Responses in dissolved nutrients and epilithon abundance to spawning salmon in Southeast Alaska streams

Mitchell, Nicole L., Gary A. Lamberti

Limnol. Oceanogr., 50(1), 2005, 217-227 | DOI: 10.4319/lo.2005.50.1.0217

ABSTRACT: Spawning Pacific salmon (*Oncorhynchus* spp.) historically transported massive quantities of marine-derived nutrients (MDN) into nutrient-poor streams of the Pacific Northwest. In southeast Alaska, we measured the effects of MDN on streamwater chemistry and epilithon standing stock (1) through time during two consecutive years in one stream, Fish Creek; (2) over space in six salmon streams; and (3) in a controlled mesocosm experiment. In Fish Creek during strong salmon runs in 2000 and 2001, streamwater concentrations of ammonium (NH_4^+) increased 10-fold and soluble reactive phosphorus (SRP) increased by 4- to 7-fold in the presence of salmon. NH_4^+ and SRP also increased with distance downstream in the salmon reach, likely related to a []carcass-loading[] effect. In contrast, nitrate (NO_3^-) and dissolved organic carbon concentrations varied only with discharge. In 2000, epilithon chlorophyll a increased by 20-fold during the salmon run, whereas no significant change was observed in 2001. Over space, the multistream survey revealed consistent increases in NH_4^+ and SRP, but no pattern in epilithon response to the salmon run. In the mesocosm experiment, NH_4^+, SRP, and epilithon standing stock all increased in the presence of salmon carcasses in artificial streams. Overall, salmon clearly increased the concentrations of important dissolved nutrients in southeast Alaska streams. Responses in epilithon were more variable, however, suggesting that multiple environmental factors including light and disturbance likely regulate epilithon growth in salmon streams. Nutrient mass transport estimates revealed that a substantial amount of MDN (46%-60% depending on element) is exported directly back to the estuarine environment, suggesting that salmon represent a key marine-freshwater coupling in nutrient cycling