

ARTICLE

Cool, Pathogen-Free Refuge Lowers Pathogen-Associated Prespawn Mortality of Willamette River Chinook Salmon

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Abstract

Spring Chinook Salmon *Oncorhynchus tshawytscha* are transported above dams in the Willamette River to provide access to blocked spawning habitat. However, 30–95% of these transplants may die before spawning in some years. To varying degrees, salmon in other tributaries—both blocked and unblocked—have similar prespawn mortality (PSM) rates. Our study determined whether holding fish in constant temperature, pathogen-free conditions prior to spawning increased survival through spawning in 2010 through 2012. In addition, we evaluated pathogens as a potential cause of PSM. To monitor survival we captured adult Chinook Salmon early and late in the season from the lower Willamette River and upper tributaries and held them until spawning in 13°C, pathogen-free water. Samples were collected at the time of transport, from moribund or dead fish throughout the summer, and after spawning in the autumn. Prespawn mortalities and postspawned fish from river surveys on holding and spawning reaches above traps were also sampled. Necropsies were performed on all fish, and representative organs were processed for histopathological analysis. Using multiple logistic regression odds ratio analysis, fish that were held were up to 12.6 times less likely to experience PSM than fish that were outplanted to the river. However, *Aeromonas salmonicida* and *Renibacterium salmoninarum* were more prevalent in held fish that had PSM than in outplanted fish with PSM, suggesting that fish that were held were more susceptible to these bacteria. Spawned held fish were more likely to have *Myxobolus* sp. brain infections and less likely to be infected with the kidney myxozoan, *Parvicapsula minibicornis*, than were spawned outplanted fish. The equal likelihood of other pathogens for held fish and outplanted spawned fish suggests interactive effects determine survival and that holding Chinook Salmon at 13°C prevented expression of lethal pathogenesis. Overall, holding could be a viable method to reduce PSM, but issues of transport stress, proliferative disease, and antibiotics remain.

The historical levels of prespawn mortality (PSM), defined here as mortalities that occur after adult salmon enter into freshwater but prior to the expression of gametes during

spawning, are not well documented. Given the physiological and environmental challenges of migration, it is natural for some death to occur before spawning (Gauthreaux 1980;

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