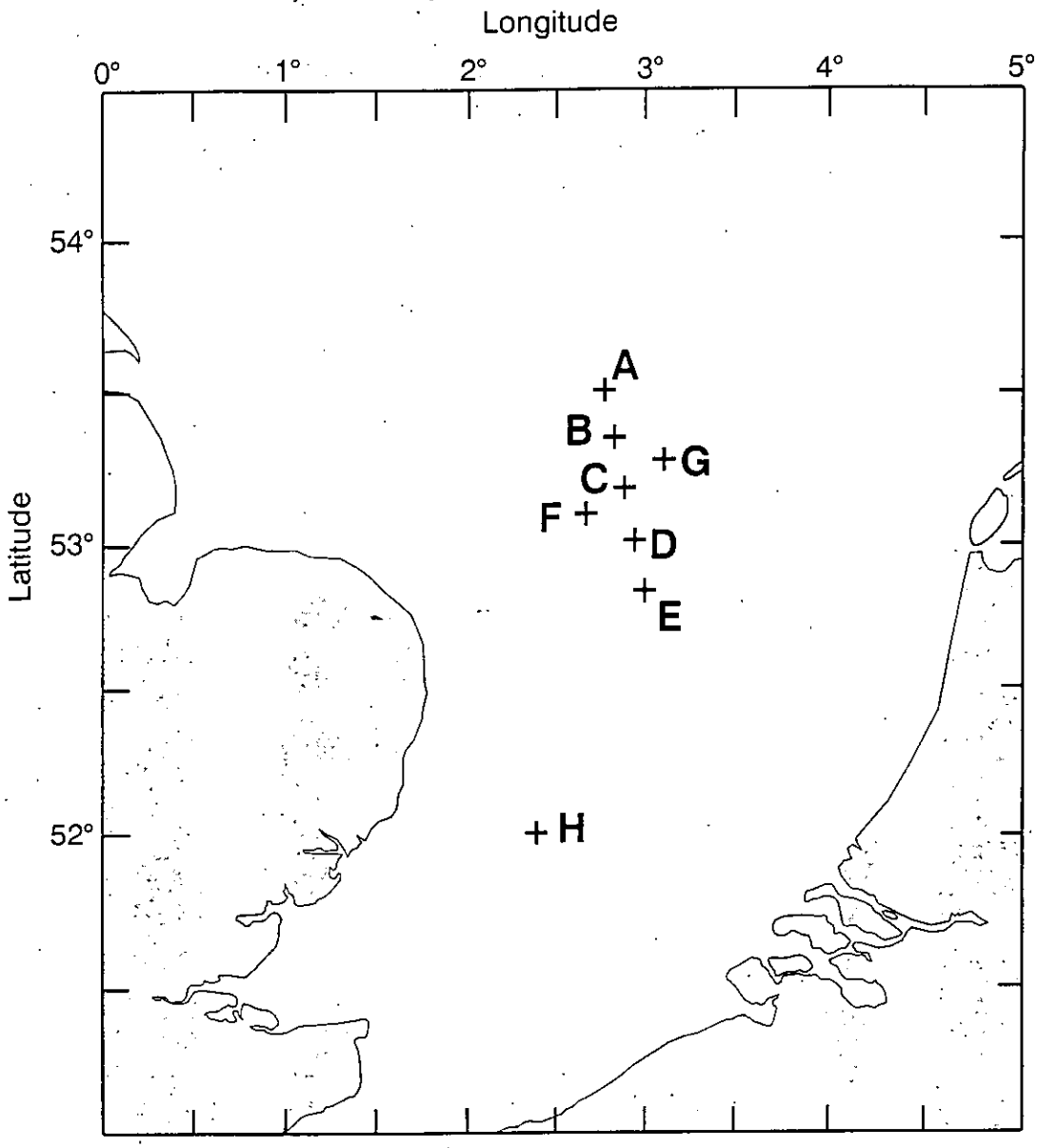


Figure 1. Locations of AE1221 mooring array plus outer gabbard (H)

Mooring positions: A - current meter
B - ADCP
C - SmartBuoy and mini-pod
D - ADCP
E - current meter
F - current meter
G - current meter
H - SmartBuoy

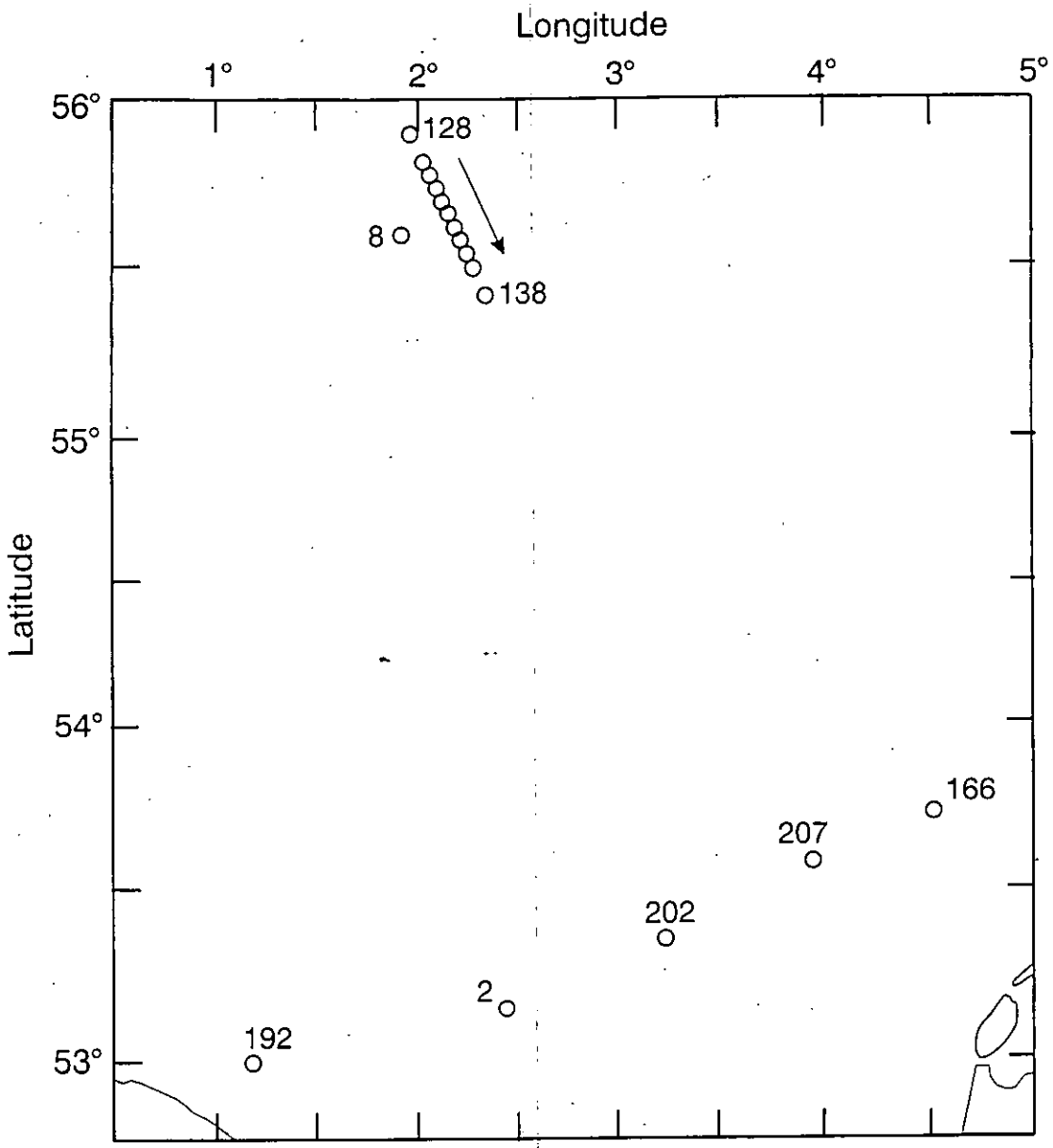


Figure 2. Locations of CTD stations and dye release frame (8).

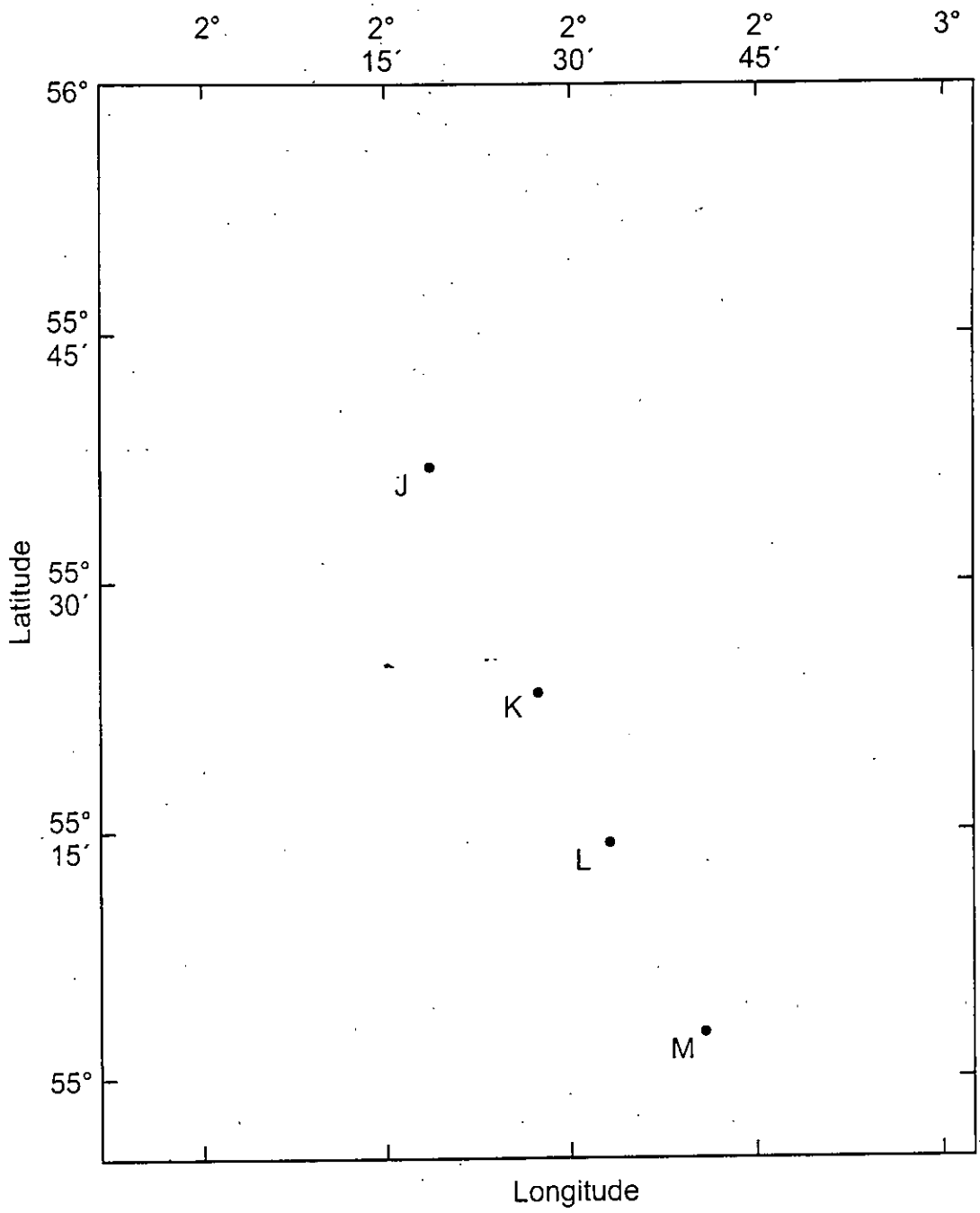


Fig. 3 Locations of ADCP moorings.

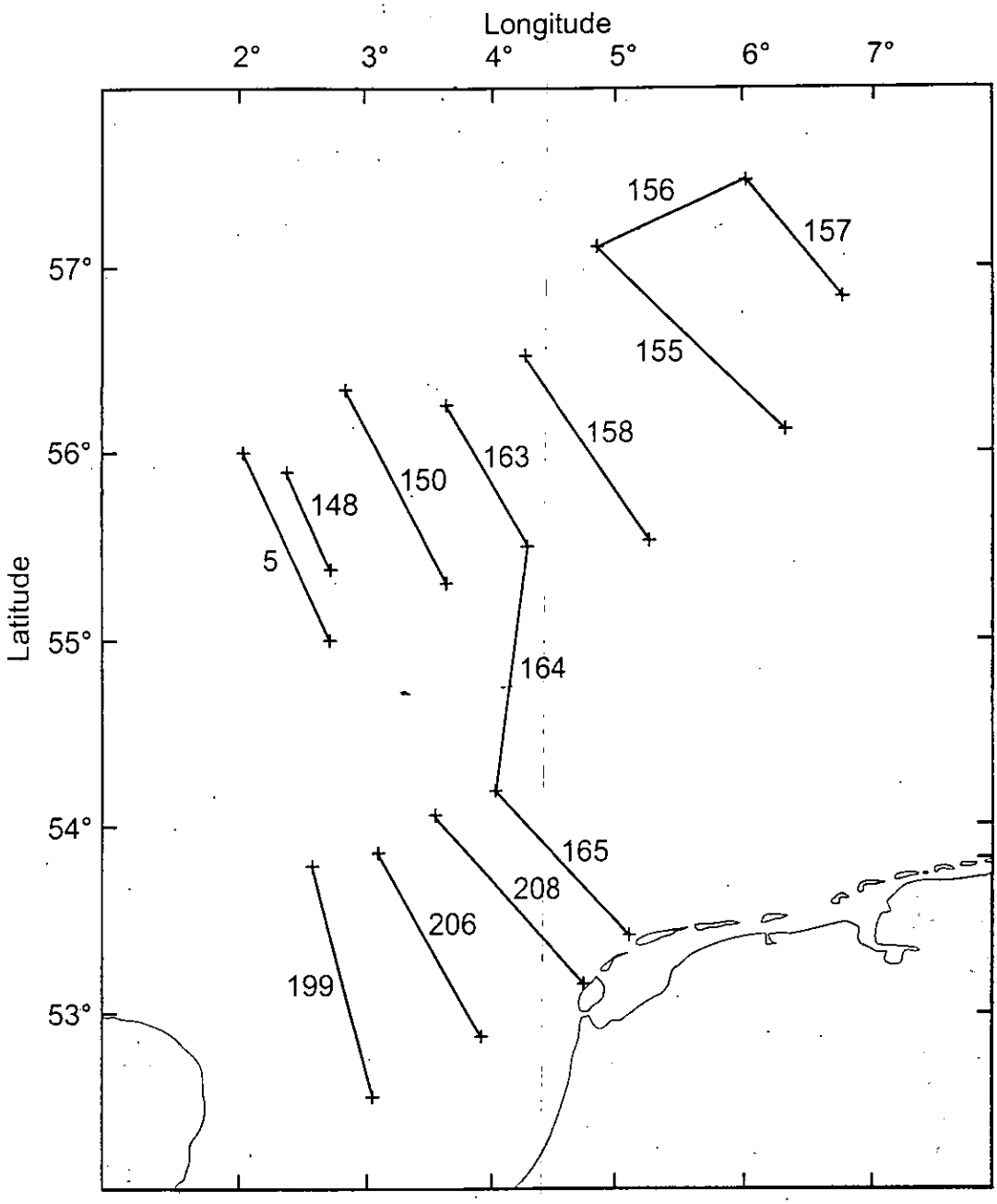


Figure 4. Locations of Scanfish transects.