Photo of ONA-owned kɬ cp̓əlk̓ stim̓ Hatchery, located on Penticton Indian Reserve. Courtesy Okanagan Nation Alliance

syilx Okanagan Nation Salmon Restoration:

A Case History of Bringing Back a Species on the Verge of Extinction

by Okanagan Nation Alliance

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capt̓ikʷɬ are the oral historic and traditional teachings—a record of the natural laws—of the syilx Okanagan People. They outline the relationship, cultural protocols, and responsibilities to *tmixʷ*, the living beings of the water and land. *capt̓ikʷɬ* recount how *snkʔlʔip* (Coyote) brought salmon up *nx̌ʷəntkʷitkʷ* (Columbia River) and eventually into the Okanagan Basin, to prepare for the arrival of the syilx People and ensure they could survive off the fish and aquatic resources. Salmon are of such cultural and spiritual importance to syilx People that *ntytyix* (chinook salmon) is one of the Four Food Chiefs and is responsible for all fishes and aquatic life. In return for the gift of salmon, syilx thank and honour their kinship and responsibilities to salmon through historic and current ceremony.[1]

Historically, the Okanagan Basin supported six runs of Pacific Salmon: chinook, sockeye, coho, steelhead, chum, and pink. These species were well understood by syilx Okanagan Traditional Ecological Knowledge through contemporary interviews with Elders and Cultural Knowledge Keepers. In addition, harvesting occurred throughout syilx Okanagan traditional territory, including *nx̌ʷəntkʷitkʷ,* tributaries in Washington State, and *nx̌ʷəntkʷitkʷ* headwaters in the Kootenay Region.[2]

calyx (Richard Armstrong), an Elder and syilx Traditional Ecological Knowledge Keeper, recalls: "When I was young and the river wandered like a snake, we would fish for salmon and our family would camp

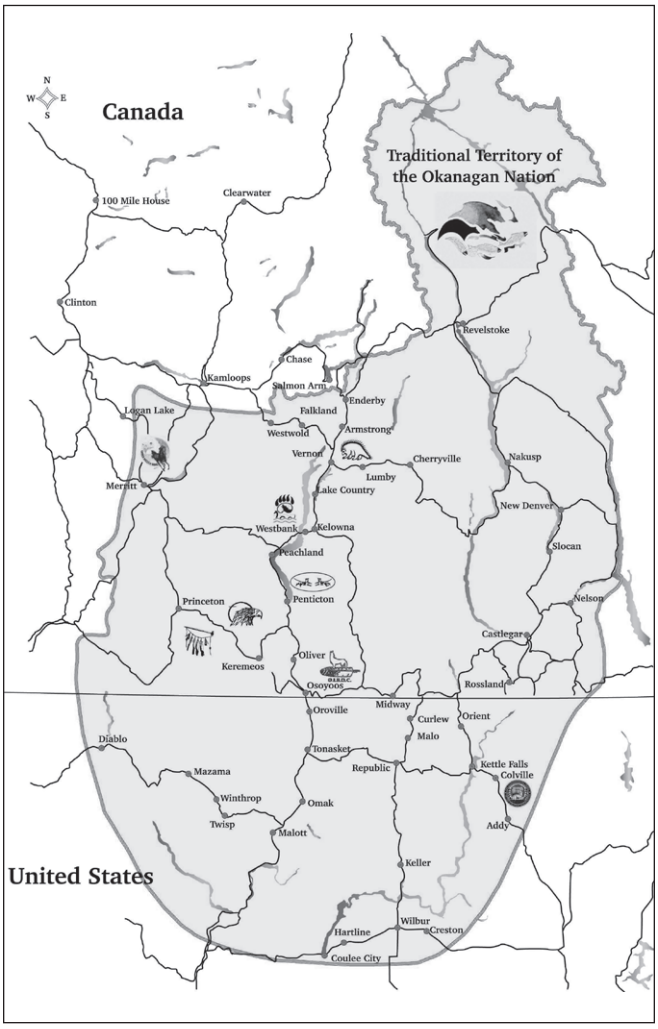
Okanagan Place Names in syilx Territory

Place Names in nsyilxcən	English Translation
nx̌ʷəntkʷitkʷ	Columbia River
sq̓awsitkʷ	Okanagan River
kɬusxənitkʷ	Okanagan Lake
sx̌ʷəx̌ʷnikʷ	Okanagan Falls
t̓uʔcin	Skaha Lake
nk'mip	Osoyoos Lake

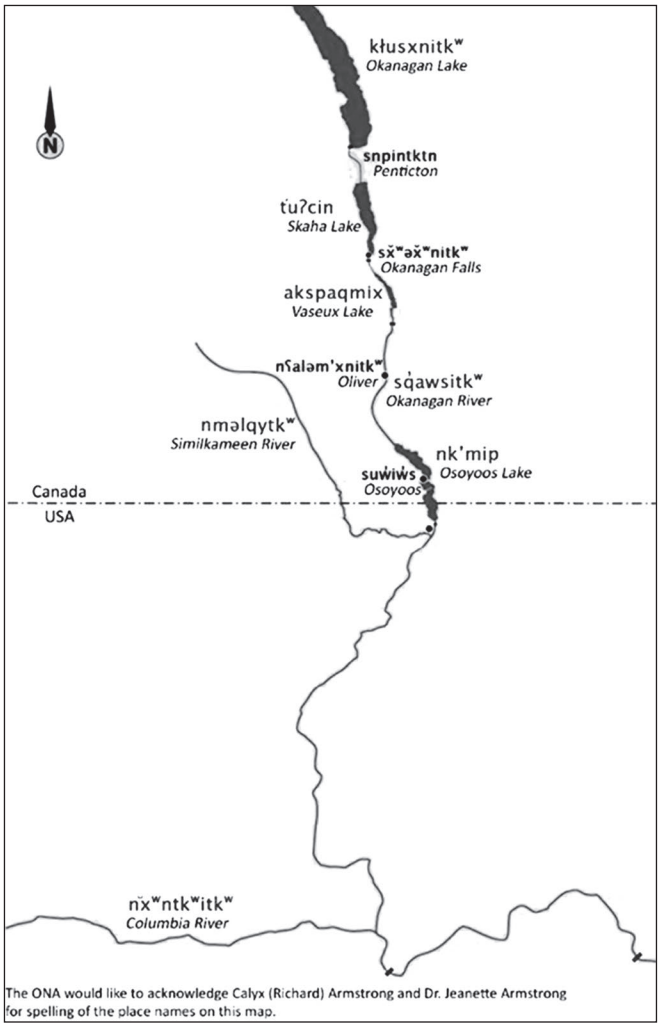
together along the riverbank. Many families would also be camped along the banks, and we could see the many fire glows at night as families would be telling their fishing stories. The river didn't flow straight back then. This was special family time and gave us a great sense of community."[3]

With the arrival of non-Indigenous settlers into the Territory, the lives of syilx community and their relationship to the land and *tmix*^{w} drastically changed and were undermined. Numerous colonial laws enacted in the nineteenth and twentieth centuries dispossessed syilx People from traditional lands, took over management of natural resources (i.e., fisheries, wildlife, forestry, land, and water), and laid the foundation for resource exploitation.[4] With the colonization of Indigenous People, Canada and British Columbia where able to construct massive hydroelectric dams on *nx̌*^{w}*əntk*^{w}*itk*^{w}—a total of 11 between 1933 and 1971—without consultation with or compensation to syilx People. The Columbia River Treaty, a 1961 international treaty between Canada and the United States, formalized dam operation in the upper *nx̌*^{w}*əntk*^{w}*itk*^{w} for power generation and flood control. At that time, the Treaty did not acknowledge either Indigenous title and rights or any negative environmental impacts. Grand Coulee Dam, completed in 1941, was a complete barrier to fish migration to the Canadian portion of *nx̌*^{w}*əntk*^{w}*itk*^{w}. It should be noted that the nine dams downstream of the Okanagan/ *nx̌*^{w}*əntk*^{w}*itk*^{w} confluence were constructed with fish ladders, which did allow for salmon migration into the Okanagan Basin.[5]

During the nineteenth century, numerous floods in the Valley resulted in governments attempting to control water flow and lake levels, resulting in the Okanagan Flood Control Project and Act in 1894.[6] Damming of *sc̓awsitk*^{w} (Okanagan River) for navigation, irrigation, and flood control was initiated in the early 1900s.[7] Specifically, construction of the first Penticton Dam at the outlet of *kłusxənitk*^{w} (Okanagan Lake) from 1914 to 1915, and construction of McIntyre Dam between *t̓uʔcin* (Skaha Lake) and *nk'mip* (Osoyoos Lake) in 1915, resulted in complete barriers for salmon



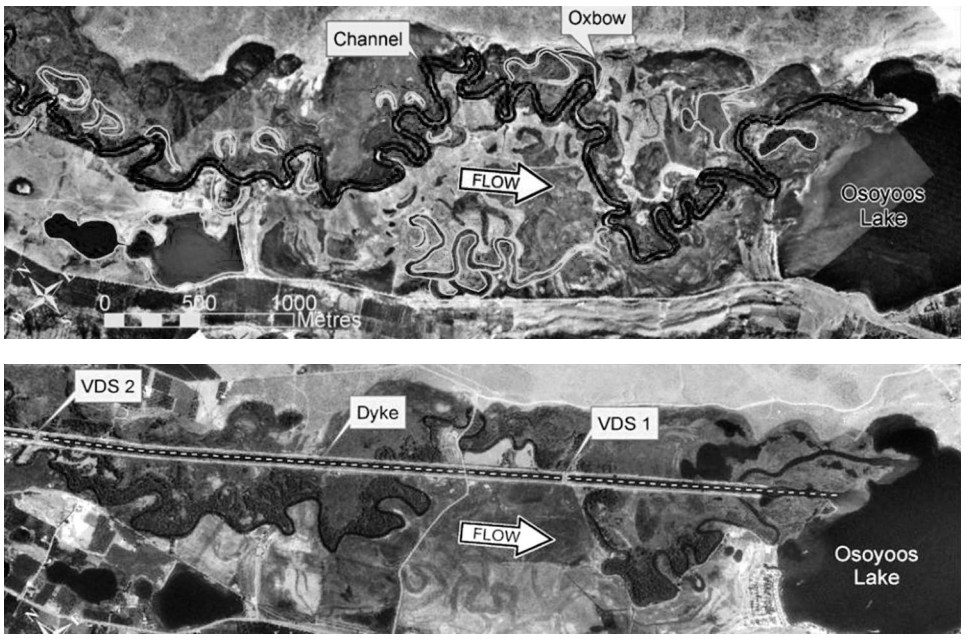
Map of Traditional syilx Okanagan Territory.
Courtesy Okanagan Nation Alliance



Map of sc̓awsitkʷ (Okanagan River).
Courtesy Okanagan Nation Alliance

migration. These barriers cut off salmon spawning to three of the four main lakes in the Okanagan Valley.[8]

In addition to migration barriers in both rivers, *sḳawsitkʷ* was channelized (dredged, widened, deepened) and straightened for flood control and irrigation supply beginning in the early 1950s. Profound river alterations occurred between the town of Oliver and *nk'mip,* and between *kłusxənitkʷ* and *ʔuʔcin* in the city of Penticton. River channelization altered the natural meandering flow, changed the historic natural vegetation beside the stream and created homogeneous stream habitat that ultimately damaged the functional stream ecosystem required to support salmon.[9]



Aerial photo of historic *(top)* and channelized *(bottom) sḳawsitkʷ* (Okanagan River) upstream of *nk'mip* (Osoyoos Lake). Courtesy of Penticton Museum and Archives

Invasive species introduced in the Valley, either accidentally or intentionally, also had a severe impact on native fish communities. Mysis shrimp were introduced in *kłusxənitkʷ* in the early 1970s[10] that ultimately caused the population of kokanee* to crash in the 1990s. Now invasive populations have established in all major lakes in the Okanagan Basin. Other invasive species that have impacted fish and fish habitat include Eurasian milfoil, common carp, smallmouth bass, and yellow perch.

Colonial industrialization of water management practices contributed to the decline in salmon populations. Since the 1950s, provincial water managers have operated *sḳawsitkʷ* flows primarily to control flood and drought and to allocate water to various users in the Valley; the highest water user is typically the booming agricultural industry. Water management regimes did not incorporate the critical components of salmon life history. This lack of understanding contributed to high salmon mortality. For example, if river flows were increased too early to control spring flooding, salmon alevins (fry that have hatched but not yet emerged from the gravel) could be scoured before becoming part of the population. During the fall, if river levels were decreased to conserve water the following summer, salmon redds (gravel nests where salmon eggs incubate) were in danger of being dewatered, with the resultant loss of fertilized eggs. Finally, the potential overallocation of water for other uses posed the risk of removing too much water from the system for healthy salmon populations.[11]

The cumulative effect of dams on both the *nx̌ʷəntkʷitkʷ* and *sḳawsitkʷ*, habitat alteration, water overallocation, and invasive aquatic species resulted in a catastrophic decline in salmon species within traditional syilx territory. All Pacific salmon that swim up river from the sea to spawn were made locally extinct from the Upper *nx̌ʷəntkʷitkʷ,* as well as from the Upper *sḳawsitkʷ* watershed. Chum and pink salmon were also eliminated from the Okanagan system, and sockeye, chinook, and steelhead populations were in severe decline.[12] In the mid-1990s, the sockeye spawning run to *nk'mip* was less than 2,000. The syilx community, Elders, and leadership were extremely alarmed at this devastating outcome, and there were fears that sockeye would become extinct in the Okanagan. Demands were made to federal and provincial governments to intervene to prevent the complete loss of sockeye.

In the 1970s and 1980s, Chief Albert Saddleman of the Okanagan Indian Band became a notable advocate for syilx title and rights and a proponent for salmon restoration in syilx territory. Throughout the 1980s and 1990s, Chief Saddleman led efforts focusing on water, land, and natural resources, specifically the declining sockeye population. He also brought attention to advancing syilx title and rights among federal and provincial governments. At the time, government representatives were noncommittal and indifferent to intervening to prevent total sockeye collapse. With

* Kokanee are sockeye salmon that do not migrate to the ocean, spending their entire lives in fresh water.

syilx Elders, who provided guidance and vision for the restoration of salmon populations, Chief Saddleman worked tirelessly to build relationships and, ultimately, the technical capacity to undertake the Nation's direction to restore salmon.[13]

In 1997, Okanagan Nation Alliance (ONA) hosted a multi-agency workshop in Kelowna to discuss challenges and opportunities to restore sockeye. The workshop was attended by Indigenous, federal, provincial, and state fisheries managers and scientists from British Columbia and Washington State. The workshop outcome provided the sylix Nation with an action plan and various avenues to address government concerns with sockeye reintroduction into *kłusxənitkʷ*.[14]

Two important outcomes resulted from the workshop. First, ONA and the Colville Confederated Tribes (the sylix Nation's relations in Washington State) signed a memorandum of understanding to collaborate on transboundary salmon restoration and management. Second, the Canadian Okanagan Basin Technical Working Group (Working Group), made up of ONA, Department of Fisheries and Oceans, and the BC Ministry of Environment, was established. The Working Group's mandate is to use adaptive management principles to cooperatively manage, assess, conserve, and restore native fish stocks in the Okanagan Basin[15] and focuses on scientific and technical questions, rather than on policy issues.

Following the 1997 workshop, the consensus was that *kłusxənitkʷ* sockeye reintroduction posed too many risks and uncertainties related to invasive species, disease transfer, and competition with resident kokanee and trout. A three-year experiment and risk assessment to reintroduce sockeye into *t̓uʔcin* was proposed. ONA and Colville Confederated Tribes collaborated, with funding from the US-based Bonneville Power Administration. The lowest risk identified was the stocking of hatchery-reared sockeye fry into *t̓uʔcin*. The Public Utilities Districts (PUDs) of Grant and Chelan Counties, based out of Washington State, funded a pilot egg collection and rearing study in 2003 to determine the feasibility of hatchery production. Following this pilot study, ONA Fisheries committed to a 12-year experimental reintroduction of sockeye salmon into *t̓uʔcin,* with Chiefs' support and with funding from Grant and Chelan PUDs.[16] This launched the work ONA Fisheries carries out to this day.[17] The experiment was designed to be adaptive based on insights from observed results, to be reversible if potential risks became apparent, and to test various methods and strategies for implementing reintroduction. A significant decision arising from the program was a commitment to constructing a syilx Nation–owned sockeye hatchery. Initially, the Shuswap Falls Salmon Hatchery (a Department of Fisheries and Oceans facility), located near Lumby, was contracted to raise *sq̓awsitkʷ* sockeye fry* until the ONA hatchery was constructed. In 2013, construction of the *kł cp̓əlk̓ stim̓*[18] Hatchery, located on the Penticton Indian Reserve, began. Since opening in 2014, *kł cp̓əlk̓ stim̓* Hatchery has raised and released over 33 million sockeye fry (ranging from 500,000 to 5.7 million fry annually). The hatchery was designed as a conservation hatchery, intended to salvage populations from further decline and to seed areas of sockeye that had been made extinct locally with new stocks, rather than as a production facility with focus on stocking high numbers of fry. *kł cp̓əlk̓ stim̓* Hatchery continues to raise and release both sockeye and a limited number of chinook salmon into the Okanagan System.

Following the 1997 workshop, the Working Group successfully initiated the Fish Water Management Tool (FWMT). Douglas County PUD, in Washington State, had previously expressed interest in sockeye recovery projects in the Canadian Okanagan and ultimately collaborated with the Working Group. Since 2003, FWMT has been instrumental in managing *sq̓awsitkʷ* flows that has contributed to salmon recovery. FWMT is a complex decision-support model that incorporates real-time data (e.g., lake levels, snowpack levels and instream forecasts, stream inflows and outflows, salmon spawner numbers and egg development, in-lake productivity) to model and predict different water management scenarios. The scenarios can change dramatically each year depending on salmon runs, snow pack and spring run-off, drought conditions, flood events, and anticipated water use from other users.

The first goal of FWMT is to manage river flows and lake levels to prevent flooding in the Valley for public safety. The second goal is to provide "fish friendly" flows that protect all critical salmon life history phases: egg incubation, fry emergence, juvenile rearing, smolt migration, and finally adult spawning. Finally, the model can be adjusted to allocate water use depending on the priority of the users (e.g., agriculture having a higher priority over recreational use). When at all possible, the rivers and lake levels are modelled to protect fish, and if potentially harmful flows are required it is for the protection of life and property. Since the inception of the FWMT, the change in water management

* Okanagan sockeye are locally adapted to the Okanagan Valley. Eggs were collected in *sq̓awsitkʷ*, raised in Shuswap Falls Salmon Hatchery, then released as fry back into *sq̓awsitkʷ*.

has likely contributed the most to salmon restoration in the Okanagan.

An additional Working Group project is the Okanagan River Restoration Initiative (ORRI), envisioned in 2000 to address the extensive river channelization and to restore it to a more natural flow.[19] The first success was to re-establish the natural meander of the *sq̓awsitkʷ* near Oliver. This section had been channelized and dyked, which had reduced salmon spawning and rearing habitat. The original concept was relatively simple: breach the dyke, rebuild a set-back dyke to control flooding, and reconnect two oxbow lakes (a free-standing, U-shaped body of water that forms when a curve in a river becomes isolated from the main river channel). Almost immediately upon reconnection in 2010, both sockeye and chinook salmon began to use the improved habitat.

Phase 1 of the original restoration initiative project was a resounding success. Since completion, additional ORRI projects in phased approaches have been completed through the *sq̓awsitkʷ*. Due to the high cost of scoping, engineering, construction, and monitoring, the phased approach of ORRI can slowly and methodically restore segments of habitat. Examples of ORRI restoration works include re-engaging an historic side channel for juvenile chinook rearing, modification of vertical drop structures[20] from Oliver to Skaha Dam to improve migration, re-engaging the historic flood plain to enhance the riparian (i.e., riverbank) ecosystem, and the addition of gravel spawning beds in Penticton Channel[21] to enhance spawning capacity.

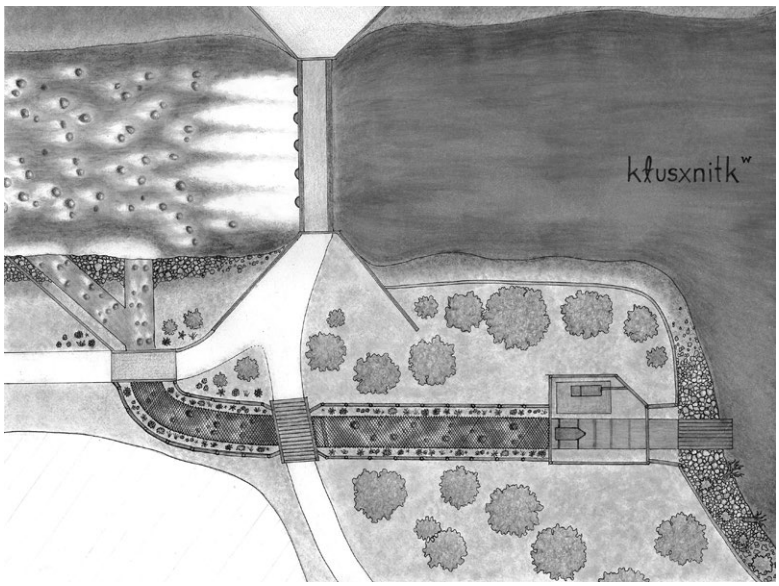
An important goal of ONA's habitat improvement vision is facilitating the movement of fish through the dams. McIntrye Dam, the first impassable structure that migrating salmon encounter, was retrofitted with modern gates in 2009. The original dam configuration used undershot gates, which are completely impassable for adult salmon and caused high mortality for ocean-migrating salmon smolts. The retrofitted gates are overshot, meaning water flows over the top rather than underneath. The addition of gravel below the dam outlet created a deep pool, and salmon were able to pass upstream over the gates. The new gates also reduced injury and mortality on smolts.

The next major barrier was Skaha Lake Outlet Dam, located at *sx̌ʷəx̌ʷnikʷ*[22] (Okanagan Falls). The dam is outfitted with radial gates rather than with undershot gates. While not impassable like undershot gates, radial

Aerial photos of Phase 1 of the Okanagan River Restoration Initiative. *Left:* **before oxbow lake reconnection;** *right:* **after.**

Courtesy Okanagan Nation Alliance (left), Michael Bezener (right)

gates are effective only at providing passage when they are opened to nearly maximum during high flow years. The earliest confirmed sockeye sighting upstream of *t̓u?cin* in Penticton Channel was during fall of 2011. The previous summer, high river flows well into July likely allowed adult sockeye to pass under the gates into the lake. When the current Skaha Dam structure was completed in 1952, a fishway was also included on the west side of the dam but never activated due to McIntyre Dam downstream. In 2014 and 2015, ONA activated the fishway by installing stop logs with appropriate jump heights in each bay. By monitoring attraction flows and optimizing jump efficiency in the fishway, migrating salmon can consistently migrate into *t̓u?cin* and spawn in Penticton Channel.



Artistic rendering of proposed Penticton Dam Salmon Passage Initiative as seen from overhead.

© Drawing by Sheena Hooley, Penticton Indian Band Community member.

The final significant migration barrier is Penticton Dam, located at the outlet of *kłusxənitkʷ*, in the city of Penticton. The dam was first constructed in the early 1900s, with numerous reconstructions over the decades until the final version was completed in 1958.[23] Like Skaha Dam, Penticton Dam was engineered with a fishway on the west side that was never activated due to McIntyre Dam. In 2019, the Working Group initiated a three-year pilot study to address three main questions: Would the fishway convey water as originally designed; would migrating sockeye migrate through the fishway and enter *kłusxənitkʷ*; and which *kłusxənitkʷ* tributaries would sockeye use for spawning? ONA activated the fishway in fall 2019 and until 2022 monitored sockeye passage through the fishway and migration to spawning grounds in *kłusxənitkʷ* tributaries. Some main conclusions were that although water could flow and salmon could navigate the 30-centimetre jump height at each bay, the fishway length was too short, the vertical height from Penticton channel to *kłusxənitkʷ* surface level was too steep, and the lower bays were too shallow for optimal salmon jumping. In brief, while salmon could use the fishway to enter the lake, the configuration is not efficient for salmon passage.

Due to the aging structure and potential safety risk, passage through Penticton Dam was not feasible. In response, ONA conceived a fish bypass channel on the east side of the dam. Engineering of the bypass optimized salmon jumping efficiency through proper bed grade and fully adjustable stop logs for various flows and lake levels. Advanced technology within the fishway allows biologists to count, identify, measure, and detect electronically tagged sockeye, chinook, and steelhead as they migrate to *kłusxənitkʷ*. Construction of the bypass was scheduled to be completed by July 2025.

The 12-year reintroduction experiment in *t̓u?cin* was intended to address uncertainties of reintroducing a locally extinct species into an extremely altered system. Methods and strategies learned from the experiment could be applied to the *kłusxənitkʷ* initiative. The original experiment was intended to sunset in 2016; since then, the program has shifted to a production stage, while continuing to be adaptively managed with intensive monitoring and evaluation to inform management decisions. The cumulative effect of the *t̓u?cin* reintroduction program, Fish Water Management Tool, Okanagan River Restoration Initiative, and dam passage initiatives resulted in the third-highest sockeye spawning run since records were kept: 142,000 adult spawners in 2024. As a keystone species, the return of salmon has also benefited other species such as kokanee and rainbow trout, ospreys and eagles, aquatic mammals such as beavers and river otters, and riparian plant species.

The next milestone is the reintroduction of salmon into *kłusxənitkʷ*. The first hatchery sockeye fry were stocked in *kłusxənitkʷ* in 2016. From 2016 to 2025, ONA has stocked close to 17.2 million fry into the lake. With the focus on hatchery production in *kłusxənitkʷ*, provision of passage at Penticton Dam, and continued fish habitat improvements in *kłusxənitkʷ* tributaries, the trajectory for salmon restoration is quite promising based on the success of ONA initiatives.

Chief Albert Saddleman's vision to put the river back, to put the fish back seems to be coming to fruition. The

Spawning adult sockeye in *sc̓awsitkʷ* (Okanagan River). Photo taken during ONA's annual broodstock collection program. Courtesy photographer Michael Bezener

***syilx* Nation members drumming and singing on the bank of sc̓awsitkʷ during ONA's annual sockeye fry release ceremony.**

Courtesy Okanagan Nation Alliance

wisdom of syilx Elders, the directives of syilx Nation Chiefs and Councils and community leaders, and the support of syilx community members have guided the process of salmon restoration. syilx Elders have been very emotional seeing the return of salmon within their lifetime. syilx youth are now able to learn salmon harvesting techniques from their parents and grandparents. The return of salmon has had a profound impact on the community for subsistence, cultural, and ceremonial goals. While challenges such as human population growth and climate change are ongoing, the rebound of salmon populations will ideally help them to persevere for many generations to come.

Endnotes

1. See Okanagan Nation Alliance [hereafter ONA], "i? sn̓aẏáẏtət tə sc̓win (Our Salmon Story): Honouring Syilx Responsibilities to and Relationships with Salmon," 2023, 1; and Adrienne Vedan, "Traditional Okanagan Environmental Knowledge and Fisheries Management," Report prepared for the Okanagan Nation Fisheries Commission, 2002, 4.
2. See Andrea Ernst and Adrienne Vedan, "Aboriginal Fisheries Information Within the Okanagan Basin," Report prepared for the Okanagan Nation Fisheries Commission, 2000, 7–11; ONA, "i? sn̓aẏáẏtət tə sc̓win (Our Salmon Story), 1; and Vedan, "Traditional Okanagan Environmental Knowledge and Fisheries Management," 5.
3. *caylx* (Richard Armstrong), Joe Enns, Dawn Machin, and Karilyn Alex, "Syilx siwɬkʷ (Water) Management Principles and European Colonization: A Contrast of Ethics in the Okanagan Basin," *OLRS Study 8 Report,* Okanagan Nation Alliance Fisheries Department, 2024, 3.
4. ONA, "i? sn̓aẏáẏtət tə sc̓win (Our Salmon Story), 1.
5. ONA, "i? sn̓aẏáẏtət tə sc̓win (Our Salmon Story), 1–2.
6. Andrea Ernst, "Okanagan Nation Fisheries Commission Dam Research," Prepared for the Okanagan Nation Fisheries Commission, 1999, 32.
7. Brian J. Symonds, "Background and History of Water Management of Okanagan Lake and River," Water Management, British Columbia Ministry of Environment Lands and Parks, 2000, 2.
8. Symonds, "Background and History of Water Management of Okanagan Lake and River, 2–3; caylx (Richard Armstrong), Joe Enns, Dawn Machin, and Karilyn Alex, "Syilx siwɬkʷ (Water) Management Principles and European Colonization, 9.
9. *caylx* (Richard Armstrong), Joe Enns, Dawn Machin, and Karilyn Alex, "Syilx siwɬkʷ (Water) Management Principles and European Colonization, 9.
10. Fishery managers introduced the invasive Mysis shrimp into many North American lakes from the 1940s to the 1980s, believing this shrimp species would be a suitable food source for sport fishes. However, in many systems sport fishes are not able to feed on the shrimp because shrimp only surface at night and migrate to deep waters during the daytime. Furthermore, competition for the same zooplankton food source resulted in fish population crashes in many lakes where they were introduced.
11. ONA, "i? sn̓aẏáẏtət tə sc̓win (Our Salmon Story), 2.
12. ONA, "i? sn̓aẏáẏtət tə sc̓win (Our Salmon Story), 1–2.
13. ONA, "i? sn̓aẏáẏtət tə sc̓win (Our Salmon Story), 2–3.
14. ONA, "i? sn̓aẏáẏtət tə sc̓win (Our Salmon Story), 5.
15. ONA, "i? sn̓aẏáẏtət tə sc̓win (Our Salmon Story), 6.
16. Mitigation for dam operations is an obligation for PUD licensing under the US Federal Energy Regulatory Commission (FERC).
17. ONA, "i? sn̓aẏáẏtət tə sc̓win (Our Salmon Story), 7.
18. The English translation of kɬ cp̀əlḵ stim̓ is "cause to come back."
19. ONA, "i? sn̓aẏáẏtət tə sc̓win (Our Salmon Story), 10.
20. Vertical drop structures are cement low-head dams built by the province to dissipate water energy following channelization, but which impeded salmon migration.
21. Penticton Channel is the upstream section of *sc̓awsitkʷ* and flows from *kłusxənitkʷ* to t̓u?cin along the eastern boundary of Penticton.
22. This site is an extremely important cultural and historic site. From time immemorial the syilx People gathered here to harvest and process fish, to come together, and to reconnect with friends and relatives from across the Territory. ONA's annual Salmon Feast continues to be held at this location.
23. Symonds, "Background and History of Water Management of Okanagan Lake and River, 2–3, 5; Ernst, "Okanagan Nation Fisheries Commission Dam Research," 22–25.

The Okanagan Nation Alliance is the Tribal Council which represents the eight syilx Okanagan member communities including Okanagan Indian Band, Upper Nicola Band, Westbank First Nation, Penticton Indian Band, Osoyoos Indian Band, Lower and Upper Similkameen Indian Bands, and the Colville Confederated Tribes on areas of common concern. Each community is represented through the Chiefs Executive Council by their Chief or Chairman.