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

2000 RESEARCH VESSEL PROGRAMME

REPORT: RV CORYSTES: CRUISE 5/00

STAFF:

JD Metcalfe (SIC)
K Turner
DA Righton
S Mackinson
BF Riches
WJ Meadows (part a)
T Hammond (part b)
E Bell (part b)
RP Flatt (part b)
I Gibb (FRS) (part b)

DURATION: Part a: 5-12 April
Part b:13-26 April

LOCALITY: North Sea

AIMS:

1. To evaluate performance of CEFAS 76 kHz sonar buoys and coded acoustic tags for monitoring the movements of cod at sea.

2. To tag cod with 76 kHz coded acoustic tags and monitor their movements remotely using a sonar buoy.

3. To use acoustic & fishing survey methods to estimate the abundance and distribution of sandeels on sandeel fishing grounds on the western Dogger Bank.

4. To use QTC and side scan sonar to describe the sea bed sediment type in relation to sandeel distribution and abundance.

NARRATIVE: (All times are British Summer Time)

CORYSTES sailed at 2300 h on 5 April and proceeded overnight to the north western end of the Indefatigable Bank to an area known as the "Hurdy Gurdy" (53° 36.2'N 02° 10.6'E). The following morning, underwater TV was used to identify the nature of the sea bed and to search for cod. Although none were observed using the UWTV, fishing with hand lines yielded two small (~40 cm) cod. Following acoustic transponder trials, one of these cod was tagged (E66 4437, 41 cm) and a 300 kHz acoustic transponder placed surgically into the peritoneum. The fish was left overnight to recover, and released at 1040 h the following morning at 53° 36.2'N 02° 10.6' E. This fish was tracked intermittently until about 1600 h when tracking was suspended in order to attend to an azimuth drive fault with the sector scanning sonar. The rest of the day was spent hand-lining for cod, and attempting to locate the fault with the sector scanning sonar. During the night a survey of the sea bed sediment in the area was carried out using QTC.

The following morning (8 April) a side-scan sonar survey of the area was carried out and continued until about 1230 h. During this time a temporary solution for the fault with the sector scanner's azimuth drive was implemented and at 1300 h the sector scanning sonar was deployed and a search for the tagged cod initiated. However, the cod was not relocated and the search was abandoned at about 1600 h. CORYSTES subsequently steamed north west to sandeel fishing grounds on the North West Riff on the south western side of the Dogger Bank, arriving at about 2145 h. On arrival, a survey of the sea bed along the sandeel survey grid (Fig. 1) using QTC was initiated and continued through the night.

The following day (9 April) was spent using side-scan sonar to search for hard ground and wrecks which might prove suitable habitats for cod. A potentially good wreck was located at 54° 33.811'N 01° 20.075'E and CORYSTES anchored close by. However, attempts to locate cod using the baited underwater TV frame and fishing with hand lines were both unsuccessful and at 2200 h CORYSTES resumed surveying the sea bed using QTC.

The following day (10 April), trials using the EK500 dual frequency echo sounder and the sandeel dredge were carried out successfully. CORYSTES subsequently resumed the final part of the QTC sea bed survey at about 2100 h. Echo sounder trials, and sediment sampling using the Day grab, continued throughout the following day (11 April). CORYSTES steamed overnight to Grimsby and scientific staff were exchanged the following morning (12 April). CORYSTES then steamed overnight back to the sandeel fishing grounds on the North West Riff. A systematic survey of the these grounds commenced at 0600 h the following morning (13 April).

Apart from occasional interruptions due to bad weather, the survey of the sandeel fishing grounds on the North West Riff continued until 0330 h on the 24 April. The rest of the day was spent attempting to use the sector scanning sonar to visualise sandeel shoals and fishing on hard ground for predator fish species (cod and whiting) with a Granton trawl. The following morning was again spent fishing for predator fish species until 0755 h when CORYSTES set sail for Lowestoft.

CORYSTES docked at 0240 h on 26 April.

*RESULTS:*

1 & 2. *Evaluation of 76 kHz sonar buoys and cod tagging with coded acoustic tags*. Aims 1 and 2 were not undertaken because the 76 kHz sonar buoy was not available for the cruise. However, attempts to catch cod and surgically implant acoustic transponders into the peritoneum proved successful. Six fish (38 – 43 cm) were caught using hand lines, two of which were equipped with transponders. One was subsequently released and tracked for about 5½ h before tracking was abandoned due a fault with the azimuth drive on the sector scanning sonar. The other cod was retained in a large deck tank in order to observe post-surgical recovery and behaviour. Unfortunately, the single cod track was not sufficiently long to establish whether cod caught by hand lines, tagged and released are likely to remain in the area in which they were caught.

3. *Estimation of the abundance and distribution of sandeels on sandeel fishing grounds on the western Dogger Bank.*

*i. Acoustic survey:* Acoustic survey methods were used to estimate the distribution and abundance of sandeels in mid-water in the study area (also see Appendix A). The acoustic survey was carried out from 0600 h to about 1400 h each day between 13 and 25 April using the Simrad EK 500 dual frequency (38 & 120 kHz), split beam echo sounder with echo integration. Validation of echo sounder marks was carried out where possible by fishing with an International Young Gadoid Pelagic Trawl (IYGPT). Good echo signals ("marks") were obtained (Fig. 2) and, although only a few large sandeel shoals were located, the characteristics of a variety of fish shoals (1+group sandeels, herring and sprat) were identified. A significant number of echo sounder data were successfully gathered for subsequent analysis of the abundance and distribution (Fig. 3) of sandeel shoals. 6 sandeel samples were taken for age/length determinations (200 lengths, 5 otoliths per 0.5 cm size class).

*ii. Dredge survey:* Surveying for sandeels in the sea bed was carried out using a 1.2 m sandeel dredge from 2200 h to about 0430 h each night between 13 and 25 April when weather permitted. Six 10-minute tows were carried out at regularly spaced stations along each grid-leg (Fig. 4), with one leg being surveyed each night (total of 54 stations). Although time permitted only single tows to be carried out at most stations, repeat tows were carried out at 9 stations. Sandeel catches ranged from 0 to 1029 fish per tow. Unless catches were well in excess of 200 sandeels, all fish were measured and frozen for subsequent analysis. Otherwise, approximately 200 fish were measured and frozen for subsequent analysis. Otoliths samples were taken (as above) where time permitted.

4. *Describing sediment type in relation to sandeel distribution and abundance.* The Questor Tangent Sea-view (QTC) system in unsupervised mode was used overnight and unmanned to survey the sea bed sediment in the study area between 8 and 10 April. Subsequent analysis will identify areas with similar acoustic back-scatter characteristics, and representative sites will be sampled during COR 8/00 using a Day grab to ground-truth the QTC data for sediment composition. The spatial distribution of similar sediment types will subsequently be related to the distribution and abundance of sandeels as revealed by the acoustic and dredge surveys (Figs. 3 & 4).

Side-scan sonar was used to survey the sea bed from about 1200 h to 2000 h each day between 13 and 25 April when weather permitted (actual times depended on the duration of the preceding echo sounder survey). The results of the side-scan sonar survey will subsequently be related to the distribution similar sediment types, as revealed by the QTC survey.

5. *Commissioning of Tower CEMAPS survey software.* Tower CEMAPS, the new and long-awaited Windows-based survey software replacement for

Sextant, was successfully integrated with ship's navigation and sector scanning sonar systems. The software is linked to the sector scanner to provide a graphical representation of the ship, target position, and the sonar transducer azimuth for the sector scanner operators and bridge staff.

JD Metcalfe
26 April 2000

SEEN IN DRAFT: A Reading, (Master)
B Salter, (Senior Fishing Mate)

INITIALLED:

DISTRIBUTION:

| | | |
|---|---|---|
| Basic list + | DA Righton | T Hammond |
| S Mackinson | WJ Meadows | RP Flatt |
| E Bell | BF Riches | K Turner |
| I Gibb | | |

Clerk, Eastern Sea Fisheries Committee

## FIGURE CAPTIONS:

**Figure 1.** The "Transas Marine" chart of the sandeel survey grid situated on the North West Riff.

**Figure 2.** Examples of sandeel shoals (vertical ellipses) recorded in mid-water using a Simrad EK500 dual frequency echo sounder operating at 38 (upper trace) and 120 (lower trace) kHz.

**Figures 3.** The distribution of sandeel shoals in mid-water by day in the survey area as revealed using the Simrad EK 500 dual frequency, split beam echo sounder.

In most cases, identification of sandeel shoals was subjective and based on the difference in target strength between 38 and 120 kHz, shoal shape, and shoal position in the water column. In some instances, identification was confirmed by fishing on "marks" with the IYGPT.

Sandeel shoals are indicated as follows:
● = fish shoals which were judged not to be sandeels
Open circles of increasing size indicate shoals which were judged either probably, or definitely, to be sandeels. Circles of increasing size indicate the relative size of the shoals based on the acoustic back-scatter (SA) values.

**Figure 4.** The distribution of sandeels in the sediment by night in the survey area as revealed using a 1.2 m sandeel dredge.

Sandeel catches are indicated as follows:
● = no sandeels
Open circles of increasing size indicate catches of 1-9, 10-99, 100-999 and 1000-9999 sandeels respectively.

Fig. 1

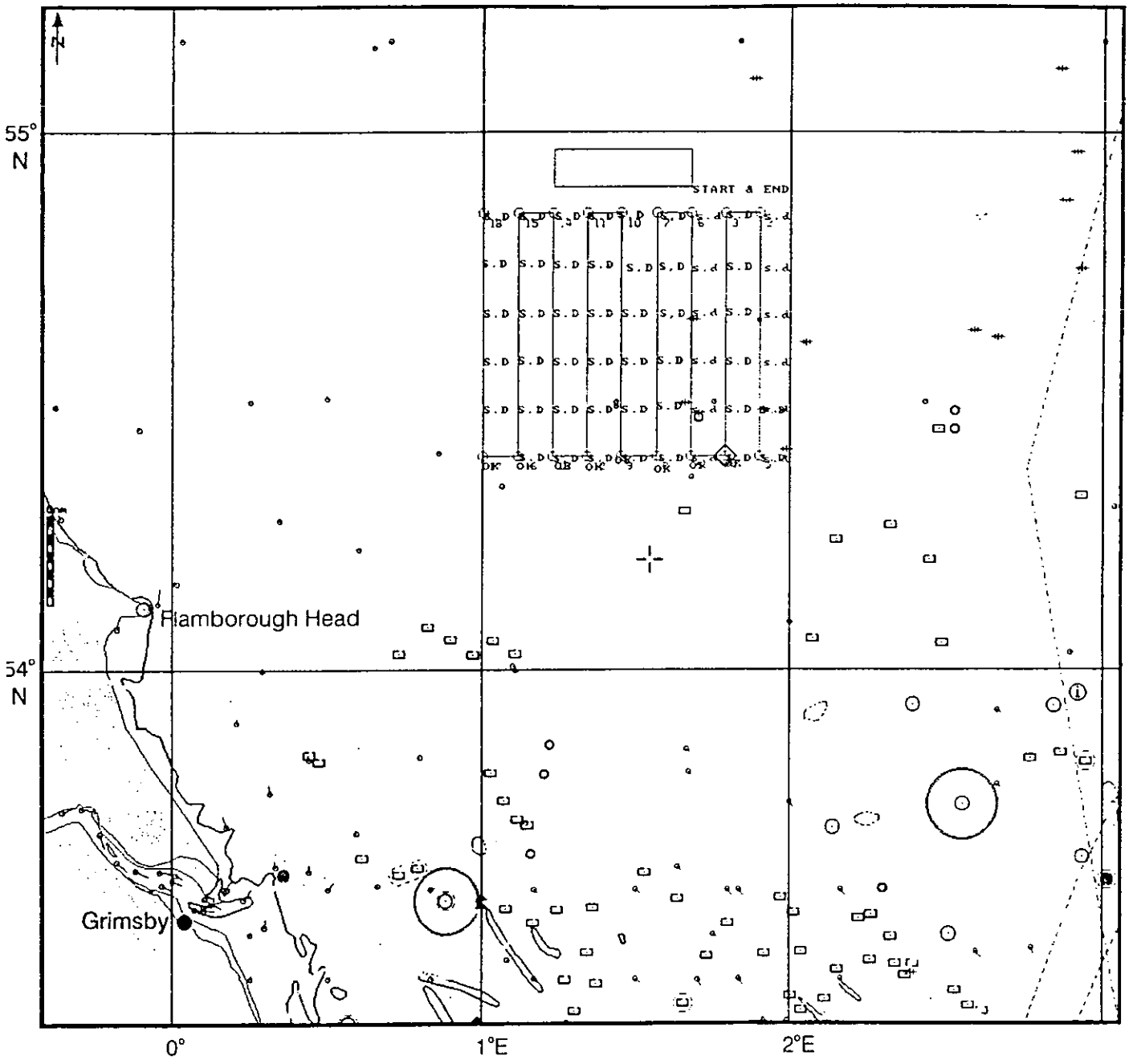


Fig. 2

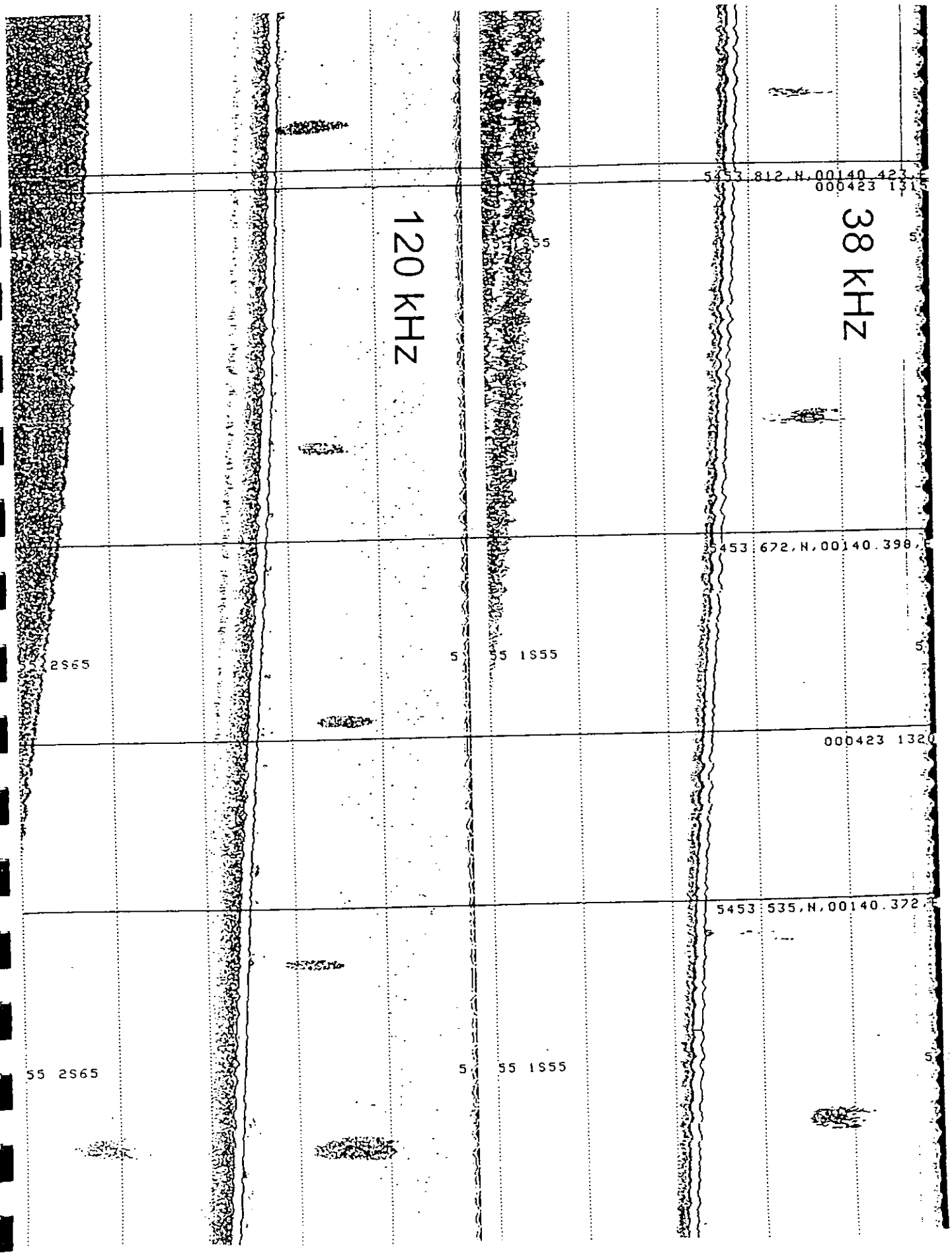

120 kHz
38 kHz
5453.812,N,00140.423
000423 131
5453.672,N,00140.398
000423 132
5453.535,N,00140.372
2S65
1S55

Fig. 3

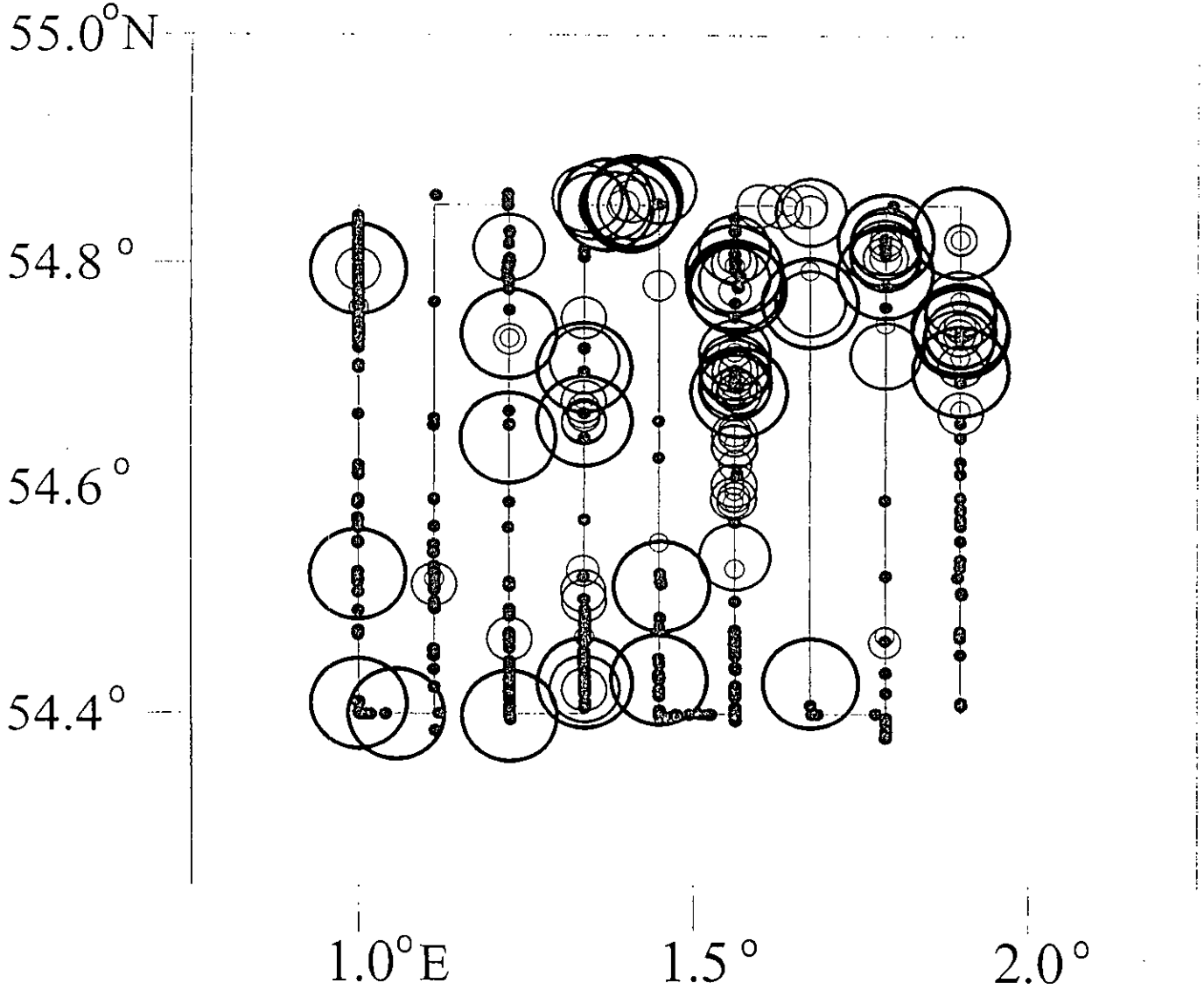
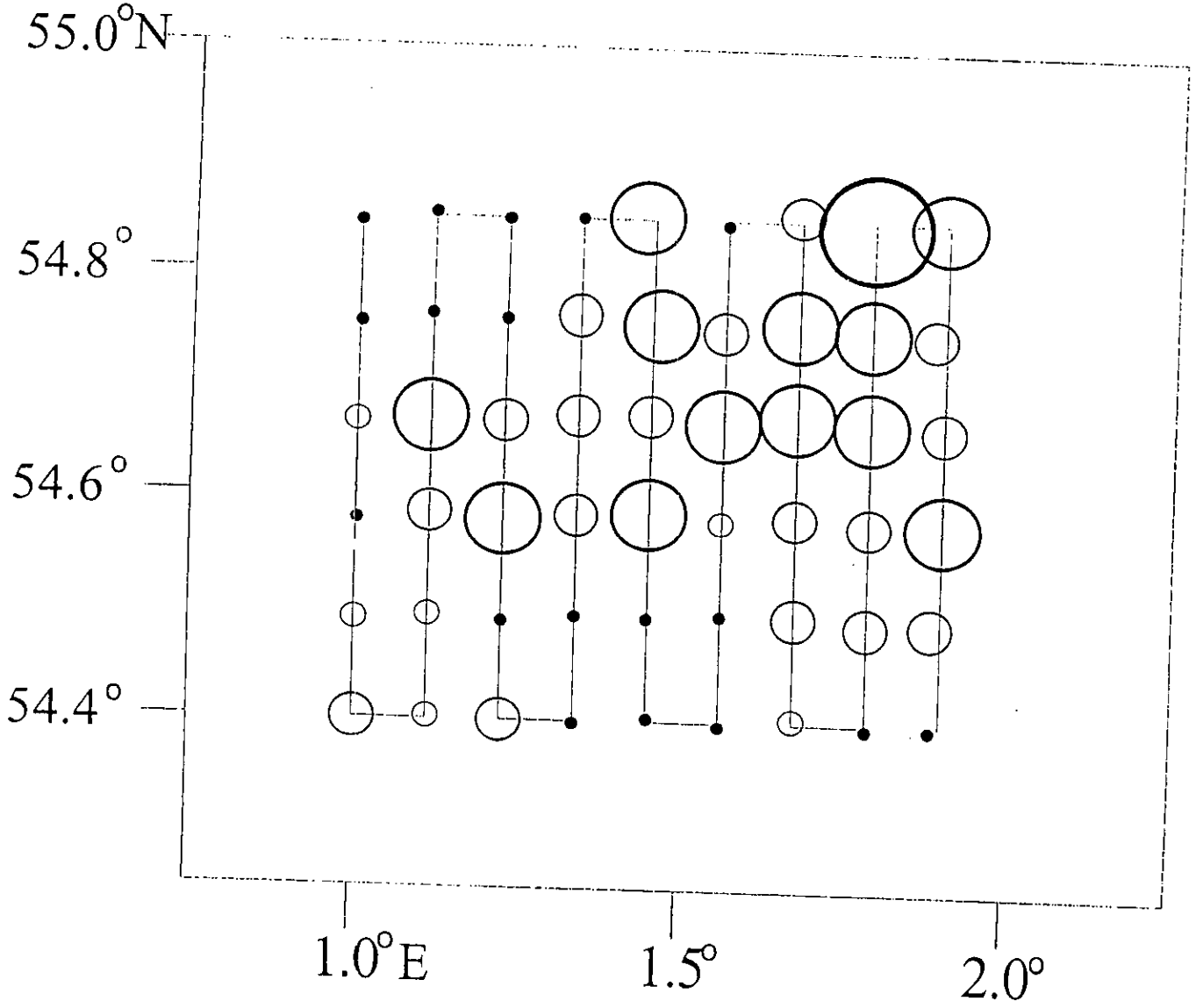


Fig. 4



## APPENDIX A

## SANDEEL SURVEY

**The survey area.**
The survey grid was located on the North West Riff, at the south western end of the Dogger Bank. The grid consisted of 9 legs, each 27 nm long, running north-south from 54° 51'N to 54° 24'N. East-west, the legs ran 6.75' apart from 01° 00'E to 01° 54'E. Each leg was labelled (A to I) from the west (Fig. 2).

**The survey strategy.**
The sea bed sediment was surveyed over the entire grid using QTC during part A of the cruise. Subsequently, during part B, each leg was surveyed sequentially using the EK500 scientific echo sounder, sidescan sonar and sandeel dredge. Weather permitting, the survey strategy allowed each leg to be surveyed in a single 24 h period.

Apart from some minor alterations due to bad weather, grid legs were surveyed alternately, starting from the west (i.e. in order: A, C, E, G, I then B, D, F, H,) with the grid area being covered twice during the survey period. Acoustic surveying for fish shoals was carried out using a split beam, dual frequency (38 & 120 kHz) scientific echosounder (Simrad EK500) between 0600 h (just after dawn in April) until about 1400 h at speeds of between 5 and 7 kts depending on weather. Fishing on marks using an IYGPT with a 6 mm mesh liner was carried out to confirm shoal identification by species, where possible.

Subsequently, a survey of the sea floor was carried out using a sidescan sonar in the opposite direction along the same grid leg between 1500 h (earlier if the acoustic survey permitted) and 2100 h using an acoustic Seabed Imaging System (SIS-1500, Datasonics) operating at 100 kHz. The sidescan sonar was towed at between 5 and 7 kts depending on weather and gave an image of the sea floor out to 200 m either side of the vessel.

Finally, the grid leg was surveyed for sandeels using a 1.2 m scallop dredge specifically modified to catch sandeels buried in the sediment. Six stations, each 5.4' apart (Fig. 2), were dredged along each leg between about 2200 h and about 0400 h the following day. The dredge was towed for 10 minutes at each station, and accurate estimates of the duration of each tow were obtained from a temperature and depth recording data storage tag, programmed to record data every 10 s, attached to the head of the dredge.

**Processing of fish catches.**
Trawl and dredge catches were processed in essentially the same manner.

**Sandeels** were counted as whole fish or heads, heads were subsequently discarded and only whole fish measured or weighed.

i. *Small catches (< 200 whole fish).* All fish were counted, measured (to the nearest 5 mm below, i.e. 12. 3 mm = 12 mm and 12.8 mm = 12.5 mm) and frozen.

ii. *Moderate catches (200 - 1000 whole fish).* The catch was counted and a sample of 200 fish measured and frozen.

iii. *Large catches (>1000 whole fish).* The catch was weighed and a sub-sample (2-3 kg) was weighed and counted. Two hundred of these fish were measured and otoliths taken from 5 fish from each 5 mm size class. A further 200 fish were frozen. The sub-sample weight was subsequently used to raise to total weight of the catch to total numbers of fish.

Samples of frozen sandeels were sent to FRS, Marine Laboratory Aberdeen for analysis.

**Other species** were either counted directly (small catches), or numbers were calculated by raising the total weight of the catch by the number in a weighed sub-sample. When time permitted, the individual fish lengths were also recorded for other species. A note was also made of the typical benthic fauna associated with the catch in the dredge.