The Potential Impact of the Severn Barrage – An Impact Assessment Revisited

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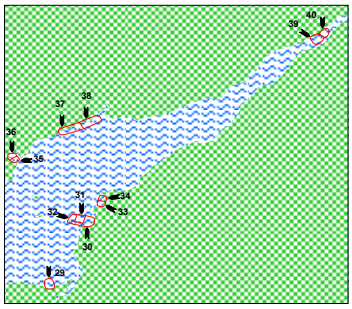
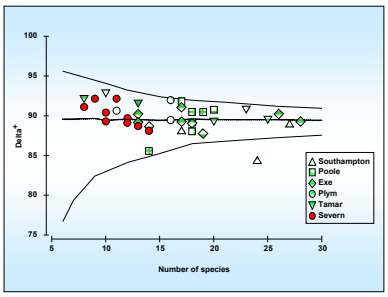
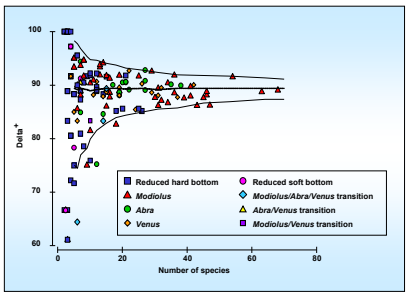
This poster is concerned with aspects of the benthic biodiversity in the Bristol Channel and Severn Estuary and with predicting the possible effects of constructing a tidal barrage for power generation. Currently, the most favoured generation scheme, and the one which would generate the most power, is a large barrage west of Cardiff to Weston-super-Mare. This is the scheme considered here. Warwick & Uncles (1980) found that the benthic faunal associations in the Bristol Channel were directly related to the tidally averaged bed stresses, as determined from a hydrodynamic model. These correlations are used to predict, albeit with unknown time-scales, the new benthic faunal associations with a barrage in place. Barrage closure would result in a rise in mean sea level of about 3.0 m landwards of the barrage, with a consequent reduction in the area of intertidal flats of about 62%. The estuary would then come to resemble more closely other relatively 'normal' estuaries in South West Britain. Relationships for these 'normal' estuaries are used to estimate post-barrage conditions in the Severn (Warwick & Somerfield, 2010).



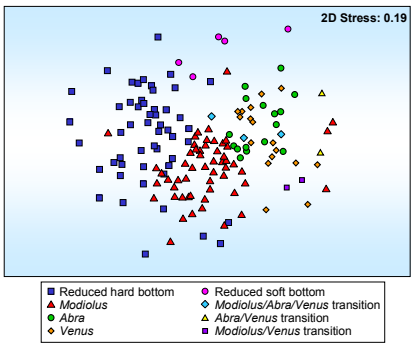
1 Areas of intertidal sediment flats in the Severn Estuary sampled by Warwick et al. (1991) in a comparative study of estuaries in South West Britain.



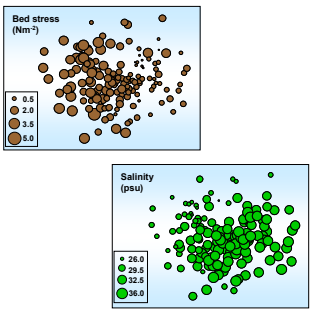
2 Average taxonomic distinctness of macrobenthic communities from tidal sediment flats in six estuaries in South West Britain. Also shown are the expected taxonomic distinctness in random subsamples from the total species list for all species included in the study (horizontal line) and the 95% probability limits for a single D+ value for various numbers of species (the funnel).



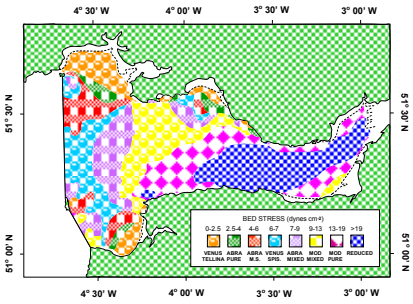
3 Average taxonomic distinctness of macrobenthos from stations in the Bristol Channel sampled by Warwick & Davies (1977). Symbols designate the community type at each station. Also shown are the expected taxonomic distinctness for random subsamples of the total species list of all species included in the study (horizontal line) and the 95% probability limits for a single D+ value for various numbers of species (the funnel).



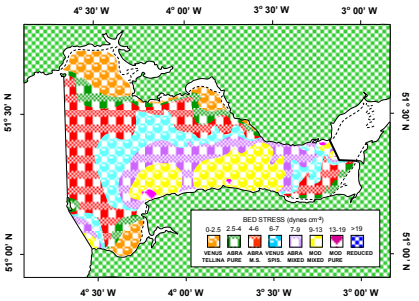
4 Non-metric MDS ordination of fourth-root transformed species abundance data for stations in the Bristol Channel sampled by Warwick & Davies (1977), using the Bray-Curtis similarity measure. Symbols designate the community type at each station.



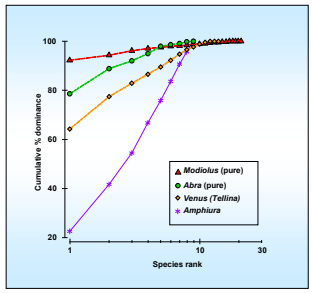
5 As (4) but with circles scaled in size to represent values of tidal bed stress and salinity, super-imposed on each station.



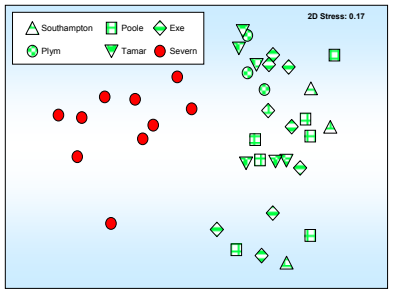
6 Simulated bed stress contours in the Bristol Channel selected to delineate benthic macrofaunal community types (redrawn from Warwick & Uncles,1980).



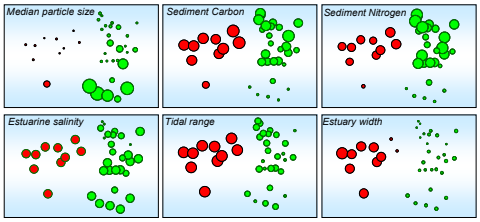
7 As (6) but with a working barrage at the Cardiff-Weston site.



8 *k*-dominance curves for annual production of macrofauna species in *Modiolus*, *Abra* and *Venus* communities in the Bristol Channel and an *Amphiura* community off the coast of Northumberland.



9 Non-metric MDS ordination of fourth-root transformed species abundance data for macrobenthic communities from tidal sediment flats in six estuaries in South West Britain, using the Bray-Curtis similarity measure. Station numbers for the Severn are the same as (2).



10 As (9) but with circles scaled in size to represent the values of six environmental variables superimposed.

CONCLUSIONS

The severity of the physical regime in the hypertidal Severn Estuary and Bristol Channel decreases in intensity in the seaward direction. As a result, the diversity of benthic macrofaunal species is very low in the Estuary and Inner Channel, but is still relatively low in the Outer Channel compared with more benign conditions elsewhere in the UK. Nevertheless, the taxonomic spread of species (taxonomic distinctness) throughout the area is no lower than expected. Barrage construction would result in an increase in the area of soft sediment relative to hard bottom benthic assemblages and the disappearance of reduced communities seaward of the barrage, although the time-scale of such a change is not known. Above the barrage, the overall species richness, density and biomass of the benthos are likely to increase, factors that will ameliorate the loss of intertidal area.

Warwick, R.M., Somerfield, P.J., 2010. The structure and functioning of the benthic macrofauna of the Bristol Channel and Severn Estuary, with predicted effects of a tidal barrage. Marine Pollution Bulletin 61, 92-99.
Warwick, R.M., Goss-Custard, J.D., Kirby, R., George, C.L., Pope, N.D., Rowden, A.A., 1991. Static and dynamic environmental factors determining the community structure of estuarine macrobenthos in SW Britain: why is the Severn Estuary different? Journal of Applied Ecology 28, 329-345.
Warwick, R.M., Uncles, R.J., 1980. The distribution of benthic macrofauna associations in the Bristol Channel in relation to tidal stress. Marine Ecology Progress Series 3, 97-103.
Warwick, R.M., Davies, J.R., 1977. The distribution of sublittoral macrofauna communities in the Bristol Channel in relation to the substrate. Estuarine and Coastal Marine Science 5, 267-288.

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