

Introduction

Results from studies undertaken to assess the effects of natural and man-made impacts on benthic infauna have established that communities are affected in a number of ways within a disturbed area, and that the faunal response can vary depending on the type, intensity and frequency of disturbance. Frequently studied impacts include fishing (Figure 1), dredgings disposal (Figure 2) and organic enrichment from activities such as fish farming (Figure 3).



Figure 1



Figure 2



Figure 3

Indices and measures of disturbance

The ultimate goal of the work presented here is to develop a tractable disturbance index which can be easily utilised by environmental managers. We aim to achieve this through the comparative assessment of the nature and time-scale of faunal responses to varying disturbances using a number of routinely and non-routinely measured community parameters (Table 1).

Table 1

Community parameters	
Routinely taken	Not routinely taken
Total abundance	Maturity Index
Species diversity	Length frequency distribution
Species number	Function (Life history, Morphology, Feeding type)
Biomass	Taxonomic distinctness

To achieve this, the following questions will be addressed

- Which parameter/s provide the best indication of environmental change and degradation?
- Do these indicators vary with the type, intensity and frequency of disturbance?
- Are indicators stable through time and able to distinguish between natural community variance and anthropogenic disturbance?
- Do these indicators vary for meiofaunal and macrofaunal communities?
- Do indicator parameters of the same perturbation vary depending on the regional area?

Field survey data

To allow any natural variation within benthic communities to be discounted from the analysis, long-term baseline data sets will be constructed and analysed from five muddy, unimpacted offshore sites around the UK coast which form part of the UK National Marine Monitoring Programme ★.

Benthic communities from various offshore sites impacted by different types of disturbance will also be analysed. The impacted sites include the Souter Point and Liverpool Bay dredge disposal grounds ◆, fishing grounds in the North Sea ▲ and a historical sewage sludge disposal ground in Liverpool Bay ■ (Figure 4).



Figure 4

Experimental approach and set-up

To confirm causality, a complementary experimental approach has also been undertaken. Two identical field manipulation experiments have been set up on intertidal mudflats, one located in the SE of England, the other in Scotland. These studies are designed to examine the effects of different frequencies of physical disturbance and organic enrichment on macrofauna and nematode communities at varying spatial scales (Figure 5). Each experiment consists of three blocks each containing three treatments (Table 2) designed to mimic anthropogenic disturbances such as fishing gear impacts (raking), inputs from fish farms (organic enrichment) and dredge disposal (burial). Each treatment is applied at two different intensities; high (every 2 weeks) and low (every 4 weeks) and is replicated twice in each block. Within each block there are also two sets of controls, one sampled and one non-sampled. Samples for meiofauna and macrofauna have been taken in months 1, 3 and 6. The experiment is planned to run for 12 months in total with further samples being taken in months 9 and 12.

Table 2

Treatment	Application
Burial	Deposit 3 cm of anoxic mud on treatment plot
Organic enrichment	Sprinkle 0.9 kg of powdered <i>Ascophyllum nodosum</i> (seaweed) over treatment plot
Raking	Rake treatment plot twice (depth of rake 4 cm)

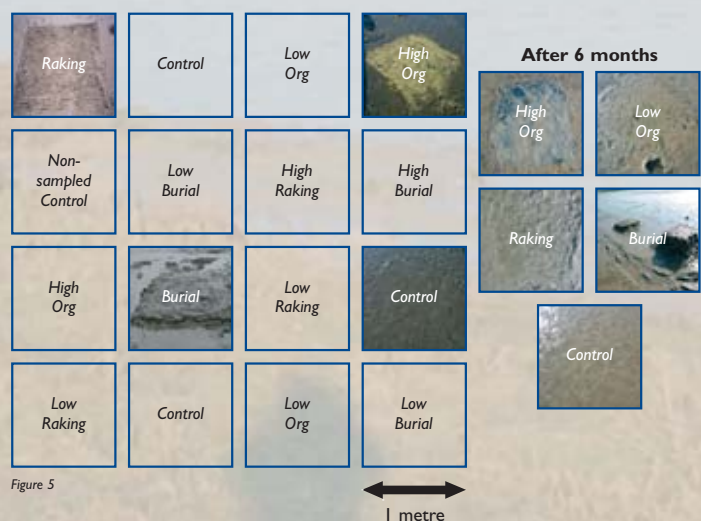


Figure 5

Aims

- To investigate the response of different benthic communities to varying anthropogenic disturbances and intensities of disturbance
- To assess and compare existing biological measures / indices of disturbance
- To construct and develop a novel and ecologically meaningful index of disturbance

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