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European Commission

Science for Environment Policy

Herbicide found in German estuaries, transported to the Baltic Sea

Glyphosate is a widely used herbicide, able to kill a broad range of plants ('weeds') that compete with crops. This study used a validated method to assess its presence in 10 German estuaries that lead to the Baltic Sea. All but one was contaminated with glyphosate, and all were contaminated with its metabolite AMPA. The researchers recommend risk assessments for these chemicals in the Baltic Sea and other marine environments.

Marine pollution is a problem worldwide, but it is particularly acute in semi-closed seas. Areas surrounded by land are more at risk of pollution than open marine areas, due to increased human input, such as chemicals from industry and agriculture, e.g. pesticides and fertilisers.

The Baltic Sea, a semi-closed sea in northern Europe, is one of the most polluted seas in the world. Due to significant agricultural inputs leading to eutrophication, oxygen levels in the sea have declined, creating large 'dead zones' and challenging the survival of marine biota.

This study focused on pollution of the Baltic Sea from Germany. The Baltic Sea is bordered by four German states. The German Baltic drainage basin (which receives inflow from three rivers) is characterised by lots of human activity. Germany has the highest agricultural activity of all Baltic countries and has in the past contributed to the Sea becoming polluted with hazardous compounds, such as pesticides. Although a number of these compounds have since been banned, many continue to persist in the environment, including the insecticide DDT, which has a known negative effect on biodiversity.

In this study, researchers focused on the levels of a chemical in current use in the EU: the herbicide glyphosate, which may have toxic effects on marine microorganisms.

Germany is Europe's second largest pesticide consumer. In 2012, over 45 000 tonnes of pesticides were used, 44% of which were herbicides (mostly glyphosate). Glyphosate has been identified in fresh surface- and ground-water bodies in Germany, at concentrations above the European threshold for drinking water (100 nanograms per litre — ng/l); however, its presence in the marine environment is difficult to monitor. Using a suitably sensitive method, this study quantified glyphosate (and its major breakdown product AMPA) in German Baltic Sea estuaries.

Water samples were collected from 10 estuaries between May and September 2012, then analysed for the presence of glyphosate and AMPA. All estuaries were contaminated with AMPA, and nine were also contaminated with glyphosate. Glyphosate was found in concentrations ranging from 28 to 1 690 ng/l, while AMPA was found at higher concentrations (between 45 and 4 156 ng/l), which the authors attribute to AMPA's higher mobility and stability. However, it is important to note that AMPA is also formed during the breakdown of other chemicals, such as laundry agents and detergents and, therefore, its presence in the samples cannot be attributed to use of glyphosate alone.

The authors looked more closely at the seventh sampling station — Mühlenfliess — which was the most heavily contaminated. Water samples from inbound sampling stations along the stream were analysed. Concentrations of glyphosate were 2 768 ng/l and of AMPA 5 190 ng/l but these decreased (as the water became saltier) towards the estuaries of the Baltic, which suggests its transport into the Sea, the authors say.

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Herbicide found in German estuaries, transported to the Baltic Sea *(continued)*

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Concentrations measured in water samples were also (generally) higher following rainfall than during dry weather, which suggests rainfall may help to transport the compounds.

The data obtained strongly suggest transport of both compounds in rivers, from their site of application into the Baltic Sea. The long-term effects of these contaminants at the concentrations measured here are unknown. The researchers, therefore, recommend assessments of the environmental fate of, and risk posed by, these two contaminants in marine environments.

This study also describes a straightforward analytical method to measure glyphosate and AMPA in marine environments above a concentration of 27 ng/L, which may facilitate monitoring programmes in the future.