

Source tracking of PFAS in humanly impacted lakes and a recently contaminated coastal area in Sweden

ANNE L SOERENSEN AND SUZANNE FAXNELD

Swedish Museum of Natural History

Per- and polyfluoralkyl substances (PFAS) are a group of manmade, highly fluorinated chemicals containing compounds that are persistent, bioaccumulative and toxic. The fractional distribution of PFAS homologues in the environment can be used to track the contribution of sources. In this study, we retrospectively analyzed four fish time series (oldest sample from 1972) for 15 targeted PFAS homologues from humanly impacted locations in Sweden: three large lakes and a coastal site.

For the coastal site, Kvädöfjärden, which is part of the Swedish National Monitoring Program, perch PFOS have been elevated (50-150 ng/g ww liver versus other coastal sites of <25 ng/g ww liver) since the site was introduced in 2016. In addition to the time series, we collected additional perch in 2023 in a radius of 6 km from the site to look for concentration gradients. Historic perch, salmon and char samples were analyzed from Sweden's three largest inland water bodies (Vänern, Vättern, Mälaren). Previous studies have shown elevated PFAS concentrations in fish caught in the lakes (100-1000 ng/g ww liver) and multiple local sources are known.

We examine variability in PFAS at the four sites over 40-50 years and compare to trends at uncontaminated sites in the Swedish National Monitoring Program. Using concentrations and fractional PFAS homologue distribution together with information on human activity (from the county boards database on hazardous substances), we determine if/when local releases have affected PFAS levels in the environment and how sources have changed over time. For the coastal site, we further investigate the spatial distribution of PFAS from coast to open ocean.

Preliminary results from the coastal site suggest that PFOS and several PFCAs have increased since the 1980s. We find a change in the fingerprint of PFAS homologues between 2005 and 2010, suggesting a change from a marine (diffuse) source to a local source that drives a fast increase in concentrations from 2010 (where reference sites at other locations start to decrease due to the effect of legislation). Results on the analysis of PFAS temporal variability and source tracking of sources for the four humanly impacted areas will be discussed.