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

1993 RESEARCH VESSEL PROGRAMME

REPORT: RV CORYSTES, CRUISE 4/93
(PROVISIONAL: Not to be quoted without prior reference to the author)

STAFF:

B E Spencer (SIC)
W Meadows
M J Kaiser
R Flatt
P Hudson
H Watkins
N Earl

DURATION: 2-18 April 1993

All times GMT

LOCALITY: Irish Sea, north Wales coast

AIMS:

1. To establish a short-term/long-term experimental site to measure the effect of fishing with a commercial 4-m beam trawl fitted with chain mat on the sea bed and on commercial and non-commercial benthic species.

2. To beam trawl an area of the site using an experimental design to measure two levels of fishing intensity (x10, and x20) and frequency (fished once only and then x2 per year) relative to unfished control areas.

3. To measure food preference and movement of predators (using pots baited with different components of the by-catch and the benthos dredge) into an area fished with a beam trawl.

4. To observe feeding activity (from stomach contents) of dogfish (*Scyliorhinus canicula*) and gurnards (Triglidae) sampled before and after an interval of beam trawling.

5. To film predators attracted to a baited camera frame on the sea bed using various components of the by-catch.

6. To estimate the survival of animals caught in the cod-end using the on-board survival system over a prolonged period.

NARRATIVE:

Messrs Spencer and Kaiser joined the ship at Lowestoft on 31 March, Watkins and Earl on the 1 April and Meadows and Hudson on the 2 April. CORYSTES sailed at 1700h on the 2 April to the RoxAnn calibration site 25 km NE of Great Yarmouth. Ground truth data was collected with three Day grab samples at each of two sites within the calibration box. CORYSTES continued on her journey that evening and during the steaming period over the next two days the *Sextant* software was interfaced with CORYSTES' gyrocompass and Sercel navigation system. Familiarisation with its use was undertaken.

CORYSTES arrived off the north Wales coast in the early morning of 5 April and the Sercel satellite positioning system (DGPS) was locked onto a strong signal from the temporary reference station installed for this cruise on the Great Orme, Llandudno. A grid measuring 3.5 x 1.5 km line lengths with a distance of 0.5 km between adjacent parallel lines (Figure 1) was entered into *Sextant* and displayed on the bridge. This grid was entered into RoxAnn for use in assessing the coverage, spread and change in sediment on the beam trawl tracks during the cruise.

Work began that morning with side scan sonar runs along the proposed trawl tracks to examine the site's suitability for the experiment. Strong winds prevented deployment of the video sledge and further work at the site. However, trials with the benthos dredge were undertaken off Moelfre. Fitment of two buoys and extra weights improved the performance of the dredge. Tows of different duration indicated that a one minute tow provided several baskets of sediment which was sufficient for benthos sampling purposes. The 3-m beam trawl was also deployed to gain experience with its sampling capabilities. Tows of different lengths indicated that a 7 min tow provided sufficient material for sample purposes. Preliminary examination of the catch indicated that the benthos dredge caught more infauna and sediment and less epifauna than the 3-m beam trawl. It was decided, therefore, to use the benthos dredge as the infauna sampling tool for this cruise. In the evening loss of signal from the Gt Orme transmitting station coincided with strong winds but whether the two events were related is not known at present.

Loss of precise position fixing with the Sercel navigation system determined that the day's work on 6 April would be directed to the secondary aim of collecting stomach contents from predatory fish before and after an interval of fishing with the 4-m beam trawl. Consequently, at a position 8 km east of Moelfre, two sets of three half hour tows were made along the same track with the two sets separated by a 3 h time interval. Fish species examined were dogfish, (*Scyliorhinus canicula*), gurnards (Triglidae) and whiting (*Merlangius merlangus*). Total fish lengths, and mouth dimensions were recorded and stomach contents preserved.

Side scan sonar runs along the tracks after each set of tows and after a 2h interval indicated that the tracks were still visible and occupied a band width of about 30-50m. The Gt. Orme differential signal was regained during the morning enabling a return to precise position fixing with Sercel.

Calm weather on 7 April allowed deployment of the video/stills camera sledge, but picture quality was poor due to the large amount of suspended matter in the water. Following this, beam trawling of the experimental site began in earnest with ten tows along the first line (10 N/S) of the experimental grid. In addition to the total weights of each catch, catch composition of the first and last three of the 10 tows was determined by sorting to species level by number and biomass. Side scan sonar runs along the avenue of 10 tows produced some clear images of the tracks on the sea bed. RoxAnn plots of tow positions indicated that greatest variation from the required track occurred at the start of the line.

This error was subsequently reduced by shooting the trawl sufficiently early ie. 1.5-2 km before the start of the track, so that the beam trawl could be brought onto the required line with reasonable accuracy.

On 8 April benthos sampling on the avenue of 10 trawl tracks and control plots was started with 32 Day grabs. After a short break in the scientific programme to collect two members of the ship's complement who joined the cruise at Point Lynas, Anglesey, sampling continued with 8 benthos dredge tows. Finally two side scan sonar runs were made along the track designated for 20 beam trawl tows (20 N/S).

On 9 April attention was directed to the next component of the experimental design which required 20 beam trawl tows along the same line (20 N/S). Fifteen tows were completed by late evening. A side scan sonar survey over the tracks was made to obtain an estimate of the width of the avenue and a general view of the paths of the trawl on the sea bed. The new sonar clearly recorded differences in bottom type (sand waves interspersed with a firmer substrate of shell), which was confirmed by RoxAnn after box re-definition from ground truth data.

On the morning of 10 April the remaining 5 of the 20 beam trawl tows were completed despite a 2 h delay caused by the failure of Gt Orme reference station again. The track was surveyed with side scan and then sampled with Day grabs. Some operational problems were experienced with the new Day grab but a few alterations improved sampling rate considerably.

On 11 April work continued on sampling the track trawled 20 times and its control areas with the benthos dredge. After side scan sonar runs along the track a start was made on beam trawling the first of the two east/west lines (10B E/W; 1.5 km in length). Six of 10 trawls were completed and the track viewed with side scan. The junctions of the N/S and E/W lines, where eventually most trawl marks will occurred, provided images of varying intensity depending on the age and therefore rate of infill of the tracks due to tidal currents. Clear images were obtained with tracks <4 days old and less distinct ones which were >4 days old.

When the opportunity arose, various species of the by-catch were placed in the survival tanks for several days to assess the effects of damage due to fishing.

On 12 April work was again delayed for several hours due to loss of the differential signal from the Gt. Orme. Once re-established, however, beam trawling was completed and the line sampled with Day grab and benthos dredge.

On 13 April work was again delayed for a short period by loss of signal from the Gt Orme. Eventually work began with beam trawling 15 of 20 tows along the second E/W line (20B E/W) which, with a side scan survey, occupied the rest of the day. In the evening an attempt to calibrate Sercel was made by steaming a cross-grid reference using, separately, the Gt Orme and a self-selected standard signal. Loss of the Gt Orme signal, however, prevented the comparison. Over the night-time period RoxAnn was used to record ground type as CORYSTES steamed a random grid over the trawl tracks created so far.

The Gt Orme signal had still not returned on 14 April despite frequent attempts to re-establish it by Conwy Laboratory staff. Since the standard differential signal reception by Sercel was also poor the remaining sampling programme which required accurate position fixing was abandoned. The previous day's effort with beam trawling was, therefore, wasted. The calm conditions, however, enabled deployment of the camera sledge on the ground near to the beam trawl tracks. Good video coverage was obtained which showed

some changes in the epibenthos community composition of trawled and untrawled areas of the sea bed. Finally several benthos dredge samples of areas not adequately covered earlier were taken.

With the scientific programme completed CORYSTES set course for South Shields at 1900h on 14 April arriving at her R Tyne berth at 1600h on 18 April.

RESULTS

1. *Sextant* navigation software generated highly accurate position lines and sampling points thus enabling display of the experimental grid. The display provided a user-friendly aid to the helmsman for steering an accurate course when beam trawling or sampling specific target areas. Logging position data to disc provided a permanent record of the experiment. The greatest error occurred with estimating gear position. An acoustic positioning system would provide this information.

The *Sextant* system (recording vessel track) high-lighted the gaps in coverage given by the standard DGPS service in this area and emphasised the need for a local reference station.

2. Sercel DGPS performed well when the Gt. Orme signal was working properly. Frequent failures in transmission of the signal, however, caused unacceptable disruption to the research programme. A back-up system may be required for the next cruise in October if better performance cannot be guaranteed.

3. RoxAnn proved a useful tool for monitoring bottom sediment type and for logging ship position over the experimental site.

4. Three of six lines were beam trawled to the required intensity and sampled with Day grab and benthos dredge. A fourth line was trawled 15 of 20 times but not sampled.

5. Estimated gear positions during beam trawling, Day grab sampling and benthos dredging are shown in Figures 2, 3, 4, and 5. The benthos dredge was deployed more accurately on the E/W lines when CORYSTES was manoeuvring in an easterly/westerly direction against the direction of tidal flow (Figure 5).

6. Side scan sonar provided clear images of beam trawl tracks, their width and their rate of decay. Tracks made at the junction of two lines (20 N/S and 10 E/W) and detail of beam shoe marks are shown in Figure 6. Side scan records showed fish, as dark spots, directly over beam trawl tracks.

7. Stomach contents of dogfish, gurnards and whiting were collected to determine diet composition before and after an interval of beam trawling. Catch composition is shown in Table 1.

8. Mortalities of a range of species from the by-catch after 72 h and 96 h in tanks of running sea water are shown in Table 2. Pogges, plaice and cuckoo rays showed mortalities of <34% and dragonets 68% after 92 h. Mortalities of all invertebrates tested was <14%.

9. Lack of time prevented completion of other secondary aims (No^{S} 3 and 5).

10. Herring collected from 53.27N, 04.02W (ICES 35 E5)were deep frozen for D Bucke (FDL).

11. Five specimens of the butterfly blenny, *Blennius ocellaris*, were collected for research purposes(MJK).

B E Spencer, SIC
18 May 1993

SEEN IN DRAFT:

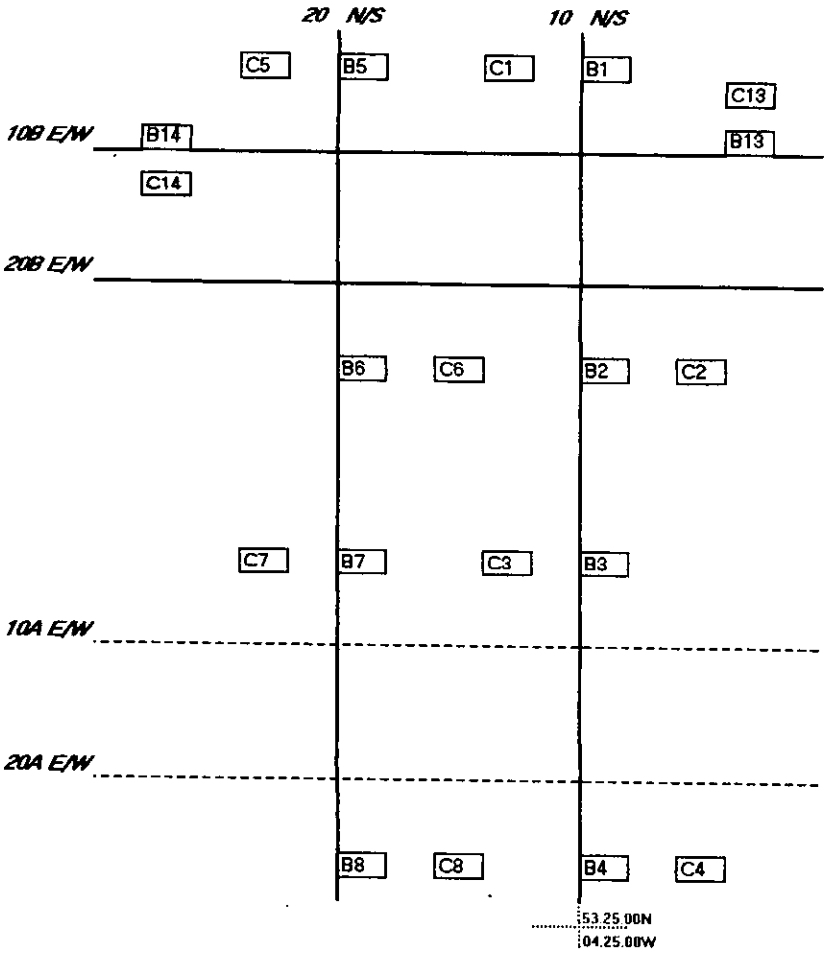
M J Willcock, Master.
R Graham, Senior Fishing Mate.

INITIALLED: JGS

DISTRIBUTION:

Basic List +

B E Spencer	R P Flatt
M J Kaiser	P Hudson
W J Meadows	N Earl
H Watkins	



KEY

Line rel	trawled	sampled
10 N/S	X10	yes
20 N/S	X20	yes
10B E/W	X10	yes
20B E/W	X15	no
10A E/W	no	no
20A E/W	no	no

FIGURE 1: Experimental design for a study of the effects of beam trawl fishing on the sea bed in the Irish Sea.

continuous lines denote trawled areas.
broken lines denote areas not trawled through lack of time
boxes indicate areas sampled for infauna with Day grab and benthos dredge

FIGURE 2 : Corystes and offset beam trawl track positions with respect to line 20 N/S

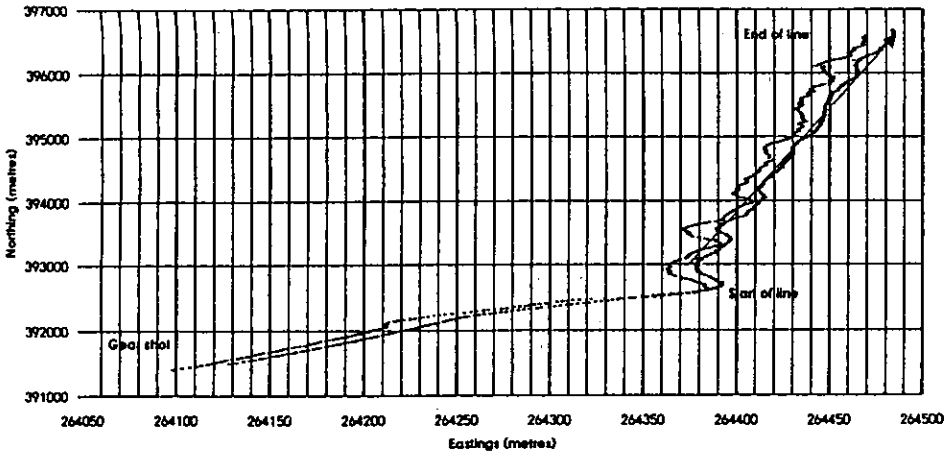


FIGURE 3 : Day grab positions with respect to beam trawl line 10 N/S

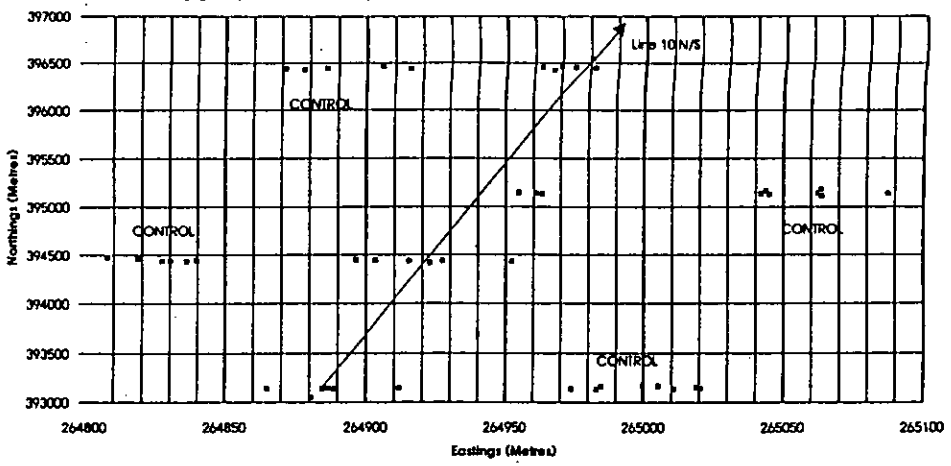
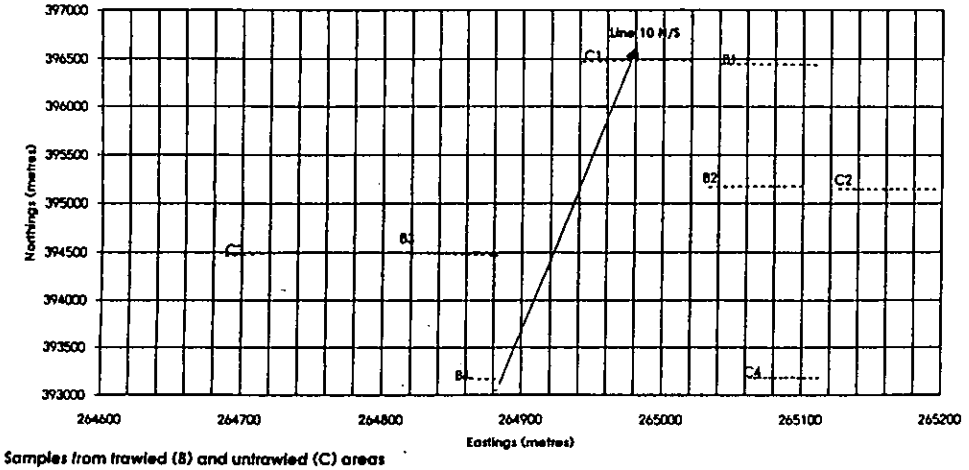
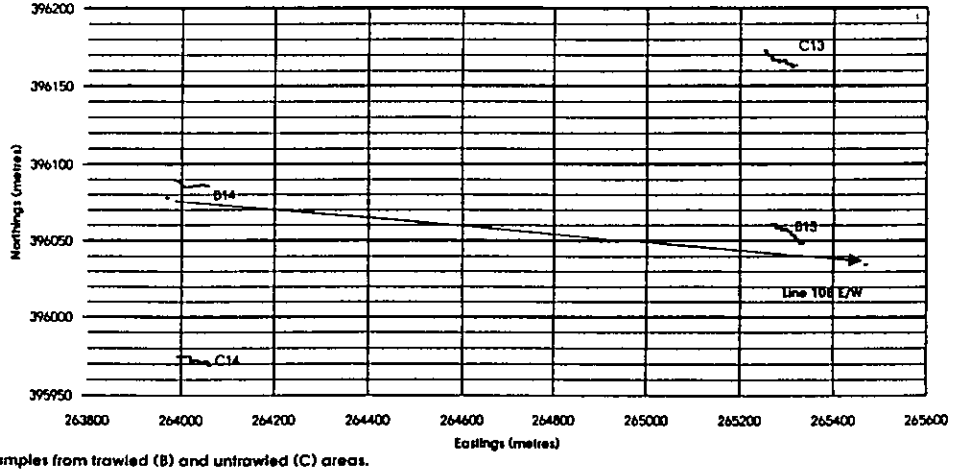


FIGURE 4: Position of benthos dredge with respect to beam trawl line 10 N/S



Samples from trawled (B) and untrawled (C) areas

FIGURE 5 : Position of benthos dredge samples with respect to beam trawl line 10B E/W.



Samples from trawled (B) and untrawled (C) areas.

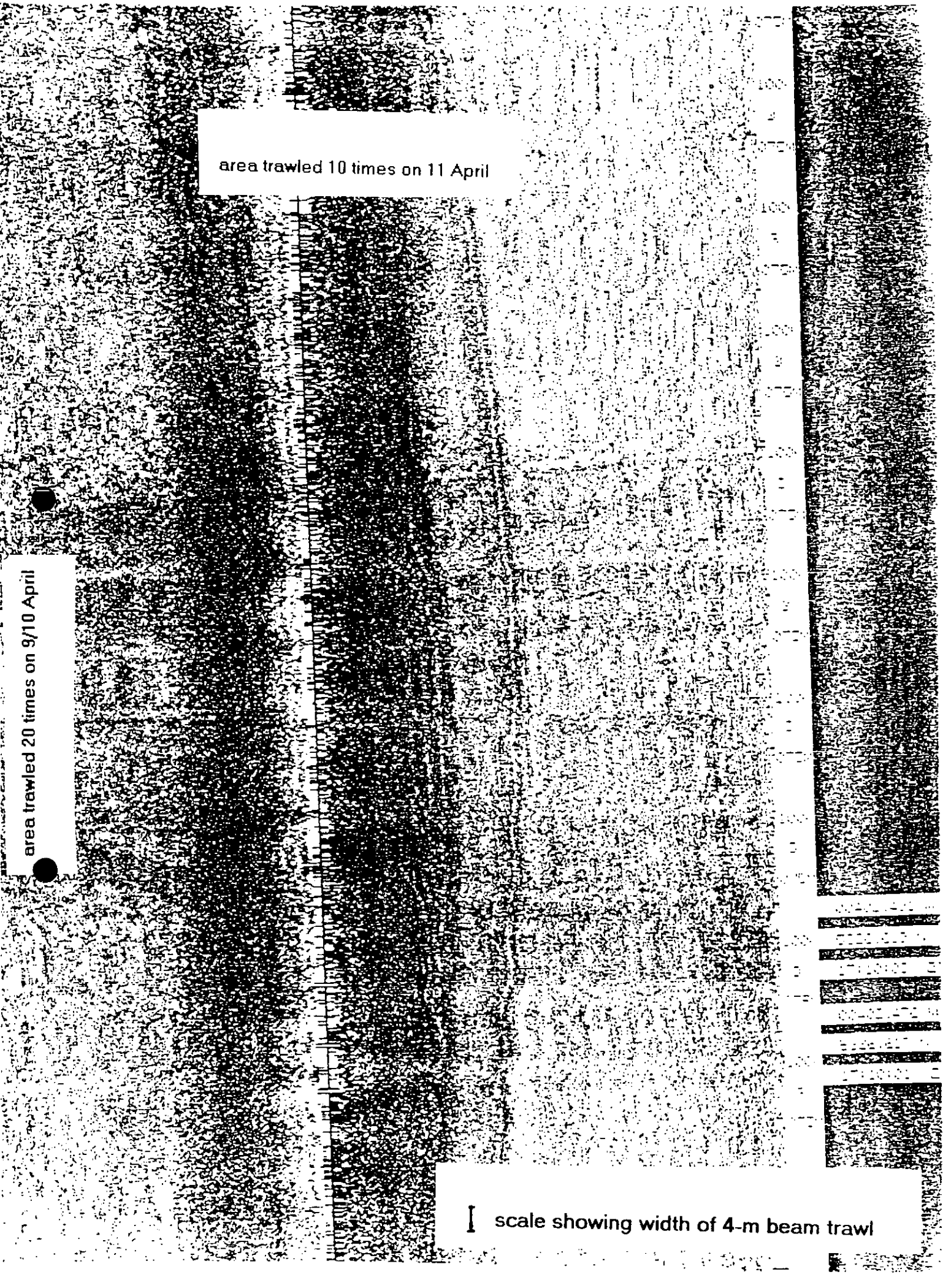


Figure 6 : Side-scan record on 11 April of an intersection of beam tracks made 2h to 2 days earlier

TABLE 1 : By-catch composition of six 4-m beam trawl tows to collect stomach contents from predatory fish (*).

Fish	NUMBER						WEIGHT (kg)					
	Tow 1	Tow 2	Tow 3	Tow 4	Tow 5	Tow 6	Tow 1	Tow 2	Tow 3	Tow 4	Tow 5	Tow 6
Limanda limanda	15	6	31	26	6	50	1.01	0.51	2.09	1.88	0.35	4.62
Plueronectes platessa	32	28	26	48	3	27	3.21	2.21	2.42	4.87	0.90	3.29
Solea solea	4	2	3	4	0	0	0.54	0.53	0.49	0.60	0.00	0.00
Pleuronectes flesus	2	4	1	9	2	9	1.11	0.91	0.21	2.58	0.54	1.39
Scyliorhinus canicula *	5	4	15	3	0	1	5.90	3.40	11.50	4.00	0.00	0.90
Gadus morhua	6	2	52	13	3	30	1.13	0.18	7.27	1.53	0.52	4.44
Merlangus merlangus *	6	49	49	14	31	54	0.57	3.59	3.67	0.71	2.00	4.06
Trisopterus minutus	12	18	42	34	7	41	0.63	1.05	2.56	1.71	0.39	2.18
Callionymus spp	21	3	17	12	4	36	0.74	0.15	0.93	0.46	0.21	1.43
*Triglids**	43	11	26	30	0	35	0.85	0.34	0.75	0.67	0.00	0.96
Agonus cataphractus	33	2	52	41	1	73	0.36	0.03	0.80	0.48	0.02	0.88
Raja naevus	13	6	6	13	2	18	2.17	0.79	0.75	1.99	0.36	2.99
Lophius piscatorius	2	0	3	2	2	0	0.69	0.00	0.98	0.59	0.41	0.00
Hyperoplus lanceolatus	1	0	0	0	0	0	0.05	0.00	0.00	0.00	0.00	0.00
Echiichthys vipera	0	1	0	0	0	0	0.00	0.05	0.00	0.00	0.00	0.00
Microstomus kitt	0	0	0	0	1	0	0.00	0.00	0.00	0.00	0.08	0.00
Total	195	136	323	249	62	374	18.97	13.74	34.42	22.08	5.77	27.15
Invertebrates												
Asterias rubens	414	220	431	661	80	896	6.76	5.30	7.72	11.25	1.85	15.13
Liocarcinus depurator	188	28	161	225	12	327	0.92	0.27	1.18	1.48	0.07	2.69
Eupagurus bernhardus	8	24	19	32	21	4	0.35	1.20	1.17	1.76	1.06	1.98
Buccinum undatum	13	36	22	34	14	38	1.24	3.21	2.01	2.09	1.17	3.65
Eledone cirrhosa	0	0	4	2	2	4	0.00	0.00	0.27	0.30	0.30	0.66
Total	623	308	637	954	129	1269	9.28	9.98	12.35	16.87	4.45	24.12

TABLE 2

Mortality of various species from the by-catch of the 4-m beam trawl after 72h and 96 h in tanks of running sea water.

Species		number	percent . mortality	
			72 h	96 h
Aphrodite aculeata	sea mouse	65	3	3
Ophiura texturata	brittle star	34	12	12
Eupagurus bernhardus	hermit crab	15	0	0
E. prideauxi	hermit crab	29	14	14
Liocarcinus depurator	swimming crab	34	13	13
Eledone cirrhosa	octopus	15	0	0
Alcyonium digitatum	dead mans fingers	50	0	0
Pleuronectes platessa	plaice	50	24	30
Agonus cataphractus	pogge	13	25	25
Callionymus lyra	dragonet	50	46	68
Raja naevus	cuckoo ray	32	12	34