

## Introduction

Mercury and polychlorinated biphenyls (PCBs) are two contaminants of concern for anglers in the San Francisco Bay. Mercury, in its elemental and methylmercury forms, can harm the nervous system. This can cause cognitive impairment, especially in children. Eating fish is the number one source of mercury exposure for Americans. Polychlorinated biphenyls (PCBs) are industrial chemicals that were manufactured until 1979. A PCB congener is one chemical compound in the PCB category. There are 209 unique PCB congeners. PCBs can cause cancer as well as negatively affect the immune, reproductive, nervous, and endocrine systems. Despite the ban on PCB manufacturing, PCBs persist in the environment and can contaminate meat, dairy, water, and especially fish.

## Methods

I obtained data from the Contaminant Data Display and Download (CD3) tool of the San Francisco Estuary Institute. I used Python 3.8 for all analysis and visualization. I used the Pandas package for data cleaning and Geoviews, Holoviews, and Bokeh for visualization.

Because the data came from different collection times and stations, I examined the units the results were reported in to ensure the data were all comparable (see supplementary information). Because of a significant difference in the distribution of mercury concentrations in fish tissue in ug/g dry weight (dw) versus ug/g wet weight (ww), I chose to plot data using the two units separately for the time series analysis. Mercury concentrations in sediment were reported in ug/kg dw and mg/kg dw, which should differ by three orders of magnitude. However, my analysis led me to conclude that the data belonged to similar distributions and the difference in units may be an error in reporting.

Fish and sediment were not collected at the same coordinates, so I grouped the data by county to facilitate comparisons.

## Findings

The EPA recommends that people avoid eating fish that contain over 0.46 ug/g mercury. In the San Francisco Bay, the concentration of mercury in fish has decreased since 2003 such that the majority of fish contain less than this threshold. In recent years (2011-2015), fish caught off Pier 40 contain the lowest concentrations of mercury. The mercury concentration in sediment from the Bay does not show any trends over time except for a recent spike in Contra Costa county (El Cerrito). There is not a strong correlation between mercury levels in sediment and in fish.

The US tolerance for total PCBs in fish is 2000 ng/g wet weight. None of the fish sampled in San Francisco Bay in 2009 and 2010 reached this level. However, over those two years, the level of total PCBs increased. Individual PCB congeners spanned from 0 to 100 ng/g in fish tissue; the maximum concentration for any individual congener did not change over time. However, sediment in San Mateo county spiked to over 0.1 g/g in 2010, over ten thousand times higher than the next highest measurement. However, sediment concentrations have recovered to typical levels. Although much less data is available for total PCBs than for mercury, increased total PCBs in sediment appears to correlate strongly with total PCBs in fish tissue.