

Example Scenarios¹

	CURRENT PATH - EXISTING LEVEL OF EFFORT	INCREASED EFFORT TO ADDRESS ALL THREATS	FRONTLOAD MAXIMUM EFFORT FOR ALL THREATS
Description	Continues efforts similar to current levels on all fronts in the near term.²	Moderate increase in efforts in the near term to address all threats.²	Maximum effort in near term on all fronts directed toward achieving goals as soon as possible.²
Tributary Habitat Strategies	Focused implementation of restoration and protection projects which restore natural stream processes and address key limiting factors in high value or high potential salmon habitats.	Increased investments and greater focus on large-scale, process-based restoration projects and protection of habitat function sufficient to demonstrably improve abundance and productivity of key populations.	Landscape/watershed scale initiatives to restore ecological processes and address major constraints (existing development, infrastructure), concurrent with substantially greater investments in preventing additional degradation.
	<i>UCR: According to an expert panel convened under the 2008 FCRPS BiOp, the current project-based strategy has the potential to produce a net 15% improvement for Spring Chinook salmon and steelhead. From the late 1990s through 2014, an investment of \$74 million, has produced an estimated 4-6% improvement.</i>	<i>UCR: The UCSRB estimates that additional effort in the currently-accessible area would be required to reach a 15% level of net improvement in light of adverse effects of continuing activities.</i>	<i>UCR: Progress becomes increasingly expensive as projects become more complex and as the available pool of projects gets smaller.</i>
	<i>Snake: Past efforts were generally focused on project opportunities but efforts are increasingly strategic and based on watershed assessments. Work is currently focused on areas with the intrinsic productivity values and potential for improvement (e.g., Lemhi, Pahsimeroi).</i>	<i>Snake: There is potential to significantly expand and build upon current efforts in both currently-degraded and in less-developed areas. Significant improvements will also require expansion of implementation infrastructure and supporting assessment information.</i>	<i>Snake: Opportunities are more constrained in watersheds with higher levels of existing development and these areas will require different approaches depending on land use.</i>
	<i>MCR: Work to date has addressed many major tributary passage issues for adults and juveniles, and opportunistic habitat restoration projects. Current funding levels have been flatlined and most of the low hanging fruit projects have been completed. Maintaining current level of investment would probably end up with status quo due to ongoing development/degradation from other activities.</i>	<i>MCR: Substantial opportunities exist for additional habitat improvements but these projects will be more costly and complex (e.g., highway/embankment relocation). Effectiveness monitoring will be essential for guiding strategic decisions on further investments.</i>	<i>MCR: Would include widespread restoration of floodplain function.</i>
	<i>LCR/Will: Extensive work has included small scale projects and passage improvements. These efforts have at least partially offset continued decline. Current efforts are estimated to be only 10-15% of what is needed to achieve recovery goals.</i>	<i>LCR/Will: Work to address continuing development, particularly in the floodplain, is essential. We are not going to recover fish if we keep losing more than we are fixing. Will also require coordination, capacity and capital, design and development and monitoring.</i>	<i>LCR/Will: Would involve far better integration of recovery needs into land and water use planning, floodplain reconnection, more natural hydrography, etc.</i>

¹ The biological strategies focus on the strategies/actions during the early portion (e.g., first 25-years) of scenario implementation. Bullets are examples of actions which might be associated with each strategy.

² For all strategies: Identify benchmarks. After 15-25 years, evaluate results relative to benchmarks. If not met, additional actions are triggered.

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Hydro Strategies	Dedicated efforts to substantially improve fish passage and survival through modifications of hydro system operation and configuration.	Expanded measures to improve system survival (in river & latent) within the (large-scale) limitations of current system configuration.	Targeted restoration of normative river conditions and function (dam breaching, natural hydrograph, flooding, temperature).
	<i>Mainstem Federal Projects: Flexible spill program and project-specific operational measures as defined in 2019 CRS Biological Opinion. Continuing refinements based on efficacy of current measures. Optimization of Dworshak temperature management benefits.</i>	<i>Mainstem Federal Projects: Further expansion of spill measures (e.g., to 125% dissolved gas less at all dams), fish priorities in management of upstream storage, actions to address tributary “overshoot” of some stocks, cold water refugia for migrating adults.</i>	<i>Mainstem Federal Products: Breaching of one or more Snake River Dams with concomitant mitigation of non-fish impacts. Flow augmentation targets. Management for fish primarily with power and navigation secondary. Additional operational measures to address flow & temperature effects from climate change.</i>
	<i>Mainstem PUD Projects: Habitat Conservation Programs (HCPs) which commit to a 50-year program to meet hydro project survival targets and compensation programs which in combination produce no net impact on mid-Columbia salmon and steelhead runs.</i>	<i>Mainstem PUD Projects: Look beyond the HCPs to find additional operational measures at each dam that could be implemented to improve survival (e.g., year-round bypass operations, alternative spill regimes, adult passage technologies).</i>	<i>Mainstem PUD Projects: Additional measures might include year-round fish passage, additional turbine restrictions, fish-friendly turbines.</i>
Blocked Area Strategies	Passage restoration and reintroduction in high potential headwaters of selected tributary rivers concurrent with exploratory and fishery-focused efforts in the Upper Columbia and Snake rivers.	Expanded efforts to explore and improve passage efficiencies into tributary and mainstem blocked areas in conjunction with dedicated programs for hatchery supplementation.	Restoration of effective adult and juvenile passage consistent with high levels of self-sustaining natural abundance and production in historical ranges.
	<i>UCR: Continue limited adult releases in currently blocked historical production areas to provide fishing opportunities and assess natural production potential of current habitats. Experimental reintroduction with interim hatchery supplementation concurrent with evaluation of passage potential.</i>	<i>UCR: Concurrent improvements have the potential in habitat in areas where significant opportunities exist. Develop dedicated hatchery production to support reintroduction efforts. Habitat restoration potential of 20% in 25 years which dedicated funding. (Would require increased funding and greater effort in preventing additional degradation)</i>	<i>UCR: Achieve functioning juvenile and adult fish passage. Have dedicated hatchery production for reintroduction. Achieve colonization of habitat in blocked areas.</i>
	<i>Snake: Trap and haul adult salmon to establish fisheries on unlisted, hatchery origin spring/summer Chinook salmon and/or steelhead in select tributaries to provide subsistence, cultural, and recreational harvest opportunities. Pursue upstream habitat improvements as well as monitoring and research in tributaries.</i>	<i>Snake: Restoration of naturally reproducing unlisted populations of salmon and steelhead within select tributaries upstream of the HCC to meet harvest, cultural, and ecological needs. Restoration of a fall Chinook population in the mainstem Snake River upstream from Hells Canyon. Expansion of tributary reintroduction efforts potentially including Wallowa Lake and the North Fork Clearwater.</i>	<i>Snake: Long-term potential for salmon reintroduction will require remedy of mainstem habitat limitations and passage effectiveness. Dams have a lifespan and future efforts may involve dam decommissioning after current license expire and systematic restoration of salmon to the capacity of habitats throughout the basin. Thus, a longer-term vision may include a future where HCC dams have been removed.</i>
	<i>LCR & MCR: Passage restoration and reintroduction in upper areas of high potential tributary systems (Cowlitz, Lewis, Deschutes, White Salmon).</i>	<i>LCR & MCR: Refinements in passage structures and operations to improve efficiencies.</i>	<i>LCR & MCR: Dam decommissioning when licensing comes up again (changing energy world etc. with increased reliance on renewables.)</i>

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Estuary Habitat Strategies	<p>Protection and small-scale restoration prioritized based on a basic understanding of limiting habitats. Where possible, protect and restore priority areas selected based on best available science to a high level of function.</p>	<p>Substantially enhanced resources and large-scale, process-based restoration and protection of habitat function sufficient to demonstrably and significantly improve survival.</p>	<p>Ecosystem scale restoration and protection of habitat function.</p>
	<ul style="list-style-type: none"> We have implemented opportunistic, low-hanging fruit projects, leaving big expensive projects. There is still some public lands restoration opportunity but the future improvements will increasingly depend on private lands. Effective land use planning will be critical in protecting against ongoing degradation. Funding is decreasing. Big question in the public mind on what has been the benefit of investments to date. 	<ul style="list-style-type: none"> Broaden the funding base and allow for more diverse applications (not just salmon). There are a lot more opportunities in riparian planting, stormwater management, toxics, reduction in impervious surfaces. Accountability (numbers, acres) sometimes gets in the way of larger projects with less certainty or an ability to quantify benefits. Future progress will require a willingness to accept more risk. 	<ul style="list-style-type: none"> Might involve working metro area and Longview to buy out properties, reconfigure land use code, properties behind dikes. Investments by cities to move industrial parks and restore floodplain. Restore more natural hydrology. Failure to effectively address climate change will drastically alter estuary habitat due to sea level rise. Address toxics.
Predation & Invasive Species Strategies	<p>Nonlethal measures designed to discourage predation by in problem areas, and limited removals in some cases.</p>	<p>Enhanced predator management efforts throughout the basin including nonlethal and lethal measures.</p>	<p>Predator removals which substantially reduce numbers and corresponding predation impacts.</p>
	<p><u>Birds</u>: Redistribution of estuary tern & cormorant colonies. Assessments of inland gull predation.</p>	<p><u>Birds</u>: Expanded redistribution and management programs including the McNary-Priest Rapids reach and Miller Island in The Dalles reservoir.</p>	
	<p><u>Pinnipeds</u>: Sea Lion hazing and removal of problem animals below Bonneville Dam & Willamette Falls.</p>	<p><u>Pinnipeds</u>: Expanded removals in target areas.</p>	
	<p><u>Predaceous fishes</u>: System-wide pikeminnow sport reward fishery. Juvenile bypass reconfigurations to reduce predation at dams.</p>		<p><u>Predaceous fishes</u>: identify & implement targeted opportunities to enhance predator control actions.</p>
	<p><u>Non-native fish species</u>: Directed removals of northern pike in Lake Roosevelt, sport fishery liberalization for walleye & smallmouth bass in Columbia & Snake rivers.</p>	<p><u>Non-native fish species</u>: Eliminate harvest limits & regulations. Consider targeted removals of selected species and water management as a potential tool to reduce recruitment. Increase focus on problem areas (e. g, lower Yakima River).</p>	<p><u>Non-native fish species</u>: Population scale removals. Modify or remove structures that have increased predators or vulnerability to predation.</p>
	<p><u>Invasive species (including mussels)</u>: Watercraft inspection & permitting programs. Early detection monitoring. Containment planning.</p>	<p><u>Invasive mussels (including mussels)</u>: Increased funding for federal, state & tribal enforcement to reduce illegal or intentional introductions.</p>	

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Hatchery Strategies	<p>Employ hatcheries to support and restore natural production where appropriate; strategically implement mitigation and supplementation programs; and limit detrimental impacts on natural production where significant.</p>	<p>Continue to reform and refine use of hatchery programs to restore of wild stocks while also ensuring that mitigation responsibilities are met.</p>	<p>Establish representative and robust natural populations of all stocks through a combination of hatchery and non-hatchery related strategies.</p>
	<ul style="list-style-type: none"> • Employ hatchery production to support fisheries as mitigation for lost natural production. • Employ hatchery supplementation to bolster local returns, harvest and natural production in areas where restoration and mitigation goals have not been met. • Employ hatchery fish for reintroduction and conservation programs where appropriate. • Reform and improve hatchery programs using the best available science to minimize natural population risks. • Regulate/limit hatchery contributions in selected wild fish production areas to protect and promote natural productivity, diversity and function. • Substantial reductions in or reprogramming of hatchery production have occurred in some areas to manage corresponding risks to wild stocks. 	<ul style="list-style-type: none"> • Identify additional opportunities for hatchery reforms for the benefit of natural production. • Implement sliding scale protocol for hatchery production as natural abundance increases and proves resilient. • Ensure that hatchery programs with a mitigation responsibility are fully and adequately funded. This includes routine and non-routine maintenance and support of modernization of hatchery infrastructure to achieve mitigation goals. • Develop dedicated hatchery production where appropriate to support expanded fishery or reintroduction efforts in currently-blocked areas. • Prepare for the likely role that hatchery programs and infrastructure will play in buffering against fluctuating environments and stochastic climate events. 	<ul style="list-style-type: none"> • Consider further reductions or limits on hatchery production where necessary for conservation of natural populations. • Note that improvements in habitat and out-of-subbasin survival will reduce hatchery influence and impact as natural populations increase. • Reevaluate mitigation hatchery production based on progress toward natural production and mitigation goals.
Fishery Strategies	<p>Manage fisheries to optimize harvest of strong stocks within constraints of reduced exploitation rates on weak or less abundant stocks to ensure that harvest does not impede recovery.</p>	<p>Continue to Implement conservative fishery management strategies which allow depleted stocks to capitalize on the benefits of other rebuilding measures while also providing fishery opportunities for strong stocks where consistent with conservation needs.</p>	<p>Reevaluate fishery limits and objectives based on progress toward natural production and mitigation goals.</p>
	<ul style="list-style-type: none"> • Reduce or eliminate direct and indirect fishery impacts to low levels that do not impede recovery. • Close fisheries at times of critical low abundance. • Employ abundance-based management using sliding scale harvest schedules to manage risks of low escapements and fishery opportunity. • Establish in-river refuges for protection of fish during migration and spawning. • Ensure that the conservation burden is shared equitably among fisheries. 	<ul style="list-style-type: none"> • Consider further fishery reductions and limits as necessary to address any continuing declines. • Expand use of in-river refuges and non-consumptive uses (e.g., catch and release) to protect migrating adults in the face of warming trends in the Columbia and Snake River mainstems. 	<ul style="list-style-type: none"> • Consider further reductions or limits on fisheries as necessary to meet natural production goals. • Long term CBP qualitative goals call for expansion of fishery opportunity concurrent with progress toward ESA delisting and broad sense goals.

Climate Strategies (alternatives)

Protect and restore stocks and populations regardless of their vulnerability to possible climate change effects.

Prioritize protection and restoration efforts for stocks and populations which are least vulnerable to climate.

Maximum improvement effort for stocks and populations which are least vulnerable to climate and/or actions most likely to improve climate resilience. Restore access to currently-blocked areas which are least vulnerable or most resilient to effects of climate change.

Critical Uncertainties

Need better understanding of capacity to improve tributary habitat productivity and constraints to improving. Uncertainty about the carrying capacity of freshwater habitats. Habitat that's in relatively good condition isn't as productive as we'd expect – why? (Why is the Middle Fork Salmon River not more productive and why is the Lemhi doing better than more pristine habitats?)

Need to evaluate hypothesis that tributary habitat restoration actions lead to increases in population-level spawner abundance. Need better understanding of habitat status and fish survival at population scale, how fish respond to habitat actions, and how habitat actions contribute to recovery.

Uncertainties re. hydro: survival studies done primarily with hatchery fish. Impacts may not be the same to natural-origin fish. Fish used in PUD hydro survival studies are predominately hatchery-origin juveniles, which are often larger and could display different characteristics than natural-origin fish.

Future changes in temperature and precipitation could have regional effects on the timing and distribution of water, water quality, ocean conditions, and the susceptibility of areas to expansion and introduction by non-native species.

through the lower Columbia are unknown.

Engineering for passage systems.

Innovative Approaches

Find areas where we can implement some approaches as pilots/experimental management. How do we test hypotheses? Can take a long time to get answers.

Need to look at innovative practices for cooling tributary water:

- (e.g., wastewater dischargers required to cool water before discharging)
- Geothermal, hyporheic cooling.
- Pay landowners to allow property to flood.
- 15-Mile Creek project – volunteer program started in 2011. Stream temp and flow forecasting model – when lethal temps projected, alert system goes out to irrigators. Water rights holders are compensated for releasing water in stream. 2015 drought conditions – released enough water to avoid lethal temps.

Elevate the power of life cycle models as tool to be tied to evaluating restoration opportunities. Elevated importance of integrated floodplain restoration strategies, including simple (BDAs) and more complex approaches. John Day steelhead LCM. McHugh et al. 2017 (or 2018).

Need to think innovatively about how to build systems for human life that support fish. Build new systems.

Importance of relationship building to change how things get done on the ground.