River otters of the Green-Duwamish: biomonitors of ecological health

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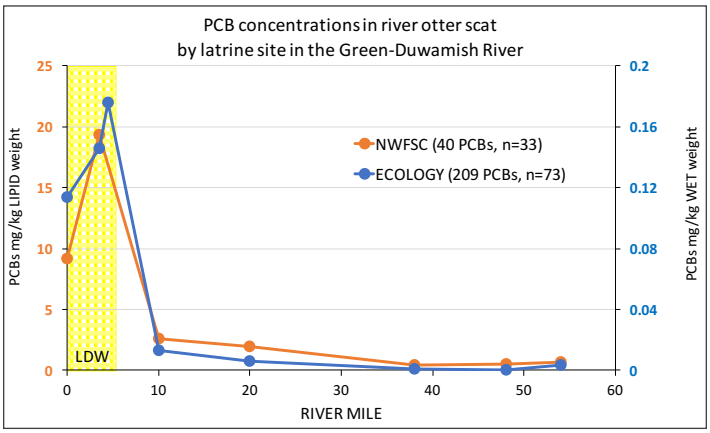
- **Scat samples suggest high levels of contaminants in river otters in the Lower Duwamish Waterway Superfund site, with levels declining upriver.**
- **Contaminants data provide a baseline and establish the value of otters as biomonitors in assessing ecological impacts of upcoming cleanup efforts.**

River otters (*Lontra canadensis*) are apex predators that play important roles in aquatic ecosystems (e.g., Ben-David et al., 1998; Cote et al., 2008; Larsen, 1984; Roemer et al., 2009). They prey primarily on fish and crustaceans, but are opportunistic predators with a diet ranging from insects to birds and mammals (see Boyle, 2006). They are vulnerable to biomagnification of persistent pollutants, and with relatively localized home ranges (Blundell, 2000; Bowyer et al., 1995), they are considered biomonitors of wildlife exposure to toxics and environmental health (Carpenter et al., 2014; Guertin et al., 2010). Empirical and modeling studies evaluating correlations between polychlorinated biphenyl (PCB) levels in river otter diet, feces and liver tissue have established scat as an accepted proxy for understanding toxicological significance (see Guertin et al., 2010). In summer and fall 2016, we collected 33 otter scats from sites along the Green-Duwamish River, ranging from river miles 0-54. River miles 0-5 represent the Lower Duwamish Waterway (LDW), a U.S. Superfund site slated for a 17-year remediation. Concentrations of PCBs at sites in the LDW were 9.1 and 19.3 mg/kg (geometric means, lipid weight) - above the reported threshold value of 9 mg/kg associated with adverse effects for river otters. By river mile 10, mean concentrations of PCBs decreased to 2.6 mg/kg, with remaining upriver sites ranging from 0.4-1.9 mg/kg. Polycyclic aromatic hydrocarbon (PAH) concentrations showed a similar pattern. The highest PAH levels (140 and 91 mg/kg, geometric means, wet weight) were measured in the LDW whereas levels upriver were 9.7-25 mg/kg. Based on preliminary genetics data from several sampling locations, we infer that otters remain in local river reaches, so scat contaminant levels likely reflect local environmental concentrations. Scat collected in 2017 and analyses for brominated flame retardants, organochlorine pesticides, stable isotopes, and genetics will provide additional depth and breadth to these results. These are the only empirical contaminants data available for a mammal or apex predator in the Green-Duwamish. They suggest that otters may be impacted by contaminant loads in the LDW; however, significant questions remain as to the potential individual health and population effects. The data also reveal that the contamination gradient along the Green-Duwamish is reflected in otters, indicating they are useful biomonitors of wildlife and food web exposure to contaminants, as well as watershed health in this system. The timing of this study provides an important baseline level of contamination in otters that may be of great value for assessing ecological impacts of long-term Duwamish Superfund site cleanup efforts.



Polychlorinated biphenyl (PCB) concentrations from river otter scat collected at latrine sites along the Green-Duwamish River, King County, WA. Values are geometric means. Samples analyzed at two separate laboratories, represented by two axes; methods vary – see axes titles. Yellow rectangle represents the Lower Duwamish Waterway Superfund site (river miles 0-5).

Game camera photo of river otters at a latrine site along the Green-Duwamish River, King County, WA. Photo: Michelle Wainstein