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Seasonal trends in Cu, Ag and Cd content in Strait of Georgia zooplankton

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Introduction

Zooplankton are important links in the food web

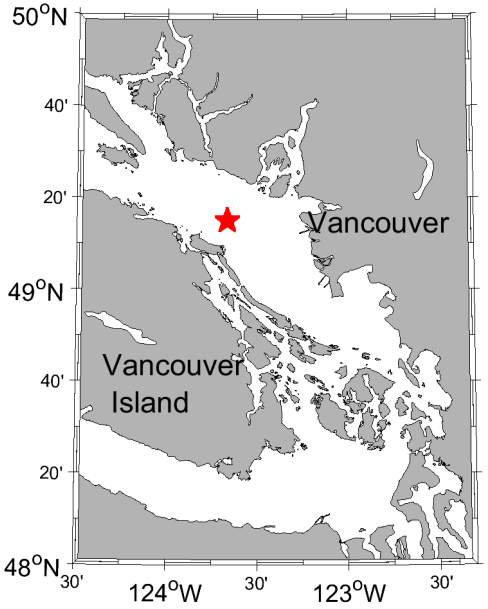
Cd, Ag, Cu can be toxic to zooplankton

Purpose of study:

- Create a **baseline** for seasonal zooplankton trace metal content in the Strait of Georgia
- Determine if there is **Cu, Ag** and **Cd bioaccumulation** in the lower trophic levels

$$\text{Bioaccumulation Factor (BAF)} = \frac{[\text{Metal in body}]}{[\text{Metal in water}]}$$

Methods



2017-2018 time series sampling in the Central Strait of Georgia

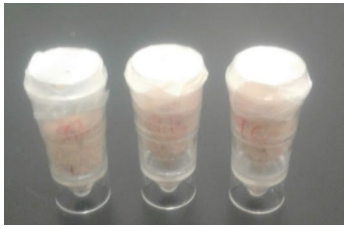
- 4 times: December ’17, April, June, August ’18
- Station depth: 380 m

Measurements:

- Zooplankton (5 size fractions)
  - Trace metal content
  - Community composition
  - Trophic position
- Dissolved Ag, Cu, Cd

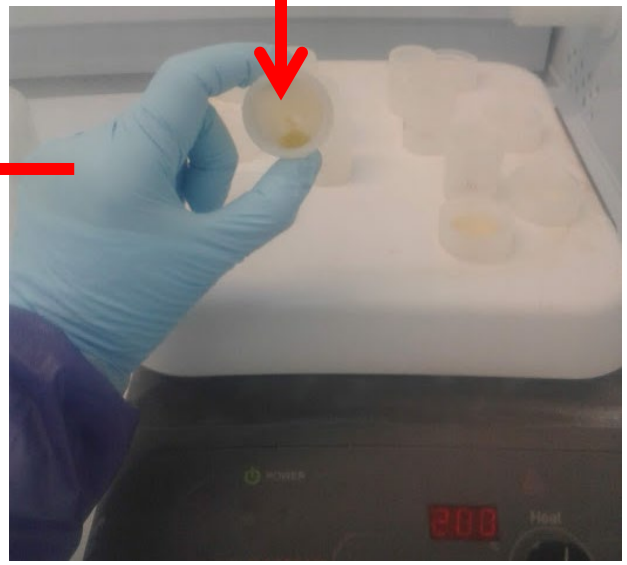
Measuring trace metal content in zooplankton is hard work

Dry



Grind

Digest



Measure

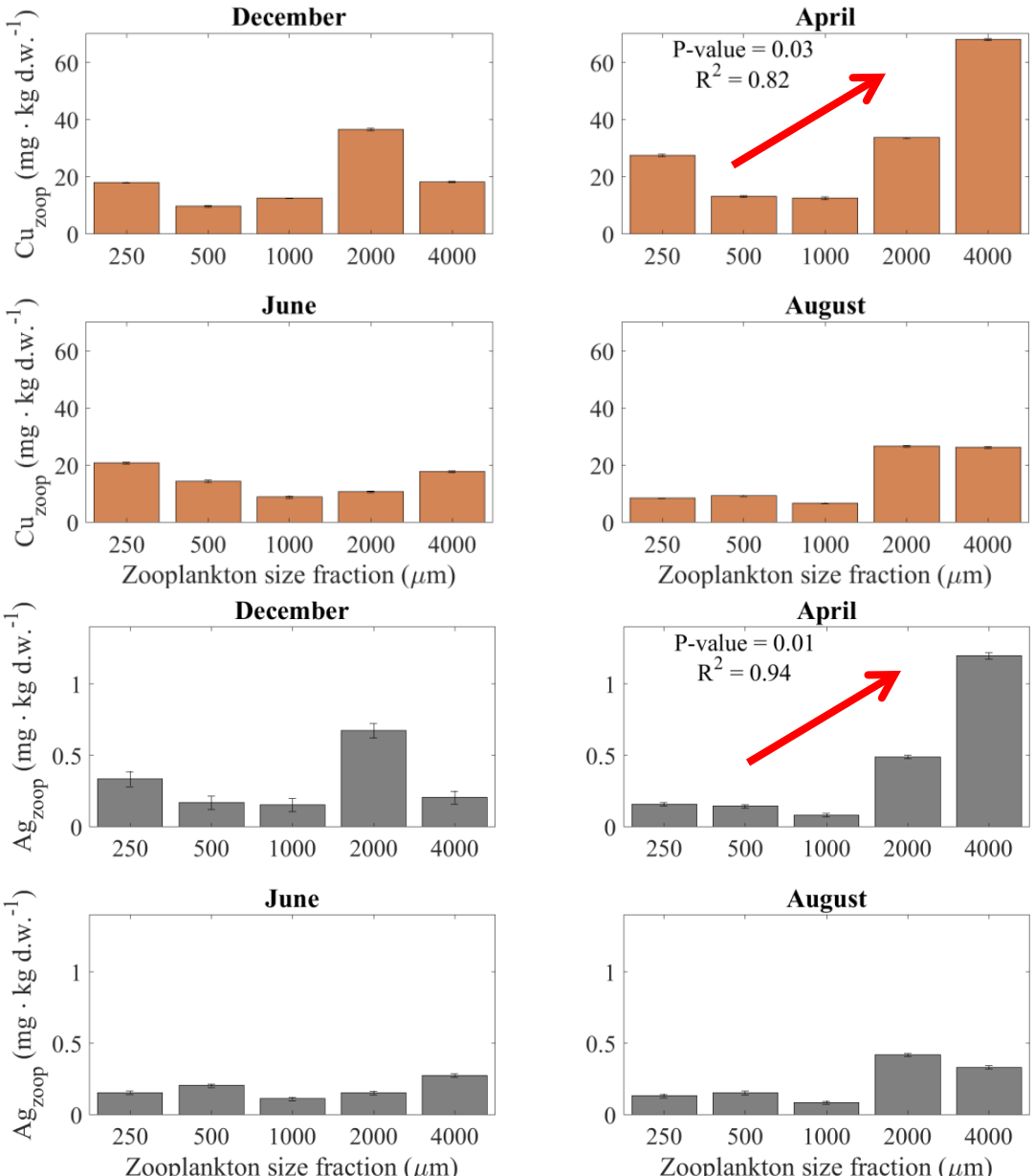
Final solution

HR-ICP-MS

Zooplankton trace metal content

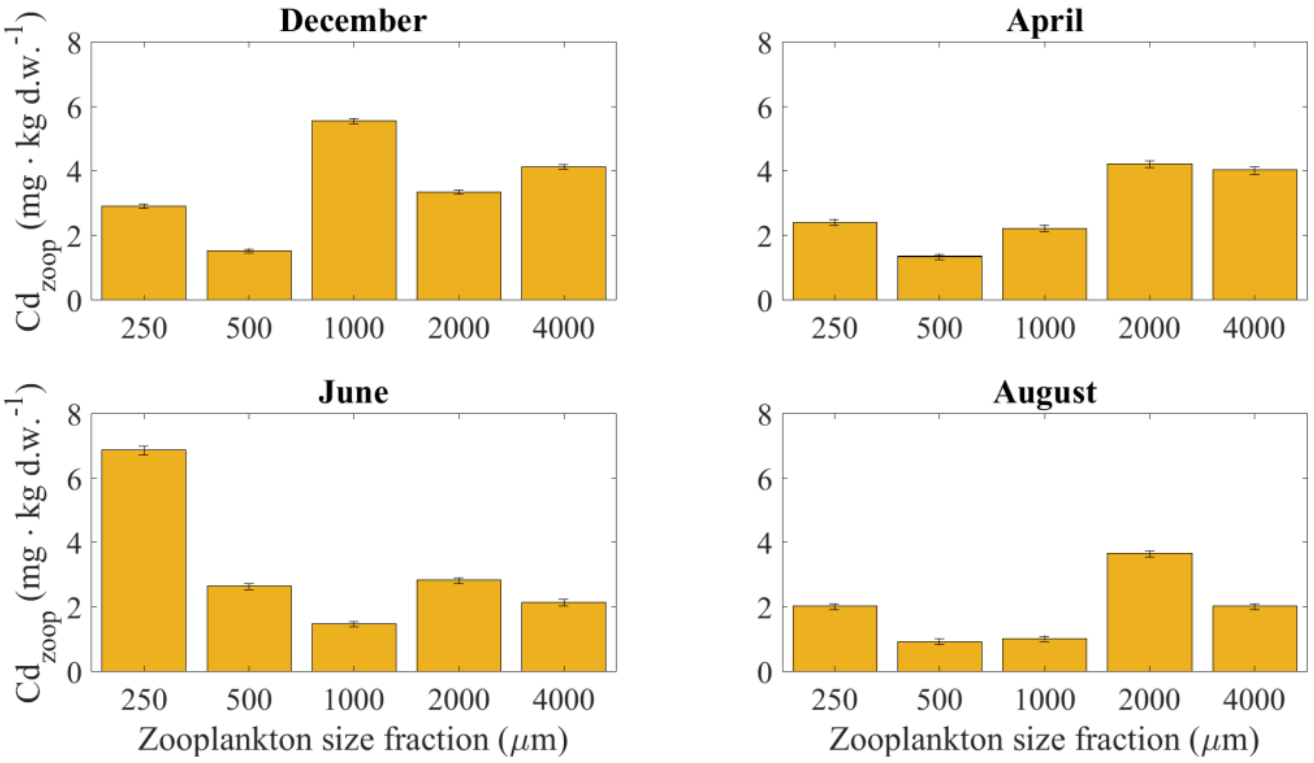
Cu

Ag



Zooplankton trace metal content continued

Cd



No difference in Cd content between size fractions or between seasons.

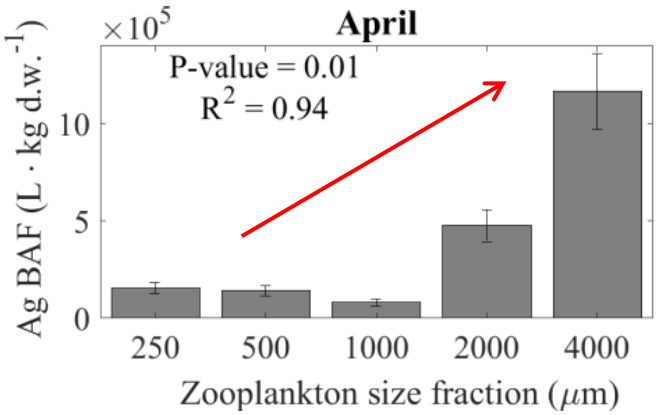
SoG zooplankton have comparable metal content to other regions in the world

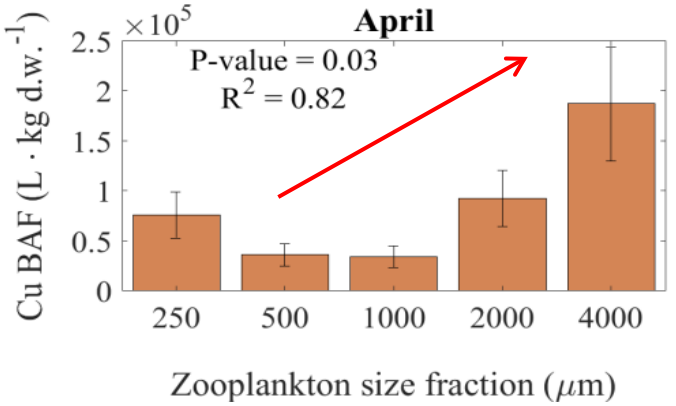
Metal content (mg/ kg d.w.)	SoG	NW Mediterranean Sea (Chauvelon et al. 2019)	Coastal NE Taiwan (Fang et al. 2014)	Global average
Cu	6.7 - 68	3.3 - 25	2.7 - 35.9	18.4
Cd	0.9 - 6.9	0.2 - 1.2	0.2 - 1.5	3.4
Ag	0.1 - 1.2	0.1 - 0.2	0 - 0.2	0.1

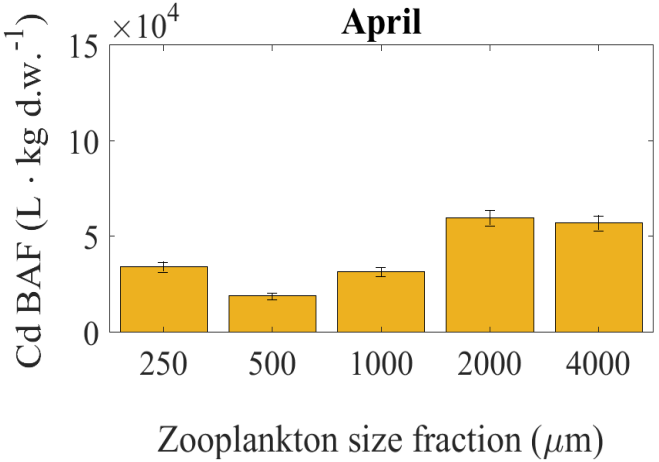
Bioaccumulation

- Ag bioaccumulates more than Cu or Cd:
  - Ag: 12.7 x10^5 (L/kg)
  - Cu: 1.9 x10^5 (L/kg)
  - Cd: 1.1 x10^5 (L/kg)

- Bioaccumulation trends are the same to those for trace metal content.







It is important to monitor [Ag] and [Cu]

	SoG Average	2019 BC Water Quality Guidelines for Marine and Estuarine Waters (total Me)	BAFs measured x 10^5 (L/kg d.w.)
Cu (nM)	3.2 - 9.7	Maximum allowable: 47 nM 30-day average: 31.5 nM	0.3 – 1.9
Cd (pM)	269 - 717	1.1 nM	0.1 – 1.1
Ag (pM)	3.4 - 11.9	Maximum allowable: 27.8 nM 30-day average: 13.9 nM	0.7 – 12.7

Zooplankton are not generally experiencing toxic dissolved metal concentrations.

Conclusions and moving forward

- First zooplankton trace metal measurements in the SoG
- We captured natural seasonal variation in trace metal content
- Zooplankton currently not exposed to harmful Ag, Cu, Cd concentrations
- Zooplankton are bioaccumulating Ag and Cu more than Cd. More careful monitoring for Ag and Cu is advised.

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