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How do you like your fish? Methods development for the analysis of lead isotopes and trace metal concentrations in Pacific Salmon

JASMINE ELIZABETH CHASE, BROOKE HOPPSTOCK-MATTSON AND DOMINIQUE WEIS

University of British Columbia

Presenting Author: jchase@eoas.ubc.ca

Geochemical analysis of trace element (TE) concentrations and lead (Pb) isotopes in marine organisms can identify sources of anthropogenic metal contamination, monitor changes in metal concentrations over time, and address questions related to fish migration (collectively termed biomonitoring) [1,2]. The preparation of fish tissue for geochemical analysis requires many steps including tissue sampling, drying, and homogenisation, yet there is no widely accepted method of sample preparation for metal analysis at each stage of the process [1,3]. This study compares the results of TE concentrations and Pb isotope composition in duplicate samples of muscle tissue from twenty-five individual salmon samples (three species: Chinook, pink, and coho) on which three common preparation methods were tested: freeze-dried homogenised, freeze-dried whole-tissue, and oven-dried homogenised. Sixty-eight resulting samples were acid digested and analysed by HR-ICP-MS at PCIGR. The findings document significant variation in Pb isotope compositions and TE concentrations (e.g., Ni and Fe) in samples processed by the different preparation methods. Whole-tissue samples have notably lower Pb concentrations than homogenised ones, and Pb isotopic ratios of oven-dried and freeze-dried homogenised samples follow different trends without evidence for Pb contamination by drying and homogenising in either case. Furthermore, and unsurprisingly, our study correlates higher Pb concentrations between species to higher trophic levels. This investigation highlights the importance of careful sample selection and preparation, and provides new opportunities for standardisation across future biomonitoring studies to improve accuracy and reproducibility.

[1] Li et al., (2020) *Anthropocene* 29 1-9.

[2] Shiel et al., (2013) *Geochim. Cosmochim. Acta* 121 155-167.

[3] Ip et al., (2005) *Environ. Pollut.* 138, 494–504.