Releases of anti-fouling chemicals

The accumulation of organisms on ships' hulls (so called fouling, see photo below) can reduce the performance of vessels and increase fuel consumption. To prevent this, paints used on ships' hulls include chemicals which discourage settlement of marine organisms on ships' hulls.

What is the problem?

Anti-fouling paints have been relying on toxic chemicals. Particular concerns have been raised about tributyltin (TBT), which has been used as in anti-fouling paints on ships, and which has an endocrine disrupting effect, particularly on shellfish. TBT is found to be present in the world's oceans in a wide range of animals and plants with adverse effects on sensitive species. The impacts from TBT can be seen even in protected areas.

What has been done?

Because of its intrinsic properties, TBT has been prioritised by OSPAR for action under its Hazardous Substances Strategy. This requires OSPAR countries to make every effort to move towards cessation of release of TBT by 2020.

Following OSPAR and EC measures, OSPAR countries have made progress in the last years towards the phasing out of the use of TBT in anti-fouling paints, supported by a partial ban of TBT containing paints in European waters. The main substitutes for TBT in anti-fouling systems are copper and Irgarol. Their use started on smaller vessels and has now continued for over a decade. Although they are less hazardous than TBT, these substitutes still rely on their toxicity to prevent the settlement of organisms on hulls. A new generation of anti-fouling systems, so called non-sticky paints, is under development which abstains from any use of biocides.

A global ban of the use of organotin compounds in anti-fouling paints entered into force under the IMO International Convention on the Control of Harmful Anti-fouling Substances in September 2008.

Did it work?

Releases of TBT are expected to cease in future while releases of copper are expected to increase.

Based on ship movement data for the Netherlands continental shelf in 2007 (Figure 4.6), a rough estimate is that some 8 tonnes of TBT in the North Sea will be released into the sea from ship coatings (OSPAR, 2009). It is expected that with the global ban of TBT, releases from ships' hulls will progressively cease. The substitution of TBT antifouling agents with copper-based paints is expected to result in increased losses of copper and Irgarol. A rough estimate, based on shipping data for the Netherlands continental shelf in 2007, suggests that copper losses at sea from coatings of moving ships are in the order of 10 tonnes in the North Sea (OSPAR, 2009).

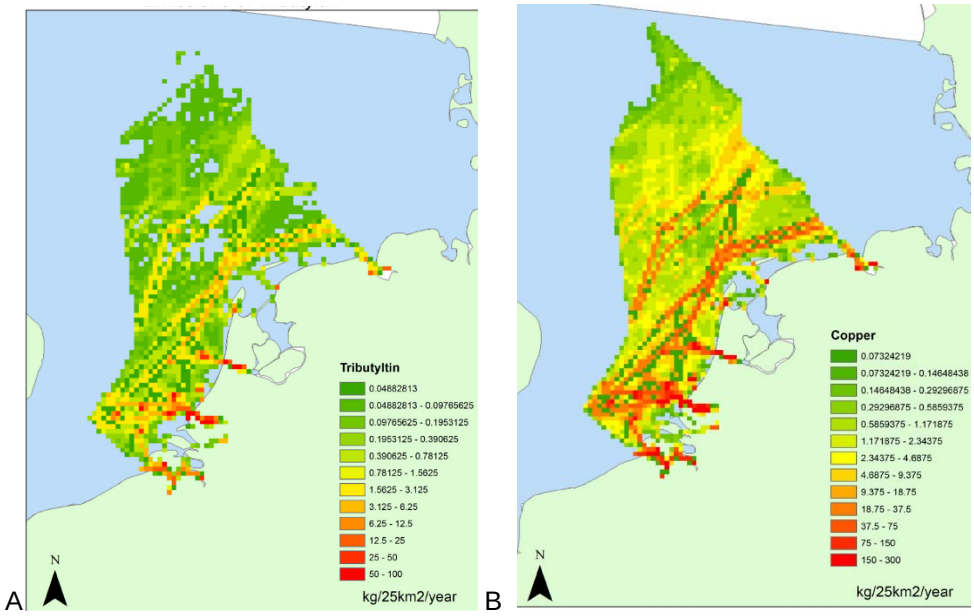

Figure 4.6 *Estimates of losses (kg/25 km^2/year) of TBT (A) and copper (B) from ship coatings at sea (excluding fishing vessels) on the Netherlands continental shelf have been calculated as the product of the wet surface area times the emission factor for the substances. This is based on Automatic Identification System (AIS) data for the Netherlands continental shelf in 2007, which allow reconstructing ships movement and provide information on their type and size. Source: OSPAR, 2009.*

How does this affect the quality status of the OSPAR maritime area?

Contamination with TBT and pollution effects are decreasing.

Progressive phase-out in Europe of TBT in anti-fouling paints is reflected in decreasing concentrations of TBT in water and sediments around some recreational harbours. An associated decline in adverse effects on populations of dogwhelks and snails (gastropods) which are sensitive to TBT and respond with non-functional male characteristics (measured as imposex) has been observed (OSPAR, 2009b). There has been encouraging evidence of recovery in gastropod populations, which have recolonised sites where they were formerly extinct due to TBT, amongst other locations this has even been found in the heavily polluted United Kingdom south coast region (Thomas *et al.,* 2000 and 2001).

Although the overall status is improving, populations of gastropods still show pollution effects from TBT over large parts of the OSPAR area, especially in Regions II, III and IV (OSPAR, 2009b). There appears to be a clear relationship with shipping. In or near busy shipping lanes, imposex levels are high as is particularly clear in the vicinity of some large harbours (e.g. Rotterdam, Clydeport, Vigo). The situation is markedly better where there is less large vessel traffic e.g. the west coast of Scotland and in the northern part of Norway. However, even in these areas, the presence of a harbour can be linked to a more impacted site.

There remain concerns about continued “hot-spots” of TBT contamination. This applies particularly to TBT-contaminated sediments often associated with commercial ports, which require constant maintenance dredging and spoil disposal operations. Contamination levels of dredged sediments has been highly variable in 1998 – 2007 but there is some evidence that TBT concentrations in disposed harbour dredged material may have decreased in recent years (OSPAR, 2009c). The issues associated with the disposal of dredged sediments have been articulated frequently (Svavarsson *et al.*, 2001; Santos *et al.*, 2004). An example of this is Southampton Water (United Kingdom), where, despite legislation restricting the use of TBT on the large number of recreational vessels in the area,

trial reintroductions of *Nucella lapillus* populations showed that severe imposex effects developed within six months, thus implicating TBT from commercial shipping.

Recent monitoring of sediment suggest that copper concentrations were at levels giving rise to concern for the marine environment at some coastal stations and were increasing at a third of trend measurement stations (OSPAR, 2008). As TBT is substituted with copper anti-fouling paints it is expected that concentrations of such metals will increase in coastal sea waters.

There are no international agreements on the use of anodes on ships. However, cadmium released by zinc anodes is a substance on the OSPAR List of Chemicals for Priority Action. Estimates of cadmium release from anodes are given in OSPAR (2009).

What lessons have we learnt since 1998?

The partial ban of TBT in the OPSAR maritime areas appears to be having a positive effect and the global ban is expected to result in progressive cessation of releases of TBT from ships. However, contaminated (harbour) sediments remain a problem and whilst losses of copper are less hazardous than TBT they are of concern and as such need attention.

➥*Go to full QSR assessment report on the impact of shipping on the marine environment (publication number 440/2009)*