TBT-INDUCED IMPOSEX IN CAGED NEOGASTROPODS IN THE RIVER TYNE ESTUARY (UK)

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Introduction

Imposex is the development of male sexual characteristics by female gastropods, usually associated with the presence of Tributyltin (TBT) in the environment. The effect is most prevalent in busy commercial harbours, estuaries and where hydrological factors allow the concentrations of TBT to accumulate.

Imposex in dogwhelks (*Nucella lapillus*) is included in the OSPAR commission JAMP (Joint Assessment and Monitoring Programme) guidelines for monitoring contaminant-specific biological effects. At many sites of interest, elevated TBT concentrations have led to the extinction of local dogwhelk populations. Monitoring temporal changes in imposex levels at these locations is not possible. In this study this constraint was overcome by monitoring the occurrence of imposex in caged populations of transplanted dogwhelks.

Method

Imposex was assessed by observation of the amount of male reproductive tract that becomes superimposed over the female structures. Penis length was measured under the microscope, and the extent of vas deferens development assessed. Changes observed in the female *Nucella* were classified into stages as illustrated in Figure 1.

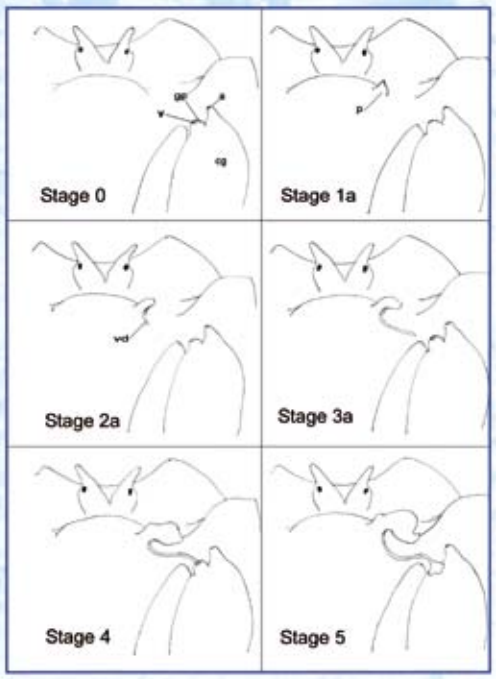

Figure 1: Development of Imposex in Nucella lapillus (After Gibbs et al., 1987 and Oehlmann et al., 1991) Abbreviations: a, anus; eg, capsule gland; gp, genital pore; p, penis; v, vagina; vd, vas deferens

Approach

Cage frames were made from stainless steel with a 6 mm plastic mesh to contain the dogwhelks and mussels.

Dogwhelks were collected from a site known to have no imposex in the population.

Mussels (*Mytilus edulis*) were used to provide a food source and were collected from areas with no history of TBT contamination. Samples from both dogwhelks and mussels were chemically tested to ensure they were free of TBT.

Figure 2: Cages in situ at South Site

Deployment

Cages were deployed on 22nd March, 2001.

They were retrieved on 22nd September, 2001.

Site locations are illustrated in figure 3.

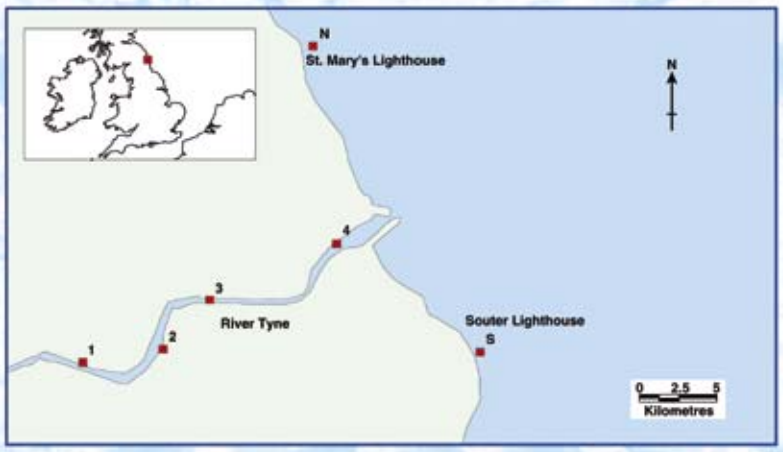

Figure 3: Map of the North East Coast and the River Tyne, showing all sites

Analysis

Dogwhelks were measured and examined for signs of imposex at day 0 and after six months using low power microscopes and calipers. Mussel and Dogwhelk soft tissue were chemically analysed to determine butyltin concentrations using GC-FPD (Waldock *et al.*, 1989)

Conclusions

1. Advanced stages of imposex were induced in dogwhelks exposed to Tyne estuary water over a period of 6 months.
2. TBT concentrations remain elevated in some areas despite limits applied to the use of TBT based antifouling since the 1980's.
3. Cage studies are an appropriate tool for studying the imposex induction potential in an area with no local populations remaining.
4. A six month cage study can provide well-defined data sets showing differences between sites backed up by several different indices and chemical analyses.

Further monitoring over the next few years would enable the effects of the recent IMO ban on all use of TBT based antifouling paints to be assessed.

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References

Gibbs, P.E., Bryan G.W., Pascoe P.L. and Burt G.R. (1987) The use of the dogwhelk, Nucella lapillus, as an indicator of Tributyltin (TBT) contamination, Journal of the Marine Biological Association, UK, 67, 507-523.

Oehlmann, J., Stroben E. and Fioroni P. (1991) The morphological expression of imposex in the dogwhelk, Nucella lapillus (Linnaeus) (Gastropoda: Muricidae). Journal of Molluscan Studies, 57, 375-390.

Waldock, M.J., Waite, M.E., Miller, D., Smith, D.J. and Law, R.J. (1989). "The determination of total tin and organotin compounds in environmental samples" Aquatic Environment Protection: Analytical Methods, No. 4. (Lowestoft).

Results

The results of this investigation are shown in Figures 4 to 7. No cages were recovered from sites 1 and 3.

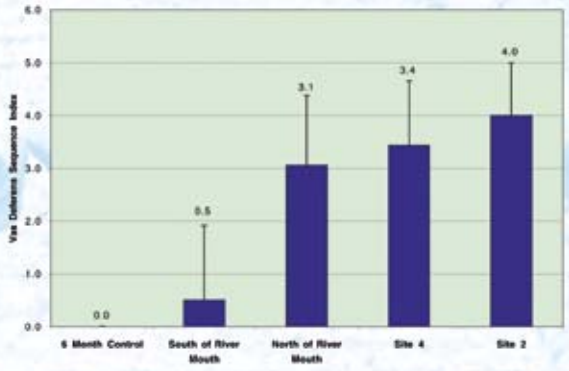

Figure 4: Vas Deferens Sequence Index

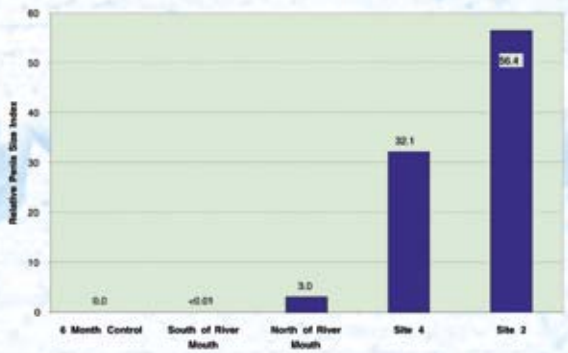

Figure 5: Relative Penis Size Index

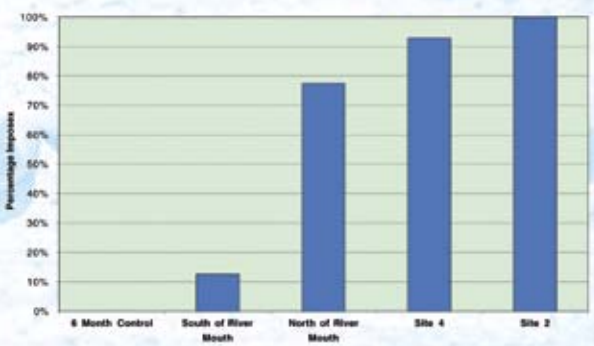

Figure 6: Percentage Imposex

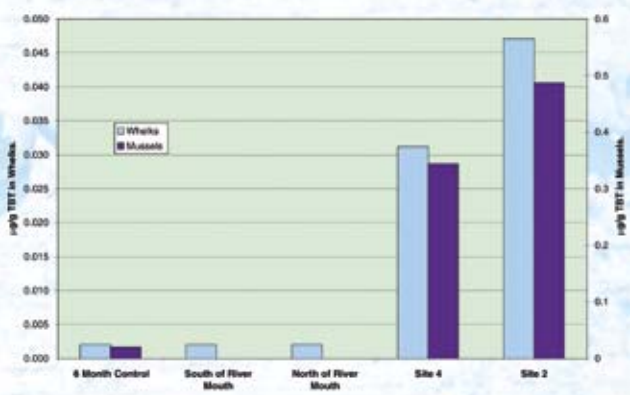

Figure 7: TBT Concentrations in Dogwhelk and Mussel Tissue

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