GROUND-TRUTHING ACOUSTIC SURVEYS AT AREAS OF ANTHROPOGENIC IMPACT I: CHARACTERISATION OF HABITATS IN AN AREA LICENSED FOR AGGREGATE EXTRACTION

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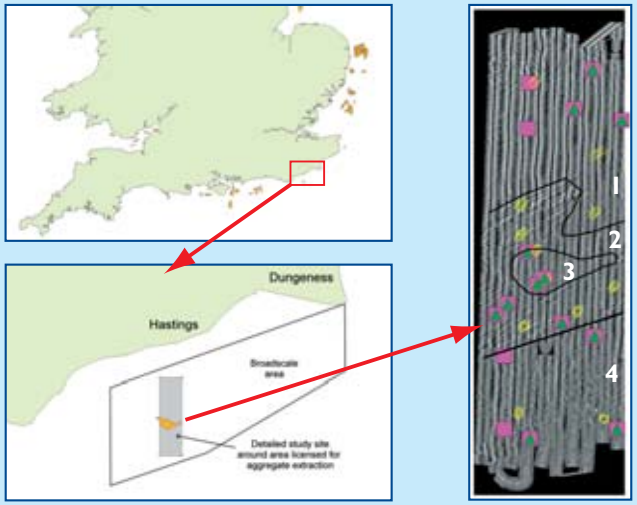
Background:

Dredging for aggregates is a significant industry around the UK shores, with an annual take of ~ 23 million tonnes. These 'marine won' aggregates are used in a variety of applications, from beach nourishment to road building. Dredging at sea is strictly controlled, and only permitted in areas licensed for aggregate extraction. These total 1,700 sq km, with a typical water depth of 20 - 40 m.

A licensed area off Hastings has been monitored since 1999. Detailed studies in a rectangle (4 x 12 km) bounding the licensed area have been complemented by broader scale surveys of a more extensive area (40 X 15 km) between Hastings and Dungeness.

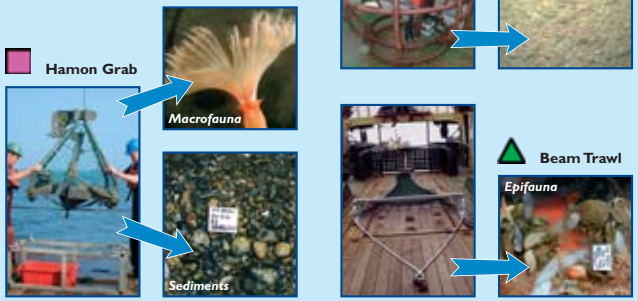


Detailed study:

The first survey aimed to acoustically map and ground-truth the detailed study site. 100% sidescan coverage was achieved and the image mosaiced overnight to enable ground-truth sampling the following day. This early interpretation of the sidescan was necessarily rapid and simple, characterising the site into four 'acoustically distinct areas' (1-4). Ground truth samples were collected from each area based on a random stratified design. Hamon grabs provided samples for particle size analysis of sediments and evaluating infaunal communities, while small beam trawls sampled the epifauna. Drift dives with a drop camera (video and stills) gave visual images of the seabed.

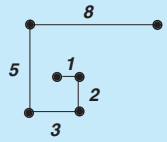
This work was first reported by Brown *et al* (2001) who used the ground-truthing data to show the acoustically distinct areas were significantly different and could be described as separate biotopes. However, they noted a relatively high degree of variability between replicate ground-truth samples within acoustic areas, both in the characteristics of the sediment and the composition of the infaunal communities.

Ground-truthing techniques



Subsequent to the first survey, a more comprehensive interpretation was made of the sidescan mosaic, taking into consideration sediment type and bedform topography. This produced a seabed facies map, having 9 distinct facies, as opposed to the 4 acoustically distinct areas of the original interpretation. Overlaying the original ground-truth positions on the new facies map showed that a number of different facies had been sampled within each acoustically distinct area, which may account for the variability within replicates noted by Brown *et al*. Consequently, the site was re-visited to ground-truth the facies map.

A novel sampling design was tested for grab sampling. Based on the Fibonacci series of numbers (1,2,3,5,8,13; add the previous two to get the next) the sampling pattern described a linear spiral (below) with sides of relative length 1,2,3,5 and 8. This gave six sampling points, having a total of 15 different lag distances between the points (5+4+3+2+1=15). Dubbed the 'snail-trail', this provided a more structured approach to testing variability within a facies than would a random stratified sampling design.



Hamon grab pattern

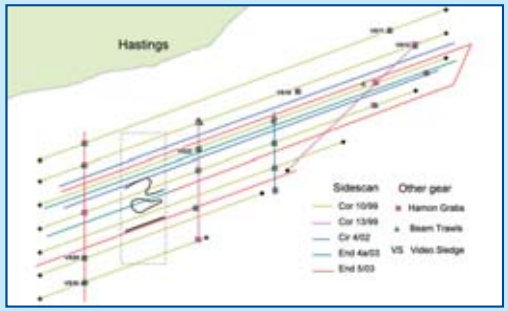
Beam trawl tows

Video sledge tows

Epifauna were again sampled by 2-metre beam trawl, using standardised tows over 200 m within each facies. However, video sledge tows were targeted to cross the boundaries between seabed facies, in order to assess how abrupt they were in reality, with positional accuracy being monitored by an acoustic location system attached to the sledge. The video record also provided valuable information for ground-truthing the bedforms and examining niche habitats such as dredge tracks or sand waves.

Broadscale Surveys:

To place the detailed surveys in context, further surveys have been conducted over a broad scale area, as outlined below. Given that 100% sidescan coverage of such an area (~ 600 sq km) can be costly and time consuming, the strategy has been to gradually build up a series of sidescan lines to achieve progressively greater density of coverage. In the first year, the basic grid of 7 parallel lines spaced 2 km apart was collected on *Corystes* (Cruise 'Cor 10/99'); subsequent cruises on *Cirolana* and *Endeavour* have augmented these with a pattern of 'in-fill' lines. These surveys are being used to explore the relationship between density of sidescan coverage and confidence in detecting and interpreting broad scale patterns and features. That interpretation will be informed by the ground-truth samples taken during the surveys and by legacy data relating to seabed sediments and sub-surface geology held by the British Geological Survey. In combination, the detailed and broad scale studies will enable us to characterise seabed habitats at different spatial scales.



Acknowledgements

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References

Brown, C.J., Hewer, A.J., Meadows, W.J., Limpenny, D.S., Cooper, K.M., Rees, H.L. & Vivian, C.M.G. (2001). Mapping of gravel biotopes and an examination of the factors controlling the distribution, type and diversity of their biological communities. CEFAS Science Series, Technical Report, Number 114.

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