Nutritional status of salmon streams

Problem Statement

Declines in salmon abundance over the last century have resulted in decreased deposition of marine-derived nutrients from salmon carcasses in streams. The effect of this nutrient subsidy reduction on freshwater habitat productivity in the Columbia River watershed must be evaluated.

Critical Factors

- Impacts on freshwater habitat productivity due to the loss of nutrient subsidies from salmon carcasses pose a significant restraint on recovery of threatened and endangered Pacific salmon.
- The Columbia River Basin streams have long been starved for the essential nutrients from salmon carcasses and this nutrient starvation has impaired salmonid productivity.
- It is necessary to determine minimum nutrient levels needed to maintain optimum salmon production.

Status of Research

Preliminary studies are now underway to evaluate the nutritional status of selected tributaries in the Columbia River Basin using stable isotope analysis. The use of stable isotope analysis has enabled direct quantitation of marine-derived nutrient enrichment of streams by salmon carcasses. Researchers in the Northwest Fisheries Science Center's (NWFSC) Watershed Program have shown that the addition of hatchery-spawned carcasses to Washington coastal streams improved the condition and caused increased density of juvenile coho salmon and steelhead. In addition, juvenile coho at the sites to which carcasses were added grew at more than twice the rate of fish in a nearby stream containing few carcasses. This result is noteworthy because increases in body size of juvenile salmonids can significantly increase their survival. Stable isotope analysis of fish tissues confirmed that marine-derived nutrients from salmon carcasses were responsible for the increased growth observed in these juvenile salmonids.

Future Considerations

While recent work has focused on the impact of salmon carcasses on coastal stream communities, the effect of salmon carcasses on nutrient-deficient interior streams of the Columbia River Basin must also be evaluated. By doing stable isotope analysis on samples (e.g., fish, vegetation, invertebrates) collected from sites with a wide range in spawning salmon densities, it is possible to determine whether saturation of marine-derived nitrogen is occurring and, if so, at what densities. This information will be essential in establishing spawning escapement levels (i.e., fish remaining after harvest) for upriver chinook to assure optimum salmon production.

Decaying chinook salmon

Key Players

Environmental Conservation (EC) Division, NWFSC
Bonneville Power Administration
Columbia Basin Fish & Wildlife Authority
Columbia River Inter-Tribal Fish Commission
Fisheries agencies in Washington, Oregon, and Idaho
Northwest Power Planning Council
Oregon State University
Pacific Fishery Management Council
Snake River Recovery Team
University of British Columbia
University of Washington
U.S. Army Corps of Engineers
U.S. Environmental Protection Agency
U.S. Forest Service
U.S. Fish & Wildlife Service
U.S. Geological Survey
Washington Tribes
Washington Department of Natural Resources
Weyerhauser Company

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