

**Using Peer-to-Peer Knowledge Transfer to Build Marine Oil Spill Preparedness Capacity and Foster Resilience Among Indigenous Communities**

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**ABSTRACT**

Indigenous communities often bear disproportionate risks from marine oil spills because of their close connections to and reliance on marine ecosystems. The impacts of an oil spill on Indigenous people and communities can be far-reaching, even for incidents that might be considered "small" from the perspective of the response community. Building community capacity for oil spill preparedness and response is a critical component to creating resilience within Indigenous communities. While the fundamental elements of capacity are the same for Indigenous communities as for any other coastal community, the approach requires an understanding and respect for Traditional Knowledge, Indigenous governance structures, and existing stewardship networks. Oil spill preparedness and response traditionally follows a top-down approach within both government and industry, because marine oil spills are low frequency, high consequence, highly complex incidents where multiple organizations and jurisdictions must work together. While this reality applies regardless of whether an oil spill impacts Indigenous communities, a top-down approach can be experienced as a threat to self-governance and compromise the effectiveness of capacity-building efforts.

There is a significant body of research in support of the concept that resilience to emergencies and disasters among Indigenous people must build upon existing social, cultural, and familial structures in order to be effective. This requires a fundamentally different approach that builds from the ground up with the goal of ultimately meshing with the existing preparedness and response framework. Peer-to-peer learning and knowledge transfer is an approach that has been used in support of a range of initiatives among Indigenous communities, such as human health initiatives. The same approach may provide a mechanism to empower Indigenous communities to enhance both capacity and resilience. This paper presents a case study from ongoing work to connect Indigenous communities from Canada's High Arctic and Pacific Coast in support of marine oil spill preparedness and response.

## **Introduction**

Diminishing sea ice coverage in the Arctic Ocean is opening up new sea routes for commercial vessels moving cargoes between Northern Europe and Eastern Asia. Economic and environmental impact studies predict that over the next 10 years, nearly 5% of future global trade could be rerouted through Arctic waters, increasing the frequency and density of vessel traffic (Yumashev et al., 2017). As vessel trips through northern sea routes become more frequent, the opportunity for accidents or oil spills also increases (Arctic Council, 2009). Arctic communities have witnessed substantial growth in the number of vessels transiting Arctic waters, not only cargo vessels but also cruise ships, research vessels, and recreational boats. A recent case study of several circumpolar Arctic communities found that they perceive a number of direct and indirect threats from increased ship traffic, ranging from disruption to wildlife migration to greywater and garbage discharges to potential contamination of wild foods (Olsen et al., 2019).

Changes to vessel traffic patterns have been particularly notable in the Canadian High Arctic Archipelago, where communities along the Northwest Passage have witnessed a near

tripling of ship movements from 1990 to 2015 (Dawson et al., 2018). As a result, Inuit communities along the Northwest Passage have expressed heightened concerns about the risk of ship accidents and marine oil spills (Downing, 2019).

## **Background**

### ***Marine Oil Spills and Indigenous Communities***

International best practice recognizes the importance of including coastal communities in planning and preparedness for shipping accidents and oil spills (API, 2013; IPIECA/IOGP, 2015; IPIECA, 2000). Community participation in planning and preparedness benefits communities, and can also enhance local response capability (Walker, 2017). This is particularly true for isolated communities in the remote Arctic and sub-Arctic regions, many of which have a predominantly Indigenous population, where long travel distances and challenging logistics may slow the initial response to marine incidents.

While the concept of involving communities in marine response planning is generally well accepted, its implementation can be challenging. Coastal communities, both Indigenous and non-Indigenous, often experience power imbalances with other entities when a spill occurs. Many of the authorities that a community would typically exercise during an emergency – such as protecting community health or providing timely, updated information – are confounded by the multi-jurisdictional nature of spill response (USCG, 2011; McPherson and DeCola, 2016). It can be very challenging for communities that are experiencing the impacts of a marine oil spill to reconcile the damages they are experiencing with a response system where the polluter or Responsible Party has an active role in directing the cleanup. This dynamic can be even more intense for Indigenous communities, because of their close connection to the natural environment and strong legacy of ecological stewardship.

### ***Cultivating Resilience***

One mechanism for enhancing the capacity for Indigenous coastal communities to prepare for marine oil spill risks is the purposeful cultivation of resilience. Community resilience has been defined as “the sustained ability of a community to withstand and recover from adversity” (Plouth et al., 2013). The concept of resilience has been applied across a range of disciplines as a means to enable communities to experience more equitable outcomes when faced with a range of issues, from climate change to nutrition to mental health (Bergstrom et al., 2012). Community resilience provides a broad framework for examining community impacts from oil spills and other environmental emergencies and has been applied to communities impacted by recent major oil spills, including U.S. cities that experienced coastal impacts from the Macondo well blowout in 2010 (Colten et al., 2012). A resilient community may be characterized by its ability to effectively anticipate, respond to, and recover from disruptive events, while also taking steps to reduce vulnerabilities to future events. At its core, resilience builds from a sense of connectedness, collaboration, and trust (Plough et al., 2013; Ranous, 2012). In the context of marine oil spills, this requires an inclusive and transparent planning and preparedness process where communities can build these connections to national and regional governments, industry, and others with a role in spill planning or response.

### ***Compiling Knowledge through Learning Exchange***

Indigenous communities compile Traditional Knowledge from a long history of interactions with the natural environment, and these knowledge bases provide the foundation for cultivating resilience. While Indigenous knowledge is intrinsic to a community, its application to fostering resilience requires a systematic planning process where knowledge is collated and applied to emergency preparedness and response scenarios (Rahman et al., 2017). For emergencies that occur with some frequency, such as seasonal flooding or extreme weather events, communities have the opportunity to incorporate lessons learned from past incidents into

existing knowledge systems to build resilience. Because marine oil spills occur infrequently, Indigenous communities may not have the opportunity to collate knowledge based on direct experience. This does not preclude them from knowledge compilation, but it does require different channels for accumulating knowledge and learning from experience.

The practices of Indigenous knowledge exchange are well established in the context of public and community health initiatives, particularly in northern Canada. The underlying concepts are rooted in reconciliation for colonial practices where Indigenous language, culture, art, and knowledge were undermined or appropriated “without consent, acknowledgement, or benefit to Indigenous peoples” (Smylie et al., 2014). While this practice area is established for health and nutrition initiatives, its application for marine oil spills and emergency preparedness is relatively new in Arctic Canada. This paper recounts a recent program where community leaders from North American Indigenous communities spanning the Arctic, sub-Arctic, and Pacific coast came together to exchange knowledge and information, and traces follow-up initiatives to apply this knowledge to foster resilience.

## **PROCESS**

### ***Marine Shipping Risks and Preparedness in Nunavut***

In 2017, WWF-Canada convened the *Arctic Shipping and Oil Spills Learning Exchange for Communities* as a multi-day workshop in Iqaluit, Nunavut. The workshop was an outcome of a desktop study of marine oil spill preparedness and response capacity in Nunavut communities, which identified significant preparedness gaps and planning needs (DeCola and Hughes, 2017; Hughes, 2016a; Hughes, 2016b). Many of the challenges identified in Nunavut aligned with those faced by other Indigenous coastal communities in the Arctic and sub-Arctic regions of North America. In particular, British Columbia First Nations had recent experience confronting challenges in building marine spill preparedness capacity in the face of increased vessel traffic

and proposed new oil and gas infrastructure projects. Recognizing that efforts to enhance community preparedness for oil spills on the west coast may be transferable to Nunavut, WWF-Canada secured funding to host the Learning Exchange workshop.

### *Arctic Shipping and Oil Spills Learning Exchange*

The 2017 Learning Exchange provided a forum for coastal communities from remote Arctic and Sub-Arctic regions to share knowledge and experience regarding oil spill and marine emergency preparedness. The workshop created opportunities for peer-to-peer knowledge exchange and transfer of experiences and lessons learned among Indigenous communities. Invited participants included federal and territorial regulators, who had the opportunity to contribute to an open dialogue about marine oil spill risks and response capacity.

Four objectives guided the Learning Exchange:

- Identify Arctic shipping oil spill risks and ways for communities to prepare for them;
- Review what is already in place to support Canadian Arctic communities;
- Share knowledge and experience between Arctic and west coast communities; and
- Identify ways that communities can enhance their preparedness for emergencies from increased Arctic shipping.

The Learning Exchange was held in Iqaluit, which is a transportation hub for the remote communities in the region, to enhance the opportunity for community members from Nunavut hamlets to participate. Participants in the two-day workshop included:

- **Community Leaders and Representatives from Arctic Canada and Inuit**

**Organizations:** Chesterfield Inlet Hunter and Trappers Organization; Nunavut Tunngavik, Inc.; Inuvialuit Game Council; Pond Inlet Hamlet Council; Qukiqtaaluk Wildlife Board; Kugluktuk Hunter and Trappers Organization; Arctic Bay Hunter and Trappers Organization; Resolute Hunter and Trappers

Association; Inuvialuit Settlement Region Fisheries Joint Management Committee; Inuvialuit Game Council; City of Iqaluit; Taloyoak Hunter and Trappers Organization; Nunavut Wildlife Management Board.

- **Indigenous Community Leaders and Representatives from other Arctic and Pacific Regions:** Kawerak, Inc (Alaska, US); Makah Tribal Council (Washington, US); Coastal First Nations-Great Bear Initiative (BC, Canada); Heiltsuk Integrated Resource Management Department (BC, Canada); Tsleil-Waututh Nation (BC, Canada); Council of Haida Nation (BC, Canada).
- **Federal and Territorial Government:** Transport Canada; Indigenous and Northern Affairs Canada; Government of Nunavut; Environment and Climate Change Canada; Canadian Coast Guard.
- **Industry, Non-Profit and Academia:** Baffinland Iron Mines Corp.; Memorial University; Gordon and Betty Moore Foundation.
- **Facilitation Team:** WWF-Canada; Nuka Research and Planning Group, LLC.

The *Arctic Shipping and Oil Spills Learning Exchange for Communities* was planned over a six-month timeframe prior to the workshop by a subset of the workshop participants. All workshop materials were provided in both English and Inuktitut, and live translation throughout the Learning Exchange ensured that Inuktitut-speaking participants could communicate comfortably with other attendees who spoke English only. Figure 1 shows an example of translated workshop materials.





regulations, and equipment that are already in place across the Canadian Arctic. Participants from northern communities had the opportunity to learn more about the federal government's existing capabilities and intended improvements under the Oceans Protection Plan (Prime Minister of Canada, 2016), while also sharing their perspective on what is most important and useful to communities in the north. Participants from British Columbia and the U.S. States of Alaska and Washington provided firsthand accounts of how oil spills and shipping initiatives had impacted their communities and the actions that they have undertaken to enhance their own preparedness. Several key themes emerged.

**Theme 1: Indigenous Communities are Substantial Knowledge-holders.** While Learning Exchange participants were not necessarily familiar with the literature cited herein regarding community resilience and knowledge-building, they readily observed the important links between community preparedness and knowledge. There was a strong consensus that most of the information that would be needed to support marine oil spill response planning and decision-making is resident in Arctic Indigenous communities. Local Hunting and Trapping Organizations and the people they represent know a great deal about wildlife movements, the logistics of accessing sites on land and water, the range of environmental and weather conditions that may be encountered, and the seasonality that defines many aspects of Arctic ecosystems. There has been a substantial collation of Traditional Knowledge by many Inuit communities, and while the compilation of knowledge may not have been directly linked to shipping risks and marine response preparedness, the contents of these knowledge bases are directly relevant to any oil spill preparedness activity. One challenge for building community preparedness from Traditional Knowledge is that some of these data sets are not necessarily collated in a manner that makes them accessible to other levels of government. Additional work is needed for many

communities to more deliberately organize knowledge so that it can be accessed and communicated at the time of an incident.

**Theme 2: Indigenous Communities are Particularly Vulnerable to Oil Spill Impacts.**

Nearly all of the participants who represented Indigenous communities – Inuit, First Nation, or U.S. tribe – described strong connections between the natural environment and their community health and wellness. There were many examples of how past oil spills had interrupted access to local foods, such as tainted clam beds and contaminated seal meat. Indigenous communities in general and Arctic Indigenous communities, in particular, may be disproportionately harmed by any pollution event that impacts or even creates the perception of impacts to subsistence and traditional foods. Regulators and risk managers from industry and other levels of government do not always appreciate how different the risk perception is for Indigenous communities; creating a better understanding of how Indigenous communities experience oil spill impacts is critical to cultivating resilience. Participants noted that “western” risk assessments often underestimate the importance of oil spill consequences, which may, in turn, undermine the preparedness process and diminish community resilience.

**Theme 3: Marine Response Capacity Gaps are not Unique to the Arctic.** Several participants from Arctic communities expressed surprise and disappointment when hearing about recent case studies from oil spills in British Columbia and the U.S. Even in these comparatively populated areas with more industrial activity and better access to equipment, the case studies presented at the Learning Exchange described response delays, challenges accessing equipment, unclear decision-making roles, and the polluter withholding compensation for response costs and damages.

**Theme 4: Western Arctic Communities Hold Knowledge and Experience from Oil and Gas Operations that May Inform Capacity-Building in Eastern Arctic.** Although increased shipping through northern routes creates new risks, the potential for oil spills in the north is not new, and communities from Canada's western Arctic (Inuvialuit Settlement Region, or ISR) have been addressing these issues for many years in the context of oil and gas operations. While they have been fortunate not to have experienced any major marine oil spills, they have experience in planning and preparedness that could be transferred or applied to shipping risks in Nunavut across the Arctic. There was strong interest among participants from the ISR to contribute what they have learned to communities to the east. The concept of the interconnectedness of communities along the Northwest Passage, despite their remoteness, came up repeatedly during discussions and led to conversations about mutual aid and other inter-community initiatives.

#### ***Gaps in Planning and Preparedness for Arctic Shipping Oil Spills***

Background information provided to participants emphasized the cycle of preparedness, and the important linkages between risk evaluation, plan development, stockpiling resources, implementing a response, and building in feedback mechanisms to learn from experience. Gaps were identified in each of these areas.

#### **Gap 1: Communities Need More Information about the Risks from Arctic Shipping.**

Participants identified gaps in how northern communities can access information to accurately understand and anticipate risks. Communities would like better access to information about the types of vessels transiting northern waterways, including their typical routes, what they are carrying onboard (fuel and cargo), whether they are carrying any emergency or spill response resources with them, whether they are visible to AIS receivers, whether they are ice-capable, and

whether the Canadian Coast Guard is tracking and monitoring their activities. Communities would also like more information about the types of pollution streams from cruise ships and other vessels operating in the north. There may be regulatory gaps that are limiting the ability for the government to track discharges or to prevent vessels from discharging certain materials (such as greywater, sewage, or ballast water) in Arctic waters.

Other identified gaps related to Arctic shipping risks included:

- Gaps in the information available to understand, assess, or anticipate how an oil spill would impact local foods and food security; and
- Gaps in marine charts across the Arctic, which creates a risk factor for oil spill occurrence, and may also complicate the response process.

**Gap 2: Arctic Oil Spill Response Regime Must Address Worst Case Scenarios from Shipping Traffic.** Participants identified gaps in how northern communities can plan and prepare for the worst-case scenario that might occur. This includes defining “worst-case” based on the volume of oil that is carried on ships now and into the future and identifying other factors that would contribute to adverse impacts to high-value resources.

The limits to existing capacity for spill response in the Canadian Arctic was a frequent discussion topic, with no clear answer as to how large a spill could be handled with current (as of November 2017) resources. Preparing for the worst case requires an understanding of the effectiveness of various response systems and resources on different types of oil. Communities recognize that there are limits to the technologies available to clean up oil spills in Arctic waters and that there may be long periods of time during which no response would be possible. From their perspective, more information is needed about the capabilities and limits of technology and

equipment to mitigate oil spill impacts. Actively involving communities in the process of developing worst-case scenarios has proven effective in other contexts to enhance preparedness and planning (Leschine, et al., 2015).

Communities also expressed concern that there are gaps in baseline data about resources at risk and no clear process for communities to prioritize areas or resources that are particularly vulnerable to oil spill impacts. There is no clear mechanism for incorporating community priorities and local and Traditional Knowledge into federal, industry, regional, and local spill response plans and preparedness initiatives. Ships operating north of the 60<sup>th</sup> parallel are not subject to federal requirements for a Response Organization (RO), as are vessels operating in the south. This creates a significant gap in equipment and capacity north of 60 and places the burden of spill response implementation on the Government of Canada. The juxtaposition of the prominent role that Canada plays in marine spill response compared to the lack of federal presence in most Arctic communities was another concern expressed by participants.

**Gap 3: Communities Want to Take an Active and Ongoing role in Preparing for and Implementing an Oil Spill Response.** Participants identified gaps in how northern communities can train and equip themselves to manage the impacts of oil spills, and then implement these capabilities during a response. These include the obvious need to supply communities with oil spill response equipment and infrastructure sufficient to mitigate an oil spill during the initial hours to days before outside resources would arrive. This includes updating the Coast Guard equipment caches (sea cans) by establishing a comprehensive program for sea can labeling, inventory, community access, resupply, maintenance, and inspection.

Plans and procedures are needed to outline how the sea cans are meant to be used, the notification process, and how these resources fit into the broader oil spill response context in the

north. This is part of a broader need to establish a shared understanding of the roles and responsibilities for different levels of government and the shipping industry for Arctic shipping oil spills, including how communities are incorporated into both planning and response. Communities do not necessarily know when Coast Guard vessels will be in their vicinity, and they do not have a clear picture of the timeframe or logistics that are in place to support the delivery of Coast Guard resources in the event of a larger spill. There may be a time and resource gap between what can be accomplished with local resources and the next phase where outside resources are brought into the area. Including communities in oil spill simulations and drills to practice how these different layers come together might address some of these gaps.

There may be significant gaps in preparedness and response during winter months compared to summer, based on availability of Coast Guard vessels, challenges transporting equipment, impact of sea ice and darkness to response effectiveness, and responder safety issues. Communities recommend developing different oil spill response plans for winter vs. summer seasons.

There appear to be gaps between community capacity-building initiatives envisioned under the Oceans Protection Plan and existing initiatives ongoing in communities. There are also gaps in how relationships are institutionalized to support preparedness and response, particularly among different departments and levels of government. There is a need to align oil spill preparedness efforts with other initiatives and programs already in place in communities, such as rangers, search and rescue groups, fire departments, Inuit marine monitors, and environmental technology programs through the Arctic College.

Preparedness gaps also include supplying communities with equipment and tools to monitor and sample oil spills, supported by a clear process for incorporating local sampling into

the broader response, and ensuring that the results are transparent to communities. Communities also see a need for a community-to-community early warning system to alert downstream communities when a spill is traveling their way.

### ***Learning from Experience***

Participants considered how northern communities can apply lessons from past experiences (including those from other regions of Canada and the U.S.) to better understand the preparedness needs in the Arctic. One issue that came up repeatedly as a key lesson from communities that had experienced marine oil spills was the need for an adequate compensation regime to cover all community costs associated with oil spill response, to assess and remediate damages, and to cover claims and compensation for injured parties, including damages to wild foods and cultural resources.

The predominantly top-down approach to oil spill preparedness under the Canadian regime was seen as another gap that must be filled to support community-based capacity. Communities recommend “decolonizing” the process of oil spill preparedness and response so that communities are not overly reliant on plans, equipment, and programs that are beyond their access or control. There are also gaps in time and funding that will create challenges for building capacity, so it is important to empower community leaders to take actions in the near term while building capacity in the long term.

### ***Fostering Open Dialogue***

Participants in the Learning Exchange were broadly supportive of the overall approach, which emphasized open dialogue and listening to all voices in the room. In that spirit,

participants identified several opportunities to continue the dialogue beyond the Learning Exchange to bolster community capacity for Arctic shipping oil spills.

The importance of two-way communication was emphasized throughout the Learning Exchange. Regional and national government initiatives and programs must be communicated to communities in a manner that allows communities to provide feedback on how these initiatives may or may not support community capacity. While there was considerable discussion about how communities should report oil spills to the Nunavut and federal governments, it became apparent that it was equally important to ensure that regional and federal agencies identify points of contact in each community and maintain open communication lines on an ongoing basis. Communities expressed a desire to be regularly updated on activities in their region, not just related to spill response but more broadly to scientific research or even enforcement activities.

Beyond levels of government, it is also important that other organizations or institutions working in the space of community oil spill response training and capacity-building occasionally look outward at other programs and initiatives and consider opportunities to align or harmonize rather than creating competition or confusion. Participants in the Learning Exchange identified at least 10 initiatives – such as Land Use Planning, Marine Spatial Planning, low impact corridors, regional environmental assessments, environmental reviews, and the Nunavut Spills Working Group – that could support elements of community-based capacity building. More work is needed to map out the connections and relationships between these initiatives.

Communities recognized the critical importance of having a “seat at the table” across a range of risk assessment, preparedness, and response activities, to empower their equal participation in decision-making and support their self-reliance.



## DISCUSSION

### *Highlighting Best Practices for Communities*

Learning Exchange participants identified a number of practices that have been effective in other regions (including the ISR) to enhance community capacity. These include:

- Creating direct communication channels between community leaders/administrative staff and federal agencies (particularly the Canadian Coast Guard), and having regular conversations and an accountability framework to include local priorities into broader federal initiatives;
- Ensuring that community outreach and engagement efforts are planned and implemented in collaboration with communities, and include an opportunity for community feedback;
- Building capacity around existing, familiar initiatives and institutions that are in place in communities;
- Establishing a shared vision for preparedness goals that address community priorities and concerns;
- Acknowledging risks and uncertainties throughout the planning and preparedness process;
- Enhancing transparency regarding federal government activities and priorities;
- Using regulatory authorities to enhance prevention and preparedness;
- Compiling and collating baseline data through multi-jurisdictional efforts to ensure that local and Traditional Knowledge, and community priorities, are incorporated into federal tools and mapping platforms; and
- Conducting collaborative planning and risk evaluations across levels of government.

In the years and months since the Learning Exchange, there has been some momentum for the initiatives envisioned by participants, along with some stalled progress.

The Resolute Marine Spill Response pilot project was initiated by WWF-Canada to conduct a community spill response planning pilot project in the Hamlet of Resolute Bay, based in part on interest expressed by representatives of the Resolute Bay Hunter and Trappers Organization (HTO) during the Learning Exchange. A multi-jurisdictional planning team that included the authors as well as representatives of Transport Canada, Canadian Coast Guard, Environment and Climate Change Canada, Department of Fisheries and Oceans, Government of Nunavut, and the Resolute HTO met regularly to plan for an initial community visit (March 2018) to gather information and discuss marine shipping risks and response with community members. A second visit was conducted in September 2018 to present a draft plan and conduct a Tabletop Exercise inclusive of community members, the HTO and Hamlet government, Coast Guard, Government of Nunavut, Royal Canadian Mounted Police, and Department of Defense. Subsequently, the Resolute Bay Marine Spill Response Action Plan was endorsed by the Government of Nunavut as an Annex to the Community Emergency Response Plan and adopted by resolution of the Resolute Bay Hamlet Council (Hamlet of Resolute Bay, 2019).

Participants in the Iqaluit workshop expressed strong enthusiasm to continue the process by conducting a follow-up exchange where Inuit community members from Nunavut and the ISR travel to British Columbia to learn from work that First Nations have been leading to develop Geographic Response Strategies and train Coastal Guardian Watchmen teams to conduct site surveys to gather data for site-specific oil spill protection plans within their territories. While a second learning exchange has not yet happened, the connections between Inuit and First Nations communities continue to evolve. In October 2019, a small group of Guardians from Arctic Bay, Nunavut visited with the Nuxalk Guardian Watchmen in BC to share practices

related to the suite of functions performed by Coastal Guardians in Indigenous territories (Coastal First Nations, 2019).

## CONCLUSION

The initial planning process for the 2017 Indigenous Learning Exchange was conceived as an opportunity to “demonstrate the possible.” The peer-to-peer knowledge transfer approach focused heavily on giving voice to Indigenous communities in the presence of governance partners and industry leaders with a role in marine spill preparedness and response. The pilot project in Resolute Bay, which was a direct outcome of the Learning Exchange, led to the promulgation of the first community-level marine spill response plan in Nunavut. Both the planning process and the plan itself provide a template for other Arctic communities.

Despite these successes, there continue to be challenges in communicating the importance of Indigenous peer-to-peer connections for building knowledge and, consequently, resilience to marine oil spills. As Canada works to implement reconciliation in BC and the Arctic, it will be important to acknowledge the fundamental importance of community-based preparedness initiatives to foster resilience. Since the 2017 Learning Exchange, BC First Nations have continued with their progress through self-directed preparedness initiatives and multi-jurisdictional planning processes. The peer-to-peer connections established in that room continue to grow. Sustaining these connections creates the opportunity for Indigenous communities to collate knowledge beyond their own direct experience with marine oil spills, cultivating resilience to marine oil spills and shipping incidents.

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