CRUISE 5/01

STAFF:	JD Metcalfe (SIC Parts A&B)	RP Flatt (Parts A&B)
	K Turner (Parts A&B)	S Freeman (Parts A&B)
	S Mackinson (Parts A&B)	DA Righton (Parts A&B)
	W Meadows (Parts A&B)	C Stewart (Parts A&B)
	R Sorhagen (Simrad) (Part A)	J Hancock (Simrad) (Parts A&B)

DURATION: 1 June - 19 June

LOCALITY: North Sea

AIMS:

Part A

7. To trial Simrad EM 3000 multibeam echo sounder and Neptune and Triton software

Part B

8. To tag cod with coded acoustic tags and deploy VEMCO sonar buoy to monitor their subsequent residence within the vicinity of the sandeel survey area (western Dogger Bank). (This aim is dependent on identifying a suitable tagging site during COR 4/01).

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

10. To use QTC to describe sea bed sediment type in relation to sandeel distribution and abundance.

11. To carry out a survey for cod tagged with coded acoustic tags using the CEFAS towed hydrophone on the eastern end of the Dogger Bank (LIFECO).

12. To service moored CEFAS 76 kHz sonar buoy on the Indefatigable Bank.

NARRATIVE: (All times are British Summer Time)

CORYSTES sailed at 1736 h on Friday 1 June and proceeded overnight to the Sole Pit area (at about 53° 38.2'N 01° 34.5' E). Trials with the Simrad EM 3000 multibeam echo sounder were carried out the following morning. In the afternoon CORYSTES steamed 9.7 km south-east to the Coal Pit (at about 53° 35.4'N 01° 42.0' E) and commenced an acoustic survey of the sea bed within a marine aggregate extraction licence area (Area 408) using the EM 3000 multibeam echo sounder and QTC (an additional Aim carried out for the Burnham Laboratory). Surveying continued through worsening weather and was finally abandoned at 0010 h. CORYSTES subsequently steamed overnight to Bridlington and one of the Simrad engineers was put ashore the following morning (3 June). CORYSTES remained at anchor in Bridlington Bay, sheltering from a north-westerly gale, until 2200h the same day. CORYSTES then steamed overnight to the survey area on the sandeel fishing grounds on the North West Riff. At 0500 h on 4 June, the systematic survey of the sandeel fishing grounds

commenced and, apart from a minor interruption due to bad weather on 7 June, continued until 0245 h on 13 June.

During the period of bad weather on 7 June CORYSTES surveyed two wrecks close to the south-eastern corner of the sandeel survey area using the EM 3000 multibeam echo sounder. The wreck of the Anne-Marie Palm II (previously sought after during COR 4/01 but not found) was located at about 1515 h, centred at 54° 27.216'N 01° 57.259'E. CORYSTES carried out a detailed swathe bathymetry survey of the wreck. It was noted that there was at least 30 commercial sandeel fishing boats in the vicinity at the time. CORYSTES then steamed south east to the site of the unnamed wreck found during COR 4/01 and located at 54° 22.960' N 02° 07.427' E. Again, a detailed survey of the wreck was carried out using the EM 3000.

On the morning of 13 June CORYSTES returned to the wreck of the Anne-Marie Palm II and commenced fishing at 0830 h for cod with both rod and line, and long-lines. Fishing continued until 1200 h, but rod and line yielded one small cod and the long-lines yielded one dab! Subsequent attempts to observe cod in vicinity of the wreck with baited camera frame were unsuccessful and CORYSTES departed at about 1500 h to investigate possible cod fishing sites further north. The evening of 13 June was spent carrying out an acoustic survey for hard ground north of the South West Patch along a line running north-east from 54° 36.10'N 01° 54.35'E to 54° 44.22'N 02° 06.34'E. Potential sites for cod were identified, and the following day (14 June) was spent fishing for cod with both rod and line and long lines in the area. However, only a few small whiting were caught and CORYSTES departed at about 1730 h and returned to the sandeel survey grid (station B3).

The evening of 14 June, and 15 June was spent surveying station B3 in order to identify the changes in sea bed characteristics associated with sandeels occupying the sediment at night. Surveying continued until 0300 h on 16 June when CORYSTES departed for Bridlington where, the following morning, the Master was put ashore and a new Master joined the ship. CORYSTES subsequently steamed overnight to the north-western end of the Indefatigable Bank (the "Hurdy Gurdy" at 53° 36.929'N 02° 11.175'E). CORYSTES arrived on station at 0500 h (17 June) and commenced an acoustic survey of an area (5 x 4 nm, from 53° 34.00'N, 02° 07.92'E to 53° 39.00N, 02° 14.67'E, Fig. 3) with the EK500 in order to determine the distribution and abundance of any sandeels in the area. The survey continued until 1200 h CORYSTES subsequntly anchored on the Hurdy Gurdy and the rest of the day was spent fishing for cod by rod and line.

The following morning (18 June) was spent carrying out a detailed multibeam survey of the Hurdy Gurdy. During the afternoon, the sonar buoy on the hydrographic mooring was replaced (the hydrophone deployed previously on 28 April during COR 4/01, having gone missing). Subsequently, 4 cod, each tagged internally with a CEFAS coded acoustic tag, were released. At 1900 h CORYSTES sailed for Lowestoft, docking at 0745 h on 19 June.

RESULTS:

7. *Evaluation of Simrad EM 3000 multibeam echo sounder.* The Simrad EM 3000 multibeam scientific echo sounder was used to good effect on numerous occasion throughout the cruise. This trial installation presented an excellent opportunity to use multibeam sonar under typical cruise conditions, allowing the system be operated alongside other acoustic equipment (e.g. the EK 500). The system, operated by a

Simrad engineer, produced extremely high-resolution bathymetry and topographic details of both the seabed and other features (e.g. wrecks). Such data would be extremely valuable for a variety of mapping functions as well as for visualising the seabed and identifying a range of seabed characteristics. The system was capable of detecting small changes in bathymetry within the swathe and, by being able to discriminate between sand and coarser substrates, was useful for assessing fine-scale seabed patchyness. A fuller report on the data gathering aspects of the trial is being prepared separately by SIGs and Simrad is contracted to provide a fully processed set of examples in due course.

8. *Cod tagging with coded acoustic tags*. Fishing for cod on the Dogger Bank in the vicinity of the sandeel survey ground was carried out on two occasions. The first took place close to the wreck of the Anne Marie Palm II, and the second in an area of hard ground north of the South West Patch. Only one small cod was caught, and this was too small (<45 cm) for tagging with coded acoustic tags.

   Subsequently, on the 17 June, 12 cod were caught on rod and line while fishing on the Hurdy Gurdy. One of these fish had previously been caught and tagged with a Petersen disc in April during COR 4/01. Four of the larger fish were tagged internally with 76 kHz coded acoustic pingers. Each fish was also tagged externally with a Petersen disc. The fish were retained in a deck tank overnight to ensure full recovery and then released at 1830 h the following day (18 June), following the replacement of the sonar buoy on the hydrographic mooring. Release details are attached.

   In order to monitor the long-term performance of the sonar buoy, a coded acoustic pinger had previously been deployed on a near-bed mooring about 180 m from the buoy during COR 4/01. Radio transmissions from the sonar buoy were monitored for a short period after the fish were released. Although tag signals were frequently detected, decoding of the tag signal was not possible with the radio receiver (c.f. Cruise Report COR 8/00).

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

   This was a repeat of the survey carried out in April (COR/04 2001).

   i. Acoustic survey: Acoustic survey methods were used to estimate the distribution and abundance of sandeels in mid-water in the study area (see Appendix A to the report of COR 4/01 for a detailed account of the survey strategy). The acoustic survey was carried out from 0400 h to about 1500 h each day between 4 and 13 June 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 a semi-pelagic trawl. Good echo signals were obtained and numerous sandeel shoals were located (Fig. 1). In addition, the characteristics of a variety of fish shoals (1+group sandeels) were identified. A significant number of echo sounder data were successfully gathered for analysis of the abundance and distribution of sandeel shoals (Fig. 1a). Seven trawls were made through sandeel shoals, yielding catches of up to 26,000 fish. For each haul, fish in a 2-3 kg sample were counted, 200-250 of which were measured. Otoliths samples for age/length determinations (5

otoliths per 0.5 cm size class) and gut samples were taken on 4 occasions (total: 265 fish).

During the acoustic survey, plankton samples and CTD casts were made at regular intervals along the survey grid.

ii. Dredge survey: Surveying for sandeels in the sea bed was carried out using a 1.2 m sandeel dredge from 2230 h to about 0400 h each night between 4 and 13 June. Six 10-minute tows were carried out at regularly spaced stations along each transect, with one transect being surveyed each night (total of 54 stations, Fig.2). Sandeel catches ranged from 0 to 2660 fish per tow. All fish were counted and, where catches were <300 fish, measured. Where catches were well in excess of 200 sandeels, a sub-sample of about 230 fish were measured. Otoliths samples for age/length determinations (5 otoliths per 0.5 cm size class) were taken on 7 occasions (total: 357 fish). Sandeel length-frequency data is presented in Fig. 3 together with that obtained during the April survey (COR 4/01).

iii. Sandeel survey of the Hurdy Gurdy area. Acoustic survey methods were used to estimate the distribution and abundance of sandeels in mid-water in an area 7.4 x 9.3 km around the Hurdy Gurdy. The acoustic survey was carried out from 0500 h to about 1200 h on 17 June using the Simrad EK 500 echo sounder (as above). Few sandeel shoals were located, but fishing with a semi-pelagic trawl one occasion yielding a catch of about 2000 0 and 1 year old sandeels.

10. *Description of sediment type in relation to sandeel distribution and abundance using QTC*. The Quester Tangent Sea-view (QTC) system in unsupervised mode was used in conjunction with the EK 500 echo sounder (see 3 above) to survey the sea bed sediment in the study area from 0400 h to about 1500 h each day between 4 and 13 June. Subsequent analysis will identify the spatial distribution of similar sediment types and will be related to the distribution and abundance of sandeels as revealed by the acoustic and dredge surveys.

    In addition to the main survey grid, small “micro-grids” (800 x 500 m) at the top of each main grid leg, and one at station B3, were surveyed in detail in an attempt to identify whether changes in the acoustic properties of different classes of sediment could be detected between day (when sandeel are absent) and night (when sandeels are present). Each micro-grid consisted of 9 legs, 500 m long (north to south) and 50 m apart. Each was surveyed several times in succession during daylight (between about 1500 h and 1800 h) and again several times during dusk and the early night (between 2000 h and 2200 h). Ground-truthing for sediment type and the presence/absence of sandeels was carried out at selected sites in each micro-grid using an underwater camera sledge.

5. *Towed hydrophone survey for cod tagged with coded acoustic tags*. No cod were caught or tagged as part of the LIFECO project during the HEINKE cruise (17 to 29 April 2001), consequently this survey was not carried out.

6. *Servicing of moored sonar buoy on the Indefatigable Bank.* The hydrographic mooring which had been deployed on 28 April during COR 4/01 was recovered successfully on 18 June. However, the recording hydrophone was missing

and the available evidence suggested that it had been deliberately removed. A replacement hydrophone was attached, and the mooring was re-deployed at 1558h at 53° 36.920'N, 02° 11.284'E and left in position for recovery on a later cruise.

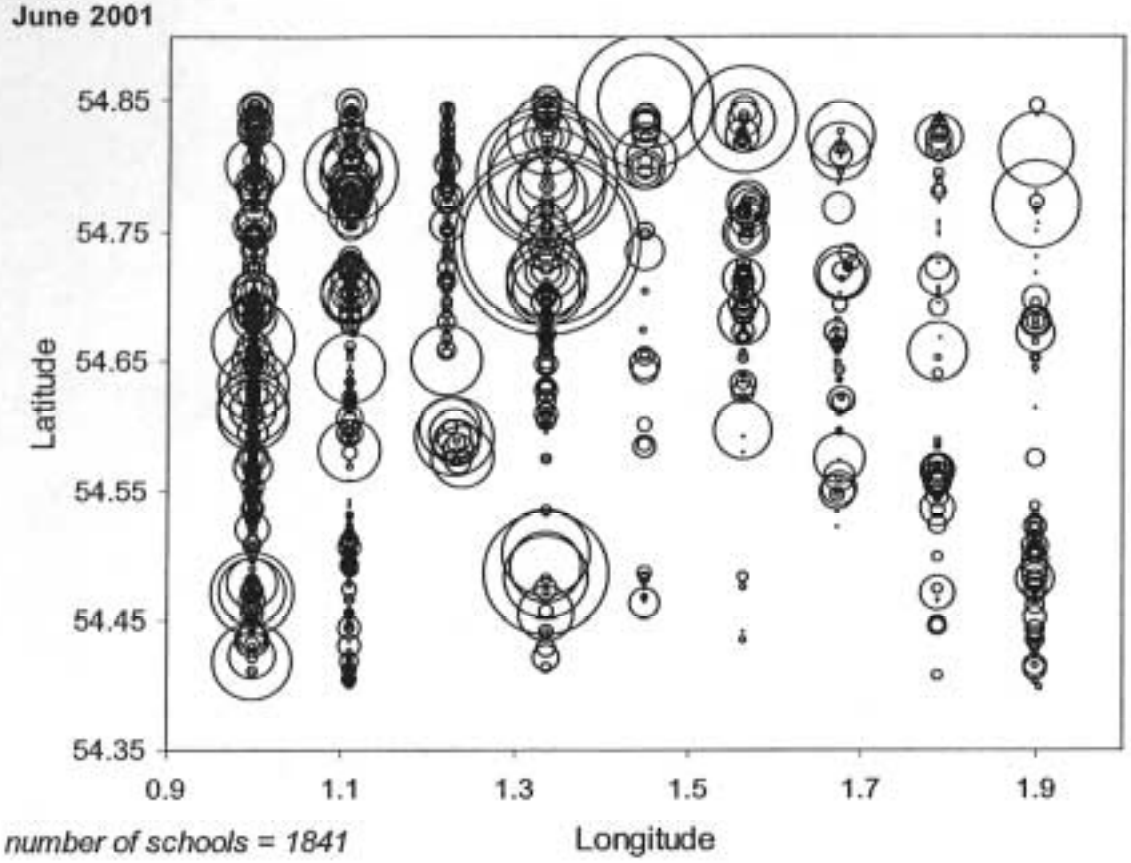
JD METCALFE

19 June 2001

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

INITIALLED:

Fig. 1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54.55
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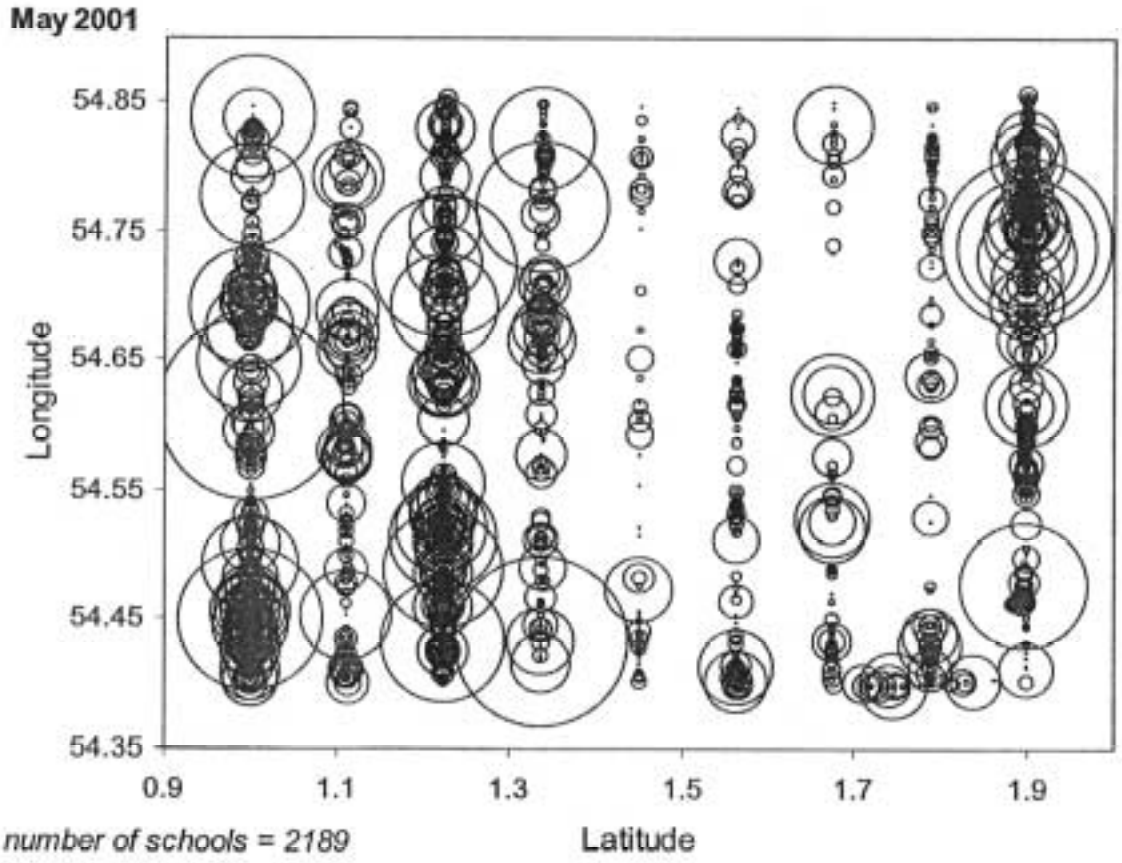
1.3
1.5
1.7
1.9
number of schools = 1841
Longitude


May 2001
54.85
54.75
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54.55
54.45
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Longitude
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1.3
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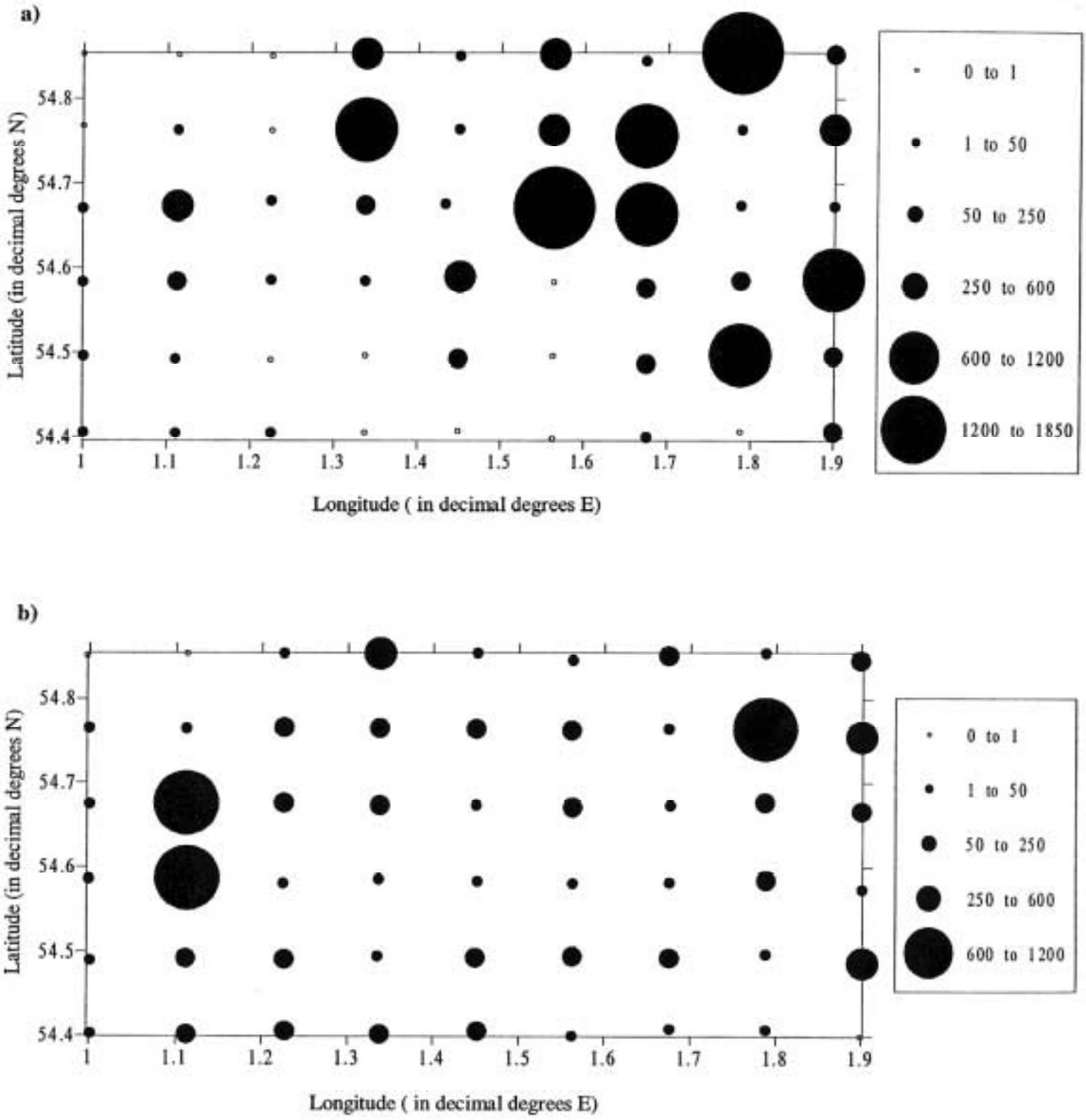
1.7
1.9
number of schools = 2189
Latitude

Fig. 2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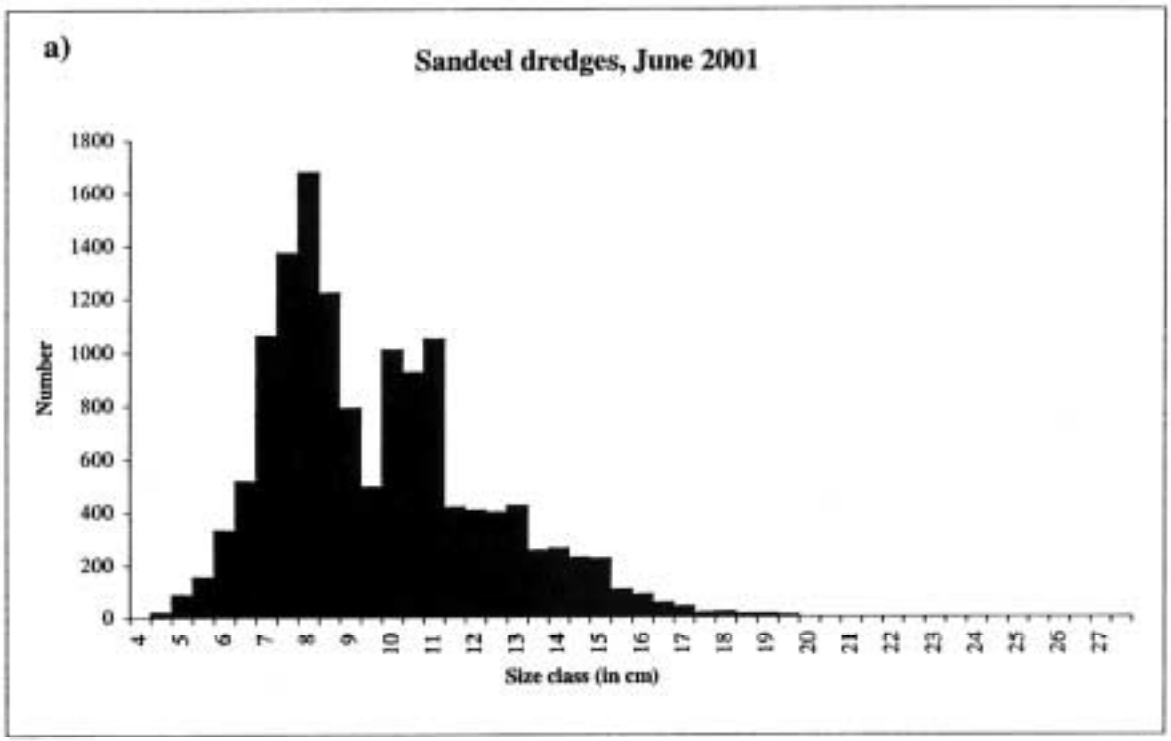
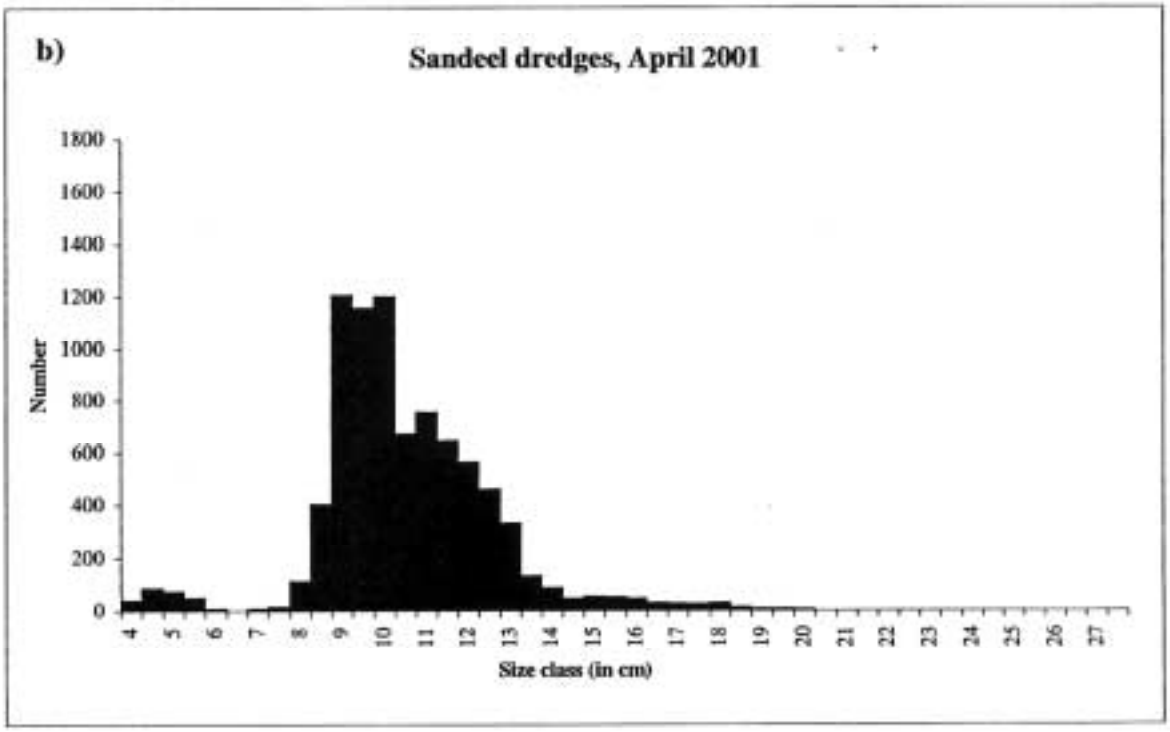
54.7
54.6
54.5
54.4
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
Longitude (in decimal degrees E)
0 to 1
1 to 50
50 to 250
250 to 600
600 to 1200
1200 to 1850
b)
Latitude (in decimal degrees N)
54.8
54.7
54.6
54.5
54.4
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
Longitude (in decimal degrees E)
0 to 1
1 to 50
50 to 250
250 to 600
600 to 1200

Fig. 3


a)
Sandeel dredges, June 2001
Number
1800
1600
1400
1200
1000
800
600
400
200
0
4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
Size class (in cm)


b)
Sandeel dredges, April 2001
Number
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1600
1400
1200
1000
800
600
400
200
0
4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
Size class (in cm)

FIGURE CAPTIONS:

Figure 1. 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 during the present cruise (upper panel) and in April/May (COR4/01) (lower panel). 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 a semi-pelagic trawl. Symbol size is proportional to the relative size of the shoals based on the acoustic back-scatter (Sa) values (NASC m^2/nm^2).

Figure 2. The distribution of sandeels in the sediment by night in the survey area as revealed using a 1.2 m sandeel dredge during the present cruise (Fig. 2a) and in April/May (COR4/01) (Fig. 2b).

Symbol size is proportional to the relative density.

Figure 3. Length-frequency distribution of sandeels caught in dredge hauls during the present cruise (Fig. 3a) and in April/May (COR4/01) (Fig. 3b).

Release of tagged fish (times are BST)

Tagged fish were released at sea on one occasion during the cruise.

Four cod and one turbot were released on 18 June. The cod were each tagged internally with coded acoustic pingers and externally with a Petersen disc. The turbot was tagged externally with a Mk3 electronic data storage tag (DST) and a Petersen disc. Release details are as follows:

Release date and time: 18 June 2001, 1825 h
Release location: 53° 36.752'N 02° 11.285'E

Pinger code	**Petersen tag N°**	**Fish length (cm)**
1 B	E69 8331	47
77 A	E69 8333	44
67 E	E69 8334	56
78 B	E69 8310	50*

Turbot:

DST	**Petersen tag N°**	**Fish length (cm)**
1432	E66 4440	39**

*NB: this fish had been previously caught, tagged with a Petersen disc and released on the Hurdy Gurdy during COR 4/01.

** This fish was caught on 11 June in a sandeel dredge at 54° 24.50'N, 01° 20.20'E

JD Metcalfe (SIC)
20 June 2000