COPPER SPECIATION IN THE STRAIT OF GEORGIA

by

Lori-jon C. Waugh
B.Sc. Honours 2020

A thesis submitted to the Department of Earth, Ocean, and Atmospheric Sciences
in conformity with the requirements of
EOSC 449
Supervised by Professor Maria Maldonado

University of British Columbia
Vancouver, British Columbia, Canada
April 2020

Abstract

Seasonal and spatial copper (Cu) speciation depth profiles were determined within the Strait of Georgia through competitive ligand exchange-adsorption cathodic stripping voltammetry, employing salicylaldoxime as the added competitive ligand for species analysis. Ambient ligand concentrations, L_i, and their conditional stability constants, $K^{cond}_{CuL_i,Cu^{2+}}$, are interpreted from Langmuir transformations, leading to estimates of the free hydrated copper concentrations (Cu^{2+}), a proxy for Cu toxicity. In all samples, L_i exceeds total dissolved copper concentrations, following trends in salinity and Strait of Georgia estuarine circulation, resulting in the complexation of 99.98% of the dissolved Cu by strong binding organic ligands. The concentrations of Cu^{2+} are less than $10^{-13.22}$ M, significantly lower than the well-established Cu toxicity threshold (10^{-12} M Cu^{2+}) for microorganisms. Our results indicate that ambient copper binding ligands effectively buffer free hydrated copper concentrations within the Strait of Georgia, posing no threat to marine life.