GROUND-TRUTHING ACOUSTIC SURVEYS AT AREAS OF ANTHROPOGENIC IMPACT II: SEABED CHARACTERISATION OF AN AREA LICENSED FOR DREDGED MATERIAL DISPOSAL

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Aim of the study:

To evaluate seabed mapping and other techniques as monitoring tools for assessing temporal changes in community structure at disturbed sites where there are time-dependant variations in the nature and intensity of impacts (e.g. dredged material disposal sites).

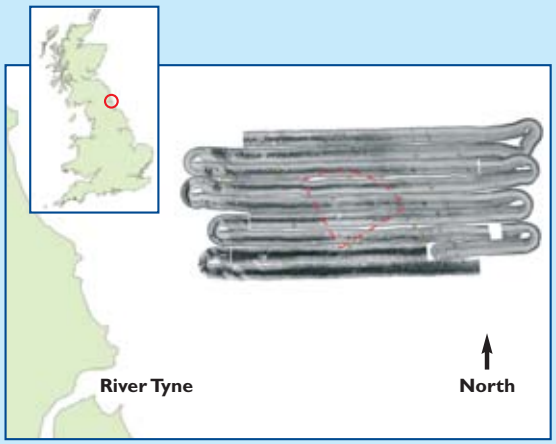


Figure 1: Location of study, showing licensed disposal area (red) and stations sampled for ground-truthing

Background:

An area of seabed offshore of the river Tyne is licensed for the disposal of dredged materials. Currents in this area are moderately strong, and the site possesses dispersive characteristics. In recent times, over 100,000 tonnes of material has been deposited per year, mostly in the form of maintenance dredgings from the Tyne estuary. This deposited material (typically sand, silt and gravel) can cause long term environmental impacts, therefore the area has been monitored using acoustic surveys and a variety of ground-truthing techniques.

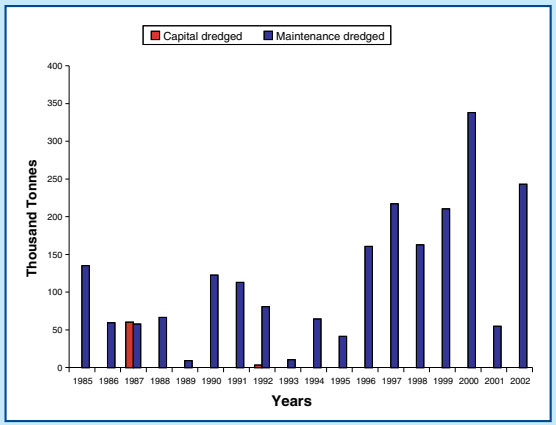


Figure 2: Annual quantities of capital and maintenance dredged material deposited at the study site

Annual surveys:

Sidescan surveys show a clear, persistent footprint of deposited material inside the licensed disposal area (Figures 3a and b). An acoustic ground discrimination system (AGDS) provided another layer of information (Figure 3c) and, in combination, the sidescan and AGDS were interpreted to map the site into acoustically distinct areas. A random stratified sampling design was then used to ground-truth each area. Sediments and infauna were sampled by a 0.1 m² Hamon grab (Figure 3c) and epifauna by small beam trawls. Optical methods (drop camera and camera sledge) were used to examine the seabed surface.

A Sediment Profile Imagery (SPI) system was tested in 2003 to compare the vertical profile of the surficial sediments in and around the disposal site (Figure 4). These images were analysed for attributes, such as penetration, surface roughness and depth of the apparent redox layer, to derive indices of Benthic Habitat Quality (BHQ) and Organism Sediment Index (OSI) that further characterise the status of the seabed.

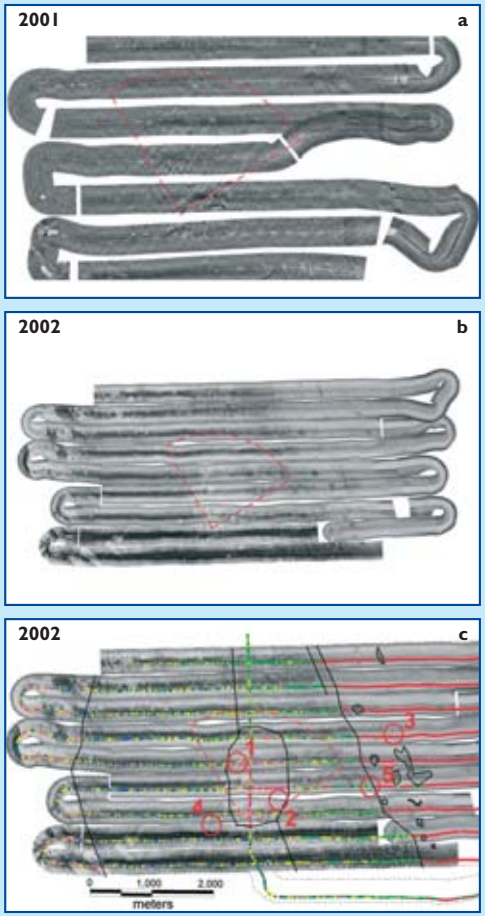
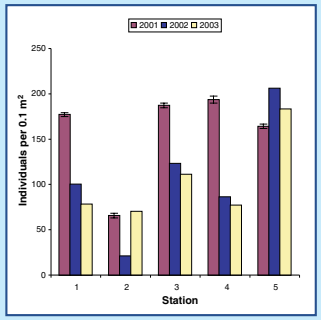
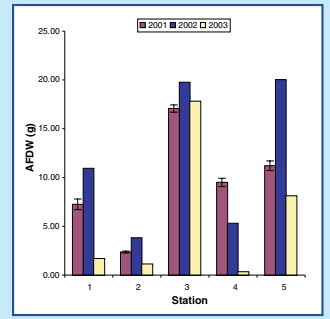
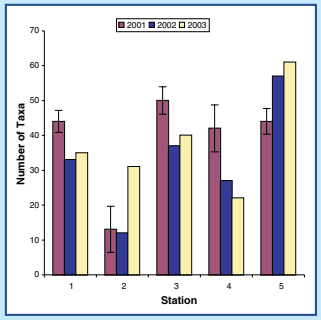


Figure 3: (a) and (b) Sidescan mosaic images of the study area for 2001 and 2002. (c) shows the sidescan mosaic overlain with the output from an AGDS survey, and the position of ground-truth sampling stations within each acoustically distinct area

Figure 4: In situ photographs captured by the SPI camera of vertical sections through surficial sediments at three of the stations in Figure 3c







Faunal studies:

Spatial and temporal changes in macrobenthic communities were assessed throughout the site. Early results indicate a reduction in total abundance (Figure 5), biomass and species richness of organisms in the vicinity of the licensed disposal area, showing station 2 having the lowest values.

Figure 5: Variations in univariate metrics for the five stations indicated in Figure 3c

Concluding remarks:

This study demonstrates the advantages of combining conventional sampling methods, acoustic techniques and optical imaging devices when assessing anthropogenic effects on the seabed and its associated communities. Their collective contribution has allowed a more thorough ecological appraisal of this site than would be possible using any single approach in isolation. In the context of environmental monitoring and management, meaningful seabed characterisation can be achieved through a combination of acoustic surveys and a variety of ground-truth sampling techniques.

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