

Bellgraph, B. J., C. Baldwin, L. Garavelli, Z. Haque, W. Perkins, M. Richmond, M. Howell, and J. McLellan. 2020. Estimates of Chinook Salmon Spawning Habitat in a Blocked Reach of the Columbia River Upstream of Grand Coulee Dam. Northwest Science Vol 94, in press.

## **Abstract**

Spawning habitat of Chinook salmon (*Oncorhynchus tshawytscha*) was estimated upstream of Grand Coulee Dam to support the feasibility evaluations of reintroducing anadromous salmon to this blocked reach of the Columbia River. A two-dimensional depth-averaged hydrodynamic model was developed for a 76-km reach between Kettle Falls, Washington, and the US-Canada international border and used to predict water velocities and depths at 10%, 50%, and 90% flow exceedance values. Hydrodynamic model outputs were combined with calculated bed slopes and empirical and modeled data on substrate availability to estimate salmon spawning habitat availability. A probabilistic spawning model was developed to estimate suitability for spawning salmon based on habitat characteristics at the exceedance flow levels and three substrate classifications. A majority of the highest probability salmon spawning habitat was located between Northport, Washington, and the international border. The model predicted 17.6 ha of spawning habitat at the 50% exceedance flow level for areas with pebble and cobble substrates; this equates to an approximate redd capacity of 2,893–4,091 non-overlapping redds, depending on mean redd size. Estimated capacity of spawning adults ranged from 5,786 (assuming two fish per redd and lowest number of redds) to 32,728 (assuming eight fish per redd at highest number of redds). We conclude that suitable Chinook salmon spawning habitat is available upstream of Grand Coulee Dam. The results of this study will be useful to fisheries managers considering salmon reintroduction and ecosystem function in various processes including the modernization of the Columbia River Treaty, the Northwest Power and Conservation Council's Fish and Wildlife Program, and tribal and other natural resource conservation initiatives.

**Keywords:** reintroduction, salmon, habitat, spawning, model

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