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MILFORD HAVEN WATERWAY  
ENVIRONMENTAL SURVEILLANCE GROUP

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**BIOACCUMULATION SURVEILLANCE IN MILFORD  
HAVEN WATERWAY 2007-2008**

**W J Langston, S O'Hara, M Imamura & N D Pope**

**2009**

**Bioaccumulation surveillance in  
Milford Haven Waterway  
2007-2008**

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## Executive Summary

Biomonitoring of contaminants (metals, organotins, PAHs, PCBs) has been carried out at sites along the Milford Haven Waterway and at a reference site in the Tywi Estuary during 2007-2008. The species used as bioindicators encompass a variety of uptake routes; i.e. *Fucus vesiculosus* (dissolved contaminants); *Littorina littorea* (grazer); *Mytilus edulis* and *Cerastoderma edule* (suspension feeders that accumulate from both dissolved phase and suspended particulates); and *Nereis diversicolor* (omnivore which often reflects bioavailable contaminants in sediment). Differences in feeding strategy and habitat preference can have subtle implications for bioaccumulation trends though, with few exceptions, contaminant body burdens in Milford Haven (MH) were higher than those at the Tywi reference site.

Substantially elevated metal concentrations were observed at individual MH sites for Mn (molluscs, seaweed), Co (mussels, seaweed), Sn (bivalves), Ni (cockles) and Fe (ragworm), whilst As and Se (molluscs and seaweed) were consistently at the higher end of the UK range for much of the MH Waterway. However, for the majority of metals, distributions in MH biota were not exceptional by UK standards. Several metal-species combinations indicated increases in bioavailability at upstream sites, which may reflect the influence of geogenic or other land-based sources - enhanced in some cases by lower salinity (greater proportions of more bioavailable forms).

TBT levels in mussels were below thresholds considered by OSPAR to be acutely toxic, though based on these guidelines, sub-lethal effects cannot be ruled out at MH sites. TBT (and other BT) levels in the Tywi were close to zero. Phenyltins were not accumulated appreciably in *Mytilus*, whereas some *Nereis* populations in MH may have been subjected to localized (historical) sources retained in sediments.

PAHs in *Nereis* tended to be evenly distributed across most sites, but with somewhat higher values at Dale for acenaphthene, fluoranthene, pyrene, benzo(a)anthracene and chrysene, whilst naphthalenes tended to be enriched further upstream in the mid-upper Haven (a pattern which is seen in mussels for most PAHs). Whilst concentrations in *Mytilus* were above OSPAR backgrounds, there was little indication that generalized exotoxicological guidelines for PAHs would be exceeded (although there has been no ground-truthing of these assumptions). PAH body burdens in Milford Haven biota were generally (but not always) higher than those in the Tywi Estuary.

Lipophilic PCBs in mussels were between upper and lower OSPAR guidelines and were unusual in their distribution in that highest levels occurred at the mouth of MH. This may be a function of better condition and nutritional status (lipids) here, rather than contamination.

Overall, condition indices of bivalves (cockles and mussels) were highest at the Tywi reference site, and at the mouth of Milford Haven, but decreased upstream in the Waterway. There were a number of significant (negative) relationships between CI and body burdens and it is possible that a combination of contaminants could have an influence on this pattern in the CI (and other markers of organism 'health'). Cause and effect needs to be tested more rigorously as there a number of (natural) factors which may be influential. Contextual physicochemical information and published data on sources, pathways and toxicology of contaminants has been included as part of the discussion of bioaccumulation results.

The strategy for biomonitoring undertaken in this project builds on established sampling protocols and is proposed as a basis for a rolling program against which future change could be measured. Complementary, harmonised monitoring in which biological condition and environmental parameters are measured and interpreted alongside body burdens - using multivariate techniques to help assess the status of the site more comprehensively - are also recommended for the future.