

A photograph of four salmon swimming in white water rapids. The fish are dark with silvery scales, and the water is turbulent and white with foam. The fish are positioned at different depths and angles, creating a sense of movement.

FISH PASSAGE & REINTRODUCTION --- into the --- U.S. & CANADIAN UPPER COLUMBIA BASIN

TABLE OF CONTENTS

a Executive Summary	2
b Introduction	4
c Fish Passage & Reintroduction Proposal	8
d Phase I Study Program	12
e Passage Strategies & Technologies	14
f Climate Change	17
g Cultural Significance of Salmon to Indigenous Peoples	19
h Native Peoples' Rights & Lack of Prior Informed Consent, Coordination, Consideration & Accommodation	20
i Potential Effects of Fish Passage on Existing Project Benefits	23
j Funding & Cost Allocation	25
k Planning Process	26
l Bibliography	27

appendix one Historical Habitat of Anadromous Fish in the Upper Columbia River	29
appendix two Historical Harvest of Anadromous Fish by Native Peoples	32

The Columbia Basin tribes and First Nations jointly developed this paper to inform the U.S. and Canadian Entities, federal governments, and other regional sovereigns and stakeholders on how anadromous salmon and resident fish can be reintroduced into the upper Columbia River Basin. Reintroduction and restoration of fish passage could be achieved through a variety of mechanisms, including the current effort to modernize the Columbia River Treaty (Treaty). Restoring fish passage and reintroducing anadromous fish should be investigated and implemented as a key element of integrating ecosystem-based function into the Treaty. Anadromous fish reintroduction is critical to restoring native peoples' cultural, harvest, spiritual values, and First Foods taken through bilateral river development for power and flood risk management. Reintroduction is also an important facet of ecosystem adaptation to climate change as updated research indicates that only the Canadian portion of the basin may be snowmelt-dominated in the future, making it a critical refugium for fish as the Columbia River warms over time.

This transboundary reintroduction proposal focuses on adult and juvenile fish passage at Chief Joseph and Grand Coulee dams in the U.S. and at Hugh Keenleyside, Brilliant, Waneta and Seven Mile dams in Canada. Reintroduction would occur incrementally, beginning with a series of preliminary planning, research, and experimental pilot studies designed to inform subsequent reintroduction and passage strategies. Long-term elements of salmon reintroduction would be adaptable and include permanent passage facilities, complemented by habitat improvement, artificial propagation, monitoring, and evaluation. Funding for planning, feasibility studies, construction and operations, and monitoring and evaluation can come from a variety of sources, with initial elements funded through the Northwest Power and Conservation Council's Columbia River Basin Fish and Wildlife Program. Some of the preliminary planning has already occurred at Canadian projects and power plant operators in Canada are legally obligated to consider fish passage at Hugh Keenleyside, Brilliant, and Waneta dams if anadromous fish are passed and restored above Chief Joseph and Grand Coulee dams in the U.S.

The bilateral development and operation of the upper Columbia River was initiated with the construction of Grand Coulee Dam and is responsible for the loss of over 1,100 miles of salmon and steelhead habitat above Chief Joseph Dam and the loss of up to 4 million salmon harvested and consumed by native peoples throughout the basin annually.

Fish passage technology has improved significantly in the past several years, particularly for juvenile fish. These newer technologies have recently been implemented at a number of other dams in the Pacific Northwest with the earlier installations

demonstrating successful salmon passage and reintroduction programs. Additionally, the scientific tools and methods for investigating fish behavior and survival have markedly improved, providing the means to plan and design passage and reintroduction with greater certainty of success (see Future of Our Salmon Conference, www.critfc.org/future). These passage technologies allow existing project benefits to continue largely unencumbered by these passage, reintroduction, and monitoring programs and facilities.

This paper is intended for informational purposes only for use in Treaty or other planning forums.



WELLS POOL, COLUMBIA RIVER

Since time immemorial, indigenous people in the Columbia Basin lived a way of life that was sustained by a healthy ecosystem. Fish were a mainstay of their diet—sustaining them both physically and spiritually. Salmon still connect the native people of the Pacific Northwest to the Earth and to each other. The Columbia Basin tribes with management authorities and responsibilities affected by the Columbia River Treaty have joined with their First Nation and Indian Band relations in Canada to develop this paper (see map showing blockages to historic fish passage, and Tribes and First Nations at <http://www.critfc.org/tribal-treaty-fishing-rights/policy-support/columbia-river-treaty/restore-fish-passage/>).

Initial damming of the Columbia River occurred in 1933 with Rock Island Dam, which was built with adult fish passage. However, Grand Coulee Dam was completed in 1942 without fish passage. In 1964 further development of the Columbia River by the United States and Canada was accelerated with ratification of the Columbia River Treaty. The Treaty was designed with two primary purposes: reducing flood risk and increasing hydropower generation. Impassable dams constructed pursuant to the Treaty blocked fish migrations and operation of large storage reservoirs significantly altered the river's natural flow regime to minimize flood risk and optimize power benefits. This altered flow regime provided an opportunity for additional dam and powerhouse construction that was undertaken for more power generation in the U.S. and Canada. Little, if any, consideration and accommodation was planned for ecosystem values, particularly for anadromous and resident fish populations, and the rights and needs of native peoples. While the construction and operation of Treaty dams did not cause the initial extirpation of upper Columbia River salmon populations, they have significantly harmed the viability of downstream salmon populations and the dams have made the task of upriver salmon restoration into Canada far more challenging.

Since the early 1960s, however, both countries have increasingly recognized and valued the importance of the basin ecosystems and the role of rivers and anadromous and resident fish in those ecosystems. For example, in the U.S., the federal government requires fish passage facilities for non-federal hydroelectric projects in the Pacific Northwest in most instances. Similarly, since the early 1960s, both countries have been forced to recognize and acknowledge their obligations to the native peoples whose subsistence, economy, culture, and spirituality depends on a healthy and functioning ecosystem. In the U.S., the Northwest Power and Conservation Council's (Council) Columbia River Basin Fish and Wildlife Program recognizes the need for exploring and evaluating fish passage and reintroduction in the upper Columbia River and in other blocked areas where anadromous fish existed historically. Recently, the Council's Fish and Wildlife Program provided clearer guidance to pursue fish passage and reintroduction investigations at Grand Coulee and Chief Joseph dams. In Canada, recent power expansions by the Columbia Power Corporation on Hugh Keenleyside, Brilliant, and Waneta dams were granted licenses subject to legally binding conditions under the British Columbia Environmental Assessment Act. These license conditions provide varying levels of commitment to consider fish passage at those dams in the event that anadromous fish are restored above Grand Coulee and Chief Joseph dams.

In the process of harnessing the river to minimize flood risk and to optimize low-cost power generation prior and subsequent to the Treaty, substantial habitat for salmon, steelhead, and other fish species was inundated or blocked (see Appendix 1). Major anadromous fish runs were eliminated or decimated and along with them, the many benefits they brought to the region's native peoples (see Appendix 2). Tribal, recreational, and commercial fishing economies in the Columbia Basin and extending out to the Pacific Ocean in both countries were sacrificed for other economic values.

Today, Columbia Basin tribes in the U.S. and First Nations in Canada are participating in their respective countries' reconsideration of the Columbia River Treaty and in other forums to promote coordinated, bilateral fish passage and reintroduction efforts. The tribes, First Nations, and other regional sovereigns and stakeholders are advocating the integration of ecosystem-based function as an equal Treaty purpose, including a watershed approach to restoring fish passage and reintroduction into historical habitats blocked by dam construction. Through Treaty reconsideration, native peoples are encouraging their communities and governments to restore fish passage at Chief Joseph and Grand Coulee dams in the U.S. and at Hugh Keenleyside, Brilliant, Waneta, and Seven Mile dams in Canada.

In the United States, the Council's Fish and Wildlife Program now includes preliminary steps for fish passage restoration into Canada. Previously, First Nations successfully achieved license provisions at three Canadian dams to install fish passage facilities in concert with fish passage at the two blockages in the U.S. Together, substantial and diverse habitats for salmon and other aquatic species could be restored to levels where fish production would benefit the entire Pacific Northwest, including coastal sport and commercial fisheries off Washington, British Columbia, and Southeast Alaska. Significant ecological and economic benefits will be gained, as well as restoration and revitalization of cultural, spiritual, and nutritional values for basin residents.

In recent years, ocean habitat conditions, actions to improve juvenile and adult salmon passage at Columbia River dams, and significant habitat improvements in the U.S. and Canada have improved survival that is leading to increased abundance and productivity of sockeye and summer chinook salmon populations below the passage blockage at Chief Joseph Dam. Additionally, ocean harvest limits implemented under the U.S.-Canada Pacific Salmon Treaty are allowing for increased runs of salmon in the Columbia River. From 2003 to 2012, the Okanagan sockeye run has averaged 153,000 adults compared to average runs of about 21,700 adults in the 1990s, a six-fold increase (ODFW 2014). In 2014, this run of salmon exceeded 500,000 adult fish. From juvenile migration years 2001 to 2010, Okanagan sockeye have returned at an average smolt-to-adult rate of 7.5 percent (Williams 2014), a very high rate for upper basin salmon populations. The upper Columbia summer chinook run has increased from an average of 17,150 in the 1980s and 1990s to an average run size of 59,800 in the 2000s (ODFW 2014), a 250 percent increase. There is significant potential to further increase the survival rates of these populations through additional planned passage improvements at U.S. dams and by lessening predation by ballooning populations of piscivorous birds and pinnipeds in the lower Columbia River. These increasing abundance and productivity levels provide a solid basis for increasing the range of the species above the upriver barriers.

Reintroduction of salmon and other species is proposed through a pragmatic and phased approach to fish passage and reintroduction planning, research, testing, and design/construction followed by monitoring, evaluation, and adaptive management. Each phase of this ecosystem recovery program would be pursued based on the knowledge gained and successful outcomes from previous phases. Recently, there have been significant advancements in legal and technical knowledge, increased transboundary collaboration, renewed interest in a modernized Columbia River Treaty, and new opportunities under the Council's Fish and Wildlife Program. Taken together, they offer substantial opportunities to reconcile the consequences of the past, which were based on narrowly-focused decisions on river development and operations.

The Federal Energy Regulatory Commission has required fish passage facilities at a number of existing, private Pacific Northwest dams that it licenses on behalf of the federal government. Similar fish passage policy is required at the federal government's own dams. At Puget Sound Energy's 300-foot-high Baker project in north-west Washington, a floating juvenile fish collector and adult trap-and-haul facility has restored sockeye salmon access to the reservoir and about 15 miles of stream habitat. Passage collection efficiencies and survivals are so high that the sockeye salmon run has increased from 99 adult fish in 1985 to 48,367 adult fish in 2012; in 2014, over 1 million juvenile sockeye, chinook, coho, and char successfully passed the project on their migration to the ocean. At Portland General Electric's 440-foot high Round Butte project on the Deschutes River, Oregon, a juvenile fish collection tower was constructed at a cost of over \$100 million. Combined with adult trap-and-haul facilities, this action has allowed reintroduction of steelhead, chinook, and sockeye. Portland General Electric is also installing a floating juvenile fish collector and modernized adult passage facilities at its Clackamas River, Oregon, projects to improve passage and viability of salmon and steelhead populations. More information on these and other recent passage and reintroduction efforts are described at the Future of Our Salmon Conference webpage (www.critfc.org/future).



This proposal is based on four initial objectives:

Objective 1:

Restore naturally spawning and hatchery-based runs of sockeye and chinook salmon into the upper Columbia River Basin, above Chief Joseph, Grand Coulee and Canadian dams to restore native peoples' cultural and spiritual values and commercial and subsistence harvest opportunities.

Objective 2:

Determine contribution of reintroductions to salmon recovery, habitat diversity, ecosystem health, and long-term sustainability of salmon and other fish species with expected climate change impacts.

Objective 3:

Establish and increase ceremonial and subsistence (food, social and ceremonial), sport, and commercial fish harvest opportunities for all communities and citizens along the Columbia River in the U.S. and Canada.

Objective 4:

Restore access and population structure of resident bull trout, lamprey, sturgeon, and other native fish species to historical habitats.

Tribes and First Nations propose that fish reintroduction should proceed initially with passage planning and experimental trials with sockeye and chinook salmon, the species that were once numerous in the upper Columbia and essential to the subsistence and culture of tribes and First Nations. These species are also more likely to successfully propagate and migrate from the streams and reservoirs in the blocked areas. Donor populations for experimental trials, passage testing, and initial reintroduction would be from stocks not listed under the Endangered Spe-

cies Act to avoid regulatory hurdles and potential conflicts with current land and water uses. Reintroduction of coho salmon and steelhead and passage for resident fish species could be subsequently considered. Passage at Waneta and Seven Mile dams on the lower Pend Oreille River would also complement recent passage actions at Boundary and Box Canyon dams further upriver to foster population connectivity of bull trout and other resident species.

Although additional historical chinook salmon habitat would be available further upstream from the Canadian Revelstoke and Mica dams, fish passage restoration above these facilities would logically occur subsequent to successful restoration lower in the basin. Fish passage restoration and reintroduction efforts at these facilities would be a long-term goal that could progress subsequent to the process outlined in this proposal.

Restoring fish passage into the upper Columbia River has been the subject of past investigations (Heinith and Karr 1997) and more recently was the subject of a workshop and report, “Scoping Document to Assess the Feasibility, Impacts, and Benefits (FIBs) of Restoring Anadromous Salmon to the Canadian Reaches of the Upper Columbia River” (April 12, 2007). The workshop and report considered a broad range of restoration issues across economic, social, and environmental objectives. The report summarizes the issues and options for fish passage. The workshop and report concluded with a recommendation that passage should proceed by implementing “...a systematic, phased approach with iterative re-assessments.” The report made specific recommendations on priority issues that could be resolved in Phase I, lasting 1 to 3 years:

1. Investigate upstream and downstream passage options and design experimental reintroduction past upper Columbia River dams and reservoirs.
 - Passage options for adults at Chief Joseph and Grand Coulee (and Canadian dams).
 - Alternative technologies for guiding and transporting smolts through Lake Roosevelt and around Grand Coulee Dam (and other projects).
 - Behavior studies of smolts in Lake Roosevelt (and other reservoirs).
 - Radio-track adult salmon.
2. Investigate potential donor stocks.
 - Identify potential donor stocks.
 - Determine disease prevalence of donor stocks.
 - Evaluate role and use of artificial propagation facilities.

3. Evaluate existing quantity, quality and capacity of salmon habitat in the upper Columbia River.
 - Baseline field assessments of reservoir, main-stem and tributary habitat quantity, quality and capacity for various life stages in the U.S. and Canada.
4. Simulate potential hydropower system operating changes required for successful upstream and downstream migrations.
 - Assess travel time of hypothetical fish stocks to reach the estuary in the critical survival window.
 - Assess juvenile and adult migration survivals to and from Chief Joseph Dam.
5. Assess socio-economic implications of alternative hydrograph scenarios.
6. Develop a comprehensive understanding of the cultural values of salmon to the First Nations and tribes' health and cultures.
7. Formulate support for passage and reintroduction of anadromous fish.
8. Develop a communications plan.

The tribes and First Nations' proposal for restoring fish passage into the upper Columbia River would proceed in an incremental approach with work progressing to the next phase only after successful conclusions or outcomes from the previous phase.

Phase I: Pre-assessment planning for reintroduction and fish passage. See the eight steps above and subsequent section for a detailed Phase I study program (some steps would proceed concurrently).

Phase II: Experimental, pilot-scale salmon reintroductions and interim passage facilities.

Phase III: Construct permanent juvenile and adult passage facilities and supporting propagation facilities. Implement priority habitat improvements.

Phase IV: Monitoring, evaluation, and adaptive management. Continue needed habitat improvements.

Investigations in Phases I and II would determine the long-term requirements for salmon passage and restoration in later phases. Initial experimental reintroductions would occur during Phase II, guided by the information gathered and experiments

designed in Phase I. Phases I and II are composed of a suite of studies and actions and it is predicted that some studies would have differing timelines and review periods; therefore, some investigations in Phase I and II could proceed concurrently.

Passage investigations should proceed with an understanding that anadromous fish runs from above Grand Coulee Dam may need to be initiated and supported with appropriate hatchery programs to counter effects of cumulative fish passage losses at mainstem hydroelectric dams and from ocean and in-river fisheries, and possibly to minimize impacts to donor populations. The need for, and extent of, long-term use of artificial propagation with hatcheries can only be determined based on M&E programs, future scientific findings, and adaptive management. Principles and guidance in the use of artificial propagation would include the recommendations of McClure et al. (2011) and the Hatchery Scientific Review Group (2014).

These initial phases proposed by the tribes and First Nations need to be conducted bilaterally by the U.S. and Canada to ensure fiscal efficiency and the development and integration of key planning and research information is conducted in a coordinated and comprehensive manner. Phase I would include the necessary strategic scoping for subsequent experiments and include the creation of a decision tree to guide testing and adaptation, based on results. Phase I can be initiated by completing a work plan pursuant to the process recently included in the Council's Fish and Wildlife Program. Additionally, Phase II would test interim juvenile passage facilities and could be accomplished in a sequential manner with adult and juvenile fish collectors potentially shared between U.S. and Canadian projects. The extensive transboundary coordination necessary for a successful program would build on the existing partnership between the countries, the tribes and First Nations, and other regional sovereigns.

This proposal could be implemented through coordinated U.S. and Canadian funding from a variety of sources for activities identified in Phase I and II. If a coordinated approach by both countries is adopted, these investigations could be conducted concurrently with US and Canadian efforts to modernize the Treaty. Alternatively, passage investigations could be undertaken pursuant to the Council's Fish and Wildlife Program; in Canada, funding arrangements could be secured through the Columbia Basin Trust and federal and provincial sources to support Phases I and II. Upon bilateral agreement on an approach, detailed work plans and schedules would be prepared, guided, and thoroughly reviewed in a transboundary forum. Emphasis would be on the work necessary for Phases I and II.



Additional scoping of necessary studies were conducted to assess the benefits, risks, and constraints to fish passage and anadromous fish reintroduction into the Columbia River above Grand Coulee Dam subsequent to the 2007 workshop. Technical information gathered at the Future of Our Salmon workshop and conference (www.critfc.org/future) has resulted in a clearer understanding of the key uncertainties and the new monitoring technologies available to scientifically investigate them. Suggested priority studies to guide Phase II investigation include:

Evaluate donor stock selection and re-colonization strategies for steelhead, chinook, and sockeye salmon that take into consideration evolutionary ancestry and ecological adaptations.

Design experimental reintroductions for each species of anadromous fish to expand knowledge of:

- Migratory behavior, mortality sources, and downstream smolt survival of released juvenile salmon from the transboundary reach (the free-flowing section of the Columbia River between Lake Roosevelt and Hugh Keenleyside Dam) through Lake Roosevelt (e.g., from capture-mark-recapture using mobile smolt collectors and a combination of PIT and micro-acoustic tags).
- Smolt behavior in the forebays and tailraces of Grand Coulee and Chief Joseph dams and survival through dam entrainment pathways.
- Adult salmon migration behavior through Lake Roosevelt and the transboundary reach (e.g., from combined acoustic radio-tracking).

Determine spawning habitat availability and carrying capacity for the three anadromous species and alternate chinook salmon life histories in tributaries to Lake Roosevelt, the transboundary reach.

Spawning habitat availability and carrying capacity for three species and alternate life histories of chinook salmon above each Canadian facility.

Evaluate recommendations of passage sequence based on cost-effectiveness analysis for both anadromous and resident fish.

Determine current suitability of migration and rearing habitat for the three anadromous species and alternate chinook salmon life histories from Chief Joseph Dam to Revelstoke Dam.

Simulate operational scenarios at Columbia Basin dams to assess potential gains in spawning, rearing, and migratory habitat availability for three anadromous species and resident fish, which would draw upon the results of previous three studies and existing literature on resident fish. Assess compatibility with downstream ecosystem flows. Assess socio-economic trade-offs within and outside context of the Columbia River Treaty. Assess interaction with climate change predictions.

Conduct engineering studies of interim and permanent fish passage facilities at Grand Coulee and Chief Joseph dams; update existing engineering studies at Canadian projects. Consider multiple species (resident and anadromous fish) passage options.

Each study would include examining the relevant potential risks associated with experimental reintroduction and permanent reintroduction on existing downstream anadromous populations, as well as risks to current ecosystems. Studies would be reviewed, administered, and sequenced by an international technical working group of relevant First Nations, tribal, provincial, state and federal agencies and dam owners/operators' experts. Additional expertise may be sought from consultants, industry, academia, or non-government organizations. This group would also be responsible for reviewing and integrating the knowledge gained in these studies and recommending and guiding the transition into subsequent phases.



FLOATING SURFACE COLLECTOR

While a thorough vetting of passage strategies and technologies would be an important subject for Phase I and II planning, the recent Future of Our Salmon Conference provided some information and options for early consideration. In summary, the adult and juvenile passage facilities at the run-of-river Columbia River dams—ladders for adults and turbine screens and spill for juveniles—may not be feasible for the higher head dams in the upper Columbia. The floating surface collectors (FSC) being assessed by Puget Sound Energy at its Baker Lake projects, Pacific Power & Light at its Lewis River projects, Portland General Electric at its Clackamas projects, and the Corps of Engineers at its Willamette Basin projects are showing success in collecting large numbers of juvenile fish in highly fluctuating reservoirs behind high head dams. Trap-and-haul facilities for adult passage continue to be a reliable technology; in the upper Columbia River such facilities could at least serve in an interim capacity while more permanent passage solutions are developed.

An initial consideration is where and in what sequence to provide adult and juvenile passage facilities at the six upper Columbia Basin dams during Phase II testing when the feasibility of reintroduction is determined. In the U.S., a likely option for Phase I would be to provide adult trap-and-haul facilities at or below Chief Joseph Dam. Adult test fish could then be transported to Lake Roosevelt and released above Grand Coulee Dam and also near the head of the reservoir. This action would provide the adult fish necessary to 1) document and assess the capacity of the upper basin's natural habitat to produce offspring, 2) subsequently test adult fish passage at Canadian dams, and 3) assess natural juvenile migration through Lake Roosevelt, a key uncertainty in feasibility determination.

For juvenile passage, a FSC could be placed, with guidance nets, before the third powerhouse at Grand Coulee Dam and a second FSC near the head of Lake Roosevelt; collected juveniles could then be transported below Chief Joseph Dam to then complete their freshwater migration. This action would allow 1) testing

collection efficiency of juveniles at the head of Lake Roosevelt, from the forebay of Grand Coulee Dam, and in combination, 2) determining smolt-to-adult survival of reintroduced fish in the upper Columbia River, and 3) later testing adult passage through Lake Roosevelt with offspring produced in Canadian waters. Juvenile passage from a head-of-reservoir FSC could use a tanker truck to transport juveniles to the dam or use a boat to move the juveniles down to the dam in floating net pens. The use of all of these options concurrently would allow many of the key feasibility questions to be addressed with the least amount of capital committed to facility construction.

WHOOSHH fish passage technology uses localized pressure differentials to move fish through a flexible tube (see www.whooshh.com) and feasibility testing should also be conducted to determine its potential application for adult and juvenile fish. With a positive feasibility determination, adult passage facilities could be planned at Chief Joseph Dam and juvenile facilities at the Grand Coulee project (with a possible third FSC at Grand Coulee Dam near the first powerhouse and Banks Lake pump station). Concurrently, juvenile passage could be studied at Chief Joseph Dam and adult passage at Grand Coulee Dam to address passage in the intervening section of the river.

In Canada, adult sockeye and chinook coming from Lake Roosevelt would be available for assessing salmon passage and reintroduction. If necessary, these fish could also be supplemented with additional adults collected from below Chief Joseph Dam. With adult salmon coming from the U.S., initial testing could be undertaken to:

1. Document the capacity of historical habitats above Hugh Keenleyside and Brilliant dams to produce offspring,
2. Test adult fish passage at Canadian dams,
3. Assess natural juvenile migration through Arrow Lakes and Brilliant reservoir, and
4. Determine juvenile passage efficiency and survival through alternative passage routes at these dams.

The sequence for passage at Canadian projects might apply four criteria:

1. Strength of provision for passage in legally binding British Columbia Environmental Assessment Certificates for these projects,
2. Habitat availability and production potential for all three species above each dam,
3. Cost effectiveness of fish passage options, and
4. Need for passage of resident fish.

Determining the initial feasibility of passage through Grand Coulee, Chief Joseph, Hugh Keenleyside, and Brilliant projects could then lead to implementation of more permanent passage facilities at these facilities while further feasibility testing is undertaken at Waneta and Seven Mile projects.

In Canada, initial passage concepts have been completed on adult passage facilities at Hugh Keenleyside, Brilliant, and Waneta dams (see Future of Our Salmon Conference presentation by Peter Christensen, R2 Resource Consultants, Inc. at www.critfc.org/future). Juvenile passage was initially proposed via powerhouse turbines, but successful demonstrations of the FSC would likely be more appropriate in view of the cumulative mortality expected in passing the multitude of downstream projects in the U.S.

In the distant future, demonstrated success in salmon reintroduction above Hugh Keenleyside Dam could even lead to testing of passage from Revelstoke Dam to above Mica Dam. If passage above Revelstoke Dam proved feasible, this success would complete the reintroduction of salmon back to historical habitats and to all native peoples in the upper Columbia Basin.

Floating surface collectors at Grand Coulee Dam and perhaps at other projects offer additional fish management and economic benefits. The FSCs at Grand Coulee Dam would be expected to collect resident fish prior to their powerhouse entrainment and loss to Lake Roosevelt fisheries. The resident fish, many of which are produced for harvest, could be repatriated higher in the reservoir keeping them available for local fisheries. Loss of rainbow trout and kokanee has been estimated at 212,000 to 577,000 annually (see Brett Nine's presentation at the Future of Our Salmon Technical Workshop, www.critfc.org/future). Similarly, the FSCs would be expected to collect non-indigenous fish species, many of which are voracious predators of native species. These non-indigenous species could be removed, thereby increasing survival of native resident and anadromous fish.

Again, the best interim passage strategies to follow and the best technologies to apply would be the subject of Phase I study, likely applying evaluation criteria and a weighting system to rank alternatives.



Salmon species and races evolved from and adapted to various habitats, largely based on water temperature. Generally, salmon develop life-history strategies that avoid warm waters. In cooler waters, salmon species often have a prolonged freshwater rearing period, including over-summering, before migrating to the ocean; adults return when river temperatures are also cool. In habitats with warmer waters, chinook salmon have mostly adopted an ocean-type life history that has juveniles migrating to the ocean prior to the onset of warmer summer temperatures and adults returning after cool down in the fall.

Climate change models are predicting that in much of the Columbia Basin in the U.S. there will be a substantial loss of the winter snow pack and the southern portion of the basin will become largely rain dominated over time. Winter snow packs, needed to keep salmon waters cool, are expected to be limited to the northern Cascade Mountains in Washington, northern Idaho, and western Montana, and remain largely intact throughout most of the basin within British Columbia. The peak in the Columbia Basin annual hydrograph is expected to shift to one month earlier and flooding in the lower basin may become more of a winter phenomenon as occurs in western Oregon. Flows in the summer and fall are expected to become lower and warmer; flows are already approaching maximum tolerances for late summer and early fall returning adults in the lower Columbia River. Many current salmon habitats in the U.S. may be lost to intolerable temperature conditions.

At this time, a significant salmon management strategy for preparing for climate change in the Columbia Basin is to restore fish access to historical habitats where water temperatures should remain cool. This means providing access to higher elevation habitats as is being done in the Willamette Basin and restoring access to habitats in snow dominated terrains, as is being proposed herein for the upper Columbia Basin to access extensive ranges within British Columbia.

Building up productive runs of salmon from the cooler water habitats of the future should be a critical strategy for the U.S. and Canada to increase the amount and diversity of habitat available to salmon populations and to continue obligations to ensure that tribes and First Nations still have bountiful fish resources protected as required through the treaty and trust responsibilities of the federal governments. Pursuing fish passage now to prepare for climate change may be an effective strategy to avoid other alternatives of addressing warming waters such as removing dams that slow and heat river flows to above biological threshold limits for salmon and other anadromous and resident fish populations. Restoration of salmon, steelhead, and other migratory species into the upper Columbia Basin would lessen the risk for these populations elsewhere in the Columbia Basin by increasing the amount and diversity of available spawning and rearing habitat, particularly as a buffer for the anticipated effects of climate change.

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WOMEN SMOKE SALMON AT "CEREMONY OF TEARS," KETTLE FALLS, 1939

The importance of salmon and other fish species to tribes and First Nations is paramount to their culture and well-being. Salmon are a sacred resource. The loss of the salmon and other fish species irreparably harmed native peoples in many ways and dimensions. For many, the loss of salmon translated to an emotional loss, a loss of connection, confidence, and sense of self-worth. Native peoples suffered spiritual and ceremonial loss, a loss of spiritual guidance. Research indicates that without fresh salmon as a major part of their daily diet, tribal members' health is reduced (increased diabetes and heart disease) and mortality rates and poverty increase (Meyer Resources 1997). Without salmon runs, tribal members lost economic activity, fishing-related jobs, and trading opportunities. With the salmon decline came the loss of social exchanges, family activities, and community unity. With the extended loss of salmon, traditional skills and knowledge associated with the harvest, preparation, and use of the fish that had been passed down for generations was lost. Additionally, the loss of salmon interrupted the ecological integrity and health of the environment.

Evaluating the path towards salmon reintroduction as proposed by the tribes and First Nations must be done relative to the values and needs for salmon within the cultures and communities of the native peoples. For some native people, they are not whole without salmon. "Before Grand Coulee Dam we wanted for nothing; after Grand Coulee Dam we had nothing" (Matt Wynne, Spokane Tribal Councilman, quoting Spokane Tribal Elder, Marion Wynecoop).

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Recognition and protection of the rights of native peoples is an established principle of the domestic legal systems of both Canada and the U.S., as well as a recognized principle of international law. Within Canada, aboriginal rights enjoy constitutional protection under s. 35 of the Constitution Act, 1982, which recognizes and affirms existing aboriginal and treaty rights of the aboriginal peoples of Canada. Canadian courts have interpreted this provision as protecting traditional aboriginal practices—most notably, salmon fisheries practiced for food, social, and ceremonial purposes—from unjustified government interference. Courts have further imposed an obligation on governments to meaningfully consult with aboriginal peoples before taking any actions that may adversely affect aboriginal rights and practices.

Provincial laws applying to Aboriginal lands are subject to meeting a justification test, which includes three parts:

1. The government has a duty to consult and accommodate,
2. The government's actions must be backed by a compelling and substantive objective, and
3. The government's action must be consistent with the Crown's fiduciary obligation to the affected First Nation.

Provincial and federal laws and actions can infringe upon Aboriginal title for broader social purposes, but they must be justified per the above criteria. There is to be no unjustifiable infringing, including incursions on Aboriginal title, that would substantially deprive future generations of the benefit of the land (*Tsilhqot'in v. British Columbia*). Aboriginal title is based on occupation of the land—regular and exclusive use of the land.

When Grand Coulee Dam was being developed in 1934, the Canadian government was informed by the U.S. about the need for fish ladders at the proposed dam. In 11 short days, the Canadian response of October 27, 1934, came back

indicating that Canadian interests were not affected based on the false belief that there were no commercial fisheries located on the Canadian portion of the Columbia River. First Nations, dependent on salmon for millennia, were not consulted much less accommodated.

In the U.S., Columbia Basin tribes' natural and cultural resources related to the Columbia River are protected through treaties, executive orders, congressionally approved agreements, and the federal trust responsibility. For several Columbia Basin tribes, treaties with the United States created reservations and reserved fishing, hunting, gathering, and other rights. Federal court decisions have upheld these rights and interpreted them to ensure that fish and wildlife are sufficiently abundant to make the rights meaningful and not an empty promise. For other tribes with reservations established by executive orders, federally protected fishing rights were either specifically or implicitly reserved. In addition, stream flows sufficient to preserve tribal fisheries, wildlife, and plant habitats were reserved and are to be protected.

The trust responsibility is a cornerstone of U.S. federal Indian law and policy. As reaffirmed in Secretarial Order No. 3335 (August 20, 2014), the federal trust responsibility is a substantive duty of the United States to protect treaty rights, reserved rights, rights recognized through executive orders, and lands and resources retained by Indian tribes through their treaties, executive orders, and reservations. Through federal court decisions, the federal government is required to protect the natural resources on which the tribes depend in their exercise of cultural, subsistence, and commercial harvest rights.

Internationally, the U.N. General Assembly adopted the Declaration on the Rights of Indigenous Peoples (UNDRIP) on September 13, 2007. UNDRIP recognizes and affirms the cultural, political, legal, and social rights of native peoples, including a right to full and informed participation in decisions affecting their traditional lands.

Regrettably, these principles were not honored at the time the U.S. and Canadian governments built the dams that have so fundamentally altered the flows of the Columbia River system and the abundant salmon runs they once supported throughout the basin. Canada did not consult with First Nations about the implications of the Grand Coulee Dam on upstream aboriginal fisheries before advising the U.S. that it had no objections to the project, which eliminated traditional salmon fisheries in the upper Columbia. Neither Canada nor the Province of British Columbia consulted with First Nations prior to negotiating the Columbia River Treaty and expanding the dam system northwards into the upper Columbia.

The result of these omissions has been the elimination of centuries-old fisheries, the loss of a valued food source, and the erosion of the deeply rooted cultural, social, economic, and spiritual values aboriginal peoples hold for those fisheries.

Similarly, in the U.S., the Columbia River Treaty was negotiated, signed, and ratified without consultation or collaboration with tribal governments, so there could be no informed consent by the tribes for the implementation of the Columbia River Treaty, nor was there any consideration and accommodation of tribes' federally protected rights relating to cultural and natural resources as now understood and upheld through subsequent federal court decisions.



TRIBAL CHIEFS WATCH THE CONSTRUCTION OF GRAND COULEE DAM

The adult and juvenile fish passage technologies being considered here should function within the current operational limits and purposes of the U.S. and Canadian projects. Existing project benefits are expected to remain largely intact.

Collection of adult fish would occur via standard fishway entrances similar to those operated at many hydroelectric projects throughout the Pacific Northwest. Once collected, adult fish would be passed either through a trap-and-haul process or volitionally through a fishway. For feasibility investigations, interim adult passage at the U.S. projects would likely be trap-and-haul facilities. Through Phase II investigations, the selection of long-term facilities would be determined based on a number of criteria. At Chief Joseph and Grand Coulee dams, adult passage should not affect existing flood control and irrigation operations. Power generation would be slightly decremented to provide the electricity to operate the collection, passage, and monitoring facilities.

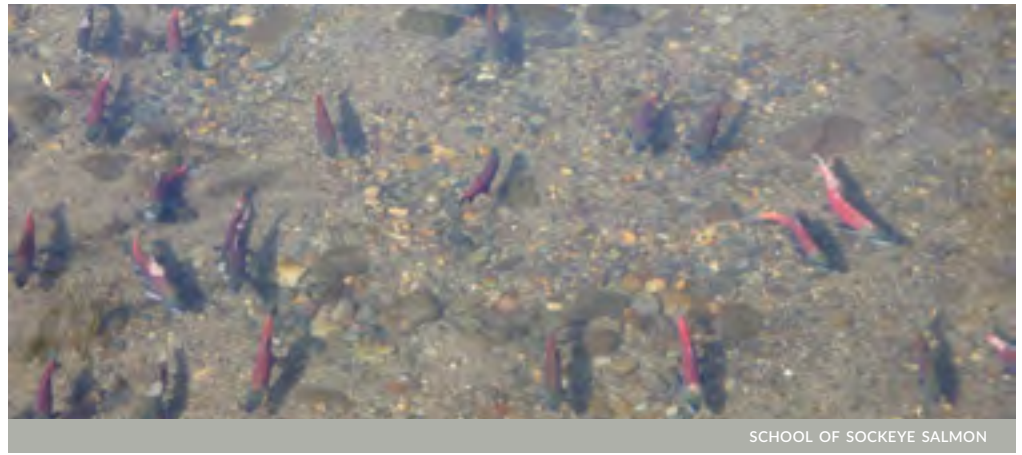
For juvenile passage, floating surface collectors (FSC) have been conceived and developed to operate within a wide range of reservoir fluctuation. Even at Grand Coulee Dam, FSCs should be capable of accommodating current flood risk management, irrigation, and power operations. Only power sales would be lessened to provide project electricity to operate the FSCs and associated facilities.

In summary, the tribes expect fish passage and reintroduction to have no substantial impacts on current flood risk management and irrigation operations at the Chief Joseph and Grand Coulee projects. Power use for the newest FSCs is expected to be about 1 Mw during operations.

At the Canadian projects, the likely important impacts to power generation might be some loss in electricity generation if surface spill is used to pass juvenile fish and/or project electricity is used to operate FSCs.

i | POTENTIAL EFFECTS
OF FISH PASSAGE ON
EXISTING PROJECT
BENEFITS

According to tribal and First Nation leaders, these potential impacts are acceptable in order to restore salmon to their homelands and cultures. Hydropower is an important clean energy source, but maximizing hydropower generation is not clean energy when it comes at the expense of ongoing salmon extinction and cultural loss.



SCHOOL OF SOCKEYE SALMON

Several options exist for funding the planning, testing, construction, and implementation of fish passage facilities and reintroduction actions. Complementary and coordinated funding avenues and opportunities should be the subject of negotiations between the U.S. and Canada to modernize the Treaty.

The Columbia Basin tribes and First Nations recognize that there are opportunities to achieve cost efficiencies in the planning and experimental phases by sequencing and sharing the use of scientific equipment, personnel, and interim passage facilities for testing. These cost efficiencies might best be achieved from a bilateral fund or, alternatively, from bilateral coordination and oversight of separate funds.

Actual construction and operation of fish passage facilities could 1) follow normal mitigation practices of each country at its own projects, or 2) proceed through a new, bilateral arrangement that recognizes a holistic approach to water and fish management. Under the current mitigation practice in the U.S., project beneficiaries have been identified and cost-allocation formulas emplaced for Chief Joseph and Grand Coulee dams that could apply to fish passage mitigation. The U.S. also has flexibility with funding, such as Congressional funding or regional payment procedures for fish mitigation facilities per the Northwest Power Act.

Tribes and First Nations recognize the importance of maintaining fiscal responsibility and achieving equity when funding fisheries mitigation related to project development and project beneficiaries.

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The recent successes in development and installation of fish passage facilities in the Pacific Northwest have relied on collaborative processes involving numerous parties, technical experts, and independent facilitation. Each case study presented at the Future of Our Salmon Conference and the preceding Technical Workshop included a recommendation for inclusive and transparent planning.

The tribes and First Nations will continue to pursue fish passage restoration as a progression through the recommended phases with technical and policy working groups. This includes functioning through analysis of alternatives ranked against predetermined objectives and criteria. Much of this work needs to progress in a transboundary structure with human and capital resources fully coordinated and sequenced in a logical manner.

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APPENDIX ONE & APPENDIX TWO

HISTORICAL HABITAT OF ANADROMOUS FISH IN THE UPPER COLUMBIA RIVER

NORTHWEST MUSEUM OF ARTS & CULTURE/EASTERN WASHINGTON STATE HISTORICAL SOCIETY, SPOKANE, WASHINGTON, L85-143.380



CHIEF JIM JAMES OF THE SAN POIL TRIBE AND OTHERS VIEW FISHING SITES AT KETTLE FALLS

Prior to construction of dams on the Columbia River and its tributaries, the distribution and abundance of salmon and other fishes varied through time. Historical salmon habitats and productivity are known from oral accounts of native peoples, journals of early European immigrants, and later by more detailed recordings of naturalists and scientists. Below is a brief synopsis of the habitats of salmon and steelhead in the upper Columbia River above the present blockage at Chief Joseph Dam:

Sockeye Salmon

Prior to blockage by Grand Coulee Dam in 1939, sockeye salmon inhabited Upper Arrow (51,904 acres), Lower Arrow (37,504 acres) Whatshan (4,004 acres) and Slocan (16,738 acres) Lakes in Canada. Sockeye salmon also used many of the tributaries to these lakes. Sockeye may have also used Kinbasket, Windermere, and Columbia Lakes (NPPC, 1986 and W. Green, 2012).

Chinook Salmon

Historically, fall chinook salmon inhabited the Pend Oreille River below Metaline Falls, 50 miles of the Kootenay River and its tributaries below Bonnington Falls (including the Slocan River), all 52 miles of the Salmo River and its major tributaries, the Columbia River intermittently below the confluence of the Columbia and Kootenay rivers, and the Columbia River downstream of Lower Arrow Lake. Chinook salmon also inhabited the lower 74 miles of the Spokane River, the Little Spokane River, the lower 55 miles of Hangman (Latah) Creek, all 75 miles of the Sanpoil River, the lower 4 miles of the Colville River, and the Kettle River into Canada (NPPC, 1986 and W. Green, 2012).

HISTORICAL HABITAT OF ANADROMOUS FISH IN THE UPPER COLUMBIA RIVER

In Canada, spring and summer chinook spawned below the confluence of the Columbia and Kootenay rivers, in the Slocan River below Slocan Lake, downstream of Bonnington Falls on the Kootenay River, in the 52 miles of the Salmo River and tributaries, in the Columbia River between the Arrow Lakes, intermittently in the Columbia River from the top end of Upper Arrow Lake to near Radium, heavily in the Columbia River downstream of Lake Windermere, in the Columbia River between Windermere and Columbia Lakes, and in accessible parts of some tributaries of the uppermost Columbia River.

Coho Salmon

Historically, coho salmon spawned in the lower 74 miles of the Spokane River, Little Spokane River, the lower 55 miles of Hangman (Latah) Creek, all 75 miles of the Sanpoil River, and the lower 4–5 miles of Hall Creek (NPPC, 1986). There is currently no knowledge of coho salmon spawning in Canada.

Steelhead

Historically, steelhead inhabited the lower 74 miles of the Spokane River, Little Spokane River, the lower 55 miles of Hangman (Latah) Creek, all 75 miles of the Sanpoil River, the lower 4 miles of the Colville River, the Kettle River into Canada, the Pend Oreille River below Metaline Falls, the 52 miles of the Salmo River and tributaries, and the lower Kootenai River below Bonnington Falls (NPPC, 1986 and Scholz et al., 1985).

The quality and suitability of current habitat above Chief Joseph Dam is likely high through most of the historical spawning and rearing areas, as most of these areas currently support high densities of resident salmonid fish that have similar habitat requirements. Some specific areas have been altered, inundated, or degraded by industrial and urban land use and development, damming and dam operations, and channelization. The quality and quantity of the vast majority of historical anadromous fish habitat in the upper Columbia River above Lake Roosevelt is predicted to remain thermally and hydrologically suitable for anadromous fish with projected climate change.

The historical mean for the total salmon and steelhead runs in the Columbia River Basin has been estimated at 10 to 16 million salmon and steelhead annually (NPPC, 1986). It is important to remember that the actual range of the total return to the basin would have been substantially higher, especially in years of high sock-eye returns. The range of the historical mean for run returns above Grand Coulee Dam was estimated at 2.6 to 3.7 million (Table 1), which means that actual returns in any year could have been substantially higher than that range. These runs and

associated tribal harvest were completely lost, with 90 percent of this loss attributed to multipurpose hydroelectric dams (Scholz, et al. 1985). Another estimate of the salmon and steelhead runs above Chief Joseph Dam is nearly 3.2 million fish (NPCC 1986).

Sockeye and chinook salmon were the primary anadromous species that migrated into the upper Columbia River in Canada (NPCC, 1986).

One estimate of the pre-1850 distribution of all Columbia Basin salmon and steelhead above Chief Joseph Dam was 14.7 percent for spring chinook, 16.6 percent for summer chinook, 14.0 percent for fall chinook, 17.3 percent for coho, 10.5 percent for steelhead and 64.7 percent for sockeye (NPCC, 1986).

Table 1.
Pre-1850 Salmon and Steelhead in Columbia Basin Originating above Chief Joseph Dam
(from NPCC, 1986)

METRIC	SPRING CHINOOK	SUMMER CHINOOK	FALL CHINOOK	COHO	SOCKEYE	STEELHEAD
% BASIN	14.7	16.6	14.0	17.3	64.7	10.5
TOTAL # ADULTS ¹						
(THOUSANDS)	88 – 338	421 – 764	230 – 322	156 – 308	1,682 – 1,839	60 – 142

¹Based upon an average range of an all-species total of Columbia River runs of 9.6 to 16.3 million. Note that total run sizes probably exceeded this range, probably with total returns exceeding 30 million. (See Table 6 in NPCC, 1986 and alternative methodologies for calculating pre-development run sizes explored at the Future of Our Salmon Technical Workshop and Conference.)

HISTORICAL HARVEST OF ANADROMOUS FISH BY NATIVE PEOPLES



The following information on historical salmon abundance are the best available and are not meant to suggest an allocation formula. This information may be updated during an incrementally-phased approach of planning, research, and experimental pilot studies designed to inform subsequent reintroduction and fish passage strategies.

Upper Columbia River salmon runs were largely depleted in the 1880s and 1890s by commercial fisheries and the advent of salmon canning in the lower Columbia (Scholz et al. 1985). Scholz, et al. (1985) estimated harvest and consumption of U.S. tribes located in the upper Columbia, as follows:

Spokane Tribe

The Spokane Tribe fished salmon principally in the Spokane River and its tributaries including Latah Creek and the Little Spokane River, and along the Columbia River upstream to Kettle Falls. They relied heavily on salmon for most of their diet. Tribal members are estimated to have consumed about 132,000 salmon annually (1.4 million to 2.4 million pounds).

Coeur d'Alene Tribe

The Coeur d'Alene Tribe fished on the upper Spokane River and occasionally at Kettle Falls, in the Clearwater River and at the mouth of the Palouse River. Tribal members are estimated to have consumed about 124,000 salmon and steelhead annually (1.3 million to 2.3 million pounds).

Kalispel Tribe

The Kalispel Tribe fished on the lower Pend Oreille River and joined other tribes at Kettle Falls and on the Spokane River. Tribal members consumed about 43,000 to 54,000 salmon annually (790,000 to 980,000 pounds).

Kootenai Tribe of Idaho

The Kootenai Tribe of Idaho relied more heavily on resident fish species, but fished salmon on the lower Kootenai River and with other tribes at Arrow Lakes, at Kettle Falls, and at Windermere and at Columbia Lakes. Tribal members consumed about 44,000 salmon annually (about 360,000 pounds). All Kootenai tribes (U.S. and Canada) are estimated to have consumed about 130,000 to 208,000 salmon annually (2.4 million to 3.8 million pounds).

Colville Confederated Tribes – Kettle Falls Fishery

The fishery at Kettle Falls, located at river mile 703 on the Columbia River, was thought to be the second largest salmon fishery on the Columbia River. It was managed by the Colville Tribes and used by several tribes, including the Lakes, San Poil, and Nez Perce tribes. Catch at the falls and nearby vicinity has been estimated at 90,000 to 120,000 fish annually.

Summary

In all, an estimated 4,000 to 5,600 tribal fishers congregated at key fishing sites in the U.S. portion of the upper Columbia Basin to fish salmon. Total average annual consumption of salmon and steelhead by these tribes was estimated at about 644,000 chinook, coho, and sockeye salmon and steelhead (6.8 million to 13.1 million pounds). Estimates of the total average run of salmon and steelhead above Grand Coulee Dam ranges from 2.6 to 3.7 million.

Bill Green of the Canadian Columbia River Intertribal Fisheries Commission did an extensive review of the historical literature on salmon harvest by First Nations in Canada. The summary of his review is as follows:

Table 2.
Estimated Harvest by Canadian First Nations of Columbia River Salmon and Steelhead

	SPECIES	MINIMUM ESTIMATE ¹	MAXIMUM ESTIMATE ²
FIRST NATIONS	CHINOOK	38,500	232,000
	SOCKEYE	28,000	169,000
	STEELHEAD	58,000	345,000
TOTAL		124,500	746,000

¹Based on Hewes’ estimates of tribal salmon consumption
²Based on Upper Columbia United Tribes estimates of tribal salmon consumption

Lower Columbia River tribal harvest of salmon and steelhead originating from above Chief Joseph Dam can be approximated from the data from Table 1 and estimates of total lower river harvest (NPCC, 1986; Table 12). Note that the numbers in Table 1 only reflect the range of the mean and not the range of the actual total returns in any particular year. It is postulated that salmon and steelhead populations arising from the blocked areas of the upper Columbia River may have accounted for an average of about 1.5 – 2.7 million fish harvested by tribes in the lower Columbia River (Table 3), with higher harvest levels occurring in years with higher returns above the range of the average.

Table 3.
 Estimated Average Harvest of Upper Columbia River Salmon and Steelhead by Native Peoples of the Lower Columbia River (in thousands)

SPECIES	ABORIGINAL CATCH # FISH ABOVE	PERCENT OF RUN FROM CHIEF JOSEPH DAM	RANGE OF AVERAGE CATCH FROM ABOVE CHIEF JOSEPH DAM
SPRING CHINOOK	135 – 316	14.7%	20 – 47
SUMMER CHINOOK	587 – 632	16.6%	97 – 105
FALL CHINOOK	316 – 384	14.0%	44 – 54
COHO	422 – 516	17.3%	73 – 89
SOCKEYE	1,909 – 3,579	64.7%	1,235 – 2,316
STEELHEAD	343 – 458	10.5%	36 – 48
TOTAL	3,712 – 5,885		1,505 – 2,659



UPPER COLUMBIA UNITED TRIBES



CANADA COLUMBIA RIVER
INTER-TRIBAL
FISHERIES COMMISSION



COLUMBIA RIVER INTER-TRIBAL
FISH COMMISSION



OKANAGAN NATION ALLIANCE



UPPER SNAKE RIVER TRIBES



COWLITZ INDIAN TRIBE



CONFEDERATED SALISH &
KOOTENAI TRIBES

