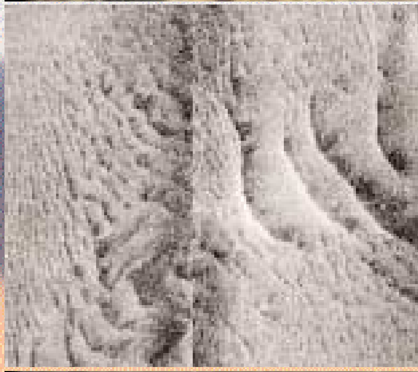
HABITAT MAPPING USING ACOUSTIC TECHNIQUES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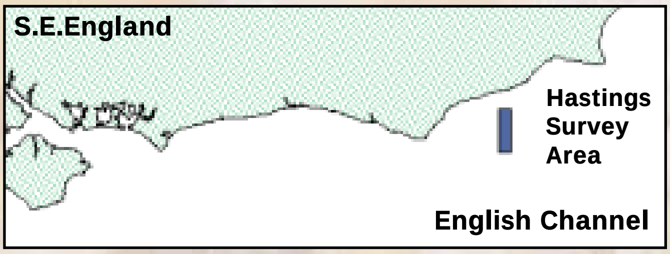
Recent advances in acoustic technologies are offering new insights and opportunities to explore and map seabed habitats. High-resolution biotope maps of the seabed may assist in future site-specific environmental assessments of potential aggregate dredging areas, and would be of value during any subsequent environmental monitoring activities.

For this reason, a three year programme of research was initiated by CEFAS in April 1998 (AE0908). 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.

The following example, from a survey site near Hastings, works through the various stages in the mapping process.

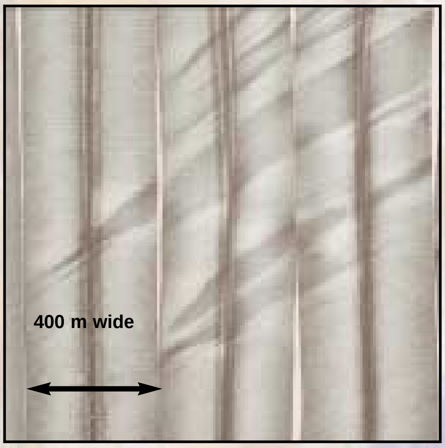


Data collection

Acoustic

Datasonics digital chirps sidescan sonar fish

An intensive survey covering 100% of the seabed within the survey area was carried out using a digital chirps sidescan sonar system. Post-processing software was used to mosaic the sidescan sonar tracks 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.



Sidescan sonar mosaic.

Ground truthing

Hamon grab with video and light attached

A 0.1m^2 Hamon grab fitted with an underwater video and light was used to sample macrobenthic communities and sediments from each acoustic region. In addition, epifaunal surveys were also carried out using a heavy-duty 2m beam trawl, 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.

Heavy duty 2m beam trawl

Data interpretation

The Hastings survey site 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.

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.

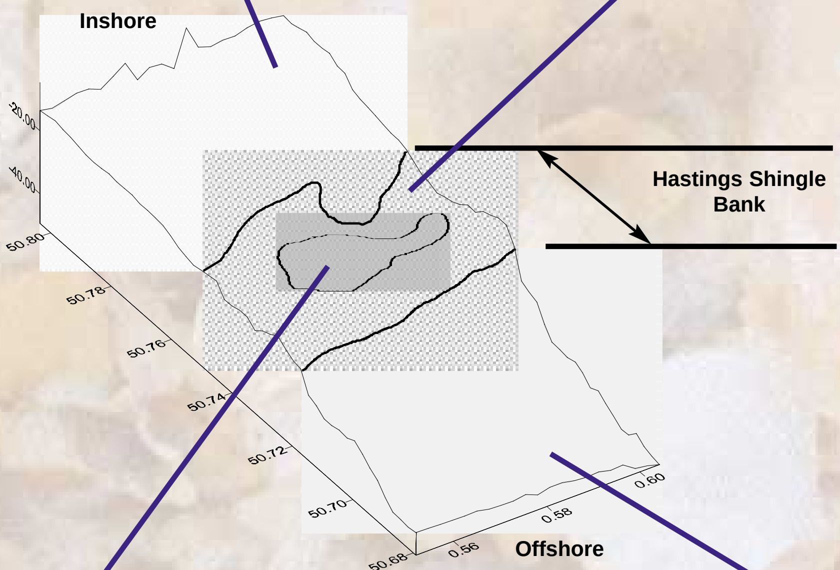
Biotopes were then derived based on the statistical analysis and interpretation of the biological, video and geophysical data sets at each site. Statistically distinct biological communities were identified within each of the four acoustic regions, meaning that each region represented a different biotope.

Biotope A - *Shallow water, polychaete dominated fine sand*

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. Characterising species were polychaete worms such as *Spiophanes bombyx*, *Magelona johnstoni*, *Nephtys cirrosa* and *Aphrodite aculeata*.

Biotope B - *Course, undredged gravel with attached epifauna*

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. Characterising species included the soft coral Dead Man's fingers (*Alcyonium digitatum*), the sea urchin *Psammechinus miliaris* and the tube dwelling polychaete *Pomatoceros triqueter*.



Biotope C - *Disturbed (dredged) sandy gravel*

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 (Biotope B). *Hinia* were characteristic of this biotope.

Biotope D - *Deeper water, coarse sand*

This region was furthest offshore. The substratum was similar to that of Biotope 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 Biotope A. This biotope was characterised by the brittle star *Ophiura ophiura*.





Conclusions

- An integrated approach, using a combination of physical (Hamon grab and 2m beam trawl), geophysical (sidescan sonar, AGDS) and visual (video) techniques provided a robust approach to seabed mapping. It is recommended that a combination of survey techniques are used when producing high-resolution biotope maps of an area.
- The techniques and approaches employed under AE0908 would be suitable for use in mapping gravel biotopes at potential aggregate extraction sites.
- Acoustic methods should NOT be used in isolation as a tool for the prediction of seabed traits (biological and physical) and ground-truthing methods should ALWAYS be used to confirm interpretations.
- Swathe acoustic systems, such as sidescan sonar, out-performed single beam acoustic systems such as AGDS. However, single beam systems tend to be much cheaper than swathe systems and provide useful information concerning the seabed surface traits which can be complementary to swathe acoustic data.
- It is recommended that as many components of the benthic community are sampled as possible (i.e. both macro-infauna and epifauna), through the use of a combination of sampling techniques, in order to provide a more realistic means of describing the benthic ecosystem.
- Sediment type and seabed morphology appeared to be the major variables influencing community composition in the areas studied during this investigation.
- Acoustic technology is constantly changing and improving. Therefore, it is important that the mapping methodology is reviewed regularly, and augmented with the incorporation of improved acoustic techniques where appropriate and where cost permits.

Additional Information

Further details regarding the techniques outlined in this leaflet are described in the CEFAS Science Series Technical Report No. 114 "Mapping of gravel biotopes and an examination of the factors controlling the distribution, type and diversity of their biological communities.". This can be found at http://www.cefas.co.uk/publications/tech114.pdf
Further details on single beam systems can be found in a report produced by CEFAS and The University of Newcastle: "Ensuring continuity in the development of broad-scale mapping methodology - direct comparison of *RoxAnn and QTC-VIEW* technologies". http://www.cefas.co.uk/publications/????

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