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

2002 RESEARCH VESSEL PROGRAMME

REPORT: RV CORYSTES: CRUISE 15/02

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DURATION: 1 November– 9 November

LOCALITY: North Sea

AIMS:

1. To use acoustic and fishing survey methods to estimate the abundance and distribution of sandeels (*Ammodytes marinus*) on sandeel fishing grounds on the western Dogger Bank.

2. To use QTC and sidescan methods to describe and identify seabed habitats, especially those occupied by sandeels, and to ground-truth those methods with grab-sampling gear e.g. Hamon grab.

3. To assess growth, age and maturity state of sandeels

4. To recover, service and re-deploy the CEFAS data transmitting sonar buoy on the Indefatigable Bank.

NARRATIVE: (All times are Universal Time)

CORYSTES sailed at 1800 h on Friday 1 November and proceeded to sandeel fishing grounds (coordinates) on the south western end of the Dogger Bank (North West Riff). A systematic survey for sandeels (Aim1), and of the sea bed sediment (Aim 2) commenced at 0900 h the following day (2 November) and continued relatively uninterrupted until 0200 h on 6th November. Following completion of the systematic survey, areas of the sampling grid which showed high sandeel abundance were targetted for sampling at a smaller scale. Areas identified by dredge sampling as likely to yield large catches of sandeels were more intensively sampled with dredge and QTC methods. CORYSTES continued targetted sampling until 2300 h on 7th November and then steamed to the north-western end of the Indefatigable Bank (the "Hurdy Gurdy" at 53° 36.93'N 02° 11.18'E). CORYSTES arrived on station at 0720 h the following day (8th November) and began to search for the sonar buoy deployed during COR 6/02. Due to unfavourable sea conditions, and despite several attempts, the buoy could not be recovered. An additional buoy was subsequently deployed at 1030 h at 53° 37.27'N 02° 11.14'E. The buoy satisfactorily detected the presence of acoustic pingers deployed during COR 6_02 in June. With almost all aims of the

cruise completed, CORYSTES then set sail for Lowestoft and docked at 2230 h on 8th November.

RESULTS:

1. *Estimation of the abundance and distribution of sandeels on sandeel fishing grounds on the western Dogger Bank.* This was a repeat of the surveys carried out in May/June in 2000-2002. The survey grid is located on the North West Riff, at the south western end of the Dogger Bank (bounded by the coordinates 54° 51'N 01° 00'E, and 54° 24'N 01° 54'E). 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 and dredge surveys to be performed simultaneously along each leg over the course of an 8 hour period, with the complete grid being surveyed over three days, weather permitting.

i. A ***systematic dredge survey*** for sandeels buried in the sea bed was carried out using a 1.2 m sandeel dredge from 0900 November 2nd to 0200 November 6th. 10-minute tows were carried out at each plankton/dredge station (total of 54 stations, Fig.1). Sandeel catches ranged from 0 to 220 fish per tow, and 1154 sandeels were taken from the grid in total. The spatial distribution of sandeels in summer (COR 6_02) and winter is shown in Fig. 1.

ii. During the acoustic survey, **plankton samples and CTD** casts were made at each dredge station. Plankton hauls were taken with a 0.5 m ring net (60 mpi).

iii. Acoustic survey methods were used to estimate the distribution and relative abundance of fish schools in the study area as the CORYSTES steamed between dredge/plankton stations (see Appendix I for a detailed account of the survey strategy). Acoustic data were collected continually from 0900 h November 1st to about 1000 h November 7th using the Simrad EK 500 dual frequency (38 & 120 kHz), split beam echo sounder with echo integration. Schools of suspected clupeids and other unknown schools were identified during both the day and night (Figure 2).

	Clupeids	Unknown	Total
Day	205	292	497
Night	4149	571	4720

No schools were identified as sandeels. Daytime clupeid schools marked stronger at 38kHZ than 120 kHz, were dense, well defined, and found close to the bottom. During night time, the suspected clupeids formed looser aggreagations and scattered individual targets. Due to inclement weather there was no opportunity to validate acoustic target identification by trawling.

2. *Description of sediment type in relation to sandeel distribution and abundance using QTC.* By combining the EK500 echo sounder output with the Quester Tangent Sea-view (QTC) seabed classification system, acoustic surveys of the sea bed sediment were carried out at the same times and locations as acoustic surveys of the water column. Unsupervised QTC data was recorded over the main survey grid. Three central lines were selected and classified to create a generalised catalogue of acoustic signatures. This general catalogue was then used to run live QTC over further survey lines. Extra minigrids were surveyed in areas of known sandeel habitat identified and confirmed by the dredge.

i. **Classification** of core sandeel habitat was undertaken using a seabed habitat catalogue created from the previous cruise (COR 6_02). Summer and winter data on three central lines of the grid were compared. Some seasonal differences could be seen but only in shallow habitats on the bank system to the east of the survey grid.

ii. **A live QTC catalogue** (i.e. supervised data collection) was run along two contrasting areas of the survey grid: line C, where sandeels were largely absent, and line D, where sandeels were abundant. The catalogue picked out subtle differences in sand dominant areas (confirmed by Day grabbing), and also detected more significant changes to a coarser gravel/stone dominated substrate in areas of habitat inhabited by sandeels. With these insights it is possible the collection of more acoustic signatures over known sandeel habitats could be used to further train the system to detect these habitats.

iii. **A targetted QTC/dredge survey** was undertaken over small areas at two sites on the grid: D4 and E1, where the seabed habitat was assumed to be ideal for sandeels i.e. sandeels had been found in abundance during the systematic dredge survey. Each minigrid consisted of 5 transects 2km long N-S and 850m apart E-W (approx 3km total width). Unsupervised QTC data were collected along transect lines before a 1000m portion of each transect line was dredged (approx 10 mins, for comparison to systematic dredge survey) to assess sandeel abundance. Post processing of QTC data demonstrated that the seabed in each minigrid was variable and patchy. Sandeel abundance within the minigrids ranged from 2 to 250 fish per tow, and approximately 900 sandeels were taken from the minigrids in total. All fish were counted and measured. Further analysis will be required to provide a more complete understanding of the dynamic range of acoustic responses met when establishing sandeel habitat

3. *Assessment of growth, age and maturity state of sandeels*. All sandeels caught during the systematic dredge survey were counted and measured. Otoliths samples for age/length determinations (5 otoliths per 0.5 cm size class, total: 120 fish).) were taken on the 2 occasions where sandeel catches at a dredge station exceeded 100. A comparison between length-frequency of sandeels in summer 2002 (COR 6_02) and winter is presented in Fig. 3. Visual inspection indicates the presence of at least 4 age-classes across the grid. Otolith samples will be analysed at the Laboratory to determine age

structure. A qualitative assessment of maturity of sandeels was made where catches were large (>100). In contrast to *A.marinus* caught during the summer months, where there was no evidence of gonadal development, all individuals of the 2+ group had well developed, although not ripe, gonads. In contrast, *Gymnammodytes semisquamatus* individuals of the 2 group had poorly developed gonads, a reverse of their readiness to spawn in summer.

4. *Recovery, service and re-deployment of the CEFAS data transmitting sonar buoy on the Indefatigable Bank*. The currently moored (at 53° 37.05'N 02° 11.21'E) CEFAS data transmitting sonar buoy could not be recovered. An additional buoy was successfully deployed on the "Hurdy Gurdy" at 1030 h on 8th November at 53° 37.27'N 02° 11.14'E. Listening trials using the radio-transmitting capability of the buoy indicated that the buoy could detect both the control and other acoustic pingers was working satisfactorily. Subsequently, information from the Laboratory in the days after deployment indicated that the sonar buoy detected tag signals and successfully transmitted the data back to the Laboratory.

DA Righton
8 November 2002

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

INITIALLED:

DISTRIBUTION:

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	Clerk, Eastern Sea Fisheries Committee	

FIGURE CAPTIONS:

Figure 1. The distribution and abundance of sandeels in the sediment by night in the survey area (as revealed using a 1.2 m sandeel dredge) during summer (COR 6_02) and winter cruises (COR 15_02).

Symbol size is proportional to the relative density.

Figure 2. The distribution and size of fish schools in the survey area by night and day. According to previously determined acoustic identification criteria, no sandeel schools were observed during the survey.

Symbol size is proportional to the relative density.

Figure 3. Length-frequency distribution of sandeels caught in dredge hauls during summer (COR 6_02) and winter cruises (COR 15_02).

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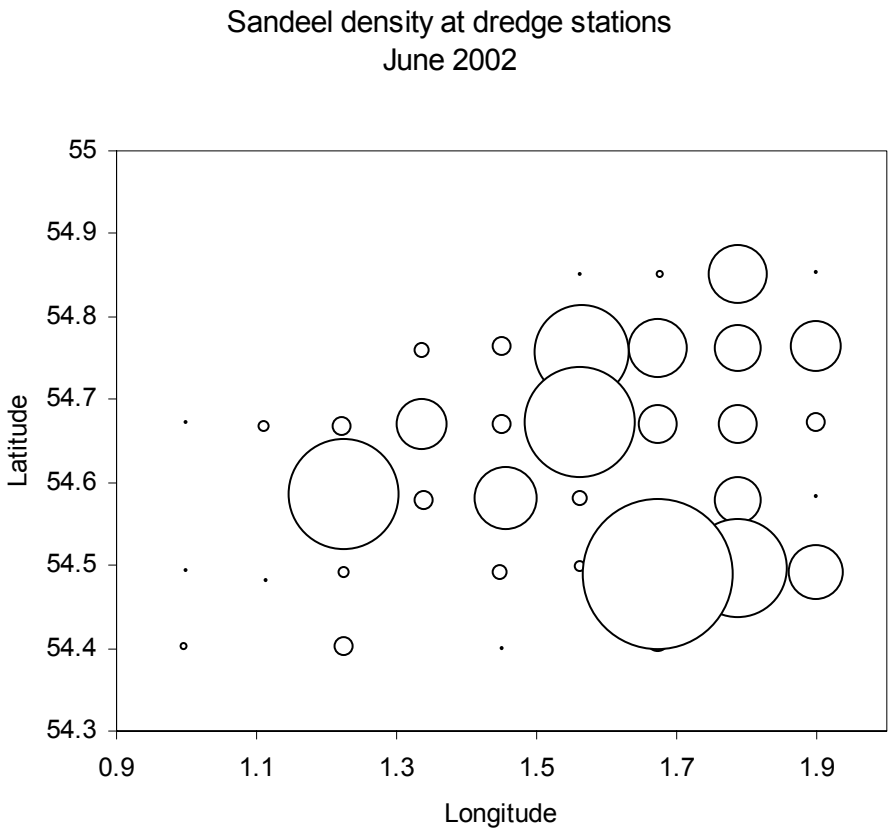
Figure 1.


Sandeel density at dredge stations
June 2002
55
54.9
54.8
54.7
54.6
54.5
54.4
54.3
Latitude
0.9
1.1
1.3
1.5
1.7
1.9
Longitude

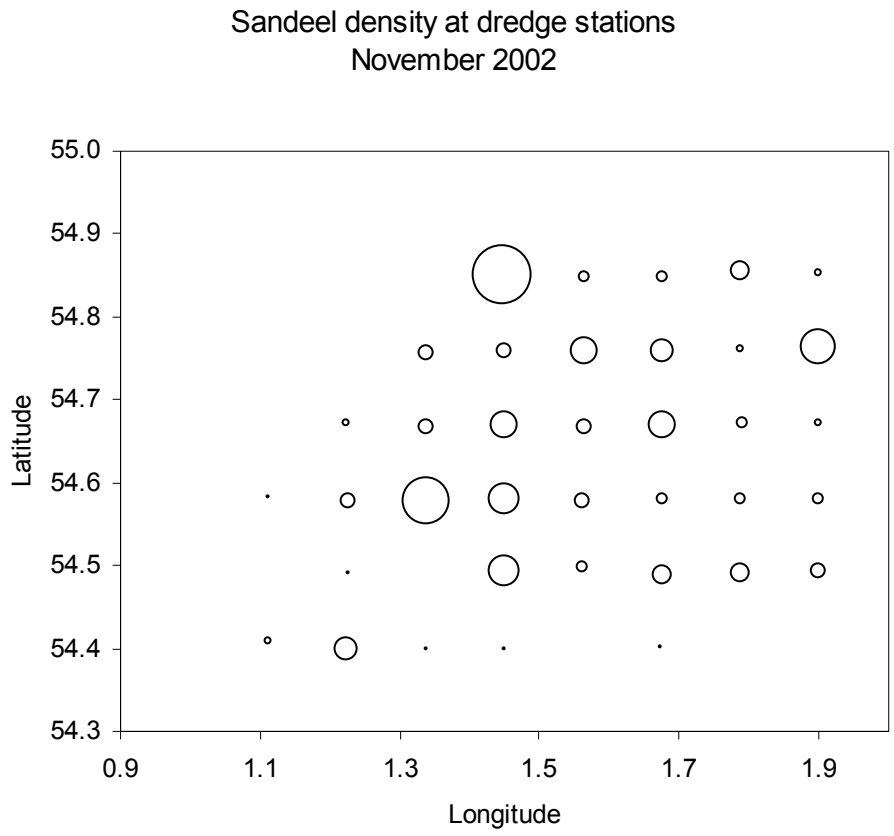

Sandeel density at dredge stations
November 2002
55.0
54.9
54.8
54.7
54.6
54.5
54.4
54.3
Latitude
0.9
1.1
1.3
1.5
1.7
1.9
Longitude

Figure 2.

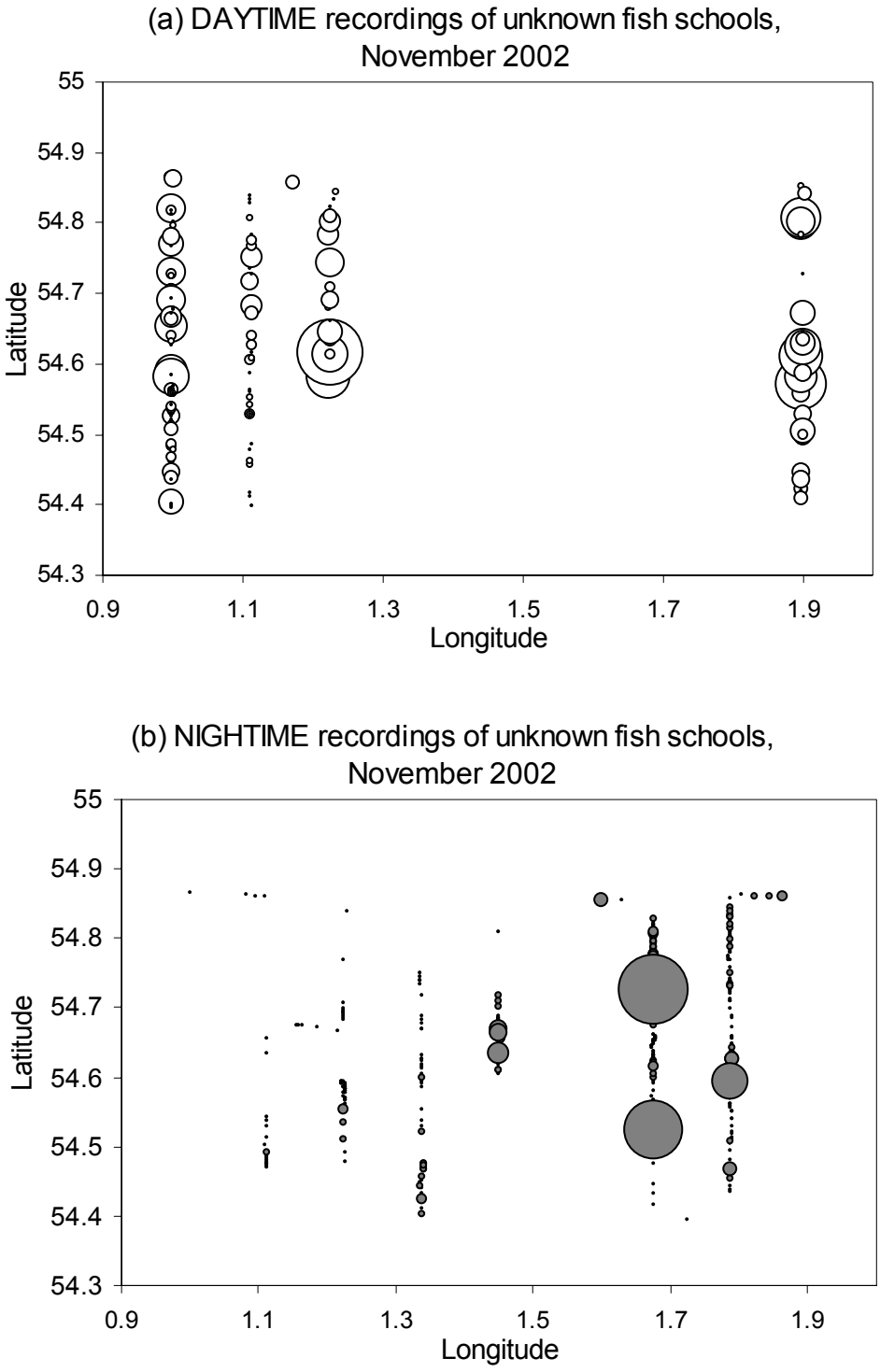
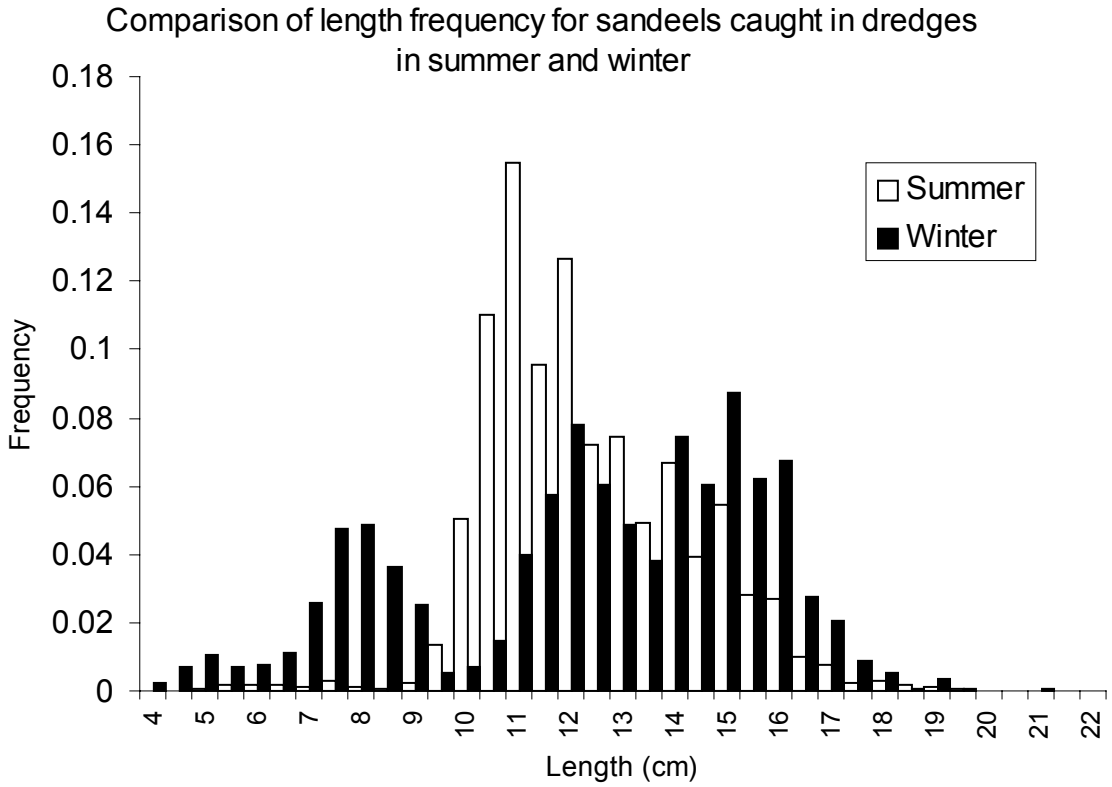

(a) DAYTIME recordings of unknown fish schools, November 2002
Latitude
55
54.9
54.8
54.7
54.6
54.5
54.4
54.3
0.9
1.1
1.3
1.5
1.7
1.9
Longitude
(b) NIGHTIME recordings of unknown fish schools, November 2002
Latitude
55
54.9
54.8
54.7
54.6
54.5
54.4
54.3
0.9
1.1
1.3
1.5
1.7
1.9
Longitude

Figure 3.


Comparison of length frequency for sandeels caught in dredges in summer and winter
Frequency
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
Summer
Winter
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
Length (cm)

Appendix I

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 (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. Each leg was labelled (A to I) from the west, and 6 plankton/dredge stations were located, 5.4' (10 km) apart, along each leg and numbered 1 to 6 from north to south (Fig. 2).

The survey strategy.

Grid legs were surveyed consecutively, starting from the south-western most sampling station (i.e. in order: A6-A1, B1-B6, C6-C1 etc). At each station, a plankton haul/ CTD cast was undertaken taken with a 0.5 m ring net (60 mpi) hung underneath a SAIV mini STD/CTD204 winched to the seafloor from the starboard gantry. Following each plankton haul, each sampling station was surveyed for sandeels using a 1.2 m scallop dredge specifically modified to catch sandeels buried in the sediment. The dredge was towed for approximately 10 minutes at 3-4 kt through each station (roughly 1000m). Accurate estimates of the duration of each tow were obtained from a temperature and depth recording data storage tag attached to the head of the dredge., programmed to record data every 10 s. Acoustic surveying for fish shoals was carried out between sampling stations using a split beam, dual frequency (38 & 120 kHz) scientific echosounder (EK500, Simrad) at speeds of between 5 and 7 kts depending on weather. By combining the EK500 echo sounder output with the Quester Tangent Sea-view (QTC) seabed classification system, acoustic surveys of the sea bed sediment could be carried out at the same time.
Subsequently, the grid leg. Weather permitting, this survey strategy allowed acoustic, trawl and dredge surveys to be performed along each leg over an 8 hour period.

Processing catches from sandeel dredges.

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 and measured (to the nearest 5 mm below, i.e. 12. 3 mm = 12 mm and 12.8 mm = 12.5 mm).

ii. *Moderate catches (200 - 1000 whole fish).* The catch was counted and a sample of approximately 200 fish measured. Otoliths were taken from 5 fish from each 5 mm size class.

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

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. A note was also made of the typical benthic fauna associated with the catch in the dredge.

Plankton samples were preserved in 4% buffered formalin and stored for later analysis.