

Pacific Salmon and their Diverse Ecological Influences on Alaskan Streams and Rivers

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During their annual spawning migrations, Pacific salmon (*Oncorhynchus spp.*) translocate large quantities of carbon, nitrogen and phosphorus from the ocean, where these fish acquire on the order of 99% of their biomass, to the streams and rivers in which they spawn and die. These nutrients – excreted as metabolic byproducts by live fish and leached from decomposing salmon carcasses – are thought to be an important resource that increases the abundance of stream organisms. Conversely, extensive nest construction in stream sediments by spawning salmon can disturb stream organisms, reducing their abundance. We conducted manipulative experiments and observational field studies on Prince of Wales Island, Southeast Alaska, that allowed an evaluation of the ecological effects of (1) nutrients excreted from live salmon, (2) nutrients leached from their carcasses, and (3) disturbance to stream sediments caused by salmon nest construction. Results suggest that live salmon can increase the concentrations of limiting nutrients, and consequently the abundance of primary producers, while carcasses have less pronounced influences. However, disturbance effects of nest-building activity can largely offset the increases in algal abundance afforded by salmon-derived nutrients. We also observed that the relative magnitude of these nutrient enrichment and disturbance effects can be influenced by timber harvest, a common land use throughout the range of salmon migrations. Collectively, these results illustrate how the diverse behaviors and life-history traits of salmon can have influences on stream ecosystems that depend on human activities, such as land use.