



Tissue toxicants and prespawn mortality in Willamette River Chinook salmon

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Abstract In some Pacific salmon *Oncorhynchus* spp. populations, many adults die after reaching freshwater spawning sites but prior to spawning, a phenomenon known as prespawn mortality (PSM). Causal factors for PSM are often uncertain, but pathogens, warm water temperature, and environmental toxicants have been implicated in several studies. In this two-year project, we examined the relationship between toxicants and PSM in a threatened population of spring-run Chinook salmon *O. tshawytscha* (Walbaum) in the Willamette River, Oregon. Muscle and skin samples from 63 female carcasses were screened for ~125 potential toxicants, including trace elements, pesticides, and organohalogenes. Mean concentrations for five toxicants selected for their known adverse effects on

salmonids were: 4.3 ($SD = 2.0$) ng/g cadmium, 72.9 (122.7) ng/g nickel, 10.0 (9.0) ng/g lead, 12.7 (8.6) ng/g polychlorinated biphenyls (PCBs), and 17.6 (10.3) ng/g DDT (an organochlorine pesticide). Using generalized linear models, we found no statistical differences in toxicants concentrations between successful ($n = 37$, 58.7%) and unsuccessful ($n = 26$, 41.3%) female spawners. We conclude that selected contaminants did not provoke acute toxicity in Willamette River Chinook salmon. It remains unknown whether sub-lethal or chronic toxicant effects on adult salmon physiology or behavior have affected the fitness of this threatened population.

Keywords Organohalogenes · Pesticides · Pollutants · Prespawn mortality · Trace elements · Toxic chemicals

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Introduction

A vast array of chemical pollutants accumulate in aquatic ecosystems and can negatively impact the behavior, survival, and fitness of fishes (Scott and Sloman 2004; Islam and Tanaka 2004; Bosch et al. 2016; Hamilton et al. 2017). Important classes of persistent xenobiotics that affect fishes include trace metals (e.g., cadmium, copper, lead, mercury), organochlorine and organophosphate pesticides (e.g., diazinon, DDT), pharmaceuticals, industrial chemicals (e.g., flame retardants, polychlorinated biphenyls [PCBs]), petroleum byproducts (e.g., polycyclic aromatic hydrocarbons [PAHs]), and many other synthetic compounds. The effects of environmental toxicants on fishes are as diverse as the pollutants, ranging from fatal toxicity (Scholz et al.