PRELIMINARY OBSERVATIONS ON THE EFFECTS OF DREDGING INTENSITY ON THE RECOLONISATION OF DREDGED SEDIMENTS

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Introduction

Investigations of the physical and biological status of licensed areas in the UK at various times following the cessation of commercial aggregate dredging are very limited and so judgements as to the likely progress towards environmental restoration and the timescales involved continue to be based on predictions rather than real data.

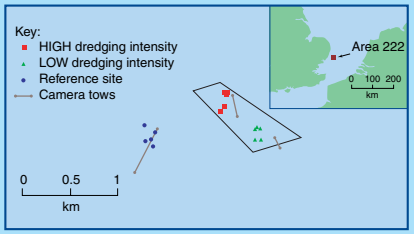


Figure 1: Map showing the location of Area 222 extraction licence and sampling positions in the Southern North Sea

The purpose of this study was to investigate whether different historical levels of dredging intensity affected the subsequent rate of benthic recolonisation at a marine aggregate extraction site (Area 222) after the cessation of dredging. This study is part of an ongoing four year field assessment programme called 'Assessment of the Re-habilitation of the seabed following marine aggregate extraction. It is designed to enhance the understanding of processes leading to physical and biological recovery of the seabed.

The recolonisation of Area 222, which was used for the extraction of sand and gravel for approximately 25 years was examined 4 years after the cessation of dredging (see Figure 1 for location of licensed site).

Survey design and data collection

Since 1993, every vessel dredging on a Crown Estate licence in the UK has been fitted with an Electronic Monitoring System (EMS). This records the date, time and position of all dredging activity, every 30 seconds, to disk. EMS information was interrogated in order to locate areas of the seabed within Area 222 which had been subjected to different levels of dredging intensity (Figure 2). Five replicate samples of the macrofauna and sediments were collected in June 2000 using a 0.1m² Hamon grab from areas representing 2 different levels:

1) >10 hours of dredging within a 100m by 100m block during 1995. This was considered to represent a HIGH dredging intensity
2) <1 hour of dredging within a 100m by 100m block during 1995. This was considered to represent a LOW dredging intensity

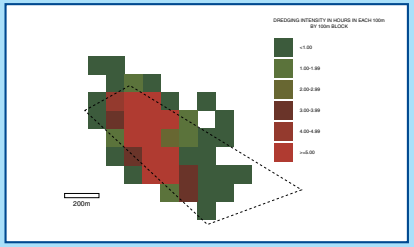


Figure 2: Block analysis of the data extracted from the Electronic Monitoring System for hours of recorded dredging for Area 222 in 1995

Five replicate samples were also collected from a nearby reference location which was considered to be representative of the wider environment surrounding this historic extraction licence (Figure 1).

A sidescan sonar survey using a digital high resolution system was also carried out to provide an indication of the spatial distribution of sediments in the area encompassing the dredge site and also to assist in the estimation of the likely spatial extent of direct and indirect effects of dredging. In addition, video footage of the seabed was collected from across the survey area using a drop camera frame fitted with an underwater video camera and lights.

Results

Fauna

Values of abundance and total numbers of species were significantly lower ($p<0.05$) in an area most recently exposed to the highest level of dredging intensity compared with samples taken from an area of lower intensity, and those from the reference site (Figure 3). Differences between previously dredged sediments and the reference location were due to a reduced abundance of a range of macrofaunal species characterising nearby sediments. Multivariate measures of community structure also indicated that there were significant differences ($p<0.01$) in the macrofaunal assemblages between areas exposed to different dredging intensities (Figure 4a).

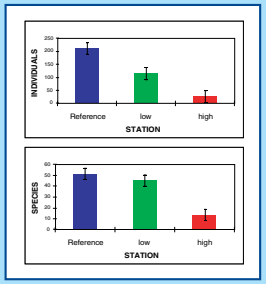


Figure 3: Mean and 95% Least Significant Intervals for univariate measures of community structure four years after the cessation of dredging at high and lower levels of dredging intensity

Correlation analyses

The relationships between various environmental factors and macrofaunal assemblage structure were explored. The best fit between the macrofaunal assemblage structure and a single environmental variable was achieved with hours of recorded dredging intensity in 1995 (Figure 4b). This was the last year that the licensed site was heavily dredged. Other variables were also significantly related to the biological pattern (Figure 4c-f).

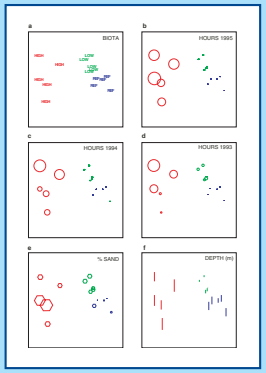
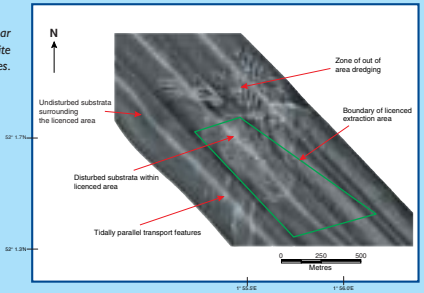


Figure 4: Multi Dimensional Scaling ordination of Bray-Curtis similarities from a) abundance data at the three stations and b-f) the same MDS but with superimposed symbols representing different values of a range of environmental factors

Remote assessment methods

Predominantly sandy substrata was found within the northern part of the extraction site (shown in Figure 5). Dredge tracks were evident from sidescan sonar records in the northern part of the extraction site. There was also an area of seabed disturbance which was characteristic of dredging activity located to the north of the extraction site. In this area, the seabed has an uneven profile and appears on the sidescan record as a series of interconnected pits. Examples of sidescan records are shown in Figure 6. Underwater photography also clearly shows differences between substrates that have been dredged at different levels of intensity and at the reference location (Figure 7).

Figure 5: Mosaiced sidescan sonar survey from Area 222 extraction site illustrating different substrate types.



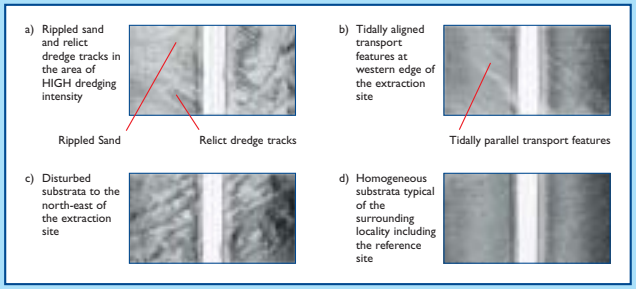


Figure 6: Examples of records from the sidescan sonar survey

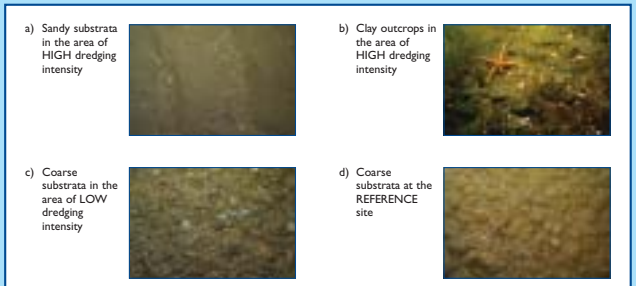


Figure 7: Underwater photographic images taken in 2000 from within and outside Area 222

Conclusions

Preliminary observations at this site indicate that the fauna remains in a perturbed state some four years after the cessation of dredging. Therefore, relatively rapid recovery rates, commonly cited as 2 to 3 years cannot be assumed to be universally applicable.

Future work

The results presented here are from the first year of a four year research programme. Further studies at this and contrasting locations are being undertaken as part of this wider study in order to establish time scales of physical and biological recovery in the aftermath of dredging. It is anticipated that the knowledge and techniques developed during this work will be of great use to aggregate companies, their consultants, regulators and the marine research community in the assessment of impacts on dredged areas, and their recovery post-dredging.

A more detailed account of this work will be available as a peer-reviewed publication during 2003 (Boyd *et al.*, in press).

Reference:

Boyd, S. E., Limpenny, D.S., Rees, H. L., Cooper, K. C. and Campbell, S. (in press). Preliminary observations of the effects of dredging intensity on the recolonisation of dredged sediments of the South-east Coast of England (Area 222). *Estuarine, Coastal and Shelf Science*

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