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Issue Brief No. 2

June 3, 2003

The Variable Impact of Dams on Columbia and Snake River Salmon Populations

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Summary

The four lower Snake River dams are not preventing the recovery of chinook salmon, according to results of a study on the impact of dams on salmon published in 2001 in the refereed journal *Animal Conservation*.

Fisheries scientists working in Idaho took a position in 1999 that a required action for recovering imperiled stocks of salmon and steelhead in Idaho is to restore the Columbia and Snake Rivers to a free-flowing river system that is not impounded by dams. (The position is still available today on the website of the Idaho Chapter, American Fisheries Society.) The proposed means to this end in Idaho would be the "breaching" or partial removal of the four lower Snake River dams in southeastern Washington. The clear logic of the breaching proposition is perhaps too simple, however, as there are other factors affecting salmon populations, including not only habitat, harvest, hatcheries, and ocean conditions, but also the variable impact of dam design and operations on salmon.

Fisheries scientists can contribute to the determination of dam impacts by providing sound ecological data based on well-constructed analyses. Reporting results of recent research on the impact of dams on chinook salmon (*Oncorhynchus tshawytcha*) in the Columbia and Snake River systems, two fisheries scientists conclude unequivocally that the four lower Snake River dams are not preventing the recovery of salmon in Idaho. However, dams may be a factor preventing recovery in the Upper Columbia River, upstream from the confluence with the Snake River in the vicinity of the Tri-Cities of Kennewick, Pasco, and Richland, Washington.

The following abstract is from the article "Differences in the impacts of dams on the dynamics of salmon populations" by Phillip S. Levin and Nicholas Tolimieri, published in the refereed journal *Animal Conservation* (2001, volume 4, issue 4, abstract online):

> Modern concrete dams have devastated fish populations world-wide. However, dams vary greatly in how they are engineered and operated, and thus pose a range of threats to riverine fauna. **Understanding the differences in the impacts of dams is critical for setting conservation priorities.** We used a modified BACI (before-after-control-impact) sampling design as a means to quantify the effects of dams on spring/summer chinook salmon in two watersheds (Snake and Upper Columbia Rivers) of the Columbia River Basin, USA. The construction of four dams in the Columbia River Basin from 1966 to 1975 allowed us to test the hypothesis that the presence of these dams does not affect the abundance, survival and population growth of chinook salmon. In both the Snake and Upper Columbia Rivers, there was a significant decline from the period before dams were constructed (1959-65) to the period after dams were constructed (1980-90). In the Upper Columbia River, declines in productivity or population performance (measured as recruits per spawner or Ricker function

> residuals) were greater than in the control region. On the other hand, patterns of fish productivity in the Snake River were similar to those seen in the control region. The disparity between fates of Upper Columbia and Snake River populations points to the differences between regions in current efforts to reduce fish mortality associated with dams. **Our analysis suggests that dams in the Upper Columbia River, but not Snake River, are a potential force preventing recovery of endangered salmon populations** (Levin & Tolimieri 2001, bold-face added for emphasis).

The disparity of results in fish productivity between the Upper Columbia and Snake Rivers sections arises from differences in efforts to reduce juvenile mortality. The Snake River dams have been equipped with elaborate structures to facilitate passage of juvenile migrants, the Upper Columbia dams have not. A large portion (75%) of the Snake River juveniles are collected and transported past the dams, whereas only a small portion of the Upper Columbia juveniles have been transported, and those that have encountered several dams without fish bypass facilities.

What inferences can be drawn from this study about the breaching of the lower Snake River dams? Here's what the authors of the refereed journal article said:

> Dams have clearly disrupted populations of salmon and other migratory fishes. In the Columbia River Basin ... these dams obviously vary in the extent of their impact. ... **While it is difficult to demonstrate clearly the magnitude of the impact of dams, our results indicate that the effects of dams will vary depending on how they are constructed and operated.** There is plainly much scope for both scientific and policy debates concerning the impact of dams on the recovery of these salmon populations. Ideally, fisheries scientists can contribute to the determination of dam impacts by providing sound ecological data based on well-constructed analyses. **Our analysis points to hydropower systems on the Upper Columbia River, but not the Snake River, as a potential force preventing recovery of endangered salmon populations** (Levin & Tolimieri 2001, bold-face added for emphasis).

The inference for policymakers seems clear enough. Because of efforts taken to bypass juvenile salmon migrants around the four lower Snake River dams in southeastern Washington, the dams are not currently preventing the recovery of threatened Snake River chinook salmon populations. The same cannot be said of dams on the Upper Columbia River, upstream from the confluence of the Snake and Columbia Rivers, where dams are a potential force preventing recovery of endangered Upper Columbia chinook salmon populations.