Active ingredients in personal care products detected throughout the environment

On a daily basis, we use a variety of personal care products, including soaps, detergents, sunscreens, fragrances, insect repellents, cosmetics, and shampoos. In fact, the US Bureau of Labor Statistics estimates that the average household spends over $750 per year on personal care products. The active ingredients in these products enter the wastewater collection system following hand-washing, bathing, and laundry-washing. Examples of active ingredients in personal care products include the antibacterial, triclosan, and the sunscreen agent, oxybenzone. As wastewater treatment plants are not designed to remove these specialty chemicals, a fraction of these products enter the environment, where they can have significant consequences. For instance, triclosan causes negative developmental and reproductive effects in fish and other aquatic organisms. Low concentrations of oxybenzone were recently shown to cause bleaching of coral reefs. For these reasons, the occurrence and toxicity of personal care products in the environment are major concerns.

In their April 2016 report, *An aggregate analysis of personal care products in the environment: Identifying the distribution of environmentally-relevant concentrations*, Hopkins and Blaney reviewed the literature on personal care product detections throughout the environment. Their motivation for this study was to prioritize the environmental monitoring of select chemicals and demonstrate the need for advanced water and wastewater treatment. The authors collected over 5000 reported environmental detections of 95 different personal care products from the literature. Most of those detections were reported for wastewater, treated wastewater, and surface waters like rivers, streams, and lakes; however, it is important to note that personal care products have also been detected in treated drinking water and breast milk.

The authors' findings demonstrated that personal care products are widely present in the aquatic environment. Figure 1 shows the collected concentrations of 29 different personal care products in surface waters around the world. Select measurements demonstrated high concentrations (> 10 µg/L), but the median (50^{th} percentile) concentrations were generally between 10 and 100 ng/L. While these concentrations are fairly low, one concern with personal care products is that they can accumulate at much higher concentrations in the tissue of fish and other aquatic organisms, resulting in toxic effects.

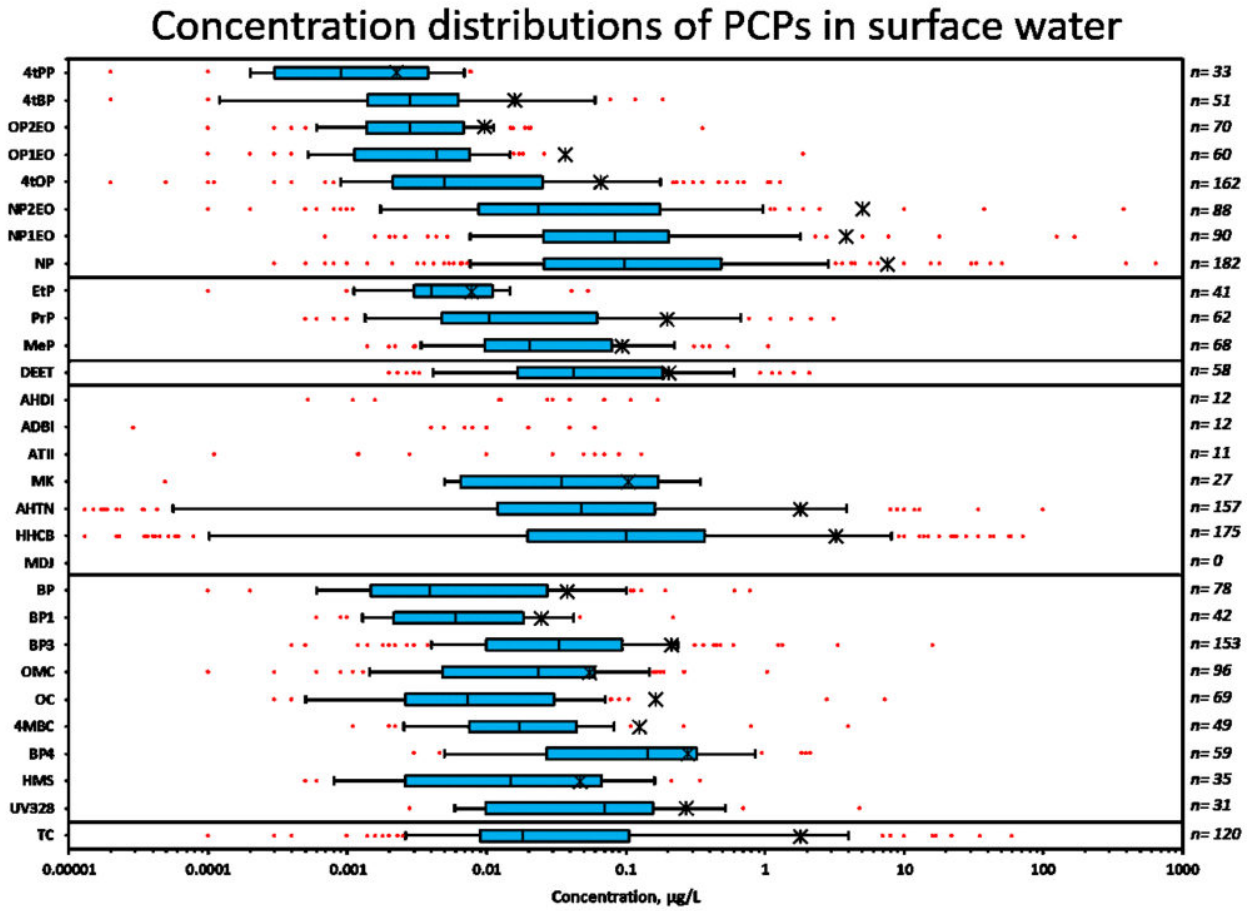

Fig. 1. Box-and-whisker diagrams representing detected concentrations of 29 active ingredients in surface waters, such as rivers, streams, and lakes, throughout the world. The red symbols represent data that fall outside of the 10th and 90th percentiles; the left-most edge of the box is the 25th percentile; the line inside of the box is the median concentration; the right-most edge of the box is the 75th percentile; the asterisk is the arithmetic mean; and the n value on the right-hand side of the plot is the number of detections.

Given the frequency and magnitude of personal care product detections in the aquatic environment, along with reported toxicity levels, Hopkins and Blaney suggested that UV-filters (sunscreen agents), polycyclic musks (fragrances), and triclosan (antibacterial) should be considered priority chemicals. In fact, the US Food and Drug Administration announced a ban on triclosan and other antibacterial chemicals in hand and body washes in September 2016. Hopkins and Blaney also called for expanded toxicity testing and continued environmental monitoring of the extensive list of active and inactive ingredients in personal care products, especially in treated drinking water. Finally, the authors indicated that advanced water and wastewater treatment processes are needed to remove the toxicity threat from these chemicals to safeguard public and

environmental health.

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