

Science for Environment Policy

Monitoring heavy metal contamination in the German Wadden Sea

Human activities, including industrial development along coastal areas, risk polluting the marine environment with heavy metals which can harm human health and aquatic life. A recent study has found elevated levels of metal pollution in the Jade area of the German Wadden Sea, but concludes that metal contamination of the sediments would not be expected to have harmful effects on the marine environment and living organisms here.

Heavy metals are typically adsorbed onto fine particles suspended in the water, which eventually settle on the seabed. Analysis of sediment deposits is therefore a useful measure of metal contamination in coastal environments.

This study focused on the current state of metal pollution in the Jade Bay, a tidal basin in the German part of the Wadden Sea – the south-eastern area of the North Sea stretching from the Netherlands to Denmark. The Jade area has been influenced by a wall constructed to control tidal movements and is partly dredged to maintain the navigation channel to the Wilhelmshaven harbour. There is also an industrial zone and a new deepwater container terminal in the area.

From 2009 to 2010, the researchers sampled sediment and water containing suspended particulate matter from Jade Bay to assess the concentration and distribution of heavy metals. Local background levels of metals derived from natural processes, e.g. weathering and erosion of rocks, were also assessed to distinguish natural and human sources.

Results suggest that metal contamination in sediments varied and depended on where the sediments were taken. Sediment from the harbour area had the highest contamination levels and was particularly enriched with lead and zinc. Nearby industries and shipping are the likely sources for this pollution.

Sediment taken from around two flood gates also had high levels of metal contamination. Freshwater from the hinterland, containing treated wastewater from domestic, agricultural and industrial sources is released via the floodgates into the bay area and is the most probable source of the metal contamination. Although harbour sludge from dredging is discarded in the centre of Jade Bay, strong tidal movements quickly redistribute or re-suspend some of the sediment in the water and consequently the basin's bottom sediments were not heavily polluted. However, they were strongly enriched with cadmium, probably mainly from natural sources.

Compared with background levels, suspended particulate matter was enriched with the metals, copper, lead and zinc and concentrations of these metal contaminants were higher in summer than in winter. This may be caused by increased levels of organic particulate matter available as surfaces for the metals to bind to in the water in summer.

Results of this study may help in marine monitoring programmes for metal contamination, such as within the OSPAR Convention¹, which is designed to protect the north-east Atlantic Ocean's marine environment. Under the OSPAR Convention, ecotoxicological assessment criteria (EAC) represent a range of contaminant concentrations within which no short-term harm to the marine environment or living organisms is likely. In this study, only the concentration of arsenic on particles suspended in the water in the Jade area was higher than the upper limit of the EAC. Compared with background levels, current contamination levels are not high enough to suggest there is significant metal pollution from human activities in the Jade area.



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1. See: www.ospar.org