Statement of Significance

Dr. K. David Hambright

Editor-in-Chief

Limnology and Oceanography

December 2, 2024

Dear Dr. Hambright,

We would like to submit the following manuscript titled, “**Spatial dynamics of animal-mediated nutrients in temperate waters**” for consideration as a Research article in *Limnology and Oceanography*.

Our paper describes both biological and physical drivers of variability in animal-regenerated nutrients across three spatial scales. Among 27 reefs separated by up to 25 km, ammonium varied up to 16 x, which is a larger difference than reported by previous studies. Surveys of reef associated biological communities revealed a potentially positive effect of animals on ammonium, but this effect was mediated by tidal exchange. At a small-scale, we found higher concentrations of ammonium inside kelp forests relative to their edges. By studying 16 kelp forests of varying composition and density, we are the first to show that the retention of ammonium by kelp forests increases with forest biomass, tidal exchange, and animal biomass to a lesser extent. Finally, we monitored ammonium concentrations in cages with vs without animals and found fine-scale enrichment on a scale of meters was possible, but only when flow was limited. Overall, we found evidence that animal-mediated nutrient cycling contributes to meso-, small-, and fine-scale variation in nutrients even in a wave exposed, temperate region. This suggests animals may contribute more to bottom-up effects through their excretion than previously thought. Overall, we describe the most extensive exploration of drives of ammonium variability in a temperate ecosystem to date.

We believe that the readers of *L&O* will find value in our paper as it combines elements of ecological research with oceanography and includes not only physical but also biological considerations. Our findings broaden our understanding of aquatic systems by documenting a potentially overlooked driver of nutrient variability and bottom-up effects in a wave-exposed temperate ecosystem.

The corresponding author, Em Lim, can be reached via email at em.g.lim13@gmail.com at your convenience. Thank you for your consideration of this manuscript.

Sincerely,

On behalf of the authors,

Em Lim