

## STREAM ECOLOGY

*Biogeochemistry*—how biota influence and are influenced by chemical cycles

Animals can directly alter nutrients through excreting readily available forms. For instance, through excretion they are transferring nutrients from an organic particulate state to a dissolved state (organic and inorganic). This dissolved form can then be taken up by plants and microbes. Animals can also indirectly alter nutrient cycling by eroding sediments (ecosystem engineering) or changing the abundance or behavior of other animals and plants.

*Nutrient recycling*—release of nutrients back into the same habitat. Thus, they are transforming nutrients from an organic particulate state to a dissolved state (organic and inorganic). Contributes to “recycled production”.

- E.g., McIntyre et al. 2008.
  - Studied fish excretion in Rio De La Madres
  - 1. Estimated fish excretion by species/size
    - Fish excretion depends on species, size, and what they eat
  - 2. Estimated fish abundance
    - Fish densities varied greatly
  - Estimated fish nutrient excretion by multiplying 1 X 2.
    - Fish excretion could meet 75% of demand for inorganic N

*Nutrient translocation*—release of nutrients into different habitat. Animals that move across physical boundaries and then die or excrete nutrients can move nutrients against abiotic flows of nutrients. These represent “new” nutrients that can increase production.

- Translocation on small spatial scales:
  - benthic foraging fish can move nutrients from sediments to water column. This can mobilize nutrients “trapped” in the sediments.
  - Emergence of aquatic insects moves nutrients to riparian ecosystems.
- Translocation on large spatial scales: e.g., salmon migration moves nutrients between ocean and streams.
  - E.g., Moore et al. 2011
  - Salmon drive import and export
  - Varies as function of abundance and density dependence
  - How does translocation vary as salmon populations decrease?

Recent research is highlighting the importance of considering fish in stream nutrient cycling.

- What happens when fish go extinct?
- Does this fundamentally change chemical cycling in streams?