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Cultural and educational releases of salmon in areas blocked by major hydroelectric projects on the Columbia River

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Salmon are revered by Pacific Northwest Tribes as a central figure in their cultural and spiritual identity and have been a critical food resource for millennia. Historic commercial overfishing and hydropower development on the Columbia River have devastated salmon runs and altered tribal communities. Before European settlement of North America, most Pacific Northwest Tribal economies were based on obtaining salmon for food and bartering for other commodities. Despite extensive efforts to promote salmon recovery in downstream areas, most salmon populations continue to struggle throughout the Columbia River Basin. Over 1,800 km of historical salmon habitat remain inaccessible upstream of Chief Joseph and Grand Coulee dams due to lack of fish passage at these facilities. The Indian Tribes of the upper Columbia Basin are working collectively on salmon reintroduction efforts through both a long-term scientific phased approach and near-term cultural and educational releases. This paper will briefly outline the Phased approach and provide detail on the initial results of some recent cultural and educational releases of salmon in the blocked area. The cultural and educational releases had a goal of reconnecting the people with the salmon and the salmon with historic habitats. These salmon release events were diverse and included school children releasing juvenile fish they raised in the classroom, releasing adult salmon to swim free and reproduce, and tribal members harvesting salmon from their ancestral waters. Ceremonies were held to celebrate the significance of salmon to the tribal cultures and the salmon's return home. In addition to the ceremonies, some fish were tagged to evaluate survival and behavior and to begin to document the effectiveness of trap and haul efforts. The effort resulted in anadromous salmon reintroduction to their traditional waters for the first time in 60 to 110 years. These efforts have generated tremendous interest from the press and given the people of the region a glimpse at what is possible, building momentum for the larger Phased reintroduction effort.

Keywords: reintroduction, restoration, Native American culture

Introduction

Salmon were an essential food for Native People of the Columbia Basin where they were fished at places like Celilo Falls and Kettle Falls for at least the past 4970 – 9280 years (Chance 1986; Butler 1993; Butler and O'Conner, 2004) and are recognized as a keystone species essential

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for maintaining a healthy ecosystem. Salmon provided marine derived nutrients (MDN) that fuel production of freshwater organisms (Stockner, 2003). Chinook Salmon (*Oncorhynchus tshawytscha*) formerly ascended the Columbia River to its headwaters 1,988 km upstream of the ocean (Bryant and Parkhurst 1950; Fulton 1968; Scholz et al. 1985). The development of the Columbia River hydropower system has reduced the distance they can ascend upriver. For example, Chief Joseph Dam (CJD) at Columbia River RKM 872 blocked Chinook Salmon from 1,116 km (56.1%) of the mainstem plus extensive quantities of habitat in the tributaries that enter the Columbia River above that point. This reduced Indigenous People's access to healthy foods and caused a decline in the productivity of the watershed above the blockage due to a lack of MDNs. Tribal cultural practices were and still are closely tied to the run of salmon each year. There is a spiritual connection between salmon and Native Americans in the Pacific Northwest that is celebrated in many ceremonies including the First Salmon Ceremony, weddings, funerals, and long house gatherings.

Prior to European settlement of the Pacific Northwest, the abundance of salmon in the Columbia River was estimated at between 7.5 and 16 million returning adults (Chapman, 1986; NPPC, 1987). Before the turn of the 19th century, the salmon runs had been greatly reduced by commercial fisheries in the lower river, as well as dams on tributaries and alteration of tributary habitat (McDonald 1894; Lackey et al., 2006). All of the Spokane and Coeur d'Alene and a large portion of the Colville Reservation was cut off from salmon returning from the ocean due to the construction of Grand Coulee Dam (GCD) at rkm 960 in 1938, followed by the construction of CJD at rkm 877 in 1955 (Figure 1). Prior to that, hydroelectric development of the Spokane River eliminated salmon from portions of the Spokane Reservation and all of the Coeur d' Alene reservation. By the time GCD was built, salmon runs to Rock Island Dam (rkm 729) were down to a few thousand Chinook (*Oncorhynchus tshawytscha*) and Sockeye (*O. nerka*) and a few dozen Coho (*O. kisutch*) (Brennan 1938). During planning for the construction of GCD, the federal government decided not to provide fish passage, and instead built salmon hatcheries in three downstream tributaries (Board of Consultants, 1939). This mitigation was intended to supplement downstream sport and commercial fisheries, but did not mitigate the loss of salmon to the people or the ecosystem upstream of GCD.

The restoration of salmon upstream of CJD, GCD, and Spokane River dams is not only about restoring a cultural connection between tribes and salmon, it could help with the overall salmon recovery effort in the Columbia Basin. Restoration actions to help improve survival and productivity of salmon stocks have been implemented, and will continue to occur across multiple sectors including harvest, hydropower, habitat, hatcheries, and predation (NPCC, 2014, 2020). Despite the multimillion-dollar annual effort, salmon stocks continue to struggle (NPCC, 2014; GRSO, 2020). To make matters worse, climate experts predict a warmer and dryer future for the Pacific Northwest, which will have negative effects on many salmon populations (ISAB, 2007; USBR, 2016; Crozier et al 2021). Salmon restoration upstream of CJD and GCD would add more habitat to increase production and diversify habitat types, and could provide access to cool water tributaries that would help alleviate the effects of climate change.

In recent years, the Columbia Basin Tribes and First Nations have pursued fish passage and reintroduction to the blocked areas upstream of CJD and GCD in a number of forums. In preparation for renegotiation of the primary objectives of the Columbia River Treaty, a coalition of 15 tribes and First Nations, organized through the Upper Columbia United Tribes, developed a fish passage and reintroduction plan that described an approach for how to reintroduce salmon upstream of GCD in four phases (CBTFN, 2015):

Phase I: Pre-assessment planning for reintroduction and fish passage.

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.

A modified version of this phased approach to fish passage and reintroduction was adopted by the Northwest Power and Conservation Council

(NPCC) in the 2014 Columbia River Basin Fish and Wildlife Program (NPCC, 2014). Pursuing fish passage and reintroduction to blocked areas, including upstream of CJD and GCD, was also included as a recommendation by the Southern Resident Killer Whale Task Force in 2018, as a means to increase prey availability for the struggling population of Orcas that heavily rely on Chinook Salmon as a food resource in the Pacific Ocean (SRKWTF, 2018).

The Confederated Tribes of the Colville Reservation (CTCR), the Spokane Tribe of Indians (STOI), the Coeur d' Alene Tribe (CDAT), the Kalispel Tribe of Indians (KTI), and the Kootenai Tribe of Idaho (KTOI) and their affiliate the Upper Columbia United Tribes (UCUT)

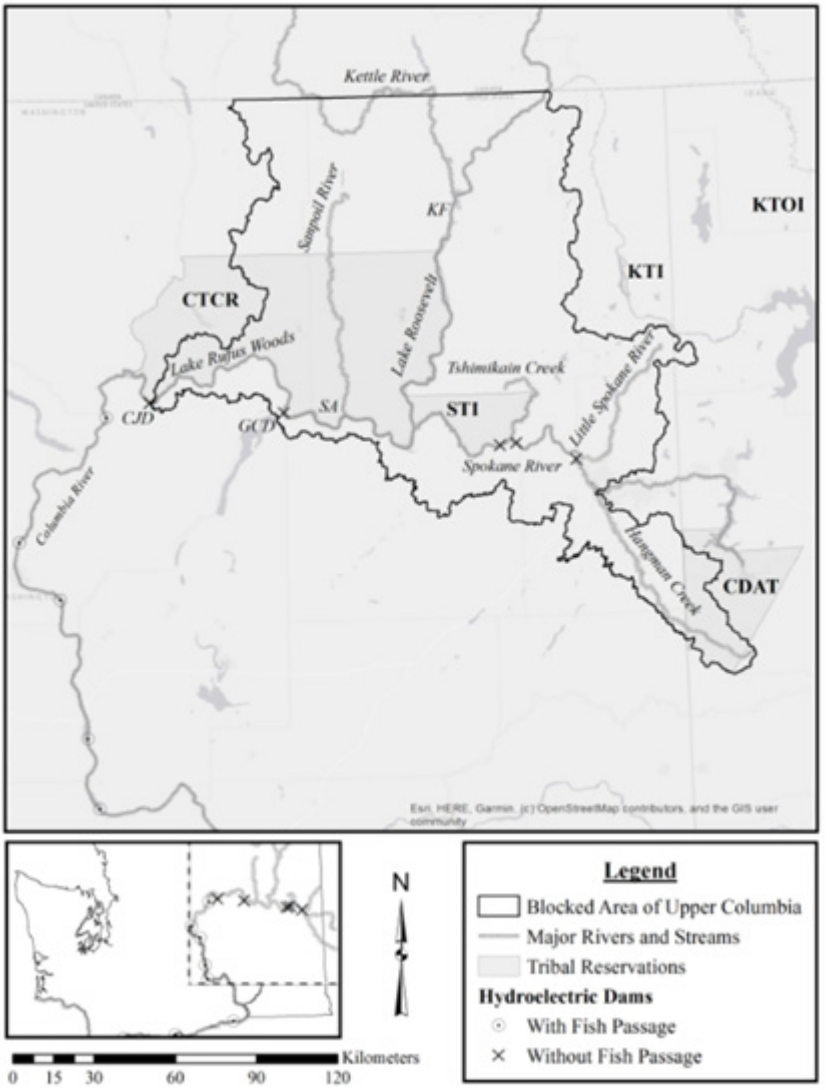

Figure 1. Map of major dams, rivers and habitats historically occupied by Salmon and steelhead in the blocked area of the upper Columbia River of the United States. Inset map of the Columbia River includes the migratory corridor downstream of Chief Joseph Dam (CJD) and Grand Coulee Dam (GCD). Upper Columbia United Tribes (UCUT) member tribe reservations are labeled by the preferred abbreviation of the respective tribe; Coeur d' Alene Tribe of Indians (CDAT), Confederated Tribes of the Colville Reservation (CTCR), Kalispel Tribe of Indians (KTI), Kootenai Tribe of Idaho (KTOI), and Spokane Tribe of Indians (STI). Other labels include Kettle Falls (KF) and the Sanpoil Arm (SA) of Lake Roosevelt.

completed the Phase 1 Report in 2019. The Phase 1 Report included six sections which synthesized assessments of potential donor stocks, risks to upstream resident fish and downstream anadromous populations, habitat availability and suitability, life-cycle modeling to evaluate possible outcomes of reintroduction strategies, high head dam passage facilities and potential applicability to CJD and GCD, and future studies and recommendations (UCUT, 2019). The report recommended that the effort move to Phase 2 and the Tribes are now working on a strategic implementation plan for Phase 2 that will include experimental releases to test the feasibility of reintroduction.

The work and process to achieve the long-term goal of volitional passage and successful reintroduction will likely span decades, as it requires scientific feasibility testing, coordination amongst many stakeholders and funding that is beyond what is in current state and federal mitigation agreements. During the first several years of fish passage and reintroduction planning, it became evident that a parallel path to the Phased approach was needed to allow the tribes to meet some short-term goals. The parallel path has been implemented by tribes in the blocked area to implement cultural and educational releases. These salmon releases are consistent with the scientific foundation of the Phased approach, but are on a smaller scale and intended to meet tribal objectives including:

- Reconnect the people with the fish and the fish with the habitat
- Exercise ceremonies and traditions to keep the salmon culture alive and well
- In some cases, provide a harvest opportunity in areas that have not had anadromous fish for 60-110 years
- Educate and involve the tribal membership, youth, the general public and other partners and stakeholders in the process of salmon reintroduction to the blocked area
- Scope reintroduction strategies and generate baseline information

This article will focus on initial efforts by several tribes to implement cultural and education releases upstream of CJD and GCD. These efforts are particularly important for social and cultural benefits, but some monitoring did occur that will contribute to the development of the long-term, science-based Phased approach.

Study area

GCD, completed in 1941, generates the largest amount of hydropower in the United States. It is located 959 km upstream from the mouth of the Columbia River and was the terminus for anadromous fish on the Columbia River before the construction of CJD. GCD stands 167 meters tall, is 1.6 km wide and creates a 243-km long reservoir known as Franklin D. Roosevelt Lake (Lake Roosevelt).

CJD, completed in 1955, generates the second largest amount of hydropower in the United States. It is located 877 km upstream from the mouth of the Columbia River and is currently the terminus for anadromous fish on the Columbia River. CJD stands 72 meters tall, is nearly two kilometers wide, and is a run-of-the-river dam that creates an 82-km long reservoir known as Rufus Woods Lake which terminates at GCD.

The dams block 325 km of mainstem Columbia River in the U.S. and 800 km in Canada, which together is approximately 57% of the historic mainstem habitat of the Columbia River. Major tributaries to Lake Roosevelt that historically supported anadromous fish include the Sanpoil River, the Spokane River and its tributaries, and the Kettle River, which extends into Canada. All of these watersheds fall within usual and accustomed areas of regional tribes while many are part of the reservations of the Coeur d'Alene, Colville, and Spokane tribes. Numerous other smaller tributaries also supported anadromous fish. Habitat assessments identified approximately 571 km of spring Chinook habitat and 1,868 km of steelhead trout (*O. mykiss*) in U.S. tributaries (UCUT 2019). An additional 85 km of mainstem Columbia River has been identified as potential spawning habitat for summer/fall Chinook (UCUT 2019).

Historical records document the location and use of various fishing sites throughout the upper Columbia. For instance, there were upwards of 1,000-2,000 fishers at Kettle Falls, 1,000-1,400 at Little Falls on the Spokane River, 1,000 at a site on the Little Spokane River, more than 1,000 at Spokane Falls, and 250 on the Sanpoil River. The Coeur d'Alene Tribe inhabited large seasonal

fishing camps at the mouth of Hangman Creek on the Spokane River and 70 km upstream near the Idaho-Washington border at present day Tekoa, Washington. Historical accounts describe the use of weirs constructed of willow, alder and dogwood during the summer and early fall at these locations in order to intercept pre-spawning Chinook Salmon (Scholz et al. 1985). There is archaeological evidence that fishing took place as long as 9,000 years ago at Kettle Falls on the Columbia in northeastern Washington. The Colville Tribes hosted a communal fishery at Kettle Falls with other tribes participating, including the Spokane, Sanpoil, Coeur d'Alene, Kalispel, and Kootenai and many others. During the peak of the run the average catch per day was 1,000 salmon for the communal fisheries. The most common technique was to use a basket net, a wicker basket with a backstop on it that was supported by long poles inserted into it and fixed in the rocks (Scholz et al., 1985). Kettle Falls was considered one of the major trading centers of the upper Columbia (NPPC, 1987). Historic tribal harvest has been estimated at approximately 644,000 fish per year by the Upper Columbia Tribes (Scholz et al.,1985).

Methodology

Juvenile salmon releases

In 2016, on the Spokane and Coeur d'Alene reservations, elementary-aged children began growing a small number of juvenile Chinook Salmon from egg in classroom aquariums with the goal of educating the community on basic fisheries science and reinvigorating an integral part of their culture that had been missing for decades, or in some cases, over a century. Fertilized eggs were donated from mid-Columbia River hatchery programs designated as mitigation facilities for lost runs of salmon and steelhead above CJD and GCD. The children watched as the eggs hatched and alevin salmon began to emerge from the gravel and swim freely throughout the aquarium. Throughout the school year, the children, with help from teachers and fisheries staff, cared for the juvenile salmon until they were released the following spring.

Over the multiple generations without runs of salmon, many of the children were unaware that salmon had ever existed in local streams. Cultural programs within the tribes quickly incorporated lessons in the classrooms and told stories passed down generations to describe salmon and their role throughout tribal history. Fisheries scientists taught lessons to describe salmon physiology, life history, and the salmon's role in ecosystem health. The students attended field trips throughout the watersheds that once supported salmon, to discuss the importance of habitat and good stewardship of the land in order to prepare the landscape for the inevitable return of salmon. The salmon in the Classroom (SIC) program quickly evolved into community events to release these juvenile salmon back into the historical anadromous waterways throughout the reservations. The children tasked with caring for these fish along with their peers were shuttled out to the streams to participate in the release. On the Coeur d'Alene Reservation, a small percentage of these fish were marked with tags to monitor their emigration from Hangman Creek. The overwhelming success and positive community feedback from the event spurred the tribes to expand the SIC Program to include small recirculating hatchery facilities that could support a few thousand juvenile salmon and provide an aquaculture education program where students could participate in raising and rearing salmon. This in turn allowed the tribes to expand their tagging and tracking program so scientists, students, and the community could monitor movement of these fish out of the blocked area and into the current anadromous zone.

Formal reintroduction feasibility studies have made significant progress since 2014. However, much of that work has applied survival assumptions that originated from studies of extant populations downstream. Coupled with the educational programs associated with the tribes' schools, tribal biologists are also using these juvenile releases as a learning opportunity. To help inform modeling assumptions biologists have implanted yearling Chinook with Passive Integrated Transponder (PIT) tags. These allow for the detection of fish as they pass by antennas deployed on mainstem Columbia River dams downstream of CJD, and as they return to the Columbia as adults.

Several releases of yearling Chinook have occurred within the blocked area of the upper Columbia River. In 2017, the Spokane Tribe released 752 yearling summer Chinook to

Tshimikain Creek, a tributary to the Spokane River along the eastern boundary of the tribe's reservation (Table 1). In 2020, the Coeur d'Alene Tribe released 1,453 yearling Chinook into Hangman Creek and the Spokane Tribe released 765 into the Spokane River, all with PIT tags (Table 1). Subsequent detections of these fish in downstream locations were documented and analyzed using the online regional PIT tag database, PTAGIS (ptagis.org).

Adult salmon translocation

Chinook Salmon from a downstream hatchery were used to supply the adult translocation activities. These hatchery fish were considered surplus because they had already escaped the fisheries and were not needed for spawning in a hatchery or downstream tributary. Pathogen testing was conducted prior to transport to ensure that Infectious Hematopoietic Necrosis Virus (IHNV) was not introduced to the blocked area, a protective measure to minimize fish health risks to native resident species. After passing the pathogen test, the adult salmon were loaded into a 5.7 m^3 hatchery truck and transported to the release site using well-oxygenated water.

Ceremonial releases of adult salmon

Ceremonial releases of adult Chinook Salmon occurred on five occasions between the three tribes. Each ceremony included speeches by tribal dignitaries, prayers to thank the Creator and to bless the salmon, and songs to celebrate the return of salmon. Festivities also included a drumming and clicking rocks together to 'call the salmon back', an ancient tradition for Northwest Tribes. At the Kettle Falls ceremony, there was a canoe landing, which is another important cultural tradition. The Spokane and Coeur d'Alene tribes' ceremonial release were an opportunity for citizens to practice harvest traditions not exercised on their reservations for over a century.

Educational releases of adult salmon

The Colville and Spokane tribes released adult salmon for educational and study purposes on seven occasions in 2019 and 2020. The collection, pathogen sampling, and transport was identical to the previously described methods for the ceremonial releases. However, lake and reservoir releases occurred at sites with a boat ramp, and the offload occurred from the truck through the outlet tube directly into the receiving waters, which minimized handling and sped up the release process. For stream and river releases in locations without a boat ramp, an inner-tube boot and manual transport to the water was used, just as it was during the ceremonial releases. Most of the educational releases of adult salmon included inserting a 12-mm PIT tag into the abdominal cavity. In August 2019, 59 fish with an acoustic tag (Vemco, V16) were released at two sites, one week apart, into Rufus Woods Lake to evaluate their post-release survival and behavior. Similarly, in July 2020, 50 adult salmon with acoustic tags were released at two locations in Lake Roosevelt.

In 2020, the releases of adult Chinook into the Sanpoil River and Tshimikain Creek were also monitored for spawning activity. During the spawning period (October), biologists walked the streams on several occasions near the release sites and observed spawning, counted redds (salmon egg nests), and found salmon carcasses.

Results and Discussion

Juvenile salmon releases

Juvenile salmon released on the Spokane and Coeur d'Alene reservations in 2017 and 2020 were detected in juvenile bypass systems in dams downstream of CJD, indicating they successfully negotiated the dams and reservoirs in the blocked area (Table 1). These salmon smolts migrated through approximately 250 km of rivers and reservoirs and three to five additional hydroelectric dams that did not have juvenile bypass facilities before reaching the anadromous zone of the Columbia. Once downstream of CJD, they encountered nine additional mainstem dams which were equipped with fish passage. The number of juvenile Chinook detected downstream of CJD (241) was not adequate to estimate survival due to low detection probabilities, but it was a testament to their resilience and it showed that the effort has potential to yield positive results.

The resilience of these fish was further affirmed

in 2019. On June 30, 2019, one of the Chinook released in 2017 was detected in a Bonneville Dam fish ladder, in the lower Columbia River. Over the course of the following two weeks she, Nucucšnetkʷ ("She Who Retraces Her Steps"), surmounted every mainstem dam on the Columbia. Ultimately, she found her way home. Two weeks after the last detection at Wells Dam the Chinook from Spokane found her way to the Chief Joseph Hatchery ladder, climbing a few steps closer to home while the Colville Tribes collected brood stock. Policy constraints prevented managers from transferring the fish alive and releasing her to her home waters. But her body was received by the Spokane Tribe so that her flesh could be preserved in a taxidermy mount to help tell her story. Her remains were returned to the stream to follow an ancient cultural tradition of returning all parts of the salmon to stream, minus what was used or consumed by people. In 2020 three of her adult siblings retraced her steps to the Columbia. One was detected as far upstream as Wells Dam. The others were detected in the lower Columbia. Two of the fish merely disappeared, presumably harvested as many of their ancestors before them. However, one was returned to the Spokane Tribe by a tribal fish processor from the lower Columbia River, who identified the fish from its tag and contacted Spokane Tribal Fisheries. They generously returned the fish to the Spokane Tribe so she could be preserved alongside her sister; a gesture of sharing true to the heritage and traditions of Columbia Basin tribes.

Adult return information from the juvenile releases in 2020 will not be available until 2022 and 2023 due to the four-to-five year lifecycle of Chinook Salmon.

Adult salmon translocation

Ceremonial releases of adult salmon

In August 2019, the Colville Tribes hosted three ceremonies to celebrate the release of 90 adult summer Chinook Salmon. The ceremonies were conducted one day per week for three successive weeks and occurred in three distinct and geographically separate areas, progressing upstream as the fish would have done. The distribution of the releases allowed salmon to access much of their historic habitats while also providing an opportunity for tribal members from across the reservation to participate in a ceremony

Figure 2. Children and tribal leaders released adult summer/fall Chinook into the Columbia River near Kettle Falls, Washington during a ceremony in 2019.

Table 1. Summary of tribal cultural releases of Salmon upstream of Chief Joseph and Grand Coulee dams by the Coeur d'Alene Tribe (CDA), the Spokane Tribe of Indians (STOI), and the Colville Confederated Tribes (CCT).

Agency	Lifestage	Release Date	Number Released	Release Location	Tags	Release Purpose	First Year Juvenile Detections[1]	Adult Returns
STOI	Juvenile	2017-04-16	752	Tshimikain Ck.	PIT	Educational	83	4
CDA	Juvenile	2018-05-01	300	Hangman Ck.	None	Educational	NA	NA
CDA	Juvenile	2020-03-01	1453	Hangman Ck.	PIT	Educational	68	TBD
STOI	Juvenile	2020-03-27	765	Spokane River	PIT	Educational	90	TBD
CCT	Adult	2019-08-09	30	Lake Rufus Woods	PIT	Ceremonial	NA	NA
CCT	Adult	2019-08-16	30	Keller/Sanpoil Arm	PIT	Ceremonial	NA	NA
CCT	Adult	2019-08-16	32	Lake Rufus Woods	PIT/Acoustic	Educational	NA	NA
STOI	Adult	2019-08-16	50	Tshimikain Ck.	None	Ceremonial and Harvest	NA	NA
CCT	Adult	2019-08-23	30	Kettle Falls	PIT	Ceremonial	NA	NA
CCT	Adult	2019-08-23	30	Lake Rufus Woods	PIT/Acoustic	Educational	NA	NA
CCT	Adult	2019-09-20	60	Lake Rufus Woods	PIT	Educational	NA	NA
CCT	Adult	2019-09-24	60	Lake Rufus Woods	PIT	Educational	NA	NA
CDA	Adult	2020-06-26	75	Hangman Ck.	None	Ceremonial and Harvest	NA	NA
STOI	Adult	2020-07-24	50	Tshimikain Ck.	None	Educational	NA	NA
CCT	Adult	2020-07-24	50	Lake Roosevelt	PIT/Acoustic	Educational	NA	NA
STOI	Adult	2020-08-07	50	Spokane River	None	Educational	NA	NA
CCT	Adult	2020-08-14	100	Sanpoil River	PIT	Educational	NA	NA

1 First year detections occurred at dams downstream of CJD and are not expanded for detection efficiency at those facilities.

in their local community. Once the hatchery truck arrived with the salmon, a human chain was formed to link the truck to the river. Fish were offloaded from the truck into a rubber inner tube "boot" and passed down the chain towards the river, providing a hands-on participation opportunity for all who wanted it. A crowd gathered at the water and people took turns returning fish to the river (Figure 2). The experience brought tears to the eyes of many and warmed the hearts of all who were present. Salmon had finally returned to the waters where they had been absent for 80 years. The fish were released to swim freely in the Columbia River. After the release, food was served including traditional foods such as huckleberries and camas root. Although harvest was not prohibited, it was not the purpose of these releases. The purpose was to celebrate the return of smłičn, the salmon, and to give them an opportunity to swim and spawn in the waters of their ancestors.

In August of 2019, the Spokane Tribe released 50 adult Summer Chinook Salmon into Tshimikain Creek, a tributary of the Spokane River on the Spokane Tribal reservation. Following blessing and song, youth harvested these Chinook as their ancestors had before them; using traditional fishing gear including nets, spears, and even their bare hands. Elders provided history and context to the younger generation while biologists helped fillet fish and give impromptu anatomy lessons. The spiritual, historical, and subsistence aspects of this release spurred hope within the community; providing an opportunity to reflect upon what once was and what is yet to come.

In June 2020, the Coeur d'Alene Tribe released 75 Spring Chinook into Hangman Creek for a ceremony and the first salmon harvest opportunity on their reservation in 110 years. With the sounds of singing and drumming in the background to honor the return of salmon, several generations of the tribal community gathered along the streambank to harvest the salmon using traditional fishing tools such as gaffs and spears. The event, however, was not centered on harvest or a put-and-take fishery, but to celebrate the return of salmon and to partially reconcile over a century of lost resources and the ensuing battle to restore what is deemed sacred to the Tribe.

Educational releases of adult salmon

In the weeks following the Colville Tribes' ceremonies, an additional 152 fish were released into Rufus Woods Lake (Table 1). Fifty-nine of these fish were tagged with an acoustic transmitter to track their movement and evaluate post-release behavior and survival. The results of this study will be published elsewhere at a later date, but some general observations were that most of the fish (76%) stayed in the reservoir and had a final detection after the onset of the spawn period (October 1). On average, the fish made five trips to or past the upstream-most receiver (near GCD) and two trips down to CJD (83 km), indicating that they were actively moving throughout the reservoir in the months following their release. As of October 14 (midway through the spawning period) only two fish had been detected downstream of CJD for an initial fallback rate of only 3%. Extensive spawning ground surveys were not conducted due to funding limitations; however, seven redds were identified, confirming that some fish did spawn in their new environment. These results indicated that the translocation of adult salmon into Lake Rufus Woods show good potential to meet objectives for both harvest and spawning.

In 2020, the adult salmon releases on both the Colville and Spokane reservations could not include large gatherings due to COVID-19 restrictions. Between the two tribes, a total of 250 fish were released upstream of GCD in six locations (Table 1). Fifty fish had acoustic tags to learn about post-release survival and behavior. These data have not yet been analyzed but will be summarized in future reports and publications to help guide the reintroduction studies that need to occur as part of the phased approach. In July 2020, the Spokane Tribe released 50 adult Chinook into Tshimikain Creek and 50 into the Spokane River, allowing them to carry out their life-cycle in waters that had sustained populations of fish and people since time immemorial (Table 1). In October 2020, biologists counted 15 redds and found 20 salmon carcasses in Tshimikain Creek. The Colville Tribes also released 100 PIT-tagged fish into the Sanpoil River. The Sanpoil River is approximately 30 km upstream of GCD and was an important salmon fishing location for the Colville Tribes before the dams blocked passage. Returning salmon to the Sanpoil River was a culturally significant event, even without a large ceremony to celebrate their

return. Zero PIT tags were detected leaving the river before the spawning period and 36 redds were counted within an eight km reach near the release locations. These educational releases proved that Chinook Salmon translocated into blocked area streams could survive and spawn and the salmon carcasses provided MDN to a river and landscape that have been starved of this important source of nutrients for over 80 years.

Conclusions

The efforts implemented thus far by the Coeur d'Alene, Colville, and Spokane tribes to restore salmon to the habitats blocked by CJD and GCD have been successful, particularly with respect to addressing social and cultural objectives. Cultural and educational salmon releases have achieved some of the tribes' short-term objectives while they are working on the longer-term phased approach that will require many years to complete. The numbers of fish released to date have been relatively modest, but they have provided an opportunity to celebrate Native American culture, hold ceremonies, educate children about salmon and their role in the ecosystem, and provide a harvest opportunity for salmon in places that have not had them for 60-110 years. Despite the moderate release numbers, the Tribes have been able to generate some juvenile and adult salmon post-release data regarding survival, travel time, and behavior that will help shape future experimental releases that can be implemented with more statistical rigor. The Upper Columbia Region was once home to millions of anadromous fish each year, and the tribes in the blocked area are working diligently to see salmon throughout their traditional areas once again.

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