

# LEVELS OF PERSISTENT ORGANIC POLLUTANTS IN EUROPEAN SEAS: A THREAT FOR HARBOUR PORPOISE AND COMMON DOLPHIN POPULATIONS?

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The European project BIO CET<sup>1</sup> has discovered that by far the highest levels of the relatively 'new' flame retardant hexabromocyclododecane (HBCD) were found in harbour porpoises from the Irish Sea and the Northwest coast of Scotland. However, only the  $\alpha$ -isomer of HBCD bioaccumulated in blubber of common dolphin and harbour porpoise. High levels of PCBs occurred in harbour porpoises from Dutch waters and in common dolphins from the English Channel. These levels were above threshold concentrations reported to cause effects on reproduction in marine mammals.

Research groups from Scotland, Ireland, France, the Netherlands, Belgium and Spain were involved in this study funded by the Energy, Environment and Sustainable Development programme of the European Commission. The work was based on analysis of samples from harbour porpoise (*Phocoena phocoena*) and common dolphin (*Delphinus delphis*; fig.1) found dead on the coast, and also looked at the possible causes and consequences of the pollutant levels.

The three-year study aimed at quantifying levels of persistent organic pollutants (POPs) and heavy metals in harbour porpoises and common dolphins stranded on the coasts of different European seas (fig. 2). NIOZ was responsible for the analysis of all POPs in this project.

The most interesting results were obtained on the occurrence of a

particular class of brominated flame retardants (BFRs) in porpoises. This is hexabromocyclododecane (HBCD), which has a high production volume within the EU; 9500 tons was produced in 2001. This BFR is often used in insulation material for the building industry. By far the highest HBCD levels occurred in harbour porpoises

stranded on the coasts of the Irish Sea (median value 2.9 microgram per ( $\mu\text{g}$ ) gram lipid) and on the Northwest coast of Scotland (5.1  $\mu\text{g g}^{-1}$  lipid).

Commercial HBCD consists of three very similar compounds, called isomers. In all commercial mixtures one of them, the  $\gamma$ -isomer, makes up 70% of the total and



Fig. 1. Common dolphin (*Delphinus delphis*) Photo: Alfredo López, CEMMA, Spain.

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<sup>1</sup> BIO CET: Bioaccumulation of persistent organic pollutants in small cetaceans in European waters: Transport pathways and impact on reproduction. Project coordinated by the university of Aberdeen. More information at [www.abdn.ac.uk/biocet/](http://www.abdn.ac.uk/biocet/).

dominates over the other two ( $\alpha$ - and  $\beta$ -HBCD). To our surprise, all residues in harbour porpoise and common dolphin contained exclusively  $\alpha$ -HBCD. Probably, biotransformation of the  $\beta$ - and  $\gamma$ -isomers by the cytochrome P450 enzyme system plays a role in their removal. We will investigate this in the current EU project FIRE, which is entirely devoted to the environmental fate and endocrine effects of brominated flame retardants.

The contribution of HBCD to adverse effects is still uncertain, since much less is known about these emerging chemicals than about the classical organochlorines such as PCBs and DDT.

The highest levels of PCBs were found in harbour porpoises from Dutch waters and common dolphins from the English Channel. These levels were above  $15 \mu\text{g g}^{-1}$  lipid and thereby high enough to have an impact on reproduction via disruption of hormonal processes. Evidence collected on pregnancy rates suggests that the reproductive rate in Dutch porpoises is considerably lower than elsewhere in Europe. Although this fits with their high PCB levels, Dutch porpoises also carry the *Brucella* bacterium. Although its effects in cetaceans are unknown, *Brucella* can cause

the first pregnancy to end in an abortion in cattle.

Polybrominated diphenyl ethers (PBDEs) represent another class of brominated flame retardants. Five PBDE congeners were found in all samples (BDEs 47, 99, 100, 153, 154); they were all tetra- to hexa brominated compounds that are also major constituents of the commercial penta-BDE mixture, which has just been banned for further use in the EU after 2008. Of the commercial mixtures, penta-BDE is the mixture with the lowest degree of bromination, but also the most toxic one. The currently most

often used commercial PBDE mixture is deca-BDE, which consists for more than 98% of one compound, the fully brominated deca-BDE congener (BDE209). This bulky molecule was never detected in the set of BIOCET samples, although it often dominated over the penta-BDE compounds in sediments from the area. The differences in levels between different seas for the PBDEs and the DDT metabolite DDE were smaller than for the PCBs and HBCD, and regional differences in the toxic effects of these compounds are therefore unlikely.

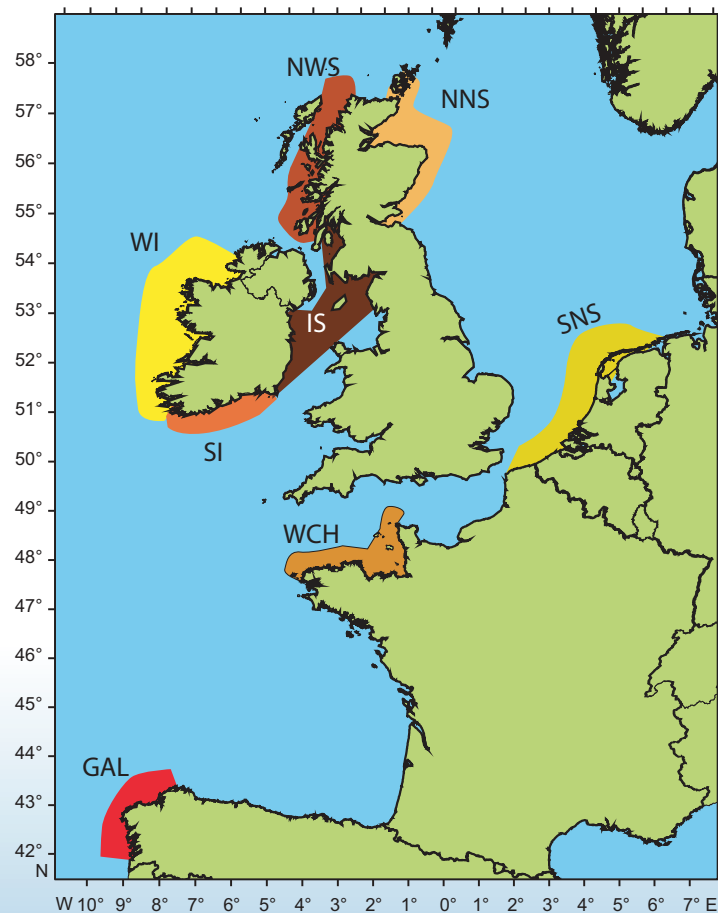


Fig. 2. Sampling areas for stranded cetaceans in the BIOCET project.