

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

**1999 RESEARCH VESSEL PROGRAMME**

**REPORT: RV CORYSTES: CRUISE 4/99**

**STAFF:**

Part A (5-19 May): JD Metcalfe (SIC)

C Stewart	T Hammond
WJ Meadows	Simrad Engineer (5-7 May)
AA Buckley	RP Flatt
BF Riches	P Wright (FRS) (13-19 May)

Part B (20-21 May): JW Read (SIC)

E Tinton	D Sivyver
A Reeve	J Taylor

**DURATION: 5-21 May**

**LOCALITY: North Sea**

**AIMS:**

1. To commission and calibrate new Simrad Dual frequency multibeam acoustic survey echo sounders.
2. To identify a sandeel ground/cod feeding area to serve as a suitable study site for M0317 (Predator-prey interactions).
3. To evaluate QTC and sidescan sonar methodologies for describing sediment type in relation to sandeel distribution and abundance.
4. To test the sector scanning sonar following refurbishment of the electrical wiring to the stabilisation package.
5. To test transmission from 300 kHz transponding acoustic tags implanted in cod.
6. To evaluate methods for tagging cod with baited acoustic tags using underwater TV.
7. To evaluate the performance of CEFAS/LOTEK 300 & 76 kHz sonar buoys and acoustic tags at sea.
8. To evaluate of methods (traps and long-lines) for catching cod in suitable condition for electronic tagging.

9. To evaluate acoustic & fishing survey methods for estimating abundance and distribution of sandeels.

10. To service hydrographic moorings in the Thames Estuary

NARRATIVE: (All times are British Summer Time)

CORYSTES sailed at 1200 h on 5 May and proceeded to The Well area in the Wash (approx.  $53^{\circ} 02.05' N$ ,  $00^{\circ} 25.81' E$ ) where the ship anchored. Initial attempts that evening to manoeuvre a calibration target into position under the 38 kHz sonar transducer were unsuccessful and CORYSTES remained at anchor overnight. Echo sounder trials continued through the following day and a partial calibration of the 38 kHz sonar was carried out successfully. The following day (7 May) CORYSTES proceeded first to Grimsby, where the Simrad engineer was put ashore, and then on to a position west of the Dogger Bank (approx.  $53^{\circ} 52.06' N$ ,  $00^{\circ} 06.21' E$ ) to carry out trials with CEFAS/LOTEK 76 kHz sonar buoys and acoustic tags. CORYSTES then steamed overnight to an area, centred on  $54^{\circ} 18' N$ ,  $00^{\circ} 48' N$ , on the sandeel fishing grounds south west of The Hills to fish for cod and sandeels.

Fishing with a Portuguese high headline trawl commenced at 0745 h the following day (8 May) and continued until 1935h the same day.

The following day (9 May) trials using an underwater TV frame were carried out to evaluate methods for tagging cod using baited acoustic tags. Three deployments of a baited camera frame were carried out but no cod were observed and trials ceased at 2130 h.

In order to find cod, CORYSTES subsequently steamed overnight to a small area of hard ground on the north western end of the Indefatigable Bank known as the "Hurdy Gurdy" ( $53^{\circ} 36.2' N$   $02^{\circ} 10.6' E$ ). The following morning trials to evaluate methods for tagging cod with acoustic tags by baiting were carried out successfully. Tagging and tracking continued until 0815 h the following day (11 May) when the tracking had to be abandoned due to problems with the azimuth control on the sector scanning sonar. Repairs to the sector scanner were carried out in the afternoon, during which time trials with a Norwegian design of cod trap were carried out.

On completing repairs to the sector scanner, a search for the tagged cod was resumed at 1540 h. The tag signal was found within 10-15 minutes in the last previously recorded location. The lack of movement was interpreted as indicating that the tag may have been regurgitated and the signal was abandoned.

Tagging trials continued in the area until 1700 h on 12 May. Subsequently, side-scanning sonar trials were carried out over the cod tracking area, and 16 cod (which had been caught on line over the previous two days and tagged with Mk 3 DSTs) were released.

CORYSTES steamed overnight to Grimsby where scientific staff were picked up the following morning (13 May). During the afternoon and evening sonar buoy trials were

carried out off Grimsby. Subsequently CORYSTES steamed overnight to the Indefatigable Bank. The following day (14 May) was spent carrying out acoustic and fishing surveys for sand eels, and sampling sediments for classification. No sandeels were found and CORYSTES steamed north overnight to the sandeel fishing grounds south west of The Hills. The following two days (15 & 16 May) were spent carrying out fish and sediment surveys in the area.

Overnight on 16/17 May CORYSTES steamed east to sandeel fishing grounds in the Outer Silver Pit area (approx.  $53^{\circ} 07'N$   $01^{\circ} 32'E$ ) and fish and sediment surveys continued. Overnight on the 17 May CORYSTES steamed back to the sandeel fishing grounds south west of The Hills to continue acoustic surveying for sandeels. No fishing was possible on 18 May due to strong winds.

In the afternoon of 18 May CORYSTES steamed south east to return to the Hurdy Gurdy to search for the cod tagged earlier in the cruise with acoustic transponders. Two tag signals were located in positions close to where tag signal had previously been abandoned. Despite carrying out a test with a rubbery-dubby bag placed about 100 m up-tide of one of the tag signals, no evidence of movement was obtained and tracking ceased at 0045 h (19 May) and CORYSTES returned to Lowestoft, docking at 1215 h.

Having exchanged scientific staff, CORYSTES sailed again at 1300 h (20 May) and proceeded to the Outer Gabbard mooring site, arriving at 1615 h. At 1630 h a single surface "Niskin Bottle" sample was taken for calibration purposes and between 1635 h and 1645 h the instrumented buoy was recovered. A replacement buoy was assembled using some recovered parts and was laid between 2235 and 2240 h at  $51^{\circ} 59.98N$ ,  $02^{\circ} 19.97E$ .

Niskin samples were then taken at hourly intervals between, 2300 - 0100h and 0600 - 1000 h, after which CORYSTES set sail for Lowestoft, arriving at 1330 h (21 May)

## RESULTS:

1. *Commissioning and calibration of new Simrad acoustic survey echo sounders.* The EK500 was successfully commissioned and integrated with the other ship's navigation systems and data-logging PCs. The temporary arrangement of mounting the 120 kHz transducer needs to be made more permanent. The 38kHz transducer was partially calibrated for target strength, but full calibration was not possible in open waters. A further period of several days in calm, still waters will be needed to complete the calibration.
2. *Identification of a sandeel ground/cod feeding area to serve as a suitable study site for M0317 (Predator-prey interactions).* No single location was found where both sandeels and cod occurred together in appreciable numbers. However sandeel grounds (south west of the Hills, centred on  $54^{\circ} 18'N$   $00^{\circ} 48'N$ , and on the southern edge of the Outer Silver Pit) and a cod feeding area (the "Hurdy Gurdy" located at  $53^{\circ} 36.2'N$ ,  $02^{\circ} 10.6'E$  on the north western end of the Indefatigable Bank)

were successfully identified. Both these areas have the potential to be very good study sites for M0317.

3. *Evaluation of QTC and sidescan sonar methodologies for describing sediment type.* Sidescan proved to be a quick and effective method of establishing seabed habitat type and patchiness over large areas (as seen in the image below). New mosaic software was used to establish sand-wave size (shown in metres) and disposition, from which sand mobility can be inferred.

The Questor Tangent Sea-view (QTC) system was used to survey a variety of areas on sandeel grounds (both large scale surveys which could be carried out unmanned overnight, and smaller surveys over areas of particular interest). The system was ground-truthed by sampling sediments with a Day grab. The QTC successfully delineated areas where commercial fishing for sandeels is known to occur (Fig. 2). QTC therefore appears to have great potential as an effective method for surveying sediment type in relation to sandeel distribution. Further work will be required to assess the data collected in "unsupervised" mode where acoustic classification is performed without first tuning the system with ground truthed calibration data.

4. *Testing of sector scanning sonar following refurbishment of package electrical wiring.* The sector scanning sonar functioned very well during the cruise. One fault occurred in the electrical wiring which caused a problem with the azimuth control. This was traced to water in one of the junction boxes, which had entered during dock trials prior to the cruise. Although the junction box had been drained, water had remained in the cable and further draining was required at sea. During this operation an azimuth interlock connection was dislodged and a temporary repair was effected. The water damaged cabling is to be renewed after the cruise.

5. *Test transmission from 300 kHz transponding acoustic tags implanted in cod.* Transmission tests were carried out on two occasions. During both, the signals from acoustic transponders placed in the stomachs of dead cod were clearly visible out to ranges of 280-300 m and appeared not to be significantly attenuated. One cod which successfully ingested and retained an acoustic transponders was easily tracked out to ranges in excess of 250 m for a period of 24 h.

6. *Evaluation of methods for tagging cod with baited acoustic tags using underwater TV.* A baited TV camera frame was (Fig 1.) deployed on 7 occasions to evaluate methods for tagging cod with acoustic transponders by baiting. In all trials the ship remained at anchor until a tagged bait had been taken. In total, three cod took tagged bait and the tag signals were subsequently tracked for 3, 44 & 24 h (N.B. signals 2 and 3 were tracked intermittently).

The first three trials were carried out on the sandeel fishing grounds south west of The Hills using squid as bait. One of these was carried out in shallow (~30 m) water and two in deeper (~60 m) water. Numerous dab and whiting (some bib on last deployment) were observed to take bait from both the bait bag and baited (with squid) lines. No cod were observed and no acoustic tags were used in any of these deployments.

In order to find cod, CORYSTES moved to a small area of hard ground on the north western end of the Indefatigable Bank known as the "Hurdy Gurdy" (53° 36.2'N, 02° 10.6'E) where a further four trials were carried out.

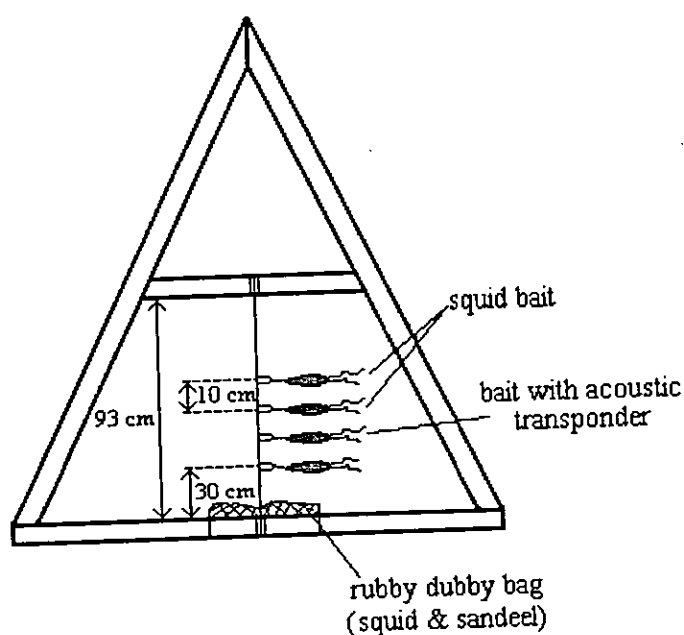


Fig 1. The arrangement of bait on the underwater TV camera frame used in cod tagging trials.

On the first deployment in which no acoustic transponders were used, cod (~50 cm) arrived at the frame within 30-40 minutes and started to feed both from the rubby-dubby bag and on the squid bait.

For the second deployment, a 300 kHz transponding acoustic tag was inserted into the mantle cavity of one of the four squid and the camera frame was re-deployed at 1225 h. The first cod arrived after 15-20 minutes, and subsequently numerous cod accumulated around the frame, taking fish from the rubby-dubby bag. Two of the squid were taken by largish cod before a smaller cod (~30-40 cm) took the tagged squid and swam off with the bait in its mouth. The camera frame was quickly recovered and tracking commenced. However, the tag signal was seen to move only a short distance away from the baited frame before remaining stationary on the sea bed for several hours. This observation was

interpreted as indicating that the bait had probably been spat out rather than swallowed.

The baited camera frame was deployed for a third time at 1952 h. Cod arrived within about 5 minutes, and the tagged bait was taken by a large (>50 cm) cod (Cod 2) at 1959 h. This fish was tracked until 0815 h the following day (11 May) when the fish had to be abandoned due to problems with the sector scanning sonar. On completing repairs to the sector scanner, a search for the tagged cod was resumed at 1540 h. The tag signal was found within 10-15 minutes in the last previously recorded location. The lack of movement was again interpreted as indicating that the tag may have been regurgitated.

The baited camera frame was deployed for a fourth time at 2005 h. Cod arrived within about 15 minutes and the tagged bait was taken by a large (>50 cm) cod (Cod 3) at 2025 h. For the first 14 h the fish remained in a very discrete location, making no detectable movement. However, to confirm that the fish had not regurgitated the tag, a test was carried out using a weighted rubbery-dubby bag. The bag was deployed about 100 m up-tide of the fish. Within about 10 minutes the fish moved directly to the position of the rubbery-dubby bag and remained there for 20-30 minutes before returning to its previous location. Over the next few hours the fish made one further excursion to the rubbery-dubby bag. Tracking continued until 1325 h on 12 May when the fish was abandoned in order to relocate Cod 2.

The tag signal from Cod 2 was quickly found in its last recorded location. Again, a test using a rubbery-dubby bag deployed about 100 m up-tide of the fish was carried out. However, on this occasion the tag signal did not move, remaining stationary over a period of about 1.5 h, strengthening the interpretation that Cod 2 may have regurgitated the tag.

During these trials tests were carried out that showed that the underwater lighting did not appear to affect the behaviour of the fish.

*7. Evaluation of performance of CEFAS/LOTEK 300 & 76 kHz sonar buoys and acoustic tags at sea.* Trials with a CEFAS sonar buoy and 76 kHz coded acoustic pingers (both LOTEK and CEFAS devices) were carried out on two occasions. During the first, in which the sonar buoy was mounted close up under the toroidal float of an oceanographic mooring, no signal was detected or decoded from either the LOTEK or CEFAS tags at any range (from about 25 m to several hundred meters). In a subsequent trial during which the sonar buoy was suspended 1.8 m below the rig, the LOTEK tag was detectable, but not decoded, at about 400 m range. The signal was decoded intermittently at 200 m range. During the same trial, signals from the CEFAS coded tag were detectable at about 520 m range, intermittently decoded at a range of about 480 m, and frequently decoded at a range of about 370 m.

The first trial was conducted with the sonar buoy drifting free and the radio receiver on the ship. During these trial there were significant problems with radio interference. The second trial was conducted with the sonar buoy drifting free but with the radio reviever in a small boat. This eliminate the radio interference.

8. *Evaluation of methods (traps and long-lines) for catching cod in suitable condition for electronic tagging.* Line fishing for cod was carried out by the ship's crew on a variety of occasions whilst carrying out other work in the vicinity of the Indefatigable Bank. In addition, trials with a Norwegian design of cod trap were carried out in this area. Performance of the cod trap was monitored by attaching it to the camera frame. No fish entered the trap when only the up-tide entrance was open. However, with both up-tide and down-tide entrances open, two cod soon entered via the down-tide entrance, one of which subsequently exited via the up-tide entrance. Fish caught in the trap were successfully aboard in good condition. However, the light "Dural" frame of the trap was damaged during recovery. A more substantial frame, fabricated from angle iron oe similar, would probably be more robust.

All fish were caught in shallow (20 m) water. Most (>80%) of the line-caught fish, and the one trap-caught fish, were in good condition and there were few problems associated with swim bladder distension. Sixteen fish were successfully tagged with MK3 electronic data storage tags and released.

9. *Evaluation of acoustic & fishing survey methods for estimating abundance and distribution of sandeels on sandeel grounds.* Combined acoustic and fishing survey methods were used on a number of occasions during the cruise. The acoustic surveys were carried out 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 using an International Young Gadoid Pelagic Trawl (IYGPT). Although it had not been possible to calibrate the echo sounders fully, good echo signals ("marks") were obtained and the characteristics of a variety of fish schools (0-group sandeels, 1+group sandeels and herring) were identified. Significant quantities of echo sounder data were successfully gathered for subsequent detailed analysis. Two sandeel samples were taken for age/length determinations (300+ lengths, 5 otoliths per 0.5 cm size class).

10. *Servicing of hydrographic moorings in the Thames Estuary.* The instrumented buoy was recovered intact and all instruments appear to have worked. The fluorometer attached to the CEFAS Micrologger was observed illuminated during recovery. The water sampler had taken 50 samples and the NAS2 had a complete data-record. The SB4 logger would not communicate, so the data are at present not retrievable, but as the NAS was acting as slave to it, and worked correctly, we assume that it contains data. The water sampler recovered from the Marsdiep mooring

and destined to be used on the replacement buoy was found have a seized manifold gearbox, so the recovered instrument was re-used.

JD Metcalfe  
19 May 1999

SEEN IN DRAFT: B Chapman, (Master)  
A Lincoln, (Senior Fishing Mate)

INITIALLED:

GNE

DISTRIBUTION:

Basic list +	C Stewart	T Hammond
WJ Meadows	AA Buckley	RP Flatt
BF Riches	P Wright	J Read
E Tinton	D Sivyver	A Reeve
J Taylor	Clerk, Eastern Sea Fisheries Committee	

## FIGURE CAPTIONS:

**Figure 1.** The arrangement of baits on the baited camera frame used to tag cod by ingestion with transponding acoustic tags.

**Figure 2.** The ground track of cod 3: 2025 h, 11 May - 2035 h, 12 May. (NB the apparent erratic movement of the fish in the upper part of the track is largely a result of position fixing errors)

**Figure 3.** A ground plot of a QTC sediment survey track (solid line) showing the positions of commercial sandeel fishing locations (open circles) in relation to sites where the sediment classification, as determined by QTC, is of a type suitable for sandeels (solid circles).

Fig. 2 Ground track of cod 3,, *Corystes* 4/99, 11-12 May 1999

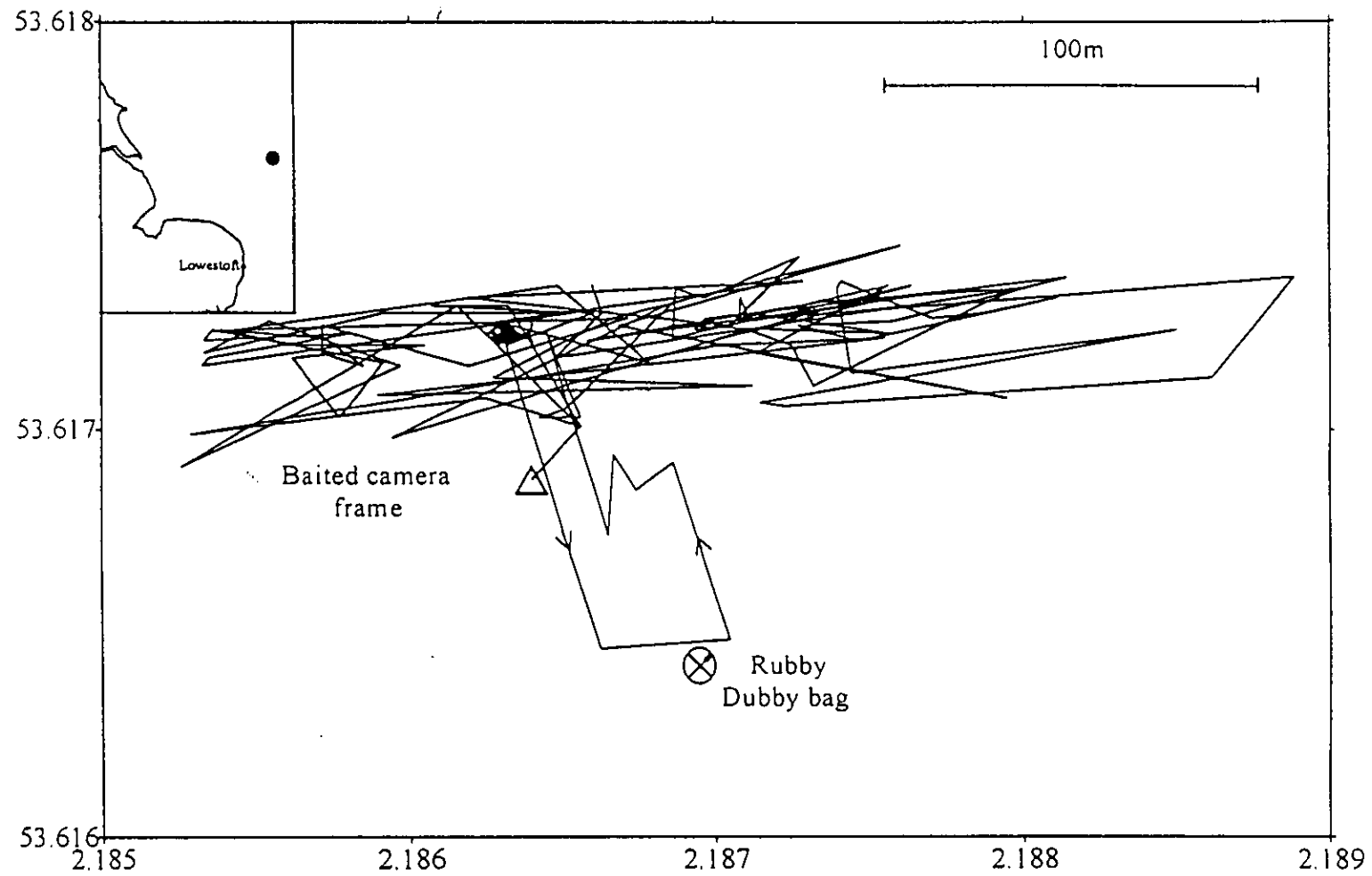


Fig. 3

