

Imposex and TBT: Status, trends and effects in marine molluscs: an improving situation?



Policy Issue: Impacts of tributyltin (TBT) on marine molluscs

Policy Objective: Continued reduction of levels of TBT in the marine environment, so that the exposure of marine molluscs and the adverse imposex effect remains below agreed OSPAR environmental assessment criteria (EACs), and ultimately reduction to 'close to zero' levels.



Background

Antifouling paints are widely used on vessels of all sizes to prevent the growth of marine organisms. Historically, antifoulants were primarily based on the use of copper, creating higher, toxic, concentrations close to the hull and so preventing the attachment of organisms. Around the beginning of the 1980s, a more effective component began to be used, TBT. This compound proved extremely effective at preventing the attachment of algal slimes, which are usually the first organisms to attach and which then provide a coating to which other organisms can attach. By the mid-1980s, oyster growers in both France and Great Britain were becoming extremely concerned about poor growth in their stocks. Cultured Pacific oysters, in particular, were misshapen and contained little meat, so were not marketable. Eventually, the cause was traced to the use of TBT in anti-fouling paints applied mainly to pleasure vessels used in estuaries and moored in marinas, close to the commercial shellfish beds.

TBT is now known to be sufficiently toxic to harm many marine organisms at very low concentrations and is unequivocally linked to impairment of reproductive performance in a number of molluscan species, with some female marine snails developing male sex characteristics in response to TBT exposure; this is termed 'imposex' (OSPAR Commission, 2000). TBT ultimately affects many creatures, but the marine mollusc's sensitivity puts it at the front line making it an important indicator species giving an early warning of trouble to the marine ecosystem. Over the past decade, a range of national and international measures have resulted in a continuous phase-out in the OSPAR area of TBT containing paints and of their use on vessels, in aquaculture and on underwater structures. A global ban on TBT in anti-fouling systems on large vessels came into effect in 2008. Together, these measures address the main TBT-related pressures on the marine environment. Assessment criteria in the form of background assessment criteria (BAC) and environmental assessment criteria (EAC) have been derived by OSPAR for imposex measurement in a variety of molluscs, representing the most sensitive species used in the OSPAR monitoring guidelines.

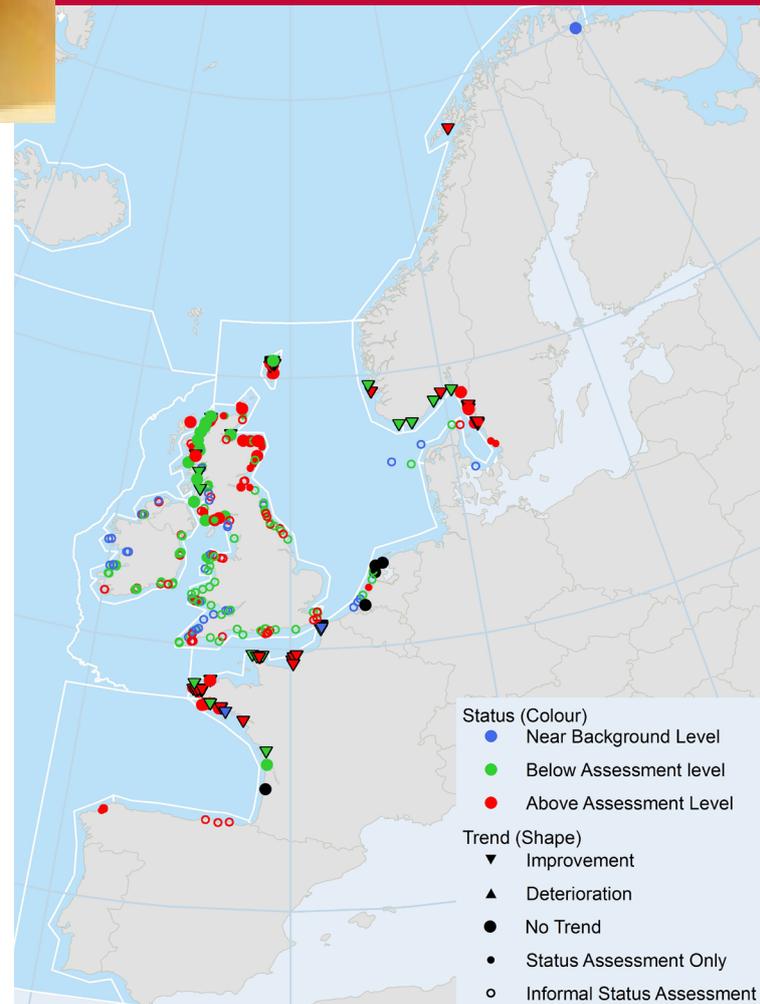


Figure 1: Current monitoring status of imposex in marine molluscs resulting from this assessment

Has regulation proved effective?

Imposex monitoring is currently completed at over 390+ sites on up to 5 marine mollusc species. There is a diversity of approaches to selecting target sampling stations, although there is an emphasis on stations which are in, or proximate to, harbours, ports and marinas where effects are most likely to occur. Currently the OSPAR EAC set for TBT-specific effects is met at most sites (~65%). It is also clear that there is an overall improvement in mollusc imposex status at locations common for both the 2010 QSR assessment (OSPAR Commission, 2009) and for this assessment (n=145 sites).

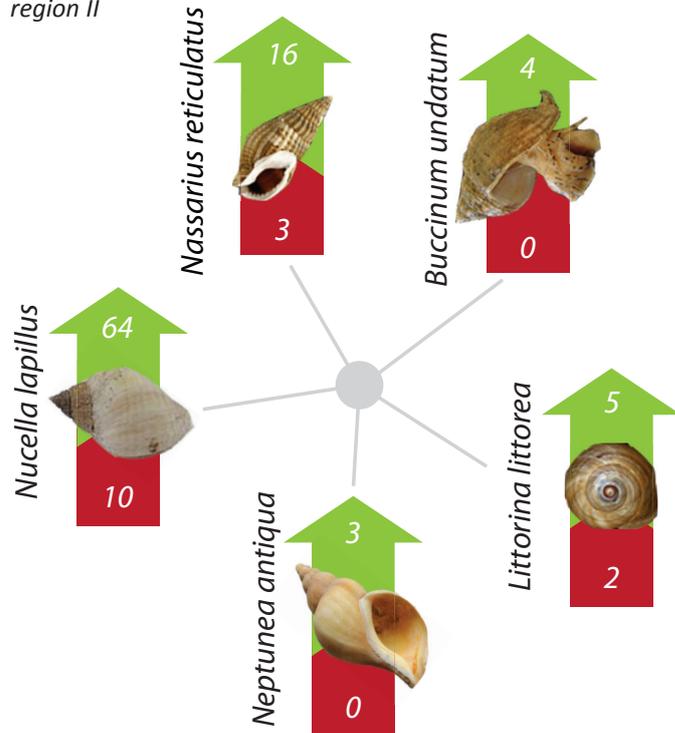


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Has regulation proved effective? (cont.)

Figure 2: Improvement (green) and non-improvement (red) in 5 marine mollusc species sampled at 107 sites in OSPAR region II



Improvement and non-improvement was measured at 145 sites common to both the QSR and CEMP 2013 assessment, using the Vas Deferens Stage Index (VDSI) – a 7 stage measurement based on degree of penis and Vas Deferens development in females. Improvement was detected at >80% of these common sites with non-improvement shown at 16% of locations, while at 4% of sites the status is at background and continues to be stable so overall improvement is clearly evident.

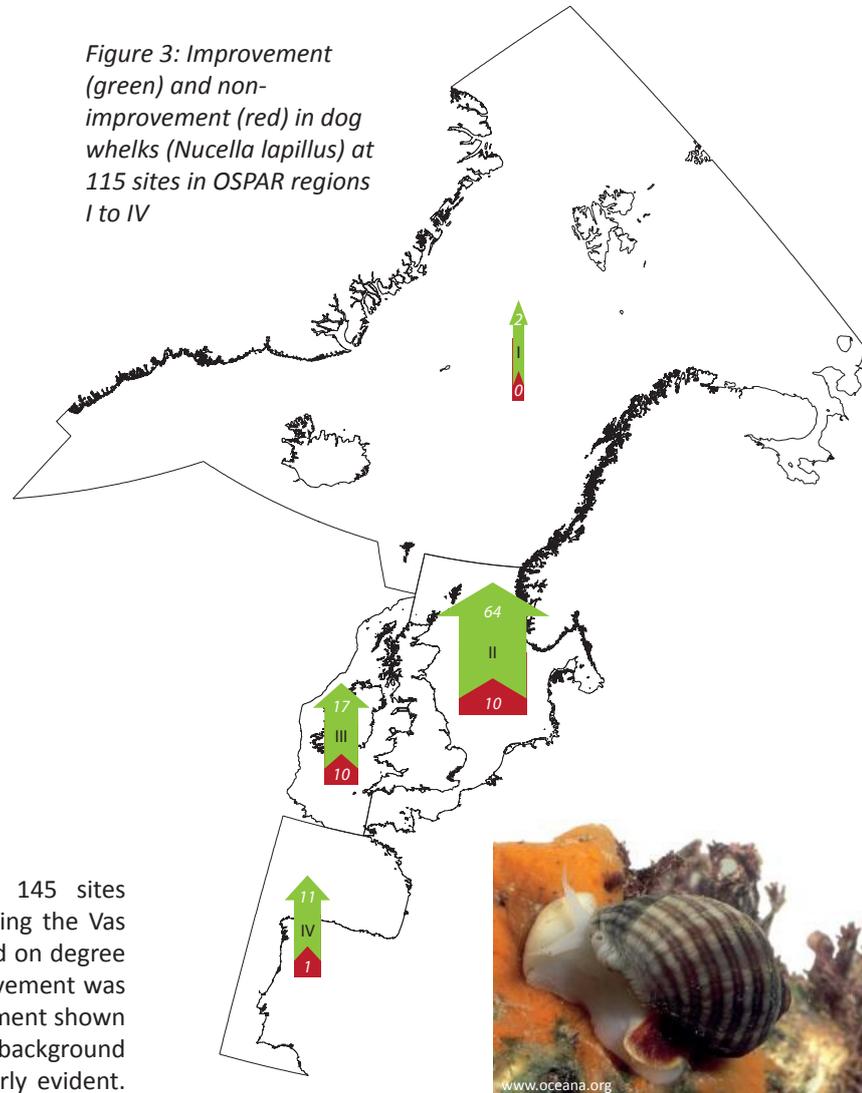
What happens next?

Ongoing monitoring in marine gastropods will continue to provide a good indicator for TBT pollution and help in identifying illegal use of stocks of TBT-containing anti-foulants or losses of TBT from dockyards, marinas and vessel maintenance activities. One or more further rounds of imposex monitoring will be conducted in order to follow the expected decline in impacts indicated by the reductions in inputs described above.

Most antifouling products have now reverted to the use of copper-based paints, in some cases with the addition of other chemicals (“booster biocides”) which enhance their efficacy. These have also been investigated for environmental persistence and effects and have also been banned. OSPAR needs to keep an eye on future developments in this area and avoid further adverse consequences of use of other compounds. In addition, there is a large reservoir of TBT in sediments, particularly in estuaries, which may continue to provide a secondary source to the water column.

Despite the evident significant downward trend in impacts from TBT, some areas are still subject to high imposex levels. Sites which show non-compliance with the EcoQO should be subject to further monitoring. The continued measurement of imposex in marine molluscs offers the most clear-cut tool for monitoring of a contaminant-specific pollution effect under the Marine Strategy Framework Directive.

Figure 3: Improvement (green) and non-improvement (red) in dog whelks (*Nucella lapillus*) at 115 sites in OSPAR regions I to IV



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Sources of data and information:

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