Statement of Significance

**Briefly state the novelty, significance, and breadth of interest of the science presented** (1000 characters including spaces). Now 990 with spaces

We investigated the drivers of variability in marine animal-mediated nutrients at three spatial scales. At scales of 10s of km, ammonium varied up to 16-fold across 27 rocky reefs, a larger difference than previously reported. The effect of reef-associated animal abundance on ammonium was positive but mediated by tidal exchange. At a smaller scale, ammonium concentrations were higher inside than outside 16 kelp forests, and ammonium retention increased with kelp biomass, tidal exchange, and animal biomass. Finally, by caging animals in situ, fine-scale enrichment on a scale of m was possible but only when flow was limited. Overall, animal-mediated nutrient cycling contributes to meso-, small-, and fine-scale variation in nutrients even in an upwelling region. This suggests animals may contribute more to bottom-up effects through excretion than previously considered. This work is the most extensive exploration of drivers of ammonium variability in temperate ecosystems to date.

**Describe why L&O is the best outlet for the publication of your paper** (500 characters including spaces). Currently at 427 characters

The readers of *L&O* will find value in our paper as it combines marine ecology with oceanography and includes both physical and biological considerations. Our research broadens our understanding of aquatic systems by documenting an overlooked driver of bottom-up effects in temperate upwelling-influenced ecosystems. This focus will appeal to all those interested in or tasked with ecosystem-based management of ocean resources.

Alt last sentence: This discourse will appeal to biologists, governments, and the public, who value marine conservation but have yet to consider the full suite of functions fulfilled by marine animals.