

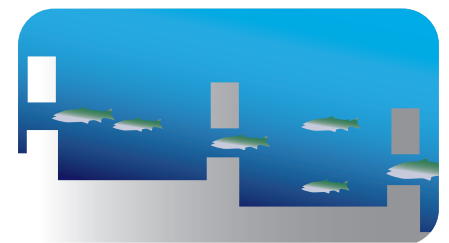
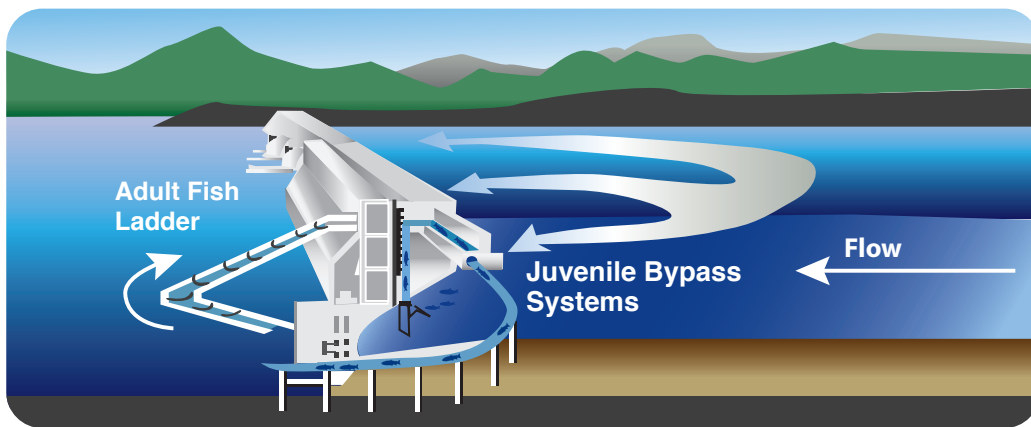
Hydropower and Fish Protection

Fish, particularly salmon and steelhead that travel long distances between fresh and ocean waters, pass through multiple environments during their life cycle.

Since 1991, 12 specific populations of salmon and steelhead have been federally listed as threatened or endangered in the Columbia River Basin. In addition, bull trout and Kootenai River white sturgeon (resident fish that migrate only within freshwater), have been listed for protection.

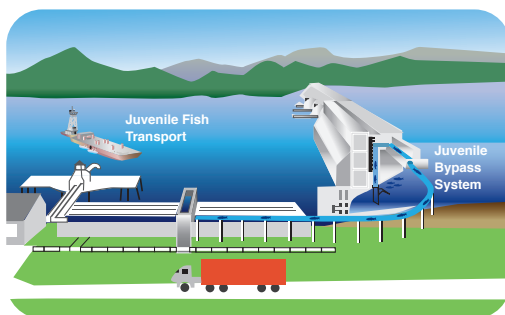
For salmon and steelhead on the Columbia River, federal performance standards call for 96 percent of spring fish migrating downstream to successfully pass through each hydropower project, and 93 percent for summer migrants. Thanks to fish bypass systems, turbine design, spillway improvements and other efforts, hydropower projects are meeting these standards.

Fish Passage Tour

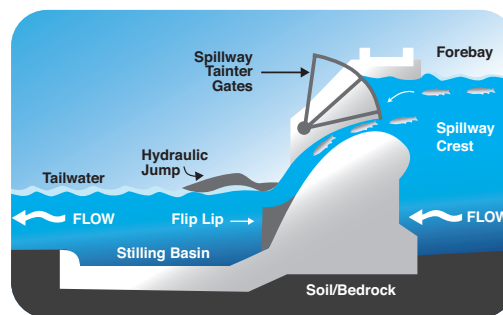


Fish Ladders are the most common way for adult salmon to migrate upstream as they journey to their spawning grounds. Upstream options also include trap-and-haul, bypass channels and other innovations.

When young salmon (smolts) migrating downstream encounter a hydroelectric project, they will either pass over a spillway, through the turbine area, be transported around a dam or enter a bypass system.

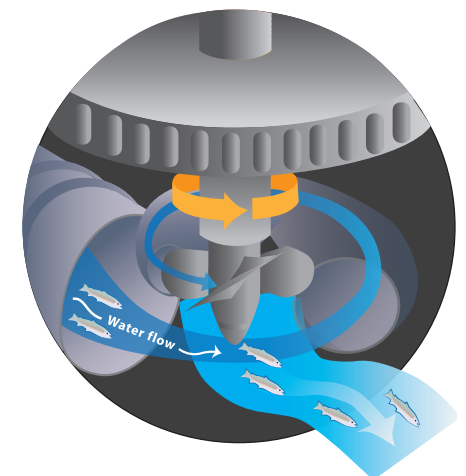


Fish Bypass Systems and Transportation: Surface collectors are a common means of guiding juvenile salmon around a project. One method is to use fish screens to guide fish into a bypass system. Another method is to use a surface collector to channel fish into a bypass system. Along the main stem of the Columbia and Snake rivers, some migrating smolts are collected in barges and then transported up to several hundred miles downstream.



Spillway Improvements: Migrating smolts can pass over a spillway, fall into the pool of water below, and then continue their journey downstream. Some weirs now provide a water ramp that allow fish to slide down to the river below.

Flip lips, also called spill deflectors, are sometimes used to reduce the effect of total dissolved gas, or TDG, which can cause gas bubble disease in fish.



Advanced Turbine Designs: Migrating smolts can pass into the turbine area and exit via the tail race. A new generation of turbines include minimum gap runners to increase turbine efficiency while decreasing the likelihood of smolts being trapped, bruised, stressed or disoriented.