DEPARTMENT FOR ENVIRONMENT, FOOD AND RURAL AFFAIRS
CEFAS, LOWESTOFT LABORATORY, SUFFOLK, ENGLAND

2003 RESEARCH VESSEL PROGRAMME

PROGRAMME: RV CEFAS CORYSTES: CRUISE 4Y/03

STAFF:	JD Metcalfe (SIC)	C Stewart
	K Turner	K Sullivan
	RJ Turner	D Righton
	J van der Kooij	S Mackinson

DURATION: 11 April - 25 April

LOCALITY: North Sea

AIMS:

1. To deploy the CEFAS acoustic telemetry buoy (ATB) on the cod feeding area at the western end of the Indefatigable Bank to monitor the presence/return of cod tagged with coded acoustic pingers in 2002.

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

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

4. To use fishing survey methods (Bongo net) to estimate the abundance and distribution of plankton on the sandeel fishing grounds on the western Dogger Bank.

5. To use QTC and Hammond grab (HamCam) to describing sediment type in relation to sandeel distribution and abundance on the sandeel fishing grounds on the western Dogger Bank.

6. To carry out a shipboard experiment to determine gut evacuation rates of sandeels.

NARRATIVE: (All times are British Summer Time)

CORYSTES sailed at 1730 h on Friday 11th April and proceeded north to Yarmouth Road to deploy hydrograhic equipment (a mini-lander, deployed at 1855 h at 52° 39.995'N 01° 45.223'E). Subsequently, CORYSTES steamed overnight to the sandeel fishing grounds on the south-western end of the Dogger Bank (North West Riff). A systematic survey for sandeels (Aim 2), sandeel predators (Aim 3), plankton (Aim 4) and of the sea bed sediment (Aim 5) commenced at 0600 h the following day (12 April) and continued uninterrupted until 1700 h on 21st April.

The following two days (22 and 23 April) were spent fishing for sandeels with a semi-pelagic trawl. Fishing was carried out along banks on the North West Riff and subsequently further south in the area of The Hills and South Western Spit.

CORYSTES subsequently steamed overnight to the north-western end of the Indefatigable Bank to an area known as the "Hurdy Gurdy" (53° 36.929'N, 02°

11.175'E), arriving on station the following morning (24 April). The acoustic telemetry buoy was deployed at 0915 h at 53° 37.00'N 02° 11.20'E together with a control pinger (code 2) deployed on static gear (chain anchor, ~ 2.5 m for rope and a trawl float) close to the buoy. The rest of the day was spent fishing for cod by hand-line. Twelve small (25-45 cm) cod were caught, 4 of which were large enough to be tagged with data storage tags. These fish were released at 1745 h at 53° 36.88'N 02° 11.09'E. CORYSTES then set sail for Lowestoft, docking at 0615 h on the following morning (25 April).

RESULTS:

1. *Deploying the CEFAS acoustic telemetry buoy.* The CEFAS acoustic telemetry buoy was successfully deployed on the north western end of the Indefatigable Bank (the "Hurdy Gurdy at 0915 h on 24 April at 53° 37.00'N 02° 11.20'E. A control pinger (code 2) was also deployed on static gear close to the buoy. Information from the Laboratory in the days after deployment indicated that the sonar buoy was successfully detecting tag signals and transmitting the data back to the Laboratory.

2. *Estimation of the abundance and distribution of sandeels, and sandeel predators, on sandeel fishing grounds on the western Dogger Bank.* This was a repeat of the surveys carried out in between April and June in 2000, 2001 and 2002. The survey grid is located on the North West Riff, at the south western end of the Dogger Bank. The grid consists of 9 legs, each 27 nm (49.22 km) long, running north-south from 54° 51'N to 54° 24'N. East-west, the legs ran 6.75' (7.24 km) apart from 01° 00'E to 01° 54'E. Six plankton/dredge stations are located 5.4' (10 km) apart along each leg (see Appendix I).The survey strategy allows acoustic, trawl and dredge surveys to be performed successively along each leg in a single 24 h period, with the complete grid being surveyed over nine days, weather permitting.

i. ***Acoustic survey*** methods were used to estimate the distribution and abundance of sandeels in mid-water in the study area (see Appendix I for a detailed account of the survey strategy).The survey was carried out from 0600 h to about 1200 h each day between 12 and 21 April using the Simrad EK 500 dual frequency (38 & 120 kHz), split beam echo sounder with echo integration. Comparatively few (71) sandeel schools were identified (Fig 1) and, based on volume back scattering, the sandeel biomass in the survey area was estimated to be 2,587 t.

   By combining the EK500 echo sounder output with the Quester Tangent Corporation (QTC View) seabed classification system, acoustic surveys of the sea bed sediment were carried out simultaneously. During the acoustic survey, plankton samples and CTD casts were made at 6 stations located at regular intervals along each leg. Plankton hauls were taken with a 0.5 m ring net (60 mpi).

ii. To estimate the distribution and abundance of sandeel predators, a ***trawl survey*** was carried out along each leg between about 1200 h and 1900 h using a standard Granton trawl with a 12 mm mesh liner. Twenty minute trawls were carried out at 53 of the 54 plankton/dredge stations (station 4 on leg E could not be trawled because of the presence of seabed obstructions). Catches were sorted by species and either counted directly (catches<200 fish), or numbers were calculated by raising the total weight of the catch by the number in a weighed sub-sample. Stomach contents were examined in 20 (fewer in smaller catches) individuals of each major sandeel predator species (Table 1, Fig 3). The species to be gut-sampled (cod, whiting,

haddock, gurnard, plaice etc.) had previously been identified from preliminary sampling undertaken during COR02/02. The 54 trawls yielded a total of 12,011 fish from 20 species of which 74% (by number) were dabs and 13.2% were whiting, only 6 (0.05% of the total catch by number) cod were caught. The spatial distribution and abundance of these sandeel predators in relation to the distribution and abundance of sandeels as revealed by dredge survey is presented in Fig. 2. A more detailed analysis of these data will be carried out subsequently.

iii. A ***dredge survey*** for sandeels buried in the seabed was carried out using a 1.2 m sandeel dredge from 2130 h to about 0300 h each night between the 12 and 21 April. The dredge was towed for 10 minutes each plankton/dredge station, with one transect (i.e. 6 stations) being surveyed each night. Sandeel catches ranged from 0 to 108 fish per tow, and 918 sandeels were taken in total over the 54 stations surveyed (Fig 2). All fish were counted and measured and the length-frequency data is presented in Fig. 4. Otoliths samples for age/length determinations (5 otoliths per 0.5 cm size class) were taken on only one occasion (total: 48 fish).

3. *Description of sediment type in relation to sandeel distribution and abundance using QTC View*. The Quester Tangent Corporation (QTC View) system in unsupervised mode was used in conjunction with the EK500 echo sounder (see 1 above) from 0600 h to about 1300 h each day between 12 and 21 April. This arrangement allowed the seabed sediment in the study area to be surveyed while simultaneously measuring the distribution and abundance of sandeels in the water column. In addition, samples of the sea bed sediment were taken with a Hammond grab at each dredge/plankton station in order to ground-truth the acoustic data. These data will subsequently be used in a detailed analysis of the relationship between the spatial distribution sandeels and sediment characteristics.

4. *Fishing for sandeels* using a semi-pelagic trawl was attempted during the day on two occasions, firstly on 22 April and again the following day. Fishing was carried out along banks in, or close to, the survey area that are established commercial sandeel fishing locations. However, an insufficient number of sandeels were caught on either occasion and shipboard experiments to determine gut evacuation rates of sandeels (Aim 6) could therefore not be carried out.

JD Metcalfe
25 April 2003

SEEN IN DRAFT: M Elliott, (Master)
M Reynolds, (Senior Fishing Mate)

INITIALLED: ECEP

DISTRIBUTION:

Basic list +	DA Righton	J van der Kooij	
	K Sullivan	S Mackinson	K Turner
	RJ Turner	C Stewart	Clerk, Eastern Sea Fisheries Committee

FIGURES

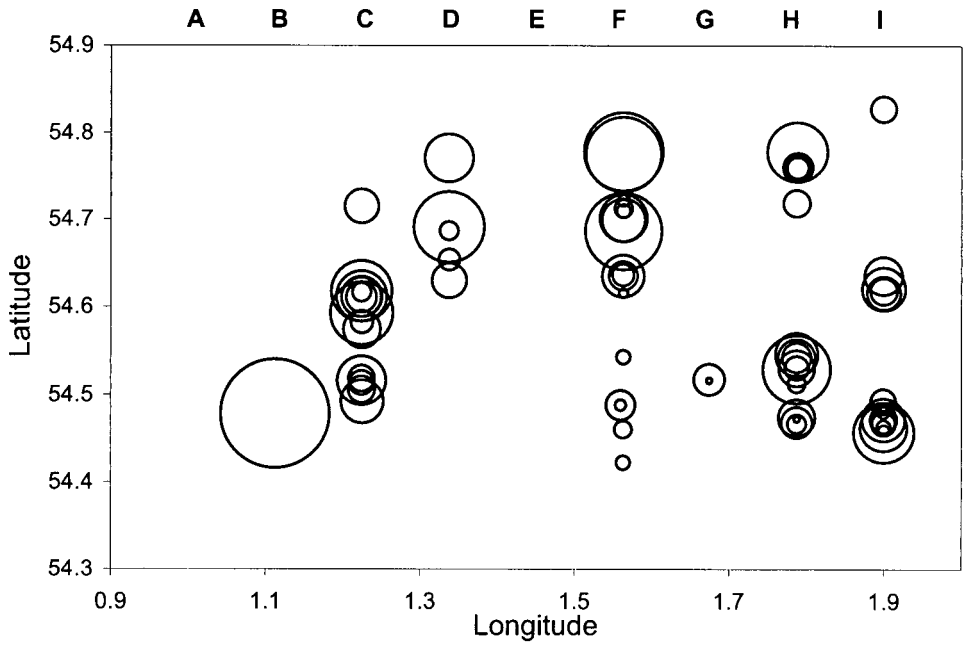

Figure 1. The distribution and relative size of sandeel shoals in mid-water by day in the survey area as revealed using the Simrad EK 500 dual frequency, split beam echo sounder. Identification of sandeel shoals was subjective and based on the difference in target strength between 38 and 120 kHz, shoal shape, and shoal position in the water column. Symbol size is proportional to the relative size of the shoals based on the acoustic back-scatter (Sa) values (NASC m^2/nm^2). Number of schools = 71.

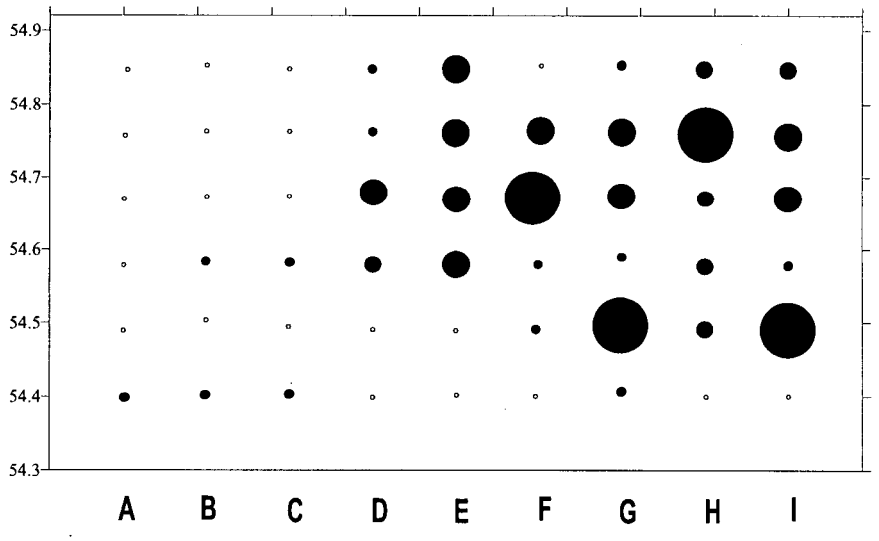

Figure 2. The distribution and abundance of sandeels in the sediment by night in the survey area (as revealed using a 1.2 m sandeel dredge). Symbol size is proportional to the relative density (open circles indicate no sandeels).

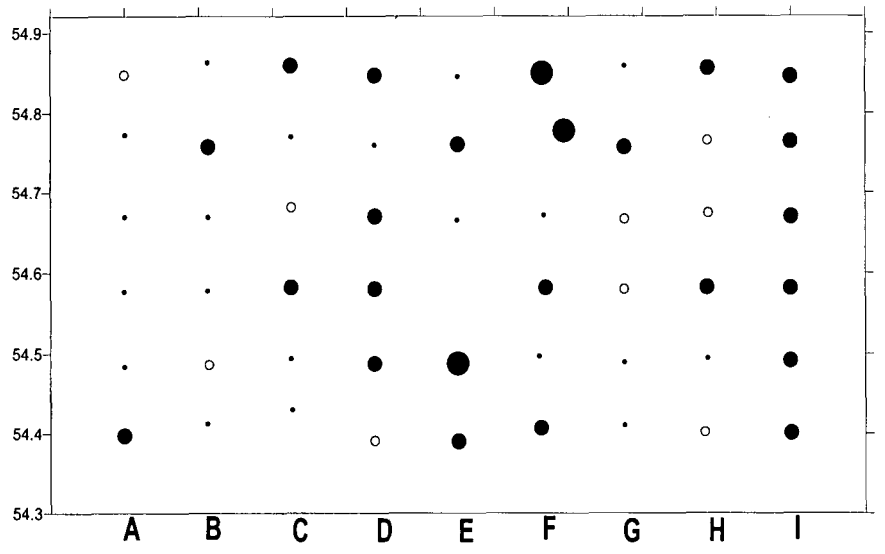

Figure 3. The pooled distribution and abundance of the five main sandeel predators (whiting, haddock, gurnard, plaice and cod) that had sandeels in their stomachs. Symbol size is proportional to the relative density, smallest dots indicate zero predators.

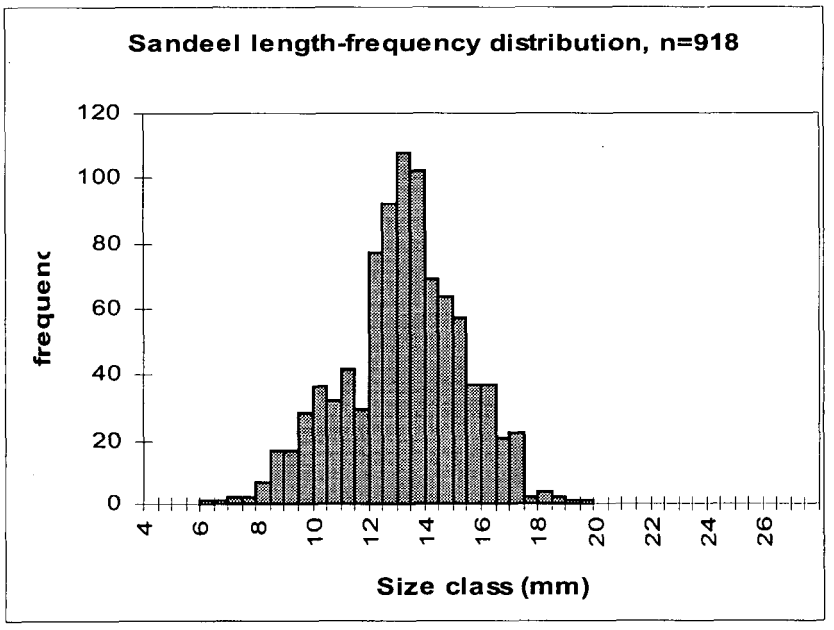

Figure 4. Length-frequency distribution of sandeels caught in dredge hauls.

Table 1. Results of Granton trawl survey for sandeel predators on the North West Riff. Numbers of fish caught and stomachs sampled over during fifty-two 20-minute minute trawls. The species to be gut-sampled had previously been identified from preliminary sampling undertaken during COR02/02.

Species	Number	% of total catch	stomachs sampled	% eating sandeels
Dab (*Limanda limanda*)	8890	74.0%		
Whiting (*Merlangius merlangus*)	1585	13.2%	435	12.6%
Grey Gurnard (*Eutriglia gurnardus*)	511	4.3%	286	24.5%
Lesser Weaver *(Echiichthys vipera)*	279	2.3%		
Haddock (*Melanogrammus aeglefinus*)	186	1.5%	130	3.1%
Solenette (Buglossidium luteum)	133	1.1%		
Herring (*Clupea harengus*)	110	0.9%		
Sprat (*Sprattus sprattus*)	97	0.8%		
Plaice (*Pleuronectese platessa*)	86	0.7%	6	<0.1%
Long Rough Dab (*Hippoglossoides platessoides*)	38	0.3%		
Sandeel (*Ammodytes marinus*)	25	0.2%		
Lemon sole (*Microstomus kitt*)	18	0.1%	1	<0.1%
Dragonet (*Callionymus lyra*)	9	0.1%		
Scaldfish (*Arnogossus laterna*)	9	0.1%		
Smooth Sandeel (*Gymnamnodytes semisquamatus*)	8	0.1%		
Greater Sandeel (*Hyperoplus lanceolatus*)	8	0.1%	5	40.0%
Rays (*Raja sp.*)	7	0.1%		
Cod (*Gadus morhua*)	6	<0.1%	2	0.0%
Poor cod (*Trisopterus minutus*)	4	<0.1%		
Starry smooth hound	2	<0.1%		
Spurdog (Squalus acanthias)	1	<0.1%		
Total	**12011**		**865**	