



# Effects of Fire and Substrate on Benthic Invertebrate Diversity and Abundance in Lakes of the Yukon-Kuskokwim Delta, AK.

Lucy Packer<sup>1</sup>, Ellen Bradley<sup>2</sup>, Bianca Rodriguez-Cardona<sup>3</sup>, Paul James Mann<sup>4</sup>, Susan Natali<sup>5</sup>, Seeta Sistla<sup>6</sup>, John D Schade<sup>7</sup>, Linda Deegan<sup>8</sup>, and Sarah Ludwig<sup>5</sup>.

<sup>1</sup>Warren Wilson College, Swannanoa, NC, United States, <sup>2</sup>Gonzaga University, Spokane, WA, United States, <sup>3</sup>University of New Hampshire Main Campus, Durham, NH, United States, <sup>4</sup>Northumbria University, Newcastle-Upon-Tyne, United Kingdom, <sup>5</sup>Woods Hole Science Center, Falmouth, MA, United States, <sup>6</sup>University of California Irvine, Irvine, CA, United States, <sup>7</sup>St. Olaf College, Northfield, MN, United States, <sup>8</sup>Marine Biological Laboratory, Ecosystems Center, Woods Hole, MA, United States

## Introduction

In recent years the Arctic has experienced increased temperatures and an altered fire regime, which has significant consequences for aquatic ecosystems. Aquatic invertebrates are often used as indicators of water quality and environmental change. With this project we are investigating how fire affects aquatic invertebrate communities and how they can be used as a metric of Arctic change.

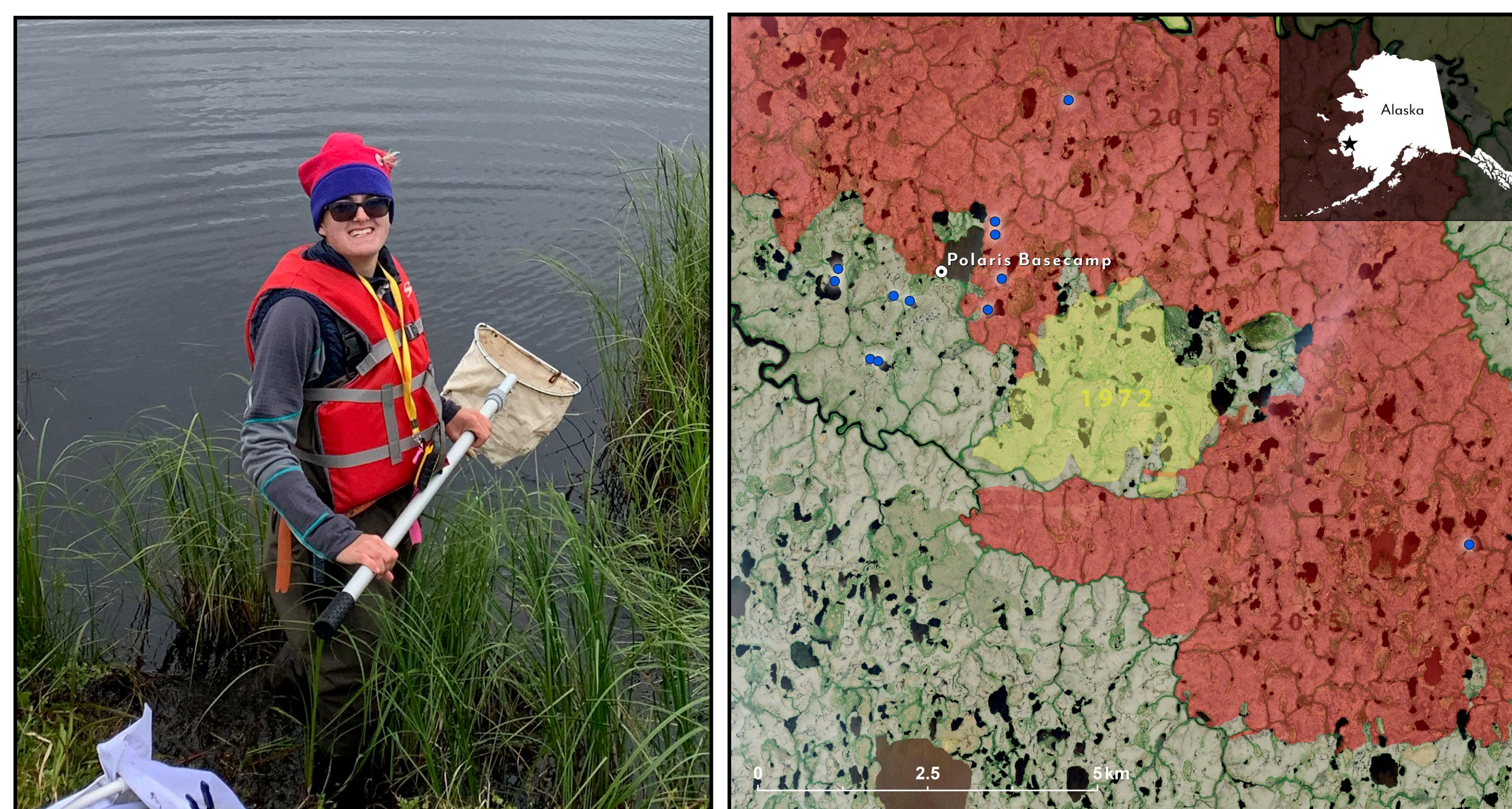


Fig 1. Sampled lakes (blue dots) and areas burned in 2015 (red) and 1972 (yellow).

## Materials and Methods

We sampled 12 lakes in the Yukon-Kuskokwim Delta about 60 miles NW of Bethel, AK—six lakes in areas burned in 2015 and six in unburned.

We collected invertebrates, water and substrate samples at each lake. Invertebrates were collected with a sweep net from the lake bottom, preserved and identified to the lowest possible taxa. Diversity was calculated using the Shannon-Wiener Index.

$$H' = - \sum p_i \log p_i$$

Substrate was categorized into three types: **Sediment** - majority fine particles

**Detritus** - large amounts of decaying vegetation

**Mixed** – combination of both

## Results

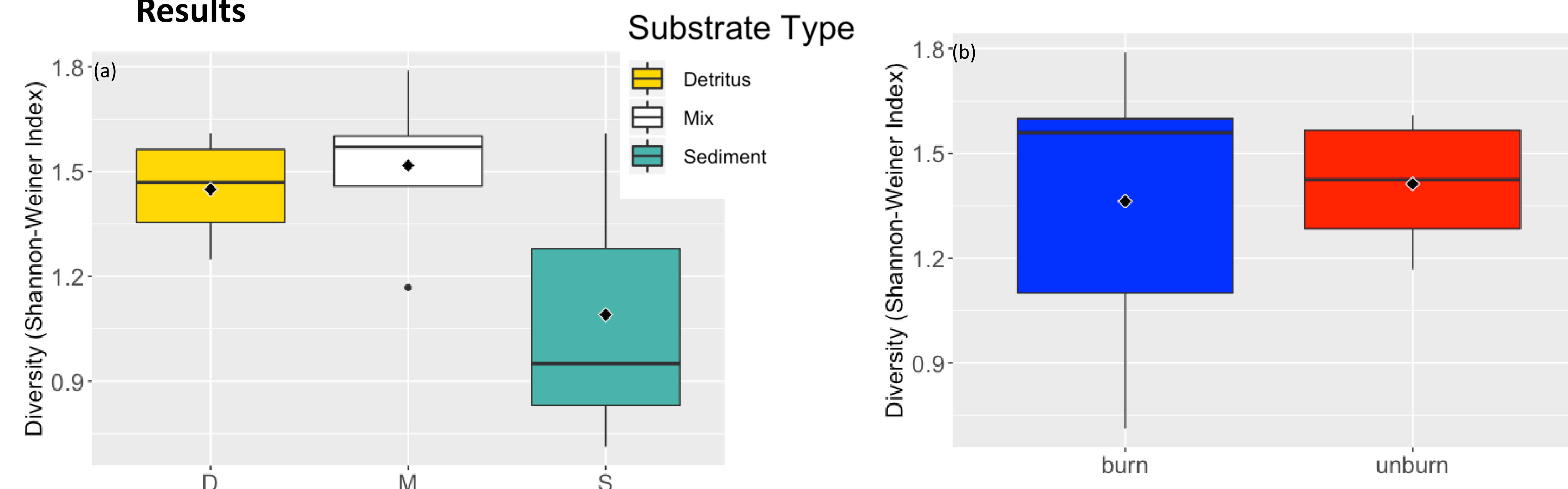


Figure 2. Invertebrate diversity in lakes with (a) different substrate and (b) burn histories. Diamonds represent mean.

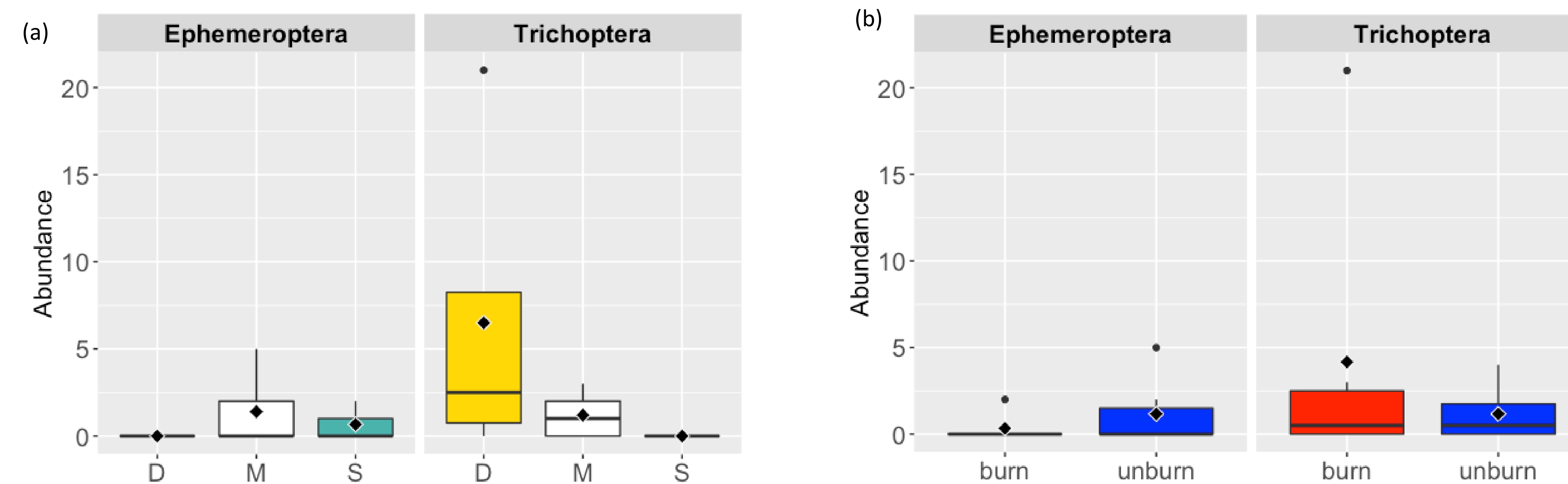


Figure 3. Abundance of Ephemeroptera and Trichoptera on (a) different substrate types and (b) burn histories. Diamonds represent mean

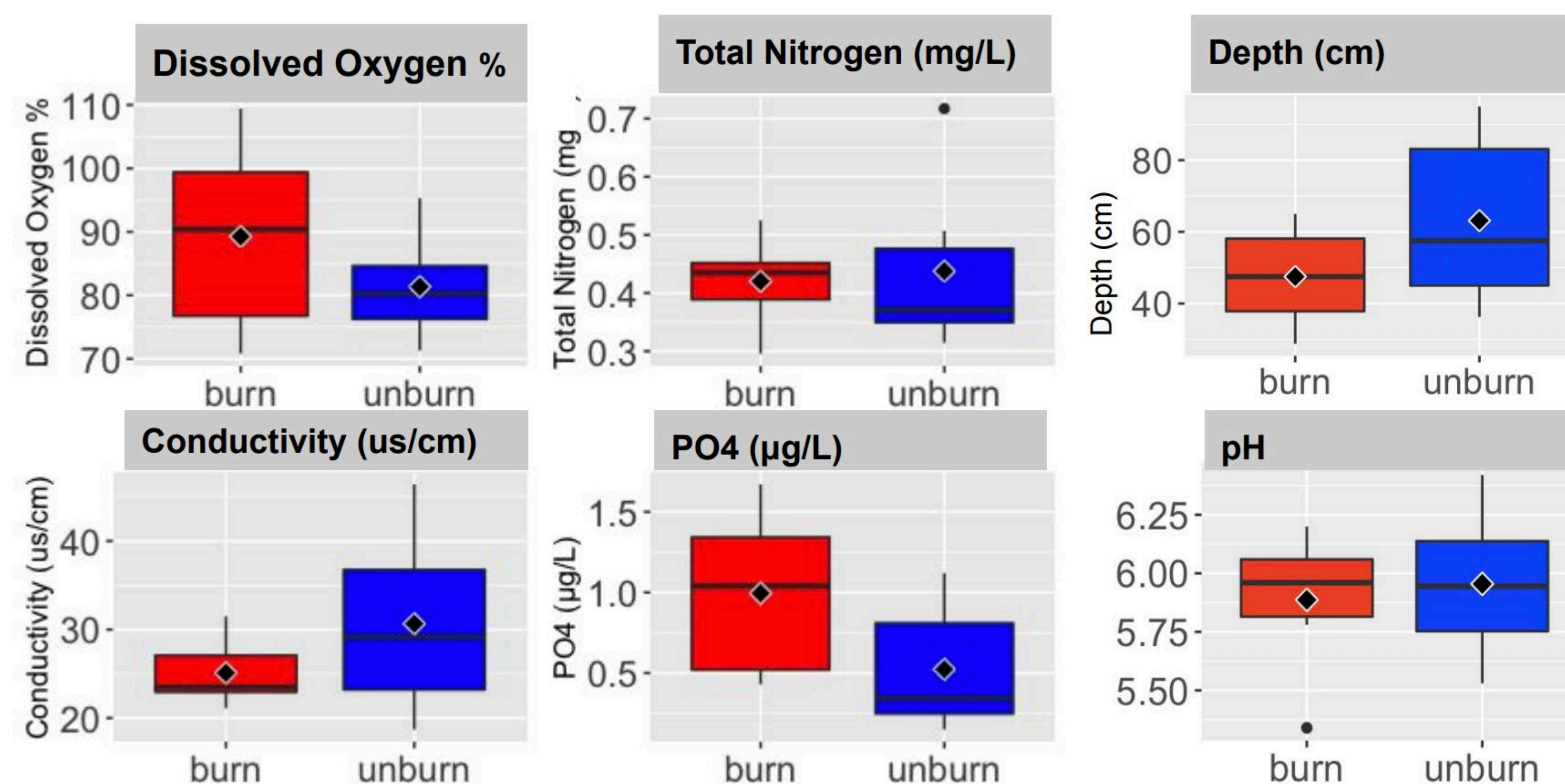


Figure 4. Physical and chemical characteristics of burned and unburned lakes. Diamonds represent mean



Ephemeroptera



Trichoptera

## Conclusions

There was little difference in invertebrate abundance and diversity between burned and unburned lakes. Diversity, however, was lower in lakes with sediment substrates than those with detritus or mixed substrates.

Abundance of Ephemeroptera and Trichoptera was related to substrate type. Trichoptera was most abundant on detritus, while Ephemeroptera was most abundant on mixed substrate. The most abundant family of Ephemeroptera was *Baetidae*, a group that includes shredders and other detritivores.

Our data suggest a link between fire and sedimentation (Neary, Ryan, & DeBano, 2005). All three lakes with sediment substrates were burned, and all but one of the four detritus substrate lakes were unburned. Fire may be altering lake sedimentation, which is altering macroinvertebrate communities (Moquin, et al. 2014)—with unknown consequences for lake food webs and ecosystems.

## References

Moquin, P. A., et al., (2014). *Freshwater Science*, 33(4), 1108–1118.  
Neary, D. G., et al., (2005). (No. RMRS-GTR- 42-V4; p. RMRS-GTR- 42-V4).