

Community participation in coastal and marine research and monitoring in Inuit Nunangat: a scoping literature review

A.K. Drake^a, A. Perkovic^a, C. Reeve^a, S.M. Alexander^b, V.M. Nguyen^a, and K.M. Dunmall^{c*}

^aDepartment of Biology and Institute of Environmental and Interdisciplinary Science, Carleton University, 1125 Colonel By Dr., Ottawa, ON K1S 5B6, Canada; ^bFisheries and Oceans Canada, 200 Kent Street, Ottawa, ON K1A 0E6, Canada; ^cFisheries and Oceans Canada, 501 University Crescent, Winnipeg, MB R3T 2N6, Canada

*karen.dunmall@dfo-mpo.gc.ca

Abstract

In Canada, the participation of Indigenous communities in research and monitoring is growing in response to calls for partnerships and heightened interest in bridging Indigenous and Western science-based knowledge. Yet, as settler scholars, we have noted inconsistencies in the articulation and operationalization of community participation in peer-reviewed literature. We conducted a scoping review of community participation in coastal and marine research and monitoring across Inuit Nunangat. This resulted in 72 studies, most of which were undertaken in Nunavut. Fourteen terms were used to articulate community participation, the most common being: participate, collaborate, community-based, consult, or variations of these terms. Among the studies that used community participation terms, we found that authors only defined terms 10% of the time. Community participation was operationalized primarily through interviews, mapping, and field observations. We assessed studies across a spectrum of community participation levels and found that most studies (81%) reflected minimal levels of participation (i.e., consultative, contractual, and less than contractual). Our results highlight the need for clarity in language use, transparency in reporting research practices, and stronger efforts to support Indigenous leadership and decision-making authority, all of which must be defined on a community or project basis.

Key words: Community-based research, participatory research, Indigenous knowledge, coastal ecosystem, marine ecosystem, Inuit Nunangat, Arctic, Canada

OPEN ACCESS

Citation: Drake AK, Perkovic A, Reeve C, Alexander SM, Nguyen VM, and Dunmall KM. 2022. Community participation in coastal and marine research and monitoring in Inuit Nunangat: a scoping literature review. *FACETS* 7: 891–911. doi:[10.1139/facets-2021-0067](https://doi.org/10.1139/facets-2021-0067)

Handling Editor: Nicole L. Klenk

Received: June 1, 2021

Accepted: April 22, 2022

Published: June 23, 2022

Copyright: © 2022 Authors: Drake, Perkovic, Reeve, Nguyen, and The Crown. This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/) (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author(s) and source are credited.

Published by: Canadian Science Publishing

Introduction

In the Canadian Arctic, reclaimed resource sovereignty and a shared interest in conserving ecosystem integrity are contributing to increasing collaborations between Inuit and Western scientists in environmental research (e.g., [CIHR et al. 2018](#); [Wong et al. 2020](#)). Additionally, there is emphasis on building partnerships that respect Inuit self-determination and ensure that research is meaningful to communities ([ITK 2018](#); [ICC 2021](#); [Government of Canada 2022](#)). This aligns with national importance placed on the rights of Indigenous Peoples in environmental management, which is supported by the Fisheries and Oceans Canada *Reconciliation Strategy* ([Fisheries and Oceans Canada 2019](#)), *Canada's Arctic and Northern Policy Framework* ([Crown-Indigenous Relations and Northern Affairs Canada 2019](#)), and the *United Nations Declaration on the Rights of Indigenous Peoples Act*

(Department of Justice Canada 2021). There is also greater recognition of Indigenous knowledge in climate change adaptation (Parry et al. 2007; Ebi 2012; Convention on Biological Diversity 2019), in environmental stewardship, and in guiding scientific decision-making (Government of Canada 2021a, 2021b). Indeed, bridging Indigenous and Western science-based knowledges (see Table 1 for definitions) can more effectively address complex biodiversity conservation and co-management issues by enabling a holistic understanding of rapid environmental change (Berkes 2018; Reid et al. 2021). These challenges have resulted in intensified coastal and marine research and monitoring efforts that incorporate both knowledge systems (Alexander et al. 2019).

The nature and extent of community participation in Arctic research and monitoring are highly variable, as are the terms used to describe participation in research studies. While not exhaustive, these terms can include: consultative, collaborative, community-based, community-led, community-directed, or community-driven research and (or) monitoring. Terms are frequently differentially defined, not defined, or meanings are alluded to. The term community-based monitoring (CBM), for instance, is often used and encompasses a range of approaches (Kouril et al. 2016). The Conservation of Arctic Flora and Fauna working group of the Arctic Council defines CBM as a collaborative process where communities, government, industry, and academia “monitor, track, and respond to issues of common community concern” (Fleener et al. 2004, p. 2). Others have equated CBM to “participatory” monitoring, noting outputs such as contribution to local stewardship and capacity enhancement (Marcoux et al. 2011). Conversely, in their atlas of community-based projects and networks across the global Arctic, Johnson et al. (2016b) chose not to define CBM so that it remains inclusive of different levels of community involvement and note that there is no single, accepted definition. The wide range of contexts and definitions (or lack thereof) associated with this term can lead to murky ethics and confuse or prevent the sharing of experience amongst scientists conducting similar research. Although authors often acknowledge the diversity of terms used (e.g., Johnson et al. 2016b; CIHR et al. 2018), to our understanding, no one has yet performed a semantic analysis to examine this diversity in research and monitoring in Canada.

It follows that with the high variability in articulating and defining community participation, similar difficulties arise in how these terms are put into practice or operationalized. A single term may be used to describe methods with very different degrees of community participation (Kouril et al. 2016; David-Chavez and Gavin 2018; Mosurska and Ford 2020), potentially misrepresenting the

Table 1. Definitions of key concepts.

Term	Definition
Bridging knowledge systems	Bridging knowledge systems refers to a process that maintains the integrity of each knowledge system while enabling the reciprocal exchange of understanding for mutual learning (Rathwell et al. 2015; Johnson et al. 2016a).
Indigenous knowledge	A cumulative wealth of environmental knowledge held by Inuit (in this paper) through interactions with ecosystems and experiences on the land, sea, and ice. This knowledge is subjective and dynamic, and is passed down through generations in oral tradition, observation, and practice (Ingold and Kurttila 2000; Berkes 2018). Similar terms include: Inuit knowledge, traditional knowledge, traditional ecological knowledge (TEK), local knowledge, local ecological knowledge (LEK), and Inuit Qaujimajatuqangit (IQ), which encompasses Inuit values and worldviews.
Western science	An evolving body of objective and quantitative knowledge that favours analytical and reductionist methods, anchored in Greek philosophy and the Renaissance (Mazzocchi 2006).
Participation	A process where individuals, groups, or organizations take a role in making decisions that affect them during the research process, which can include initiation, design, implementation, analysis, interpretation, and dissemination (adapted from Reed 2008).
Community	A “group of people with a shared identity or interest that has the capacity to act or express itself as a collective” (CIHR et al. 2018 p. 109).

community decision-making capacity in the research and (or) monitoring process (hereafter referred to as research process) and perceived benefits. To assess the degree and nature of community participation across the research process, several authors have created levels on a spectrum, from participation of community members as research subjects to projects in which research is led by the community (e.g., [Danielsen et al. 2009](#); [David-Chavez and Gavin 2018](#)). This assessment can enable insight into the inclusion of Indigenous knowledges, as well as the use of responsible research practices that uphold Indigenous rights ([David-Chavez and Gavin 2018](#)). There is a need to characterize participation and improve the transparency of this participation to continue to develop good practices.

This scoping literature review explores peer-reviewed research and monitoring studies undertaken with community participation in coastal and marine environments across Inuit Nunangat (ᐃᓄᐃᑦ ᓄᓇᓴᑦ; includes lands, waters, and ice). Inuit Nunangat is a distinct geographic, cultural, and political region encompassing four regions in the place now called Canada: the Inuvialuit Settlement Region (Northwest Territories and Yukon Territory), Territory of Nunavut, Nunavik (Northern Québec), and Nunatsiavut (Northern Labrador). Our first objective examines the ways in which participation has been articulated in the studies through semantic analysis by investigating terms used to describe participation, their associated definitions, and their use over time. Our second objective examines how participation has been operationalized through Indigenous and Western science-based data compilation methods and an assessment of community participation in the research process for each study, using levels from [David-Chavez and Gavin \(2018\)](#). We highlight inconsistencies in language use and level of participation to illustrate the importance of concisely describing community participation on a community or research project basis. We assert that it is imperative that researchers work with individual Indigenous communities to develop processes and terminologies that reflect community understanding and priorities. As calls for collaborations intensify in parallel to efforts to facilitate Indigenous self-determination in research, it is vital that researchers clearly communicate their use of terms and describe the associated participatory methods to promote transparent, robust, and reciprocal research that benefits both researchers and partner communities. While this paper is intended to inform environmental and social scientists, findings may also prove useful for researchers in other disciplines. Considerations presented here may be particularly helpful for early career researchers as they approach participatory research projects and establish relationships with communities.

This review arose from our work co-developing and conducting coastal monitoring programs and documenting local knowledge with Inuit communities across Inuit Nunangat. The need for improved reporting and enhanced transparency emerged from our difficulties as settler academic, government, early career, and student researchers in grasping the nature and extent of community participation in published research and monitoring. In this paper, we consciously sought to draw and build upon the work of Indigenous scholars working with and within Indigenous communities. In doing so, we hope to amplify Indigenous voices, and we gratefully acknowledge the contributions and knowledge shared by these scholars and by all those who participated in each study. We are committed to ongoing learning and unlearning and do not purport to speak for Indigenous Peoples.

Methods

Study search

A scoping literature review was performed on research and monitoring studies undertaken with community participation in coastal and marine environments across Inuit Nunangat ([Fig. 1](#)). The advanced search function was used in two scientific databases: Web of Science and Scopus, with search strings comprised of community participation terms (e.g., community-based, collaborat*, co-product*), location, people involved, and subject of study (i.e., related to coastal and marine environments) ([Table 2](#)). The search string was created in consultation with an academic librarian through

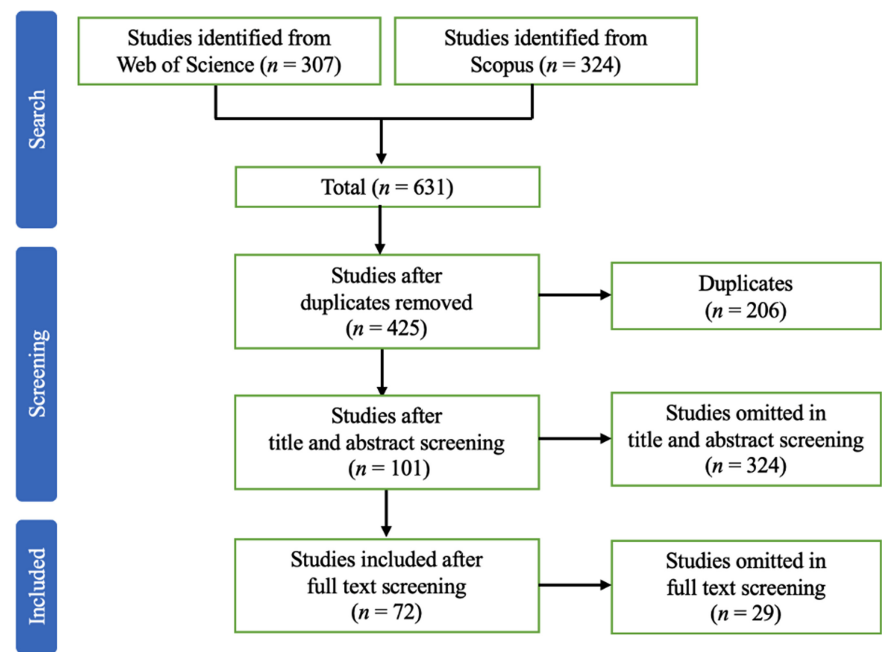


Fig. 1. Flow chart of literature reviewed on coastal and marine research and monitoring in Inuit Nunangat communities.

Table 2. Databases and search strings.

Database	Search String	Number of Returns
Web of Science	TS=(communit* OR community-based OR community-led OR community-driven OR co-produc* OR co-integrat* OR collaborat* OR consult* OR participat*) AND TS=(Canad*) AND TS=(polar OR Arctic OR Yukon OR “Northwest Territories” OR Inuvialuit OR Nunavut OR Québec OR Nunavik OR Labrador OR Nunatsiavut OR “Inuit Nunangat”) AND TS=(Inuit OR Indigenous OR Aboriginal) AND TS=(ecolog* OR fisheries OR coast* OR shore* OR ice OR ocean OR sea OR marine)	307
Scopus	TITLE-ABS-KEY (communit* OR community-based OR community-led OR community-driven OR co-produc* OR co-integrat* OR collaborat* OR consult* OR participat*) AND TITLE-ABS-KEY (Canad*) AND TITLE-ABS-KEY (polar OR Arctic OR Yukon OR “Northwest Territories” OR Inuvialuit OR Nunavut OR Québec OR Nunavik OR Labrador OR Nunatsiavut OR “Inuit Nunangat”) AND TITLE-ABS-KEY (Inuit OR Indigenous OR Aboriginal) AND TITLE-ABS-KEY (ecolog* OR fisheries OR coast* OR shore* OR ice OR ocean OR sea OR marine)	324

Note: TS (Topic Search) and TITLE-ABS-KEY are advanced search options offered by Web of Science and Scopus, respectively. Each operator functions to specify that the search string will search the study title, abstract, and keywords for the search terms exclusively. Note that the number of returns includes duplicates between databases.

an iterative process to identify inclusive terms that were reflected in the databases searched. Terms with an asterisk refer to all variants of that word, and Boolean operators “AND” and “OR” were used to separate search terms. Limits were not placed on the year of publication as we were interested in trends over time. The collection of papers from these databases was conducted in July 2020 and included studies from peer-reviewed journals, books, and conference proceedings.

Our scope was limited to two bibliographic databases to target peer-reviewed publications. Grey literature (e.g., working papers, government documents, newsletters, reports) was not included as the objective was to examine how participation was articulated and operationalized in research and monitoring studies. In particular, this required details related to research design and methods. We recognize that, due to the scope, this review does not include reports on fish and wildlife stored in community or regional archives that are not readily accessible or known to researchers (Hitomi and Loring 2018). Relevant literature may also have been excluded due to the classification of studies encompassing multiple ways of knowing into individual disciplines, which is an inherent challenge of interdisciplinary research (Alexander et al. 2019). Moreover, our search was limited to English search terms and publications, which excluded studies written in French. This may be applicable given that our study area included Québec (Nunavik) and thus some reports may have been missed.

Study eligibility and screening

Six hundred and thirty-one publications were compiled, and duplicates ($n = 206$) were then removed. The remaining publications ($n = 425$) were screened for eligibility in two stages; a title and abstract screening stage and full-text screening stage, using the eligibility criteria listed in Table 3. During the title and abstract screening stage, the publications were screened by reviewers AD and AP, resulting in approximately 93% agreement in inclusion/exclusion decisions ($n = 324$ removed). This was followed by a full text screening of the remaining 101 studies by reviewers AD, AP, and CR. A three-way consistency check that occurred through discussion and deliberations among the reviewers was performed using a subset of studies (~11%; 11/101 publications) to ensure consistent interpretations. Our inter-reviewer Kappa score (0.593, Light Kappa; Conger 1980) suggested “moderate” agreement among the reviewers. Inconsistencies were discussed following the consistency check, which allowed for increased confidence in reviewer ability to uniformly include or exclude any of the remaining studies ($n = 29$ removed, $n = 72$ remaining).

Study coding

We developed a questionnaire that co-authors AD, AP, and CR used to code the final set of 72 publications (Supplementary File A), and used Google Forms to facilitate data extraction, where all data were subsequently imported into a spreadsheet for analysis. The questionnaire contained 27 questions that captured bibliographic information, study location, terminology use, Indigenous and Western science data compilation methods, and details of participation (e.g., amount, frequency, and nature

Table 3. Eligibility criteria.

Type of study	Coastal research or monitoring* studies
Subject	Involved a component of the coastal and (or) marine aquatic environment
People	Undertaken with the participation of Inuit communities
Geography	Conducted within one of the four regions of Inuit Nunangat in the Canadian Arctic

Note: *Definitions adapted from Ehrman et al. (2022) are as follows. Research strives to delineate the connections between environmental components to understand, predict, and provide advice to mitigate the consequences of potential future changes to the environment. Research is often developed around a hypothesis and conducted on a relatively short time scale and can cumulate such that subsequent iterations allow for a more holistic understanding. Monitoring collects information at regular time intervals on components of the ecosystem to evaluate temporal change or stability in environmental indicators. Monitoring is usually descriptive, with trends observed often stimulating targeted research to better understand the implications of change, or being used to develop appropriate strategies for ecosystem management. A well-developed monitoring program tends to include parameters that are conducive to cause-effect understanding and thus development and testing of hypotheses. Monitoring ranges from that for a small suite of parameters focused on a specific topic or species, to that encompassing a much wider range of topics.

of participation), adapted from a published protocol from Alexander et al. (2019). Both quantitative and qualitative data were gathered, with several open-ended questions allowing for the inclusion of verbatim passages to provide context. Community names were recorded in Inuktitut (Roman orthography) and anglicized forms whenever possible (Supplementary File B).

A central question consisted of assessing community participation levels for each study, based upon information found within the publication. We added a participation level (less than contractual) to five levels defined by David-Chavez and Gavin (2018), from least to most Indigenous decision-making authority in the research process (Table 4). The six levels used in this paper are: less than contractual, contractual, consultative, collaborative, collegial, and Indigenous-led (note that these community participation levels are not to be confused with participation terms). David-Chavez and Gavin’s (2018) levels have been used in similar contexts, for example, by Mosurska and Ford (2020) in their systematic review of community-based and participatory research in Alaska. Arawak Taíno scholar Dominique David-Chavez and co-author Michael Gavin approached their research with careful intention by inviting subject experts (some of whom identify as Indigenous) to help refine their review and assessment methods (David-Chavez and Gavin 2018). These authors assigned participation levels to each of three research phases: design, implementation, and analysis. We chose to assign one level to the entirety of the research process for each study because of the iterative and overlapping nature of research phases often intrinsic to community collaboration, and our intention to provide a broad rather than detailed assessment of participation. It is important to note that fragmented or absent community participation information does not mean that participatory practices were limited or lacking. All coded data can be found in Supplementary File C.

A coding consistency check was performed (~10%; 7/72 publications) by AD, AP, and CR to ensure robust, repeatable decision-making. Inter-coder agreement in their decisions for this subset of studies was found to be 75%. Because of the complexity and qualitative aspects of this survey, a Kappa score could not be calculated for this step. Following this consistency check, reviewers identified any discrepancies and discussed their results to ensure that a shared understanding and interpretation were

Table 4. Community participation levels for the entire research process, from lowest (less than contractual) to highest (Indigenous-led) participation.

Participation level	Definition
Less than contractual	Community participants are research subjects from whom data are extracted. Researchers make all project decisions.
Contractual	Community participants are contracted to perform tasks. Researchers make all project decisions.
Consultative	Community participants are asked for opinions and consulted. Researchers make all project decisions.
Collaborative	Community participants and researchers work together. Researchers have primary authority over the research process.
Collegial	Community participants and researchers work together. Community members have primary authority over the research process.
Indigenous-led	Research process centered in Indigenous value systems and historical context. Community members have full authority and leadership over the research process.

Note: One participation level (less than contractual) was added to five levels defined by David-Chavez and Gavin (2018). Note that each level may include elements of the previous levels (i.e., consultative studies may include contractual tasks, collaborative studies may include contractual tasks and (or) consultation, collegial studies may include contractual tasks, consultation, and (or) collaborative elements).

reached. Reviewers worked closely while coding data from all studies, and discussions were held when difficulties arose. When necessary, discrepancies were discussed with a fourth author (SA).

Data analyses

Meta-data (i.e., bibliographic information), semi-quantitative data (e.g., ordinal variables), and qualitative data (i.e., verbatim text) were extracted from studies. We used several different methods to analyze data (e.g., content analysis; Drisko and Maschi 2016), visualize trends (e.g., descriptive statistics, framework-based synthesis), and identify knowledge gaps. Figures were developed in GraphPad PRISM (Prism 6, GraphPad Software, Inc. San Diego, California, USA) to illustrate data trends such as the frequency of publications over time, and the number and frequency of participation terms used. Structured matrices were developed using the coded data extracted from studies to visualize knowledge clusters and gaps. Specifically, the levels of community participation were contrasted with terminology used to describe community participation, and with Indigenous and Western science data compilation methods employed.

Results

The publication year of the seventy-two studies in this review ranged from 1992 to 2020 (Fig. 2); however, considerable growth in this field did not occur until 2006. Following an initial peak in publications, the number of studies remained relatively consistent post-2011 (averaging approximately four studies per year from 2012 to 2020). Research and monitoring efforts were concentrated in Nunavut (52 of 72 studies), where there were approximately five times more studies compared to Nunavik ($n = 12$) and the Inuvialuit Settlement Region ($n = 11$) (Fig. 3). Even fewer studies were published within Nunatsiavut ($n = 6$). Additionally, we found that there were a disproportionate number of studies conducted in Igloolik/Iglulik ($n = 13$), Arviat ($n = 12$), Iqaluit ($n = 10$), and Pangnirtung/Panniqtuuq ($n = 9$), Nunavut, which together accounted for 43% of studies.

Articulation of community participation

Community participation terms

Fourteen terms were used in the studies included in this review (Fig. 4), yet authors most often used participat* (participate, participating, participated, participation, participatory; $n = 52$) and

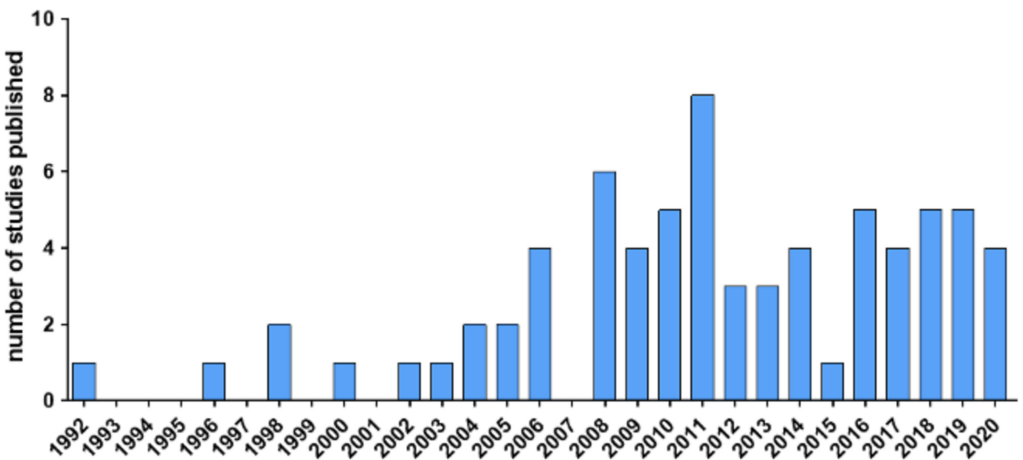


Fig. 2. The frequency of studies included within this review by publication year.

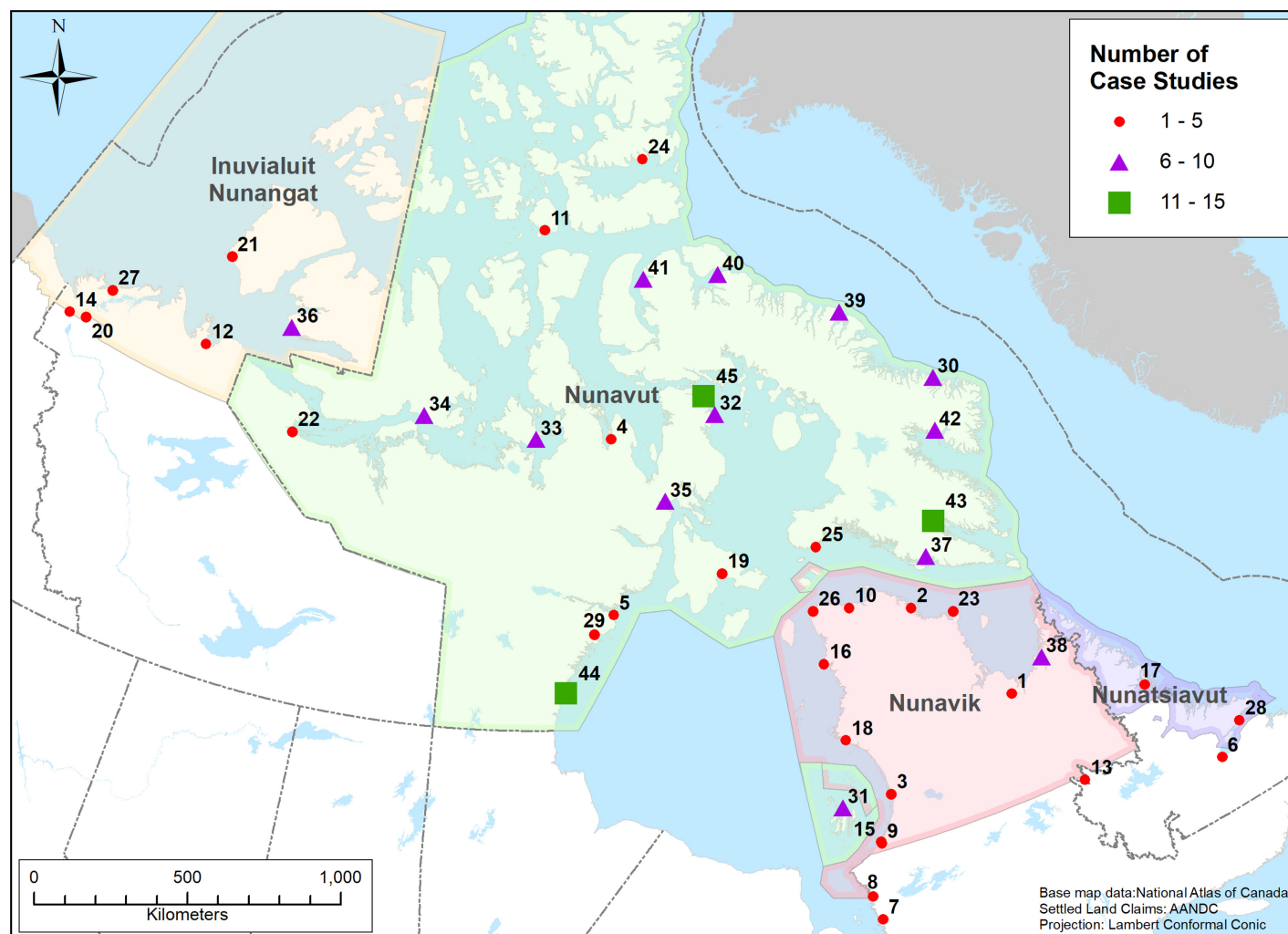


Fig. 3. Community study locations, each depicted with a number. Note that studies that occurred in multiple communities were retained since methods were consistently replicated among communities. To reflect this, Cree and Naskapi First Nations communities are included in this map. The most current community names are written in Inuktitut (Roman orthography) and in anglicized forms and are drawn from [ITK \(2019\)](#): 1-Kuujuuaq, 2-Kangiarsuaq, 3-Umiuq, 4-Kugaaruk/Kuugaarjuk, 5-Chesterfield Inlet/Igluligaarjuk, 6-North West River, 7-Wemindji, 8-Chisasibi, 9-Whapmagoostui, 10-Salluit, 11-Resolute Bay/Qausuittuq, 12-Paulatuk/Paulatuq, 13-Kawawachikamach, 14-Aklavik/Aklarvik, 15-Kuujuaq/Kuujuaapik, 16-Akulivik, 17-Nain/Nunainguk, 18-Inukjuak, 19-Coral Harbour/Salliq, 20-Inuvik/Inuvik, 21-Sachs Harbour/Ikaahuk, 22-Kugluktuk/Qurluqtuq, 23-Quaqtaq, 24-Grise Fiord/Ausittuq, 25-Kinngait, 26-Ivujivik, 27-Tuktoyaktuk/Tuktuuyaqtuq, 28-Rigolet/kikiak, 29-Rankin Inlet/Kangiqliniq, 30-Qikiqtarjuaq, 31-Sanikiluaq, 32-Sanirajak, 33-Gjoa Haven/Uqsuqtuq, 34-Cambridge Bay/Iqaluktuuttiaq, 35-Nauyasat, 36-Uluhaktok/Uluhaqtuq, 37-Kimmirut, 38-Kangiarsualujuaq, 39-Clyde River/Kangiqtugaapik, 40-Pond Inlet/Mittimatalik, 41-Arctic Bay/Ikpiarjuk, 42-Pangnirtung/Panniqtuq, 43-Iqaluit, 44-Arviat, 45-Igloodik/Iglulik.

collaborat* (collaborate, collaborating, collaborated, collaboration, collaborative; $n = 38$). These terms were common across contractual, consultative, and collaborative levels (levels defined in [Table 4](#)) and remained the most frequently used throughout the three decades in this review. Community-based ($n = 28$), and consult* (consult, consulting, consulted, consultation, consultative, $n = 27$) featured prominently from 2008 onwards ([Fig. 5](#)), and appeared across these same participation levels. Post-2007, there was an expansion in the variety of community participation terms used. Partner* (partner, partnering, partnered, partnership), co-produc* (co-produce, co-producing, co-produced,

Community-based	1	4	10	12	1		28
Community-led				2			2
Community-driven				2			2
Co-produce*		1	2	2			5
Collaborat*	1	6	18	12	1		38
Consult*		6	12	9			27
Participat*	4	15	20	12	1		52
Partner*		2	1	2			5
Co-*			1	5			6
Community-*					2		2
No community research terms were used	5	5	1				11
	Less than contractual	Contractual	Consultative	Collaborative	Collegial	Indigenous-led	Totals

Fig. 4. Structured matrix showing the frequency with which community participation terms were associated with levels of community participation. Co-* includes the terms co-learning, co-creation, co-leadership, and co-developing. Community-* includes the terms community-run and community-directed. Note that frequency values within this matrix are not directly proportional to number of studies since many papers included multiple entries. The total occurrences of each community participation term are presented in the right-most column.

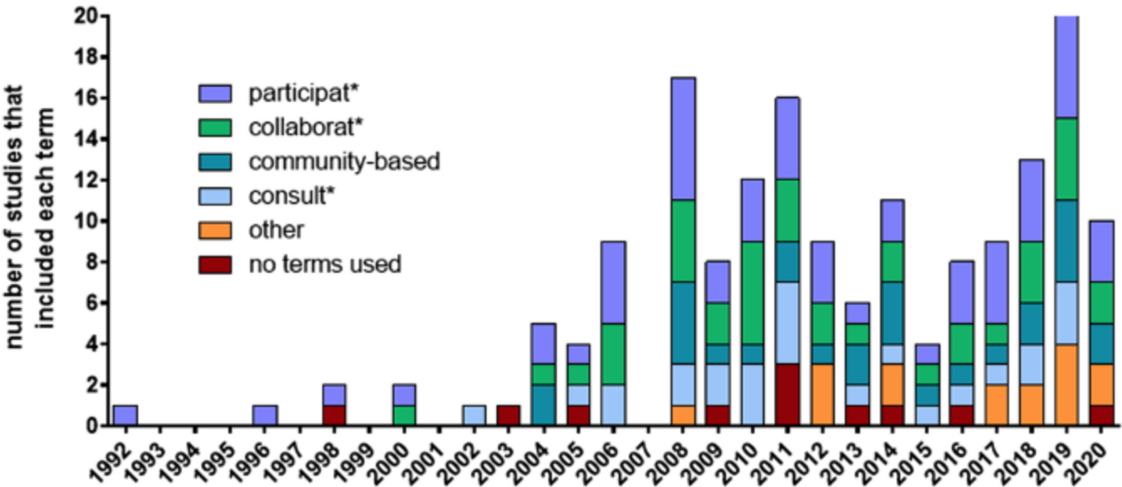


Fig. 5. The number of studies that included the term or variations of the term participat*, collaborat*, community-based, consult*, or other terms relating to community participation over time (see Fig. 4 for other terms). Note that individual studies may have used multiple terms relating to community participation.

co-production), and community-led were comparably less commonly used. The terms community-led and community-driven were absent until a collaborative level of participation, where there were also comparably higher frequencies of partner* and co-* (which included terms such as co-develop or co-lead). We noted that 11 studies (15%) did not use any terms relating to community participation (Fig. 4).

Term definitions

Within the 61 studies that included community participation terms, definitions were uncommon, with only six studies (10% of 61 studies) defining their usage of terms (Table 5). Within these six studies, only four terms were defined: participat*, collaborat*, community-based, and co-produc*, with one study by Galappaththi et al. (2019) defining two terms (co-produc* and collaborat*). Two definitions were used in 2012, with the other five appearing in publications since 2018. Interestingly, the most used terms appeared to be the least defined. For example, while participation and variations (participat*) and collaboration and variations (collaborat*) were used in 72% of studies, they were only defined in one study each. Community-based appeared in approximately 40% of studies and was defined in only three of the 28 studies that used this term. Lastly, co-production and variations (co-produc*) appeared in only five studies; nonetheless, two studies defined these terms.

Table 5. Community participation terms and their associated definitions (verbatim from studies).

Term	N of studies	% defined	Verbatim definitions in context of use
Participat*	52	2%	Participation in research: “Stakeholders—including, but not limited to government, bi-laterals, multilaterals, nongovernmental organizations, community-based organizations, and community members— actively participating in all phases of research design, implementation, interpretation, evaluation, and action, which enhances the research process, resulting action, and the sustainability of the project” (Harper et al. 2012, p. 91)
Collaborat*	38	3%	Collective action and collaboration: “Action taken together (or shared) by a group of two or more people to meet a common desired objective” (Galappaththi et al. 2019, p. 4)
Community-based	28	11%	Community-based research: “begins with a ‘concern that is important to the community and is conducted with a community and not just in a community setting’ (Kue et al., 2015: 411). The approach adds credibility to studies by integrating community input (Christopher et al., 2008), enhancing community interactions, and enabling training opportunities (Castleden et al., 2008)” (Dawson et al. 2020, p. 22) Community-based research: “emphasizes ‘a robust level of community involvement that (ideally) leads to the coproduction of culturally respectful, relevant, and empowering knowledge’ (Castleden et al., 2012:173)” (Carter et al. 2019, p. 386) Community-based monitoring: “‘a process where concerned citizens, government agencies, industry, academia, community groups, and local institutions collaborate to monitor, track, and respond to issues of common community concern’ (Whitelaw et al., 2003, p. 8)” (Gérin-Lajoie et al. 2018, p. 396)
Co-produc*	5	40%	Co-production of knowledge: “combining indigenous knowledge with other kinds of knowledge such as local knowledge and (or) modern technical knowledge” (Galappaththi et al. 2019, p. 4) Co-produced knowledge: “By working together and sharing and learning from each other, and working together with DFO and HTA, fishers combine and co-produce new knowledge” (Galappaththi et al. 2019, p. 8) Knowledge coproduction: “Armitage et al. (2011:996) define knowledge coproduction as ‘the collaborative process of bringing a plurality of knowledge sources and types together to address a defined problem and build an integrated or systems-oriented understanding of that problem’” (Idrobo and Berkes 2012, p. 405)

Note: All studies that contained definitions were included. “N of studies” refers to the number of studies that included the community participation term and “% defined” to the percent of these studies that defined each term.

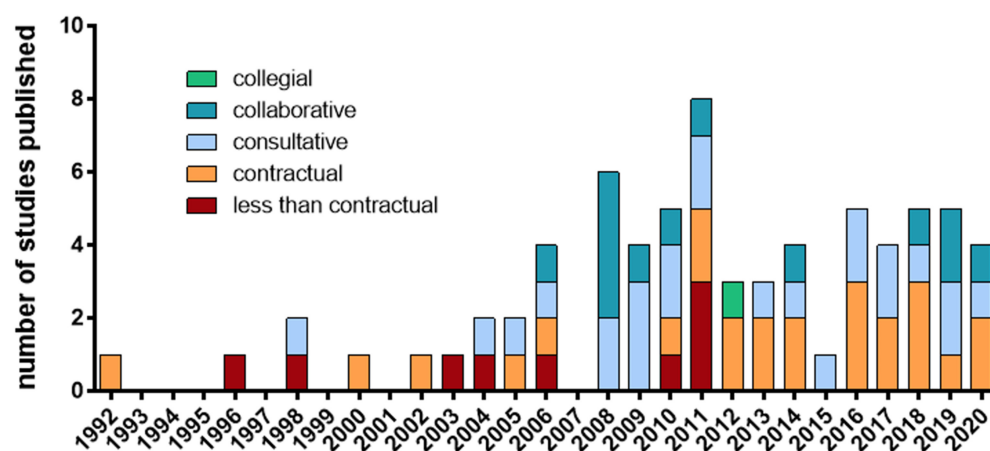


Fig. 6. The number of studies classified at each level of community participation over time.

Operationalization of community participation

Community participants

The most common research participants were hunters and fishers ($n = 64$), followed by members of Hunters and Trappers organizations, and Elders ($n = 36$ each). Youth were engaged in 14% of studies ($n = 10$). Community ($n = 3$) and co-management committees ($n = 3$) or local governments ($n = 4$) were not as heavily involved in these studies.

Community participation levels

We classified nearly the same number of studies as contractual (35%, $n = 25$) and consultative (33%, $n = 24$). These two levels of participation were almost twice as common as collaborative (18%, $n = 13$) and less than contractual studies (13%, $n = 9$). A single study was considered to have a collegial level of participation, while none were Indigenous-led. Early studies in the 1990s were less than contractual and contractual, with stronger levels of community participation appearing in 1998 (consultative) and 2006 (collaborative) (Fig. 6). Over the last decade, studies with contractual and consultative levels of community participation have dominated the research landscape, with collaborative studies appearing more frequently.

Indigenous knowledge and Western science-based data compilation methods

Indigenous knowledge was compiled and documented through a multitude of methods, the most common being interviews (structured and unstructured), used in 58 studies (Fig. 7). The presence of interviews spanned across all levels of community participation. The greatest use of this method occurred equally at the contractual and consultative levels ($n = 21$), followed by the collaborative level ($n = 11$). Field observations ($n = 27$), participatory mapping ($n = 25$), focus groups ($n = 16$), participant observations ($n = 16$), and workshops ($n = 15$) were all common. Field and participant observations primarily appeared at a contractual level, where the use of workshops and focus groups was infrequent. At a consultative level, participatory mapping, workshops, focus groups, and field observations were used at similar frequencies. The collaborative level of community participation was characterized by participatory mapping and field observations. Less common methods to compile and document Indigenous knowledge included surveys, science land camps, or those requiring the use of technology (e.g., photovoice or media, such as radio broadcasts). Importantly, the sole collegial

Interviews (structured, unstructured)	4	21	21	11	1		58
Survey				1	1		2
Focus groups	1	2	8	5	1		16
Workshops (includes community meetings)		1	9	4	1		15
Participatory mapping	1	3	10	10	1		25
Field observation	1	10	7	9			27
Participant observation (in community)	1	7	6	2			16
Photovoice			1	1	1		3
Media (participatory video, digital storytelling, radio broadcasts)		1	3	1	1		6
Informal meetings		4					4
Science land camps				1			1
Indigenous knowledge was not gathered	4	6					6
	Less than contractual	Contractual	Consultative	Collaborative	Collegial	Indigenous-led	Totals

Fig. 7. Structured matrix showing the frequency with which methods for compiling and documenting Indigenous knowledge were associated with levels of community participation. Note that frequency values within this matrix are not directly proportional to number of studies since many papers included multiple entries for each Indigenous knowledge-based data compilation method. The total occurrences of each method are presented in the right-most column.

study did not utilize Western science-based data compilation methods (e.g., telemetry, tissue sampling), and used seven different methods of gathering Indigenous knowledge.

Western scientific data compilation most often involved mapping ($n = 15$), sea ice measurements or observations ($n = 13$), and tissue sampling ($n = 9$) (Fig. 8). Studies that employed mapping and sea ice measurements or observations occurred at similar frequencies in studies with consultative and collaborative levels of participation, while studies with tissue sampling were generally contractual in nature. Consultative studies saw the infrequent usage of natural history observations, document or literature reviews, and co-management meetings. Occurrences of telemetry, water sampling, assessment of environmental conditions, software interface design, and others, occurred in one collaborative study each. Community participants contributed to the process of gathering data in approximately 80% of studies.

Both Indigenous knowledge and Western scientific data were gathered in nearly half the studies ($n = 32$). A similar number of studies ($n = 34$) only included methods to compile and document Indigenous knowledge. Conversely, in very few studies ($n = 6$), communities only participated in data compilation using Western scientific methods; these studies were all classified at lower levels of participation.

Telemetry, tracking devices				1			1
Natural history observations		1	2	1			4
Counts, census data, stock assessment	1	2		2			4
Tissue sampling	3	5		1			9
Examination of whole carcasses	1	3					4
Water sampling				1			1
Sea ice observations/measurements		1	6	6			13
Mapping		1	6	8			15
Document/literature review			1				1
Co-management consultations			1				1
Researchers and hunters co-designed software interface				1			1
Environmental conditions assessment				1			1
Economic data associated with cost of subsistence activities		1					1
Not applicable	5	15	12	3	1		36
	Less than contractual	Contractual	Consultative	Collaborative	Collegial	Indigenous-led	Totals

Fig. 8. Structured matrix showing the frequency with which Western science-based data compilation methods were associated with levels of community participation. Note that frequency values within this matrix are not directly proportional to number of studies since many papers included multiple entries for each Western science-based data compilation method. The total occurrences of each method are presented in the right-most column.

Discussion

Our findings are a small part of an ongoing discussion related to authentic community participation rooted in respect, relevance, reciprocity, and responsibility (Kirkness and Barnhardt 1991). We focused on exploring key insights and gaps regarding the articulation (term use and definitions) and operationalization (data compilation methods and level of participation) of community participation in coastal and marine research and monitoring studies in Inuit Nunangat over a 28-year period from 1992 to 2020.

Of the studies reviewed, 14 terms were used to reference community participation, and these were only defined in 10% of the studies. Despite this range in terms used, most of the studies included in this review were considered to have a contractual or consultative level of community participation, where community members performed tasks or were consulted, but researchers made decisions. In fact, we noted that while most studies used the term collaborative and variations (collaborat*, 72% of studies), when operationalized many were contractual (35% of studies) or consultative (33%). Only 18% of studies were aligned with collaborative processes. Collaborative studies have appeared

more frequently in recent years, as have terms associated with community leadership in research (e.g., partner* and co-*), which may reflect movement towards research and monitoring that supports greater Inuit self-determination (ITK 2018; ICC 2021). The inconsistency in definitions and the operationalization of research speaks to the need for transparency to ensure that research does not lend itself to tokenism or the misrepresentation of participation. To this end, we offer insights and suggestions to guide environmental and social scientists, but emphasize that Inuit decision-making on a community basis must be central to all phases and forms of research conducted within Inuit Nunangat.

One main objective of this paper was to determine how community participation has been articulated in research and monitoring studies through semantic analysis. A few terms used to represent community participation appeared much more frequently than others, notably participation and variations (participat*) and collaboration and variations (collaborat*). Variations of these terms may be more common in the literature due to disproportionate circulation of more general terms in comparison to specific terms (e.g., partner*, community-led). The prevalence of participation and variations (participat*) at contractual and consultative levels suggests that a large proportion of research deemed to be “participatory”, for example, often primarily involves community members as data collectors, which is similar to the findings of other researchers (Turreira-García et al. 2018; David-Chavez and Gavin 2018). There are increasing calls for higher levels of participatory research with northern communities, but the misalignment between terms used and how they are operationalized can exacerbate uneven power dynamics and the history of extractive research practices with Indigenous communities (Wilson et al. 2018). The prevalence of the term community-based and first appearances of community-led and community-driven in studies with higher levels of participation (e.g., collaborative) are not surprising as they convey a higher level of community decision-making authority in the research process. Similarly, terms that allude to balanced contribution and a relationship between researchers and community participants, such as variations of partnership and co-* terms, were found when studies had greater community participation.

Our finding that very few studies defined their usage of terms, with an absence of definitions for 71% of terms (10/14 terms), elucidates a major gap that is further confused by varied term use. The definitions of community-based differed, with emphasis on response to issues of common community concern (Gérin-Lajoie et al. 2018; Dawson et al. 2020) and a “robust” level of community involvement leading to knowledge co-production (Carter et al. 2019) (Table 5). The term co-production and variations (co-produc*) also used alternate definitions, which referred to knowledge co-production as a process (Idrobo and Berkes 2012) and an outcome (Galappaththi et al. 2019). Galappaththi et al. (2019) provided the sole definition among collaborat* variations (collaboration), which was broad in reference to action taken by a group of people to reach a common objective. Similarly, only one participat* variation was defined (participation), with Harper et al. (2012) highlighting the involvement of rightsholders and stakeholders in every phase of the research process. While many of these definitions share similar elements, they differ with respect to the individuals involved in the process, by whom the research objective is defined (community, or community and researchers), the intensity of participation throughout the process, and whether community-centred outcomes are attained. The appearance of most of these definitions over the last few years is promising. However, with this growth, there is a heightened need for the transparent articulation of community participation in research methods to further develop good practices in community research and monitoring.

Our second objective was to describe how community participation has been operationalized. A wide variety of methods were used in Indigenous knowledge and Western science data compilation, as seen in other reviews (e.g., Alexander et al. 2019; Thompson et al. 2020). The overwhelming majority of studies compiled and documented Indigenous knowledge through interviews, followed by field

observations and participatory mapping, while Western science methods were dominated by mapping and ice measurements, which are likely a reflection of a broader geographic focus. The many data compilation methods available to researchers and communities as identified in this scoping review offer opportunities for learning. We found that common approaches such as interviews or participatory methods (e.g., participatory mapping, focus groups) can span all five levels of community participation from least to most community involvement. This points to a need for further research examining characteristics that differentiate studies that use these methods but have higher (e.g., collaborative) versus lower (e.g., contractual) overall levels of participation to better understand how to improve research approaches. For example, in regard to interview methods, a closer look at design and delivery or community–researcher relationships may explain differential participation. This insight would be valuable in identifying specific actions that increase meaningful community participation while using familiar, effective, and respectful methods.

The near absence of collegial and Indigenous-led studies in our review emphasizes the need for projects in which communities have significantly more decision-making authority in aquatic research and monitoring. This absence has been echoed in other recent reviews (e.g., [Kouril et al. 2016](#); [David-Chavez and Gavin 2018](#); [Mosurska and Ford 2020](#)). Most studies are categorized in lower tiers of community participation at the contractual and consultative levels, which can rely heavily on community knowledge. At these lower participation levels, methods used (e.g., tissue sampling) reflect the relative ease with which community members can participate in projects through their knowledge of local species and related skills (i.e., working with animals for food or cultural purposes). Methods such as these offer possibilities of community participation in research as a means of maintaining and even supporting the intergenerational transfer of Indigenous knowledge ([Tang and Gavin 2016](#)), especially if the research has strong Indigenous leadership. Certain research methods may offer opportunities for movement towards more inclusive collaboration, such as those requiring context associated with the environment to understand trends (e.g., mapping, sea ice measurements), or requiring intensive community collaboration (e.g., workshops, focus groups). An in-depth analysis of methods and data compilation approaches could yield insight into processes that enable greater community participation. However, collegial or Indigenous-led projects can likely only be attained through increased community decision-making authority throughout the entire research process, with objectives centered on community needs and the co-production of community-owned outcomes. A closer look at participation throughout the research process and ways to amplify Indigenous voices throughout all project phases is necessary.

It is important to consider several contributing reasons for lower community participation in research and monitoring. The abundance of collaborative studies in comparison to collegial studies may point to a time lag in which leadership in the research process is transferred from researchers to Indigenous communities. This process could be enabled by established relationships between researchers and communities centered in skill enhancement, outcome ownership, and empowerment. Furthermore, in this scoping review, our use of a scientific metric (i.e., database searches) to gather studies with community participation may have resulted in our missing Indigenous-led studies that may not be published due to concerns related to intellectual property rights and data sovereignty. However, these reasons alone cannot fully explain the scarcity of studies led by Indigenous communities in the academic literature. Many recommendations by leading organizations in Canada aim to address this near absence of community leadership in research. The Inuit Tapiriit Kanatami *National Inuit Strategy on Research* is focused on actions leading to mutually beneficial relationships and Inuit self-determination ([ITK 2018](#)). Statements in the *Canadian Tri-Council Policy Statement on Ethical Conduct for Research Involving Humans* and the Inuit Circumpolar Council *Ethical and Equitable Engagement Synthesis Report* further express that it is a powerful motivating force for community members to assume decisive roles in research ([CIHR et al. 2018](#); [ICC 2021](#)). Policy issues,

administrative capacity, community skillsets, or funding processes and allocations can serve as significant obstacles to participation, as can infrastructure and difficulties obtaining equipment (ITK and NRI 2006). Many dimensions (e.g., political, economic, social) that interact would be fruitful areas for further inquiry as they affect opportunities and capacity for stronger participation by Inuit communities. In addition, critical considerations of participant voices that remain underrepresented (e.g., youth, women) in community research are necessary (Hitomi and Loring 2018; Aaluk et al. 2019; Mosurska and Ford 2020; Sadowsky et al. 2022).

With environmental changes occurring rapidly in the Canadian Arctic, there are increasing funding opportunities for research that may result in an influx of new researchers and programs in this field. As new scientists engage with Indigenous communities, a greater understanding of terms, methods, and approaches used for community participation, and manners to further Indigenous leadership in research, are becoming more important. The growth in relevant papers may have been spurred by the founding of the research network ArcticNet in Canada in 2004 (ArcticNet 2020) as well as the fourth and most recent International Polar Year, which occurred from 2007 to 2008 and drew attention to research with northern Indigenous communities. The increasing calls and funding for community participation in research have been intended to ensure greater decision-making authority for community members in research and monitoring.

Geographically, the majority of studies were conducted in Nunavut as similarly reported in Alexander et al. (2019), which may result from a greater influx of funding and increased opportunities for research associated with this region being a territory of its own. The prevalence of studies conducted in four Nunavut communities points to a need for inquiry into factors that influence and enable such research and monitoring. For example, a community may have built relationships over time with specific collaborators or have previously partnered with researchers on different projects that may even span across disciplines. As our results are skewed in primarily representing the participation of Nunavummiut (inhabitants of Nunavut), there is a need for further research to be conducted elsewhere in Inuit Nunangat, and in Nunatsiavut in Labrador in particular, to address underrepresentation.

Conclusion

Although researchers from environmental and social sciences and other disciplines are striving to implement respectful ways to engage with Indigenous communities, our findings reveal a number of barriers and opportunities. A lack of clarity in terminologies used to describe community participation, and the inclusion of definitions not as a norm, but rather, individual decisions made by few authors, may delay, undermine, or misrepresent community participatory research as this field expands rapidly. We observed a misalignment between community participation terms and how they are reflected in practice. As such, there is a need for greater transparency in the operationalization of community participation to ensure that principles and intentions of meaningful research are met. Ethical research and monitoring approaches and detailed reporting are the responsibility of researchers, governments, and institutions to implement. However, we emphasize that it is imperative that researchers work with individual communities—Inuit as well as First Nations and Métis—to develop an understanding and use of terminology and methods that centre on community priorities. We maintain that these terms must be defined on a community and research project basis. Moreover, it is important to note that articulation of participation is undoubtedly less important than participatory work itself, and the continuous exploration and implementation of new relational approaches at a community level. We emphasize the importance of building relationships with communities, and of following their lead in research and monitoring endeavours (ICC 2021). There is much room to increase Inuit leadership, decision-making authority, and by extension, ownership, in coastal and marine research and monitoring and in the application of knowledge compiled. Consequently,

considerations of term usage and the operationalization of community participation are timely and far-reaching.

Acknowledgements

In this paper, the authors discuss only some of the knowledge of Inuit across Inuit Nunangat. We are grateful to every individual who participated or contributed to each study in this review. Nakurmiik (South Qikiqtaaluk). Qujannamiik (North Qikiqtaaluk). Quyanainni (Inuvialuktun). Quana (Inuinnaqtun). Qujanaqutit (Nattilingmiutut). Ma'na (Paallirmiutut). And in the many more dialects not written here, we express our thanks. We thank Mark Ouellette (Fisheries and Oceans Canada) for producing the map and Dr. Steven Cooke for providing comments on the first draft of this manuscript. We further thank three anonymous reviewers for their thought-provoking suggestions that improved this paper.

Land Acknowledgement

We gratefully acknowledge that this research was completed in the unceded, traditional territory of Algonquin Anishinaabe Peoples in Ottawa, Ontario, and in Treaty No. 1 Territory in the traditional lands of the Anishinaabe, Ininew, Oji-Cree, Dene, and Dakota, and the homeland of the Métis Nation in Winnipeg, Manitoba.

Authorship contributions

Conceptualization: AD, SA, VN, KD. Study screening: AD, AP, CR. Data extraction: AD, AP, CR. Data analysis: AD, AP, CR. Writing – original draft: AD, AP, CR. Writing – review and editing: AD, SA, VN, KD.

Funding statement

Funding was provided by Fisheries and Oceans Canada (Results Fund) and Carleton University.

Data availability statement

All relevant data are available in the supplementary files within this paper.

Competing interests

The authors have declared that no competing interests exist.

Supplementary material

The following Supplementary Material is available with the article through the journal website at doi:[10.1139/facets-2021-0067](https://doi.org/10.1139/facets-2021-0067).

Supplementary Material A

Supplementary Material B

Supplementary Material C

References

Aaluk T, Analviapik A, Koonoo I, and Tiriraniaq B. 2019. Ikaarvik position paper on meaningful engagement of northern Indigenous communities in research. Submitted for the National Dialogue on Strengthening Indigenous Research Capacity.

Alexander SM, Provencher JF, Henri DA, Taylor JJ, Lloren JI, Nanayakkara L, et al. 2019. Bridging Indigenous and science-based knowledge in coastal-marine research, monitoring, and management in Canada. *Environmental Evidence*, 8(36): 1–24. DOI: [10.1186/s13750-019-0181-3](https://doi.org/10.1186/s13750-019-0181-3)

ArcticNet. 2020. About us. [online]: Available from arcticnet.ulaval.ca/vision-and-mission/about-us.

Berkes F. 2018. *Sacred ecology*. 4th ed. Routledge, New York, New York. 394 pp.

Canadian Institutes of Health Research (CIHR), Natural Sciences and Engineering Research Council of Canada (NSERC) and Social Sciences and Humanities Research Council of Canada (SSHRC). 2018. Tri-council policy statement: ethical conduct for research involving humans. 231 pp. [online]: Available from ethics.gc.ca/eng/policy-politique_tcps2-eptc2_2018.html.

Carter N, Dawson J, Simonee N, Tagalik S, and Ljubicic G. 2019. Lessons learned through research partnership and capacity enhancement in Inuit Nunangat. *Arctic*, 72(4): 381–403. DOI: [10.14430/arctic69507](https://doi.org/10.14430/arctic69507)

Conger AJ. 1980. Integration and generalization of Kappas for multiple raters. *Psychological Bulletin*, 88(2): 322–328. DOI: [10.1037/0033-2909.88.2.322](https://doi.org/10.1037/0033-2909.88.2.322)

Convention on Biological Diversity. 2019. Report of the ad hoc open-ended inter-sessional working group on article 8(J) and related provisions of the Convention on Biological Diversity on its eleventh meeting. Montreal, Canada.

Crown-Indigenous Relations and Northern Affairs Canada. 18 November 2019. Canada's Arctic and Northern Policy Framework. Government of Canada. [online]: Available from rcaanc-cirnac.gc.ca/eng/1560523306861/1560523330587#fn1.

Danielsen F, Burgess ND, Balmford A, Donald PF, Funder M, Jones JPG, et al. 2009. Local participation in natural resource monitoring: A characterization of approaches. *Conservation Biology*, 23(1): 31–42. PMID: [18798859](https://pubmed.ncbi.nlm.nih.gov/18798859/) DOI: [10.1111/j.1523-1739.2008.01063.x](https://doi.org/10.1111/j.1523-1739.2008.01063.x)

David-Chavez DM, and Gavin MC. 2018. A global assessment of Indigenous community engagement in climate research. *Environmental Research Letters*, 13(12): 123005–123017. DOI: [10.1088/1748-9326/aaf300](https://doi.org/10.1088/1748-9326/aaf300)

Dawson J, Carter N, van Luijk N, Parker C, Weber M, Cook A, et al. 2020. Infusing Inuit and local knowledge into the low impact shipping corridors: An adaptation to increased shipping activity and climate change in Arctic Canada. *Environmental Science and Policy*, 105: 19–36. DOI: [10.1016/j.envsci.2019.11.013](https://doi.org/10.1016/j.envsci.2019.11.013)

Department of Justice Canada. 10 December 2021. Background: United Nations Declaration on the Rights of Indigenous Peoples Act. Government of Canada [online]: Available from justice.gc.ca/eng/declaration/about-apropos.html

Drisko JW, and Maschi T. 2016. *Content analysis*. Oxford University Press, Oxford, UK. 191 pp.

Ebi KL. 2012. Key themes in the working group II contribution to the Intergovernmental Panel on Climate Change 5th assessment report. *Climatic Change*, 114: 417–426. DOI: [10.1007/s10584-012-0442-4](https://doi.org/10.1007/s10584-012-0442-4)

Ehrman AD, Loseto LL, Pućko M, Melling H, Michel C, Reist J, et al. 2022. Potential ecological monitoring indicators and strategies for the Anguniaqvia niqiqyuam Marine Protected Area and a

synopsis of available information. DFO Can. Sci. Advis. Sec. Res. Doc. 2022/036. vii + 148 p. [online]: Available from dfo-mpo.gc.ca/csas-sccs/Publications/ResDocs-DocRech/2022/2022_036-eng.pdf

Fisheries and Oceans Canada. September 2019. DFO-Coast Guard Reconciliation Strategy [online]: Available from waves-vagues.dfo-mpo.gc.ca/Library/40947208.pdf

Fleener C, Gofman V, Peskov V, Retter G-B, and Torikka-Gelencsér R. 2004. Community-based Monitoring – a discussion paper. Supporting publication to the CAFF Circumpolar Biodiversity Monitoring Program – Framework Document. CAFF CBMP Report No. 9, CAFF International Secretariat, Akureyri, Iceland. 21 pp.

Galappaththi EK, Ford JD, Bennett EM, and Berkes F. 2019. Climate change and community fisheries in the arctic: A case study from Pangnirtung, Canada. *Journal of Environmental Management*, 250: 109534. PMID: 31526961 DOI: [10.1016/j.jenvman.2019.109534](https://doi.org/10.1016/j.jenvman.2019.109534)

Gérin-Lajoie J, Herrman TM, MacMillan GA, Hébert-Houle E, Monfette M, Rowell JA, et al. 2018. IMALIRIJIT: A community-based environmental monitoring program in the George River watershed, Nunavik, Canada. *Écoscience*, 25(4): 381–399. DOI: [10.1080/11956860.2018.1498226](https://doi.org/10.1080/11956860.2018.1498226)

Government of Canada. 19 December 2021a. Minister of Environment and Climate Change Mandate Letter [online]: Available from pm.gc.ca/en/mandate-letters/2021/12/16/minister-environment-and-climate-change-mandate-letter

Government of Canada. 16 December 2021b. Minister of Fisheries, Oceans, and the Canadian Coast Guard Mandate Letter [online]: Available from pm.gc.ca/en/mandate-letters/2021/12/16/minister-fisheries-oceans-and-canadian-coast-guard-mandate-letter

Government of Canada. 21 April 2022. Inuit-Crown Partnership Committee endorses historic Inuit Nunangat Policy to better support Inuit self-determination [online]: Available from pm.gc.ca/en/news/news-releases/2022/04/21/inuit-crown-partnership-committee-endorses-historic-inuit-nunangat

Harper SL, Edge VL, Willox AC and Rigolet Inuit Community Government. 2012. ‘Changing climate, changing health, changing stories’ profile: Using an ecohealth approach to explore impacts of climate change on inuit health. *EcoHealth*, 9: 89–101. DOI: [10.1007/s10393-012-0762-x](https://doi.org/10.1007/s10393-012-0762-x)

Hitomi MK, and Loring PA. 2018. Hidden participants and unheard voices? A systematic review of gender, age, and other influences on local and traditional knowledge research in the north. *FACETS*, 3(1): 830–848. DOI: [10.1139/facets-2018-0010](https://doi.org/10.1139/facets-2018-0010)

Idrobo CJ, and Berkes F. 2012. Pangnirtung Inuit and the Greenland Shark: Co-producing Knowledge of a Little Discussed Species. *Human Ecology*, 40(3): 405–414. DOI: [10.1007/s10745-012-9490-7](https://doi.org/10.1007/s10745-012-9490-7)

Ingold T, and Kurttila T. 2000. Perceiving the Environment in Finnish Lapland. *Body and Society*, 6(3-4): 183–196. DOI: [10.1177/1357034X00006003010](https://doi.org/10.1177/1357034X00006003010)

Inuit Circumpolar Council (ICC). 2021. Ethical and Equitable Engagement Synthesis Report: A collection of Inuit rules, guidelines, protocols, and values for the engagement of Inuit Communities and Indigenous Knowledge from Across Inuit Nunaat. Synthesis Report. International. 40 pp.

Inuit Tapiriit Kanatami (ITK), and Nunavut Research Institute (NRI). 2006. Negotiating research relationships with Inuit communities: A guide for researchers. 25 p. [online]: Available from nri.nu.ca/sites/default/files/public/files/06-068%20ITK%20NRR%20booklet.pdf.

Inuit Tapiriit Kanatami (ITK). 2018. National Inuit strategy on research. 48 p. [online]: Available from itk.ca/wp-content/uploads/2018/03/National-Inuit-Strategy-on-Research.pdf.

Inuit Tapiriit Kanatami (ITK). 2019. Inuit Nunangat Map [online]: Available from itk.ca/inuit-nunangat-map/.

Johnson JT, Howitt R, Cajete G, Berkes F, Louis RP, and Kliskey A. 2016a. Weaving Indigenous and sustainability sciences to diversify our methods. *Sustainability Science*, 11(1): 1–11. DOI: [10.1007/s11625-015-0349-x](https://doi.org/10.1007/s11625-015-0349-x)

Johnson N, Behe C, Danielsen F, Krümmel E-M, Nickels S, and Pulsifer PL. 2016b. Community-based monitoring and indigenous knowledge in a changing arctic: a review for the sustaining arctic observing networks. Task # 9 (Ottawa): Inuit Circumpolar Council.

Kirkness V, and Barnhardt R. 1991. First nations and higher education: The four Rs—respect, relevance, reciprocity, responsibility. *Journal of American Indian Education*, 30: 1–15. DOI: [10.2307/24397980](https://doi.org/10.2307/24397980)

Kouril D, Furgal C, and Whillans T. 2016. Trends and key elements in community-based monitoring: a systematic review of the literature with an emphasis on Arctic and Subarctic regions. *Environmental Reviews*, 24(2): 151–163. DOI: [10.1139/er-2015-0041](https://doi.org/10.1139/er-2015-0041)

Marcoux M, Auger-Méthé M, Chmelnitsky EG, Ferguson SH, and Humphries MM. 2011. Local passive acoustic monitoring of narwhal presence in the Canadian Arctic: a pilot project. *Arctic*, 62(3): 307–316. DOI: [10.14430/arctic4121](https://doi.org/10.14430/arctic4121)

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. PMID: [16670675](https://pubmed.ncbi.nlm.nih.gov/16670675/) DOI: [10.1038/sj.embor.7400693](https://doi.org/10.1038/sj.embor.7400693)

Mosurska A, and Ford JD. 2020. Unpacking Community Participation in Research: A Systematic Literature Review of Community-based and Participatory Research in Alaska. *Arctic*, 73(3): 347. DOI: [10.14430/arctic71080](https://doi.org/10.14430/arctic71080)

Parry ML, Canziani OF, Palutikof JP, van der Linden PJ, and Hanson CE eds. 2007. Cross-chapter case study. *In: Climate change 2007: impacts, adaptation and vulnerability. Contribution of working group II to the fourth assessment report of the Intergovernmental Panel on Climate Change.* Cambridge University Press, Cambridge, UK. 843–868 pp.

Rathwell KJ, Armitage D, and Berkes F. 2015. Bridging knowledge systems to enhance governance of the environmental commons: a typology of settings. *International Journal of the Commons*, 9(2): 851–880. DOI: [10.18352/ijc.584](https://doi.org/10.18352/ijc.584)

Reed MS. 2008. Stakeholder participation for environmental management: A literature review. *Biological Conservation*, 141(10): 2417–2431. DOI: [10.1016/j.biocon.2008.07.014](https://doi.org/10.1016/j.biocon.2008.07.014)

Reid AJ, Eckert LE, Lane J-F, Young N, Hinch SG, Darimont CT, et al. 2021. “Two-Eyed Seeing”: An Indigenous framework to transform fisheries research and management. *Fish and Fisheries*, 22(2): 243–261. DOI: [10.1111/faf.12516](https://doi.org/10.1111/faf.12516)

Sadowsky H, Brunet ND, Anaviapik A, Kublu A, Killiktee C, and Henri DA. 2022. Inuit youth and environmental research: Exploring engagement barriers, strategies, and impacts. *FACETS*, 7: 45–70. DOI: [10.1139/facets-2021-0035](https://doi.org/10.1139/facets-2021-0035)

Tang R, and Gavin MC. 2016. A classification of threats to traditional ecological knowledge and conservation responses. *Conservation and Society*, 14(1): 57–70. DOI: [10.4103/0972-4923.182799](https://doi.org/10.4103/0972-4923.182799)

Thompson KL, Lantz T, and Ban NC. 2020. A review of Indigenous knowledge and participation in environmental monitoring. *Ecology and Society*, 25(2): 10. DOI: [10.5751/ES-11503-250210](https://doi.org/10.5751/ES-11503-250210)

Turreira-García N, Lund JF, Domínguez P, Carrillo-Anglés E, Brummer MC, Duenn P, and Reyes-García, V. 2018. What's in a name? Unpacking “participatory” environmental monitoring. *Ecology and Society*, 23(2): 24. DOI: [10.5751/ES-10144-230224](https://doi.org/10.5751/ES-10144-230224)

Wilson NJ, Mutter E, Inkster J, and Satterfield T. 2018. Community-based monitoring as the practice of Indigenous governance: A case study of Indigenous-led water quality monitoring in the Yukon River Basin. *Journal of Environmental Management*, 210: 290–298. PMID: [29407189](https://pubmed.ncbi.nlm.nih.gov/29407189/) DOI: [10.1016/j.jenvman.2018.01.020](https://doi.org/10.1016/j.jenvman.2018.01.020)

Wong C, Ballegooyen K, Ignace L, Johnson MJG, and Swanson H. 2020. Towards reconciliation: 10 Calls to Action to natural scientists working in Canada. *FACETS*, 5: 769–783. DOI: [10.1139/facets-2020-0005](https://doi.org/10.1139/facets-2020-0005)