

Overview of the Corps of Engineers Anadromous Fish Evaluation Program, Delayed Mortality Research, and Significance for Recovery of Listed Stocks

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The Columbia Basin drains 675,000 sq km (260,000 sq miles); it is the second largest river system in the US outside of the Mississippi River system. Over a period of 70 years, roughly 400 dams and diversion structures were built in the Basin. Although the Federal Columbia River Power System (FCRPS) has become instrumental in providing irrigation water, flood protection, navigation, and recreation, the system has critically affected a number of fish species, including: Chinook salmon, sockeye salmon, steelhead, coho salmon, chum salmon, white sturgeon, pacific Lamprey, and bull trout.

Some of the Columbia River Basin Endangered Species Units (ESUs) of salmon migrate past as many as eight dams. Aside from restricting access to adult reproductive habitat, the FCRPS contributes to stock losses in juveniles during river rearing and outmigration. In the absence of the FCRPS, mortality of outmigrant salmon in the river and estuary may occur due to predation, exposure to chemical contaminants or pathogens, reduced water quality, poor nutrition, injury, and physiological stresses associated with smoltification. The FCRPS may further exacerbate these 'natural' causes of mortality, as well as impose additional sources of direct mortality (e.g., passage through turbines). Direct mortality is defined as death that takes place during the same life stage as the stressor. Delayed mortality is defined as death that occurs at a life stage subsequent to the stressor. Delayed mortality attributable to the FCRPS that occurs after the last dam in the FCRPS (Bonneville Dam) during outmigration is referred to herein as latent mortality.

The US Army Corps of Engineers' (USACE's) role within the Basin is to operate the hydropower system, in conjunction with other producers, in a manner that balances the needs of fish with other uses. The USACE accomplishes this through multiple regional forums and special programs that address fish passage improvements throughout the hydrosystem. USACE annually funds over 85 million dollars in research, capital improvements, and operations specifically targeted at improving population numbers of targeted species.

Historically, research, operations, and capital improvements within the Basin have largely focused on mitigating direct mortality within the FCRPS; management actions have included construction of juvenile fish-passage and collection facilities at all the mainstream dams (except The Dalles Dam), redesign of turbines, predator control, transportation (barging), flow augmentation, and reservoir drawdown. Recent evidence suggests that the extent of delayed mortality of outmigrant salmon may be substantial in the estuary and near-shore ocean environment. Causes of delayed mortality may include, but are not limited to: (a) unintended consequences of management actions targeted at reducing the incidence of direct mortality in the FCRPS, (b) contaminant exposure, (c) size of smolts and timing of estuary and ocean entry, and (d) selected hatchery practices. Hence, research, operations, and capital improvements associated with delayed mortality are becoming an important component in the recovery planning process in the Columbia River Basin.