Long Term Studies on Biogenic Reefs

IMPLICATIONS FOR OFFSHORE DEVELOPMENTS

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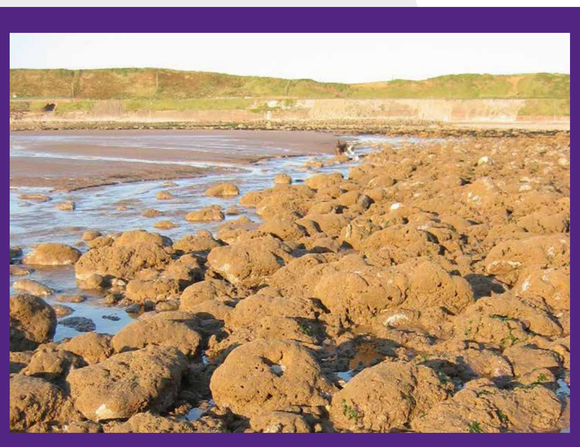
Introduction

Assessing the impact of offshore wind farms and their cabling infrastructure on marine ecology can be challenging due to natural fluctuations in invertebrate assemblages and their habitats. Nowhere is this more apparent than with the biogenic reefs that form in the intertidal areas of the west coast of England and Wales. Here areas are dominated by either edible mussels (*Mytilus edulis*) or the honey comb worm (*Sabellaria alveolata*). They can form large biogenic reefs which dominate large areas of the shore. Their presence on the shore is not however permanent with complex population dynamics occurring, resulting in fluctuations in dominance of each biogenic reef. Long term data sets were examined in order to assess the external influences of competition and climate on these reefs. This revealed that wind speed and direction has a large influence on their abundance and on which type of reef can form. This therefore must be taken into consideration when assessing impacts in relation to renewables.

Data Collection

- 20 years of abundance data from 5 sites on the Cumbrian coast (Figure 1) were analysed to assess patterns of development of *S. alveolata* and *M. edulis*
- 5 sites were chosen due to observation of a cyclical dominance pattern, apparently facilitated by mussel spat settlement onto algae found in the pools created by the *S. alveolata* reef platforms



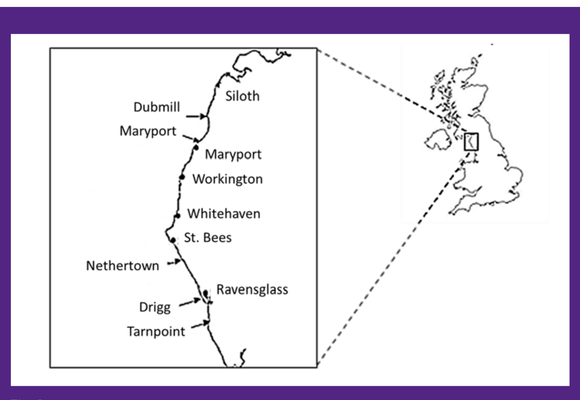


Fig. 1
Survey locations

Analysis and Results – Initial Assesment

RELATE statistical analysis Marked decline in *M. edulis* abundance.

- Fluctuation (overall increase) in *S. alveolata* abundance
- No cyclical trend identified

Anecdotal evidence suggested that changing wind direction has effected larval supply to the survey sites, and *S. alveolata* is known to be a warm water species.

IS THE HISTORICAL INTERSPECIFIC RELATIONSHIP NOW OVERSHADOWED BY WIDER ABIOTIC/BIOTIC INFLUENCES?

Analysis – Secondary Assesment

- Dynamic factor analysis (DFA) - to detect common trends in time series data
- MDS plot - to explore the similarity between the species
- Pearson's correlation coefficient - to correlate *S. alveolata* and *M. edulis* with relevant environmental variables

Results – Secondary Assesment

- DFA - decline among the most abundant sessile species and algae, and increase in *S. alveolata* abundance (Fig 2)
- MDS confirmed this distinct difference between *S. alveolata* and other species included in the analyses (Fig 3 and 4)
- Pearson's correlation coefficient:
  - ***S. alveolata* was correlated with sea surface temperature (P < 0.005)**
  - ***M. edulis* was correlated with wind (P < 0.005)**
- The addition of SST to the DFA most improved the fit of the common trend to the time series - suggesting SST is explaining some of the variation in the 2 time series

Fig. 2
DFA Common trend for *M. edulis* and *S. alveolata* with SST added as an environmental variable.

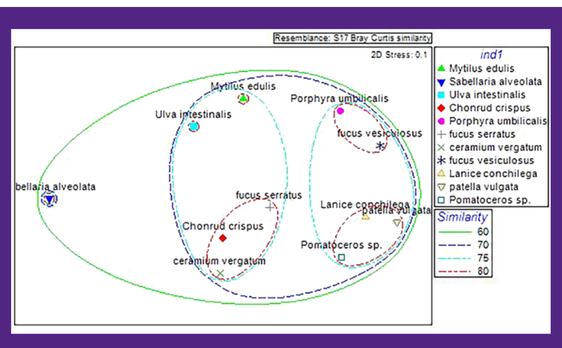


Fig. 3
MDS plot of top ten abundant sessile fauna, algae, and *M.edulis* throuhout the 20 year survey period.

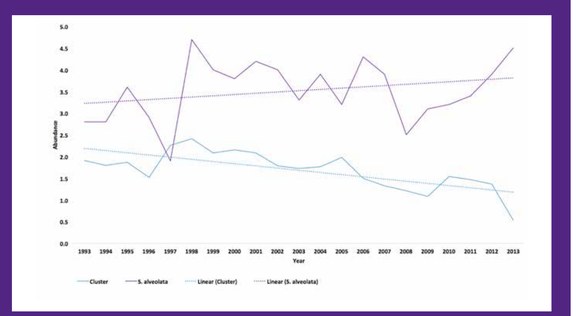


Fig. 4
S. alveolata and the cluster of species present in the MDS plot at the 70% similarity level.

Conclusion

Environmental variables are affecting abundances of *S. alveolata* and *M. edulis*:

- *S. alveolata* is effected by SST
- *M. edulis* is declining due to a change in wind disrupting larval supply

Decline in *M. edulis* interrupted an *M. edulis / S. alveolata* succession and enabled *S. alveolata* to reach abundances not previously attained, helped by increasing SST.

- Long term data sets are crucial in allowing climatic changes to be detected and their ecological effects analysed
- Natural population fluctuations ,compounded by climatic effects, continue to pose problems for ecologists, developers and regulators
- There is a need therefore to understand and, if possible, account for background changes (e.g. due to biotic or abiotic influences) and climatic trends throughout all stages of project development (e.g. in survey planning, during the design of monitoring protocols and during data analysis and review)

natural power