

# **The relationship of Snake River stream-type Chinook survival rates to in-river, ocean and climate conditions**

**Howard Schaller\*<sup>1</sup>, and Charlie Petrosky<sup>2</sup>**

<sup>1</sup> Columbia River Fisheries Program Office  
USFWS, 1211 SE Cardinal Court, Suite 100  
Vancouver, WA 98683.

Phone: (360) 604-2500 [Howard.Schaller@fws.gov](mailto:Howard.Schaller@fws.gov).

<sup>2</sup> Idaho Department of Fish and Game  
600 S. Walnut Avenue, P.O. Box 25 Boise, ID 83707  
Phone: (208) 334-3791

Snake River salmon and steelhead have substantially declined since the completion of the Columbia River hydrosystem. Most survival rate declines were in the smolt-to-adult life stage rather than in the spawner-to-smolt life stage. A key remaining uncertainty for evaluating recovery options for upper basin salmon populations relates to the source of mortality that fish experience while in the estuary and early ocean. Sources of estuary and early ocean mortality include not only elements of the natural ocean environment, but also effects of earlier life-stage experiences. Multiple analytical approaches are presented addressing this mortality for Snake River spring/summer Chinook and steelhead. We found that Snake River stream-type Chinook salmon populations continued to exhibit survival patterns similar to those of their downriver counterparts but survived only one-fourth to one-third as well. The water velocity conditions in the river (water travel time) and ocean/climatic conditions are considered in describing the variation in survival rates. In all results water travel time proved to be a significant factor in explaining the variation in survival. The FCRPS has increased water travel time and delayed migration of in-river fish; with later arriving components of the population exhibiting lower survival rates. The results of these multiple analyses provide compelling evidence that passage through the FCRPS, along with ocean/climatic conditions, strongly influences levels of mortality of in-river migrants for Snake River populations.

## **Key References:**

- Berggren T., P. McHugh, P. Wilson, H. Schaller, C. Petrosky, E. Weber, and R. Boyce. 2006. Comparative Survival Study (CSS) of PIT-tagged Spring/Summer Chinook and Summer Steelhead. 2006 Annual Report. BPA Contract # 19960200.
- Budy, P., G.P. Thiede, N. Bouwes, C.E. Petrosky, and H. Schaller. 2002. Evidence linking delayed mortality of Snake River salmon to their earlier hydrosystem experience. *North American Journal of Fisheries Management* 22:35-51.
- Deriso, R.B., D.R. Marmorek, and I.J. Parnell. 2001. Retrospective patterns of differential mortality and common year effects experienced by spring and summer chinook salmon (*Oncorhynchus tshawytscha*) of the Columbia River. *Canadian Journal of Fisheries and Aquatic Sciences* 58:2419-2430.

- Peters, C.N. and D.R. Marmorek. 2001. Application of decision analysis to evaluate recovery actions for threatened Snake River spring and summer chinook salmon (*Oncorhynchus tshawytscha*). Canadian Journal of Fisheries and Aquatic Sciences 58:2431-2446.
- Petrosky, C.E., H.A. Schaller, and P. Budy. 2001. Productivity and survival rate trends in the freshwater spawning and rearing stage of Snake River chinook salmon (*Oncorhynchus tshawytscha*). Canadian Journal of Fisheries and Aquatic Sciences 58:1196-1207.
- Schaller, H. A, C. E. Petrosky, and O. P. Langness. 1999. Contrasting patterns of productivity and survival rates for stream-type chinook salmon (*Oncorhynchus tshawytscha*) populations of the Snake and Columbia rivers. Canadian Journal of Fisheries and Aquatic Sciences 56: 1-15.
- Schaller, H.A., C.E. Petrosky and O.P. Langness. 2000. Reply to Zabel and Williams' comments on "Contrasting patterns of productivity and survival rates for stream-type chinook salmon (*Oncorhynchus tshawytscha*) of the Snake and Columbia Rivers" by Schaller et al. (1999). Canadian Journal of Fisheries and Aquatic Sciences 57:1742-1746.
- Schaller, H.A and C.E. Petrosky. 2007. Assessing hydrosystem influence on delayed mortality of Snake River stream-type Chinook salmon. North American Journal of Fisheries Management 27:810-824.
- Schaller, H., P. Wilson, S. Haesecker, C. Petrosky, E. Tinus, T. Dalton, R. Wooden, E. Weber, N. Bouwes, T. Berggren, J. McCann, S. Rassk, H. Franzoni, and P. McHugh. 2007. Comparative Survival Study (CSS) of PIT-Tagged Spring/Summer Chinook and Steelhead in the Columbia River Basin: Draft Ten-year Retrospective Analyses Report BPA Contract # 19960200. Prepared by Comparative Survival Study Oversight Committee and Fish Passage Center representing the Columbia Basin Fish and Wildlife Agencies and Columbia Basin Tribes. 212 pp plus Appendices. (<http://fpc.org/>)
- Wilson, P.H. 2003. Using population projection matrices to evaluate recovery strategies for Snake River spring and summer Chinook salmon. Conservation Biology 17:782-794.
- Zabel, R., M. Scheuerell, M. McClure, and J. G. Williams. 2006. The interplay between climate variability and density dependence in the population viability of Chinook salmon. . Conservation Biology 20:190-200.