



---

**Literature Review**

## **Indigenous Traditional Ecological Knowledge and Ocean Observing: Exploring the Potential for Partnership in Atlantic Canada**

MaryJane Proulx, BA History & Environmental Studies, EMD, MMC, (CIOOS Atlantic Research Assistant, [maryjane.proulx@gmail.com](mailto:maryjane.proulx@gmail.com))

---

### **Abstract**

*The Canadian Integrated Ocean Observing System (CIOOS) [sea-use] is a national online platform for sharing, discovering and accessing ocean data collected in Canada. Data that is integrated into CIOOS is visible regionally and nationally. CIOOS Atlantic, one of three Regional Associations, is focused on the integration of oceanographic data from the Atlantic seaboard, a region spanning from Labrador to Maine (USA). Within this region there are many Indigenous coastal-dwelling communities that have acted as caretakers and stewards of the land(s) and ocean(s) for thousands of years. CIOOS Atlantic is dedicated to building partnerships with researchers, scientists and centres of expertise in ocean sciences. Building these relationships involves recognizing that Indigenous peoples play a special role in the area of ocean stewardship and care, as they have held an innate relationship with the natural environment since time immemorial. As such, CIOOS Atlantic is exploring ways to develop relationships with Indigenous communities in Atlantic Canada, including through developing an understanding of how Indigenous Traditional Ecological Knowledge (TEK) can be successfully coordinated or utilized alongside western scientific systems. This study serves to explore collaborative relations with Indigenous communities, specifically addressing the potential coordination of TEK with CIOOS. This is done by looking at various methodologies, such Participatory Mapping, Community-Based Research and Structured Decision Making, and collaborative projects, including cases where TEK has been collected, digitized and the meta(data) has been made open under some or all the FAIR principles (Findable, Accessible, Interoperable, Re-Usable). This study also highlights enabling factors that notably contribute to successful outcomes in digitization, and mitigation measures to avoid the decontextualization of TEK, including co-development of research objectives, respect of community ethical guidelines, and acknowledgement of intellectual property rights. Concluding recommendations for CIOOS Atlantic are primarily value and process based, rather than action based.*

**Keywords:** Collaborative Relations, TEK, Traditional Ecological Knowledge, Indigenous Traditional Ecological Knowledge, Data Exploration, Digitization, Indigenous Knowledge, Ocean Observation

---

### **Introduction**

In its most basic form, Traditional Ecological Knowledge (TEK) is a living understanding of how the world works. There are many factors that make TEK a unique form

of knowledge. One of the most notable factors is the inherent nature and relationship-based process of TEK. Unlike the objectivity of western scientific ways of knowing, TEK acknowledges that people hold close

---

relationships with all living beings, making them inseparable from the natural environment. Most common definitions emphasize that “Traditional Ecological Knowledge represents the collective knowledge of all people from a (tribal) area that has come through generations over time” (Living Traditions, 2013). Others note that TEK is a feeling of responsibility for future generations, explaining that we “owe thanks to everything that comes before us”. Despite these varying definitions, it is clear that TEK is beyond just one way of understanding how the world works. TEK is embodied by many different principles and values that may vary based on the knowledge holder. Some of the most common principles include responsibility, respect, reciprocity and connectivity to each other and the environment. Indigenous Traditional Ecological Knowledge recognizes that Indigenous people hold unique relationships with the land and waters as their original caretakers. These relationships make TEK difficult to define, as traditional knowledge means something different to each person, each community, and each caretaker.<sup>1</sup> International declarations acknowledge that ocean observing communities need to formally recognize the traditional knowledge of Indigenous peoples (Canadian Indigenous Declaration, 2019). This includes learning to respect each other’s ways of knowing and working together to establish meaningful partnerships. Recognizing the importance and value of TEK, CIOOS Atlantic is working to build meaningful, reciprocal relationships with Indigenous communities in Atlantic Canada.

The Canadian Integrated Ocean Observing System (CIOOS) is designed to increase discovery, access and re-use of oceanographic data for various users across the nation. This involves ensuring that data integrated within the system is Findable, Accessible, Interoperable and Re-usable (FAIR) (Wilkinson et al., 2016). These principles serve to actively support productive ocean science and management, while promoting collaborative opportunities among ocean sectors. CIOOS Atlantic is one of three Regional Associations (RAs) that make up the ocean observing system, along with the St. Lawrence and Pacific RAs. CIOOS Atlantic is committed to the development of a data management and dissemination approach that meets the needs of local oceanographic communities and contributes to global ocean observing initiatives. Key aspects of CIOOS include an online open access platform and a team of staff who are focused on building collaborative relations with different organizations, agencies and communities. Given the oceanographic nature of CIOOS, respectful engagement with Indigenous communities is essential for meeting the goals that CIOOS has proposed. Furthermore, Indigenous communities may benefit from data sharing and collaboration, as it can work to inform communities about ocean observing activities taking place in their traditional territories. Other advantages for coastal Indigenous communities include access to digital infrastructure and online tools and resources to help manage their own ocean observing data. To explain, CIOOS provides a network to facilitate knowledge exchange

---

<sup>1</sup> It should be noted that throughout this literature review TEK refers to a body of environmental knowledge encompassed by Indigenous peoples. Indigenous peoples refer to the original inhabitants of a particular place. Indigenous in Canada

is an umbrella term that refers to First Nations, Inuit and Métis peoples; the original inhabitants of Turtle Island, each with their own distinct cultures, histories and values.

---

between data contributors and users of diverse groups and organizations. This could include both TEK and western scientific data depending on community needs and desires. This literature review serves to explore successful initiatives where TEK has been digitized, while identifying any risks and limitations associated with different projects. This literature review has been conducted in an attempt to address the following objectives:

- 1) To reveal cases where TEK has been collected, digitized and the meta(data) made open under some or all of the FAIR principles
- 2) To identify the important enabling factors that notably contributed to successful outcomes
- 3) To identify and explore any risks and limitations with the digitization of TEK and provide recommendations for CIOOS Atlantic to consider based on the resources investigated

This project does not come without controversies and complications, as there are differing opinions and values held about sharing and accessing Indigenous Traditional Ecological Knowledge. Some of the most notable concerns with the digitization of TEK include sensitivity of data, intellectual property ownership, consultation protocols, decontextualization of Indigenous knowledge systems and the risk of reinforcing colonial narratives; these concerns are spoken to throughout this Literature Review. The uncharted waters of collaborative approaches make it difficult to know where or how to begin. Many researchers and organizations are unfamiliar with how to appropriately approach Indigenous communities as previous

approaches have been extractive, Eurocentric and unethical, causing an understandable mistrust between non-Indigenous researchers and Indigenous partners (Wiwchar, 2000). Other barriers include a lack of financial resources and institutional limitations such as time constraints that fail to acknowledge the nature of meaningful relationship building (Castleden, Morgan & Lamb, 2012). Furthermore, many Indigenous scholars argue that TEK should not be digitized at all, as the risks of decontextualization are too high (Simpson, 2014).

Exploring these challenges and limitations is essential to understanding the complexity of collaborative projects. The concerns surrounding the digitization of TEK should not be overlooked as they can lead to the unintentional harm of Indigenous communities.

## **Geographic Context**

### *The Importance of Place*

Local Traditional Knowledge, Place Based Knowledge and Traditional Ecological Knowledge are terms that have often been used interchangeably to describe a body of knowledge that encompasses people's relationship to place. Place plays an important role in understanding TEK, because it relates to how people interact and understand the natural world at a localized level.

CIOOS Atlantic operates on the Atlantic Seaboard in the traditional territory of the Mi'kmaw, Innu, Maliseet, Passamaquoddy, Nunatsiavut, Southern Inuit of NunatuKavut and in the ancestral homelands of the Mi'kmaw and Beothuk. Each of these respective Indigenous peoples hold unique relationships with the natural environment in the form of cultural, ecological and historical teachings

---

(which have been defined here as TEK). It should be noted that accurately identifying the geographic scopes of the traditional territories that CIOOS Atlantic operates in is difficult, because of the complexity surrounding geographic context. For example, prior to colonization, Indigenous peoples were able to move freely within their territory without the limitations of segregation by colonial officials. Reserve systems were not yet imposed on Indigenous peoples that limited them to a singular place within their traditional territory. With these changes in territorial freedom, relationships between Indigenous peoples and the natural environment have been altered, making it difficult to define a respectful land acknowledgement that is inclusive and authentic to Indigenous Atlantic communities.

CIOOS Atlantic is defined by its relationship to the coastal environment. Geographic delineations are therefore a result of Atlantic oceanic boundaries, rather than political, provincial or territorial boundaries. In addition, the geographic scope of all three CIOOS Regional Associations (Pacific, St. Lawrence, and Atlantic) are largely defined by Fisheries and Oceans Canada (DFO). Currently DFO has 6 administrative regions, 3 of which overlap with CIOOS Atlantic and CIOOS St. Lawrence (See Appendix A, figure 1). These DFO regions include: Newfoundland and Labrador, Maritimes-Scotia-Fundy and Gulf (Appendix A). Out of respect for the original inhabitants and caretakers of Atlantic Canada, a geographic context map has been included in this report that acknowledges the many Indigenous communities of the Atlantic coast (see

Appendix A, figures 2, 3 and 4). It is important to note that territory maps are best defined by Indigenous nations themselves. As CIOOS Atlantic begins and continues to build relationships with Indigenous communities, these maps may change to more accurately reflect the original inhabitants and caretakers of the Atlantic seaboard.

## Historical Context

### *Trauma in Research Partnerships*

A history of colonial narratives and Eurocentric research methods often make it difficult to know where or how to start building respectful, meaningful relationships with Indigenous communities. Similarly, the most successful relationships between western scientific institutions and traditional knowledge holders recognize the historical and cultural context that precede their relationships. There have been cases all around the world where Indigenous knowledge and property has been misused, decontextualized and even stolen by researchers. There are other cases where researchers are purely outsiders that show up to collect information and leave without providing any clear benefit to the communities of the geographic area being studied (Fidel et al., 2014).

An article written for the *American Journal of Public Health* notes that “research has been a source of distress for indigenous people because of inappropriate methods and practices” (p.22). Specifically in the health industry, there have been instances where samples have been misused and distributed without consent from the communities they were taken from (Cochran et al., 2008).<sup>2</sup>

---

<sup>2</sup> In the 1980s a medical team led by Dr. Richard Ward partnered with the Nuu-Chah-Nulth people of Vancouver Island to learn more about rheumatic diseases. Volunteers provided blood samples to researchers that were later discovered to

have traveled the world. The Nuu-chah-nulth people waited 15 years to find out that their blood samples were used for a variety of genetic anthropological studies outside the boundaries of what they agreed to (Wiwchar, 2000).

---

Indigenous communities are often reluctant to work with researchers because there is a lot of trauma associated with past practices. The article concludes with recommendations for all academic researchers to undertake when working with Indigenous communities. This includes recognizing that participatory research may not use a lot of the western scientific methods that researchers are accustomed to (Cochran et al., 2008). It is also important to acknowledge that honesty and transparency are key to building healthy, ethical relationships.

The environmental field is no exception to these patterns of mistrust exemplified by health studies. For example, Mauna Kea, on the big Island of Hawaii, is a tremendous shield volcano that remains the tallest mountain on Earth (LaFrance, 2015). Currently, the mountain has become a huge area of tension between native Hawaiians and astronomers, as the University of Hawaii has proposed to build a \$1 billion observatory known as the Thirty Meter Telescope (TMT) directly on top of the sacred site (that already has 13 other telescopes). In addition to holding extreme ecological and astronomical significance, Mauna Kea holds cultural and sacred meaning to the native Hawaiians who have cared for and occupied the area for thousands of years (Witze, 2020). It is no coincidence that ecologically significant and culturally significant spaces are often the same. This connection reaffirms the ties that Indigenous cultures hold to place. In this particular case, western scientific astronomers have failed to recognize that native Hawaiians have developed their own technologies and knowledge systems for navigating and understanding space.<sup>3</sup> Likewise, sites like

Mauna Kea hold spiritual significance and teachings. All to say that if scientists engaged in an ethical way, communities may be less reluctant to share some of their valuable ecological knowledge that can protect areas of both environmental and cultural significance. Similarly, western science could have been used in a different way to work with Indigenous communities, that could very possibly, have similar goals in understanding the world around them.

Unfortunately, there are many research methods and approaches that western scientists have yet to recognize as harmful. For example, an article by Montana University associate professor Dr. Vanessa Simonds, notes that the analytical aspect of western scientific research methods can be dehumanizing to Indigenous ways of knowing by picking apart their knowledge, traditions and stories (2013). Specifically, researchers have collected stories from Elders purely for the purpose of picking them apart and analyzing them. Simonds explains that there is an absence of published guidance for the process of decolonizing research, noting that scientists must work towards being constantly reflective of their actions (Simonds & Christopher, 2013). As we continue to deconstruct and decolonize harmful practices in scientific research, we can foster a more inclusive, and reciprocal scientific approach.

One way to avoid harmful research approaches is to review protocols and ethical guidelines that have been put in place by Indigenous communities. For example, The Mi'kmaw Ethics Watch, a committee appointed by the Unama'ki College of Cape Breton University, has a set of research

---

<sup>3</sup> A note on terminology; the word science throughout this literature review is not limited to western academia. In this sense, TEK is considered science. Differentiating

the two types of science can be done by preceding the word with western. Language is an important component to decolonizing research.

---

principles to guide studies in a way that will guarantee the right ownership to Mi'kmaw communities. At the same time, the principles and protocols ensure that Mi'kmaw are treated fairly and ethically in their participatory research. A key component within this set of protocols includes a consent form and application to describe how a study will impact and/or benefit Mi'kmaw participants (see Appendix B). This ensures that the research project is fully understood, and participants understand what they are consenting to prior to participating. Another important aspect of the protocol is language. Researchers are asked to describe accommodations for Mi'kmaw language, culture and community protocols, including how Mi'kmaw people will be accommodated in communicating or deriving consent (Mi'kmaw Ethics Watch, 2020). Similar to the Mi'kmaw Ethics Watch, Memorial University of Newfoundland has recently released a Policy on Research Impacting Indigenous Groups. Recommendations and guidelines include early engagement, consensual relationships, ethical conduct, reciprocity and research result distribution. The policy begins by emphasizing that the guide “works to acknowledge the needs of Indigenous communities to be recognized as distinct from other groups”, furthering that “engaging with Indigenous communities early in the research process is paramount” (Memorial University, 2020a). Memorial also provides a guide to *Research Impacting Indigenous Groups* (Memorial University, 2020b). Included in this document is an overview of how research affects Indigenous peoples. The guide provides recommendations of responsibilities and support that researchers should provide when working with different communities. The text

itself is based off of the Ocean Frontier Institute's (OFI) Indigenous Engagement Strategy, which was created by the OFI Indigenous Engagement Steering Committee composed of non-Indigenous OFI staff and four Indigenous members with an expertise in Indigenous research and engagement (OFI, 2020).

There are other more collective examples of ethical protocols that can be reviewed for best general practice. For example, the Assembly of First Nations (AFN), a national advocacy organization representing First Nation citizens in Canada, has created a resource booklet on First Nations Ethics. The *First Nations Ethics Guide on Research and Aboriginal Traditional Knowledge* was developed to provide insightful guidance for western scientific researchers and government officials (AFN, n.d.). This includes various recommendations for conducting research and working with Indigenous people in a ‘good way’. In addition, AFN provides a table that lists all of the Aboriginal Traditional Knowledge Protocols that have been developed by individual Nations and communities. Included in this table, and specifically relevant to CIOOS Atlantic, is the Unama'ki Institute and Maliseet Nation Conservation Council Principles and Protocols. Taking the time to research guidelines that have already been put in place for researchers can inform scientific institutions of protocols and principles they may not have considered. It is also important to note that individual communities may have differing guidelines and values that they would like to communicate with researchers. Local context should be carefully considered and prioritized by CIOOS Atlantic when seeking out these relationships.

---

CIOOS Atlantic is in a unique position, as its primary interest is not to extract information but build relationships that work to serve ocean observing needs. To explain, CIOOS Atlantic does not actively collect data, but works with many organizations and partners that do collect data in order to populate the online platform. CIOOS is in the preliminary stages of relationship development, so any research objectives will be developed with community members, rather than presented to them. It is important to note that CIOOS Atlantic's mandate as an openly accessible ocean data platform can be alarming and problematic for Indigenous communities, making them reluctant to contribute data. For example, TEK is at risk of being misused and misinterpreted by western scientific systems. Care must be taken to assure that research projects align with the needs and interests of Indigenous communities. With this, it is important to acknowledge that communities have their own protocols in place to avoid participating in projects that do more harm than good. Doing this preliminary research is important to avoid making the same mistakes of the past. In addition, co-developing research objectives and methods is a way of decolonizing science.

## Literature Review

### *The Approach*

Most definitions agree that science is “knowledge about or study of the natural world based on facts learned through experiments and observations” (Merriam-Webster, 2020). Interestingly, TEK is based on the same principles of experiential learning. What differentiates western science from TEK is the normative values attached to each practice. To explain, western scientific methods depend on

objectivity, ensuring that researchers are not influenced by personal feelings or opinions. Whereas, TEK is often guided by subjectivity, and is very much dependent on experiential observations and relationships over time. In addition, western science is often quantitative and represented by numerical data transmitted by instrumental observations. TEK is often qualitative and represents a body of knowledge that is transmitted orally (Mazzocchi, 2006). These distinctions are important to note as they acknowledge two different ways of understanding the world, each with their own benefits. In general, these knowledge systems, while distinct from one another, can work together to create a more holistic approach to conducting scientific research. This concept has been coined as “Two-Eyed Seeing”.

### *Two-Eyed Seeing*

World Renowned Mi'kmaw leader, Elder Albert Marshall coined the concept “Two-Eyed Seeing” in 2004 (Institute for Integrative Science & Health, 2004). The concept refers to “learning to see from one eye with the strengths of Indigenous knowledges and ways of knowing, and from the other eye with the strengths of Western knowledges and ways of knowing... and learning to use both these eyes together, for the benefit of all” (Ermine, Sinclair & Jeffrey, 2004). This approach to research has resulted in many successful partnerships at the international and local levels. These projects include environmental work, educational studies, health sciences and everything in between. For example, *Bridging Cultures: Indigenous and Scientific Ways of Knowing Nature* is a book that provides examples of positive integrative projects across Africa, the United States, New Zealand,

---

Australia and Canada.<sup>4</sup> Author Glen Aikenhead, a professor of Aboriginal Education at the University of Saskatchewan, writes about integrating Indigenous knowledge into school curriculums. Many of the projects were noted as successful because they involved co-ownership, responsibility and decision-making powers. “Two-Eyed Seeing” is not meant to be one knowledge system consuming another. Rather, it encompasses a co-learning journey that can utilize multiple approaches to gain a better understanding of the world. Projects that utilize the “Two-Eyed Seeing” approach vary drastically based on the needs of the different participants involved. This literature review will provide examples of “Two-Eyed Seeing” in action, by examining case studies that utilize different collaborative approaches in a way that is relevant to CIOOS Atlantic. Some common values in many of these projects include the four principles of Indigenous research; respect, responsibility, reciprocity and re-usability (Kirkness and Barnhardt, 2001). These principles work to ensure that research is done ethically and fairly.

### **Methodology:**

Exploring different digitization projects brings to light different methods used to record, display and make accessible Indigenous knowledge. While there remain concerns over digitizing TEK, different methods provide crucial insights into mitigation measures that have been developed on an individual basis. Furthermore, these projects have differing enabling factors that make them successful and mutually beneficial to those involved. Some of the different

methods that have been discovered in collaborative projects include: Participatory Mapping, Community-Based Research and Structured Decision Making. Participatory Geographic Information Systems (PGIS) is an approach to spatial planning that combines community research with digital mapping exercises. Similarly, Community-Based Research (CBP) is a research method that is conducted with and for, not on, members of a community (Strand et al., 2003). Finally, Structured Decision Making (SDM) is an organized process for engaging multiple parties in a productive decision-oriented dialogue (Failing et al., 2007). Reviewing these case studies works to inform CIOOS Atlantic of different enabling factors that have made collaborative projects successful or unfavorable. These examples of TEK digitization are not explored for the purpose of prescribing a method that CIOOS Atlantic should undertake. Instead they work to develop an understanding of benefits and limitations to digitizing TEK based on literature and specific examples. In addition, the FAIR data principles that CIOOS Atlantic serves to implement within the platform may be a concern for digitizing TEK. To explain, many Indigenous communities are reluctant to have their TEK readily findable, accessible, interoperable and reusable. Care should be taken to understand these concerns and how they relate to CIOOS Atlantic as an open-data platform.

### *Participatory Geographic Information Systems*

Plenty of projects in the Arctic North have been initiated in an attempt to digitize

---

<sup>4</sup> 'Integrative' in this context does not refer to one knowledge system merging into another. Instead, it refers to multiple knowledge systems working alongside one another where appropriate.

---

TEK for future generations and current scientific communities (both Indigenous and non-Indigenous). This demand is largely due to the environmental pressure of climate change that continually impacts coastal-dwelling communities. This is especially true to coastal communities, whose livelihoods are directly impacted by our warming climate. For example, the Nunavut Coastal Resource Inventory is an initiative of the Fisheries and Sealing Division of the Government of Nunavut to create a comprehensive dataset of Inuit knowledge. The Inventory provides information on aquatic and coastal species for all communities in the territory (Department of Environment Fisheries and Sealing Division, 2013). Other initiatives include various participatory GIS projects with narrations and oral components to avoid decontextualizing Indigenous knowledge systems.<sup>5</sup> Below is an overview of three successful projects that have digitized TEK while building an open-based platform of oceanographic and coastal data.

#### Kitikmeot Place Names Atlas

Cyber cartographic atlases are one method of digitizing TEK that engages community members to share and preserve their knowledge in an online setting. There are many different examples of online databases and atlases that use PGIS as a method for mapping TEK. The Kitikmeot Place Name Atlas (KPNA) is an interactive map that allows users to navigate through the Kitikmeot Region of Nunavut, Canada. The KPNA is the result of an ongoing program of place name recording in communities of the region. The purpose of the project is to preserve

pronunciations, meanings and associated oral traditions of traditional Inuktitut and Inuinnaqtun places. The Atlas functions by incorporating different layers over a satellite map with place-based data points (see Appendix C, figure 4). Each point represents a data set that includes a name and meaning associated with the coordinate. Many points also provide a media component that allows users to listen to the pronunciation of the traditional place names (Appendix C, figure 5). The technology to complete this project was developed at the Geomatics and Cartographic Research Centre of Carleton University. The Kitikmeot Heritage Society, a community-led heritage association, has partnered with Carleton University, to enhance technology to support new community requirements (Kitikmeot Heritage Society, 2020). Like many other digitization projects, the KPNA serves to meet the needs of specific communities.

Decontextualization is an increasing concern with digitization projects, as TEK is preserved through certain methods of teaching and learning that the western scientific realm might not embody. For example, the KPNA includes an interactive oral component to keep the original integrity and knowledge transmission alive. Ultimately, this Atlas is a form of preservation that utilizes a western scientific tool to record TEK. What makes this database unique is an oral component that allows users to click on different aspects of the map and listen to audio recordings. Much of Inuit knowledge, like other Indigenous knowledge systems, is not written down. As such, the recordings allow Elders to share their knowledge in a way that is authentic and

---

<sup>5</sup> Isolating TEK from its source can be counterproductive. Decontextualization is a concern that only part of the story is being told; importantly noting that transmission is as important as the story itself.

---

comfortable for them. Some examples of audio features include pronunciations of traditional names, interviews and stories to accompany different datasets.

In relation to the goals of CIOOS Atlantic, the KPNA is a digitized collection of traditional knowledge that is open and accessible to all users. Furthermore, the purpose of the Atlas is to provide users with information regarding the traditional and ecological significance of the region. The Atlas was created through a collaborative partnership between Indigenous communities and western scientific institutions. One of the most notable factors that made this project successful is the interest in community needs. Carleton University prioritized the needs of Inuit people (as defined by the peoples themselves) when developing the technology to support the project. The KPNA prioritized qualitative research to populate this project by incorporating oral histories, and information that linked people with place. While the goals of CIOOS may differ from that of the KPNA project, it is important to recognize the strength in co-developing goals and priorities for ocean observation.

### The Inuit Siku Atlas

Reflecting on the vulnerability of Arctic communities, The Inuit Siku Atlas is another example of digitized TEK that focuses on environmental observation. Sea ice is a fundamental feature of the polar environment; it is also one of the most tangible indicators of change in the Arctic. During the last two decades, and in the past several years, both polar scientists and local Inuit residents have detected important shifts in the extent, timing,

dynamics and other key parameters of arctic sea ice (Siku Atlas, 2017). The Inuit Siku Atlas is an open based platform that allows viewers to learn about Inuit knowledge of sea ice ('Siku') around Baffin Island, Nunavut. The Atlas has been co-developed by Inuit experts, community researchers, and university researchers.<sup>6</sup> Community members have observed and experienced large amounts of change in their local climatic environments. The project aims to document Inuit knowledge about sea ice for future generations, while informing the scientific community of climatic changes throughout the region. Similar to the Kitikmeot Place Names Atlas, the Siku Atlas utilizes several different map layers over a satellite map to display different features. Some different layers of the sea ice map include travel routes, floe edges, ice ridges, cracks, camps, melts, reefs and open water areas. Each layer allows the viewer to navigate the map and click on different coordinate points or routes. Once selected, a sidebar appears that provides more information regarding the point or route (see Appendix C, figure 6). The Siku Atlas has four different platforms (Cape Dorset, Clyde River, Igloodik and Pagnirtung) that allow users to experience unique observations made by each community; respecting the diversity of traditional knowledge throughout different regions.

A number of different research methods were employed to develop this Atlas. Some of these methods include interviews with local experts, participatory mapping, experiential travel (using the land to teach), focus groups, workshops, community-based monitoring, satellite monitoring and multi-media use. Perhaps one of the most interesting

---

<sup>6</sup> It is important to note that often these categorizations of people may be blurry. For example, Indigenous knowledge holders may also be trained in western

scientific methods of data collection. Similarly, university researchers may be Indigenous. Researchers must take care to not dichotomize knowledge holders or assume their needs based on their profession or defined role.

---

components of this Atlas is the recognition of Inuit knowledge holders as scientists. For example, weather variability, often measured in physical temperature readings, is evaluated by the decrease in ice crystal formation on people's faces and parka hoods. Other sea ice changes that are noted by knowledge holders include changing winds, water temperatures, precipitation patterns, freezing processes, ice thickness and break up timing. In this scenario, Inuit Quajimajatuqangit (Inuit TEK) is the accumulation of methods for measuring these changes.

Every component of the Siku Atlas tells a story. The Siku Atlas provides a narrative to data that has been captured using quantitative and qualitative approaches from both Indigenous and non-Indigenous scientists. This method provides cultural and environmental context to research that has been conducted through various approaches. This context is crucial to Indigenous knowledge systems as it recognizes the relationship between people and the environment. In relation to CIOOS Atlantic, it is important to acknowledge that ocean observation should not be limited to quantitative datasets. Observation is defined as "the action or process of closely observing or monitoring something or someone." (Oxford, 2020). What makes the Inuit Siku Atlas so compelling and successful, is the use of narration to accompany instrumental readings. This approach has aided in building positive relationships while providing a comprehensive and useful system of ocean observations for both Indigenous and non-Indigenous scientists. While CIOOS currently houses raw instrumental data, it may be beneficial to explore the addition of qualitative ocean observations. In turn this may help to provide

a clearer picture regarding the state of our oceans.

#### The Pikialasorsuaq Atlas

A similar project, the Pikialasorsuaq Atlas (North Waters Polynya Atlas) attempts to bridge and represent both scientific knowledge and Inuit knowledge about a critically important Arctic sea-ice feature. The North Water Polynya is a large area of year-round open water, surrounded by sea-ice cover (Pikialasorsuaq Commission, 2017). The polynya is located in the northern part of Baffin Bay between Arctic Canada and Greenland. Pikialasorsuaq is the largest polynya in the Canadian Arctic and has been noted as one of the most biologically active regions north of the Arctic Circle (Pikialasorsuaq, 2020). The area sustains Inuit with food and resources, making it invaluable for physical, cultural and spiritual wellbeing. In addition, it is a rich biologically diverse habitat for marine mammals, migratory birds, fish and plankton.

The Pikialasorsuaq Atlas was born out of the growing concern to safeguard and monitor the health of the polynya. The Atlas is a web-based platform that contains a variety of data points, allowing the viewer to develop a comprehensive understanding of the ecological and cultural importance of the polynya. The project is a collaboration between Dalhousie University, the Inuit Circumpolar Council's Pikialasorsuaq Commission, KNAPK (The Association of Fishers and Hunters in Greenland) and World Wildlife Fund (WWF), released in 2017.

One of the most prominent features of the Atlas is an interactive story map supported by ESRI that allows users to learn about place names, sea ice change delineations, Arctic animals, local uses and non-traditional uses.

---

For example, by clicking on ‘local use’ at the top of the page, users can view established Inuit trails that were digitized from the Inuit Land Use and Occupancy Project (Milton Freeman Research Limited, 1976). Information to populate the Atlas has been coordinated through a variety of sources including Indigenous knowledge systems, western scientific knowledge systems, and previous projects. In addition to the story map feature, a ‘planning tool’ allows users to explore how different activities may interact (or counteract) with marine resources in the region. This is done by providing several layers of information that can be used to explore the space. For example, one can look at overlap between undiscovered oil in the Arctic and narwhal habitat by selecting the appropriate layers on the map (see Appendix C, figure 7). Users can also download or upload their own layers to the system. Similar to the goals proposed by CIOOS, the Pikialasoruaq Atlas provides users with information that can allow them to make informed decisions regarding an ecologically significant area such as the ocean. Similar to the Siku Atlas and Kitikmeot Place Names Map, the Pikialasoruaq Atlas provides a narrative to accompany geographic points and polygons, ultimately providing users with important contextual information surrounding the data they are exploring.

In response to this project, researchers have noted that “Inuit data if carefully curated and presented, can be employed in the co-production of knowledge” (Tesar et al., 2019, p. 14). To explain, the article in the *Journal of Ocean Technology* explores the ethics and effectiveness of representing Inuit Knowledge in an online atlas. One of the main concerns with cyber cartographic atlases is the decontextualization of TEK. Losing the

importance of context can diminish Indigenous knowledge systems. Tesar et al. explains that without providing proper context, a place-name may be diminished to simply a point on a map, inevitably leading to the degradation of meaning (2019). The article concludes with suggested steps for digitizing TEK. These steps, include:

- 1) Involving Indigenous groups in designing usable systems
- 2) Providing context in a degree that is ‘acceptable’
- 3) Developing Intellectual Property policies and
- 4) Providing guidelines for how to interpret Indigenous datasets

These steps summarize and provide viable solutions to challenges that may be faced through the process of digitizing TEK. Further, the article recognizes that despite these many concerns, the “practice of using Indigenous knowledge together with scientific knowledge in a layered atlas can be used to challenge prevailing cartographic representations and empower Indigenous communities” (Tesar et al., 2019, p. 21).

Digital Cartography provides many opportunities for recording Indigenous knowledge. This method has been used increasingly for digitizing TEK in the North, where territories are facing unprecedented social and environmental changes. While there are many advantages to PGIS, there are also several challenges and limitations. For example, having TEK readily findable and accessible can lead to misuse. TEK exploitation is the misuse of information, harming both communities and the natural environment they depend on. To explain, mapping rare habitats or resources that are

---

ecologically and culturally significant may lead to economic exploitation or create new pressures on Indigenous communities. Similarly, cybercartography raises legal questions regarding intellectual property rights and ownership of knowledge (Engler et al., 2013). These concerns make it difficult to determine if digitizing TEK is ethically appropriate, especially for an open-based web platform, such as CIOOS. With these concerns in mind, there are other ways to collaborate with Indigenous communities in a meaningful and reciprocal way. Community-based research is one method that has been used by researchers to collaborate respectfully, and reciprocally with Indigenous communities.

#### Community Based Research

Digitization projects that have been explored thus far in this Literature Review are mostly atlases in which material has been organized and digitized geospatially. There have been numerous successful projects across the Arctic North that utilize multiple knowledge systems to populate cybercartography. In some instances, TEK has been digitized to provide ecological context to western scientific data that has been collected using technological instruments (Pikialasorsauq, 2020). In other ways TEK has been used to determine where scientists should look to collect ecologically significant data based on Indigenous observations over time (Siku Atlas 2017). Many cases demonstrate that digitizing TEK can be a potential method of preserving knowledge systems while contextualizing static instrumental data. Others argue that TEK should be preserved through traditional methods of teaching to avoid eurocentrism and colonialist thinking (Simpson, 2004). Regardless of the purpose

and methods, digitizing TEK has been a debated subject among many different scientific and Indigenous communities. In some instances, however, these communities are the same. Often “community members want to know what scientists want to know” (P. Romer, personal communication, July 9, 2020).

Understanding the needs of Indigenous communities includes having an open mind; acknowledging that scientific and Indigenous communities may be the same or have similar objectives. For example, in contrast to many culturally focused cybercartographic projects, Ocean Networks Canada (ONC), based out of the University of Victoria, has partnered with community observatories to collect scientific data. Many of the observatories are owned and operated by First Nations communities in partnership with universities. These observatories are responsible for conducting and collecting instrumental data on the Pacific coast. There are many benefits to Indigenous peoples hosting their own observatories. For example, they allow communities to maintain ownership over their own data in their own territories. At the same time, it develops an understanding of how oceanographic science works in a way that is beneficial to community members (as ocean caretakers). Observatories also provide employment and educational opportunities supporting local development. Furthermore, these relationships complement existing marine research activities that can help populate data in systems, such as CIOOS.

A similar community-based research approach has been applied on the east coast with the Apoqmatult’ik (We Help Each Other Project) in Nova Scotia. The Apoqmatult’ik (pronounced ah-boggin-ah-mah-tul-teeg)

---

project is a partnership between the Ocean Tracking Network (OTN), Unama'ki Institute of Natural Resources (UINR), and the Mi'kmaw Conservation Group (MCG) to study culturally and commercially important fish species of Nova Scotia. The three-year collaborative study tracks valued aquatic species in the Bay of Fundy, and Bras d'Or Lake, while incorporating the knowledge of those who live there (Apoqnamatulti'k, 2020). One of the key approaches to this research is using "Two-Eyed Seeing" to develop a better understanding of the marine environment. Similar to ONC's community observatories, the Apoqnamatulti'k partnership does not prioritize digitizing TEK. Instead principles and ethical protocols of TEK are used to approach data collection. Recognizing the diversity of needs and values that Indigenous communities have is crucial to building authentic relationships that go beyond advisory roles. Many nations may want to protect their environment but that does not necessarily mean that they are anti-business (P. Romer, personal communication, July 9, 2020). Similarly, not all academic, western trained scientists are non-Indigenous. In some cases, Indigenous communities do not want to digitize TEK because of the risks and resources involved. Understanding individual community needs, and how they vary, can go a long way toward co-building relationships.

Projects such as Apoqnamatulti'k and ONC's community observatories are referred to as community-based participatory research (CBPR). CBPR is a process in which decision-making power and ownership is shared between the researcher and community involved (Holkup et al., 2004). In these particular cases, community members are the researchers that are out on the water collecting

data. Community observatories and the Apoqnamatulti'k project operate by having universities and Indigenous communities work together to collect instrumental data. In many ways, TEK varies in the role it plays within scientific research. For example, collecting instrumental data in a 'good way', may involve following traditional values, such as having respect for samples and other ethical commitments that tie into cultural practices. This is particularly relevant to the Apoqnamatulti'k project. MSc student and Apoqnamatulti'k team member Shannon Landovskis highlights her journey noting that "working on this project has impacted the way I conduct research by encouraging me to really question myself and the position I hold. I had to confront how I perceive the world and what has influenced my perceptions, practices, and beliefs"(Apoqnamatulti'k 2020a). Similarly, community liaison and field technician for Apoqnamatulti'k, Skyley Jeddore highlights that "Apoqnamatulti'k means working together as one from all corners, not just the scientists, but elders, local knowledge holders, and, of course, the fishermen" (Apoqnamatulti'k, 2020a). In this case, the sharing of Mi'kmaw knowledge works to guide research and partnerships. The crucial enabling factor that has made ONC and OTN's partnerships successful, is community involvement and co-developing research objectives. In this sense TEK is not collected or incorporated into any system, it is used to guide how research is conducted and how data is collected. This brings up an important factor regarding the role of Indigenous people in oceanographic research.

Academia has historically been *on* Indigenous peoples in Canada rather than by, for or with them. An article in *The Canadian Geographer* called "I spent the first year drinking

---

tea” acknowledges some of the challenges of CBPR and relationship building. For example, finding time for relationship building poses as a big challenge (Castleden et al., 2012). There are many institutional and financial limitations that make it difficult to commit to building relationships. For example, Masters and PhD students often have timelines to meet in order to reach academic milestones. Similarly, organizations may not have prioritized funding to invest in relationship building. Despite these challenges, the article encourages non-Indigenous and western scientists to critically reflect on their own practices to better address unethical research, that has, for decades, “plagued Indigenous communities” (Castleden et al., 2012, p.177). It is important to recognize that investing in these relationships, providing time, energy and resources, actively works to serve Indigenous peoples as part of the broader ocean observing community. Trust building and ‘getting to know each other’ are also valuable uses of time that should not be underestimated. This article recognizes that partnerships with Indigenous communities are unique and not always comparable to institutional based relationships that have prescribed timelines and action items. While it is recognized that CIOOS Atlantic has both funding and time constraints, prioritizing and making space for Indigenous peoples may involve stepping outside of conventional research methods. In light of this, patience is an important component to building meaningful relationships. Developing trust with communities prior to embarking on a data collection journey is not only respectful (one of the four R’s of Indigenous research) but encourages the longevity of a relationship.<sup>7</sup>

CIOOS Atlantic should take care in ‘starting off on the right foot’.

“Decentering the University from Community Based Research” is a similar article that encourages researchers to carefully consider their research process. Adams et al. acknowledges that “academics can be part of communities, just as community members can be researchers” (Adams et al., 2015, p.2). This clarification is crucial to understanding community-based research methods. It is also very much reflective of the methods employed by ONC and OTN in their collaborative projects. Similar to Castleden et. al, the article emphasizes the importance of including Indigenous communities in the research framework. It is important that CIOOS Atlantic focuses on the oceanographic needs of Atlantic Indigenous communities before developing collaborative goals. Hopefully, as CIOOS Atlantic continues to engage with different communities, these needs will become more apparent. In addition, it is important to address the concern of intellectual property ownership, remembering that “any information gathered from knowledge holders remains their property and does not become ‘intellectual property’ of universities” (Adams et al., 2015, p.7). On a localized level, the Mi’kmaw Ethics Watch has laid out guidelines CIOOS Atlantic can undertake to ensure that Intellectual property rights are not violated. As CIOOS Atlantic continues to build partnerships with Atlantic Indigenous communities across the region, careful consideration should be taken to ensure local protocols and guidelines are followed.

---

<sup>7</sup> The four R’s of Indigenous research include respect, reciprocity, responsibility and relevance. Being mindful of these values is a way to decolonize science, while

ensuring research is not harmful to the communities involved (Kirkness & Barnhardt, 2001).

---

## Structured Decision Making

Another method of coordinating western science and TEK into environmental research is Structured Decision Making (SDM). SDM is an organized process for engaging multiple parties in a productive decision-oriented dialogue (Failing et al., 2007). The literature and case studies integrating TEK into SDM are limited in comparison to PGIS and CBPR approaches. In most scholarly and academic articles, SDM is referred to as a model or approach for analyzing natural resource management decisions.

Lee Failing, scholar in public decision-making literature, explores how a structured decision process can contribute to the integration of TEK and western science in resource management. Failing (2007) notes that often TEK, which is referred to as local knowledge, is “uncritically rejected because it is viewed by science-dominated processes” (p.48). On the same token “scientific inputs to the environmental decision-making process are often uncritically accepted” (p.48). This is a crucial observation that reaffirms the importance of “Two-Eyed Seeing”, recognizing that knowledge systems should work alongside one another. It can be harmful and counterproductive to prioritize and claim that one knowledge system is more effective or valued than another. Failing advocates for the rigorous treatment of both science (western) and values (TEK) in resource management decisions. Examples are presented in BC, Canada where stakeholders utilize SDM to facilitate mutual learning.<sup>8</sup>

A similar article called “From Invisibility to Transparency” explores the need

for a broader and more inclusive approach to land use and resource decision-making (Turner et al., 2008). The paper acknowledges the many ‘invisible’ losses that First Nations communities have experienced are due to the undervalued nature of Indigenous knowledge in resource planning. Recognizing culturally derived values as relevant can work to create better alternatives for land use planning that acknowledge Indigenous rights. In relation to ocean observation, scientific activities, such as data collection, should be done ethically and with the input of local Indigenous communities. Although CIOOS does not actively collect data in the field, the platform does provide a space for data collectors. Care should be taken to ensure that the data CIOOS integrates and makes accessible, have been collected ethically with the consent of the traditional territory holders.

In relation to decision making processes, many Indigenous communities have developed their own processes for making decisions. Indigenous governance systems or traditional government differs based on the community. For example, Kahente Horn-Miller explains that the Kahnawa:ke’s decision making process is participatory based and requires input from multiple community members (Miller, 2013). Other governance systems have hereditary chiefs who inherit the responsibilities according to the history and cultural values of their community. The Indian Act of 1876 enforced a governance structure on First Nations in Canada known as the Elected Chief and Band Council System, which still operates today (ICTINC, 2015). These governance systems may be a determinant in

---

<sup>8</sup> It is important to recognize that Indigenous peoples are rights holders and not just stakeholders in decision making processes despite common themes throughout Canadian decision-making literature.

---

how (and if) communities choose to engage with CIOOS Atlantic. With this, it is important to emphasize the value of patience, as community processes for making decisions may take longer than desired or anticipated.

## **Challenges**

### *The Ethical Debate of Research*

Along with the many methods that have been used to digitize TEK and bridge cultures through collaborative projects, there are notable challenges and limitations that should be considered. For example, decontextualization is a common concern specifically associated with collecting, archiving and digitizing Indigenous knowledge. Author and Indigenous rights activist Leanne Simpson expresses this concern in an article called “Land as Pedagogy” (2014). Simpson utilizes traditional Nishnaabeg knowledge and storytelling to advocate for reclamation of land as a method for teaching and preserving TEK. There is concern that presenting traditional teachings through an online venue fails to recognize the physical and spiritual connection to land. In this sense, “If we do not create a generation of people attached to the land and committed to living out our culturally inherent ways of coming to know, we risk losing what it means to be Nishnaabeg within our own systems” (Simpson, 2014, p.13). In relation to CIOOS Atlantic, care should be taken to understand individual community standpoints on the digitization of TEK. Many Arctic communities have embraced the digitization of TEK, actively working to ensure that their knowledge does not become decontextualized. One method that has been used in Arctic communities to prevent decontextualization is providing audio components to accompany data. Mapping exercises with Elders were also

used to accurately encompass Inuit relationships with the environment. While these methods were a viable solution for one community, they may not be suitable for another. Many Indigenous communities have different methods and ways to preserve their knowledge systems that do not require digitization. Similarly, partnerships like that of ONC and OTN emphasize that community needs should guide research objectives. As CIOOS Atlantic begins to build and invest in relationships with Indigenous communities, these needs and in turn research objectives, will become more apparent.

In another article that explores anticolonial strategies for the recovery and maintenance of Indigenous knowledge, Simpson notes that there is a colonial narrative to digitizing and documenting TEK (2004). For example, utilizing language like ‘integrating’, ‘incorporating’ and ‘collecting’ is (unintentionally) Eurocentric by assuming that western scientists have the right to take a body of knowledge and mold it into a system that was developed without the input of Indigenous peoples (Simpson, 2004). This not only repeats historical traumas of the past but perpetuates an idea that Indigenous knowledge is a component of science to fill in western scientific gaps. Digitizing TEK is not the only way to build reciprocal, meaningful relations with Atlantic communities. Simpson emphasizes that Indigenous knowledge became threatened at precisely the same time that Indigenous nations lost control over their land (2004). It is argued that instead of digitizing TEK, academics should actively work to protect the land and waters. In relation to CIOOS Atlantic’s observation needs; as people have fewer reasons to go out on the land or water, there are fewer occasions for

---

children to observe, experience and learn from the natural world. As a result, qualitative observational data is threatened. Simpson (2004) concludes, stating “while I acknowledge that there are situations where documenting Indigenous knowledge may be helpful in preservation, I challenge academics and knowledge holders to think critically about the process of documentation before they begin” (p.384). These articles surface important sensitivities that are important for CIOOS Atlantic to be cognizant of.

### *Intellectual Ownership*

In addition to the many concerns revolving around decontextualization, digitizing TEK also raises the concern of intellectual ownership. Out of this concern there have been international, national, and local declarations that address the importance of intellectual rights for Indigenous peoples. For example, the First Nations principles of OCAP (Ownership, Control, Access, and Possession) acknowledges the right of First Nations communities to own, control, access and possess information about their people (AFN, 2007). This includes all aspects of research and information management processes that impact them. OCAP strives to ensure that information is accessible. First Nations must have access to information and data about themselves and their communities, regardless of where it is currently held. Data about the natural environment should be no exception as it provides First Nations with information regarding the state of their traditional lands and waters. In this sense, CIOOS Atlantic actively supports the accessibility of oceanographic observation data that can be beneficial to Indigenous communities.

On an international level, the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP, 2007) specifically addresses Indigenous rights to knowledge and place. For example, Article 11.1 of the UNDRIP states that “Indigenous peoples have the right to practice and revitalize their traditions and customs”. Furthermore, Article 13.1 asserts that “Indigenous peoples have the right to revitalize, use, develop and transmit to future generations their histories, languages, oral traditions”. In recognition of Indigenous connectivity to the natural world, Article 25 acknowledges that “Indigenous peoples have the right to maintain and strengthen their distinctive spiritual relationship with their traditionally owned or otherwise occupied and used lands, territories, waters and coastal seas... to uphold their responsibilities to future generations”. In relation to the digitization of TEK, Indigenous peoples have the right to maintain, control, protect and develop their intellectual property over traditional knowledge. Recognizing these important assertions can allow CIOOS to work alongside Indigenous people to develop goals and research objectives. Similarly, the Aha Honua Declaration specifically speaks to ocean observing scientific communities.

The Aha Honua Coastal Indigenous Peoples’ Declaration, developed at OceanObs’19 by the Indigenous Delegation, asserts that “our existences come from all life and therefore we (Indigenous peoples), as first stewards have a responsibility to our oceans and shoreline ecosystems”, following that “we call on the ocean observing community to formally recognize traditional knowledge of Indigenous peoples worldwide”. In addition, there is a mutual understanding that Indigenous peoples will work alongside ocean

---

observers to advance the United Nations Sustainable Development Goals. The Declaration furthers that “we call on the ocean observing community to establish meaningful partnerships with Indigenous communities, organizations and Nations to learn to further respect each other’s ways of knowing” (Canadian Indigenous Declaration, 2019). This Declaration specifically speaks to CIOOS as an ocean observing platform and community. Initiating these relationships and investing in this research is part of formally recognizing the knowledge of Indigenous peoples. To further answer this call, actions to meet ocean observing needs must be determined with Indigenous communities.

Lastly, the International Federation of Library Associations and Institutions (IFLA) Statement on Indigenous Traditional Knowledge notes that communities need “to protect indigenous traditional knowledge and local knowledge for the benefit of indigenous peoples as well as for the benefit of the rest of the world”, furthering that “it is vulnerable both because it is exploitable and has been exploited” (IFLA, 2019). This statement works to promote the proper protection and use of TEK.

CIOOS Atlantic is in a unique position, where discussions are being held on how TEK fits into the realm of oceanographic data integration. These various assertions, statements and declarations are crucial as they stress the rights of Indigenous peoples. In this sense, these declarations go beyond just ethical guidelines and need to be considered with care to ensure that Indigenous rights, as knowledge holders, are not violated. Actionable items that bring to life UNDRIP, Aha Honua, OCAP and statements on Indigenous knowledge will become more apparent as CIOOS Atlantic

embarks on relationship building with Indigenous peoples. At the core of digitizing TEK should be the recognition of Intellectual ownership and consent.

Protecting the rights of Indigenous Intellectual ownership while actively working to preserve Indigenous knowledge systems has resulted in innovative web-platforms that digitize TEK. One example is a system called Mukurtu.

### Mukurtu

Mukurtu is one example of a tool used by Indigenous people, organizations, and communities to digitize their own data. Mukurtu (MOOK-oo-too) is a grassroots project that aims to empower communities to manage, share, and exchange their digital heritage in culturally relevant and ethically minded ways (Mukurtu, 2020). Like CIOOS, Mukurtu is committed to maintaining an open source platform that is driven by different partnerships. The core mandate of Mukurtu is to build a simple to use, secure, and safe platform that is affordable, scalable, and updatable. This is very similar to CIOOS’s interests in maintaining a platform that provides the public with findable, accessible, interoperable, reusable data. The Mukurtu database is primarily used to allow communities to share and digitize their cultural heritage by building their own website or digital archive. Core features include a ‘communities’ function that allows users to group different people and content together, a ‘cultural protocols’ function used to develop levels of access within communities, and a ‘categories’ function that can be used to describe content about the site. Media metadata allows users to share narratives, videos and audio components that may accompany different data such as

---

maps, photographs or artifacts. It is important to distinguish that Mukurtu does not digitize TEK, but rather provides a tool in the form of a web-publishing platform. This tool allows communities to share and publish their knowledge in a customizable way that suits their own ethical guidelines. The cultural protocols function allows communities to 'lock' their knowledge or apply a 'request access function'. Local Contexts, a labeling system for Indigenous knowledge, is an outcome of Mukurtu that works to protect Indigenous intellectual ownership by providing Traditional Knowledge (TK) labels. These labels can be used by organizations, institutions and communities to safeguard and contextualize digitized collections of TK (see Appendix C, figure 9). Unlike CIOOS, Mukurtu is not specific to oceanographic information and can be utilized in a diverse number of contexts. It also gives full responsibility to Indigenous communities to decide how they want to present their knowledge and who they want to access it.

Accessibility is a key component of CIOOS that can be problematic when working with TEK as it may not be appropriate to digitize Indigenous data according to cultural protocols. Mukurtu works around this issue by creating a function for communities to lock or limit access to their knowledge. Most users of Mukurtu have created platforms for museum databases, or different projects. With requests from Indigenous users, Mukurtu has added an Interactive mapping component which allows users to create map datasets that can showcase knowledge, similar to a cyber cartographic atlas. The platform has been developed with several different partnerships between cultural heritage centres, universities and museums. In summary, Mukurtu is a western scientific

platform that acts as a tool for communities to use, emphasizing the importance of maintaining Indigenous Intellectual ownership. This could be a potential avenue for CIOOS Atlantic to explore. Utilizing or replicating features of Mukurtu should be dependent on the needs of Atlantic Indigenous communities and their desire to digitize TEK and ocean observations.

Exploring the many different concerns, challenges and limitations of digitizing TEK is not to say that it should not be done. Instead, it is important for CIOOS Atlantic to be aware and cognizant of these concerns before pursuing projects. Similarly, potential methods of mitigation should be discussed with the communities that CIOOS is working to engage with. Accessibility and knowledge governance are two key concerns that may stem from CIOOS principles as an openly accessible data platform.

#### *CIOOS and FAIR Data*

The FAIR principles are considered by many as best practice and standard for data collectors. As a data platform, CIOOS values openly accessible data and strives to provide users with data that is readily findable (discoverable), accessible (downloadable), interoperable (standardized and compatible with other systems), and reusable (accurate provenance within metadata). Some of the benefits of having data accessible and standardized is compatibility and reusability. CIOOS data can be used on an international scale, striving to be compatible with other globally recognizable systems such as the Global Ocean Observing System (GOOS) and the U.S. Integrated Ocean Observing System (IOOS). Standardizing data involves using similar file formats, vocabularies and tools to

---

make information readily available and transferable. Ultimately these objectives allow CIOOS to provide a clearer picture regarding the state of our oceans by minimizing some of the challenges of data accessibility. CIOOS strives to make data FAIR by using servers and software that are open-source and free such as CKAN and ERDDAP. The CKAN portal provides CIOOS with a rich cataloguing tool for recording and discovering metadata, while ERDDAP allows users to easily access and download datasets in multiple formats. This data management approach works to meet the needs of both local communities and global ocean observing initiatives. In the cyber cartographic atlases explored, both the Kitikmeot Place Names Atlas and the Inuit Siku Atlas utilize a software called Nunaliit. Nunaliit is a free software developed by Geomatics and Cartographic Research Centre (GCRC) of Carleton University. The software is an open-source template that operates under a New BSD license as it permits use, redistribution, and modification by anyone with no obligation to make the modifications available for others. A fundamental component of the GCRC is that technology to build and interact with information, particularly tools and information developed with public funds, should be free and open for anyone to use and modify (GCRC, 2020).

With these principles in mind, data cannot be fully recognized as valuable unless it is shared. By the same token, CIOOS recognizes that some data is sensitive and cannot be made fully accessible and usable for all. In these cases, sensitive data has a higher risk of misuse and exploitation. One goal of outreach with Indigenous communities is to gain an understanding of how CIOOS can work with sensitive data in appropriate and

ethical ways, while maintaining the integrity of FAIR data principles. Similarly, as CIOOS learns more about the oceanographic data needs of Indigenous communities, new methods to data sharing may be explored.

New data principles, such as the CARE Principles for Indigenous Data Governance, have been developed out of the growing concern regarding Indigenous data sovereignty (GIDA, 2020). Some mitigation measures for minimizing risk of data misuse include appropriate data training (such as OCAP), applying traditional knowledge labels to accompany data (such as Local Contexts), and enforcing data restrictions with appropriate information about *why* data is not openly accessible. The CARE Principles for Indigenous Data Governance are “people and purpose-oriented, reflecting the crucial role of data in advancing Indigenous innovation and self-determination” (Exchange for Local Knowledge and Observations of the Arctic [ELOKA], 2020, para. 2). It is important to note that the CARE principles do not advocate against FAIR data principles. Instead they serve to “complement the existing FAIR principles encouraging open and other data movements to consider both people and purpose” (ELOKA, 2020, para. 2). In summary, the CARE principles encourage data users and collectors to be conscientious of collective benefit, authority to control, responsibility and ethics (CARE) around data. With these considerations in mind, CIOOS Atlantic should work with Indigenous communities to develop a clearer understanding of data sharing sensitivities.

## **CIOOS Recommendations**

---

Out of this research and Literature Review there have been several noted benefits, challenges and limitations to digitizing TEK. Many communities and organizations have their own methods to address issues that arise. Similarly, there have been many enabling factors that have made digitization projects successful. Below are some recommendations that CIOOS Atlantic should consider when working with Indigenous communities and digitizing TEK.

- 1) As CIOOS Atlantic continues to build partnerships with Atlantic Indigenous communities, careful consideration should be taken to ensure local protocols and guidelines are followed.
- 2) CIOOS Atlantic should consciously consider research methods employed to engage with Indigenous peoples, paying close attention to historical trauma and Eurocentric tendencies of the past.
- 3) Research objectives and processes should be co-developed with Atlantic Indigenous communities rather than presented to them.
- 4) The risks associated with digitizing TEK need to be fully understood. This includes paying close care and attention to Intellectual property ownership, decontextualization, and unique community concerns. With this, mitigation measures should be put in place to avoid the exploitation of TEK.  
Further,
- 5) The digitization of TEK should be initiated by or with Atlantic Indigenous communities.

- 6) CIOOS Atlantic should consider engagement meetings to better understand Indigenous community's ocean observing needs on the Atlantic coast. This may be in the form of workshops, discussions, or forums.
- 7) Although CIOOS does not actively collect data in the field, the platform does provide a space for data collectors. Care should be taken to ensure that the data CIOOS houses, has been collected ethically.

### **Future Research**

Limitations in time and resources have posed a lot of different questions about future research for CIOOS Atlantic. CIOOS Atlantic is in the preliminary stages of forming relationships. As such, opportunities and research objectives may evolve over time. Below is a small list of potential research projects, opportunities and relationships that CIOOS Atlantic may find useful to pursue in their journey to building meaningful relationships with Atlantic Indigenous communities.

#### **1) A Formal Land Acknowledgement**

One large challenge within this framework of research is defining an appropriate land acknowledgement that respectfully incorporates all Indigenous communities within the Atlantic seaboard. A land acknowledgement, and in this case a waters acknowledgement, recognizes the original inhabitants of an area. Further, it respects and acknowledges Indigenous peoples as traditional stewards of the land and waters. Without the input of Indigenous peoples, it is difficult to determine an appropriate land acknowledgement that is inclusive and

---

acknowledges the living history and connections of Atlantic Indigenous communities. To explain, because CIOOS Atlantic is unique in the geographic delineation of its regional association, there is a large diversity of nations that should be acknowledged. As CIOOS Atlantic begins to engage with different communities, it may be useful to inquire about how they would like to be acknowledged (in the context of being part of a broader Atlantic region). Developing a unique land acknowledgement to CIOOS Atlantic serves to recognize the rights, knowledge and practices of Indigenous peoples. Similarly, it perpetuates a constant awareness and mindfulness that we are guests to a territory that has been cared for by Indigenous peoples. See Appendix D for a list of land acknowledgements that have been developed by organizations, institutions and communities within the Atlantic RA.

## 2) Contact List

Throughout this research journey there have been many opportunities to connect with different scholars, researchers and community members. Many of these contacts have had similar experiences and interests in working with Indigenous communities. Having discussions and building partnerships with people who have pursued similar project interests have been very valuable for CIOOS Atlantic. CIOOS Atlantic can learn from others who have had successful or negative experiences in the field of collaborative relations and “Two-Eyed Seeing”. Similarly, CIOOS Atlantic can gain an understanding of work that is already being done within the Regional Association and partner organizations to avoid duplicating efforts and putting unnecessary pressure on Indigenous

partners. Appendix E is a list of potential contacts that CIOOS Atlantic may be interested in pursuing. Included with each contact is a brief explanation of why that particular connection may be valuable and relevant, along with publicly available contact information.

## Conclusion

This research is the beginning of a long journey that CIOOS Atlantic has embarked on to build meaningful, respectful, and reciprocal relationships with Atlantic Indigenous communities. As partnerships begin to form, the cloudy waters of collaborative approaches will become clearer. This is especially true in relation to reciprocal objectives that recognize the coastal and ocean data observation needs of both CIOOS Atlantic and Indigenous communities. Care and consideration should be given to ensure that digitizing TEK is initiated and prioritized by Indigenous communities, if pursued by CIOOS Atlantic. Further, mitigation measures should be put in place to ensure the risks of digitizing TEK are limited. This includes addressing themes of decontextualization and intellectual property ownership. Many different communities have developed their own methods to ensure that these risks do not indirectly harm the knowledge systems they are looking to preserve. It is important to note that there is not a ‘one size fits all approach’ to digitizing TEK. CIOOS Atlantic must work with communities to ensure that the risks and challenges of digitization do not outweigh the benefits. Similarly, full transparency should be valued and prioritized to ensure that both CIOOS Atlantic, and partner communities, understand where TEK is being housed and who has access to it.

Some Indigenous scholars and researchers argue that TEK should not be digitized as it is impossible to replicate the transmission process that makes TEK so unique. In light of this, CIOOS Atlantic should

---

be open to other alternatives if communities are not interested in digitizing their knowledge systems (or if the risks are too great). Relationships should not be limited to collecting Indigenous data. A good start for CIOOS Atlantic is to host a community engagement meeting to fully understand what Atlantic Ocean observing needs consist of for Indigenous peoples. It should be noted that CIOOS Atlantic is well on their way to doing this with a series of hosted discussions to engage with Atlantic communities.

Building relationships is never easy, and there are bound to be challenges, misunderstandings and frustrations along the way, but this is not to say it should not be done. Failing to engage with Indigenous communities can result in the exclusion of centuries of

knowledge about the environment and ecological relationships within them. From a human standpoint, failing to respectfully engage with Indigenous people is unethical and Eurocentric, especially given the oceanographic nature of CIOOS. From a scientific standpoint, failing to engage with Indigenous Atlantic communities undermines their value as knowledge holders and scientists who have held innate relationships with the natural environment for time immemorial. All in all, embracing these concerns and actively working to combat the challenges of collaborative relations can actively work to advance CIOOS Atlantic as an ocean observing platform and community of ocean observers.



*CIOOS Atlantic would like to thank the Ocean Frontier Institute and Canada's Ocean Supercluster for funding this research project.*

---

## References

- Adams, M., J. Carpenter, J.A. Housty, D. Neasloss, Paul C. Paquet, C.N. Service, J. Walkus, and C.T. Darimont. (2015). De-centering the university from community-based research: a framework for engagement between academic and indigenous collaborators in conservation and natural resource research. *Toolbox on the Research Principles in an Aboriginal Context: Ethics, Respect, Equity, Reciprocity, Collaboration and Culture*, 7-17.
- Apoqnmulti'k. (2020a). In Facebook. Retrieved from <https://www.facebook.com/apoqnmulti'k>
- Apoqnmulti'k. (2020b). *Faces of Apoqnmulti'k*. Retrieved from <https://www.apoqnmulti'k.ca/faces-of-apoqnmulti'k>
- Assembly of First Nations (AFN). (n.d.). First Nations Ethics First Nations Ethics Guide on Research and Aboriginal Traditional Knowledge. Retrieved from [https://www.afn.ca/uploads/files/fn\\_ethics\\_guide\\_on\\_research\\_and\\_atk.pdf](https://www.afn.ca/uploads/files/fn_ethics_guide_on_research_and_atk.pdf)
- Assembly of First Nations (AFN). (2007). OCAP Ownership, Control, Access and Possession: First Nations Inherent Right to Govern First Nations Data. Retrieved from <https://fnigc.ca/sites/default/files/OCAP%20First%20Nations%20Inherent%20Right%20to%20Govern%20First%20Nations%20Data.pdf>
- Assembly of Nova Scotia Mi'kmaq Chiefs. (n.d.). *Mi'kmaq Ecological Knowledge Study protocol* (2nd ed.). Truro, NS: Kwilmu'kw Maw-klusuaqn Negotiation Office.
- ALVA. (June 2, 2013). *Living Traditions: Living Lands*. [Documentary]. Retrieved from <https://www.youtube.com/watch?v=d2LsHHSDiWg>
- Canadian Indigenous Delegation. (2019). *Aha Honua Coastal Indigenous Peoples' Declaration at OceanObs'19*". Retrieved from [http://www.oceanobs19.net/wp-content/uploads/2019/09/Indigenous-Ocean-Obs19-Declaration\\_8.5x15\\_Final.pdf](http://www.oceanobs19.net/wp-content/uploads/2019/09/Indigenous-Ocean-Obs19-Declaration_8.5x15_Final.pdf)
- Castleden, H., Morgan, V., & Lamb, C. (2012). "I spent the first year drinking tea": Exploring Canadian university researchers' perspectives on community-based participatory research involving Indigenous peoples. *Canadian Geographer / Le Géographe Canadien*, 56(2), 160-179.
- Cochran, P., Marshall, C., Garcia-Downing, C., Kendall, E., Cook, D., McCubbin, L., & Gover, R. (2008). Indigenous ways of knowing: Implications for participatory research and community. *American Journal of Public Health*, 98(1), 22-27.
- Department of Environment Fisheries and Sealing Division. (2013). *Nunavut Coastal Resource Inventory*. Retrieved from [https://www.gov.nu.ca/sites/default/files/ncri\\_pangnirtung\\_en\\_0.pdf](https://www.gov.nu.ca/sites/default/files/ncri_pangnirtung_en_0.pdf)
- Engler, N., Scassa, T., & Taylor, D. (2013). Mapping Traditional Knowledge: Digital Cartography in the Canadian North. *Cartographica*, 48(3), 189-199.

- 
- Ermine, W., Sinclair, R., & Jeffrey, B. (2004). The ethics of research involving Indigenous peoples. Report of the Indigenous Peoples' Health Research Centre to the Interagency Advisory Panel on Research Ethics.
- Exchange for Local Knowledge and Observations of the Arctic (ELOKA). (2020, January 7). Advancing Indigenous data sovereignty. Retrieved from <https://eloka-arctic.org/news/advancing-indigenous-data-sovereignty>
- Failing, L., Gregory, R., & Harstone, M. (2007). Integrating science and local knowledge in environmental risk management: A decision-focused approach. *Ecological Economics*, 64(1), 47-60.
- Fidel, M., Kliskey, A., Alessa, L., & Sutton, P. (2014). Walrus harvest locations reflect adaptation: a contribution from a community-based observation network in the Bering Sea. *Polar Geography*, 37(1), 48–68.
- Geomatics and Cartographic Research Centre (GCRC). *Welcome to Nunaliit: Nunaliit Map Makers*. Retrieved from <http://nunaliit.org>
- Global Indigenous Data Alliance [GIDA]. (2020). CARE principles for Indigenous Data Governance. Retrieved from <https://www.gida-global.org/care>
- Holkup, P. A., Tripp-Reimer, T., Salois, E. M., & Weinert, C. (2004). Community-based participatory research: an approach to intervention research with a Native American community. *ANS. Advances in nursing science*, 27(3), 162–175.
- Indigenous Corporate Training Inc. (2015). Indian Act and Elected Chief and Band Council System. Retrieved from <https://www.ictinc.ca/blog/indian-act-and-elected-chief-and-band-council-system>
- Institute for Integrative Science & Health. (2004). *Two-Eyed Seeing*. Retrieved from <http://www.integrativescience.ca/Principles/TwoEyedSeeing/>
- International Federation of Library Associations and Institutions (IFLA). (May 2019). IFLA Statement on Indigenous Traditional Knowledge. Retrieved from <https://www.ifla.org/publications/ifla-statement-on-indigenous-traditional-knowledge?og=7607>
- Kirkness, V.J., Barnhardt, R. (2001). First Nations and Higher Education: The Four R's – Respect, Relevance, Reciprocity, Responsibility. *Knowledge Across Cultures*, 1-18.
- Kitikmeot Heritage Society. (2020). *Kitikmeot Place Names Atlas*. Retrieved from <https://atlas.kitikmeotheritage.ca/index.html?module=module.about>
- LaFrance, A. (2015, October 30). *Astronomers and Native Hawaiian activists agree that Mauna Kea is a portal to the universe, they just can't agree how it should be used*. Retrieved from <https://www.theatlantic.com/technology/archive/2015/10/what-makes-a-volcano-sacred/413203/>
- Mazzocchi, F. (2006). Western science and traditional knowledge: Despite their variations, different forms of knowledge can learn from each other. *EMBO Reports*, 7(5), 463-466.
- Memorial University. (2020a). *Memorial University's Proposed Policy on Research Impacting Indigenous Groups: Principles for Engagement*. Retrieved from [https://www.mun.ca/research/Indigenous/Principles\\_of\\_Engagement\\_.pdf](https://www.mun.ca/research/Indigenous/Principles_of_Engagement_.pdf)

- 
- Memorial University. (2020b). *Research Impacting Indigenous Groups*. Retrieved from [http://www.mun.ca/research/Indigenous/Intro\\_Indigenous\\_Research\\_Memorial.pdf](http://www.mun.ca/research/Indigenous/Intro_Indigenous_Research_Memorial.pdf)
- Merriam-Webster. (2020). Science. Retrieved from <https://www.learnersdictionary.com/definition/science>
- Mi'kmaw Ethics Watch. (2000). *Mi'kmaw Research Principles and Protocols Conducting Research with/or Among Mi'kmaw People*. Retrieved from <https://www.cbu.ca/wp-content/uploads/2019/08/MEW-Principles-and-Protocols.pdf>
- Miller, K. (2013). What does Indigenous participatory democracy look like? Kahnawà:ke's community decision making process. *Review of Constitutional Studies*, 18(1), 111-132.
- Milton Freeman Research Limited. (1976). Inuit Land Use and Occupancy Project: a report. Canada. Dept. of Indian Affairs and Northern Development.
- Mukurtu. (2020). *Development and Contribution of Mukurtu*. Retrieved from <https://mukurtu.org/about/>
- Nelson, M. (2008). *Original Instructions: Indigenous Teachings for a Sustainable Future*. Rochester, Vermont: Bear & Company.
- Oxford English Dictionary. (2020). Observation. Retrieved from <https://www.lexico.com/definition/observation>
- Pikialasorsuaq Commission. (2019). *An Inuit strategy for the future of Pikialasorsuaq*. Retrieved from <http://pikialasorsuaq.org/en/>
- SikuAtlas. (2017). Overview of the Inuit Sea Ice Use and Occupancy Project. Retrieved from [https://sikuatlas.ca/index.html?module=module.sikuatlas.about.project\\_background](https://sikuatlas.ca/index.html?module=module.sikuatlas.about.project_background)
- Simpson, L. (2004). Anticolonial Strategies for the Recovery and Maintenance of Indigenous Knowledge. *The American Indian Quarterly*, 28(3), 373-384.
- Simpson, L. (2014). Land as pedagogy: Nishnaabeg intelligence and rebellious transformation. *Decolonization: Indigeneity, Education & Society*, 3(4), 1-25.
- Simonds, V., & Christopher, S. (2013). Adapting Western research methods to indigenous ways of knowing. *American Journal of Public Health*, 103(12), 2185-2192.
- Strand, K.J., Cutforth, N., Stoecker, R., Marullo, S. & Donohue, P. (2003). *Community-Based Research and Higher Education: Principles and Practices*. San Francisco, CA: Jossey-Bass
- Tesar, C., Dahl, P. E., & Aporta, C. (2019). Picturing Pikialasorsuaq: Ethics and Effectiveness of Representing Inuit Knowledge in an Online Atlas. *Journal of Ocean Technology*, 14, 13-21.
- Turner, N., Gregory, R., Brooks, C., Failing, L., & Satterfield, T. (2008). From Invisibility to Transparency: Identifying the Implications. *Ecology and Society*, 13(2), 7.
- United Nations General Assembly. (2007). *Declaration on the Rights of Indigenous Peoples*. [https://www.un.org/development/desa/indigenouspeoples/wp-content/uploads/sites/19/2018/11/UNDRIP\\_E\\_web.pdf](https://www.un.org/development/desa/indigenouspeoples/wp-content/uploads/sites/19/2018/11/UNDRIP_E_web.pdf)

---

Wilkinson, M., Dumontier, M., Aalbersberg, I. et al. (2016). The FAIR Guiding Principles for scientific data management and stewardship. *Scientific Data*, 3, 160018. Retrieved from <https://doi.org/10.1038/sdata.2016.18>

Witze, A. (2020, January 14). How the fight over a Hawaii mega telescope could change astronomy: Thirty Meter Telescope controversy is forcing scientists to grapple with how their research affects Indigenous peoples. Retrieved from <https://www.nature.com/articles/d41586-020-00076-7>

Wiwchar, D. (2000, September 21). *Genetic researcher uses Nuu-chah-nulth blood for unapproved studies in Genetic Anthropology*. Retrieved from <https://hashilthsa.com/archive/news/2013-07-22/genetic-researcher-uses-nuu-chah-nulth-blood-unapproved-studies-genetic-anth>

### Other Relevant Resources

Anonymous. (2019). Indigenous Peoples Present Declaration to Ocean-Observing Community. *Sea Technology*, p. 30.

Barber, M., & Jackson, S. (2015). 'Knowledge Making': Issues in Modelling Local and Indigenous Ecological Knowledge. *Human Ecology*, 43(1), 119-130.

Castleden, H. E., Martin, D., Cunsolo, A., Harper, S., Hart, C., Sylvestre, P., Stefanelli, R., Day, L., Lauridsen, K. (2017). Implementing Indigenous and Western Knowledge Systems (Part 2): "You Have to Take a Backseat" and Abandon the Arrogance of Expertise. *The International Indigenous Policy Journal*, 8(4).

Chauvin M. E. (2000). Useful and Conceptual Astronomy in Ancient Hawaii. In Ziaochun S. (eds) *Astronomy Across Cultures: The History of Non-Western Science*, 1(1).

Duarte, M., Vigil-Hayes, M., Littletree, S., & Belarde-Lewis, M. (2017). "Of Course, Data Can Never Fully Represent Reality": Assessing the Relationship between "Indigenous Data" and "Indigenous Knowledge," "Traditional Ecological Knowledge," and "Traditional Knowledge". *Human Biology* 0.

Dunlap Institute. (2020, June 16). *Cosmos From Your Couch - Connect with Mi'kmaw Moons*. [Video file]. Retrieved from [https://www.youtube.com/watch?time\\_continue=3&v=I6b40tiu7fc&feature=emb\\_title](https://www.youtube.com/watch?time_continue=3&v=I6b40tiu7fc&feature=emb_title)

First Nations Information Governance Center (FNIGC). (2014, July). *Understanding the First Nations Principles of OCAP: Our Road Map to Information Governance*. [Video file]. Retrieved from [https://www.youtube.com/watch?time\\_continue=32&v=y32aUFVfCM0&feature=emb\\_title](https://www.youtube.com/watch?time_continue=32&v=y32aUFVfCM0&feature=emb_title)

Friedland, H. & Napoleon, V. (2015). Gathering the Threads: Developing a Methodology for Researching and Rebuilding Indigenous Legal Traditions. *Lakehead Law Journal* 1(1), 17-44.

Glazier-Lawson, M. (2013, June 2). *Living Traditions: Living Lands* [Video File]. Retrieved from <https://www.youtube.com/watch?v=d2LsHHSDiWg>

Mackenzie, K., Siabato, W., Reitsma, F., & Claramunt, C. (2017). Spatio-temporal Visualisation and Data Exploration of Traditional Ecological Knowledge/Indigenous Knowledge. *Conservation and Society*, 15(1), 41-58.

National Marine Educators Association. (2019). *Traditional Knowledge Gains Recognition by Ocean Observing Community*. Retrieved from <https://www.marine-ed.org/news/traditional-knowledge-gains-recognition-by-ocean-observing-community>

---

Ocean Networks Canada. (2019, February 19). *OceanObs'19 - Bringing Indigenous Knowledge to the Table*. Retrieved from <https://www.youtube.com/watch?v=-umhkhuLLgA>

Teixeira, J., Martins, A., Pinheiro, H., Secchin, N., De Moura, R., & Bastos, A. (2013). Traditional Ecological Knowledge and the mapping of benthic marine habitats. *Journal of Environmental Management*, 115, 241

TED. (2017, November). *'Qatuwas Jessica Brown: Indigenous Knowledge and Ocean Science* [Video file]. Retrieved from <https://www.youtube.com/watch?v=0vuZ5Jm67fg>

Wahaanga, H., Bainbridge, D., Anderson, M., Scrivener, K., Cader, P., Roa, T., & Keegan, T. (2015). He Matapihi Mā Mua, Mō Muri: The Ethics, Processes, and Procedures Associated with the Digitization of Indigenous Knowledge-The Pei Jones Collection. *Cataloging & Classification Quarterly: Indigenous Knowledge Organization*, 53(5-6), 520

---

## Appendix A – Geographic Context Maps



*Figure 1. The geographic scope of all three CIOOS Regional Associations (Pacific, St. Lawrence, and Atlantic) are largely defined by Fisheries and Oceans Canada (DFO). Currently DFO has 6 administrative regions, 3 of which overlap with CIOOS Atlantic and CIOOS St. Lawrence. These DFO regions include: Newfoundland and Labrador, Maritimes-Scotia-Fundy and Gulf. Retrieved from <https://www.dfo-mpo.gc.ca/regions/index-eng.htm>*

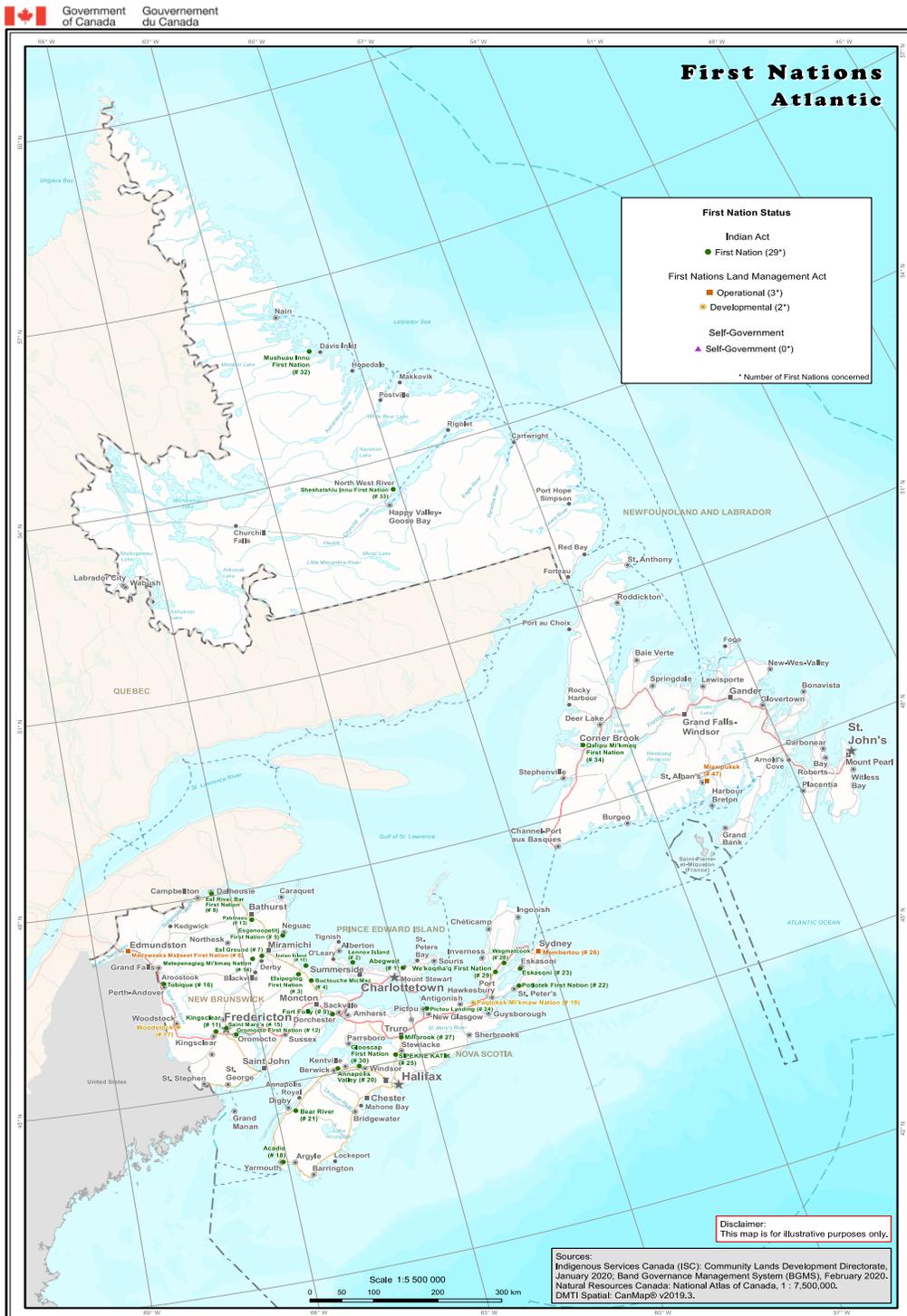


Figure 2. Source: Indigenous and Northern Affairs Canada.

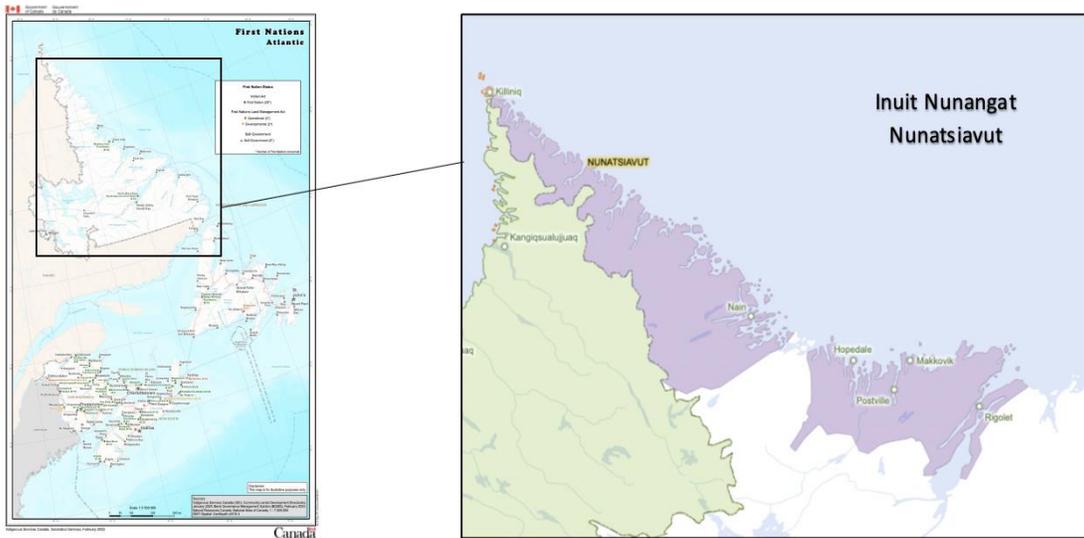
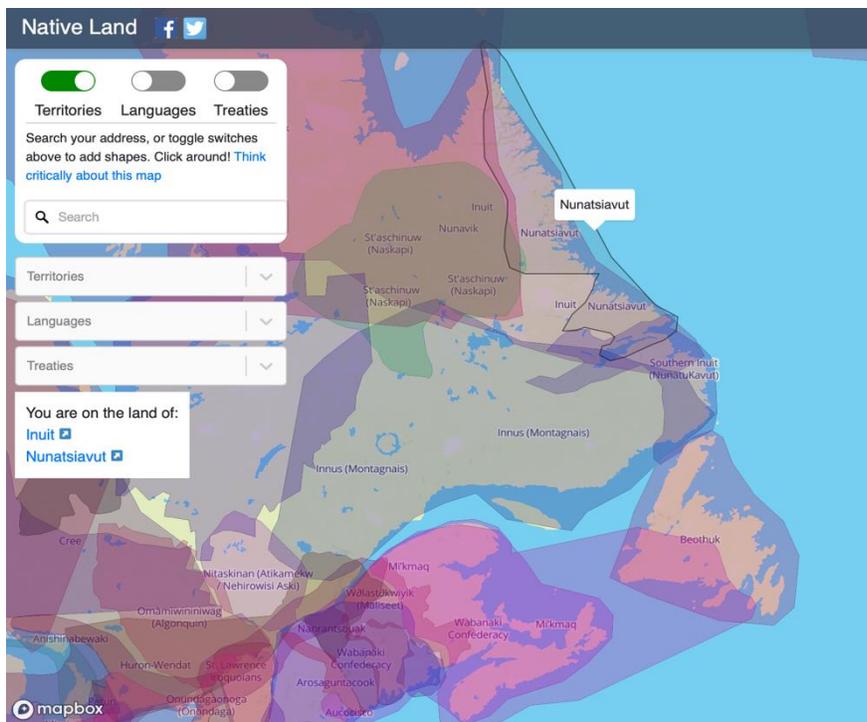


Figure 3. Source: Indigenous and Northern Affairs Canada.

CIOOS Atlantic Regional Association operates within the territory of many different Indigenous communities, including both First Nations and Inuit. The maps on page 30 (Figure 2.) identifies Atlantic First Nations communities spanning from Maine, USA to Newfoundland and Labrador, Canada. Whereas the map above (Figure 3.) identifies the Nunatsiavut, Inuit of Labrador. It is difficult to delineate exact boundaries that define the geographic relationship between Indigenous communities and CIOOS Atlantic because they cannot be determined by provincial or national borders. CIOOS Atlantic is largely defined by the Department of Fisheries and Oceans Canada regions (Figure 1.). The oceanic nature of CIOOS Atlantic requires unique geographic context. As such, these maps serve the

purpose of identifying potential collaborative partners within the Regional Associations. Western Newfoundland, the Nova Scotia side of Northumberland Strait and Western Cape Breton are not within CIOOS Atlantic oceanic region. Similarly, the shores within New Brunswick are also outside the CIOOS Atlantic Regional Association.

*Native Land Digital* is a Canadian not-for-profit organization that is Indigenous led. They actively work to map Indigenous territories according to Indigenous nations themselves. An Interactive map allows users to navigate all around the world to learn about traditional territories, treaties and languages. This close up screenshot (Figure 4.) of the Atlantic seaboard emphasizes the complexity and diversity of traditional territories prior to colonization. This map is best understood through user navigation. Users can click on different layers to



view territories, language zones and treaties.

## Appendix B

---

### **Mi'kmaw Research Principles and Protocols: Conducting Research With and/or Among Mi'kmaw People**

1. Name of researcher(s) and/or supervisor(s) and related department(s). Name of contact person(s) and contact address (indicate summer addresses if pertinent).
2. Anticipated start date of the research study and expected completion date. Include anticipated field research dates.
3. Title of study.
4. Abstract (100-250 words), giving a brief statement of the purpose, hypotheses (or brief statement of research questions and significant proposed research) to be examined.
5. Funding source: indicate the source of research or study funds, and whether grant funds have already been provided.
6. Participants: describe the procedures for recruiting, selecting, and assigning participants.
7. Consent: describe process by which participants consent to participate in the research project; that is, how will participants be informed of their rights as participants, and by what means they will signify their understanding of those rights and consent to participate. Any research involving children under the age of 14, shall require parental informed consent.
8. Language: describe accommodations for Mi'kmaw language, culture and community protocols in the proposed study, including how Mi'kmaw people will be accommodated in communicating or deriving consent. Describe process for determining and using appropriate protocols and traditions for entering into Mi'kmaq territory and homes.
9. Methods/Procedures: Describe the methodologies for this study including choice of methods, approaches, and include any questionnaires, surveys, interview guides, or other questioning techniques in attached documents or Appendix.
10. Risk or deception: indicate if any aspects of the study involve risk to the participants or to the Mi'kmaw people collectively. Describe any risk to the person/persons as a result of the findings being reported or published or risk to the Mi'kmaq, such as to their treaty or Aboriginal rights.
11. Usefulness and Benefits: describe the benefit(s) for individual Mi'kmaw persons, groups such as youth, women or Elders, etc. or to the Mi'kmaw Nation as a whole as a result of this study or its published report or findings.

- 
12. Interpretation of Results: explain how the data will be analyzed and who will be analyzing the data, including if any Mi'kmaw people will be involved in, consulted with, or informed about, the interpretation process of analyzing the data or in its presentation of its findings and conclusions.
  13. Storage of data: detail how the data will be stored to ensure safety and confidentiality of the participants in the study. How long will the data be kept? Will the data be used again in another aspect of the study? Will the participants have the right to consent to this next phase of study?
  14. Confidentiality: describe what measures will be taken to protect Mi'kmaw participants and third-party privacy (confidentiality and anonymity). Describe if any data may be kept by the community (ies) for their own community research, and where it will be stored. Discuss how confidentiality can be maintained, or how the researchers have informed participants if they seek to have confidentiality released for the communities to have the data.
  15. Describe who will be the copyright holder of the final document, the author(s), and where can this report be accessed at the completion of the study?
  16. Publication and royalties: describe anticipated publications or plans for publication from this research and how any royalties from book sales will be shared with participants of the study.

\*\*Consent form must be requested from the *Mi'kmaw Ethics Watch*

### **Appendix C – Project Screenshots**

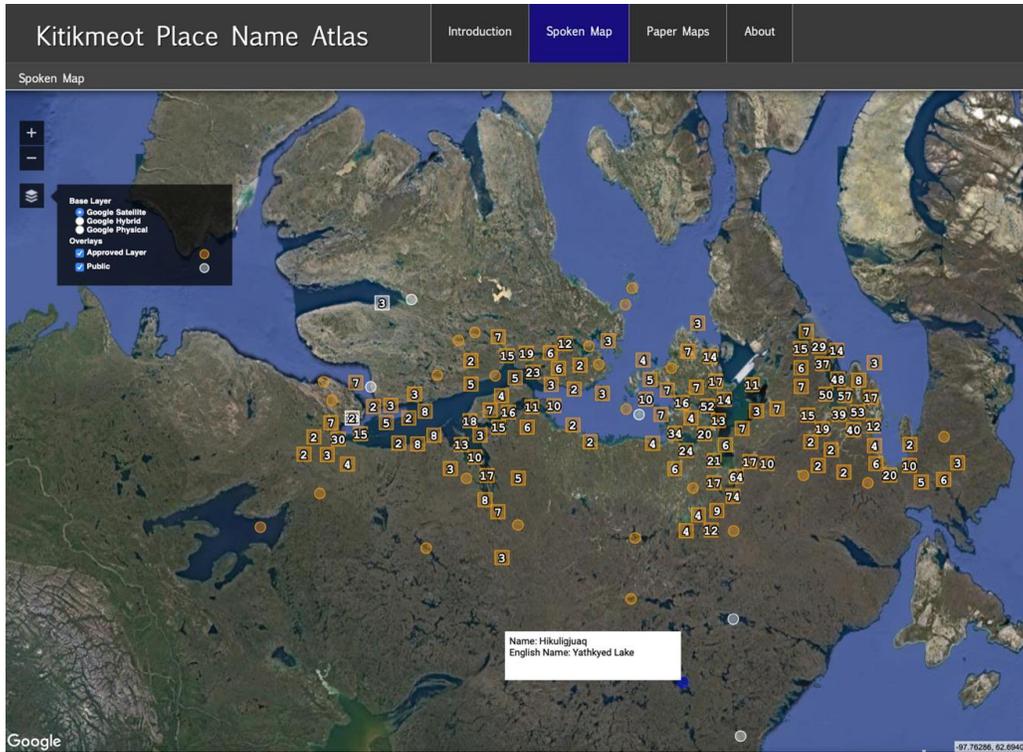


Figure 5. Kitikmeot Place Name Atlas map. The map features different clusters that incorporate several points. The orange circles are individual points that include a traditional name, coordinate, 'common' name and media associated with the datapoint (if available). Retrieved from <https://atlas.kitikmeoheritage.ca/index.html?module=module.names>.



Figure 6. Kitikmeot Place Name coordinate. Users can click on a coordinate to learn the Inuit name by pronunciation. The media button, located at the bottom of the image, allows users to explore any associated oral traditions, meanings and pronunciations. Many points are still being developed and added to. Retrieved from <https://atlas.kitikmeoheritage.ca/index.html?module=module.names#eyJ0IjoieCIslmkiOiJiZjJkOWVjMGE5ZTRiN2Q1MmY3ODc5ZGMxMmQyZDlkZCIsInMiOjE1OTUyNTIwMDEzODB9>.

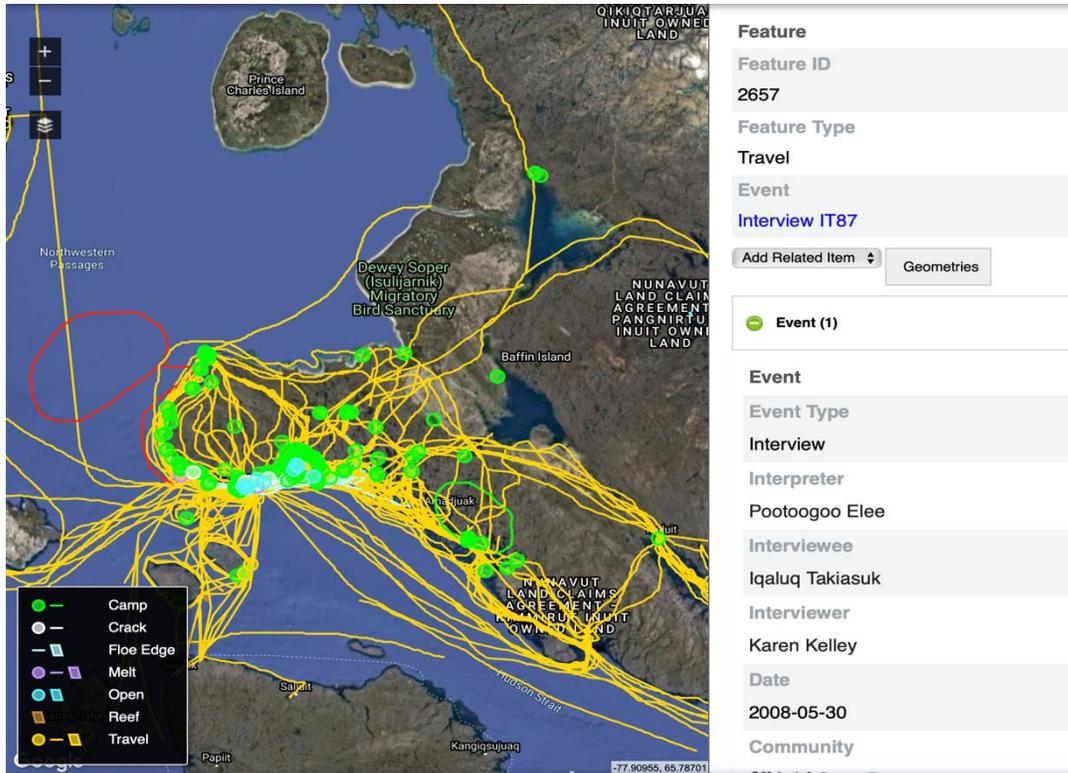


Figure 7. The Siku Sea Ice map is interactive and allow users to click on different features to learn about how the information was collected and where it was collected from. For example, the yellow lines represent travel routes (mapped through participatory mapping sessions). Retrieved from [https://sikuatlas.ca/index.html?module=module.sikuatlas.igloolik.sea\\_ice#](https://sikuatlas.ca/index.html?module=module.sikuatlas.igloolik.sea_ice#)

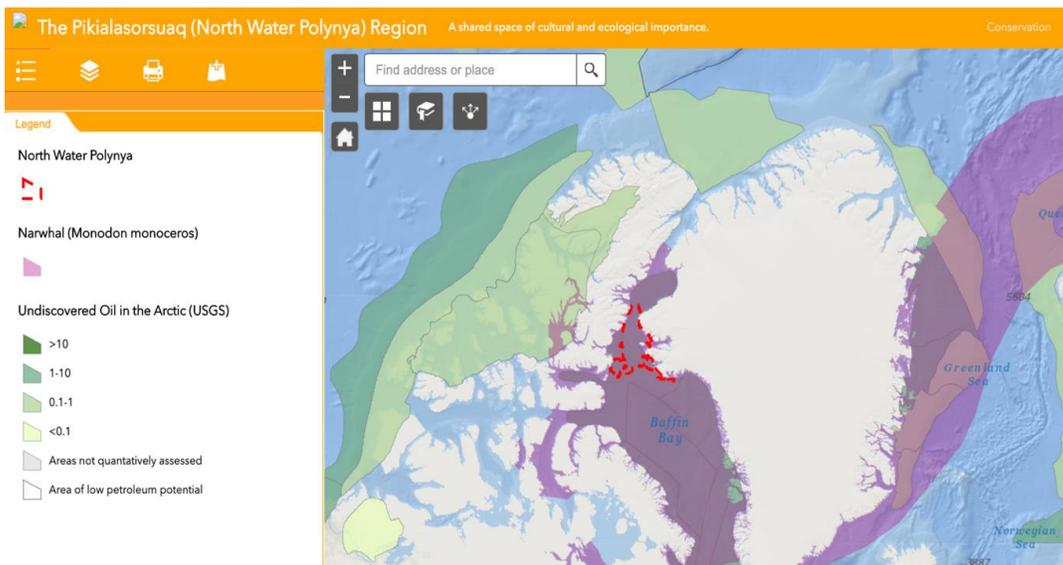


Figure 8. The Pikialasorsuaq (North Water Polynya) Planning Tool allows users to upload and navigate through different layers to develop an understanding of how different activities may impact the polynya. For example, this screenshot displays overlap between narwhal habitat and undiscovered oil in the Arctic. Retrieved from <https://panda.maps.arcgis.com/apps/webappviewer/index.html?id=35081265064a460da83e89d43c041f5c>

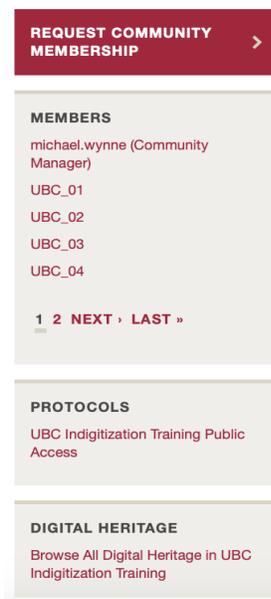


Figure 9. The Mukurtu toolbar allows users to browse different digital collections and archives. Many communities are 'locked' and require users to request access in order to view the content. Shown here is a sidebar within a community page, complete with members, protocols and digital heritage links. As users browse the different communities, they have the option to 'request community membership'. Retrieved from <https://mukurtudemo.libraries.wsu.edu/community/ubc-indigitization-training>



Figure 10. The TK Labels are a tool for Indigenous communities to add existing local protocols for access and use to recorded cultural heritage that is digitally circulating outside community contexts. The TK Labels offer an educative and informational strategy to help non-community users of this cultural heritage understand its importance and significance to the communities from where it derives and continues to have meaning. Retrieved from [localcontexts.org](http://localcontexts.org)

---

## Appendix D – Atlantic Land Acknowledgements

Source: <https://www.caut.ca/content/guide-acknowledging-first-peoples-traditional-territory>

### **Newfoundland and Labrador:**

#### **Memorial University (St. John's) –**

1/ I [we] would like to respectfully acknowledge the territory in which we gather, as the ancestral unceded homelands of the Beothuk and the island of Newfoundland as the ancestral unceded homelands of the Mi'kmaq and Beothuk.

2/ I [we] would like to respectfully acknowledge the territory in which we gather, as the ancestral home-lands of the Beothuk and the island of Newfoundland as the ancestral homelands of the Mi'kmaq and Beothuk. I (we) would also like to recognize the Inuit of Nunatsiavut and NunatuKavut and the Innu of Nitassinan, and their ancestors, as the original people of Labrador. We strive for respectful partnerships with all the peoples of this province as we search for collective healing and true reconciliation and honour this beautiful land together.

— Acknowledgement provided by Office of Aboriginal Affairs, Memorial University

#### **Memorial University of Newfoundland Grenfell Campus (Corner Brook) –**

1/ I [we] would like to respectfully acknowledge that the land on which we gather is in traditional unceded Mi'kmaw territory.

2/ I [we] would like to respectfully acknowledge that the land on which we gather is in traditional Mi'kmaw territory, and we acknowledge with respect the diverse histories and cultures of all the Mi'kmaw, Innu, and Inuit Peoples of this province.

— Acknowledgement provided by Office of Aboriginal Affairs, Memorial University

### **Prince Edward Island**

**University of Prince Edward Island (Charlottetown)** – We [I] would like to begin by acknowledging that the land on which we gather is the traditional and unceded territory of the Abegweit Mi'kmaq First Nation.

### **Nova Scotia**

**Acadia University (Wolfville)** – We [I] would like to begin by acknowledging that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People. This territory is covered by the “Treaties of Peace and Friendship” which Mi'kmaq Wəlastəkwiyyik (Maliseet), and Passamaquoddy Peoples first signed with the British Crown in 1726. The treaties did not deal with surrender of lands and resources but in fact recognized Mi'kmaq and Wəlastəkwiyyik (Maliseet) title and established the rules for what was to be an ongoing relationship between nations.

**Atlantic School of Theology (Halifax)** – We [I] would like to begin by acknowledging that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People. This territory is covered by the “Treaties of Peace and Friendship” which Mi'kmaq Wəlastəkwiyyik (Maliseet), and Passamaquoddy Peoples first signed with the British Crown in 1726. The treaties did not deal with surrender of lands and resources but in fact recognized Mi'kmaq and Wəlastəkwiyyik (Maliseet) title and established the rules for what was to be an ongoing relationship between nations.

**Cape Breton University (Sydney)** – We [I] would like to begin by acknowledging that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People. This territory is covered by the “Treaties of Peace and Friendship” which Mi'kmaq Wəlastəkwiyyik (Maliseet), and Passamaquoddy Peoples first signed with the British Crown in 1726. The treaties did not deal with surrender of lands and resources but in fact recognized Mi'kmaq and Wəlastəkwiyyik (Maliseet) title and established the rules for what was to be an ongoing relationship between nations.

---

**Dalhousie University (Halifax)** –

1/ We [I] would like to begin by acknowledging that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People. This territory is covered by the “Treaties of Peace and Friendship” which Mi'kmaq Wəlastəkwiyyik (Maliseet), and Passamaquoddy Peoples first signed with the British Crown in 1726. The treaties did not deal with surrender of lands and resources but in fact recognized Mi'kmaq and Wəlastəkwiyyik (Maliseet) title and established the rules for what was to be an ongoing relationship between nations.

2/ Dalhousie University sits on the Traditional Territory of the Mi'kmaq. We are all Treaty people.

— Official university acknowledgement provided by Executive Director, Diversity and Inclusiveness, Dalhousie University

**Mount Saint Vincent University (Halifax)** – We [I] would like to begin by acknowledging that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People. This territory is covered by the “Treaties of Peace and Friendship” which Mi'kmaq Wəlastəkwiyyik (Maliseet), and Passamaquoddy Peoples first signed with the British Crown in 1726. The treaties did not deal with surrender of lands and resources but in fact recognized Mi'kmaq and Wəlastəkwiyyik (Maliseet) title and established the rules for what was to be an ongoing relationship between nations.

**Nova Scotia College of Art and Design (Halifax)** – We [I] would like to begin by acknowledging that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People. This territory is covered by the “Treaties of Peace and Friendship” which Mi'kmaq Wəlastəkwiyyik (Maliseet), and Passamaquoddy Peoples first signed with the British Crown in 1726. The treaties did not deal with surrender of lands and resources but in fact recognized Mi'kmaq and Wəlastəkwiyyik (Maliseet) title and established the rules for what was to be an ongoing relationship between nations.

**Saint Mary's University (Halifax)** – We [I] would like to begin by acknowledging that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People. This territory is covered by the “Treaties of Peace and Friendship” which Mi'kmaq Wəlastəkwiyyik (Maliseet), and Passamaquoddy Peoples first signed with the British Crown in 1726. The treaties did not deal with surrender of lands and resources but in fact recognized Mi'kmaq and Wəlastəkwiyyik (Maliseet) title and established the rules for what was to be an ongoing relationship between nations.

**St. Francis Xavier University (Antigonish)** – We [I] would like to begin by acknowledging that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People. This territory is covered by the “Treaties of Peace and Friendship” which Mi'kmaq Wəlastəkwiyyik (Maliseet), and Passamaquoddy Peoples first signed with the British Crown in 1726. The treaties did not deal with surrender of lands and resources but in fact recognized Mi'kmaq and Wəlastəkwiyyik (Maliseet) title and established the rules for what was to be an ongoing relationship between nations.

**Université Sainte-Anne (Halifax)** – We [I] would like to begin by acknowledging that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People. This territory is covered by the “Treaties of Peace and Friendship” which Mi'kmaq Wəlastəkwiyyik (Maliseet), and Passamaquoddy Peoples first signed with the British Crown in 1726. The treaties did not deal with surrender of lands and resources but in fact recognized Mi'kmaq and Wəlastəkwiyyik (Maliseet) title and established the rules for what was to be an ongoing relationship between nations.

**Université Sainte-Anne (Petit-de-Grat)** – We [I] would like to begin by acknowledging that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People. This territory is covered by the “Treaties of Peace and Friendship” which Mi'kmaq Wəlastəkwiyyik (Maliseet), and Passamaquoddy Peoples first signed with the British Crown in 1726. The treaties did not deal with surrender of lands and resources but in fact recognized Mi'kmaq and Wəlastəkwiyyik (Maliseet) title and established the rules for what was to be an ongoing relationship between nations.

**Université Sainte-Anne (Pointe-de-l'Église)** – We [I] would like to begin by acknowledging that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People. This territory is covered by the “Treaties of Peace and Friendship” which Mi'kmaq Wəlastəkwiyyik (Maliseet), and Passamaquoddy Peoples first signed with the British Crown in 1726. The treaties did not deal with surrender of lands and resources but in fact recognized

---

Mi'kmaq and Wəlastəkwiyyik (Maliseet) title and established the rules for what was to be an ongoing relationship between nations.

**Université Sainte-Anne (Saint-Joseph-du-Moine)** – We [I] would like to begin by acknowledging that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People. This territory is covered by the “Treaties of Peace and Friendship” which Mi'kmaq Wəlastəkwiyyik (Maliseet), and Passamaquoddy Peoples first signed with the British Crown in 1726. The treaties did not deal with surrender of lands and resources but in fact recognized Mi'kmaq and Wəlastəkwiyyik (Maliseet) title and established the rules for what was to be an ongoing relationship between nations.

**Université Sainte-Anne (Tusket)** – We [I] would like to begin by acknowledging that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People. This territory is covered by the “Treaties of Peace and Friendship” which Mi'kmaq Wəlastəkwiyyik (Maliseet), and Passamaquoddy Peoples first signed with the British Crown in 1726. The treaties did not deal with surrender of lands and resources but in fact recognized Mi'kmaq and Wəlastəkwiyyik (Maliseet) title and established the rules for what was to be an ongoing relationship between nations.

**University of King's College (Halifax)** – We [I] would like to begin by acknowledging that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People. This territory is covered by the “Treaties of Peace and Friendship” which Mi'kmaq Wəlastəkwiyyik (Maliseet), and Passamaquoddy Peoples first signed with the British Crown in 1726. The treaties did not deal with surrender of lands and resources but in fact recognized Mi'kmaq and Wəlastəkwiyyik (Maliseet) title and established the rules for what was to be an ongoing relationship between nations.

### **New Brunswick**

**Mount Allison University (Sackville)** – We [I] would like to acknowledge, honour, and pay respect to the traditional owners and custodians (from all four directions), of the land on which we gather. It is upon the unceded ancestral lands of the Mi'kmaw people, that Mount Allison University is built. While this area is known as Sackville, NB the territory is part of the greater territory of Mi'kma'ki.

**St. Thomas University (Fredericton)** – We [I] would like to begin by acknowledging that the land on which we gather is the traditional unceded territory of the Wəlastəkwiyyik (Maliseet) whose ancestors along with the Mi'Kmaq / Mi'kmaw and Passamaquoddy / Peskotomuhkati Tribes / Nations signed Peace and Friendship Treaties with the British Crown in the 1700s.

**Université de Moncton (Moncton)** – We [I] would like to begin by acknowledging that the land on which we gather is the traditional unceded territory of the Mi'kmaq Peoples. This territory is covered by the “Treaties of Peace and Friendship” which Wəlastəkwiyyik (Maliseet), Mi'kmaq and Passamaquoddy Peoples first signed with the British Crown in 1726. The treaties did not deal with surrender of lands and resources but in fact recognized Mi'kmaq and Wəlastəkwiyyik (Maliseet) title and established the rules for what was to be an ongoing relationship between nations.

**Université de Moncton (Edmundston)** – We [I] would like to begin by acknowledging that the land on which we gather is the traditional unceded territory of the Mi'kmaq Peoples. This territory is covered by the “Treaties of Peace and Friendship” which Wəlastəkwiyyik (Maliseet), Mi'kmaq and Passamaquoddy Peoples first signed with the British Crown in 1726. The treaties did not deal with surrender of lands and resources but in fact recognized Mi'kmaq and Wəlastəkwiyyik (Maliseet) title and established the rules for what was to be an ongoing relationship between nations.

**Université de Moncton (Shippagan)** – We [I] would like to begin by acknowledging that the land on which we gather is the traditional unceded territory of the Mi'kmaq Peoples. This territory is covered by the “Treaties of Peace and Friendship” which Wəlastəkwiyyik (Maliseet), Mi'kmaq and Passamaquoddy Peoples first signed with the British Crown in 1726. The treaties did not deal with surrender of lands and resources but in fact recognized Mi'kmaq and Wəlastəkwiyyik (Maliseet) title and established the rules for what was to be an ongoing relationship between nations.

**University of New Brunswick (Fredericton)** – We [I] would like to begin by acknowledging that the land on which we gather is the traditional unceded territory of the Wəlastəkwiyyik (Maliseet) Peoples. This territory is

---

covered by the “Treaties of Peace and Friendship” which Wəlastəkwiyyik (Maliseet), Mi’kmaq and Passamaquoddy Peoples first signed with the British Crown in 1726. The treaties did not deal with surrender of lands and resources but in fact recognized Mi’kmaq and Wəlastəkwiyyik (Maliseet) title and established the rules for what was to be an ongoing relationship between nations.

**University of New Brunswick (Saint John)** – We [I] would like to begin by acknowledging that the land on which we gather is the traditional unceded territory of the Wəlastəkwiyyik (Maliseet). This territory is covered by the “Treaties of Peace and Friendship” which Wəlastəkwiyyik (Maliseet), Mi’kmaq and Passamaquoddy Peoples first signed with the British Crown in 1726. The treaties did not deal with surrender of lands and resources but in fact recognized Mi’kmaq and Wəlastəkwiyyik (Maliseet) title and established the rules for what was to be an ongoing relationship between nations.

---

## Appendix E – Contact List

This list of contacts serves to identify individuals within partner organizations whose research or interests are relevant, in the hopes of including these individuals to share insights and collectively identify productive next steps. Each researcher or organization includes contact information along with a brief overview of their role and how it may be relevant or beneficial to CIOOS Atlantic.

**Name:** Dr. Karen Beazley

**Role/Organization:** Professor, Academic Coordinator, School for Resource and Environmental Studies, Dalhousie University

**Email:** [karen.beazley@dal.ca](mailto:karen.beazley@dal.ca)

**Phone:** 902-949-1383 (dal phone number)

Dr. Beazley focuses on Indigenous perspectives on biodiversity conservation and stewardship of land and water. She has established research relationships with Indigenous communities and individuals in Nova Scotia. Professor Beazley's research interests include biodiversity conservation system planning, protected area selection and delineation, regional habitat connectivity planning, and environmental ethics. Currently Dr. Beazley teaches several higher-level environmental management and conservation classes. Additionally, Dr. Beazley has received several awards in educational and environmental leadership. In relation to CIOOS Atlantic, Dr. Beazley may be able to provide some valuable insight into previous work with Indigenous communities in Nova Scotia. Further, Dr. Beazley has several years of experience in environmental ethics and management. A lot of this work has combined social sciences and environmental ethics with biodiversity and marine management.

**Name:** Cathy Martin

**Role/Organization:** Director of Indigenous Community Engagement, Dalhousie University

**Contact:** Cathy has just recently joined the Dal team, so there is not yet contact information. In the future, it may be available on the Dalhousie directory <https://directory.dal.ca/?q=>

Cathy Martin is Dalhousie's new director of Indigenous Community Engagement. Martin is also a filmmaker and became the first female Mi'kmaw director in the Atlantic region. "The Truth and Reconciliation Commission of Canada's call to action was yet another reminder to Dalhousie that we needed to act and act now," says Rajack-Talley. "We need to do our part in redressing the colonial history of residential schools and attempts to decimate the identity, education and life chances of Indigenous peoples. Acknowledging that Dalhousie University is located in Mi'kma'ki — the ancestral and unceded territory of the Mi'kmaq — is just the beginning of what we can do." It is within this context that the university's Indigenous Strategy Committee recommended Martin's position and the establishment of an Indigenous Advisory Board. Martin will facilitate ongoing communications with people in Mi'kma'ki, foster partnerships with Mi'kmaw leaders, offer cultural sensitization to Dalhousie as well as work with others at Dal to ensure Indigenous faculty, staff and students feel welcomed and supported at the university. One of the many recommendations for researchers provided through the Mi'kmaw Ethics Watch is to make accommodation for language. Cathy Martin has been recommended by other connections for CIOOS Atlantic as a potential partnership. Additionally, Martin is passionate about answering the call to reconciliation and may have some recommendations for CIOOS Atlantic to undertake when engaging with Indigenous communities, and specifically, Mi'kmaw communities.

---

**Name:** Dr. Lucia Fanning

**Role/Organization:** Professor Emeritus, Principle Investigator, Marine Affairs Program, Dalhousie University

**Contact:** [lucia.fanning@dal.ca](mailto:lucia.fanning@dal.ca)

Dr. Lucia Fanning is a member of the Fish-WIKS steering committee. Fish-WIKS research looks at understanding western and Indigenous knowledge systems and explores how the different processes by which knowledge is acquired, transmitted and used can be harnessed to enhance Canadian fisheries policy. Fanning is very interested in understanding how western and indigenous knowledge systems influence fisheries decision-making on Canada's Pacific, Atlantic and Arctic coasts as well as inland fisheries in Ontario. The Fish-WIKS project has been noted by many as a successful collaborative project between western scientists and Indigenous knowledge holders. Fanning may be able to provide some insights on enabling factors that have made projects such as Fish-WIKS successful.

**Name:** Dr. Peter Evans

**Role/Organization:** Outreach, Trailmark Systems

**Contact:** [peter.evans@trailmarksys.com](mailto:peter.evans@trailmarksys.com)

Peter Evans is a human geographer and intersection of the burgeoning resource sector and Aboriginal communities subsistence economies. He looks at the relationship through qualitative and mixed method tools, including historical and geographical analysis, land use and local knowledge studies. Trailmarks is a software that specializes in digitizing traditional knowledge and land use studies. Many First Nation communities have used Trailmarks systems for marine and land planning. For example, Trailmark is conducting a large marine baseline study of Tsawout First Nation's current and traditional use; and accumulating traditional ecological knowledge of their marine territory (hunting, fishing, gathering). The project involves quantitative and qualitative research, training of local researchers, integration of TEK with biophysical assessment, and extensive communications. Peter Evans was recommended through a connection with Songhees First Nation (Vancouver). Evans has plenty of experience working with Indigenous communities and providing them with ways to digitize their TEK. CIOOS Atlantic may benefit from a conversation regarding Evan's experiences digitizing TEK with different Nations on the west coast.

**Name:** Hannah Wilcox

**Role/Organization:** Software Developer, ELOKA (Exchange for Local Observations and Knowledge of the Arctic)

**Contact:** [eloka@nsidc.org](mailto:eloka@nsidc.org) (general email for communication inquiries)

The Exchange for Local Knowledge and Observations of the Arctic (ELOKA) is a program at the National Snow and Ice Data Center, a research center of the Cooperative Institute for Research in Environmental Sciences at the University of Colorado. ELOKA is an Arctic research data management program that combines local traditional knowledge and local observations data from Indigenous Arctic residents utilizing effective and appropriate western methods to properly share Arctic Indigenous knowledge. Hannah Wilcox is a software developer that specifically works with data management protocols for digitizing traditional knowledge. Hannah would be an excellent contact for discussing the technical aspects of TEK digitization. ELOKA works with the understanding that data systems and methods for digitizing local and traditional knowledge are complex.