

# Arsenic Bioaccumulation in Tissues of Chinese Mystery Snails Collected from Lake Ecosystems



Holly H Henry, Sarah R Alaei, Alison Gardell  
Division of Sciences & Mathematics | University of Washington Tacoma

## Introduction

- Arsenic (As) is a legacy contaminant that was released by the American Smelting and Refining Company (ASARCO) smelter in Ruston, WA throughout its 100-year operation.
- The pollutant was distributed to many lakes in the Puget Sound lowland region, which presented concern about As entering the food chain in these lakes. Chinese mystery snails (CMS) are a primary consumer in these lakes and have been shown to bioaccumulate substantial amounts of As in their bodies; however, it is unclear whether As is localized to a particular tissue region.
- **Hypothesis:** More As would bioaccumulate in CMS gut collected from Lake Killarney (20 ppb As in water) than in CMS collected from Trout Lake (~0 ppb As in water).

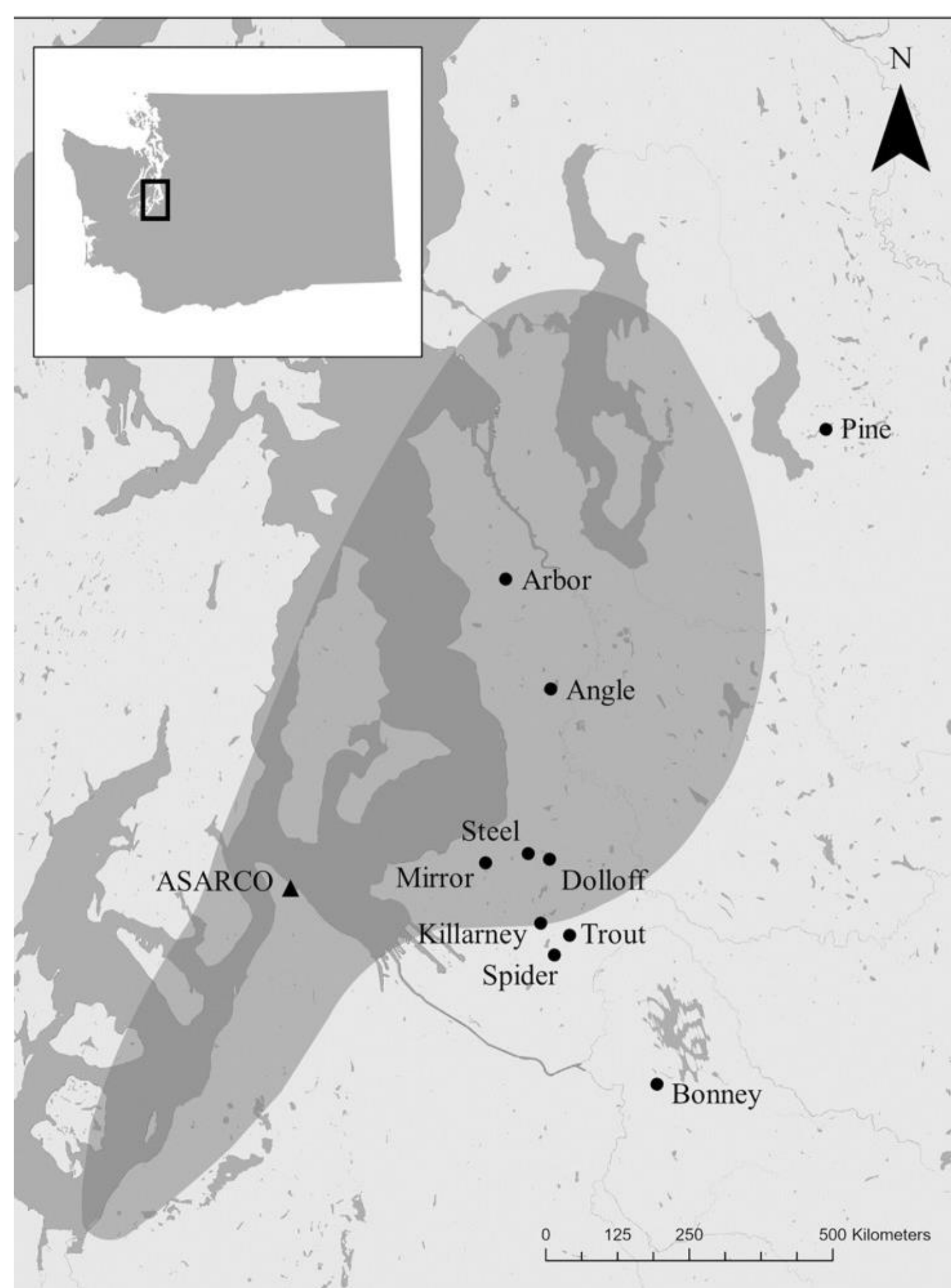


Figure 1. Map of polluted regions and various lakes within ASARCO's smelter plume (grey-shaded area). (Figure from Hull et al. 2023)

## Methods

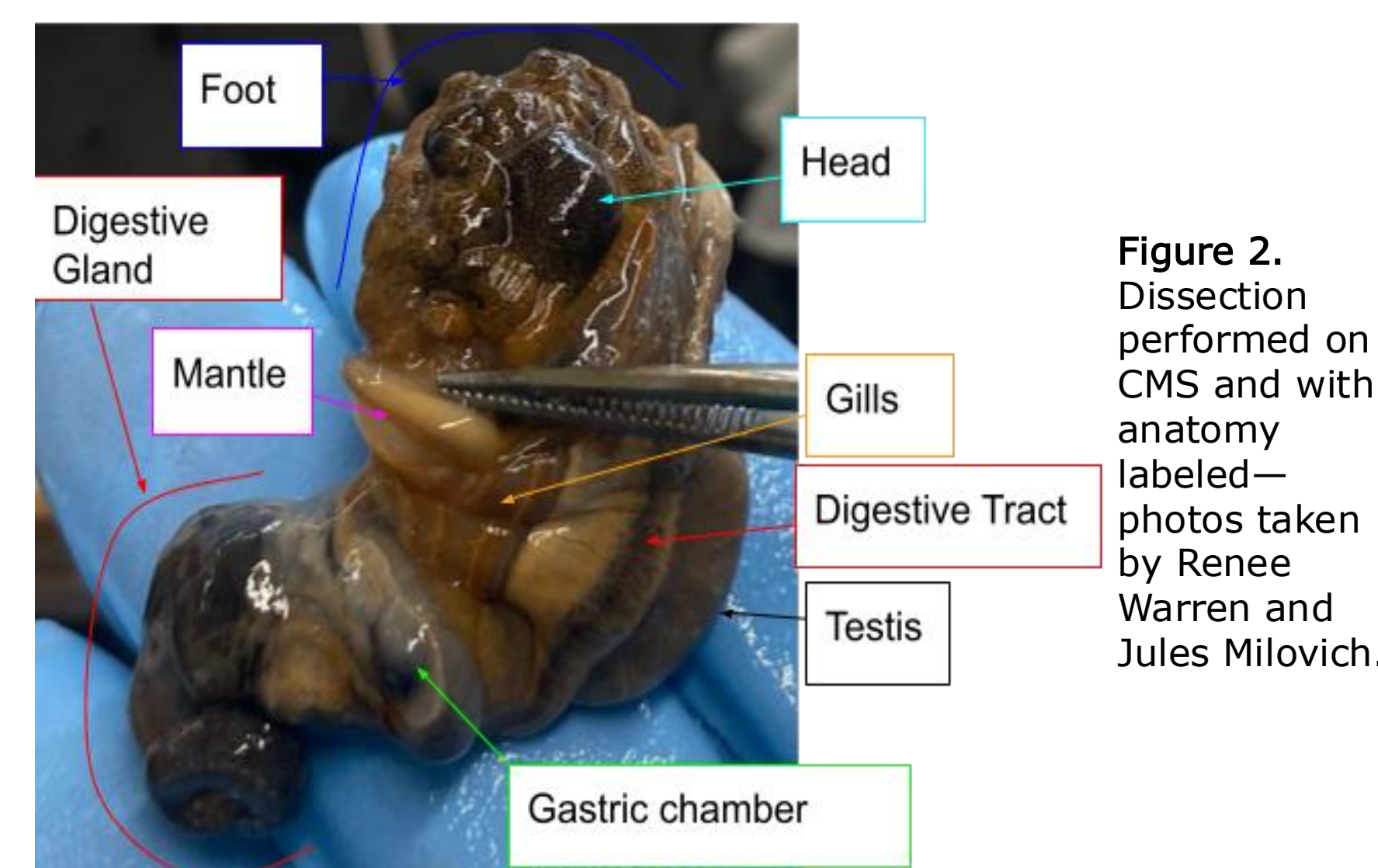
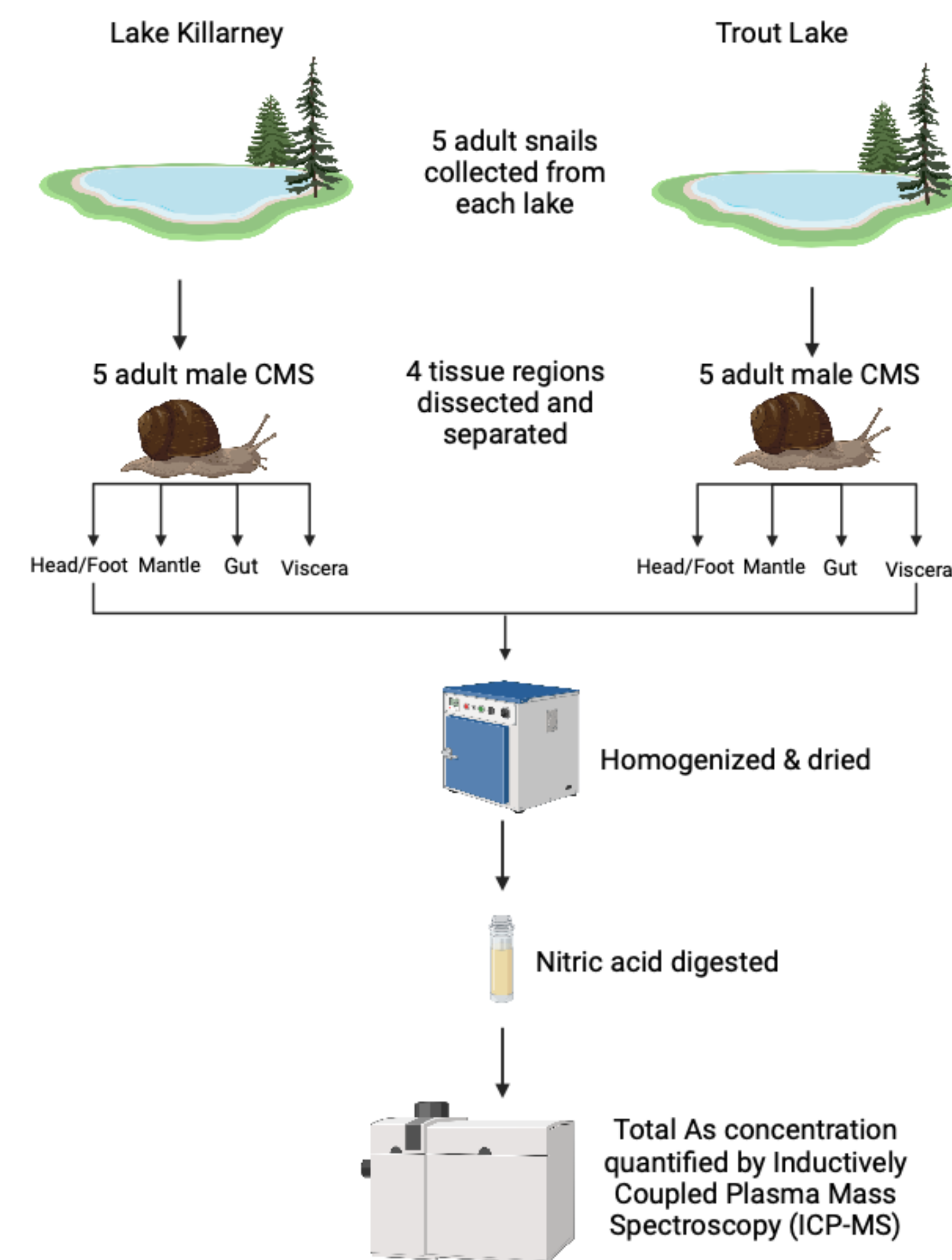


Figure 2. Dissection performed on CMS and with anatomy labeled—photos taken by Renee Warren and Jules Milovich.

## Results

- Higher amount of Total Arsenic in the Guts of CMS from Lake Killarney than Trout Lake
- Arsenic bioaccumulates in the Gut of CMS from Lake Killarney
- Arsenic bioaccumulates in Viscera Tissue of CMS from Trout Lake

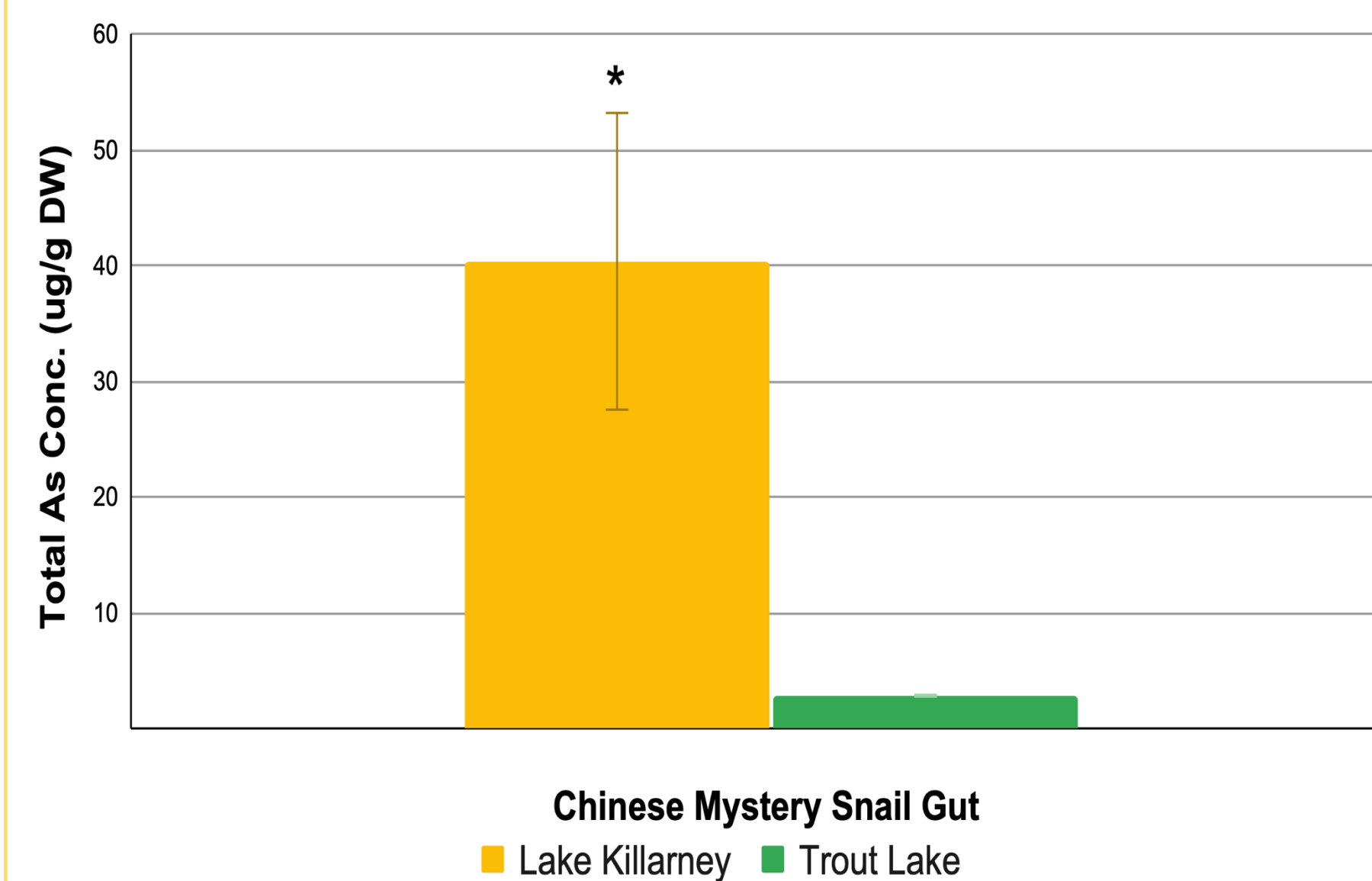


Figure 3. Total Arsenic concentration in the gut of CMS from Lake Killarney and Trout Lake. ICP-MS was performed on gut CMS tissue. Results show higher As bioaccumulation in gut from Lake Killarney (n = 5 for each Lake). Error bars represent +/- standard error from the mean. Two-tailed T-test revealed a significant difference between As concentrations in samples from both lakes,  $p < 0.05$ .

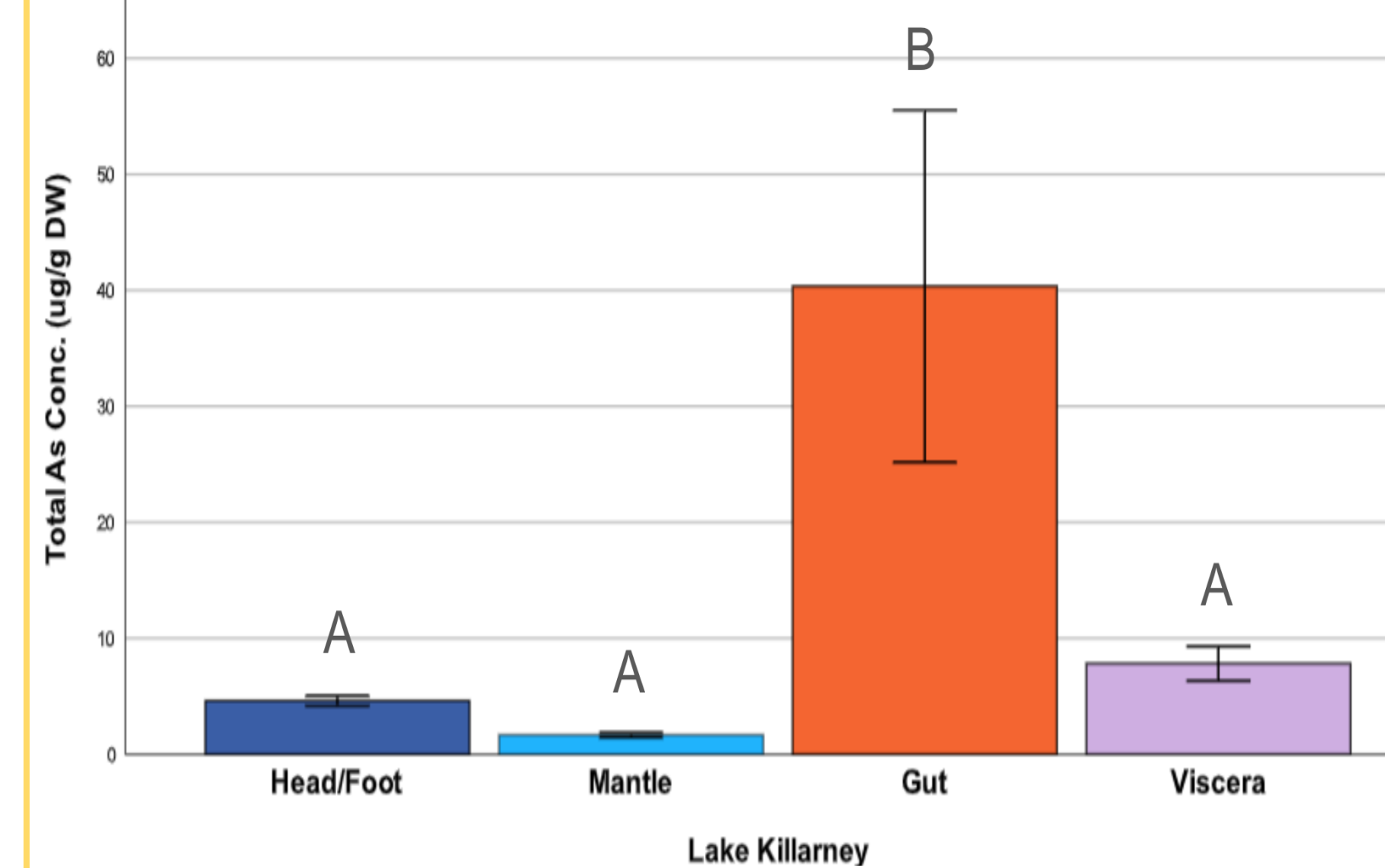


Figure 4. Arsenic Total concentration of Chinese Mystery Snails (CMS) from Lake Killarney. ICP-MS was performed on various CMS tissue. Results show higher As bioaccumulation in gut of CMS (n = 5 for all samples). Error bars represent +/- standard error from the mean. Statistical analysis was performed using one-way ANOVA,  $p < 0.01$ . Tissues not sharing any letter are significantly different by the Post-hoc Tukey Test.

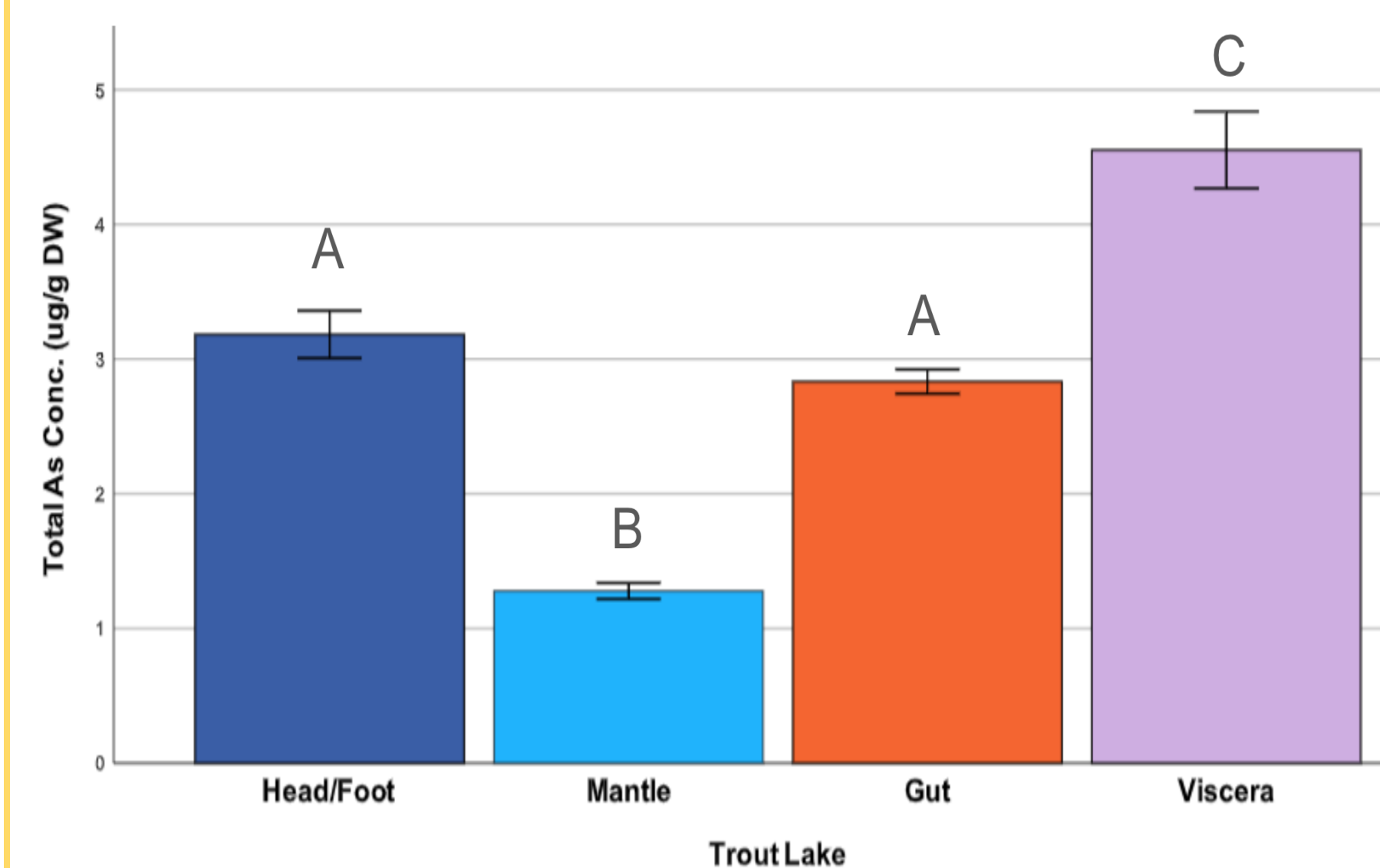


Figure 5. Arsenic Total concentration of Chinese Mystery Snails (CMS) from Trout Lake. ICP-MS was performed on various CMS tissue. Results show higher As bioaccumulation in visceral tissue of CMS (n = 5 for all samples). Error bars represent +/- standard error from the mean. Statistical analysis was performed using one-way ANOVA,  $p < 0.001$ . Tissues not sharing any letter are significantly different by the Post-hoc Tukey Test.

## Conclusion

- CMS from Lake Killarney showed significant bioaccumulation of arsenic in the gut (40.4 ug/g dry weight) compared to other tissue groups from Lake Killarney.
- The ICP-MS results also showed that visceral tissue (4.55 ug/g dry weight) had significantly higher arsenic bioaccumulation for Trout Lake.
- The gut, head/foot, and viscera tissue groups had significantly higher concentrations of arsenic in Lake Killarney compared to Trout Lake.
- Future research on quantification of arsenic species (arsenate, arsenite, and organic forms) that are bioaccumulating in the CMS tissues may give insight into biotransformation processes that affect toxicity.

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## References

Hull EA, Stiling RR, Barajas M, Neumann RB, Olden JD, Gawel JE. 2023. Littoral sediment arsenic concentrations predict arsenic trophic transfer and human health risk in contaminated lakes. PLOS ONE. 18(10):e0293214. doi:10.1371/journal.pone.0293214

Van Bocxlaer B, Strong EE. 2016. Anatomy, functional morphology, evolutionary ecology and systematics of the invasive gastropod *Cipangopaludina japonica* (Viviparidae: Bellamyinae). Contributions to zoology (Amsterdam, Netherlands : 1995). 85(2):235-263. doi:10.1163/18759866-08502005.