Potential Human Exposure to Per- and Polyfluoroalkyl Substances (PFAS) via Consumption of Fish from U.S. and International Sources

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Background/ Objectives. Dietary exposure is estimated to contribute approximately 60 to 80 percent of total exposure to per- and polyfluoroalkyl substances (PFAS), particularly long-chain PFAS (Vestergren and Cousins 2009; Vestergren et al. 2012; Trudel et al. 2008). However, the relative proportion of contributions from drinking water versus food (or food packaging) is not well understood. A number of European studies have shown fish consumption to be a significant route of exposure for high-end consumers of commercial market fish, with species-specific differences (Domingo and Nadal 2017; Barbarossa et al. 2016). However, data on PFAS levels in common food products, including commercial fish and shellfish available in U.S. markets, are limited.

Approach/ Activities. A review of published studies of PFAS levels in fish and shellfish from the U.S. and international waters was performed to summarize levels and trends by species, source, and PFAS type. The literature review was augmented with an empirical study to compare PFAS levels in commercially-available U.S. finfish with levels reported in the literature. The species selected for analysis represent national and regional species, with a focus on higher trophic level species where bioaccumulation of PFAS is expected to be greater. A mix of popular marine and freshwater species caught from U.S. waters was purchased at commercial fish markets and supermarkets from four regions of the U.S. (Northeast, Southeast, Midwest, and West). Fresh fish of local origin was targeted. Species that are widely available in U.S. markets, such as salmon and swordfish, were also purchased. Each sample consisted of approximately one half-pound to represent a typical fish meal size. The majority of samples were fillet tissue, with the whole body for a subset of species (e.g., herring, trout). The fish were analyzed for 26 PFAS, including carboxylic, sulfonic, and intermediate degradation products using an isotope dilution method that achieves a detection limit of 2 ng/g and meets the criteria of the Department of Defense (DoD) Quality Standard Methods (QSM) Version 5.1.

Results/ Lessons Learned. The 26 PFAS compounds analyzed include the most widespread and commonly reported long-chain PFAS (PFOS, PFOA), short-chain (PFBS, PFBA), precursors of interest (FOSA, FTSAs) and other long-chain and short-chain PFAS that have been reported in abiotic and tissue media. PFAS concentrations in U.S. commercial finfish are close to method quantitation limits and lower than levels reported in many other fish tissue studies. The results provide a valuable perspective on exposures to PFAS from fish consumption on a national basis.