

# DEVELOPMENT OF TECHNIQUES FOR MAPPING SEABED BIOTOPES IN UK COASTAL WATERS - AN INTEGRATED APPROACH

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## Introduction

Recent advances in acoustic technologies are offering new insights and opportunities to explore and map seabed habitats.

High-resolution biotope maps of the seabed may assist in future site-specific environmental assessments of potential aggregate dredging areas, and would be of value during any subsequent environmental monitoring activities. For this reason, a three year programme of research funded by the Ministry of Agriculture, Fisheries and Food was initiated by CEFAS in April 1998. The main aim of the work was to investigate the utility of several acoustic remote sensing techniques, used in conjunction with biological sampling and underwater video surveys, for mapping seabed biotopes (i.e. physical habitats and their associated biological communities) over regions of coarse substrates.

Four sites were selected in the eastern English Channel to develop the mapping techniques (Figure 1). The sites were chosen to offer a wide range of substrata of varying degrees of spatial complexity (sediment patchiness) in order to determine the capacity of the techniques to discriminate between neighbouring biotopes. The following example, from the Hastings survey site, works through the various stages in the mapping process.

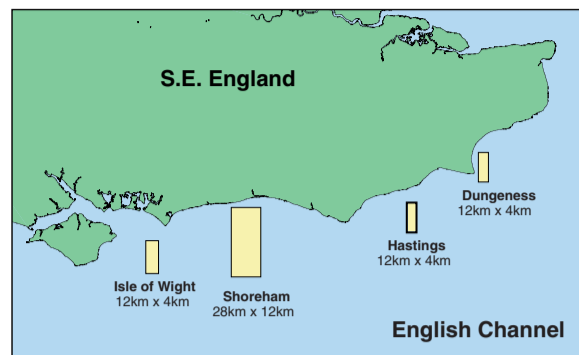


Figure 1: Eastern English Channel

## Data interpretation

The example below shows the Hastings survey site which covered an area of seabed 12km x 4km in size (Figure 1) and crossed Hastings Shingle Bank. The site was divided into four acoustically distinct regions (A, B, C and D) based on the sidescan sonar data. Ground-truthing using underwater video revealed that each region related to a discrete physical habitat. Examples from the sidescan record from each region, along with photographic images of the seabed, are shown below.

Sampling stations for the Hamon grab and 2m beam trawl surveys were randomly distributed within each of the four regions. Macrofaunal species were identified and enumerated, and sediment samples were analysed for their particle size distribution.

### Region A



Seabed

Sidescan

### Region B

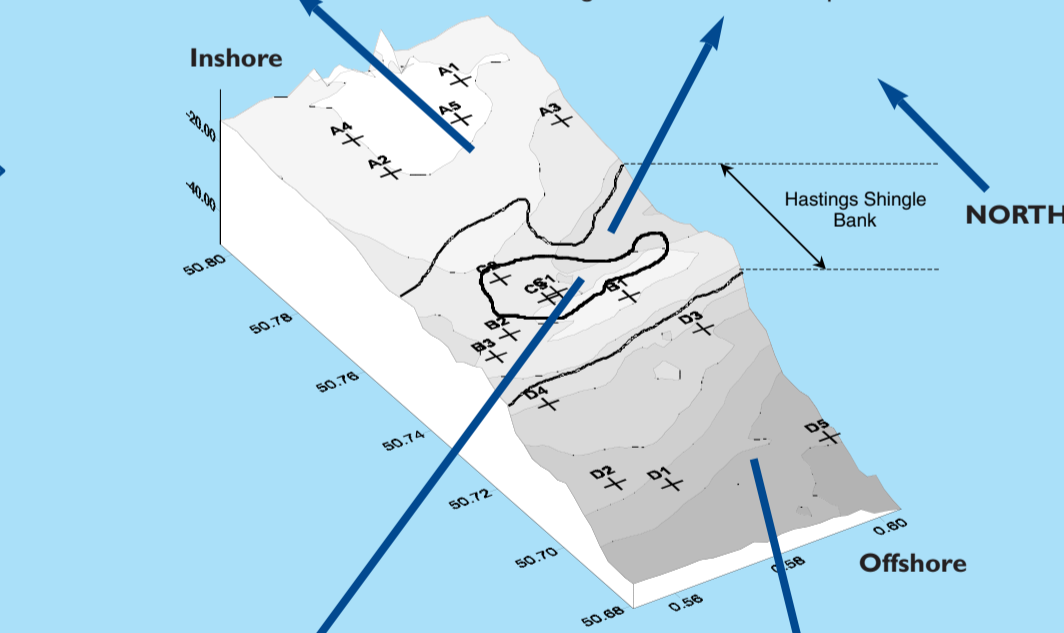


Seabed

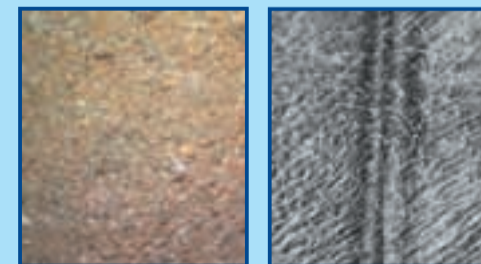
Sidescan

Region A – This was the region furthest inshore. The substratum consisted of fine rippled sand, the morphology of which was visible on the sidescan sonar mosaic. Large numbers of polychaete tubes were present across the region just below the surface of the sand.

Region B – The dark sidescan sonar trace from this region indicated the presence of a highly reflective (i.e. hard) seabed. This region related to the undredged area of Hastings Shingle Bank, and underwater video footage revealed the presence of coarse gravel with abundant epifauna.



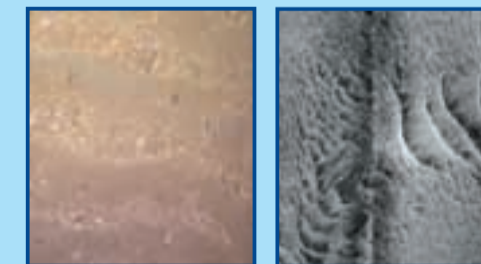
### Region C



Seabed

Sidescan

### Region D



Seabed

Sidescan

Region C – The sidescan sonar data revealed the presence of dense dredge tracks. The substratum within this region consisted of finer, sandier gravel than that present in the undredged area (Region B). There was very little epifauna.

Region D – This region was furthest offshore. The substratum was similar to that of Region A, but there were small amounts of gravel mixed in with the sand. The seabed surface consisted of larger sand waves than those identified from the sidescan sonar data in Region A.

## Output

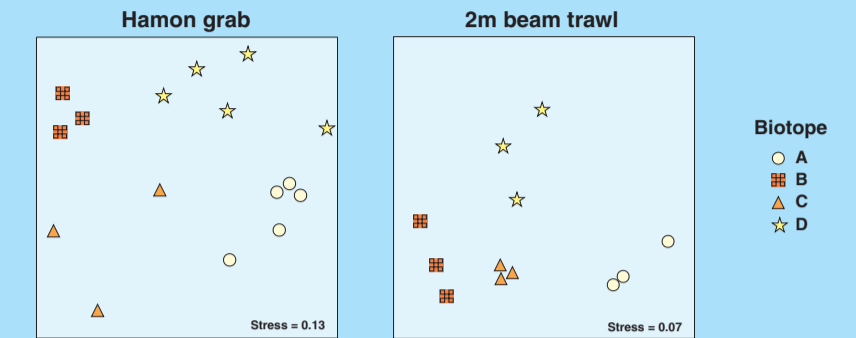


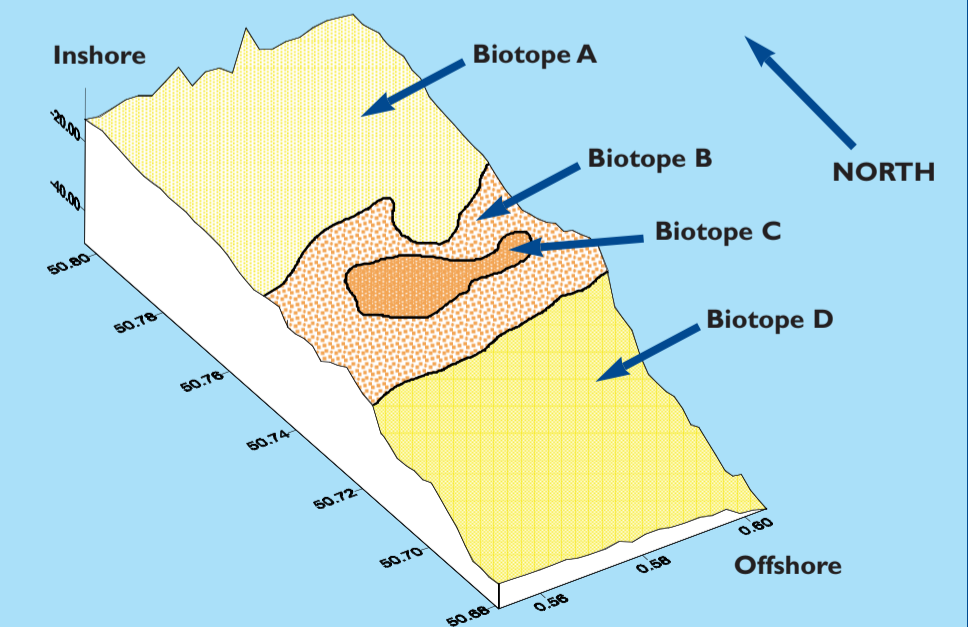
Figure 6: MDS plots for macrofaunal assemblages from the Hamon grab and 2m beam trawl surveys

Using the Hamon grab and beam trawl data from each of the survey sites, sample and species associations were assessed by non-metric multi-dimensional scaling (MDS) ordination. Further multivariate statistical methods were used to test whether community structure was statistically distinct within each acoustic region and to identify characterising species. MDS plots from the Hastings site are shown in Figure 6. Statistically distinct communities were identified within each of the four regions, and this was the case for data collected using both the Hamon grab and 2m beam trawl.

Biotope	Symbol	Biotope description	Characterising species
A	○	Shallow water, polychaete dominated fine sand	Polychaete worms such as <i>Spiophanes bombyx</i> , <i>Magelona johnstoni</i> , <i>Nephtys cirrosa</i> and <i>Aphrodita aculeata</i> .
B	■	Coarse, undredged gravel with attached epifauna	The soft coral Dead Man's Fingers ( <i>Alcyonium digitatum</i> ), The sea urchin <i>Psammechinus miliaris</i> , the sea anemone <i>Metridium senile</i> , the hydroid <i>Sertularia</i> , the serpulid polychaete <i>Pomatoceros triquetus</i> and the encrusting bryozoan <i>Schizomavella</i> .
C	▲	Disturbed (dredged) sandy gravel	Whelks of the genus <i>Hinia</i> .
D	★	Deeper water, coarse sand	The brittle star <i>Ophiura ophiura</i> .

Table 1. Biotope descriptions and characterising species from each of the four regions

The derivation of biotopes was based on the statistical analysis and interpretation of the biological, video and geophysical data sets at each site. Where possible, both Hamon grab and beam trawl data were used to obtain a good cross section of the benthic assemblages from each physical habitat. Using all the available information it was possible to identify discrete biotopes at each of the survey sites, although acoustic regions did not always support statistically distinct communities. In such cases two or more acoustic regions were often grouped together to form one biotope on the basis of similar biological traits. At the Hastings site four biotopes, one from each region, were identified (Table 1). The geographical distribution of these biotopes could then be mapped based on the 100% sidescan sonar coverage of the area.



## Acknowledgement

The work described here was funded by the UK Ministry of Agriculture Fisheries and Food under contract AE0908.

## Data acquisition

At each of the four study sites intensive surveys covering 100% of the seabed were carried out using a digital chirps sidescan sonar system (Figure 2). Post-processing software was used to mosaic the sidescan sonar tracks (Figure 3) and each survey area was divided into acoustically distinct regions based on the textural information derived from the sidescan record and underwater video data collected from across the sites. These regions were subsequently used to design ground-truthing surveys.



Figure 2: Datasonics digital chirps sidescan sonar fish

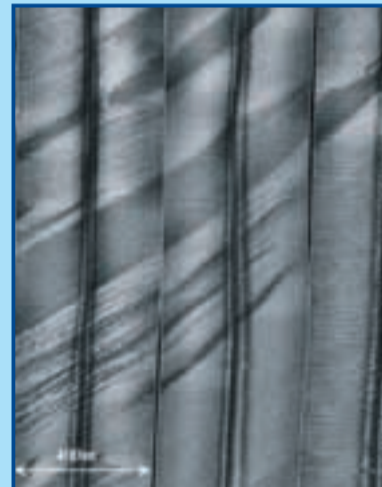


Figure 3: Sidescan sonar mosaic. Each track is 400m wide



Figure 4: Hamon grab with video and light attached

A 0.1m<sup>2</sup> Hamon grab fitted with an underwater video and light was used to sample macrobenthic communities and sediments from each acoustic region at each of the four sites (Figure 4). In addition, epifaunal surveys were also carried out using a heavy-duty 2m beam trawl (Figure 5), and video footage of the seabed was collected from across the survey areas using a drop camera frame fitted with an underwater video and lights.

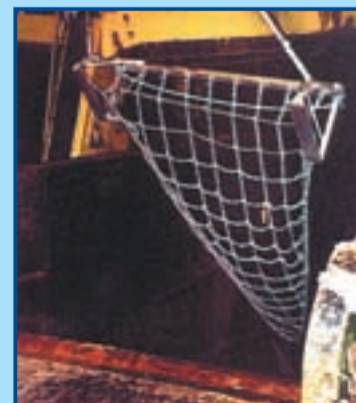


Figure 5: Heavy duty 2m beam trawl