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Report

Survey CEND 17/12
North Sea (FU5 and FU6)

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07/10/2012 10:00 BST – 17/10/2012 23:00 BST

INTRODUCTION

The Norway lobster (*Nephrops norvegicus*) is common throughout the North Sea being a very important fishery for the UK. The present survey focuses two areas of the North Sea, the Farn Deeps (FU6) in the NE coast of England and the Botney Gut / Silver Pit (FU5), an offshore ground shared by the UK and Dutch national waters (Figure 1). Total landings in 2011 for these areas reported 2070 tonnes and 1053 tonnes, respectively.
Currently the assessment on *Nephrops* stocks, in the North Sea, is based on underwater television surveys (UWTV) which provides a fishery independent estimate of stock size, exploitation status and catch advice (ICES, 2008). The *Nephrops* stock assessments are run annually and accordingly on advice from ICES the EC sets annual TACs for this species.

CEFAS has performed annual UWTV surveys since 1996 in the Farn Deeps while just in autumn 2010, for the first time, a TV *Nephrops* survey was undertaken at Botney Gut Silver Pit grounds. In the last couple of years, due to bad weather and lack of visibility the total coverage of the grid in the Botney Gut Silver Pit grounds was never complete.

The specifics objectives of 2012 survey are listed below:

1. To conduct a standard underwater TV survey of *Nephrops* burrow densities.
   - Farn Deeps grounds, 55° 35' - 54° 45' N and 1° 30' - 0 ° 40' W (110 stations).
   - Botney Gut Silver Pit grounds, 54° 20' - 53° 40' N and 1° 20' - 3 ° 15' E (54 stations).
2. To conduct seabed multibeam survey at and between TV survey stations (both grounds, to characterise sediment features).
3. To collect turbidity data (both grounds)
4. To conduct seabed sediment sampling at the Botney Gut Silver Pit grounds, using a day-grab.
5. To conduct some trials with the sediment profile imagery (SPI) camera to take cross section photographs of soft sediment.

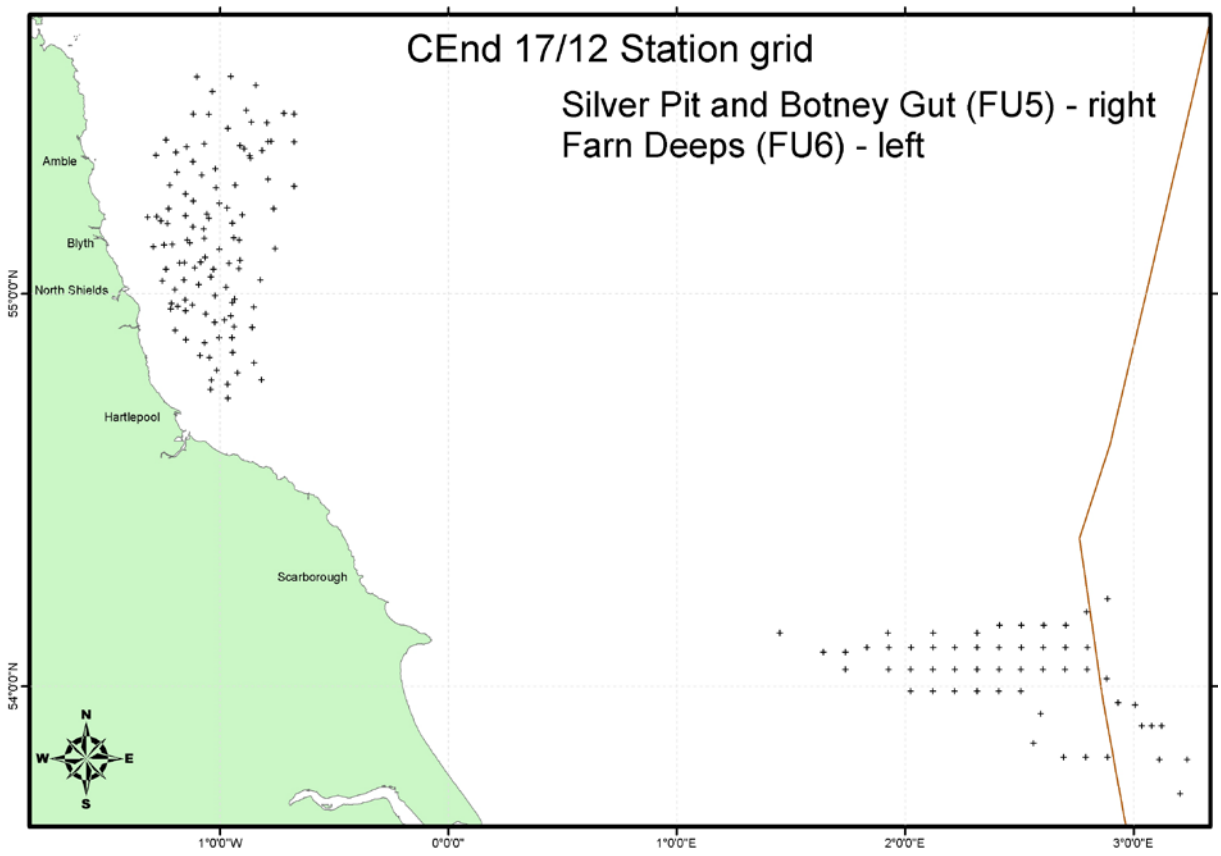


Figure 1 – Map showing the location of both Function Units surveyed.

MATERIAL AND METHODS

The 2012 North Sea *Nephrops* UWTV survey took place on RV Endeavour between 7th to 17th October. The departure and arrival port was Lowestoft.

Survey design

For the Farn Deeps the survey design is based on a randomised fixed grid and includes a total of 110 stations. The survey design for the main area of the Botney Gut / Silver Pit grounds is also based on a randomised fixed grid with approximate 3 nautical miles distance in-between stations. The initial ground perimeter has been delimited by the combination of VMS data and BGS sediment maps.
At each station a sledge mounted TV camera was deployed and a clear 10 minute tow was recorded onto DVD and DVT. Vessel position (DGPS) and position of sledge (using a USBL transponder) were recorded every 1 to 2 seconds.

The sledge was equipped with (see Figure 2):

- A camera at an oblique angle to the sea bed, sighted towards the front of the sled; the standard Smirad camera was used in this survey. After doing some trial runs with the HD camera in Apr 2012 survey and comparing standard footage with HD recordings no clear evidence was found that the HD footage was clearer. Thus, until further technological

developments the Simard camera will be the standard camera used allowing also a wider filed of view.

- The sledge was mounted with 5 LED lights. The novelty this year was the use of new software (build in-house) that allowed a remote control of the light intensity: 2+2 LED lights on the side plus 1 LED light on the top to fully illuminate the field of view.
- Two fan lasers (red colour) to delimit the field of view (field of view 81.5 cm);
- A transponder so that the sledge can be retrieved if lost;
- An ESM2 logger, to record turbidity readings.

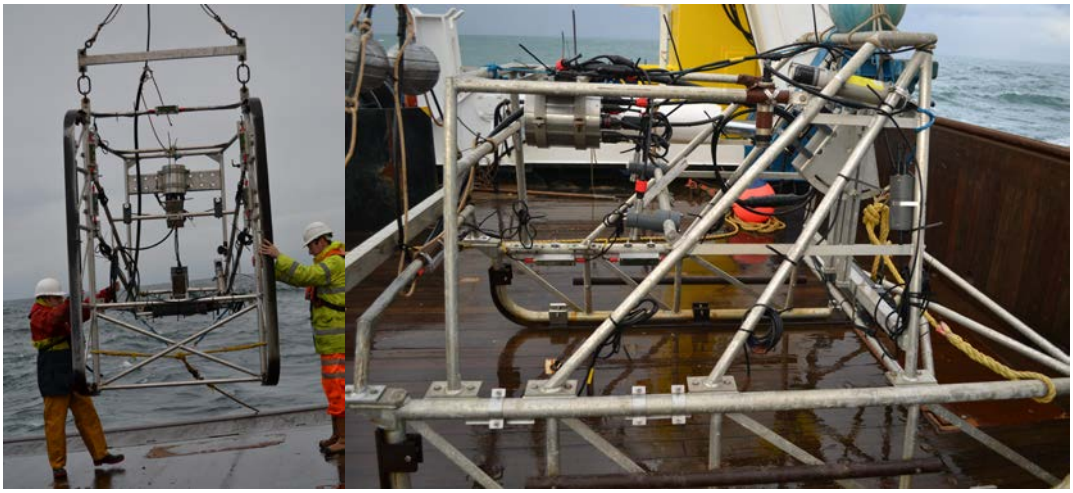


Figure 2 – Sledge used during CEnd17/12, showing the equipment setup. *Photos by Robin Masefield (Cefas)*.

The Dynamic Positioning system (DP) was used throughout the survey to provide a controlled towing speed of around 0.7 knot.

Swathe data were collected on the survey between and over TV stations. Due to time constraints the run through the stations in the Farn Deeps was cut down, so approximately 36 TVIDs on the Farn Deeps were covered. In the Botney Gut / Silver Pit grounds 20 TVIDs were surveyed.

Recounts

In line with SGNEPS recommendations all scientists were trained/re-familiarised using training material and validated using reference footage (measured by Linn's concordance correlation coefficient (CCC)) prior to recounting Oct 2012 footage. A limit of 0.5 was used to identify counters who need further training. On completion of this process, all CEND 17/12 recounts were conducted, as blind counts, by two persons during the survey. Here, the number of *Nephrops* burrow systems and the activity in and out of the burrows were counted by each minute block (for 7 clear minutes). In case the field of view became obscured by cloud the seconds obscured were recorded and all minute blocks with more than 20 minutes obscured were rejected. After all counts completed again the Linn's CCC was applied to check which stations needed to be revisited and were a 3rd or 4th counter needed to be added.

Whilst reviewing the videos, the visibility, ground type, trawl marks, occurrence of bio-fauna, ground contact of the sledge, cloud and any other interference was recorded during each one-minute intervals, using a classification key.

For posterior analysis, counts of burrow systems are converted into densities at each station using the width of view (81.5 cm) and the length of the tow (extracted from tower position vessel logging). Each system is assumed to represent one adult *Nephrops* and occupancy is assumed to be 100%. To estimate the spatial structure of *Nephrops* densities a geo-statistical analysis is carried out in the whole area and the total survey abundance, variance and confidence limits are then calculated.

Sediment samples (Botney Gut/Silver Pit grounds)

In order to map the sediment of the Botney Gut/Silver Pit grounds a 0.1 m^2 day-grab was used in each station. This device samples an area of 0.1 m^2, to a maximum depth of 14 cm. The garb was deployed from the side gantry.

The procedure of collecting these samples included:

- Record positions of each day grab dip (manual fix on tower).
- Photograph sediment samples (sample proof).
- From each day grab sample (one per station) 2 sediment samples were collected:
    - One box of sediment (just first 2 cm, fill at least ½ box) for posterior PSA analysis. This sample was frozen after collection;
    - One syringe of sediment was also keep aside in a small jar for testing a new analysis to be compared with the standard PSA analysis. This sample was kept on the fridge.

Figure 2 – Use of the 0.1 m^2 Day grab during retrieving. *Photo by Robin Masefield (Cefas)*.

Sediment profile images - SPI (Botney Gut/Silver Pit grounds)

Figure 3 – Use of the SPI camera during deployment. *Photo by Robin Masefield (Cefas)*.

Sediment profile images were taken in each station (5 replicates in each station, few meters apart). Position was recorded for each replicate. SPI camera deployed from the side gantry (Figure 3).

Health and Safety

As required all staff had a valid ENG1 health certificate and a Personal Sea Survival Certificate.

Also the following risk assessments were acknowledged:

- ✓ FD-C&F-SHELL-SOP-01 MB001 NEPTVBurrowCount SOP V1.3.DOC
- ✓ G02 – Travelling while on official duty in Official or private vehicles, including loading and unloading equipment, baggage, etc, but excluding the carriage of dangerous chemicals, the use of HGV or specialised vehicles;
- ✓ G03 – Participation in research cruises on CEFAS owned and managed ships. The collection of samples and data all subsequent processing whilst on-board, including the use of the ships sea-rider.
- ✓ FD-CF-SHELL-RA-09-MB001 – *Nephrops* TV cruise activities
- ✓ SOP_ 1386_SPI.doc
- ✓ HS26 EE-MENA-MET-RA-07 SOP 1386-Sediment Profile imaging.XLSX
- ✓ HS26 EE-MENA-MET-RA-03 SOP 1381-Day grabbing(2).XLSX
- ✓ Updated Day Grab SOP 1381.pdf

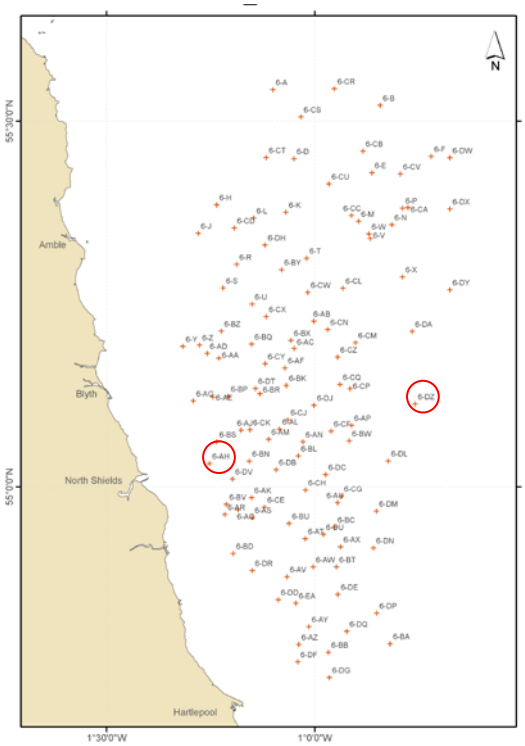
No COSHH required for the present survey.

RESULTS and FINAL CONSIDEARATIONS

Technical aspects/failures

Minor issues were raised regarding tower, which showed frequent error messages and failed in some stations. Also the multibeam system showed recurrent error messages due to a problem identified after the survey in one of the sensors. At the moment the multibeam data was not yet analysed so it is uncertain how this failure affected the data collected.

TV survey – Farn Deeps



In October 2012, 110 stations (TVID) were surveyed in the Farn Deeps (FU6), from 8 Oct (02:15 GMT) to 13 Oct (20:00 GMT) (see figure on left).

Due to a very intense trawling activity this year, 16 TVID stations were repeated at least once (Table 1), until a reasonable good visibility was achieved. With the exception of 6-AH and 6-DZ stations (marked with a red circle in the figure) all others were successfully completed. This has been a recurring problem from last surveys and so it is recommended that the survey moves back, before the start of the fishing season.

A total of 3 CTD dips were carried out to calibrate the multibeam.

Table 1 – Shows the invalid number of repetitions. *after several attempts no footage recorded. **edge station where were too many rocks to be considered safe to record any footage; zero counts.

TVID	Invalid number of repetitions	TVID	Invalid number of repetitions
6-AC	1	6-BV	1
6-AH*	3	6-BX	1
6-AL	1	6-CE	1
6-AR	2	6-CH	1
6-AS	1	6-CM	1
6-AV	2	6-DV	1
6-AY	3	6-DZ**	1
6-BS	1	6-EA	2

Nephrops burrow live-counts were made over a 10-minute tow, which was recorded on DVD and DV tape. All recordings were then recounted under controlled conditions; burrows were counted by each minute block for 7 clear minutes. The counting performance of the 2012 counters was generally high with Linn's CCC scores >0.7 for most of the stations. A map of the observed burrow counts for 2012 on the Farn Deeps is showed in Figure 4.

Preliminary results suggest that stations close to shore tend to show higher counts than those in the eastern side of the ground, similar to last year results.

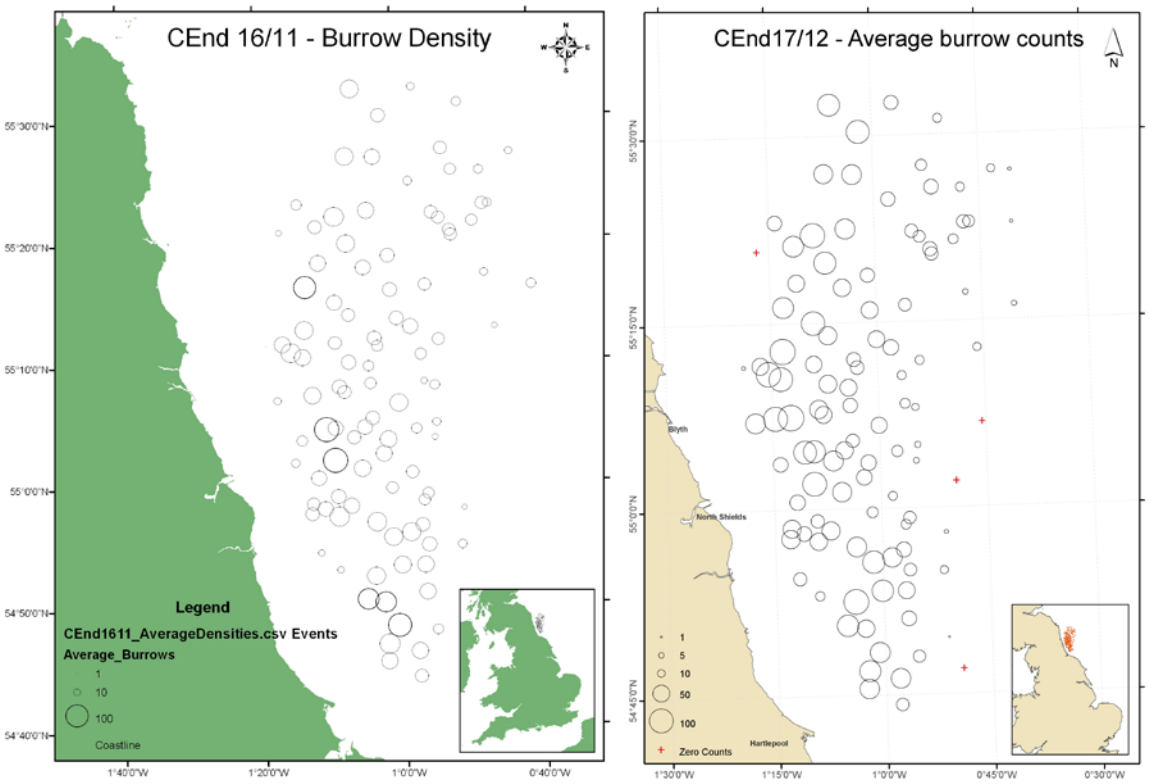
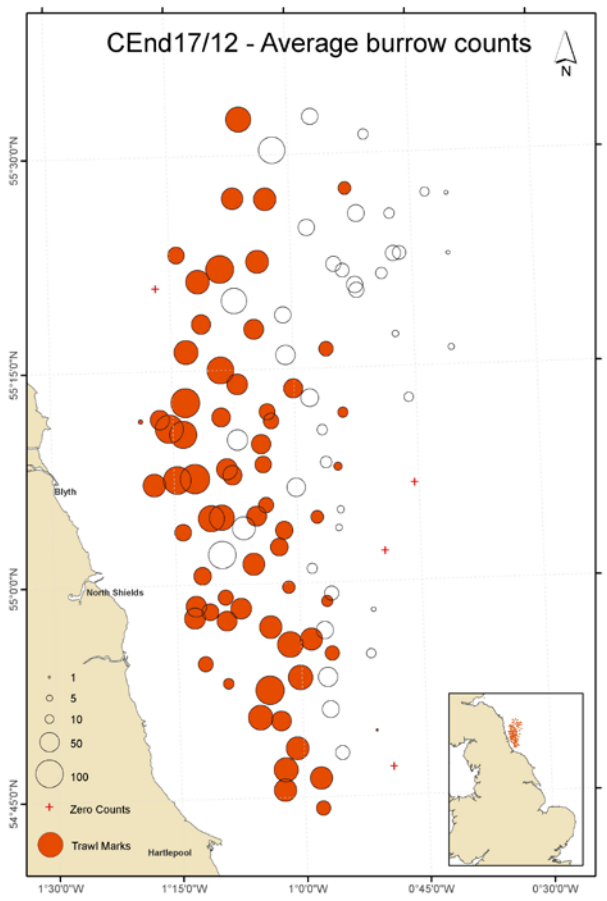


Figure 4 – CEND 17/12 bubble plot of the relative burrow counts from standard TV tows on the Farn Deeps ground. Comparison of 2011 and 2012 average counts.



Trawl marks were noted at 62% of the stations surveyed (Figure 5 – orange stations) compared with 43.6% in last year. The survey timing ran into the start of the fishing season and this activity disturbed our work, mainly close to shore off North Shields.

It is important to highlight the occurrence of trawl marks on the footage; it makes identification of *Nephrops* burrows more difficult as the trawl marks remove some signature features making accurate burrow identification more difficult; only occupied *Nephrops* burrows will persist in heavily trawled grounds and it is assumed that each burrow is occupied by one individual *Nephrops*.

Figure 5 – CEND 17/12 bubble plot of the relative burrow counts from standard TV tows on the Farn Deeps ground showing in orange the stations with observed trawl marks.

TV survey – Botney Gut / Silver Pit

In this year survey, on the Botney Gut / Silver Pit ground, poor weather hampered and did not allow the full coverage of the grid. The time spent in the Botney Gut / Silver Pit area was from 14 Oct (06:00 GMT) to 16 Oct (17:00 GMT).

Due to bad weather only 13 of the planned 54 stations were fully completed (sledge + sediment sample + SPI camera + Multibeam coverage) at Botney Gut / Silver Pit. In this ground 20 stations were covered with the TV sledge, but sediment samples were collected just at 14 stations and the SPI camera used at 13 stations (Figure 6).

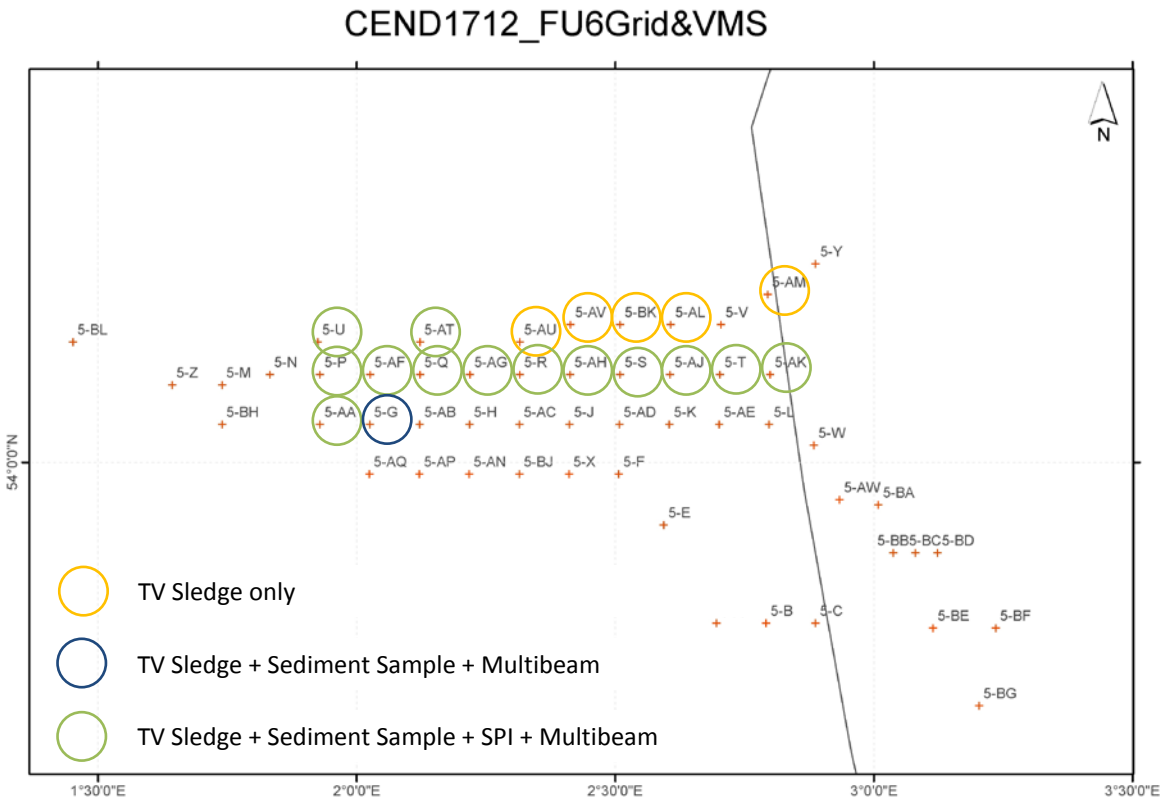


Figure 6 – Map of stations completed in the Botney Gut / Silver Pit area, in Oct 2012.

Data retrieved from the multibeam (backscatter data), sediment samples and SPI will be processed and analysed later on and integrated with the burrow counts densities.
Sediment samples are used to ground-truth multibeam data and the use of sediment profile images could contribute with valuable information on *Nephrops*-sediment assessments, mainly in relation to areas which could exhibit presence of *Nephrops* and relate this to the depth of the apparent redox discontinuity layer (aRPD). The images collected with the SPI camera can provide complementary profile information on burrow depth, structure and sizes.

Few stations were complete to be able to do any abundance comparisons with last survey. Although the general trend was the same being Nephrops more abundant in the eastern side of the ground. No stations were completed in the Dutch national waters (Figure 7).

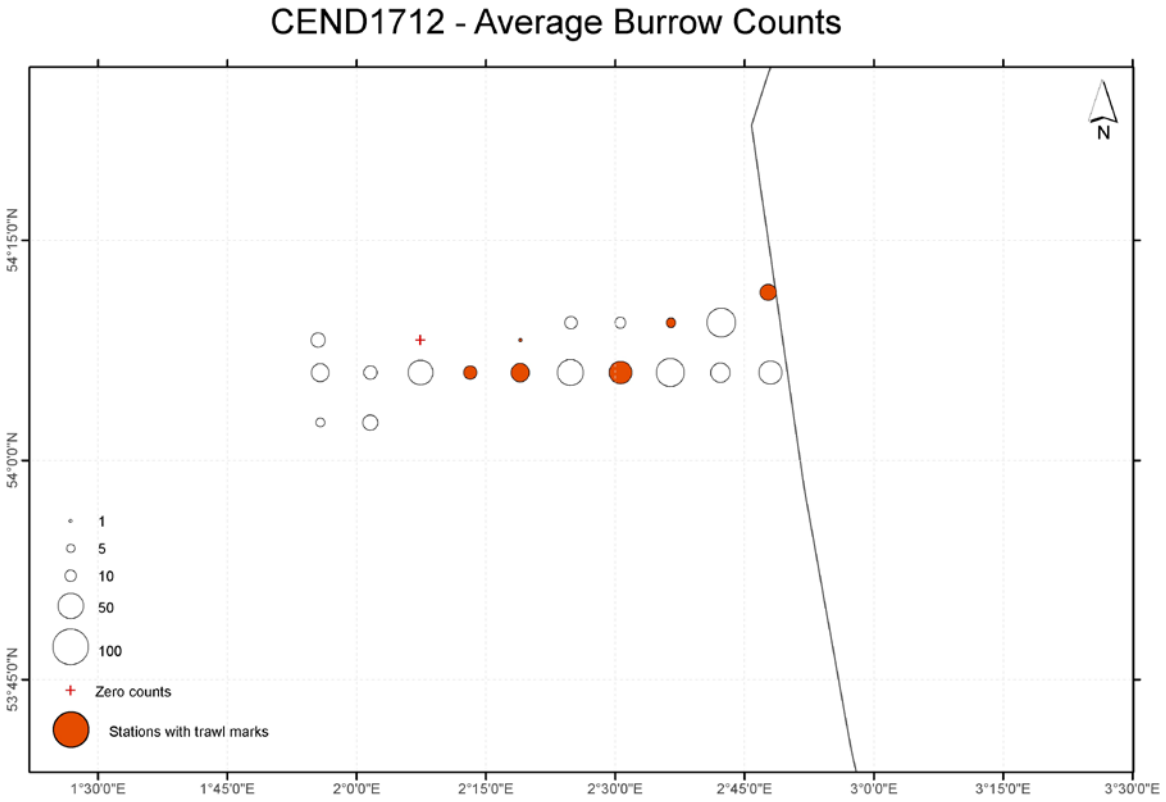


Figure 7 – CEND 17/12 bubble plot of the relative burrow counts from standard TV tows on the Botney Gut / Silver Pit ground showing in orange the stations with observed trawl marks.

The main objectives of the survey were successfully met for this year in the Farn Deeps. The UWTV coverage was excellent (99% stations done) and the overall footage quality was reasonable good in the Farn Deeps grounds due to favourable weather conditions and minimal technical difficulties. Although the survey timing ran into the start of the fishing season making the recording of good footage in the more western stations more difficult. One way of going around the problem was covering these stations overnight when the fishing activity is minimal, although the sediment needs several hours to settle down and the visibility was compromised in some cases.
In this year survey, beside the several attempts on covering the Botney Gut / Silver Pit grid the poor weather did not allow the full coverage of the TV stations.

ACKNOWLEDGMENTS

We would like to express our thanks and gratitude to the Captain and crew of RV Endeavour for their good will and professionalism during the survey. Also thanks to P&O Maritime for handling all gear and sort any technical difficulties. Finally, thanks to all CEFAS staffs onboard for their hard work and enthusiasm in making this survey a success.

Ana Leocadio (SIC), 05/11/2012