Geophysical Research Abstracts
Vol. 13, EGU2011-13015, 2011
EGU General Assembly 2011

Marine-derived organic matter transport in river systems: upstream and downstream salmon nutrient transfers, storage and use.

Ellen Petticrew (1), John Rex (1,2), and Sam Albers (1)

(1) University of Northern British Columbia, Geography Program and Quesnel River Research Centre, Prince George, Canada (ellen@unbc.ca, 1 250 960 6533), (2) British Columbia Ministry of Forests and Range, Forest Science, 1011 Fourth Ave., 5th Floor,Prince George, British Columbia, Canada, V2L 3H9

Pacific salmon migrate from the open ocean, upstream to their natal habitat where they spawn and die. In excess of 95% of their biomass is gained outside their natal habitat. Therefore, returning salmon represent a net gain of marine-derived nutrients (MDN) to the local environment that helps stimulate aquatic productivity This nutrient subsidy to inland rivers has been evaluated in the context of foodweb uptake and seen as an important pulse for downstream hatchery lakes which support the fry in year two of their lifecycle. However in-stream processes associated with the abundant salmon decay products increase the potential for the river to act as a gravelbed nutrient sink structuring the timing and magnitude of the downstream nutrient pulse. This nutrient pulse ultimately confers a size and survivorship benefit to subsequent generations of juvenile salmon.

Research on the influence of salmon spawning and die-off on in-stream sediment movement and retention indicates the importance of the salmon disturbance regime (SDR). Salmon act as (i) a bio-geomorphic agent, reworking the gravel bed and resuspending fine sediment as (ii) a rich source of organic matter and nutrients via post-spawn carcass decay. These two processes comprise the SDR. In natural systems these two aspects of the disturbance regime overlap temporally and spatially such that fine sediments are in suspension when and where organic matter is delivered to the stream. The process of in-stream flocculation has been shown to be a significant mechanism which allows the retention of the MDNs in the near-field stream environment. This disturbance by salmon and their role in enhancing the retention of in-stream nutrients was depicted by a fish-floc feedback loop which has been verified in flume studies and semi-controlled channel conditions. A second biofilm loop, characterized in 2010, identifies the importance of surficial biofilm growth in both fine sediment and MDN retention and identifies spatial patterns of MDN-driven productivity. The near-field retention of MDN in the gravel bed, whether within biofilms or the gravel matrix, appears to last for at least 14 days, allowing the salmon subsidy to be realized not just in downstream lakes but also in foodwebs in stream reaches. A conceptual diagram relating these feedback loops through the full lifecycle of salmon will be presented emphasing the importance of upstream fine sediment processes in the sustainability of salmon stocks.