FEATURE

Preparing fisheries professionals to work with and for Indigenous fisheries agencies and organizations

Hannah G. Postma* | Fish Ecology and Conservation Physiology Laboratory, Department of Biology and Institute of Environmental and Interdisciplinary Science, Carleton University, Ottawa, Ontario K1S 5B6, Canada | Social Ecology and Conservation Collaborative Lab, Department of Biology and Institute of Environmental and Interdisciplinary Science, Carleton University, Ottawa, Ontario, Canada

Elizabeth A. Nyboer | Adaptive Fisheries Lab, Department of Fish and Wildlife Conservation, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, USA

Alexander T. Duncan | Centre for Indigenous Fisheries, Institute for the Oceans and Fisheries, Faculty of Science, University of British Columbia, Vancouver, British Columbia, Canada

Nathan Young | School of Sociological and Anthropological Studies, University of Ottawa, Ottawa, Ontario, Canada

William P. Mattes | Great Lakes Indian Fish and Wildlife Commission, Odanah, Wisconsin, USA

Marc Gaden | Great Lakes Fishery Commission, Ann Arbor, Michigan, USA | School for Environment and Sustainability, University of Michigan, Ann Arbor, Michigan, USA

Andrea J. Reid | Centre for Indigenous Fisheries, Institute for the Oceans and Fisheries, Faculty of Science, University of British Columbia, Vancouver, British Columbia, Canada

Vivian M. Nguyen | Social Ecology and Conservation Collaborative Lab, Department of Biology and Institute of Environmental and Interdisciplinary Science, Carleton University, Ottawa, Ontario, Canada

Steven J. Cooke | Fish Ecology and Conservation Physiology Laboratory, Department of Biology and Institute of Environmental and Interdisciplinary Science, Carleton University, Ottawa, Ontario K1S 5B6, Canada

*Corresponding author: Hannah G. Postma. Email: hannahpostma@cmail.carleton.ca.

Third Sister Lake in Saginaw, Michigan, USA. Photo credit: University of Michigan School for Environment and Sustainability.

© The Author(s) 2026. Published by Oxford University Press on behalf of American Fisheries Society.
This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs licence (https://creativecommons.org/licenses/by-nc-nd/4.0/), which permits non-commercial reproduction and distribution of the work, in any medium, provided the original work is not altered or transformed in any way, and that the work is properly cited. For commercial re-use, please contact reprints@oup.com for reprints and translation rights for reprints. All other permissions can be obtained through our RightsLink service via the Permissions link on the article page on our site—for further information please contact journals.permissions@oup.com.

Downloaded from academic.oup.com/fisheries/article/51/6/239/8490441 by guest on 30 September 2026

https://doi.org/10.1093/fshmag/vuaf125

ABSTRACT

Treating Indigenous Peoples as equal participants in decision making requires that groups be prepared to work together in mutually respectful ways. Here, we draw on interviews with Indigenous and non-Indigenous fisheries professionals working for Indigenous fisheries agencies and organizations around the Laurentian Great Lakes (in Canada and the United States) to hear their perspectives on relevant training and learning opportunities that could be helpful to individuals preparing to work in such roles and contexts. We note that participants, most of whom were trained in Western academic institutions and the majority of which were themselves non-Indigenous, felt largely underprepared coming into their roles. We found that the most useful learning opportunities were acquired through mentorship and lived experience on the job. We share reflections on the importance of readiness and training that emerged from the interviews that are useful for individuals who are employed by, or who work in collaboration with, Indigenous groups, such as Indigenous fisheries agencies and organizations. These reflections include a desire for more training on Indigenous history, issues, and culture, which are useful for future fisheries professionals no matter their employer. However, participants also described how personal behaviors, such as genuine intentions, respect, openness, and honesty, are necessary to translate learning into meaningful action. Collectively, the outcomes from this study have the potential to transform not only formal educational opportunities and professional development, especially for non-Indigenous people wishing to work with and for Indigenous Nations, but also set expectations for individual responsibilities and reframe the way in which Indigenous knowledge systems are bridged with Western science and treated by all fisheries professionals.

INTRODUCTION

Indigenous Peoples actively resist infringements of colonialism on their rights and relationships with the natural world (Muller et al., 2019; Parsons & Fisher, 2020; Reibold, 2022; Wilson & Inkster, 2018). This is evident in a variety of contexts and regions around the world as Indigenous Peoples reclaim their rights to govern waters, fish, and lands in their traditional territories (Phare, 2009; Wilson, 2014). Examples include the following: In Aotearoa—the Indigenous name for New Zealand—the Whanganui Iwi (a Māori Tribe) are asserting their rights to manage the Whanganui River and advocating for the rights of the Whanganui to be the same as that of a human being (Hsiao, 2012; Kramm, 2020). In Peru and Bolivia, Quechua and Aymara women are taking action to protect sacred waters, such as those of Lake Titicaca. Finally, in the Pacific Northwest, the Yinka Dene "Uza'hné" have enacted water protection legislation, including opportunities for collaborative water management (Carrier Sekani Tribal Council, 2016). In the Laurentian Great Lakes, the focus of this study, Tribes and First Nations are likewise continuing to confront their exclusion from, and advocate for, approaches to fisheries management that center and uphold Indigenous rights (see Almack et al., 2023; Mussett et al., 2023).

Since time immemorial, Indigenous communities around the Great Lakes have entered into Nation-to-Nation agreements to make decisions about the lands and waters that span the 17,000-km shoreline (D. S. Thomas, 2022); for example, the Dish with One Spoon Wampum Belt (see Jacobs & Lytwyn, 2020) and the Three Fires Confederacy (Fixico, 1994). Early European settlers also entered into agreements and treaties with Indigenous Peoples, including the Two Row Wampum covenant (Lytwyn, 1997; Muller, 2007). In 1982, the Canadian Constitution affirmed "Aboriginal" rights (the favored term at the time) for First Nations, Métis, and Inuit Peoples in Canada (The Constitution Act, 1982, s 35). However, the governments of Canada and the United States alike also enacted laws and regulations that prevented, and continue to prevent, Indigenous Peoples from protecting and living in relation with their lands and waters (see Lowitt et al., 2019; McGregor et al., 2023; Mussett et al., 2023). Over time, Indigenous Peoples around the Great Lakes have been largely alienated from decision making, as well as from the waters themselves in many instances, and have seen their rights systematically denied (Lowitt et al., 2023).

In what are known today as Canada and the USA, Indigenous fisheries management practices differ, and they are regulated in different manners, depending on which side of the border activities are occurring. In the USA, federal courts ruled that states could not manage fisheries on behalf of the Tribes (Lac Courte Oreilles Band of Chippewa Indians vs. Lester. P. Voigt et al., 1983; Minnesota vs. Mille Lacs Band of Chippewa Indians, 1999; People v. Jondreau, 1963; USA v. Michigan, 1979). These rulings forced the states of Michigan, Minnesota, and Wisconsin to interact with Tribes in a manner resembling co-management (Gaden et al., 2013). In Canada, the courts have not gone as far as their U.S. counterparts, instead maintaining, as in the 1990 case *R. vs. Sparrow*, that there is nothing in Canadian law or regulations that "demonstrates a clear and plain intention to extinguish the Indian aboriginal right to fish (*R v.* Sparrow, 1990)." Thus, Canadian federal and provincial powers limit First Nations authority to fully exercise their sovereign management rights despite the constitutional protections introduced through *R v.* Sparrow (1990), namely the Doctrine of Priority that places Indigenous fisheries rights and access ahead of recreational and commercial fisheries interests, and second only to conservation concern, where applicable.

Decision making in the Great Lakes spans multiple countries, communities, and regulatory frameworks. Managing the fishery requires collaboration (see Smith et al., 2019). In 1955, the governments of Canada and the USA established the Great Lakes Fisheries Commission (GLFC) as a focal point for bilateral Great Lakes fisheries management. The GLFC serves as a longstanding collaborative entity, which facilitates the cooperative perspectives of the eight Great Lakes states (Minnesota, Wisconsin, Illinois, Indiana, Michigan, Ohio, Pennsylvania, and New York), the province of Ontario, Tribes with management authority, and U.S. and Canadian federal agencies. Each of these entities are signatories to a Joint Strategic Plan for Management of Great Lakes Fisheries (JSP; an agreement to cooperate for day-to-day and long-term strategic fisheries management). Federal, provincial, and state agencies became signatories to the JSP in 1981. It was not until the mid 1980s that some Tribes in the United States gained formal representation on committees organized under the JSP. In Canada, to date,

Downloaded from academic.oup.com/fisheries/article/51/6/239/8490441 by guest on 30 September 2026

First Nations are represented only by the province of Ontario (Gaden et al., 2008).

The complexity of managing Great Lakes fisheries requires that the individuals involved in collaborative and multijurisdictional spaces (such as with the GLFC) bring more than just biological knowledge to the table. Fisheries professionals (including managers, technicians, and specialists) must understand the socioeconomic needs of the myriad stakeholders and rightsholders and be willing to engage in meaningful dialogue with counterparts in other jurisdictions (Krueger & Decker, 1999). A fisheries professional, in other words, must be part biologist and part diplomat. This is further amplified in the case of fisheries professionals that work with and/or for Indigenous government agencies and organizations where there are additional needs that relate to the specific histories and contexts introduced above.

This paper draws on interviews with Indigenous and non-Indigenous fisheries professionals who work for Indigenous fisheries agencies and organizations on the Laurentian Great Lakes. This group navigates the interfaces between Indigenous and non-Indigenous interests and perspectives, while working within regulations that define the extent of their involvement. These individuals live out the realities of engaging with jurisdictional counterparts and communicating decisions and information back to the Indigenous agencies, organizations, and communities for whom they work. Here, we (1) assess the extent to which participants felt prepared to work in roles that involve upholding Indigenous rights in fisheries decision making, and (2) identify opportunities that can help prepare fisheries professionals to work for or in collaboration with Indigenous fisheries agencies and organizations. We draw out themes emerging from the interviews that center readiness and training, which could help prepare individuals to work in these complex roles and contexts. We acknowledge that other scholars have called for improvements in the training of environmental professionals that reviews or outlines how to respectfully engage with Indigenous Peoples, knowledge systems, and governments (e.g., Appleton et al., 2022; Wong et al., 2020; Zidny et al., 2020); yet, to our knowledge, none of those calls are based on primary research, such as interviews with individuals that work for Indigenous agencies and organizations as we do here.

Positionality

This work is part of the larger collaborative Great Lakes research project titled "Understanding Indigenous Perspectives on Sea Lamprey Control in the Laurentian Great Lakes." It is a project funded in full by the GLFC. By supporting this work, we (the author team) feel that the GLFC is beginning, in a long-term process, to recognize and critically reflect on its role in colonial process and responsivities to Indigenous rightsholders across the Laurentian basin.

I (Hannah Postma/first author) am a Carleton University graduate of settler–European descent. This paper was prepared from the lands of the Algonquin Anishinaabe Peoples, upon which Carleton University sits, as well as from communities around the Great Lakes, where interviews were carried out and relationships formed. The final stages of preparing this paper took place in Lheidli T'enneh First Nation (Prince George, British Columbia), where I first came to this research and continue to work as a fisheries professional for Takla Nation. These experiences shape how I come into and view this work, as well as the benefits I derive from the research experience itself (e.g., obtaining a degree, enhancing my own learning and readiness for my profession). I am joined in this work by Indigenous and non-Indigenous coauthors, mentors, and colleagues, that work from within universities as well as Indigenous fisheries agencies and organizations, and I am grateful to this collective for their important and ongoing guidance. The shape of this work and how it is presented reflects yet another site of worldview and experience convergence.

METHODS

This study followed a constructivist research approach, which emphasizes that individuals construct their own understanding and knowledge through experiences and reflections (Honebein, 1996). It acknowledges the subjective nature of interpretations and aims to uncover diverse meanings attributed to phenomena, considering social, cultural, and historical factors (Mackenzie & Knipe, 2006). The research used an exploratory, inductive methodology to generate hypotheses instead of testing preexisting ones. The research team recognizes the relational responsibility to appropriately and accurately represent the views and perspectives shared by all research participants. We have sought to practice ongoing reflexivity throughout the study on how interpretation through the lens of the research team (see *Positionality* above) reflects the complexity and nuance of these data.

This study examines perspectives and experiences of fisheries professionals working for Indigenous fisheries agencies and organizations on fisheries management in the Great Lakes. Semi-structured interviews gathered insights about preparing current and future fisheries professionals to be effective in such roles. These roles involve upholding Indigenous rights and interests in fisheries decision making, including at the interface between Indigenous and non-Indigenous governments (including relevant agencies) and organizations (Table 1).

Sampling strategy and participant recruitment

We conducted semi-structured interviews with a targeted sample of participants who work for Indigenous fisheries agencies and possess specific knowledge and experience in fisheries decision making in the Laurentian Great Lakes basin. A total of 23 participants were individually interviewed. Eight participants identified as Indigenous, of whom three were women (for four women total). Participants ranged in length of time in their role from approximately 1 year, to over 40 years. The average length of time spent in these roles (at the time of interviews) was about 12 years.

Table 1. Affiliations of interview participants

Affiliation	Abbreviation	*n*
Indigenous intertribal agency (USA)	INTTR	7
Inter-agency for First Nations (CAN)	INTFN	1
Tribal government (USA)	TRG	9
First Nation government (CAN)	FNG	6

Downloaded from academic.oup.com/fisheries/article/51/6/239/8490441 by guest on 30 September 2026

Potential participants were identified by the research team that is collectively working to achieve an improved understanding of Indigenous perspectives on and experiences with Sea Lamprey *Petromyzon marinus* control (see *Positionality*). Additional participants were recruited through chain referral sampling (Raifman et al., 2022). Potential participants received invitations via an email that explained the study, participation requirements, ethical considerations, and that situated this work within the larger collaborative project. Of the 49 individuals contacted, 23 met our eligibility criteria and confirmed their interest. Interviews were subsequently scheduled. Fifteen of the 23 interviews were with individuals representing 12 Nation or Tribal fishery agencies, and eight individuals representing four intertribal (or similar) organizations. Six Tribes and three intertribal agencies were based in the United States, while six First Nations and one fishery agencies representing multiple First Nations were based in Canada. Consent was obtained through written or verbal means before the interviews. Participants who agreed to receive an honorarium were offered Can $200 in gratitude for their time and participation (many participants were unable to accept honoraria given their role).

Data collection

Participants were assigned code numbers to ensure confidentiality during transcription, analysis, and reporting of results. Ethics approval for the research procedures was obtained from the Carleton University Research Ethics Board-B, in accordance with the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (protocol #117457).

Our project adhered to the First Nations principle of OCAP, meaning that participants had rights to own, control, access, and possess the information they shared (First Nations Information Governance Centre, https://fnigc.ca/ocap-training/). For example, after transcription was completed, a summary of the key points was created, and both the summary and full transcript were shared with participants for their review, verification, and potential expansion. Response and conversation were welcomed at all stages of the analysis. Some participants provided edits and suggestions to their transcripts, which were incorporated into the final document before analysis. Adjustments were made if any participant requested changes after the analysis was completed; there were no instances where reported results could not be revised.

Semi-structured interviews lasted between 50 and 180 min and were conducted by H. Postma between June and October 2022. The majority of interviews (19 of 23) were conducted through Zoom, 2 took place in person, and 2 by phone. It is important to note that at the time of the interviews, concerns about the COVID-19 pandemic were still present and may have influenced participant preference to connect online. The interview guide was developed collaboratively with the larger research and covered various topics related to participant backgrounds, fisheries priorities, reflections on Sea Lamprey and fisheries decision making, and approaches to co-management relationships in the Great Lakes. The interviews were recorded using Zoom internal recording software, or Open Broadcaster Software as a backup. The best quality recording was retained, transcribed using Trint transcription software, and manually reviewed and corrected using the audio recordings.

Analysis methods and techniques

Transcripts were analyzed using a thematic analysis approach, specifically employing the codebook method with a general inductive approach following D. R. Thomas (2006). In the first phase, each interview transcript was read and summarized. The second phase involved generating initial codes, which were then applied to the transcripts using NVivo 12.0 qualitative data analysis software. A final codebook was developed, incorporating new codes that emerged during the initial coding analysis.

The qualitative analysis focused on finding thematic patterns and areas of consensus among participants. Each participant was asked to describe their learning background and experiences preparing them for their employment to (1) assess the extent of their preparedness, and (2) identify learning and/or training experiences that were useful for performing well in their role working for Indigenous fisheries agencies.

Codes with related content were grouped into categories and summarized in the results (e.g., learning experiences found most useful). To ensure accuracy, themes were reviewed, and data excerpts were reread to ensure that participants' responses were represented accurately and within their original context. The emergent themes from this study are supported with quotations and excerpts from within the interviews to present commonly held views of multiple participants. There are some commonalities and overlap between the themes reflecting the interconnectedness of issues around Indigenous knowledge, training, and environmental practice. The quotations describe themes and intend to ground content within their original context (and relationship) with other ideas.

RESULTS AND DISCUSSION

Participants (identified as FP [fisheries professional] plus their designated number in all of the following quotes) were asked to describe their background and learning experiences to identify experiences that may be helpful for next (and current) generations of fisheries professionals working for Indigenous fisheries agencies.

Participant learning backgrounds and preparedness for roles

Participants described their scopes of work as being guided by the interests and perspectives of the Indigenous communities they are affiliated with and received primarily from Indigenous leaders and councils/committees. Participants' work responsibilities ranged from interacting with community members to carrying out biological assessments to negotiating and advocating for Indigenous interests in collaborative and multijurisdictional spaces. When interacting with others (such as community members or external partners), participants described responsibilities to connect and communicate different perspectives about science and decision making. One participant shared the following:

> Part of our mission at [intertribal agency] ... is that we infuse culture into all aspects of our work. That, right there, is two-eyed seeing. I need to bring my best sciences to the table,

Downloaded from academic.oup.com/fisheries/article/51/6/239/8490441 by guest on 30 September 2026

> and I also need to infuse that science with [Indigenous] culture. That's the two ways of looking at things, and that's not an easy prospect, right? This is difficult work. It's new. There's no playbook, and we're constantly learning ... Each day, I am thinking about both the [Western] science way of looking, and the Indigenous way of looking (FP16, INTTR).

Nearly all participants ($n = 22$) described their learning backgrounds to include Western training (e.g., 75% of participants referenced a master's degree or further level of study). Other experiences included diverse work opportunities (e.g., employment with other Indigenous fisheries agencies or with environmental nongovernmental organizations to gain field and "soft" office skills), and cultural and/or outdoors education gained from living in or spending time on community lands.

Participants gave varied responses to the question, "Did you feel prepared coming into your role?" A minority of participants said "yes" (4 of 23), but also described ways in which they could have been better prepared. Many participants told us they did not feel prepared. One participant shared the following:

> Interviewer: Do you feel that those different [background] experiences prepared you well for your current role?
>
> Participant: No, because mostly with fisheries, in grad school and undergrad, it's all research and working with the animals and doing your studies and writing those studies up … there's a whole social interaction that you have to have as a biologist … you have to figure out a way to communicate what you found effectively [to people that aren't in the profession]. And that just wasn't something that was developed when I was in school … So, in terms of the science, school is great. You're learning how to develop hypotheses … but learning to communicate to other people? That has been a [new] learning experience (FP03, INTTR).

Participants explained that they did not expect, nor did they receive training, to navigate interpersonal dimensions. One participant shared an example of how their role extended beyond biological responsibilities, saying the following:

> All of this work that we're doing is about humans. It involves fish and habitat, and wildlife and habitat, but it's a human-to-human job. The skills you need to succeed are the human-to-human skills … and folks have told me that they didn't know that they were getting into a human dimensions job (FP15, TRG).

Some participants noted that they expected their professional responsibilities to be more than biological. However, they were not prepared for the degree to which their work would require navigating relationships and drawing upon approaches to science and decision making that differed from what was learned in Western education. One participant described how coming into these roles required a "different way of thinking and communicating" and that "it's a little jarring when you come straight from other graduate programs, like, from academia, it's a very different way of interacting with the environment" (FP03, INTTR). Another participant explained that "it's a fair learning curve. I'm a white guy with a Western science background coming into an Indigenous community that doesn't necessarily follow [Western-based scientific approaches]" (FP11, INTTR).

When asked what elements of their learning or training helped prepare them for their role, many participants indicated a lack of preparedness for the relational elements of their work. One participant mentioned that "absolutely nothing that could have prepared me for it" (FP07, TRG), while another explained that "the only way to prepare for it is just to have an open mind and good work ethic and come in and try to figure it out" (FP12, TRG). Participants frequently spoke about acquiring relevant skills through "experience and exposure" (FP23, INTTR), on-the-job training, and place-based learning opportunities. Many indicated that department leaders and mentors (such as community Knowledge Holders, Indigenous fisheries colleagues, and other community citizens) were instrumental in developing an understanding of their role. They also described learning from resources that were made available through intertribal agencies (e.g., introductory resources to Anishinaabemowin) and spending time on Indigenous lands and with the peoples who live on those lands.

Attending community events was described as important for relationship building, identifying mentors, and learning about community interests and perspectives. Several non-Indigenous participants explained that their values and beliefs are what shaped their interest in working for Indigenous agencies. For example, perspectives centered on human–nature connectivity and the long-term preservation of natural resources were common areas of connection. Two participants shared how they gained the experiences to work successfully in their roles:

> You come in with a background of fish biology and science, [but] it's not about science, it's about everything else that comes with it. It's about the people. I made my own effort … I started attending ceremonies and powwows. I kind of immersed myself, and I think that's how you learn [in these types of roles] (FP07, TRG).
>
> If I had to design a course, or the curriculum for that course, in order to teach somebody about this job? I couldn't do it. And I was an instructor for 30 years … It's pretty much on-the-job learning, and training, and talking to local residents and making sure you're listening and hearing what they're telling you (FP20, FNG).

Western education was described as a relevant requisite to participants' abilities to carry out technical work and "go toe-to-toe with the other biologists" (FP06, INTTR). However, several participants noted that Western training (and a mindset focused exclusively on Western training) can be a limitation. One participant explained the following:

> I think formal education puts you on a level playing field with the state or federal or other biologists. If you don't have that formal education, I sometimes get the impression that they don't value what you're saying as much. Now, on the flip side, I've received comments from Tribal Elders that my formal education means pretty much nothing to them … The

Downloaded from academic.oup.com/fisheries/article/51/6/239/8490441 by guest on 30 September 2026

> gist of it was that I need a better education in their lifeways, and that my formal education did not prepare me to interact with the Tribes. Yeah, so, I guess formal education helped, but it was also a hindrance in some regards (FP02, INTTR).

Participants described how a diversity of professional and lived experiences proved helpful because of the wide variety of roles one is expected to fill. One participant said, "we don't have as much capacity as a bigger agency. You're expected to do more, wear a whole bunch of different hats" (FP12, TRG). Participants mentioned that in-field training and abilities (e.g., setting nets, trailering) were skills desired by employers and useful in day-to-day work. Others spoke of the benefit of having developed "soft-office skills" (FP01, FNG; e.g., learning to write grants, develop work plans, and manage tight budgets). In this study, 8 of the 23 participants mentioned that they had previous work experience with Indigenous agencies other than the one they currently work for. Although these experiences helped individuals know what to expect, we learned that each position and each Indigenous agency (and the communities they serve) is unique. Indigenous participants described how their background—such as growing up on the land and "[having] a very strong ecological knowledge and a lot of strong outdoors experience" (FP01, FNG)—provided a foundation from which to draw from in complement to other academic and professional learning experiences.

Indigenous fisheries agencies tend to be smaller organizations than state, federal, and provincial counterparts, and often operate with comparatively less overall funding and human capacity, e.g., "there's one person that's in charge of doing all of these activities and serving on all these committees, and I don't think anything really prepares you for that" (FP19, FNG). Participants referenced "interacting on committees that people don't usually serve on until much later in their career" (FP12, TRG). We also learned that positions are typically funded through proposals and grants, relying on funding provided by federal and state/provincial governments. Other scholars (e.g., Parsons et al., 2021; Wilson, 2020) describe how funding for Indigenous governments can change in response to shifting government priorities. This means that roles can be unstable in nature, and departments may only be able to employ a few individuals, as they are often underfunded and under-resourced due to externally imposed constraints, such as narrowly defined eligibility for funding programs or short-term grant cycles that do not align with long-term planning (and not a lack of capacity on the part of these agencies, organizations, and/or individuals).

Working with Indigenous ways of knowing: Preparation and experiences

All participants told us they were guided by Indigenous ways of knowing in their roles. However, many participants (both non-Indigenous and Indigenous) emphasized that they did not make decisions on behalf of Indigenous communities. One participant shared an illustrative example of how Indigenous knowledge played a role in shaping their work:

> I was riding with one of the [Indigenous] commercial fishers, and we were going over a spawning reef. He said the mining tailings that are on the shore are moving toward this reef, they're going to cover this reef, and there aren't going to be any fish spawning here. And I'm going to get blamed that I overfished them. Then he said, "You need to do something." Well, we wrote up a study, we studied the reef, we documented where those mining tailings were in the water in relation to the reef. And, over the course of my career, we've been trying to get those mine tailings sands removed … It all comes back to riding on a commercial fishing tug with a Tribal member who had fished there for generations, and who knew that changes were happening to that reef (FP06, INTTR).

In their roles, participants described "learning new ways to think about things that do not exist in Western literature" (FP14, TRG). They expressed an interest in and need for more Indigenous approaches to science and planning in collaborative decision making (such as a perspective that prioritizes preservation over restoration initiatives). One participant shared an illustrative example:

> Interviewer: Do you use Indigenous knowledge in your role?
>
> Participant: [There] needs to be a lot more. I'll give you a real-life example that happened in Lake Huron. Under the 2000 Consent Decree, the parties, much to my dismay, agreed to manage lake trout … with a model generated quota that had never been tried here in the Great Lakes before … The quota that the models introduced did not seem to match what we were seeing on the water, or what Tribal fishers were seeing on the water. Tribal fishers on Lake Huron have been there for a very long time. They saw changes coming … We would talk to them at committee meetings, and I would have to talk to them about next years' quota. And [I remember] they looked at me with daggers and said, "You don't have a clue what you're talking about. That's not what we're seeing. We're seeing this" … And, lo and behold, a couple of years later, the modeling group had to recognize that the model wasn't working, it was not lining up with what was being observed on the water. So, the parties stepped in and negotiated a harvest limit, which was the very thing the state said they didn't want to do under the 2000 Consent Decree. They wanted to remove all politics from quota management, make it "science-based." But it wasn't working, and everything the fishers said they were observing ultimately turned out to be right (FP23, INTTR)

Participants emphasized that Indigenous ways of knowing are distinct to the communities and peoples from which they originate, emphasizing the importance of preserving the integrity of each distinct knowledge system when sharing information. These responses echo scholars such as Wilson et al. (2018) and Nonkes et al. (2023), who suggest that while Indigenous knowledge systems can help improve understanding of environmental change (such as through place-based and long-term data sets), involvement cannot be uncoupled from the community or peoples from which it originates, nor their involvement in decision making.

Downloaded from academic.oup.com/fisheries/article/51/6/239/8490441 by guest on 30 September 2026

When asked how they learned about working with Indigenous ways of knowing in their roles, participants referenced mentorship from department leaders and Indigenous mentors, e.g., "I try to lean on our Elders, our commercial fishers, as much as possible because they have a very detailed, long history of [Indigenous knowledge] that I'd say is generally unknown to, you know, the scientists working in the area" (FP12, TRG). Some participants explained that learning about Indigenous ways of knowing "[is] very off the cuff and requires just a lot of interfacing with our community [members]" (FP18, TRG). One participant explained that they "learned a lot from [my boss and coworkers] about living this way, thanking the animals that give their lives for us each and every day, and by saying prayers and going to ceremonies and doing things the way we culturally should be doing them" (FP14, TRG).

We come to understand that although non-Indigenous individuals can acquire some learning experiences about Indigenous ways of knowing, it is Indigenous communities who hold these knowledge systems and perspectives. Some participants explained how a more direct relationship between colonial fisheries agencies and the community an Indigenous fisheries agency is affiliated with could support greater knowledge in collaborative decision making. For example participants said the following:

> There's a push to include, whatever you want to call it, it's got a million names, but Traditional Ecological Knowledge, or Indigenous Knowledge, into the proposals and into the actual work. And they contact me and I'm like, "I don't know what to put in there." I think maybe connecting those researchers to [a group of Elders that would advise on fisheries-related issues] and kind of being the go between, or mediator facilitator, could be very beneficial to both parties (FP02, INTTR).

> Tribal biologists are all still, at least in Michigan, all Western trained. They're mostly settler descendants. And so, in many cases, [co-managers are] preaching to the choir … what would it look like if instead of engaging with us, what would it look like if [they] engaged with Tribal citizenry? (FP15, TRG).

Bridging ways of knowing: Preparation and experiences

Participants told us they had not received training related to working with multiple knowledges, with one stating "it's not something that's built into formal education" (FP02, INTTR). They expressed interest in having access to such trainings and suggested that opportunities are likely to arise in the short- and long-term, e.g., "there probably are examples of [trainings related to bridging knowledge systems] that I'm not aware of because we are in a new sort of age" (FP09, FNG).

Some participants referenced the Reid et al. (2021) paper, "Two-Eyed Seeing: An Indigenous framework to transform fisheries research and management" as an informative piece to guide future work. Participants also described that working with both Indigenous and Western knowledge systems was a fundamental part of their roles. Participants explained the following:

> Training that weaves together two different ways of knowing? … No, I mean, I think that's something we do in our jobs consciously. It's more of an active, engaging component than it is something that's really taught. That'd be interesting, though, and I think we're there now, where you could probably create a curriculum around [working with multiple knowledges]. In terms of that two-eyed seeing approach, it's just something I do in my own job, my workflows and in my research methodologies (FP09, FNG).

When asked how they were able to work with multiple knowledges without training, most participants struggled to be specific. Some participants described bridging knowledges as an ongoing learning process that involves drawing from new and diverse experiences, interactions with community citizens, and "think[ing] about the science way of looking, and the Indigenous perspective way of looking" (FP16, INTTR).

Most participants in this study were familiar with Mi'kmaw Elder, Albert Marshall's Etuaptmumk framework and used "Two-Eyed Seeing" unprompted and interchangeably throughout the interviews. Participants often described two-eyed seeing as a way to communicate knowledges, e.g., "[a lot of our role is] listening and hearing what [Indigenous citizens] say, and then being able to translate it into "science talk," right, and then when the science people talk, I'm able to translate it back into the way the Tribal leaders are talking about things" (FP16, INTTR). One participant shared how seeing with many eyes is important and helpful, saying, "rather than two-eyed, I'd say many-eyed seeing" (FP20, FNG).

Participants emphasized the benefit and necessity of working together across the Great Lakes, including with diverse perspectives and varying worldviews. One participant explained how "a lot of the challenges that we're facing now? No one agency can do it on its own. We have to do it with partners, or we're all going to fail. It's becoming more and more important" (FP02, INTTR).

Preparing current and future fisheries professionals

Participants identified a number of recommendations to guide both current and future fisheries professionals (Table 2). These are not limited to individuals currently working for Indigenous fisheries agencies but can be applicable to all individuals engaged in spaces involving Indigenous and non-Indigenous interests and perspectives. These findings highlight participant reflections and suggestions (e.g., what was missing from their learning experiences and what would have been or would be helpful to receive).

Preparedness would (ideally) include both technical experiences (such as those gained from Western academic institutions) and interpersonal training/learning experiences (such as conflict resolution training and learning how to work respectfully with multiple knowledge systems). Cross cultural training should include both broad and community-specific learning experiences, such as Indigenous and settler–colonial histories and learning experiences related to the traditions, languages, and practices of individual communities. Several participants noted that the best ways to learn were to "get involved in everything, do not sit on your hands" (FP23, INTTR) and to "just ask questions" (FP11, TRG).

Downloaded from academic.oup.com/fisheries/article/51/6/239/8490441 by guest on 30 September 2026

Table 2. Learning opportunities that could be helpful for fisheries professionals working for or in collaboration with Indigenous groups. Reflections are grouped into organizing themes and listed in order from most referenced (top) to least (bottom). Illustrative quotes are provided as examples. OCAP = own, control, access, and possess (pertaining to information).

Reflection	Participant voices
Complete mandatory courses about Indigenous and settler-colonial histories, including Indigenous rights (inherent, treaty).	(Interviewer: Would you feel that those courses would be beneficial to graduate students, fishery graduate students?) "Yes, no doubt. It's an attitudinal thing. My experience is that [the state] doesn't like the fact that we're doing what we're doing [fishing pursuant to Treaty rights]. And they act that way … Because either they don't get it, or they don't want to get it … If someone is going to work in the field of Great Lakes fisheries, if they have a career path in fisheries management, they should understand Treaty rights." (FP23, INTTR)
Participate in cross cultural learning opportunities (e.g., cultural awareness and sensitivity training as part of onboarding requirements; integrate multicultural learning requirements into graduate programs).	"I think cultural awareness would also be good for people who have been in this field for a long time, because, especially with the [state], there are a lot of biologists that are set in their ways, and set in their viewpoints, and they're hesitant to kind of accept other viewpoints. I think a broader appreciation for different perspectives would be good." (FP03, INTTR) "I think engaging with both the American Fisheries Society as well as the Native American Fisheries Society would help folks get an idea of both viewpoints early on." (FP02, TRG) "We train our up-and-coming professionals well in the sciences, hypothesis testing, statistics, all of that. But we do not train them at all in cross-cultural abilities, and that is a major weakness in our graduate level training … I'm trying to convince universities … that this kind of cross-cultural education needs to be a requirement in their graduate educational structures … And there are [more and more] receptive audiences out there … But it's a major hole in our natural resources educational process." (FP16, INTTR)
Receive training/experience in how to communicate in respectful and equity-seeking ways across diverse groups.	"The other thing that I think is missing [in our education system] is being able to convey, so, if worldviews are in the minority, how to convey those and in a way that puts them on the same level playing field as a predominating world view. And I guess the other piece of that is how to negotiate effectively with other co-managers. It's something that was never taught." (FP02, INTTR) "If they exist, take a lot of courses that offer the two-eyed seeing approach. Because, to come on a reserve with a wholly-Western-approach, it'd just, it'd go over the head [of the community] a bunch of the time. Like, if you go to Council with a big document with a bunch of wording, a bunch of scientific words in it, it doesn't go very far. So, you have to use our approach to it, and bring both together. It goes over a lot smoother that way." (FP17, FNG)
Seek training/experience in how to work effectively and ethically with multiple knowledge systems.	"I would like to see, if there was to be a formal training, both parties come together and present both viewpoints, and maybe provide case studies, like how and where [co-management] can work really well, and then where it can just be a dumpster fire … I think that would help students to see that range of interactions between scientists and Tribal members, or managers and Tribal members, and get an idea of those paths that are successful and the ones that are not." (FP02, INTTR) "I don't know of any courses, although there are some schools that are developing curriculum [that focuses on] Indigenous knowledge and Western science. I think it's getting there, but it's not on the curriculum quite yet." (FP06, INTTR)
Spend time in Indigenous communities and with the people who live in those communities (e.g., internships).	"My recommendation to a student would be to try to get an internship with an Indigenous agency, or with an agency that's working within Indigenous communities, say, Fish and Wildlife Service." (FP06, INTTR) "I think that there's so much value in the knowledge that comes from within the community. And so I think the only real way you could get that is from actually being here on the ground and being open to learning from people … I don't know if there would really be another way to do that, except for going out with fishers and going fishing with them for the day and listening to what they had to say." (FP22, FNG)
Participate in conflict resolution/navigation training.	"Conflict resolution will be something nice to get training in, because when negotiating agreements with other parties there tends to be a lot of conflict. Pretty hard to navigate, sometimes, not being trained in that." (FP12, TRG)
Learn about Indigenous data sovereignty (e.g., OCAP).	"Just recently I took an online course, the First Nations Principles of OCAP, which is ownership, control, access and possession. That was a surprisingly good online course which I think would probably be valuable for anyone that works with data and Indigenous communities." (FP01, FNG)
Embrace self-directed efforts to learn about the land, including whose lands you are on, the geographies and biota, the stewardship practices.	"Anything that goes over traditional land use and anything that could kind of help you, like regulatory requirements … Understanding whose land you're on." (FP05, INTFN) "I mean, having a good background on local communities, species, is invaluable. If you're going to be working with fish … know what different species there are." (FP10, TRG)
Consider history and management structures relevant to a given location/issue (i.e., context).	"One of the biggest challenges when I first came was understanding the players. You know, we didn't spend much time talking about governance. And I think we should do a better job of that at university. I think if you graduate with a bachelor's degree in fisheries, especially from a place that's on the Great Lakes, you should be able to draw a chart of what Great Lakes management governance looks like." (FP15, TRG)
Enroll in interdisciplinary courses that frame natural resource management in a more holistic and encompassing manner.	"In the current world of fisheries management, it's modeling, modeling, modeling. Every time you turn around, there's another course in modeling. I think a lot of fisheries professionals come out of grad school with modelling drilled into them, but when they get into the real world, they think all they need to do is write a model and the managers should just do what the model says. And it just almost never works out. Some managers will say, 'I don't believe what your model is telling me because I've seen this over my lifetime, that's contrary to what your model says', that type of thing … I think leaning more towards interdisciplinary approaches in graduate school could encourage some of that, and maybe we'll drift that way, when First Nations and Tribes push us that way." (FP23, INTTR)

Downloaded from academic.oup.com/fisheries/article/51/6/239/8490441 by guest on 30 September 2026

Participants told us that training attuned to the diverse and interpersonal scopes of work that fisheries professionals across contexts encounter can be helpful in preparing for a role working for or in collaboration with an Indigenous fisheries agency (as a Tribal or First Nation representative, or as an employee from a non-Indigenous government/government agency working in collaboration with Indigenous groups). However, participants emphasized that training is just one part of what can contribute to an individual's success in working with or for Indigenous communities. Throughout the interviews, participants told us that individuals require "the right kind of attitude" (FP17, FNG) and a "good heart" (FP15, TRG). One participant explained, "The only way to really learn [if someone has what it takes] is to test one's diplomatic ability, the skills to work with others. Sometimes it's not the trainable traits that give an idea of how well you'll do working with other governments" (FP23, INTTR).

Characteristics of healthy and effective relationships

This section presents findings about the characteristics important to relationships that can help translate learning experiences into positive action between individuals involved in spaces that represent a diversity of perspectives. Coding of the interview data resulted in the identification of four interacting main themes and are illustrated by participant quotes. These include genuine intentions, respect, openmindedness, and honesty, and were developed based on their frequency in the data. Within each of the four main themes, individual willingness emerged as a key underlying factor. Attitudes with these characteristics can translate to a willingness to embrace training, to learn about and appreciate the ways of knowing and perspectives of each other, and to build healthy relationships with which to carry out effective collaborative work. Attitudes can be encouraged in agency departments by leaders and mentors who model these characteristics.

Genuine intentions

Successful collaboration can be defined as the ability of all involved parties to achieve mutual and individual goals (Dwyer, 2010; Newell & Bain, 2018). However, considering the historical and contemporary context of hegemonic control, and the underfunding generally experienced by Indigenous communities/governments, participants expressed that it has a "big [positive] impact" when individuals and agencies working for non-Indigenous institutions "[use their] own skills and [their] own resources to do a project … that benefits [the] community" (FP01, FNG). We learned that genuine relationships require commitments of time and mutual benefits and go beyond short-term projects and interactions to emphasize equitable and enduring partnerships. One example includes the following:

> [working] with communities directly as a partner, not as a land consultant that you have to talk to. Actually being involved, maybe hiring monitors and coordinators and putting that money into the community to kind of build those capacities … Genuine help, wanting to engage communities and work with them and learn from them, not only just to do work, but to learn from them and the areas and the culture (FP09, FNG).

Respect

Respect is foundational to successful relationships, encompassing both the individuals involved and their perspectives/worldviews (Gerpott et al., 2019). We learned that respect involves embracing other ways of knowing as valid, important, and on a par with Western/contemporary approaches. It involves understanding that Indigenous governments have distinct rights and knowledges that include ceremony, laws, governance structures, languages, and traditions. Indigenous rights "do not start and stop with counting fish at the dock" (FP15, TRG), and Indigenous knowledge systems are not homogenous, e.g., "What's valued in one group may not be valued in the same ways as another group, or there may be a different perspective … It's not a monolith. There's a lot of different cultures and entities within [the Indigenous population]" (FP13, TRG). Several participants explained that shared values of protecting natural resources can help diverse parties find and focus on common ground. Respect involves thoughtful consideration towards others and realizes the implication of power disparities that advantage and normalize Western ways of thinking, communicating, and acting.

Open mind, open ears, open heart

A willingness to listen to and embrace new ways of knowing is a "critical characteristic of successful research … when a researcher comes in and they're rigid in their way of thinking and doing things, that usually does not work well" (FP16, INTTR). Openness to new perspectives between Indigenous and non-Indigenous actors can help address existing prejudices. One participant explained the following:

> If you have somebody that comes in [to these roles and spaces] with a preconceived notion of how things are done, whether it's [a perspective that] Tribal fisheries are depleting the resources and, you know, taking away all the opportunities, I think you're going to have some issues. But if you are open and willing to listen, and willing to learn and willing to accept that, you know, there are these Treaties and there's these rights that these groups of people have, and what they, what they sacrificed for to get those rights … being open and willing to listen and being educated on both sides is vital to successful relationships (FP08, INTTR).

Honesty

Transparency and accountability in interactions (e.g., being clear and upfront about reasons for engagement) can help individuals and agencies ensure that relationships are based on intentions of equitable collaboration and shared objectives, rather than opportunism or the interests of other parties. We learn that good communication (e.g., early and consistent dialogue) and the willingness to share information, including about topics beyond mandates or other parties' interests, helps reduce doubt and develop foundations of trust.

CONCLUSION

An overarching theme in our study was that participants (mostly Western trained) felt largely underprepared coming

Downloaded from academic.oup.com/fisheries/article/51/6/239/8490441 by guest on 30 September 2026

into their roles. These Indigenous fisheries agency professionals explained that while they expected their professional responsibilities to be more than biological, they were not prepared for the extent to which their scopes of work would require navigating relationships and drawing upon approaches to science and management that differed from what they had learned in Western education. Participants also emphasized that Indigenous ways of knowing are distinct to the communities and peoples from which it originates. They referenced responsibility to, as one participant said, "infuse Indigenous perspectives and culture in all aspects" (FP16, INTTR) of their work. Many participants highlighted how learning opportunities related to working with multiple knowledges, such as training in frameworks that honor/enable pluralism (e.g., Etuaptmumk, Two Row Wampum), would be helpful to receive. They noted that while they themselves had not received formal training, drawing upon both Indigenous and Western knowledges was an inherent aspect of their role and something that is increasingly being embraced by other government agencies and bodies (see Kadykalo et al., 2021).

Learning experiences necessary for effective work were largely gained on-the-job, including through agency and organizational leaders and community mentorship, and by participating in community events and activities. A background in Western education was described as a relevant requisite to interact with biologists from other non-Indigenous agencies, but it was also described as a possible limitation insofar that a mindset focused exclusively on Western training can hinder growth and fuller understanding. Participants noted that Western education did not include any learning experiences related to Indigenous ways of knowing, Indigenous and settler–colonial histories, or how to communicate and engage in spaces where diverse interests and perspectives were present. Fortunately, there are a growing number of resources to support such learnings (see Mussett et al., 2023; Reid et al., 2024; Wong et al., 2020), including the findings from this study. Additional examples exist with an express focus on readying next generations of Indigenous fisheries leaders, including the Centre for Indigenous Fisheries (https://www.cif.fish/) at The University of British Columbia (the affiliation of authors E. Nyboer [at the time this work took place], A. Duncan, and A. Reid) and Tamamta (a National Science Foundation Research Traineeship program, https://tamamta.org/) at the University of Alaska.

Participants provided reflections that could be helpful for current and future fisheries professionals who work in spaces that involve Indigenous and non-Indigenous interests and perspectives. Several of these recommendations could be pursued through courses for students or as professional development (as per Appleton et al., 2022; Chinn, 2007). For example, obtaining a certificate in Tribal relations from Portland State University (a program that seeks to improve working relationships between individuals who work for non-Indigenous agencies and the Indigenous communities they serve) or completing the skill-based training offered by Indigenous Corporate Training (https://www.ictinc.ca/). Additionally, the Indigenous Protected and Conserved Areas Knowledge Basket (https://bit.ly/49DdlsE) offers a toolkit for respectful collaboration with Indigenous Peoples that focuses on building relationships grounded in truth and trust, and the U.S. Fish & Wildlife Service hosts a variety of Indigenous relations training courses. These are just some myriad examples of established or new training offerings that can help bridge some of the gaps identified in this work.

These findings highlight the role of the individual in enacting meaningful progress. While the learning opportunities identified (Table 2) were acknowledged as constructive, participants emphasized that having the right attitude and a "good heart" (FP15, TRG) were critical for success when working with (as a collaborative partner/agency) or for (as a representative of) Indigenous communities. The key characteristics that establish a conducive environment for healthy and effective relationships include genuine intentions, respect, openmindedness, and honesty. Underlying each of these is the willingness to learn from and embrace the perspectives of others. Encouraging such relational characteristics in agency departments and organizations, supported by leaders and mentors who model these attitudes/values, can support Indigenous Peoples and partnerships, as well as promote beneficial outcomes for all. In the context of this paper and topic, beneficial outcomes would include ensuring that all fisheries professionals receive training to prepare them for working with Indigenous Peoples (including Indigenous fisheries professionals), governments, and knowledge systems (no matter their employer) in ways that are respectful, ethical, and informed.

DATA AVAILABILITY

This project adhered to OCAP, meaning that participants had rights to own, control, access, and possess the information they shared.

ETHICS STATEMENT

Ethics approval for the research procedures was obtained from the Carleton University Research Ethics Board-B, in accordance with the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (protocol #117457).

FUNDING

This work is part of the collaborative project titled "Understanding Indigenous Perspectives on Sea Lamprey Control in the Laurentian Great Lakes" (3I Project) led by Andrea Reid from the University of British Columbia Centre for Indigenous Fisheries. The 3I Project (project code 2021_REI_541002) is funded in full by the Great Lakes Fishery Commission.

CONFLICTS OF INTEREST

Author S. J. Cooke holds the position of Editor in Chief for *Fisheries*, and authors E. A. Nyboer and V. M. Nguyen hold the position of Science Editor for *Fisheries*, and they did not participate in the review of this manuscript.

ACKNOWLEDGMENTS

We acknowledge with gratitude the support of Jessica Barber, Mike Steeves, and Gary Pritchard in providing input on this

Downloaded from academic.oup.com/fisheries/article/51/6/239/8490441 by guest on 30 September 2026

research and the resulting paper. We also thank the interviewees who shared their insights—thank you for your time and commitment to supporting this research.

REFERENCES

Almack, K., Dunlop, E. S., Lauzon, R., Nadjiwon, S., & Duncan, A. T. (2023). Building trust through the two-eyed seeing approach to joint fisheries research. *Journal of Great Lakes Research*, *49*, 46–57. https://doi.org/10.1016/j.jglr.2022.11.005

Appleton, M. R, Barborak, J. R., Daltry, J. C., Long, B., O'Connell, M., Owen, N. R., Singh, R., Parkes, E. S., Sterling, E. J., & Valencia, L. M. (2022). How should conservation be professionalized? *Oryx: The Journal of the Fauna Preservation Society*, *56*, 654–663. https://doi.org/10.1017/S0030605321000594

Carrier Sekani Tribal Council. (2016). *Yinke Dene "Uza'hne" guide to surface water quality standards*. https://bit.ly/4oi1x2F

Chinn, P. W. U. (2007). Decolonizing methodologies and indigenous knowledge: The role of culture, place and personal experience in professional development. *Journal of Research in Science Teaching*, *44*, 1247–1268. https://doi.org/10.1002/tea.20192

Constitution Act. (1982). *Being Schedule B to the Canada Act 1982* (UK, 1982, c. 11).

Dwyer, A. (2010). Models of successful collaboration. In L. A. Grenoble & N. L. Furbee (Eds.), *Language documentation: Practice and values* (pp. 193–212). John Benjamins Publishing Company. https://doi.org/10.1075/z.158.19dwy

Fixico, D. L. (1994). The alliance of the three fires in trade and war, 1630–1812. *The Michigan Historical Review*, *20*, 1–23. https://doi.org/10.2307/20173458

Gaden, M., Goddard, C., & Read, J. (2013). Multi-jurisdictional management of the shared Great Lakes fishery: Transcending conflict and diffuse political authority. In W. Taylor, A. Lynch, & N. Leonard (Eds.), *Great Lakes fisheries policy and management: A binational perspective* (2nd ed., pp. 305–338). Michigan State University Press.

Gaden, M., Krueger, C., Goddard, G., & Barnhart, G. (2008). A joint strategic plan for management of Great Lakes fisheries: A cooperative regime in a multi-jurisdictional setting. *Aquatic and Ecosystem Health Management*, *11*, 50–60. https://doi.org/10.1080/14634980701877043

Gerpott, F. H., Fasbender, U., & Burmeister, A. (2019). Respectful leadership and followers' knowledge sharing: A social mindfulness lens. *Human Relations; Studies Towards the Integration of the Social Sciences*, *73*, 789–810. https://doi.org/10.1177/0018726719844813

Honebein, P. C. (1996). Seven goals for the design of constructivist learning environments. In B. G. Wilson, (Ed.), *Constructivist learning environments: Case studies in instructional design* (pp. 11–24). Educational Technology Publications.

Hsiao, E. C. (2012). Whanganui river agreement—Indigenous rights and rights of nature. *Environmental Policy and Law*, *42*, 371–375. https://doi.org/10.3233/EPL-2012-42_6_05

Jacobs, D. M., & Lytwyn, V. P. (2020). Naagan ge bezhig emkwaan: A dish with one spoon reconsidered. *Ontario History*, *112*, 191–210. https://doi.org/10.7202/1072237ar

Kadykalo, A. N., Cooke, S. J., & Young, N. (2021). The role of western-based scientific, Indigenous, and local knowledge in wildlife management and conservation. *People and Nature*, *3*, 610–626. https://doi.org/10.1002/pan3.10241

Kramm, M. (2020). When a river becomes a person. *Journal of Human Development and Capabilities*, *21*, 307–319. https://doi.org/10.1080/19452829.2020.1801610

Krueger, C. C., & Decker, D. J. (1999). The process of fisheries management. In W. A. Hubert & M. C. Quist (Eds.), *Inland fisheries management in North America* (3rd ed., pp. 31–59). American Fisheries Society. https://doi.org/10.47886/9781934874165.ch5

Lac Courte Oreilles Band of Lake Superior Chippewa Indians v. Voigt, 700 F.2d 341 (7th Cir. 1983). https://law.justia.com/cases/federal/appellate-courts/F2/700/341/117313/

Lowitt, K., Levkoe, C., Lauzon, R., & Ryan, K. (2019). Indigenous self-determination and food sovereignty through fisheries governance in the Great Lakes region. In P. Andrée, J. K. Clark, C. Z. Levkoe, & K. Lowitt (Eds.), *Civil society and social movements in food system governance* (pp. 105–120). Routledge.

Lowitt, K., Levkoe, C. Z., & Sayers, D. (2023). Towards self-determination and resurgence in small-scale fisheries: Insights from Batchewana First Nation fisheries. *Maritime Studies: MAST*, *22*, Article 4. https://doi.org/10.1007/s40152-022-00292-z

Lytwyn, V. P. (1997). A dish with one spoon: The shared hunting grounds agreement in the Great Lakes and St. Lawrence valley region. In D. H. Pentland (Ed.), *Papers of the twenty-eighth Algonquian conference* (Vol. *28*, pp. 210–225). University of Manitoba.

Mackenzie, N., & Knipe, S. (2006). Research dilemmas: Paradigms, methods, and methodology. *Issues in Educational Research*, *16*, 193–205. https://www.iier.org.au/iier16/mackenzie.html

McGregor, D., Latulippe, N., Whitlow, R., Gansworth, K. L., McGregor, L., & Allen, S. (2023). Towards meaningful research and engagement: Indigenous knowledge systems and Great Lakes governance. *Journal of Great Lakes Research*, *49*, 22–31. https://doi.org/10.1016/j.jglr.2023.02.009

Minnesota v. Mille Lacs Band of Chippewa Indians, 526 U.S. 172 (1999). https://supreme.justia.com/cases/federal/us/526/172/

Minnesota v. Mille Lacs Band of Chippewa Indians, 526 U.S. 172 (1999). https://supreme.justia.com/cases/federal/us/526/172/

Muller, K. V. (2007). The two "mystery" belts of grand river: A biography of the two row wampum and the friendship belt. *American Indian Quarterly*, *31*, 129–164. https://doi.org/10.1353/aiq.2007.0013

Muller, S., Hemming, S., & Rigney, D. (2019). Indigenous sovereignties: Relational ontologies and environmental management. *Geographical Research*, *57*, 399–410. https://doi.org/10.1111/1745-5871.12362

Mussett, K. J., Chiblow, S. B., McGregor, D., Whitlow, R., Lauzon, R., Almack, K., Boucher, N., Duncan, A. T., & Reid, A. J. (2023). Wise practices: Indigenous-settler relations in Laurentian Great Lakes fishery governance and water protection. *Journal of Great Lakes Research*, *49*, S12–S21. https://doi.org/10.1016/j.jglr.2022.09.010

Newell, C., & Bain, A. (2018). Defining collaboration and previewing success factors for effective collaboration. In *Team-based collaboration in higher education learning and teaching* (pp. 9–27). Springer. https://doi.org/10.1007/978-981-13-1855-9

Nonkes, C., Duncan, A. T., Lauzon, R., Ryan, K., Reid, A. J., Cooke, S. J., & Young, N. (2023). Two-eyed seeing: Developing perspective and wisdom on Sea Lamprey in the Laurentian Great Lakes. *Journal of Great Lakes Research*, *49*, 148–159. https://doi.org/10.1016/j.jglr.2023.03.001

Parsons, M., Taylor, L., & Crease, R. (2021). Indigenous environmental justice within marine ecosystems: A systematic review of the literature on Indigenous peoples' involvement in marine governance and management. *Sustainability*, *13*, Article 4217. https://doi.org/10.3390/su13084217

People v. Jondreau, 371 Mich. 17 (1963). https://law.justia.com/cases/michigan/supreme-court/1963/371-mich-17-2.html

Phare, M.-A. S. (2009). *Denying the source: The crisis of First Nations water rights*. Rocky Mountain Books.

R. v. Sparrow, [1990]. 1 S.C.R. 1075, https://decisions.scc-csc.ca/scc-csc/scc-csc/en/item/609/index.do

Raifman, S., DeVost, M. A., Digitale, J. C., Chen, Y.-H., & Morris, M. D. (2022). Respondent driven sampling: A sampling method for hard-to-reach populations and beyond. *Current Epidemiology Reports*, *9*, 38–47. https://doi.org/10.1007/s40471-022-00287-8

Reibold, K. (2022). Settler colonialism, decolonization, and climate change. *Journal of Applied Philosophy*, *40*, 624–641. https://doi.org/10.1111/japp.12573

Reid, A. J., Eckert, L. E., Lane, J. F., Young, N., Hinch, S. G., Darimont, C. T., Cooke, S. J., Ban, N. C., & Marshall, A. (2021)."Two-eyed seeing": An Indigenous framework to transform fisheries research and management. *Fish and Fisheries*, *22*, 243–261. https://doi.org/10.1111/faf.12516

Downloaded from academic.oup.com/fisheries/article/51/6/239/8490441 by guest on 30 September 2026

Reid, A. J., McGregor, D. A., Menzies, A. K., Eckert, L. E., Febria, C. M., & Popp, J. N. (2024). Ecological research "in a good way" means ethical and equitable relationships with Indigenous peoples and lands. *Nature Ecology & Evolution*, *8*, 595–598. https://doi.org/10.1038/s41559-023-02309-0

Smith, S. D. P., Gaden, M., & Taylor, W. W. (2019). The role of a multi-jurisdictional organization in developing ecosystem-based fisheries management: Examples from the Great Lakes Fishery Commission. *Aquatic Ecosystem Health & Management*, *22*, 276–286. https://doi.org/10.1080/14634988.2019.1658423

State v. Gurnoe, 53 Wis. 2d 390, 192 N.W.2d 892 (Wis. 1972). https://law.justia.com/cases/wisconsin/supreme-court/1972/state-92-4-1.html

Thomas, D. R. (2006). A general inductive approach for analyzing qualitative evaluation data. *The American Journal of Evaluation*, *27*, 237–246. https://doi.org/10.1177/1098214005283748

Thomas, D. S. (2022). Applying *One Dish, One Spoon* as an indigenous research methodology. *AlterNative*, *18*, 84–93. https://doi.org/10.1177/11771801221087864

United States v. State of Mich., 471 F. Supp. 192 (W.D. Mich. 1979), aff'd, 653 F.2d 277 (6th Cir. 1981). https://law.justia.com/cases/federal/district-courts/FSupp/471/192/1805015/.

Wilson, N. J. (2014). Indigenous water governance: Insights from the hydrosocial relations of the Koyukon Athabascan village of Ruby, Alaska. *Geoforum; Journal of Physical, Human, and Regional Geosciences*, *57*, 1–11. https://doi.org/10.1016/j.geoforum.2014.08.005

Wilson, N. J. (2020). Querying water co-governance: Yukon First Nations and water governance in the context of modern land claim agreements. *Water Alternatives*, *13*, 93–118. https://bit.ly/4ih9zYh

Wilson, N. J., & Inkster, J. (2018). Respecting water: Indigenous water governance, ontologies, and the politics of kinship on the ground. *Environment and Planning: E, Nature and Space*, *1*, 516–538. https://doi.org/10.1177/2514848618789378

Wilson, N. J., Mutter, E., Inkster, J., & Satterfield, T. (2018). Community-based monitoring as the practice of Indigenous governance: A case study of Indigenous-led water quality monitoring in the Yukon river basin. *Journal of Environmental Management*, *2*, 290–298. https://doi.org/10.1016/j.jenvman.2018.01.020

Wong, C., Ballegooyen, K., Ignace, L., Johnson, M. J., & Swanson, H. (2020). Towards reconciliation: 10 calls to action to natural scientists working in Canada. *Facets (Ottawa)*, *5*, 769–783. https://doi.org/10.1139/facets-2020-0005

Zidny, R., Sjöström, J., & Eilks, I. (2020). A multi-perspective reflection on how indigenous knowledge and related ideas can improve science education for sustainability. *Science & Education*, *29*, 145–185. https://doi.org/10.1007/s11191-019-00100-x

Standard Methods for Sampling North American Freshwater Fishes, Second Edition

TO ORDER
https://fisheries.org/bookstore

Scott A. Bonar, Norman Mercado-Silva, and Kevin L. Pope, editors

886 pages, index

Pricing:
Paperback $84 (AFS Member $58.80)
Hardcover $98 (AFS Member $68.60)

Published August 2024

Second edition of an important, popular reference book that provides standard sampling methods recommended by the American Fisheries Society for assessing and monitoring freshwater fishes in North America. Involves contributions from over 500 fisheries scientists from almost 200 agencies, universities, and nongovernmental organizations from Canada, Mexico, and the United States.

Methods apply to ponds, reservoirs, natural lakes, streams, and rivers containing cold- and warmwater fishes and, new to this edition, Great Lakes, cenotes, and wetlands. Rangewide and ecoregional averages for indices of abundance, population structure, and condition for almost 50 individual species are supplied to facilitate comparisons of standard data among populations and are much expanded for this edition.

Downloaded from academic.oup.com/fisheries/article/51/6/239/8490441 by guest on 30 September 2026