

Investigating the influence of xenobiotic pollutants on CYP1A enzyme levels in abundant Ohio populations of endangered Canadian Redside dace (*Clinostomus elongatus*) populations

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Abstract

Redside dace (*Clinostomus elongatus*), an endangered species in Canada, abundantly found in Northeastern Ohio, were used to examine the effects of xenobiotic contaminant exposure, specifically polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs). Redside dace were exposed to sediment samples from different sites in Northeast Toronto and Northeast Ohio. No statistical significance was found between control and experimental groups. Future research should investigate dace filtration mechanisms and population decline factors to better inform conservation and remediation strategies.

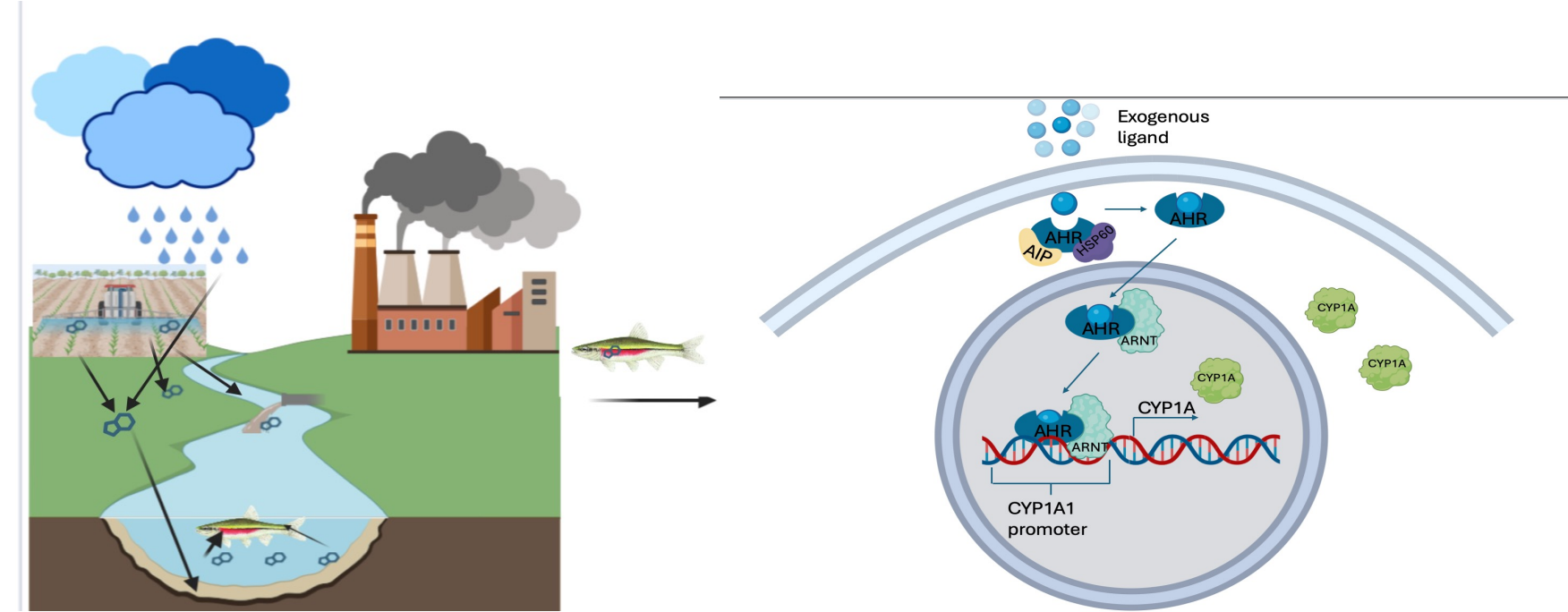


Figure 1: Routes of xenobiotic pollution and AhR pathway in response to pollutants. Urbanization, pesticides, run-off all contribute to xenobiotic pollution. Exposed fish used the AhR pathway in response to xenobiotic contaminants for detoxification

Background Information

- Xenobiotic pollutants** are non-naturally occurring chemicals. **PAHs** and **PCBs** are two more commonly found in ecosystems [1]
- Redside dace** are an **endangered species in Canada** but have **thriving populations in Ohio**. [2]
- This species is **sensitive** to environmental changes [3]
- Pollutants **induce** expression of the **detoxification enzyme CYP1A**, which indicates exposure levels and reflects the health of aquatic ecosystems [4]

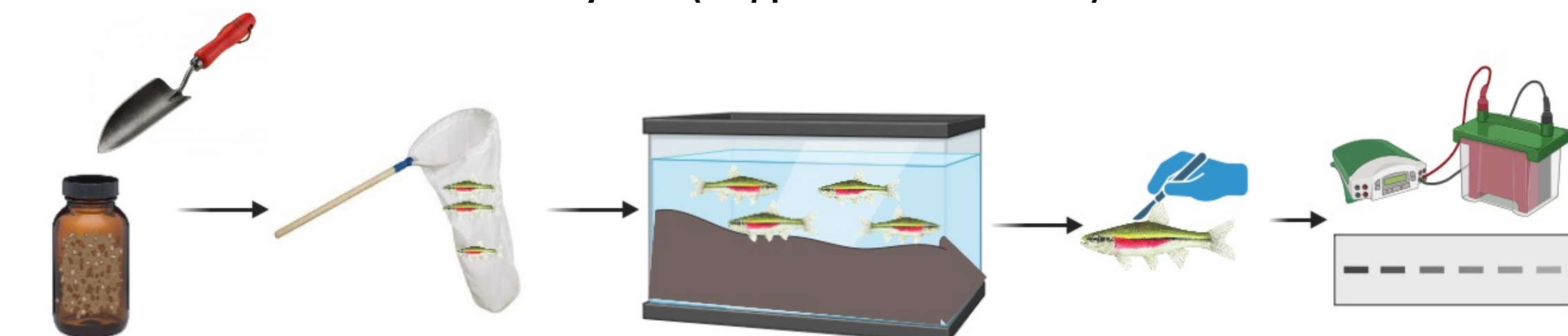


Research Objectives and Hypothesis

- Research Objectives:** Investigate **urbanization** as a potential **source of endangerment**. Quantify **CYP1A** expression levels in Redside dace exposed to xenobiotic pollutants in sediment from urbanized areas.
- Hypothesis:** Redside dace **exposed to contaminated sediment** sites will exhibit **higher CYP1A** levels of expression.

Experimental Design

- Sediment collection (Figure 2)
- Fish capture (Wooster Memorial Park)
- Expose fish to clean (Wooster) or contaminated treatment (Canada) sediment (96h)
- Preservation of spleen, muscle, gill, and liver tissue
- Western Blot Analysis (Figures 3 and 4)



Do xenobiotic contaminants in sediment samples induce CYP1A in Redside dace?



Figure 2: Sediment Collection in Northeast Toronto Redside dace endangered sites and Northeast Ohio sustained Redside dace populations.

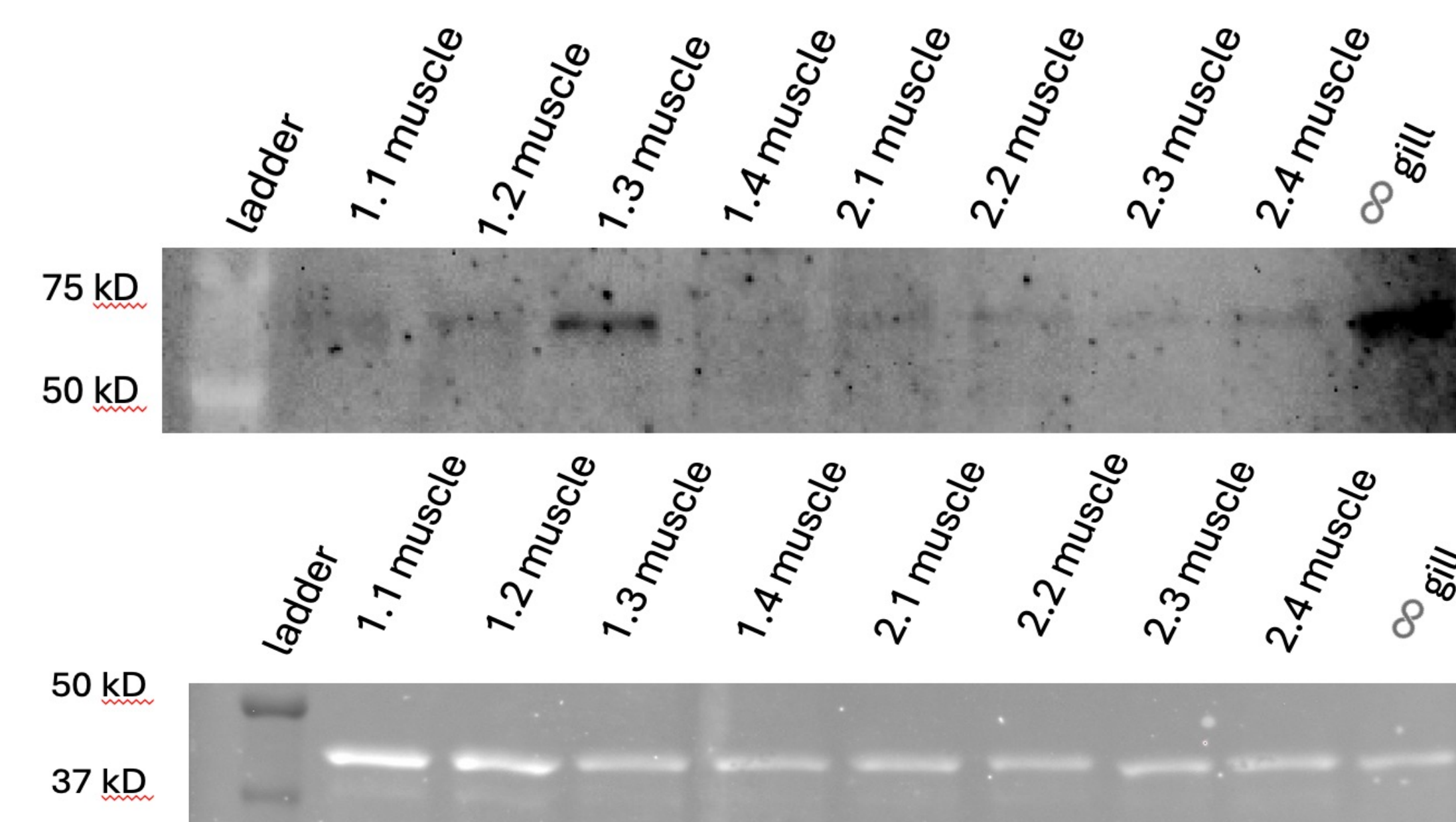


Figure 3: CYP1A and Rhodamine Anti-Actin loading control western blot membranes ∞ gill used as a positive control. 1.1-1.4 represents Berczy Creek sediment and 2.1-2.4 represents Carruthers Creek sediment

Conclusions

- First known CYP1A induction and expression in Redside dace.**
- Sediment analysis revealed **no detected PAHs or PCBs** in samples.
- No statistically significant difference** between control and experimental sites.
- Highest CYP1A expression** was found in **Berczy Creek** exposed fish.
- Higher expression in experimental sights** than control sites, indicating **possible trace amounts of contaminants** present in samples.
- Inconclusive results for Beaver Creek and Little Rouge River experimental sites due to complications with the secondary antibody used.
- CYP1A was consistently detected in gill tissue** amongst all tested tissues (Figure 3, last lane).

Future Directions

- Clarify the way in which minnows filter contaminants** when compared to larger fish species.
- Obtain results from all experimental sites

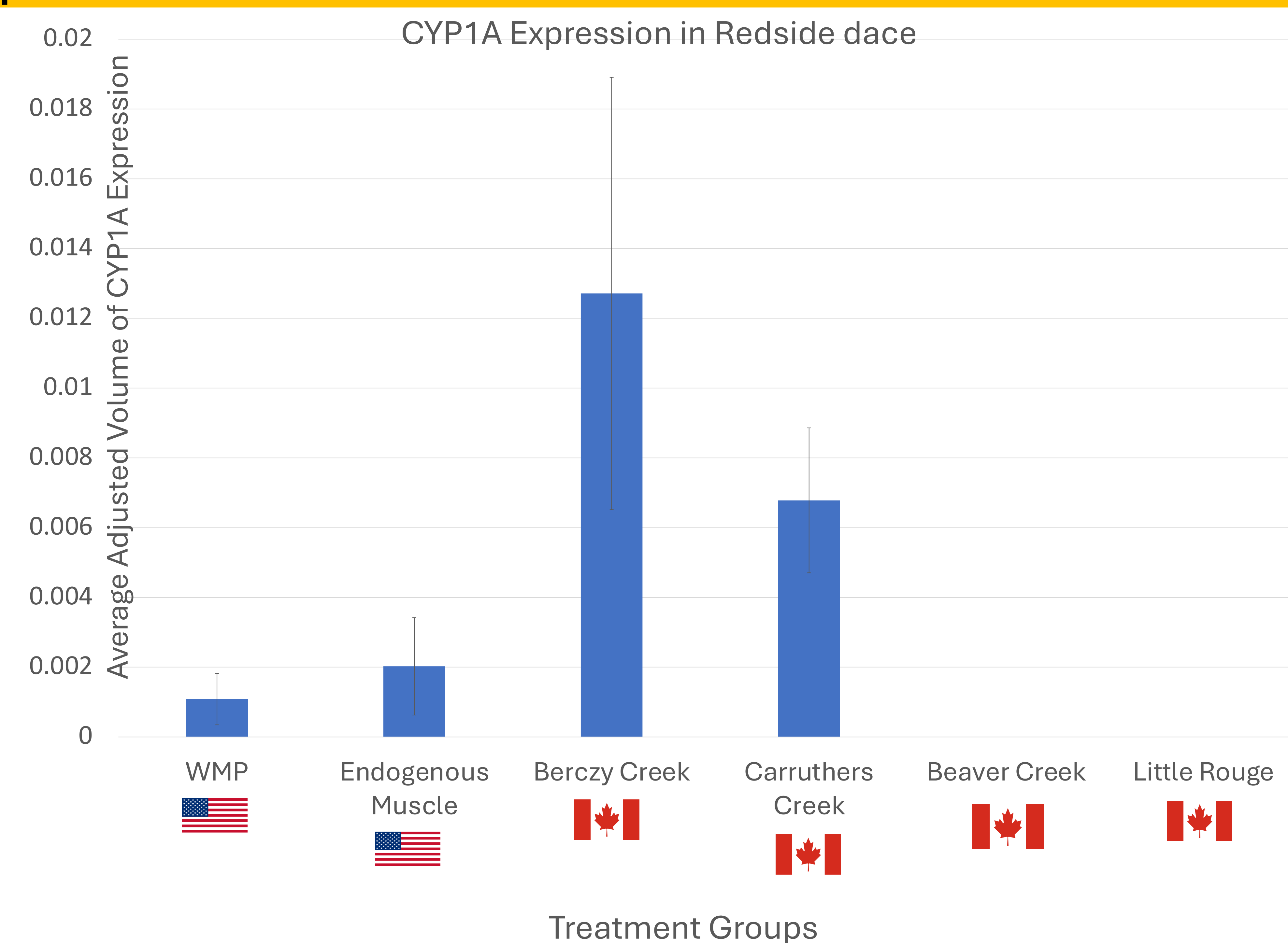


Figure 4: CYP1A densitometric expression profile of fish in each experimental group. A one-way ANOVA revealed there was no statistically significant difference between groups. (p -value = 0.108, $F(3, 15)=2.511$). Error bars denote the standard error of the mean of each group.

Tropiques toxiques et le chlordécone

- Utilisation des **bandes dessinées** comme un moyen **d'illustrer** et de **partager des découvertes scientifiques**,
- Rendre la **science plus accessible à tous** [5]

Acknowledgements

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