

Determination of emerging substances in top predators and their prey using state-of-the-art chemical monitoring methods

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Abstract

Contaminants of emerging concern (CECs) are defined as chemicals that are currently not regulated and not included in routine monitoring programmes at European level. In general, limited information is available for their occurrence in the various environmental compartments, their (eco)toxicity, and potential health effects. CECs are introduced in the environment by various anthropogenic activities and some of these substances may have the potential to enter marine, freshwater and/or terrestrial food webs, where they can be magnified. Currently, exposure information is often missing and there is urgent need for sufficient exposure and effects data to be able to assess CECs and initiate risk mitigation measures where appropriate.

The objective of the study was to apply generic and fully-validated sample preparation protocols on top predators and prey samples and use state-of-the-art analytical instrumental methods to define the predominant chemical mixtures. To fulfil the objective, 100 samples of top predators (harbour seal, common buzzard, Eurasian otter) and their prey (bream, roach, perch, eelpout) were retrieved from European Environmental Specimen Banks (ESBs), Research Collections (RI) and Natural History Museums (NHMs). The samples were carefully selected to maximize the geographical coverage of northern Europe (United Kingdom, Germany, Netherlands and Sweden) and obtain spatial distribution data and clear pollution patterns. The specimens were transferred on dry ice and were extracted using a generic sample preparation protocol based on accelerated solvent extraction, followed by solid phase extraction. The extracts were analyzed for both polar and non-polar CECs by liquid chromatography coupled to high-resolution mass spectrometry and gas chromatography coupled to high-resolution mass spectrometry, respectively.

Wide-scope target screening of more than 2,400 CECs, wide-scope suspect screening of 40,053 CECs and non-target screening were used to capture as many CECs as possible. The detected substances were prioritised based on the established NORMAN prioritization schemes for targeted and suspected substances. An exposure assessment was performed in combination with a PBT screening to identify and thoroughly assess a selection of top-prioritised compounds. Finally, the samples were digitally archived for future retrospective screening efforts.

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Keywords: emerging contaminants, top predators and prey, wide-scope target and suspect screening, non-target screening, NTS prioritization, PBT assessment