

# DEVELOPMENT OF A MEIOBENTHIC NEMATODE COMMUNITY FOLLOWING THE INTERTIDAL PLACEMENT OF VARIOUS TYPES OF SEDIMENT: AN *in situ* EXPERIMENT

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## Introduction

Several hundred million cubic metres of dredged material are being dredged annually world-wide to maintain accessibility of coastal ports, harbours and navigable waterways (Figure 1). Around 100 million tonnes of dredged material (dry weight) are being disposed of around the coast of Europe alone and this material must be managed in an economically and environmentally sound manner. The OSPAR Convention requires that alternative options for conventional marine disposal of dredged material are examined. This is usually focused on "beneficial uses" including the use of uncontaminated dredged material to recharge or recreate intertidal habitats (Figure 2).



Figure 1: Dredging operation



Figure 2: Use of uncontaminated dredged material for habitat creation

To date, there is little information on how materials placement will affect the ecology of impacted environments and in particular at what rate the recolonisation of newly created habitats proceeds. A field experiment was conducted at an intertidal mudflat in SE England to investigate processes affecting the development of meiobenthic nematode assemblages in response to the placement of different types of sediment, simulating the deposition of fine-grained maintenance dredged material for habitat creation.

## Experimental set-up

A randomised block design with mesh enclosures was used. Three blocks with five treatments each were set up at the study site (Figure 3 and 4). Treatment plots consisted of steel frames (100 cm x 100 cm wide x 10 cm deep), covered with a 200 µm Nylon mesh on all sides except the top. These were pushed into the sediment until flush with the natural sediment surface and filled with different types of defaunated sediment (Table 1).

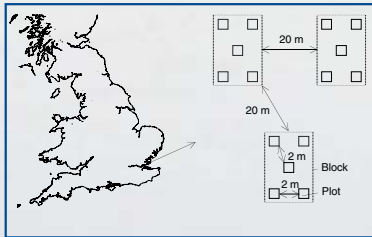


Figure 3: Experimental set-up (meiofauna from a fifth treatment with elevated sand and organic content was not analysed)



Figure 4: Experimental study site

Table 1: Experimental treatments (defaunation was achieved by repeated freezing to -20 °C for 12 h and thawing at room temperature for 48 h)

Treatment	Description
Ambient control	Intertidal sediment with the natural invertebrate community (no steel frame)
Defaunated control	Defaunated sediment with natural sand and organic content (~ 8 % sand, ~ 1.5 % organic Carbon content)
High sand content	Defaunated sediment with ~ 3 to 4-times elevated sand content (addition of "Soft Sand"; 80 % < 300 µm)
High organic content	Defaunated sediment with ~ 2 to 3-times elevated organic content (addition of powdered <i>Ascophyllum nodosum</i> )

## Nematode abundance, diversity and biomass

Nematode density, number of species and total biomass in the defaunated control and high sand content treatment came to resemble those in the ambient control sediment after three months. In the organically enriched sediment, values only attained background level at the end of the experiment (Figure 5).

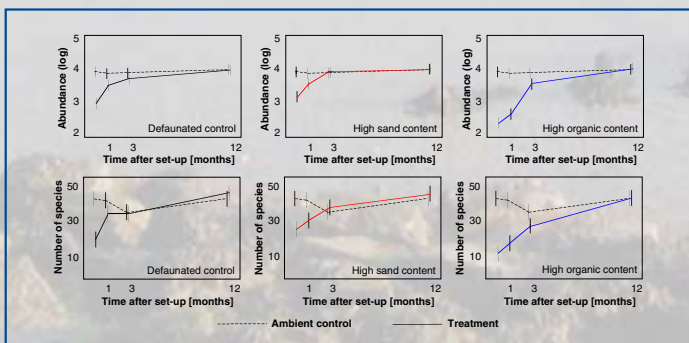


Figure 5: Mean (± 95 % pooled confidence intervals) abundance (log) and number of species

## Nematode assemblage structure

Multivariate analyses revealed that, although assemblage structure in all treatments, and in particular the defaunated control and the high sand content treatment, became increasingly similar to the ambient sediment over time, recovery to ambient condition had not occurred one year after the set-up of the experiment (Figure 6).

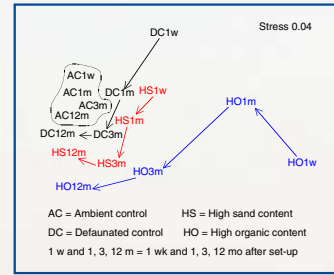


Figure 6: Multi-dimensional scaling (MDS) ordination (√√ transformation)

## Nematode size spectra

By month 12, the size spectrum had shifted towards smaller size classes in the plots with elevated organic content compared to the ambient sediment and other experimental treatments (Figure 7). This pattern was primarily determined by a low abundance of species belonging to larger-sized nematode genera including *Sabatieria*, *Sphaerolaimus* and *Terschellingia* and a high abundance of the chromadorids *Ptycholaimellus ponticus* and *Chromadora macrolaima* in the plots with elevated organic content (Figure 8).

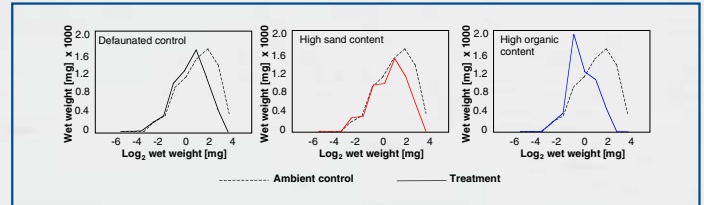


Figure 7: Mean nematode biomass in samples collected after 12 months plotted against geometric size class

Despite their tolerance to oxygen-poor conditions, the slow growth of *Sabatieria punctata* populations in the high organic content treatment suggests that the response of nematode communities to organic enrichment might have been due to an enhancement of the quality and variety of food resources for exploitation by those species with the reproductive potential to take advantage of them such as *Ptycholaimellus ponticus*.

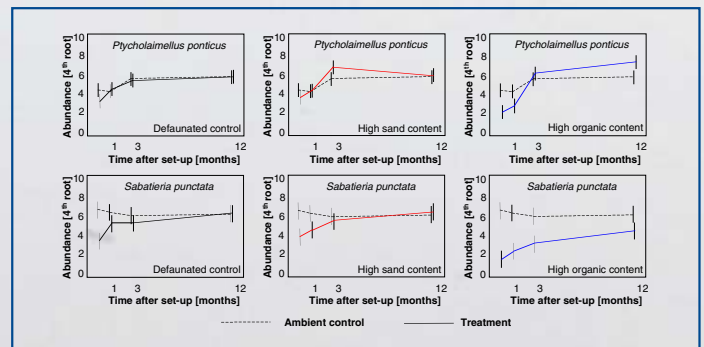


Figure 8: Mean (± 95 % pooled confidence intervals) abundance of *Ptycholaimellus ponticus* (top) and *Sabatieria punctata* (bottom)

## Conclusions

Differences between colonising assemblages and those from ambient control sediment in terms of total nematode abundance, taxonomic membership (i.e. number of species, species composition) and size (i.e. total biomass, biomass size spectra) were most marked in the plots with elevated organic content.

The constructed "habitats" in this experiment were relatively small and colonisation and assemblage developmental rates of larger-scale constructed habitats will inevitably vary (Figure 9). Nonetheless, the outcome of this study provided compelling evidence that characteristics of the sediment in new habitat, and in particular elevations of organic matter content compared to native substrate, can strongly influence the composition and function of colonising nematode assemblages.



Figure 9: Saltmarsh

## Acknowledgements

The work was supported by the Department for Environment, Food and Rural Affairs (project AE0231).

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