March 6, 2019

Dr. David Schimel

Editor

Ecological Applications

Ecological Society of America

Dear Dr. Schimel and Editorial Board Members,

Please find our attached manuscript entitled “Effects of salmon inputs on soil nitrogen: implications for marine derived nitrogen subsidies to riparian areas,” which we are submitting as an Article.

A major theme in ecology is identifying important nutrient sources that support ecosystem processes and quantifying ecosystem responses to these sources. Using nitrogen (N) stable isotope analysis, it has been established anadromous, semelparous fish species contribute substantial amounts of nutrients to coastal ecosystems and their importance to consumers is widely recognized(Cederholm et al 1999). In areas such as the Columbia River Basin where Pacific salmon populations have declined, legislation requiring compensatory mitigation has led to nutrient enhancement, on the foundation that habitats have lost salmon and therefore it is necessary to maintain ecosystem function (Collins et al. 2015). There is also widespread belief that salmon nutrients enhance terrestrial primary productivity through nutrient fertilization and this, in-turn, enhances salmon populations (sensu, Helfield and Naiman 2001). In fact, the scientific basis for this belief is generally weak (reviewed in this manuscript) and recent work published in Ecology shows an equivocal response of riparian tree growth to an extremely large salmon nutrient manipulation (Quinn et al 2018).

In this manuscript, we measure the response of soil N pools, N transformation rates, and N stable isotope ratios to a 20-year salmon carcass manipulation (Quinn et al 2018). We assess whether expectations of increased vegetative growth in response to salmon subsidies are warranted given nitrogen cycling and consider the implications for management.

Key finding in our paper are:

1. Salmon carcass manipulation did not increase plant-available nitrogen pools (NH4+ and NO3-) or inorganic nitrogen transformation rates, indicating a minimal effect of salmon on soil fertility over the long-term.
2. The isotopic signature of soil ammonium is highly enriched in 15N relative to the N sources indicating strong fractionations with soil N cycling. This demonstrates that previous estimates of percent marine derived nutrient contribution to terrestrial producers are overestimates.
3. Landscape and population factors including stand demography and/or water availability are likely more important drivers of vegetative growth than salmon derived nitrogen.

We believe this work is well-suited for *Ecological Applications* for the following reasons:

1. This study examines a single ecosystem in Alaska, but we believe these results are applicable in all salmon systems (Pacific, Atlantic, and Great Lakes).
2. This work is really the first large-scale experiment to examine soil responses to a salmon manipulation in detail. Given that soils have an essential mediating role in the transfer of salmon nutrients to plants, this has been a major gap in knowledge to date.
3. The manuscript provides additional insight into the salmon manipulation conducted in Quinn et al. 2018 (previously published by Ecology) by measuring separate but complimentary ecological responses thus providing a more complete understanding of salmon contributions to the entirety of riparian ecosystems.

This manuscript has been approved for submission by all authors and is not being considered for publication elsewhere. Please address correspondence to me at: University of Washington, School of Aquatic and Fishery Sciences, Seattle, WA 98195. Email: mfeddern@uw.edu; Phone: (603) 651-6802.

Please contact me with any questions.

Sincerely,

Megan Feddern

**References**

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Quinn, T.P., J. Helfield, C.S. Austin, R. Hovel, and A.G. Bunn. 2018. A multidecade experiment shows that fertilization by salmon carcasses enhanced tree growth in the riparian zone. *Ecology* **99**: 2433-2441.