

Elevated Nutrient Concentrations Affect Accumulation of Metals in Periphyton and Invertebrates

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Periphyton and invertebrates are key basal resources for many stream food webs

- Periphyton is an assemblage of algae, bacteria, and fungi that grows on submerged surfaces



Contaminants accumulate in periphyton and invertebrates

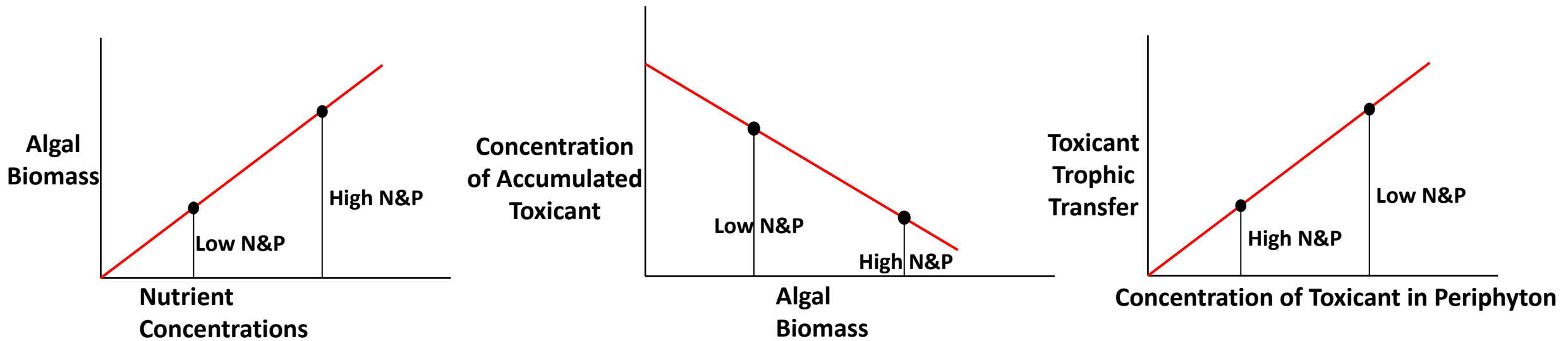
- Dietary Exposure Pathway
- Many contaminants accumulate in periphyton including metals
- Many invertebrates are sensitive to metal contamination



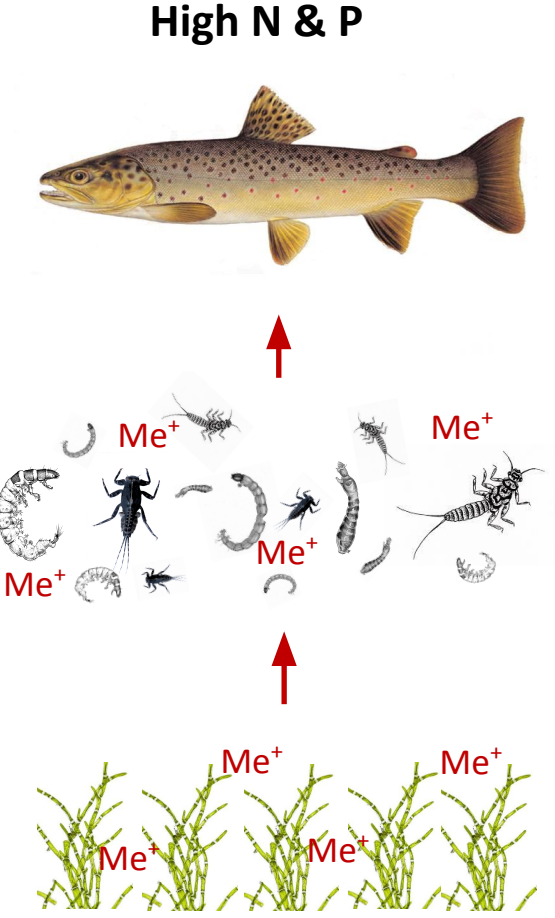
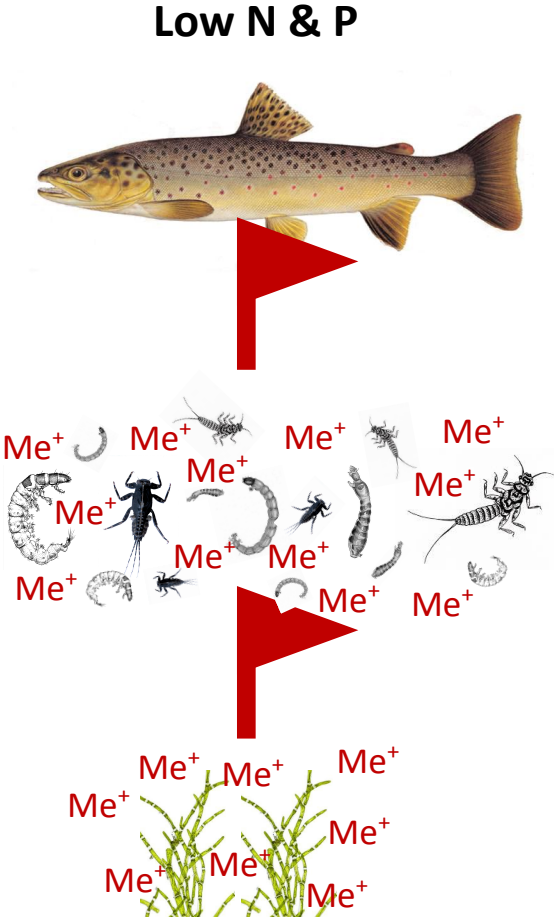
How do algal blooms affect the accumulation and trophic transfer of metals in streams?



Bloom Dilution Hypothesis: Elevated nutrients **reduce** the concentration of accumulated toxicants in periphyton because increased algal biomass **dilutes** toxicants and reduces trophic transfer.



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Artificial Streams (i.e. Mesocosm) Experiment

Periphyton and Invertebrates were colonized on clean gravel
near Missoula for 30 days



15 Day Mesocosm Experiment

Nitrogen and Phosphorus added to Clark Fork River water containing elevated ambient metal concentrations

Design:

Recirculating, dosed at 4 mL per minute

Water Sampling:

Treatment and Mesocosm Sampling

Periphyton:

Pigments, AFDM, Metal Content

Invertebrates:

“Grazers”:

Ephemeroptera baetidae

Ephemeroptera ephemereleidae

Ephemeroptera heptageniidae

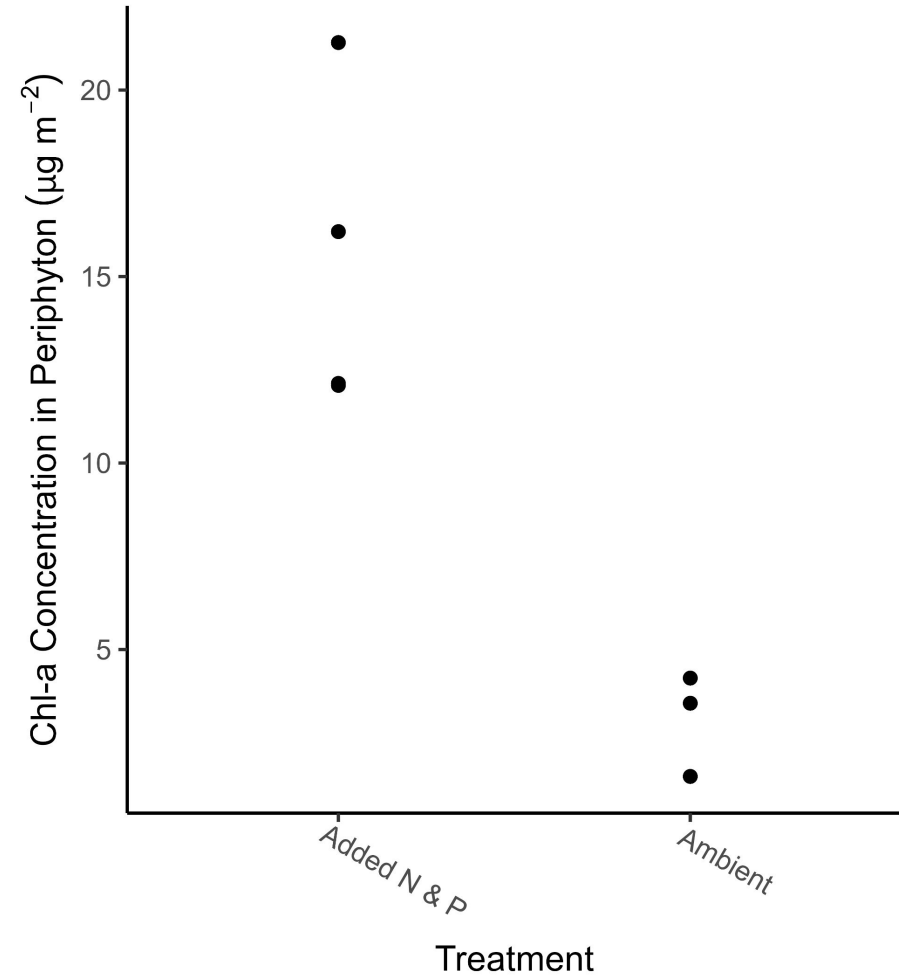
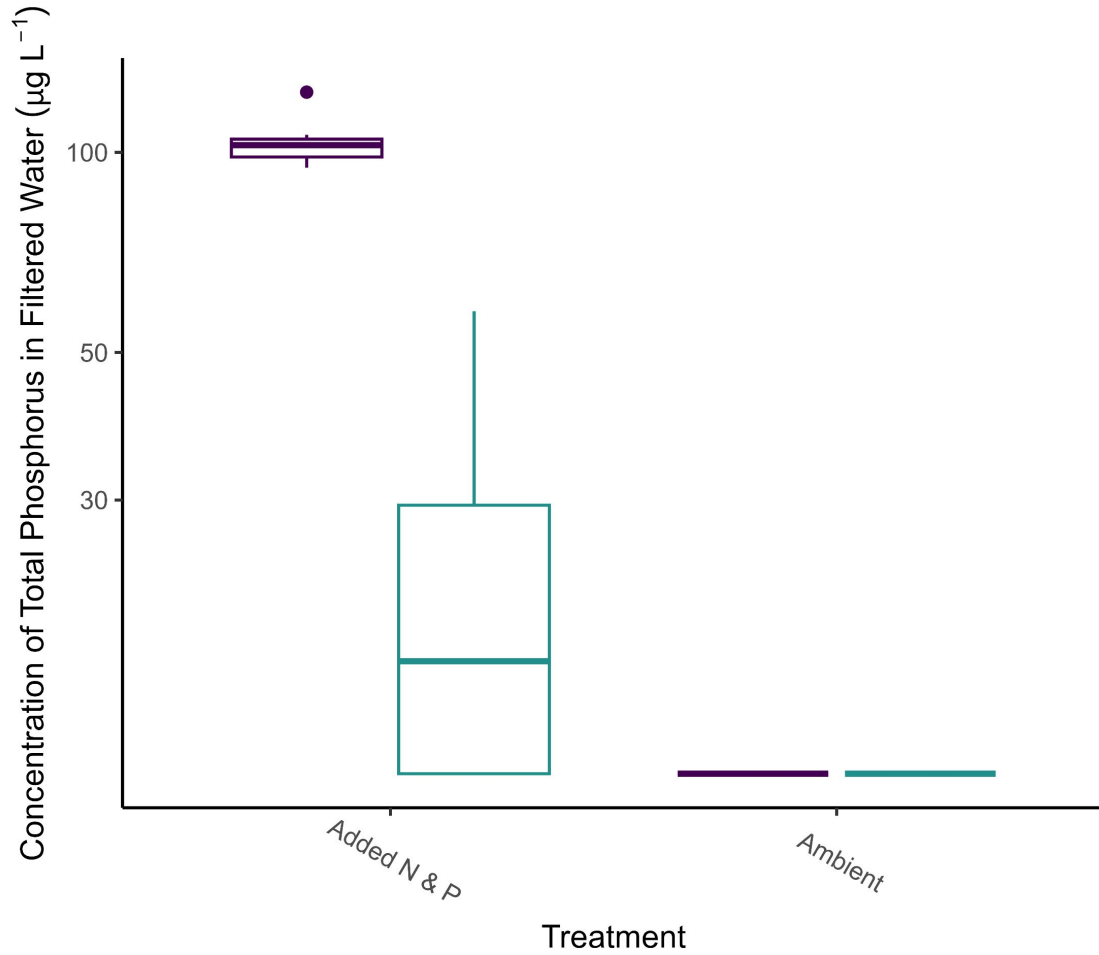
“Filter-Feeders”:

Trichoptera hydropychidae

“Predators”:



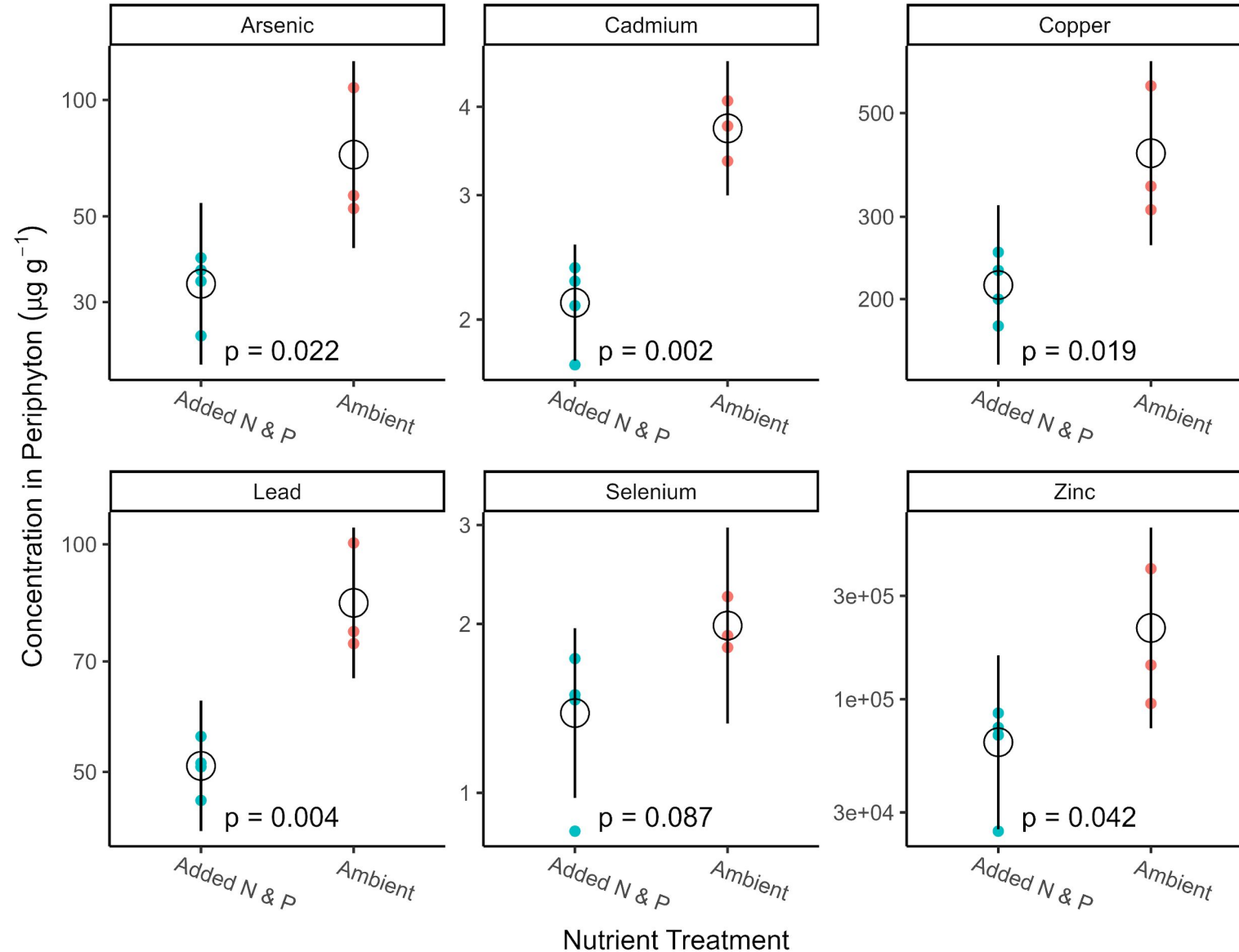
Elevated Phosphorus and Chl-a



Sample Type  Treatment Carboy  Mesocosm

Periphyton

Strong Evidence: Nutrient Additions Affect Metal Accumulation

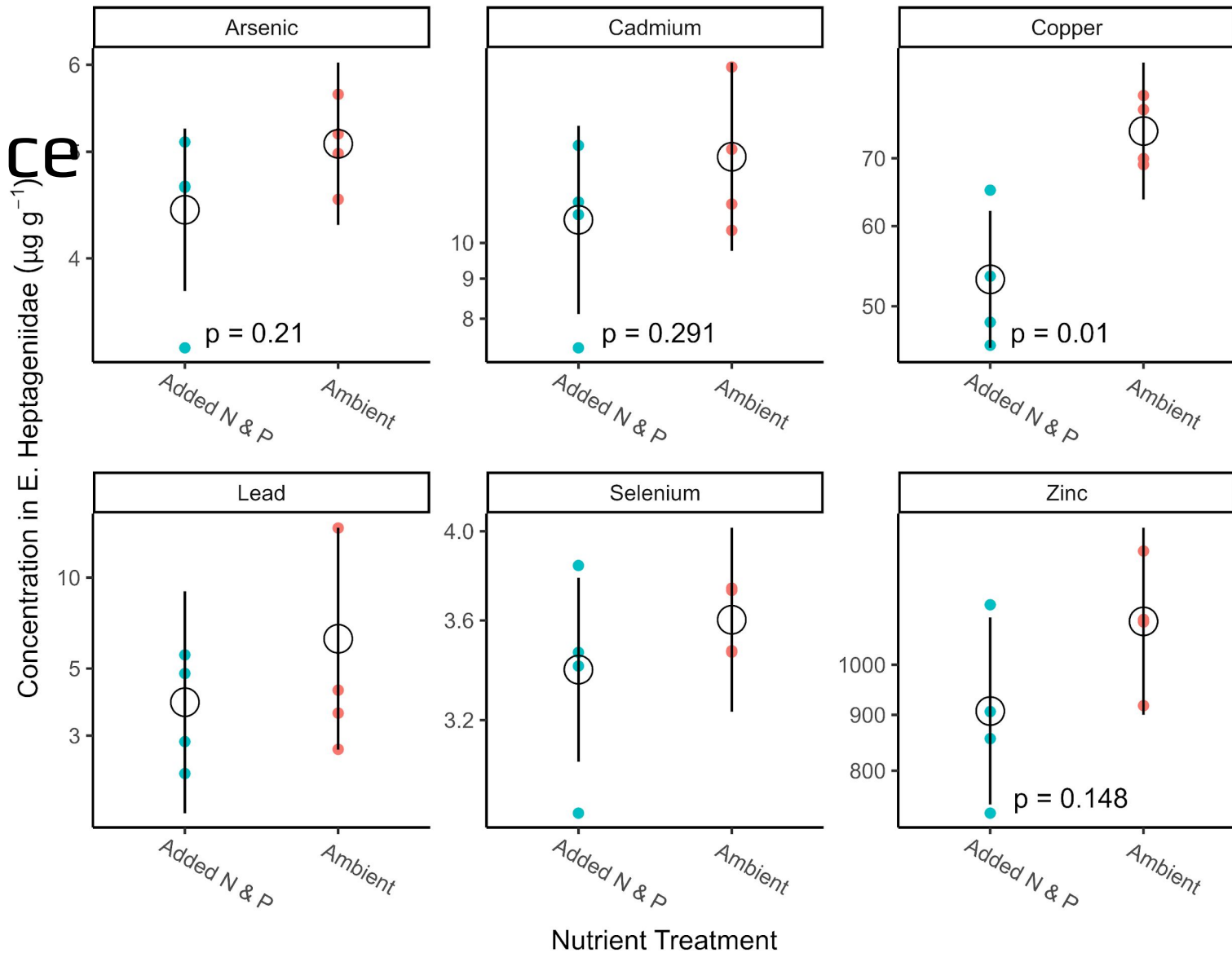


Nutrients ● Ambient ● Nutrients Added

Heptageniidae

Strong & Weak Evidence

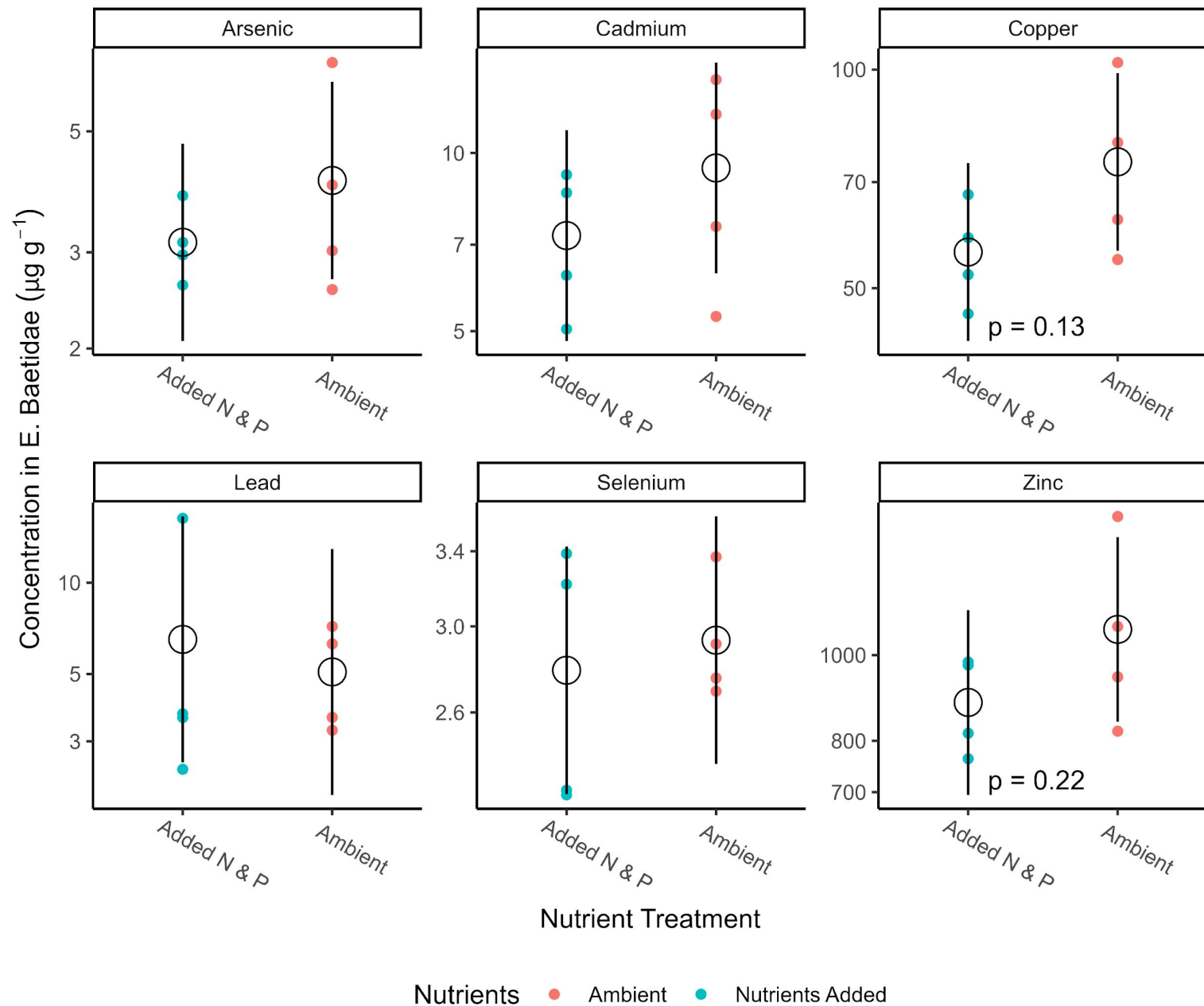
“Grazer”



Nutrients ● Ambient ● Nutrients Added

Baetidae Less Evidence

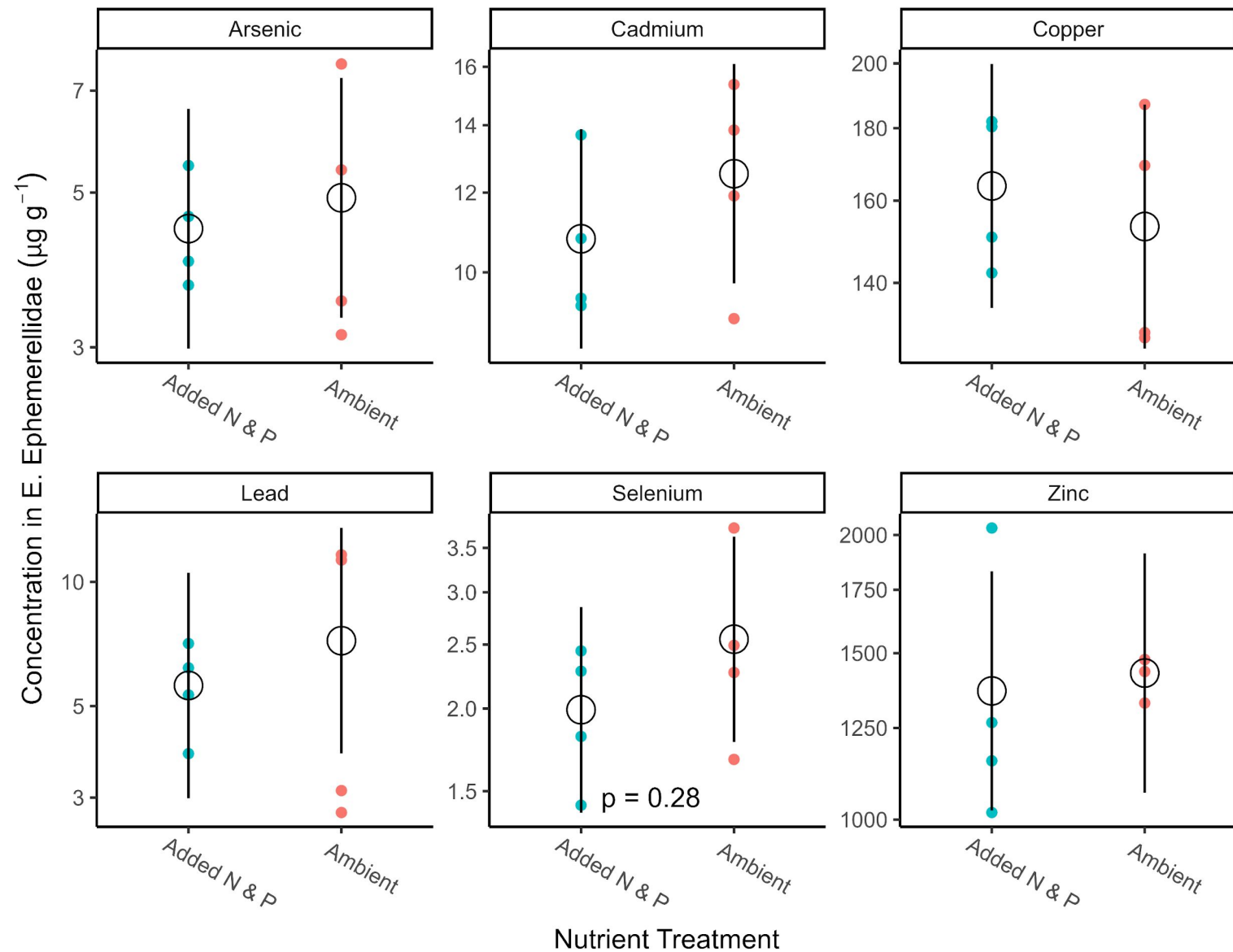
“Grazer/Collector/Gatherer”



Ephemereilidae

No Evidence

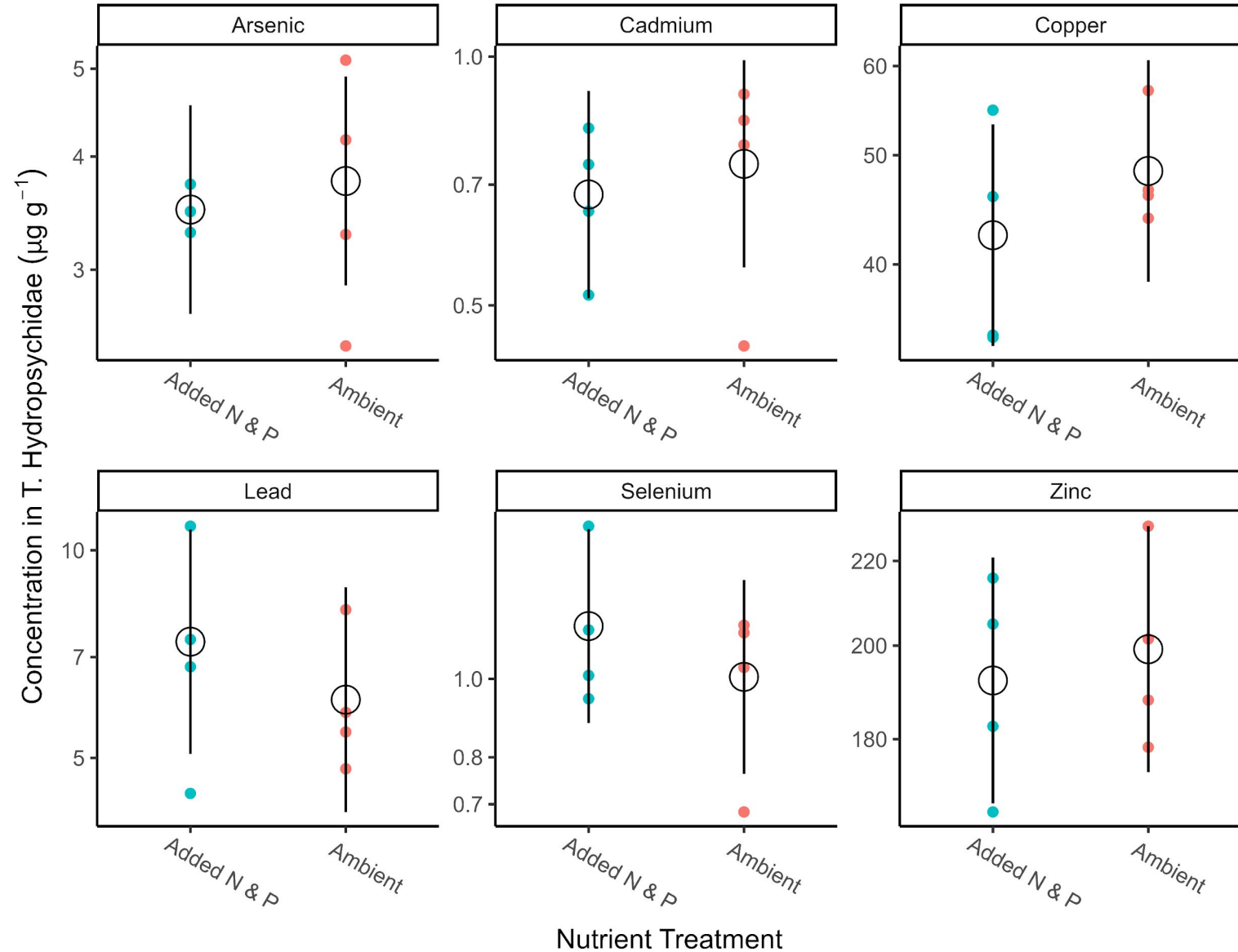
“Grazer”



Hydropsychidae

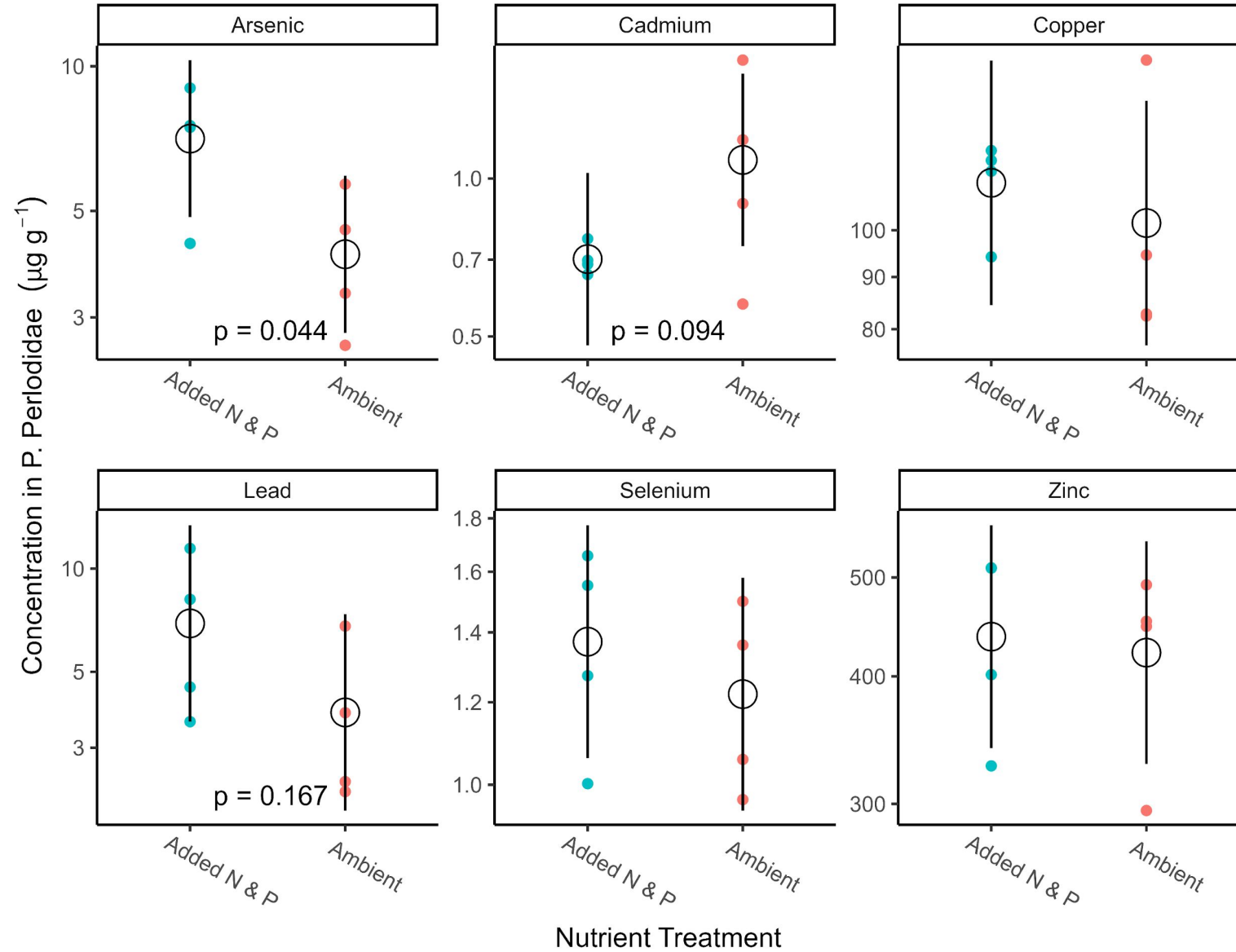
No Evidence

“Filter-Feeders”



Perlodidae Conflicting Evidence

“Predators”



Summary & Discussion

- **Evidence of Bloom Dilution:** Elevated nutrients decreased periphyton metal concentrations
- **Tropic Transfer:** Heptageniidae and Baetidae show some evidence of bloom dilution, but overall less evidence from invertebrates.
 - 15 days too short?
- Invertebrate results are metal and taxa specific
- Perlodidae shows the opposite pattern for Arsenic and Lead
 - Aquatic Exposure Route?

Questions?

Thank you!
USGS Wyoming-Montana Water
Science Center, Jose
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Bain-White, and Sam Turner.



