
# Status and Trends for Heavy Metals (Mercury, Cadmium and Lead) in Fish and Shellfish

MSFD Descriptor: 8 - Concentration of contaminants

MSFD Criterion: 8.1 - Concentration of contaminants

OSPAR COMMISSION

**Key Message** In most areas assessed (since 2009) concentrations of mercury, cadmium and lead in mussels and fish are above background levels. Nevertheless, all concentrations are below European Commission limits for foodstuffs. Concentrations are decreasing or show no significant change in all areas assessed; except for cadmium in a few North Sea and Irish Sea locations

## Background

OSPAR's strategic objective is to prevent pollution of the OSPAR Maritime Area by continuously reducing discharges, emissions and losses of hazardous substances. Metals are ubiquitous hazardous substances in the environment, and are found in mussels and fish in all OSPAR regions. The most toxic metals to humans and animals are mercury, cadmium and lead, known as heavy metals, all of which naturally occur in the environment.

Mercury, cadmium and lead enter the marine environment from a number of natural, agricultural and industrial processes (see heavy metal inputs indicator assessments ), via long-range transportation by air, riverine input or run-off from land. In some cases direct input occurs. For example, some metals used as antifouling chemicals (mainly copper) and corrosion anodes (mainly zinc) are deliberately placed in the marine environment, through their use on ships' hulls or marine installations, causing hot spots of metal concentrations in and around harbours.

Mercury is highly toxic. Mercury and cadmium accumulate in the food chain. Lead is not accumulated via the food chain.

Heavy metals do not disappear over time and can be trapped in deeper levels of sediment until mining, geological or biological processes release them, at which point they may affect biota. There are natural concentrations of heavy metals in all waters, sediments, mussels and fish, referred to as background concentrations. OSPAR uses the maximum concentration limits for heavy metals in fish and mussels set by the European Commission as proxy values for Environmental Assessment Criteria (EAC).

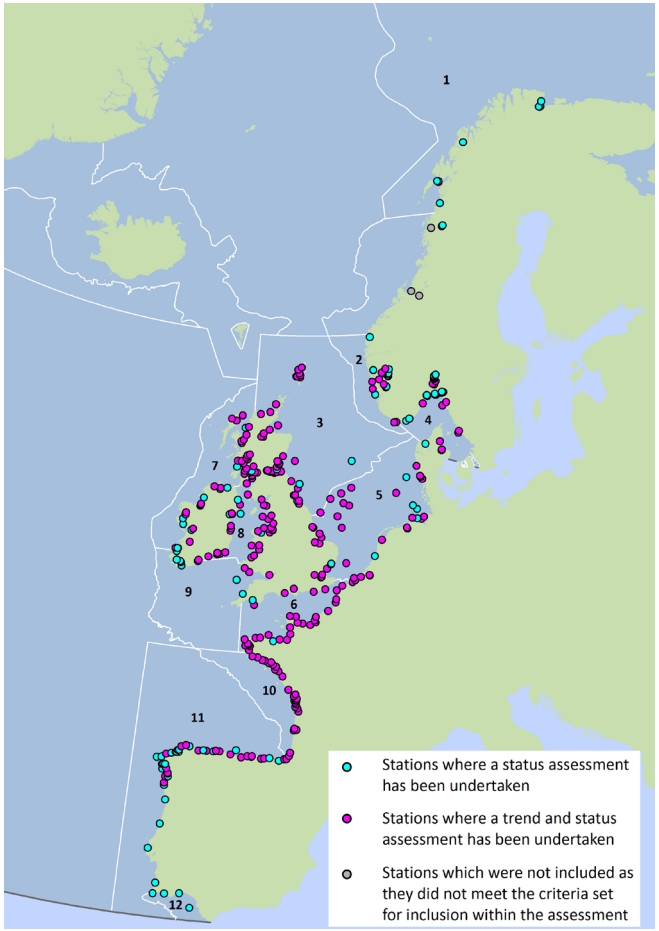


Figure 1: Monitoring sites used to assess heavy metal concentrations in fish and shellfish per OSPAR contaminants assessment area (white lines) determined by hydrogeographic principles and expert knowledge, not OSPAR internal boundaries.

## Results

Different species of fish and shellfish are monitored for metal concentrations in the OSPAR Maritime Area. At coastal sites monitoring is mainly in blue mussels. Oysters are monitored in the Bay of Biscay and the Irish coast. At the remaining monitoring sites, mostly in open water, flatfish are monitored (**Figure 1**).

There are 22 monitoring sites in Arctic Waters not reported because they are not geographically representative of the region as a whole. This includes six to eight temporal trend monitoring sites in the Barents Sea, depending on the heavy metal monitored, and no heavy metals showed upward trends in concentration.

EC maximum levels for heavy metal concentrations in fish and shellfish are five times greater, or more, than background concentrations. In all OSPAR regions assessed since 2009 the average heavy metal concentrations are below EC maximum levels.

Images: Blue mussels (*Mytilus edulis*) © Mark A Wilson
Common dab (*Limanda limanda*) Wikimedia commons
Both species are routinely used for PCB monitoring in biota

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## Results cont...

Mercury concentrations in biota are at or above background in all sub-regions (**Figure 2**). The highest concentrations are found in the Norwegian Trench, Northern North Sea, Southern North Sea and Irish Sea, at around twice the background concentration.

Cadmium concentrations in biota are above background in nine of the 12 OSPAR sub-regions; the exceptions are the English Channel, Northern Bay of Biscay and Iberian Sea. Concentrations in biota from the Barents Sea and Southern North Sea are at 2–5 times higher than the background level (**Figure 2**).

With the exception of the Irish and Scottish West Coast (**Figure 2**), lead concentrations in biota are above background. Mean concentrations in the Barents Sea, Skagerrak and Kattegat, and Northern Bay of Biscay are below the background level, but the upper confidence limits are above background. Lead concentrations in the Northern North Sea, Irish Sea, and Gulf of Cadiz all are at 2–5 times the background concentration.

There is high confidence in the assessment and sampling methodology and high confidence in the data used.

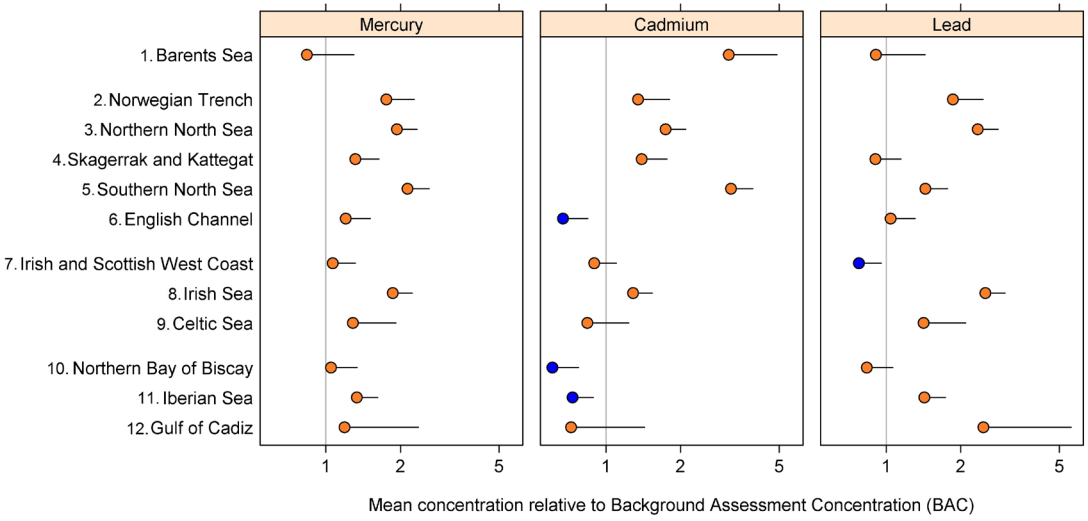


Figure 2: Mean concentrations of each heavy metals in biota in each OSPAR sub-region relative to Background Assessment Concentrations (BAC) (with 95% upper confidence limits), where value of 1 means that the mean concentration equals the BAC. Blue: mean concentration statistically significantly ($p < 0.05$) below the Background Assessment Concentration (BAC) and the European Commission maximum levels for food, orange: mean concentration at (if confidence limit crosses 1), or above the BAC, but significantly below the EC maximum levels for food. The EC maximum levels are generally more than five times higher than the BAC and hence not shown

## Results cont...

Mercury concentrations in biota show no statistically significant change in all sub-regions except for the Iberian Sea where there is a downward trend. In contrast, lead concentrations are declining in seven of the ten sub-regions and show no significant change at three.

The only sub-region where concentrations are increasing is the Southern North Sea, and for cadmium. Here, half of the monitoring sites show upward trends for cadmium, resulting in an annual increase in concentration of approximately 2%. Concentrations of lead and cadmium in mussels in the Northern North Sea (Shetlands) are low, but increasing.

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## Conclusion

The ultimate aim of the OSPAR Hazardous Substances Strategy is for concentrations of heavy metals in biota to be at natural background levels. However, heavy metal concentrations in biota in most assessment areas are above natural background concentrations.

Average heavy metal concentrations in shellfish and fish are below European Commission maximum limits for foodstuffs in all OSPAR regions. Mercury concentrations show no significant change or show a downward trend in most sub-regions. The only sub-region showing an increasing trend in metal concentrations in biota is the Southern North Sea for cadmium.

Although mercury, cadmium and lead concentrations in shellfish and fish are below EC maximum levels in foodstuffs in all areas assessed, there is a potential to further reduce heavy metal levels in biota in order to reach natural background levels.

## Knowledge Gaps

The assessment criteria are based on background concentrations and European Commission maximum levels in foodstuffs, rather than on environmental limits.

The European Commission has derived environmental quality criteria for fish only for mercury, which are lower than background concentrations, and should be re-examined. Environmental Assessment Criteria for all heavy metals in mussels and fish should be developed.

The reasons for the increasing concentrations of cadmium in the Southern North Sea need to be investigated to identify the sources.

This document was published as part of OSPAR's Intermediate Assessment 2017.
The full assessment can be found at www.ospar.org/assessments