

# Enhancing cultural food security among the Syilx Okanagan adults with the reintroduction of Okanagan sockeye salmon<sup>1</sup>

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**Abstract:** For the Syilx Okanagan Nation, food sovereignty is foundational to ensuring their cultural food security and health. Salmon being a central Syilx food, the Nation has worked relentlessly since the 1990s to reintroduce Okanagan sockeye salmon into their traditional territory. This study describes the reach of this initiative and assesses its impact on Syilx households' income-related and cultural food security status. In total, 265 households participated in the study. Overall, 48.6% of participants ate Okanagan sockeye salmon during the year prior to the survey. Most participants (89.1%) reported that during the prior year their household accessed salmon from a community member or through trade (53.7%), community program (49.8%), a feast or ceremony (35.8%), or household harvest (27.2%). The number of ways that households accessed salmon was associated with a greater frequency of salmon consumption ( $p < 0.0001$ ). Income-related (46.5%) and cultural (63.1%) food insecurity were prevalent. Households' access to salmon was significantly associated with cultural food security and the perceived importance of cultural food security. This study suggests Indigenous food sovereignty initiatives can increase traditional food access and consumption, thereby enhancing cultural food security. They should be supported by governments, organizations and corporations.

## Novelty:

- Indigenous food sovereignty initiatives can increase traditional food access and consumption, thereby enhancing cultural food security.
- Indigenous-led wild habitat restoration interventions can help reconcile past social and environmental injustices.
- This study was conducted on the unceded territory of the Syilx Okanagan People.

**Key words:** cultural food security, food security, food sovereignty, traditional food, salmon, Indigenous, First Nation, food access.

**Résumé :** Pour la Nation Syilx Okanagan, la souveraineté alimentaire est fondamentale afin de préserver leur sécurité alimentaire culturelle et leur santé. Le saumon étant un aliment Syilx primordial, la Nation a travaillé sans relâche depuis les années 1990 pour réintroduire le saumon sockeye de l'Okanagan dans son territoire traditionnel. Cette étude décrit la portée de cette initiative et évalue son impact sur la sécurité alimentaire liée au revenu et culturelle des ménages Syilx. Au total, 265 ménages ont participé à l'étude. Dans l'ensemble, 48,6 % des participants ont consommé du saumon sockeye de l'Okanagan au cours de l'année précédant l'enquête. La plupart des participants (89,1 %) ont déclaré qu'au cours de l'année précédente, leur ménage avait eu accès au saumon par l'intermédiaire d'un membre de la communauté ou d'un échange (53,7 %), d'un programme communautaire (49,8 %), d'un festin ou d'une cérémonie (35,8 %) ou de la récolte familiale (27,2 %). Le nombre de façons dont les ménages accédaient au saumon était positivement associé à la fréquence de consommation de saumon ( $p < 0,0001$ ). L'insécurité alimentaire liée au revenu (46,5 %) et culturelle (63,1 %) était prévalente. L'accès des ménages au saumon était significativement associé à la sécurité alimentaire culturelle et à l'importance perçue de la sécurité alimentaire culturelle. Cette étude suggère que les initiatives de souveraineté alimentaire Autochtone peuvent accroître l'accès aux aliments traditionnels et leur consommation, renforçant ainsi la sécurité alimentaire culturelle. Elles devraient être soutenues par les gouvernements, les organisations et les entreprises.

## Les nouveautés :

- Les initiatives de souveraineté alimentaire Autochtone peuvent accroître l'accès et la consommation d'aliments traditionnels, améliorant ainsi la sécurité alimentaire culturelle.

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- Les initiatives de souveraineté alimentaire Autochtone peuvent aider à réconcilier les injustices sociales et environnementales.
- Cette recherche a eu lieu sur le territoire non cédé du peuple Syilx Okanagan.

**Mots-clés :** sécurité alimentaire culturelle, sécurité alimentaire, souveraineté alimentaire, alimentation traditionnelle, saumon, Autochtone, Première Nation, accès à la nourriture.

## Introduction

European colonization resulted in the environmental degradation of many First Nations territories in Canada and had a severe impact upon First Nations' culture, livelihood, self-determination, food security and food sovereignty, all of which have negatively impacted First Nations' access to culturally important traditional food (Kuhnlein and Receveur 1996; Willows 2005; Loppie Reading and Wien 2009; Grey and Patel 2015; Laberge Gaudin et al. 2015; Lowitt et al. 2019; Batal et al. 2020). Consequently, First Nations, including First Nations in British Columbia (BC), were forced to replace traditional food (TF) with market food of poor quality (Chan et al. 2011; Batal et al. 2021a, 2021b) and therefore are at great risk of experiencing food insecurity and diet-related chronic disease (Batal et al. 2021a, 2021b). Food security exists "when all people at all times have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (Food and Agriculture Organization (FAO) 1996). For First Nations, food security encompasses access to both traditional food (cultural food security) and market food (income-related food security) (Power 2008).

For First Nations, traditional food, defined as wild animals, fowl, fish and plants harvested from local Indigenous food systems (Kuhnlein and Receveur 1996), is important for nutritional, cultural, social, economic, and health reasons (Power 2008; Chan et al. 2011; Egeland and Harrison 2013; Blanchet et al. 2020). Thus, for First Nations, reclaiming their food sovereignty, defined as the right of Indigenous peoples to honour, value and protect their traditional food systems (Desmarais and Wittman 2014), is foundational to preserving their cultural food security, health, well-being, and way of life (Power 2008; Kuhnlein and Burlingame 2013; Council of Canadian Academies 2014; Amberson et al. 2016; Islam and Berkes 2016). Indigenous food sovereignty and cultural food security are interrelated, with the former considered as a necessary condition to achieve the latter (Council of Canadian Academies 2014; Batal et al. 2021b). Indigenous food sovereignty is based on the principle that decisions about Indigenous food systems should be made by Indigenous people (Council of Canadian Academies 2014). Some Indigenous communities in BC, such as the Nuxalk (Kuhnlein et al. 2013), the Nuu-chah-nulth-aht (Coté 2016), the Snuneymuxw (Hutchings 2016) and the Syilx Okanagan (ONA 2017c) Nations, are asserting their Indigenous food sovereignty by restoring, maintaining, and protecting their Indigenous food systems, affirming their self-determination, and restoring their cultural responsibilities and relationships to land, water, each other, and the natural world (Corntassel and Bryce 2012; Coté 2016; Delormier et al. 2017; ONA 2017c).

The traditional territory of the Syilx Okanagan Nation spans the Canada–United States (US) border. Currently, the Nation is represented by the Okanagan Nation Alliance (ONA), and comprises 7 communities in BC and 1 in Washington State. Prior to colonization, Syilx Okanagan people (referred to as Syilx from herein) had a thriving food system based on a prolific inland fisheries and abundant wild foods and medicines (ONA 2017c; *suiki?st [Terbasket] and Shields 2019*). Salmon is a cultural keystone species for Syilx, given its role as a food 'Chief' in Syilx inter-generational teachings and its central role in their social and governing systems, trade traditions, and nutritional well-being (ONA 2005, 2014; *suiki?st [Terbasket] and Shields 2019*). Salmon is considered by Syilx as one of their relatives, and an essential constituent connecting "generations, communities, humans and nonhumans,

terrestrial and aquatic species, and transboundary watersheds along the Columbia River system" (*suiki?st [Terbasket] and Shields 2019*). Therefore, the existence of salmon in the Syilx traditional watershed is imperative for the continuation of the Syilx language and cultural teachings. A sustainable salmon fishery depends on a well-functioning ecosystem and adequate fish habitat. Alas, this past century has been very detrimental to the environments of the Columbia and Okanagan Rivers, for the salmon that spawn in these rivers, and for Syilx people who harvested vast quantities of salmon in pre-colonial times (*Good Water 2018*). The salmon populations were decimated from high historical levels for myriad reasons, primarily stemming from colonization, such as human-induced habitat degradation (e.g., forestry, farming, urbanization, suburban housing development), poor water management practices, salmon overexploitation, increased predation and competition caused by recreational fish stocking, and climate change (ONA 2005, 2014; Hyatt and Stockwell 2019). For instance, salmon passage to the upper Columbia River was blocked when the Grand Coulee Dam was built in the 1930s to produce hydroelectric power and provide irrigation water and flood control in the US (*Good Water 2018*). Consequently, many salmon species, including sockeye salmon, ceased to return to these rivers. The near extirpation of salmon led to a decline in salmon consumption and contributed to the disruption of environmental, economic, and social welfare of Syilx people and their Nation (*Good Water 2018; Johnson 2020*).

Near extirpation of salmon in the Okanagan River Basin, including Okanagan sockeye salmon (*Oncorhynchus nerka*), which is a distinct salmon species, compelled the Syilx Okanagan Nation to begin the work of bringing the salmon back to the Okanagan River. In the 1990s, Syilx leadership (elected leaders, Elders, Nation members, technical staff, and cultural knowledge keepers) decided to develop a restoration program for the Okanagan sockeye salmon (ONA 2014). Reintroduction options were explored and possible risks associated with the reintroduction of Okanagan sockeye salmon into the ecosystem were evaluated by the ONA in collaboration with Fisheries and Oceans Canada and the British Columbia Ministry of Forests, Lands, and Natural Resource Operations (Hyatt and Stockwell 2019). As salmon is a transboundary anadromous species, the restoration program required the assertion of Syilx title and rights, and negotiations with the provincial (BC) and federal governments in Canada, and with governments in Washington state (US). It also required consultation with Indigenous Nations whose territories overlapped with Syilx territory, and with other traditional fisheries in BC and in the US, while respecting laws and obligations of international trade agreements and treaties such as the Columbia River Treaty and Pacific Salmon Treaty (Hyatt and Stockwell 2019). A 3-year pilot project (2000–2003), conducted for risk assessment and restoration program design, led to the development of a multi-level intervention, called the 12-Year Reintroduction of Sockeye Salmon into Skaha Lake. This complex Syilx-led food sovereignty intervention, integrating Traditional Syilx knowledge and Western science, was gradually implemented by the Syilx Okanagan Nation starting in 2004 (ONA 2014).

The 12-Year Reintroduction of Sockeye Salmon into Skaha Lake intervention, described elsewhere (ONA 2013, 2014, 2017b; Hyatt and Stockwell 2019), included community engagement; cultural revitalization through social gatherings, ceremony and Nsyilxcen language transmission; active participation in regional water management and flow decisions; design and development of fish passage over hydroelectric dams; and river habitat restoration. Since 2015, the intervention includes yearly releases of Okanagan

sockeye salmon fry raised at the *kl c̓p̓alk st̓im* Hatchery, a state-of-the-art ecologically and culturally sound hatchery owned by the Syilx Okanagan Nation (ONA 2017c). Salmon released by the *kl c̓p̓alk st̓im* Hatchery are released in their fry life stage (about 6 months after fertilization; at that stage salmon are about 2–3 cm long) and spend more than 80% of their lives in their natural habitat. Acknowledging the ongoing debate on hatcheries (Brannon et al. 2004), the Nation collects the brood stock only from the wild population and follows the Hatchery Scientific Review Group framework recommendations for population recovery (HSRG Issues New Report 2014). Unique in Canada, the ONA hatchery program has a hatchery and genetic management plan with specific adaptive management objectives for each lake in the Okanagan River System to increase the benefits and reduce the risks associated with its operation (ONA 2017c). The aim of the program is to use hatchery supplementation for the restoration of sockeye salmon until the number of returning spawning salmon has reached the capacity of the spawning habitat in lakes where salmon was locally extirpated (Hyatt and Stockwell 2019). The intervention also includes an education component, Fish in Schools (FinS), that allows children in regional public schools and Syilx Okanagan Nation schools to raise salmon fry in their classroom and release them at the Annual ONA Sockeye Fry Release Ceremony (ONA 2017c). Fish Fry Release Ceremonies, Salmon Feast, and Salmon Ceremonies facilitate the cultural connection to salmon. These practices are ways that express gratitude to salmon through songs, prayers and feasting for giving its life to feed Syilx, honour existing responsibilities for ongoing ceremonial reciprocal actions, and contribute to increasing awareness about the initiatives and to building relationships among Syilx, settler populations (non-Syilx) and salmon (Johnson 2020).

The Okanagan sockeye salmon is now the main species of salmon returning to the Columbia and Okanagan River; yet, it would have likely been extirpated if it were not for the relentless efforts of the Syilx Okanagan Nation to bring it back to their homeland. Since 2013, increased salmon returns have supported food, social and ceremonial needs of Syilx in most years (ONA 2014). When the fish runs permit it, a communal harvest using a professional harvesting model and a fish distribution to communities are organized by the ONA (ONA 2017c). Communities then distribute salmon to their early childhood programs, schools, and health programs, as well as to members who want salmon (Good Water 2018). How much fish is distributed to communities each year depends on the harvest. For instance, the abundant fish run in 2016 allowed ONA to distribute 10 000 fish (>13 000 kg) (ONA 2017a), while the fish run in 2017 was low and did not allow a communal harvest, therefore the ONA distributed 120 cases of 24 cans of salmon harvested in 2016 (ONA 2018). When the number of returning salmon is sufficient, a participatory fishery, economic pilot and recreation fisheries that respect a sustainable food sovereignty and food security model are also implemented to increase the economic sustainability of the intervention (Syilx Okanagan Nation Alliance 2017; Good Water 2018).

There is little empirical research evaluating the effectiveness of Indigenous food sovereignty interventions in fostering food security (Weiler et al. 2015; Delormier et al. 2017), and this is especially true with regards to Indigenous fisheries (Lowitt et al. 2019). Therefore, the current study aims to describe the reach of the Syilx-led reintroduction of Okanagan Sockeye salmon intervention and assess its impact on Syilx households' income-related and cultural food security status.

## Materials and methods

### Study sampling and data collection

This was a cross-sectional study based on survey data. The data collection methods for this study have been described in detail elsewhere (Blanchet et al. 2020). Briefly, this study is part of the Salmon and Our Health Study, which aims to document the

health and health equity outcomes of the Syilx-led 12-Year Reintroduction of Sockeye Salmon into Skaha Lake intervention. A strengths-based approach was implemented throughout this research program with the goal of highlighting strengths of Syilx People with minimal focus on deficits. This research is being done in full partnership with ONA, Syilx communities, University of Alberta, and Université de Montréal. A community research agreement that outlines the terms of the participatory evaluative research helps to ensure the development of meaningful, respectful, and collaborative partnerships throughout the research project. We also respect the Ownership, Control, Access and Possession (OCAP) Principles and the Canadian Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (First Nations Information Governance Centre (FNIGC) 2011; Canadian Institutes of Health Research et al. 2010) to uphold ethical research approaches with First Nations. Participating communities and ONA were involved in the planning of study activities and in the interpretation of research findings. Participating communities and the Nation own their data. Findings were shared with community members before being widely distributed. All participants gave written informed consent. Ethics approval was obtained from the Research Ethics Office of the University of Alberta (Pro00067679) and the Research Ethics Committee of the Université de Montréal (16-074-CERES-D).

Three authors (R.B., M.B., N.W.) are non-Indigenous settler academics living in Canada who position themselves as community-based participatory researchers. Of the 2 Syilx authors, one (S.J.) is a Syilx scholar and the other (ONSRI) represents the study advisory group that is constituted of Syilx/Okanagan Nation members and other Indigenous people working for the Okanagan Nation Alliance. Authors practice decolonizing research that honours Indigenous cultural values and worldviews and used a decolonizing health promotion framework (Chandanabhumma and Narasimhan 2020) to inform this research (Blanchet et al. 2021).

All 7 Syilx communities located within Canada were invited to participate in this study and 3 agreed to do so. Trained community interviewers administered the questionnaire using Android tablets. Survey questions were designed to follow community norms and were pretested with community members. Data were collected between February and August 2018. Households were randomly selected (if there were more than 250 households in the community) or all were selected (if the community contained fewer than 250 households). Inclusion criteria included being aged 19 years or older, self-identifying as Syilx or being in a kin relationship with a person who self-identified as Syilx, and living on a Syilx reserve or an adjacent town. Pregnant and breastfeeding women were excluded. When multiple household members were eligible, the one with the next birthday was selected. Participants received a CDN\$50 gift certificate to acknowledge their contribution, time and cost associated with participation.

Traditional food consumption, including wild salmon eating, was evaluated using a traditional food frequency questionnaire (TFFQ) that estimated seasonal traditional food consumption in the year prior to the survey. The TFFQ was adapted from the TFFQ used in the First Nations Food Nutrition Environment Study (Marushka et al. 2021) by Syilx community members and traditional knowledge keepers to reflect traditional food availability and cultural use by Nation members. The frequency of salmon eating was obtained by summing the eating frequency of each wild salmon species and harvest origin. Participants were asked if and how their household accessed salmon (any species or harvest origin) during the same period. Participants could choose as many answers as applicable among the following: harvested by themselves or another member of their household; received from community members (e.g., shared, offered) or traded; received from a community program (e.g., fish distribution); received at a feast or ceremony; bought from a store. Participants were asked if they would like to eat more salmon and for those who did, barriers to salmon consumption were inquired

**Table 1.** Characteristics of participants.

	Total
Sex (%women)	70.0
Age (years) (mean $\pm$ SD)	49.9 $\pm$ 16.3
Household size (mean $\pm$ SD)	3.5 $\pm$ 2.0
Household with older adults ( $\geq$ 65 y) (%yes)	73.9
Household with children (<18 y) (%yes)	52.5
Schooling (%)	
Less than high school diploma or its equivalent	10.3
High school diploma or its equivalent or higher	89.7
Income source (%)	
Employment	64.0
Pension	17.6
Other	18.4
Awareness of Nation's efforts to increase Okanagan sockeye salmon population (%yes)	87.8
Household participation in a community Salmon Feast or Fish Fry Release Ceremony (%)	
None	26.7
Salmon Feast only	11.4
Fish Fry Release Ceremony only	7.8
Both	54.1
Ate salmon (any species or harvest origin) in the year prior to the survey (%)	85.6
Specifically ate Okanagan sockeye salmon in the year prior to the survey (%)	48.6
Frequency of salmon (any species or harvest origin) eating in the previous year (mean $\pm$ SD)	28.9 $\pm$ 38.4
Frequency of Okanagan sockeye salmon eating in the previous year (mean $\pm$ SD)	18.0 $\pm$ 17.3
Wants more salmon (any species or harvest origin) (%yes)	79.6
Salmon (any species or harvest origin) preservation (%yes)	
Freezing	60.2
Drying/smoking	14.8
Canning	28.5
Access to salmon (any species or harvest origin) (%yes)	
Overall access	89.1
Received from community member or by trade	53.7
Received from a community program	49.8
Received at a feast or ceremony	35.8
Self-harvested or harvested by a household member	27.2
Bought from a store	10.9

about with an open-ended question. Answers were then coded using common qualitative methods (Miles and Huberman 1994).

Food security status was assessed 2 ways. The 18-item USDA Household Food Security Survey Module (HFSSM) adapted to Indigenous populations in Canada (Chan et al. 2011) was used to assess income-related household food security status (food secure: 0 affirmative responses; marginal food insecure: 1 affirmative response on the adult food security scale and/or the child food security scale; moderate food insecure: 2 to 5 affirmative responses on the adult food security scale and/or 2 to 4 affirmative responses on the child food security scale; severe food insecure: 6 or more affirmative responses on the adult food security scale and/or 5 or more affirmative responses on the child food security scale) (Klingbaum and Tarasuk 2018). If there was a discrepancy in food security status between a household's adult and child food insecurity scales, the more severe classification was attributed to the household (Klingbaum and Tarasuk 2018). Cultural food security (Power 2008) was assessed by asking participants if they worried that traditional food would run out before they could get more (cultural food secure: never; sometimes cultural food insecure: sometimes; often cultural food insecure: often). To understand the contemporary importance of cultural food security, participants responded to a close-ended question about how important traditional food was in ensuring that their family had enough to eat (Important: very important or somewhat important; Not important: not very important or not important) (Chan et al. 2011).

In total, 561 households were selected, 329 (58%) were contacted, 3 households were ineligible, and 6 homes were vacant, resulting in 320 eligible households. Of those, 265 households completed the interviews, representing a participation rate of

82.8%. Eight households were excluded due to missing data on salmon access, which left 257 participants for the current analyses.

### Statistical analyses

Statistical analyses were conducted using SAS 9.4 (SAS Institute Inc. Cary, NC, USA). Frequencies (%) and means were used to describe characteristics of participants and their households. A Spearman correlation was performed to examine the association between the number of ways households accessed salmon and the frequency with which participants reported eating salmon.  $\chi^2$  tests were conducted to assess the associations between the different ways of accessing salmon.  $\chi^2$  tests, Fisher's exact tests, and t-test analyses were performed to assess differences in food security indicators between households that did and did not access salmon through each way of accessing salmon (globally and individually). These analyses were not performed according to whether or not households bought salmon from a store, because too few households bought salmon to allow statistical analyses. A  $p$ -value < 0.05 was considered to be significant.

### Results

Participant characteristics are reported in Table 1. Participants were 49.8 (SD 16.2) years old on average and 70.2% were women. Almost two-thirds (64%) of participants reported wages or self-employment as their main source of income, with 77.7% of them working full-time in the wage economy and 22.3% working part-time. Most (73.3%) participants reported that their household participated in at least 1 community Salmon Feast or Fish Fry Release Ceremony. The vast majority of participants ( $n = 224$ , 87.8%) were aware of the Nation's efforts to increase the Okanagan sockeye

salmon population. These individuals reported that as a result of the intervention their household had received salmon from a community program (80.4%), harvested more Okanagan sockeye salmon (28.1%), bought Okanagan sockeye salmon from a store (13.4%), or accessed fishing equipment or other resources provided by ONA (9.4%) (data not shown). Only 12.5% of participants who were aware of the intervention reported not benefiting from it.

The majority ( $n = 220$ , 85.6%) of participants ate salmon (any species or harvest origin) about twice per month ( $2.4 \pm 3.2$ ; range 0.1–26.0) during the year prior to the survey (Table 1). Participants who ate Okanagan sockeye salmon during the year prior to the survey ( $n = 125$ , 48.6%) ate this species on average  $1.5 \pm 1.4$  times per month (range: 0.1–8.0). Also, 79.6% of participants reported that they would like to eat more salmon (any species or harvest origin); main barriers to salmon consumption mentioned by these individuals included lack of access and availability, life and time constraints, lack of resources, lack of knowledge and skills, and loss of family connection. Most households (66.4%) preserved salmon during the year prior to the survey, with freezing, canning and smoking/drying being used in decreasing order of frequency. Among households that used these preservation techniques, households froze a median of 8 fish (interquartile range (IQR): 4–12, range: 1–400), canned a median of 10 fish (IQR: 5–15, range: 1–120), and smoked/dried a median of 5 fish (IQR: 2–12, range: 1–63).

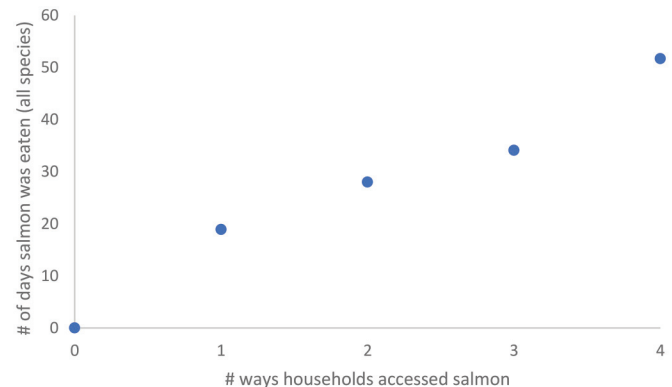
The vast majority (89.1%) of participants reported that their household accessed salmon (any species or harvest origin) in the year prior to the survey (Table 1). The most frequent ways of accessing salmon were receiving it from a community member or by trade (53.7%), receiving it from a community program (49.8%), receiving it at a feast or ceremony (35.8%), and harvesting salmon themselves or by another member of their household (27.2%). Only 10.9% of households bought salmon from a store. There was a significantly positive association between the number of ways through which households accessed salmon and the number of days that salmon was eaten by participants in the year prior to the survey (Fig. 1:  $r = 0.51750$ ,  $p < 0.0001$ ). Accessing salmon at a feast or ceremony was significantly associated with other ways of accessing salmon, except for buying salmon at the store (Table 2). Other ways of accessing salmon were not associated with each other.

Food insecurity was prevalent. As shown in Table 3, 46.5% of participants lived in income-related food insecure households and 63.1% lived in culturally food insecure households that often (20.9%) or sometimes (42.2%) worried that their traditional food would run out. Households' access to salmon (overall or through each access way) was not significantly associated with household income-related food security status but was significantly associated with cultural food security status. Indeed, households that accessed salmon (overall and from community members or by trade) were less frequently worried that traditional food would run out than households that did not access salmon. Households that accessed salmon (overall and through each access way) were significantly more likely to report that traditional food was important in ensuring their household had enough to eat than households that did not access salmon, suggesting that cultural food security was more significant for the former than the latter. Cultural food security status was positively and significantly associated with income-related food security status and with perceived importance of cultural food security, but income-related food security status was not associated with perceived importance of cultural food security (Table 4).

## Discussion

Findings from this study provide empirical evidence that the Syilx-led Sockeye Salmon Reintroduction to Skaha Lake Project, an Indigenous food sovereignty intervention, reached most Syilx households as demonstrated by the high proportion of participants who were aware of the Syilx Okanagan Nation's effort to

**Fig. 1.** Association between the number of ways households accessed salmon and the number of days participants reported eating salmon in the year prior to the survey (Spearman correlation:  $n = 257$ ,  $r = 0.51727$ ,  $p < 0.0001$ ).



reintroduce Okanagan sockeye salmon back into the local ecosystem and whose households participated in ancillary cultural activities or accessed Okanagan sockeye salmon because of the intervention. With the efforts to restore the Okanagan sockeye salmon population and with the communal fish distribution, the Nation increased both Okanagan sockeye salmon availability and accessibility, improving 2 of the 4 pillars of food security as defined by the FAO (Committee on World Food Security 2014). Yet, a statistically significant association between household salmon access and income-related household food security status was not observed in the present study. This result is different from what was observed in the Cree First Nation community of Norway House where the fishery has been proposed as part of the explanation for the community's relatively high level of food security (Islam and Berkes 2016). Many reasons may explain this discrepancy. It is plausible that salmon has not returned in enough abundance in the Okanagan to result in quantifiable improvement in Syilx households' income-related food security status. In other words, the quantity of fish accessed by Syilx households may be insufficient to enhance income-related food security. Overall, salmon was eaten less often by Syilx adults than fish was eaten by Cree adults in Norway House (2.5 times per month versus once a week, respectively) (Islam and Berkes 2016). Therefore, it is possible that a statistically significant impact would be observed during years with abundant fish returns. This hypothesis is in agreement with the result showing that increased household access to salmon (conceptualized as the number of access ways) was associated with increased salmon consumption among participants. Currently, only Okanagan sockeye salmon return to the Okanagan in significant numbers (ONA 2005), but evidence shows that other salmon species, which used to be abundant in the Syilx watershed, are slowly making their way back to the Okanagan River Basin and could potentially contribute further to enhancing income-related and cultural food security among Syilx. This study also demonstrated that access to salmon was associated with enhanced cultural food security and the perceived importance of cultural food security among Syilx community members. Cultural food security has been deemed integral to cultural health and survival among First Nations (Power 2008; Willows 2005). Simply put, salmon is not only important to enhance Syilx's food security, its presence on the Syilx territory is also essential for the preservation of Syilx culture (suiki?st [Terbasket] and Shields 2019). Altogether, these findings strengthen the call to support interventions to enhance availability of and access to traditional foods, such as Indigenous food sovereignty initiatives, as a way to increase cultural food security and traditional food consumption among

**Table 2.** Association matrix between ways of accessing salmon (any species or harvest origin;  $p$ -values of  $\chi^2$  presented).

	Received salmon from a community member (e.g., shared or offered) or traded for salmon	Received salmon from a community program	Received salmon at a feast or ceremony	Salmon was self-harvested or harvested by a household member	Bought salmon from a store
Received salmon from a community member (e.g., shared or offered) or traded for salmon	—	0.7081	0.0271	0.8890	0.8413
Received salmon from a community program	0.7081	—	<0.0001	0.2647	0.4309
Received salmon at a feast or ceremony	0.0271	<0.0001	—	0.0127	0.0583
Salmon was self-harvested or harvested by a household member	0.8890	0.2647	0.0127	—	0.6530
Bought salmon from a store	0.8413	0.4309	0.0583	0.6530	—

First Nations (Blanchet et al. 2020; Willows 2005; Power 2008; Laberge Gaudin et al. 2015).

Participants in the current study reported similar rates of income-related food insecurity and cultural food insecurity as First Nations adults in BC who participated in the First Nation Food, Nutrition and Environment Study (FNFNES) more than 10 years ago (Chan et al. 2011). Obstacles to eating more salmon identified by Syilx participants were similar to barriers to accessing, harvesting and consuming traditional food reported by First Nations adults in BC (e.g., poor availability of traditional foods, lack of knowledge and skills, etc.) (Chan et al. 2011). First Nations adults in BC also named barriers to income-related food security such as the high cost of nutritious store-bought food and poverty (Willows 2005), and even if these barriers were not studied in the present research, we can hypothesize that they were at play. Indeed, a significant proportion of participants did not work full-time. Also, the low proportion of participants who bought Okanagan sockeye salmon may be attributable to its prohibitive cost.

The present study showed that Syilx households utilized several complementary ways to access salmon. Findings revealed that community programs, such as community salmon distribution, were critical to ensure access to salmon for certain community members. Indeed, some community members did not have access to salmon through informal channels such as receiving salmon from community members or by trade. Islam and Berkes (2016) similarly observed that not all community members in Norway House were part of a food-sharing network. There were substantially fewer Syilx households that harvested salmon (27%) as compared with Cree households in Norway House (77%) (Islam and Berkes 2016). This difference emphasizes the importance of salmon distribution by community programs and food-sharing networks to provide access to salmon to household members who may not be in a position to harvest salmon themselves, such as elderly persons, widows, or female lone-parents. Community salmon distribution may also be important for households that have less social capital (e.g., family connections) necessary for informal traditional food sharing, as it has been shown elsewhere that food sharing is often regulated by concepts of reciprocity between households that harvest traditional foods (Ready 2018). This low level of participation in fishing also highlights the critical need to support Syilx community members to ensure they have sufficient knowledge, skills and equipment to fish Okanagan sockeye salmon, in addition to ecosystem and political supports for increased methods and locations for harvest. The ONA organized a fishing camp to overcome barriers in knowledge, skills and equipment in the first years of the intervention. Alas, fishing camps could not be held in subsequent years due to a lack of funding and resources. This highlights the importance of support from communities, governments and funding agencies for Indigenous traditional knowledge transmission opportunities where knowledge keepers, Elders and fishers can pass their knowledge on traditional ways of fishing to ensure both cultural

continuity and access to a nutritious food, while training community members in fishing, food-sharing protocols, and other traditional skills.

The association observed between accessing salmon at a feast or ceremonies and being aware of the Nation's efforts to reintroduce salmon in the Okanagan River System could be explained by the fact that salmon is served at the Salmon Feast or following the Annual ONA Sockeye Fry Release Ceremony and the Nation's efforts to restore the salmon population are also presented and discussed at these ceremonies. It is also possible that individuals with enhanced cultural connectedness were more likely to attend ceremonies and to participate in cultural activities such as fishing (Blanchet et al. 2021).

Findings from the current study have immediate implications for Indigenous fisheries and public health planning. They suggest that Indigenous-led multi-level wild habitat restoration interventions can expand availability of and access to traditional foods, increase traditional food consumption (Laberge Gaudin et al. 2015) and help reconcile past social and environmental injustices, through increasing Indigenous food sovereignty (Egeland and Harrison 2013). Indigenous food sovereignty can be seen as a path towards decolonizing land, watersheds, and peoples as it emphasizes self-determination and the revitalization of Indigenous food systems, cultural practices and ecological knowledge systems (Kamal et al. 2015, Grey and Patel 2015; Coté 2016). Therefore, governments, organizations and corporations should take into account traditional food systems (land-based and water-based) when planning natural resources actions, and support Indigenous food sovereignty interventions in their policies and activities (Kamal et al. 2015). At the Syilx Nation and community level, there is still considerable work to be done to increase access to other traditional foods and to ensure cultural transmission of traditional knowledge and skills. This study also calls for a strengthening of community-based participatory research to showcase the success stories taking place in Indigenous communities. It is our hope that this work will inspire others to reclaim their food sovereignty and that this study may help guide initial planning and decision-making of interventions and their evaluations.

### Strengths and limitations

This study is strength-based. It is among the first studies to describe the reach of an Indigenous food sovereignty initiative pertaining to fisheries (i.e., the Syilx-led Reintroduction of Okanagan Sockeye Salmon into Skaha Lake) and to assess its impact on income-related and cultural food security status. This community-based participatory research study was developed and implemented in partnership with Syilx community members. The project was approved by Syilx leadership and all Syilx communities were invited to participate in the study. Syilx partners reviewed findings and their interpretation to ensure their cultural relevance. Limitations exist related to the study's cross-sectional design, which precludes conclusions on causation or the direction of associations. The effectiveness of Syilx community programming and dimensions

**Table 3.** Income-related food security status, cultural food security status, and contemporary importance of cultural food security according to whether participants accessed salmon (any species or harvest origin) through different access ways.

	Overall access to salmon			Received salmon from a community member (e.g., shared or offered) or traded for salmon			Received salmon from a community program			Received salmon at a feast or ceremony			Salmon was self-harvested or harvested by a household member			
	Total	No (n = 28)	Yes (n = 229)	p	No (n = 119)	Yes (n = 138)	p	No (n = 129)	Yes (n = 128)	p	No (n = 165)	Yes (n = 92)	p	No (n = 187)	Yes (n = 70)	p
Income-related household food security <sup>a</sup> (%)				0.0519			0.7146			0.8738			0.7278			0.6159
Food secure	53.5	35.7	55.8		56.4	51.1		51.6	55.6		53.7	53.3		54.3	51.6	
Marginal food insecure	12.6	7.1	13.3		10.3	14.6		13.3	11.9		14.0	10.0		11.3	16.2	
Moderate food insecure	20.5	35.7	18.6		19.7	21.2		20.3	20.6		18.9	23.3		19.9	22.1	
Severe food insecure	13.4	21.4	12.4		13.7	13.1		14.8	11.9		13.4	13.3		14.5	10.3	
Cultural food security <sup>b</sup> (%)				0.0216			0.0403			0.5604			0.7615			0.3436
Food secure	37.0	53.6	34.8		45.2	29.9		40.0	33.9		38.0	34.9		37.9	34.3	
Sometimes food insecure	42.2	17.9	45.3		35.7	47.8		39.2	45.2		40.5	45.4		39.6	49.3	
Often food insecure	20.9	28.6	19.9		19.1	22.4		20.8	21.0		21.5	19.8		22.5	16.4	
Contemporary importance of cultural food security <sup>c</sup> (%)				0.0001			0.0379			0.0014			0.0453			0.0036
Important	80.6	50.0	84.4		74.8	85.5		72.7	88.8		76.7	87.8		76.2	92.7	
Not important	19.4	50.0	15.6		25.2	14.5		27.3	11.2		23.3	12.2		23.8	7.4	

<sup>a</sup>Assessed with the 18-item USDA Household Food Security Survey Module (HFSSM) adapted to Indigenous populations in Canada (food secure: 0 affirmative responses; marginal food insecure: 1 affirmative responses on the adult food security scale and/or the child food security scale; moderate food insecure: 2 to 5 affirmative responses on the adult food security scale and/or 2 to 4 affirmative responses on the child food security scale; severe food insecure: 6 or more affirmative responses on the adult food security scale and/or 5 or more affirmative responses on the child food security scale).

<sup>b</sup>Assessed by asking participants if they worried that traditional food would run out before they could get more (cultural food secure: never; sometimes cultural food insecure: sometimes; often cultural food insecure: often).

<sup>c</sup>Assessed with a close-ended question about how important traditional food was in ensuring that participants' family had enough to eat (Important: very important or somewhat important; Not important: not very important or not important).

**Table 4.** Association between income-related food security status, cultural food security status, and perceived importance of cultural food security.

	Cultural food security <sup>b</sup> (%)			<i>p</i> <sup>d</sup>	Perceived importance of cultural food security <sup>c</sup> (%)		
	Food secure (n = 92)	Sometimes food insecure (n = 105)	Often food insecure (n = 52)		Important (n = 203)	Not important (n = 49)	<i>p</i> <sup>d</sup>
Income-related household food security <sup>a</sup> (%)				0.0115			0.1672
Food secure	66.3	51.4	32.7		49.8	67.4	
Marginal food insecure	10.9	13.3	15.4		13.3	10.2	
Moderate food insecure	14.1	21.9	28.9		22.2	14.3	
Severe food insecure	8.7	13.3	23.1		14.8	8.2	
Cultural food security <sup>b</sup> (%)				—			<0.0001
Food secure	—	—	—		30.2	62.5	
Sometimes food insecure	—	—	—		48.2	18.8	
Often food insecure	—	—	—		21.6	18.8	

<sup>a</sup>Assessed with the 18-item USDA Household Food Security Survey Module (HFSSM) adapted to Indigenous populations in Canada (food secure: 0 affirmative responses; marginal food insecure: 1 affirmative responses on the adult food security scale and/or the child food security scale; moderate food insecure: 2 to 5 affirmative responses on the adult food security scale and/or 2 to 4 affirmative responses on the child food security scale; severe food insecure: 6 or more affirmative responses on the adult food security scale and/or 5 or more affirmative responses on the child food security scale).

<sup>b</sup>Assessed by asking participants if they worried that traditional food would run out before they could get (cultural food secure: never; sometimes cultural food insecure: sometimes; often cultural food insecure: often).

<sup>c</sup>Assessed with a close-ended question about how important traditional food was in ensuring that participants' family had enough to eat (Important: very important or somewhat important; Not important: not very important or not important).

<sup>d</sup> $\chi^2$  tests.

of Syilx food sovereignty might be best captured using qualitative methods in addition to the survey. Future research should strive to comprehensively assess these aspects along with any areas of improvements in the programs (reach, frequency, accompanying awareness, etc.) using mixed methods approaches. This study may not be generalizable to all Syilx adults because fewer men than women participated in the study, only 58% of selected households were contacted by local community interviewers and the 3 communities that participated in the study may have been different from the 4 communities that did not participate. Salmon access pathways could be influenced by unaccounted factors at play in communities where participants lived. For instance, community-level fish distribution, community cohesion, and physical location may have impacted access to salmon and therefore results presented in this manuscript. We did not distinguish between species or harvest origin of salmon when assessing salmon access. Consequently, households may have accessed salmon from other river systems. Although the questions used to assess income-related and cultural household food security status have been validated and are widely used, self-reported responses remain subjective and may be prone to misreporting. For instance, some participants may have been ashamed to disclose household experiences of food insecurity to a member of their community. To mitigate this potential bias, interviewers were trained to administer the questionnaire with kindness. Lastly, the current findings may have been impacted by the low fish run in 2017—salmon harvest, distribution and consumption depend on salmon availability. This study should be replicated after an abundant fish run to validate findings.

## Conclusion

This study demonstrated that Indigenous food sovereignty initiatives, such as the Syilx-led Sockeye Salmon Reintroduction into Skaha Lake Project, can expand access to traditional foods, enhance cultural food security, and increase traditional food consumption. The Okanagan sockeye salmon have sustained multiple assaults that nearly extirpated them. The Syilx Okanagan Nation rebuilt the sockeye salmon population through outright determination while concurrently upholding their culture and ceremonies through yearly fish fry releases, restoring natural habitats and migratory pathways, and controlling water levels, resulting in a rise in fish harvesting (ONA 2013; Hyatt and Stockwell

2019). While the survival of the Okanagan sockeye salmon is undoubtedly a testament of their strength and resilience as a species, their story also resonates with Syilx peoples' experiences in the face of colonization, globalization, neoliberal policies, and environmental destruction. The Syilx's demonstration of resilience in their fight against salmon extinction also illuminates their cultural resilience and is a powerful example for Indigenous people and the world. For the Syilx people, the protection, promotion, and preservation of the sockeye salmon through this food sovereignty initiative is a momentous achievement in reclaiming what was once their way of life. Though efforts to bring back the salmon must continue, the salmon's Indigenous caretakers have made it clear that they will continue to fight for this important cultural keystone food to maintain salmon as a way of life.

## Okanagan Nation Salmon Reintroduction Initiatives

The Okanagan Nation Salmon Reintroduction Initiatives is constituted of, in alphabetical order, Colette Louie (Osoyoos Indian Band, 1155 Sen Pok Chin Blvd., Oliver, BC V0H 1T8, Canada), Eliza Terbasket (Lower Similkameen Indian Band, 1420 BC-3, Cawston, BC V0X 1C3, Canada), Gareth Jones (Okanagan Indian Band, 12420 Westside Road, Vernon, BC V1H 2A2, Canada), Pauline Terbasket (Okanagan Nation Alliance, 3535 Old Okanagan Hwy, West Kelowna, BC V4T 3L7, Canada; Lower Similkameen Indian Band, 1420 BC-3, Cawston, BC Canada V0X 1C3), and Howie Wright (Okanagan Nation Alliance, 3535 Old Okanagan Hwy, West Kelowna, BC V4T 3L7, Canada).

## Conflict of interest statement

The authors report no conflicts of interest.

## Data availability statement

The datasets generated during the current study are not publicly available. Each community and the Indigenous Nation own their data. Any data request should be addressed to them through the corresponding author.



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