Aboriginal Affairs and Northern Development Canada

Beaufort Regional Environmental Assessment Cumulative Effects Framework




DRAFT Report

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Aboriginal Affairs and Northern Development Canada

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Acronym	Definition
AANDC	Aboriginal Affairs and Northern Development Canada
AAROM	Aboriginal Aquatic Resource and Oceans Management
ACC	Aklavik Community Corporation
ACES	Arctic Coastal Ecosystems Study
AFSAR	Aboriginal Fund for Species at Risk
AMAP	Arctic Monitoring and Assessment Programme
AOC	Apprenticeship and Occupational Certification
AOGS	Arctic Oil & Gas Services Inc.
APS	Aboriginal Peoples Survey
APTN	Aboriginal Peoples Television Network
ASEP	Aboriginal Skills and Employment Partnership
BDR	Beaufort Delta Region
BEMP	Beaufort Environmental Monitoring Program
BREA	Beaufort Region Environmental Assessment
BREAM	Beaufort Regional Environmental Assessment and Monitoring Program
BSBMP	Beaufort Sea Beluga Management Plan
BSStRPA	Beaufort Sea Strategic Plan of Action
CanNor	Canadian Northern Economic Development Agency
CBC	Canadian Broadcasting Corporation
CC/CCs	Community Corporation(s)
CCIW	Canadian Centre for International Waters
CE	Cumulative Effects
CEA	Cumulative Effects Assessment
CEDO	Community Economic Development Organization
CEM	Cumulative Effects Management
CPUE	catch-per-unit-effort
CWS	Canadian Wildlife Service
DDT	dichlorodiphenyltrichloroethane
DENR	Department of Environment and Natural Resources (ENR)
DFO	Department of Fisheries and Oceans
DIAND	Department of Indian Affairs and Northern Development
DND	Department of National Defence
DOT	Department of Transportation
EIRB	Environmental Impact Review Board
EISC	Environmental Impact Screening Committee
ENR	Environment and Natural Resources
ESIA	Environmental and Social Impact Assessment
ESRF	Environmental Studies Research Fund

Acronym	Definition
FJMC	Fisheries Joint Management Committee
FL	Fork length
FSC	Food, social or ceremonial
GED	General Equivalency Diploma
GEKP	Gwich'in Environmental Knowledge Project
GMVF	Genuine Mackenzie Valley Fur
GNWT	Government of the Northwest Territories
GNWT MCA	Department of Municipal and Community Affairs
GNWTBS	Government of the Northwest Territories Bureau of Statistics
GNWTDT	Government of the Northwest Territories Department of Transportation
GNWTECE	Government of the Northwest Territories Department of Education, Culture and Employment
GNWTECE	Northwest Territories Department of Education, Culture and Employment
GNWTENR	GNWT Environment & Natural Resources
GNWTHSS	GNWT Health & Social Services
GNWTITI	Government of the Northwest Territories Department of Industry, Tourism and Investment
GRRB	Gwich’in Renewable Resource Board
GSA	Gwich'in Settlement Area
GSCI	Gwich’in Social and Cultural Institute
GTC	Gwich’in Tribal Council
HCB	Hexachlorobenzene
HCC	Ulukhaktok (Holman) Community Corporation
HCI	Healthy Children Initiative
Hg	Mercury
HR	Human Resources
HRSDC	Human Resources and Skills Development Canada
HTC	Hunters and Trappers Committee
IBP	International Biological Programme
ICC	Inuvik Community Corporation
ICG	Inuvialuit Corporate Group
ICRC	Inuvialuit Cultural Resource Centre
IDC	Inuvialuit Development Corporation
IEF	Inuvialuit Education Foundation
IFA	Inuvialuit Final Agreement
IGC	Inuvialuit Game Council
IHAP	Inuvialuit Harvesters Assistance Program
IIC	Inuvialuit Investment Corporation
ILA	Inuvialuit Land Administration
ILA	Inuvialuit Land Administration

Acronym	Definition
ILAC	Inuvialuit Land Administration Commission
IOC	Iron Ore Company of Canada
IOMP	Beaufort Sea Integrated Oceans Management Plan
IPC	Inuvialuit Petroleum Corporation
IQAS	International Qualifications Assessment Service
IRC	Inuvialuit Regional Corporation
ISDP	Inuvialuit Social Development Program
ISR	Inuvialuit Settlement Region
ITK	Inuit Tapiriit Kanatami
JS	Joint Secretariat
MGP	Mackenzie Gas Project
MiHR	Mining Industry Human Resources Council
MMO	Marine Mammal Observer
MTS	Mine Training Society
NABE	Northern Adult Basic Education Program
NATO	North Atlantic Treaty Organization
NCMS	Northern Coastal Marine Studies
NCP	Northern Contaminants Program
NCS	Native Communications Society of the NWT
NEB	National Energy Board
NHS	National Household Survey
NRCan	Natural Resources Canada
NTCL	Northern Transportation Co. Ltd.
NWMB	Nunavut Wildlife Management Board
NWT	Northwest Territories
NWT CIMP	Northwest Territories Cumulative Impact Monitoring Program
OHTC	Olokhaktomiut Hunters and Trappers Committee
PAM	Passive Acoustic Monitoring
PCBs	Polychlorinated biphenyls
PCC	Paulatuk Community Corporation
PCDD	Polychlorinated dibenzodioxins (dioxins)
PCDF	Polychlorinated dibenzofurans (Furans)
PGNAETA	Prince George Nechako Aboriginal Employment and Training Association
POP	Persistent Organic Pollutants
PWNHC	Prince of Wales Northern Heritage Centre
RRC	Renewable Resource Committee (Gwich'in)
SBS	Shifting baseline syndrome
SEAs	Socio Economic Agreements
SEPH	Survey of Employment, Payrolls and Hours
SHCC	Sachs Harbour Community Corporation

Acronym	Definition
SRRB	Sahtu Renewable Resource Board
TC	Transport Canada
TCC	Tuktoyaktuk Community Corporation
TL	Total length
TNMPA	Tarium Niryutait Marine Protected Area
UCC	Ulukhaktok Community Corporation
VC	Valued Component
WMACNS	Wildlife Management Advisory Council (North Slope)
WMACNWT	Wildlife Management Advisory Council (Northwest Territories)
YTG	Yukon Territorial Government

Executive Summary

Aboriginal Affairs and Northern Development Canada, on behalf of the BREA Working Group on Cumulative Effects, contracted the services of AMEC Environment and Infrastructure to facilitate a study and provide recommendations for the development of a Cumulative Effects Framework.

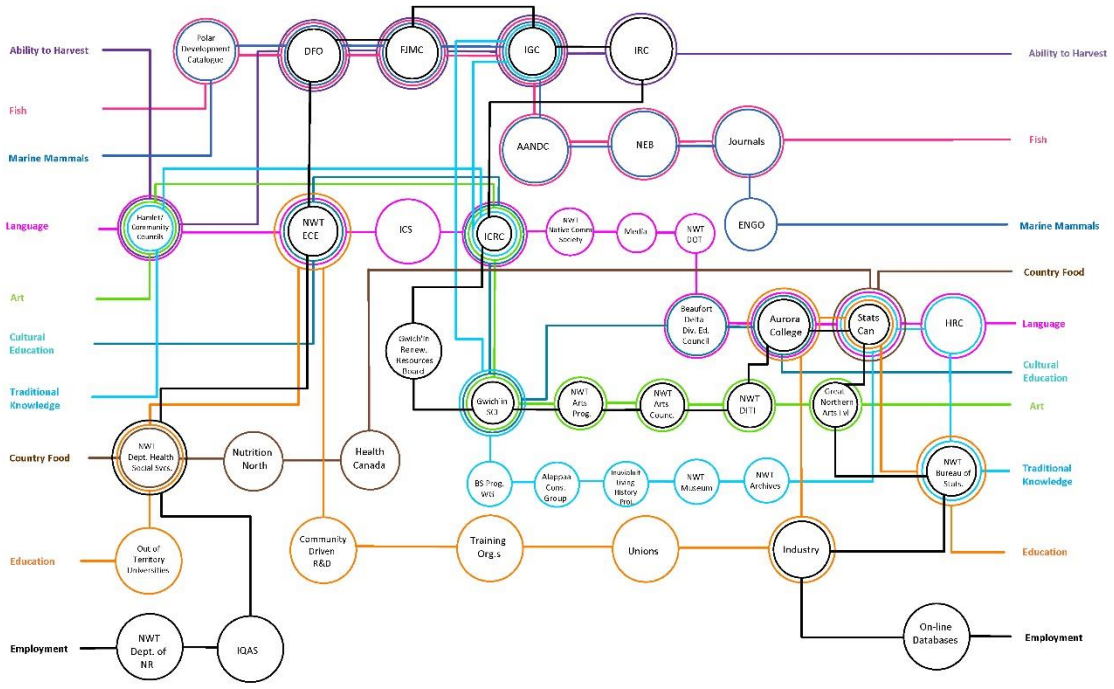
As an initial step in working towards the project objective, AMEC undertook a comprehensive review of Cumulative Effects (CE) monitoring and management activities in Canada as well as other international jurisdictions. The results of this desktop study were presented at a stakeholder workshop in which the BREA Working Group participated. Summary findings from the study are provided in Appendix B of this report.

The purpose of the stakeholder workshop was to identify environmental, economic, social, and cultural Valued Components (VCs) for consideration in the further advancement of cumulative effects monitoring and management activities in the Beaufort Region. The workshop results, which are presented and discussed in Section 2 of this report, included the selection of four priority Valued Components (VCs) (fish/whales, employment, education, and cultural vitality) on which to focus development of a CE Framework. The cultural vitality VC is comprised of several components indicative of the cultural well-being of the Inuvialuit communities in the Beaufort region.

AMEC subsequently undertook a review of past and ongoing environmental research and monitoring activities conducted by government (federal, territorial and Inuvialuit) to identify relevant sources of information for each of the pilot VCs. This study provided insight into appropriate Indicators for each VC upon which monitoring of cumulative effects can be founded, and through which CE management decisions can be effected.

It was determined that there are multiple Indicators for each VC which can be useful for CE monitoring and there are multiple agencies involved in the management of each VC. As a result, it was determined that the CE Framework should provide a means through which relevant Indicator data and information can be shared and by which information can be collaboratively reviewed and analyzed, with the goal of providing relevant CE management recommendations to the appropriate Regulatory Authorities. The Framework for CE information sharing and collaboration on CE management is presented in Section 4 of the Report. The schematic diagram from this section (below) illustrates the broad range of organizations involved in VC monitoring and information management.

Figure 4.1 Cumulative Effects Framework - Information Network



Finally, based on the results of the workshop in which the pilot VCs were selected, and the subsequent review of completed and ongoing research and monitoring activities by the various government, academic and industry agencies, AMEC offers the following recommendations to the BREA CE WG.

It is recommended that efforts be made to continue the work of the BREA Cumulative Effects Working Group. The Working Group can play a pivotal role in coordination of information exchange and oversee the continued development and implementation of a Beaufort Regional Cumulative Effects Framework.

The BREA Cumulative Effects Working Group should be expanded to include representatives from those organizations involved with data collection, storage, and reporting on multiple Valued Components.

The CE Framework should provide support to existing environmental Regulatory Agencies (NEB, CEAA, EISC and EIRB) in making informed decisions. These Agencies should consider including CE monitoring and mitigation requirements for the target VCs as a condition of Approval for each new Project.

A concerted effort should be made to enhance communication between organizations with a common interest or involvement in collection and compilation of information related to the various Valued Components. The approach to communication and tools used should be multifaceted, involving face to face meetings, teleconference meetings, email correspondence, newsletters, social media, and web-based surveys. This should be undertaken separately for each of the four pilot VCs.

Representatives from the BREA CE WG should oversee the development of data sharing forms and promote the use of these forms by organizations involved in routine collection of data and information regarding

the pilot VC Indicators. The forms should be simple and enable easy transfer of basic information between organizations on an ongoing basis. These forms should be distributed widely to ensure broad use by all organizations, potentially as digital forms.

Representatives from the BREA CE WG should meet annually at the beginning of the fiscal year to review information compiled for the previous calendar year and provide recommendations to Regulatory Agencies regarding CE management actions in the upcoming year.

The BREA Cumulative Effects Working Group should identify the financial support (public and private sector) necessary to hire data collection coordinators who will be tasked with collecting and compiling academic research reports and governmental reports containing information specific to the identified VC indicators. Furthermore, the BREA CE WG should designate one member organization to secure the funding and facilitate hiring of the data coordinator for each VC.

Representatives from the BREA CE WG should, in consultation with stakeholder groups, identify additional VCs for inclusion in further development of the CE Framework. These VCs should be added to ensure smooth and continued development of the CE Framework.

1.0 Introduction

The Beaufort Sea has increasingly received international attention as a region for oil and gas exploration. Located in the remote, sparsely populated, and climatically harsh region of the Northwest Territories, relatively little research has been conducted in the Beaufort Sea relative to other regions supporting offshore oil and gas development, such as the North Sea and eastern Canada. As a result, there is little environmental and socio-economic baseline data available for this region.

In 2010, the government of Canada initiated a four-year, $21.7 million program to fill the information gaps related to offshore oil and gas activities. The Program, the Beaufort Region Environmental Assessment (BREA), is a multi-stakeholder initiative intended to assist regulators in decision-making by increasing the amount of relevant historical and up-to-date baseline data available to all stakeholders. A targeted research program and six working groups have been addressing key regional issues including information management, regional waste management, oil spill preparedness and response, socio-economic indicators, climate change, and cumulative effects assessment. More than 22 research projects were selected to gather new regional data on various issues related to potential oil and gas exploration. Together these activities should help ensure that government, Inuvialuit, and industry have information to prepare for offshore oil and gas exploration and development in the Beaufort Sea. Figure 1.1 illustrates the area of interest for the BREA program, and some of the current project areas (https://www.aadnc-aandc.gc.ca/DAM/DAM-INTER-HQ/STAGING/textetext/mr_nr_23570_map_1330363519370_eng.pdf).

One of the action items the BREA program has focussed on is the advancement of cumulative effects management capacity in the region. Control of this initiative has been the responsibility of a focussed Working Group, which has engaged the services of AMEC Environment and Infrastructure to provide a conceptual framework for Cumulative Effect (CE) monitoring and management.

Section 1 of this document provides a summary of the BREA process and an overview of the concept of cumulative effects. This includes discussions of shifting baseline syndrome and climate change impacts, both of which are important issues relevant to understanding the complex nature of cumulative effects management.

Section 2 provides an overview of the processes undertaken by AMEC and the BREA Cumulative Effects Working Group to identify target valued components in order to focus initial CE monitoring and management activities.

Section 3 provides a description of the multiple information sources which can be utilized within a framework to monitor and manage CE in the Beaufort region.

Section 4 presents a conceptual CE framework which focusses on information management and sharing that will provide the basis for ongoing CE management.

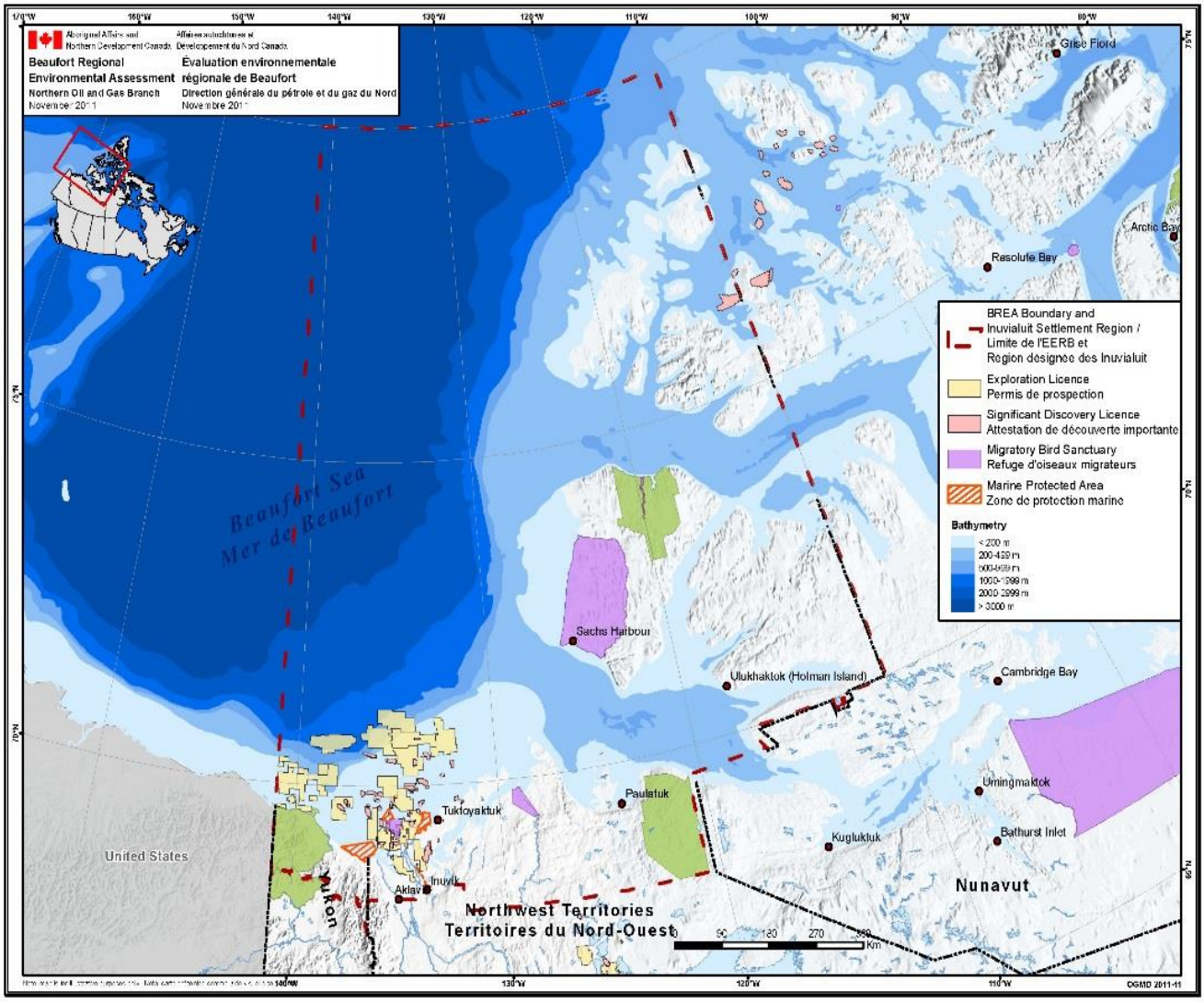


Figure 1-1 BREA Program Area.

Section 5 provides summary recommendations for the continued development and implementation of a Beaufort Regional Cumulative Effects Management Framework.

1.1 BREA

BREA is a multi-stakeholder initiative designed to help ensure that governments, Inuvialuit, and industry are better prepared for oil and gas exploration and development in the Beaufort Sea offshore. The purpose of the Beaufort Regional Environmental Assessment is:

"to help ensure Inuvialuit, government, and industry are better prepared for oil and gas exploration and development in the offshore by: 1) filling regional information and data gaps related to offshore oil and gas activities; and 2) supporting effective and efficient regulatory decision making by providing the necessary data and information to all stakeholders."

The BREA Committee has agreed, through consensus, that a Cumulative Effects Framework is an essential component of the overall strategy to better inform decision-makers.

The issue of Cumulative Effects in the Beaufort Region has received considerable attention due to the real possibility of major resource development activities in the marine environment in this region. Potential development of oil and gas projects as well as new shipping initiatives will add increasing pressures to biophysical and cultural environments already impacted by social development programs, past oil and gas projects, development of transportation infrastructure, and inland mining and forestry development which has resulted in environmental changes with the region's rivers and associated downstream habitats.

Several new oil and gas projects are currently proposed for the Beaufort Region. Proposed new projects such as these are continually scrutinized by regulators who have an ever-increasing understanding of the risk of significant and cumulative environmental effects. Regulators are often the subject of public attention since the perceived risk, and the actual risk are often quite different. For this reason Regulators must consider projects in an open and transparent manner and ensure that appropriate mitigation measures are included in the consideration of new projects, including mitigation and management of cumulative effects. Oil and gas developments which are currently under consideration include:

Proponent/Developer	Activity (SDL - Significant Discovery Licence; EL - Exploration Licence)
Imperial Oil Resources Limited	• 17 SDLs (050, 051, 053 - 055, 058, 061, 065, 091, 092, 095, 110 - 112, 115 – 117)
Imperial Oil Resources Ventures Limited	• 2 ELs (476 (Ajurak) and 477 (Pokak)) ○ Exploration drilling program ○ Beaufort Sea – 120 km offshore ○
ConocoPhillips	• 9 SDLs (083 – 088, 096, 097, 126) • 1 EL (483) ○ Initial planning phase of Amauligak field ○ 50 km NW of Tuktoyaktuk
BP Exploration Operating Company Ltd	• 2 ELs (478, 479)
BP Canada Energy Development Company	• 8 SDLs (037 – 041, 047 – 049)
BP Canada Energy Group ULC	• 3 SDLs (089, 113, 114)

Franklin Petroleum Canada Limited	• 6 ELs (485, 488, 491 – 493, 496)
Chevron Canada Limited	• 1 SDL (014)
Nytis Exploration Company Canada Ltd.	• 3 SDLs (025, 026, 028)
Devon NEC Corporation	• 1 SDL (130)
MGM Energy Corp.	• 6 SDLs (132 – 136, 146)

These projects will be occurring in an area with recognized extreme environmental and climatic conditions and where other development activities will be occurring, including international shipping, marine tourism (cruise ships) and possibly commercial fisheries. In the short term, much of the shipping specific to the Beaufort Sea is expected to be associated with the development of an offshore oil and gas industry, however there is the potential for development of mineral transportation as the inceasingly ice-free North West Passage becomes a more economical options for some markets.

Community resupply vessels are an important component of local shipping activity. This is likely to increase in scope and volume as new offshore developments begin. Coastal community resupply shipping currently provides service to the communities ofAklavik, Inuvik, Paulatuk, Sachs Harbour, Tuktoyaktuk, and Ulukhaktok (Holman).

Marine tourism will also likely contribute to increased shipping activity independently of offshore oil and gas development in the Beaufort Sea Region. It has already been noted by community members that more and more tourists (cruise ships and "adventurers") are present in the Region[1] (Leah Beveridge, pers comm. 2015).

The Canadian Coast Guard, in collaboration with Environment Canada and Transport Canada, has been working to identify preliminary shipping corridors through an analysis of Arctic survey data, bathymetry data, seafloor complexity, traffic data, and important marine ecosystems identified through traditional knowledge. Identified shipping corridors include:

Primary corridors: major well-known routes that provide access to other corridors (Northwest Passage, Hudson Bay routes);
Secondary corridors: routes from Primary corridors to communities; and,
Tertiary corridors: routes to North Warning System sites and places of refuge.

[1] This is a concern at the local and national level, since only vessels over 300 gross tonnes must report their activity to Canadian officials, and vessels in distress can have significant impact on SAR and create potential hazards to large project activities. Joint Task Force North is currently monitoring the personal blogs of persons conducting Arctic adventures to track their activities. The absence of a new post on their blog for a significant amount of time is an indication that the adventurer(s) may be in trouble.

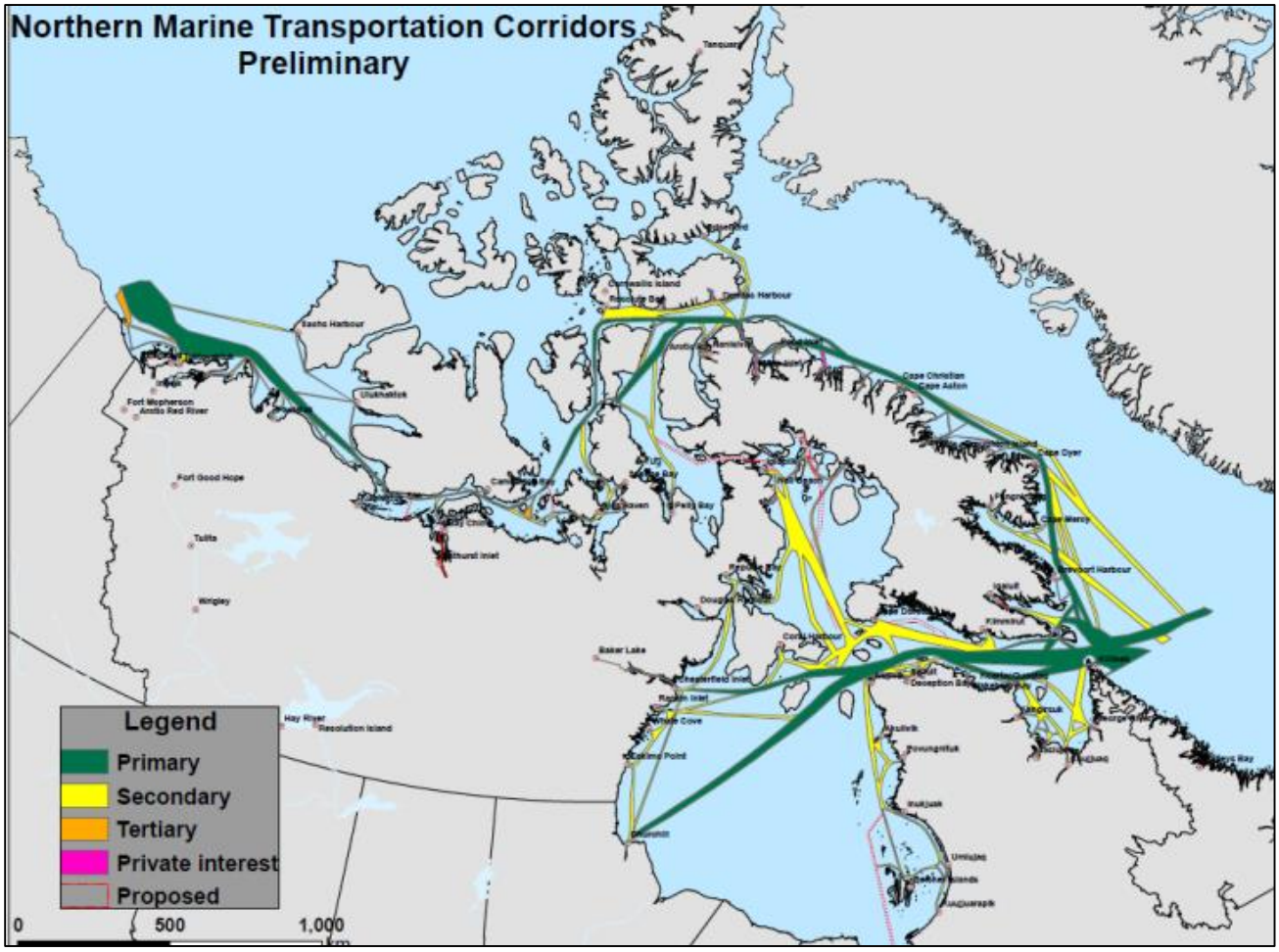


Figure 1-2. Shipping Routes in the Canadian Arctic

More information is available at:

http://www.mastermariners.ca/maritimes/uploads/05marinecorridors.pdf

The BREA Cumulative Effects Working Group (BREA CE WG) has endeavoured to develop a framework that outlines the tools needed to support management decision-making that integrates existing science-based information with value-based consideration of environmental and socio-cultural components and thresholds of acceptable change. To this end, the BREA-CE WG has, with the consultative support of AMEC Environment and Infrastructure, undertaken the task of identifying critical steps in establishing a Cumulative Effects Framework (CEF), identifying and selecting a short list of Valued Components (VCs) which can be used to pilot the development and implementation of a CEF, and the preparation of recommendations for the continued development of the CEF.

The focus of the development of the CEF was to use methods or tools that will efficiently support decision-making. The goal is to introduce a simple framework (that could potentially be implemented by key

regulators in upcoming offshore oil and gas applications) that will be implemented, tested, and refined through experience and multi-stakeholder engagement.

The BREA-CE WG built upon work previously undertaken in the Beaufort Region including Beaufort Sea Strategic Plan of Action (BSStRPA), Beaufort Sea Integrated Oceans Management Plan (IOMP), Beaufort Environmental Monitoring Program (BEMP), and Beaufort Regional Environmental Assessment and Monitoring Program (BREAM). Also to be considered are data mining and gaps work published by Environmental Studies Research Fund (ESRF) and ArcticNet.

There was unanimous agreement amongst members of the BREA-CE WG that a shift in focus was required, from the development of a monitoring plan(s) to a CEF in which data analysis and assessment could be enhanced and used to inform and support management decision-makers and within which decisions associated with cumulative effects management could be implemented. It was felt that this is critical to the health and well-being of the overall Beaufort Region human and biophysical environment.

1.2 Cumulative Effects: concepts and approaches

Human activity often, if not always, causes a change in the local natural (bio-physical) and human (socio-cultural) environment. Particular attention is often paid to the impacts of development projects (such as a mine development, new road construction, *etc*.) but effects can also result from routine resource harvesting, ongoing resource extraction and other land-use activities (such as logging, farming, tourism, transportation, *etc*.). In order to avoid unhealthy disturbance of the environment, proponents of new projects are required to conduct an assessment of the impacts of the project on the local natural and human environment (Environmental and Social Impact Assessment – ESIA).

The Canadian Council of Ministers of the Environment has defined the operational concepts and processes which explain the importance of Cumulative Effects Assessment (CEA). These principles form the foundation upon which provincial, territorial and federal agencies have advanced cumulative effects Assessment (see Table 1-1). However, there is a growing awareness of the complexity of issues that cause and contribute to local cumulative effects, including impacts which result from larger scale trans-geographical issues (such as Climate Change), or the common occurrence of public perception of change which is not based on documented or recorded environmental changes (Shifting Baseline Syndrome). These concepts should be further explored to ensure the local efforts to manage cumulative effects can be effective.

Table 1-1. Summary of CCME Cumulative Effects Assessment Principles

CCME Cumulative Effects Assessment Principles
***Knowledge-based**: Knowledge is needed to assess the cumulative effects of activities on air, water, land and biodiversity. Effective science and monitoring systems and networks provide the information needed to measure performance and support the development of outcomes and objectives.*
***Outcomes and environmental objectives-based**: Cumulative effects management is driven by defined outcomes or objectives for the desired quality or state of air, water, land and biodiversity now and in the future. Cumulative effects approaches recognize the economic, environmental and social (may include cultural and spiritual) implications of meeting those objectives.*
***Future-focused**: Cumulative effects denote the combined impacts of past, present and reasonably foreseeable future human activities on the region's environmental objectives. It requires a broader, forward-looking approach to planning and management that balances environmental factors with economic and social (may include cultural and spiritual) considerations.*
***Place-based**: Cumulative effects management is place-based or site-specific and intended to bring people and their activities together and build relationships among stakeholders to support shared stewardship within an area. Any outcomes must support and reflect the interests of the area being considered and its people.*
***Collaborative**: Collaboration is a significant and challenging component of a cumulative effects management approach.*
***Adaptive**: Cumulative effects management includes a shared responsibility to adapt and take corrective actions if outcomes or objectives are not being achieved.*
***Comprehensive**: Uses both regulatory and non-regulatory approaches.*
http://www.ccme.ca/en/current_priorities/cumulative_effects

1.2.1 Local Cumulative Impact Assessment

Not all of the impacts or effects of a new development are apparent at the onset, and it is now well understood that multiple human activities can result in significant cumulative effects on the environment. Cumulative effects are changes to the environment that are caused by new activities in combination with other past, present and future human actions. Cumulative effects occur when there are new or additional interactions between activities, new or additional interactions between activities and the environment, and/or new or additional interactions between components of the environment. The incremental effects of new activities may not always be apparent at the onset of a new project and may be significant even though the effects of each individual activity are considered insignificant if they are assessed independently.

In Canada, Cumulative Effects Assessments (CEAs) are necessary to determine the anticipated cumulative effects of new projects. According to the Canadian Environmental Assessment Agency (CEAA), the additional requirement to conduct a CEA is consistent with the existing EIA principles. In fact, CEA enhances the overall process of Effects Assessment as it has always been intended, that is to conduct a thorough and complete ESIA (http://www.acee-ceaa.gc.ca/default.asp?lang=En&n=43952694-1&offset=6&toc=show).

The processes for conducting CEA are evolving and there is no single accepted state of global practice. It is important that during the process of identifying environmental and social impacts and risks, developers or project proponents must recognize that their actions, activities, and projects may contribute to cumulative effects on valued environmental and social components (VCs) on which other existing or future developments may also have effects. It is also important for developers to avoid and/or minimize these impacts to the greatest extent possible. It is now understood that new and existing developments may be put at risk because of the cumulative effects on ecosystem services upon which the projects may depend.

In practice, the assessment of cumulative effects requires consideration of some concepts that are not always found in conventional approaches followed in ESIAs.

According to the World Bank's International Finance Corporation, CEA processes involve continuous engagement with affected communities, developers, and other stakeholders. As a result, effective design and implementation of CEA processes must be a shared responsibility involving the technical and financial capacity of all relevant government agencies, communities and developers. As such, CEA is beyond the responsibility of a single project developer. In some instances, it may be in the best interest of a private sector developer to lead the CEA process.

There is no one standard method to address CE assessment. Understanding cumulative effects is complex and requires the involvement of multiple stakeholders in an iterative process that involves multiple multidisciplinary teams and an effective and efficient governance structure. CEAs tend to be time and data intensive, involving monitoring and inclusion of significant understanding of past conditions. Therefore effective CEAs are dependent upon CE monitoring and CE management activities.

The CEAA Operational Policy Statement sets out the general requirements and approach to consider cumulative environmental effects of designated projects under CEAA 2012:

- ***Scoping*** *- identifying VCs for which residual environmental effects are predicted, determining spatial and temporal boundaries, and examining the relationship of the residual environmental effects of the designated project with those of other physical activities*
- ***Analysis*** *- methodologies used to predict cumulative environmental effects*
- ***Mitigation*** *- technically and economically feasible measures must be identified that would mitigate any significant adverse cumulative environmental effects*
- ***Significance*** *- significance of any cumulative environmental effects that are likely to result from a designated project in combination with other physical activities, taking into account the implementation of mitigation measures*
- ***Follow-Up - programs should address project-specific environmental effects and cumulative environmental effects***

http://www.ceaa.gc.ca/default.asp?lang=En&n=1DA9E048-1

Cumulative effects assessment, monitoring and management activities can greatly benefit from a Cumulative Effects framework. CEAs typically build upon existing methods and approaches to EIA. Considering that there is no single prescriptive method to conduct a CEA, a framework can provide practitioners with information and options relevant to choosing an approach appropriate for their unique assessment requirements. The Framework should provide a description of the CEA process that organizes actions and ideas, usually in a step-by-step fashion.

The need to better understand the information needed to assess cumulative effects and the collaboration needed amongst government departments/agencies, researchers and project proponents is a critical first step in defining CE assessment and management procedures in the Beaufort region. The nature of this collaboration is further explored and discussed in Section 4.

Ultimately, governments are responsible for preparing CEA frameworks to assist private sectors in the identification and management of cumulative impacts. Because these frameworks rarely exist in emerging markets, it is clearly in private developers' interests to take into consideration not only their own potential

contribution to cumulative impacts, but also other projects and external factors that may affect similar VCs. This will enhance the long term success of the proposed development and enhance the developer's reputation. However, it is clearly understood that this process can be challenging and requires the cooperation of government, Inuvialuit, and other stakeholders and developers.

An important step in building an understanding of cumulative effects (either for assessment or management purposes) is consultation. This is particularly important for development projects which are being considered where the project may be a significant contributor to cumulative impacts or will be the first of several future reasonably anticipated developments that will use the same resource and/or potentially affect the same VCs. In these cases, through consultation with stakeholders, the CEA will help assess potential cumulative impacts that could be expected over time, and guide the developer in defining the required mitigation measures.

The CEA should be considered a learning process by which proponents, governments and communities advance understanding for improved decision-making. In this case, the CEA will help the developer determine the significance of the overall cumulative impacts and its contribution to these cumulative impacts. Over time, CEAs can promote environmental and social management plans and procedures which can appropriately mitigate individual project contributions to cumulative effects.

There are a few considerations that further complicate the CEA process which extend beyond the temporal or geographical boundaries of the area potentially impacted by a development. Perceived changes in environmental conditions are not always fully understood nor based on evidence, and many effects can be the result of influences well beyond the defined area. As a result, multiple sources of information should be considered in creating a better understanding of the actual change. This includes international research programs as well as local Traditional Knowledge studies. These considerations can greatly influence a cumulative effects framework and are discussed more fully in Sections 1.3 and 1.4.

1.2.2 Shifting Baselines Theory

The assessment of cumulative effects has been a component of the Environmental Assessment process under the *Canadian Environmental Assessment Act* since 1995. It has since undergone extensive development and advancement and is an integral component of an Environmental Assessment.

Responsible authorities and practitioners have developed various means to satisfy this requirement as part of screenings and comprehensive studies, but as research and a deeper understanding of the objective of CEA has advanced – so has the need to re-evaluate the starting point or "baseline" from which cumulative effects are measured.

Pauly (1995) has been credited with coining the phrase "shifting baseline syndrome" (SBS). The concept was first proposed by Kahn and Friedman (1995). Pauly, a noted fisheries expert, defined SBS in terms of fisheries management and the problem of establishing baseline stock size and species. The root problem is that each generation of scientists uses fisheries data from the beginning of their career to evaluate changes in various stock parameters. Thus, as fish stocks decline, subsequent generations use the decreased stock size as the baseline. This results in a gradual accommodation of the creeping disappearance of a resource/species, or a gradual shift of the baseline (Pauly 1995). Pauly proposed that the loss, or omission, of anecdotal information was the missing component in assessing impacts on fish stocks. The development of frameworks for collecting and incorporating anecdotal information into current models would add historical context and assist in understanding, and indeed overcoming, the shifting baseline syndrome and permit evaluation of the true social and ecological costs of fisheries (Pauly 1995).

Subsection 16(1) of the Act requires every environmental assessment to include consideration of the environmental effects of a project, including "any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out."

https://www.ceaa-acee.gc.ca/default.asp?lang=En&n=1F77F3C2-1

Papworth *et al.* (2009) defined two types of SBS:

(i) generational amnesia, where knowledge extinction occurs because younger generations are not aware of past conditions and;
(ii) personal amnesia, where knowledge extinction occurs as individuals forget their own experience.

SBS is typically demonstrated by linking human perceptions to verifiable biological change. Changing human perception of past conditions due to loss of experience about past conditions is especially relevant when establishing baseline conditions for VCs that rely heavily on human perceptions and observations, such as employment and cultural vitality.

Paramount in assessing cumulative effects is establishing a meaningful baseline from which to assess the effects of development and set goals for conservation. SBS can significantly impact this process if it is not understood and accounted for in determining baseline conditions. Depending on the stage of development in a particular region and the identified conservation goals, the baseline selected may be present conditions or an agreed upon pre-development condition. Perception of the past may influence setting of targets, particularly when verifiable data are not available (Papwort *et al.* 2009).

Shifting baseline syndrome (SBS) is a cautionary tale referring to changing human perceptions of biological systems due to loss of experience about past conditions.

S.K. Papworth, J. Rist, L. Coad, and E.J. Milner-Gulland (2009)

The baseline conditions are restricted both spatially and temporally, and may provide limited representation of the overall VC being considered. Each time the baseline condition is 'determined', the control, or representative, areas used may have drifted further and further away from 'true' baseline conditions (Sheppard 1995). Humans have been impacting ecosystems for millennia and there are very few, if any, pristine ecosystems remaining. This complicates efforts to define baseline conditions. The primary objective of the BREA CEF is to establish informed and representative baseline conditions for VCs that provide a consistent set of values for the assessment of cumulative effects in the Beaufort Region. This will improve the ability to assess and manage for desired outcomes and provide increased certainty and stability for industry investment.

> *Knowledge of SBS could also be used to inform environmental education and community based conservation programs. If younger or less experienced observers do not acknowledge change, they may be less co-operative with conservation programs. However, Pyle (1993) suggested that reference to personal or community-level baselines strongly affects engagement with conservation programs, and that investment in activities designed to combat SBS (such as facilitating inter-generational transfer of experience) could have a strong influence on community buy-in to conservation action.*
>
> *S.K. Papworth, J. Rist, L. Coad, & E.J. Milner-Gulland (2009)*

Human observations and participation will be especially relevant in making accurate assessments of change and setting baselines for these VCs. When considering socio-cultural VCs, baseline conditions are established using a combination of qualitative and quantitative data sources. For example, employment statistics may indicate a positive regional trend, while the local perception may be of a decline in employment opportunities. This can be due to the demographic participating in data collection, skill sets and the reference point that an individual or group is measuring against. In order for the baseline conditions used in assessing the cumulative effects of a particular project or regional development in general, the methods for assessment must be able to be applied in the absence of development (*i.e.,* how would employment change in the region if no development were to occur? Would this in turn have an effect on cultural vitality if people returned to traditional methods of subsistence?). Perception may be that employment would stagnate, or even decline if demand for a particular skill set no longer exists (*i.e.* offshore workers). The perception would be highly dependent on the demographic or group surveyed as well. For example, community elders may not perceive a shift or change in employment while the generation/group that participated in a specialized employment opportunity may report a decline, since their reference point, or baseline, is very different. This would lead to the conclusion that increased reliance on quantitative data to establish baseline conditions is more effective. But how can this be assessed in the absence of data? This issue becomes particularly significant when working with social VCs as they do not easily lend themselves to numerical quantification. Additionally, in the context of the Beaufort Region, small isolated communities will likely each have varying perceptions of current or past conditions.

To begin the task of accommodating for SBS, the indicators for VCs must be clearly defined and the established baseline conditions must endeavour to provide accurate data within the spatial and temporal confines of these indicators. Methods to achieve this may include:

- well defined spatial and temporal boundaries;
- assessment in relation to selected indicators;
- questions/interviews defined to gather facts, and limit opinion; and
- involving as many groups (age, education status, community groups) as possible to provide a representative snapshot of conditions.

This is particularly important for the Beaufort Region, where there is significant flux in local population and considerable resource development opportunity. As can be seen in Section 3, there are numerous government agencies, community organizations and research projects which can be involved in avoiding SBS when dealing with CEA in the Beaufort Region.

The reliance on perception in evaluating social VCs is highly subjective. To minimize this bias it is important to establish definitive temporal boundaries. Thus, relying less on perception of past conditions and more on perception of current conditions which are more easily ground-truthed will allow SBS to be gauged amongst different groups and/or demographics. Secondly, collection of data from as many groups and statistical sources as possible is required to present the most accurate picture as possible. Processes used (*i.e.,* groups interviewed, questionnaire/interview design, data sources, *etc.*) should also be clearly documented so that when assessing the cumulative effects of a development, similar processes and information are used to interpret and analyze cumulative impacts.

The establishment of clear and representative baseline conditions is integral to the objective of establishing a framework for assessing the cumulative effects of development in the Beaufort Region. In the Beaufort Region, where development has occurred at a relatively slow rate, it is proposed that baseline conditions be limited to the present day. Limiting SBS is fundamental in ensuring that the framework is functional and a meaningful tool for the assessment of cumulative effects.

1.2.3 Climate Change Effects/Trans-Geographical Impacts

In many instances, activities outside a specific area of interest can contribute to the cumulative effects within that area. These transboundary impacts are the results of an action or event which takes place outside of the region that experiences the impact. For example, in the Beaufort Region sources of transboundary impacts include the effects of climate change, effects caused by air pollution outside the region, and the effects of changes in government development policies and social programs. Each of these will be explored further in the following subsections.

1.2.3.1 Climate Change Impacts

For the Canadian Arctic, the most apparent and recognized transboundary impact has been climate change. Caused primarily by combustion of fossil fuels in other regions of the world, climate change has been more noticeable in northern regions due to the more dramatic impact of slight warming on the extreme arctic environment, and the intimate knowledge and awareness arctic people have of their environment.

Changes in Sea Ice

It is understood by the Invuvialuit that climate change has caused and will continue to cause significant local impacts. Melting of sea ice is an internationally documented effect of climate change on the Arctic. This is a wide-ranging effect that has and will continue to impact many aspects of arctic life. Sea ice has decreased noticeably in physical extent, thickness, and duration[2], and multi-year ice has also decreased. In 2007, it was noted that sea ice had reduced in the past decade over three times faster than in the previous three decades (Maslanik *et al.* 2007).

Decreases in sea ice will affect marine species that depend on ice cover for many reasons[3]. Some marine mammals use ice for birthing of young (Kovacs and Lydersen 2008). Others use sea ice to hide from predators or as protection from bad weather, while others prey on the fish, invertebrate, and marine mammal species that are associated with sea ice (Barber and Iacozza 2004, Kovacs and Lydersen 2008, Laidre *et al.* 2008). The decline in sea ice is also known to be affecting arctic food webs in ways that will affect the quality and quantity of zooplankton and fish prey available to arctic marine mammals (*e.g.*, Grebmeier *et al.* 2006a, 2006b). As summarized by Kovacs *et al.* (2011), some ice-associated marine mammals are already showing distribution shifts, compromised body condition and declines in production and/or abundance in response to declines in sea ice.

Changes in sea ice extent and seasonal distribution will also change the ability of both people and animals to travel over ice. Changes in sea ice extent has had the most impact on late summer and autumn sea ice extents (Grebmeier *et al.* 2010), resulting in increased duration of the summer ice-free period. Northern people rely on ice a lot for travel, and the lengthened summer breakup increases the difficulty of travel over ice. Conversely, the longer ice free period may make some areas accessible by boat and will facilitate travel by water during summer.

In 2007- 2009, the extreme sea ice retreats lengthened the open water season by a full 4 weeks (Grebmeier *et al.* 2010). Summer sea ice will continue to decline, and it has been suggested that a nearly sea-ice free summer condition may develop as early as 2035 (Wang and Overland 2009). An increase in the length of the open water season will have negative effects on some species such as polar bears (*Ursus maritimus*), which are known to show decreased female breeding rates and lower cub litter survival with increasing duration of the ice-free period in the southern Beaufort Sea (Regehr *et al.* 2010). Periods of decreased ice cover in the High Arctic also appear to be allowing killer whales (*Orcinus orca*) to spend more time in the Artic and expand their range northward (*e.g.*, Higdon and Ferguson 2009).

Permafrost Degradation

Climate change effects associated with the general warming of the arctic environment include the thawing of permafrost and consequential lowering of the permanently frozen zone. Permafrost soils settle as they

[2] Maslanik *et al*. 2007, Chapman and Walsh 1993, Johannessen *et al.* 1995, Cavalieri *et al.* 1997, Rothrock *et al*. 1999, Vinnikov *et al*. 1999, Walsh and Chapman 2001, Parkinson and Cavalieri 2002, Serreze *et al*. 2007

[3] ACIA 2005, Johnston *et al.* 2005, Laidre and Heide-Jørgensen 2005, Moore and Laidre 2006, Simmonds and Isaac 2007, Kovacs and Lydersen 2008, Laidre *et al.* 2008, Moore and Huntington 2008

thaw, resulting in settling of structures built on them. Thawing and lowering of the permafrost will lead to many issues with building foundations and damage to infrastructure such as runways, pipelines, and other industrial facilities (ACIA 2004). Infrastructure designed without consideration for potential permafrost thawing may be compromised or damaged, resulting in increased repair and maintenance costs. Designing new infrastructure capable of handling permafrost thawing may result in increased construction costs. Mackenzie Delta settlements are considered particularly sensitive to permafrost thaw, due their construction on ice-rich flood plains (Worsley 1992).

Thawing of roads in previously frozen areas may make travel over land more difficult due to unstable ground and the loss of winter ice roads, resulting in increased costs for transport and difficulty accessing some areas due to the shortened travel period (ACIA 2004).

Changes in permafrost can also lead to changes in groundwater storage regimes (Muskett and Romanovsky 2011), which can affect winter baseline flows in rivers. Increased melting of snow and ice cover can lead to increased river flows. Other impacts of permafrost thawing will include collapsing or slumping of ground, draining of lakes, and creation of new wetlands. In forested areas, toppling of trees can occur.

Changes in Species Distribution

Changes in air temperatures and moisture regimes will affect the distribution and abundance of many plant species which will then affect vegetation communities with resultant effects on animal species reliant on those vegetative communities. This can impact local biodiversity and species abundance.

Increases in temperature and moisture regimes can also lead to increased tree growth. Tree growth may provide a source of fuel and building materials for local Inuvialuit, but will also lead to a loss of tundra habitat, with resulting decline in tundra- dependent species, such as caribou. It has been suggested that tundra habitat will ultimately become restricted to higher latitude and elevations (ACIA 2004).

Finally, changes in temperatures and moisture regimes may lead to outbreaks of insect infestation. “New” insects to the region have already been observed, and local people are wary of these unfamiliar biting insects (ACIA 2004). Changes in the arctic environment could also have global impacts on bird species which breed in the arctic, such as many species of shorebirds which winter in more southern areas.

Coastal Geomorphological Change

It is expected that there will be increased incidence of large storms and severe weather resulting from climate change which will likely lead to increased coastal erosion. Erosion may be exacerbated by the decreased extent and duration of sea ice in summer, as well as permafrost degradation of shorelines. Sea level rise will compound this issue. Increased rates of cliff erosion and beach migration and more extreme flooding will also likely occur as a result of sea level rise and increased storm events (Manson and Solomon 2007). This will lead to increase costs of maintaining shoreline structures and may necessitate relocation of coastal communities. Mackenzie Delta settlements, which are often situated on floodplains, are likely also at increased risk of flood damage. It is of note that much of the community of Aklavik, a delta community, was relocated due to severe flooding and land erosion in 1958, to present-day Inuvik, however

some residents remained and the original community of Aklavik still exists (http://www.aklavik.ca/index.php?p=history). Increased flooding levels and rates can also affect sediment loads in rivers and estuaries, with potential detrimental effects on downstream aquatic habitats.

Elevated Ultraviolet Ray Exposure

Damage to the ozone layer is expected to result in increased UV ray penetration for the next several decades. This will result in increased UV exposure for Inuvialuit people and wildlife. In humans, increased UV rays is known to increase the risk of skin cancer. Increased UV exposure can also disrupt photosynthesis in plants and can affect phytoplankton, zooplankton, and fish (Häder *et al.* 2007).

Effects on traditional lifestyles

Climate change effects will lead to changes in species abundance and distribution, likely disrupting traditional resource-based economies. The decline in sea ice may lead to declines in sea-ice dependent species, and will also increase the risk of harm to hunters harvesting such species. This will threaten food security and traditional lifestyles.

Fewer animals to hunt, combined with increased difficulty in hunting and increased cost of hunting travel, will lead to decreased hunting and, as a result, decreased amount of traditional country foods consumed. This is turn will increase the reliance of Inuvialuit on less nutritious and more expense store bought foods which must be imported which can cause health issues for Inuvialuit consuming non-traditional diets. Evidence of compromised food security, restricted transportation and travel routes to traditional hunting areas, damage to infrastructure and decreased ability to engage in traditional cultural activities has already been observed in all six ISR communities (Berkes and Jolly 2002, Pearce *et al.* 2010).

1.2.3.2 Government Policies and Programs

The Canadian Arctic has witnessed drastic social, political, and economic changes over the past several decades (Irwin 1989, Hamilton 1994, Damas 2002). Within a few generations, traditionally nomadic arctic subsistence societies have been transformed into a settled society with an increasing reliance on a new wage-based economy. Much of this is due to the Government's policies on dealing with arctic people and the assertion of Canadian sovereignty over the north.

Changes in government policies, particularly federal policies, can have far-reaching impacts. An overview of the types of policies and their potential effects are outlined in the following subsections.

Education impacts

Changes to education policies can result in increased access to and emphasis on education resulting in a more formally educated workforce with enhanced employment opportunities. Increased access to distance education programs can provide options for a broader range of topics. This can however, have some impact on traditional Inuvialuit ways of life. While exposure to other cultures and access to a broader knowledge base can provide economic benefit to Inuvialuit communities, it can also be detrimental to

traditional cultural activities unless there is a concerted effort by the community to maintain and promote traditional knowledge and values.

Employment Policies

National or territorial government policies and the associated programs which seek to create or enhance employment skills and create jobs can ultimately lead to increased employment and increased financial security for local community members. However, an increase in employment levels will likely also result in a decrease in time spent 'on the land' and engaging in traditional activities. This will result in less hunting and consumption of traditional country foods, with a concurrent increased reliance on less healthy and more expensive store-bought foods imported from other regions, thus decreasing food security for the Inuvialuit.

Social Policies

Other national or territorial government policies, such as employment insurance, social assistance and old-age security can result in more financial security for local residents, with resulting increases in food and housing security. However, this may also have the unintended impact of lessening the reliance on traditional food sources and lifestyles, which can have an impact on traditional cultural practices.

Development Policies

The encouragement of economic development, either through government policies, or external investment can lead to diversification of industry, resource utilization and employment activities within a particular region or local area. For example, territorial efforts to promote northern tourism can lead to the growth of the tourism industry in the Beaufort Region, thus increasing the demand for accommodations, dining, hunting and fishing guides, and by increasing markets for local art. However, it will also increase the influence of other cultures and could potentially lead to changes in traditional lifestyles.

Policies to advance development of oil and gas resources, large-scale hydroelectric projects, and extensive mining and smelter works are activities that have already led to trans-boundary impacts in the western arctic region. Increased interest in arctic resources by other countries can lead to more exploration, shipping, oil and gas development, mining prospecting and development.

There has been interest in the Beaufort Sea as a potential source of oil and gas for several decades, with the first well being drilled in 1972. Over 90 wells have been drilled since then, though none have been drilled since 2006 (Callow 2012). Interest continues, however, as evidenced by the number of new exploration licenses acquired in the deeper offshore Beaufort Sea waters in recent years.

Oil and gas exploration requires a considerable amount of support infrastructure, such as vessels, drilling platforms, docks, and land-based camps or offshore warehouses (Environment Canada and Aboriginal Affairs and Northern Development Canada 2013).

Fisheries Policies

Changes to fisheries policies may affect the ability of people to rely on fish species traditionally used for food, or require them to rely on different species. For example, promoting commercial harvesting of traditional resources can create sufficient demand that there is competition with local consumption of the traditionally harvested fish.

The development of commercial fisheries for marine fish stocks in the Beaufort Sea will also lead to more vessel traffic, with increased risk of spills and contamination.

Fish harvesting policies in other jurisdictions may result in declines in migratory fish or whales stocks in those areas. This can, in turn, cause a decrease in the availability of these resources in the ISR. For example, the Eastern Beaufort Sea beluga stock is also hunted in Alaska by the Inupiat communities along the Alaskan North Slope and the Bering Strait (FJMC 2013). While this harvest is currently less than half of the size of the Canadian harvest (FJMC 2013), a large increase in this harvest could lead to impacts on harvest levels in the ISR.

National Security Policies and Priorities

As global political dynamics change, many nations have become more interested in the arctic region. This places arctic sovereignty, and associated security issues at a higher level of priority at the national level. Enhancing northern defense capabilities has resulted in Canada's decision to build an ice-breaking patrol fleet. Similarly, the North Atlantic Treaty Organization (NATO) has also become more interested in the arctic, which can result in local effects on traditional transportation routes, and the increased presence of intermittent residents placing new demands on local resources and infrastructure.

Transportation Policies

There remains international debate over the nature of the northern sea route, namely disagreement over whether it should be considered inland waters or international passage. This debate has been fueled by the extended ice-free period which may be conducive to cheaper shipping routes for international trade. Increased shipping may be the result of policies set by national or extra-national governments. The opening of new sea routes in the high arctic, with the associated required port facilities, is also likely to cause trans-boundary impacts.

The presence of an increased number of ships traversing the Northwest Passage can bring increased risk of oil or fuel spills and other pollution discharges from vessels. Such spills would cause significant environmental impacts in the sensitive Beaufort Sea ecosystem, especially with the region's remoteness and seasonally harsh weather likely hampering cleanup efforts.

Increased shipping can cause impacts to marine mammals, such as beluga and bowhead whales, and will increase the potential for the introduction of non-indigenous aquatic species to the region. Such species are transported via ballast water or as part of fouling communities on ship hulls and can have serious ecological and economic consequences.

1.2.3.3 Pollution

Pollution of the natural environment is another major environmental impact that is due largely to factors outside of the Beaufort Region. There are many types of pollutants present in the arctic, which arrive in many ways. Some are transported thousands of kilometres from mid- and low-latitude sources, via gases or attached to particles in the atmosphere, before settling to the ground. This includes heavy metals, persistent organic pollutants (POPs), hydrocarbon contaminants, radionuclides, and sulphurous gases (SO_x), (Macdonald *et al.* 2000, 2003, Barrie *et al.* 1992, 1997). Other pollutants may be transported via ocean currents (Macdonald *et al.* 2000, 2003, Barrie *et al.* 1992, 1997).

However, with increasing resource development, particularly oil and gas, there will be an ever-increasing risk of pollution sources from with the Beaufort Region.

Persistent Organic Pollutants (POPs)

The category known as persistent organic pollutants (POPs) includes a wide range of compounds from a variety of sources. Persistent pollutants can be significant contributors to cumulative effects. This category includes polychlorinated biphenyls (PCBs), dioxins (PCDDs) and furans (PCDFs), hexachlorobenzene (HCB), brominated flame retardants. Many pesticides are also included, such as dichlorodiphenyltrichloroethane (DDT), toxaphene, chlordane, hexachlorocyclohexane/lindane, Dieldrin, Mirex, and tributyltin (TBT). These compounds are known to have a range of negative effects on wildlife and humans. Effects include suppression of the immune system, disruption of behavior and reproduction in birds, fish, and mammals, and impacts to developing nervous systems. They also affect the liver, cause birth defects and can cause cancer (ACIA 2004).

DDT was first detected in ringed seals in the arctic in 1970 (Holden 1970) and it and other pesticides were soon detected in beluga, polar bear, and fish as well (Addison and Brodie 1973, Addison and Smith 1974, Bowes and Jonkel 1975).

Mercury

Mercury is a heavy metal which is known to cause a range of toxic effects in fish, birds, and mammals, including behavioral, neurochemical, hormonal, and reproductive changes. In the water column, inorganic mercury is transformed by microorganisms into methylmercury, which bioaccumulates in food webs. Mercury was first reported in marine mammals in the Canadian arctic in the early 1970s (Bligh and Armstrong 1971, Smith and Armstrong 1975). The MacKenzie River is considered to the be the major source of mercury in the Beaufort Sea (Graydon *et al.* 2009, Leitcha *et al*. 2007). There are no industrial sources of mercury in the Canadian arctic, and its presence is thought to be due to anthropogenic sources from outside of the arctic. The presence of elevated mercury levels in arctic fauna raises serious concerns for the arctic ecosystem and of the residents who rely on country foods for a substantial part of their diet.

2.0 Cumulative Effects in BREA

As a preliminary step in the development of a Cumulative Effects Framework for the Beaufort Region, a study on existing academic and professional literature was conducted. This study compiled much of the relevant literature from academic journals and other research reports regarding cumulative effects assessment and monitoring activities in Canada and internationally. This information was presented at a stakeholder workshop in which members of the BREA-WG participated.

Previous projects relevant to BREA are described briefly in Appendix A.

2.1 Workshop and Results

2.1.1 Review of Beaufort Related Documents

The intent of the review of existing documents specifically related to the Beaufort region was to:

- generate awareness of information that exists;
- ensure an understanding of the regional context (social, cultural, environmental); and
- identify lessons learned, issues, challenges, and dynamics of change related to cumulative effects assessment.

The BREA-WG provided a short list of documents specifically relevant to the Beaufort region for detailed review, including:

- Antoniuk, T., S. Kennett, C. Aumann, M. Weber, S. Davis Schuetz, R. McManus, K. McKinnon and K. Manuel, (2009). Valued Component Thresholds (Management Objectives) Project. Environmental Studies Research Funds Report No. 172. Calgary, AB. 164 p.
- LTLC Consulting and Salmo Consulting Inc. (2013). Updated Oil and Gas Exploration and Development Activity Forecast – Canadian Beaufort Sea 2013-2028. 44 p.
- Beaufort Sea Strategic Regional Plan of Action (BSStRPA) Steering Committee (2008). Beaufort Sea Strategic Regional Plan of Action (BSStRPA). 47 p. + Appendices.
- Beaufort Sea Partnership (2009). Integrated Ocean Management Plan for the Beaufort Sea: 2009 and beyond. 57 p.

These documents helped with preliminary identification and selection of potential Valued Components (VCs) for the BREA CEF.

2.1.2 Review of Academic and Other Relevant Literature

The purpose of the literature review was to better understand environmental assessment and cumulative effects processes from areas outside the Beaufort Region. Specifically, the focus of the review was to:

- generate awareness of information that exists;
- ensure an understanding of different approaches, strengths and weaknesses;

- identify framework selection methods/criteria given the characteristics of the receiving environment; and
- assess the relevance and utility (i.e., is location of the study area relevant to the BREA study area? Is information relevant for addressing cumulative effects assessment objectives?).

The project team conducted a literature search for reports and academic journal articles that were potentially relevant to the study, including full reports and 'oneoff' scientific studies (*i.e.*, academic research papers). Some of these documents were selected based on their relevance to describing cumulative effects monitoring within the Beaufort region, elsewhere in the arctic (*i.e.*, pan-arctic) or in other jurisdictions across Canada and internationally.

The principal aim of the review was to provide the BREA Working Group with a summary of available CEA frameworks and to identify reports containing information relevant to the overall objectives of the study. The review was designed as a two-stage process as outlined below.

2.1.2.1 Stage 1: Preliminary Review of Reports

The preliminary review process addressed the following: (i) is there sufficient information to help with the selection of potential Valued Components for the BREA CEF?; and (ii) are there concepts and approaches that could be adopted as part of developing the BREA CEF? Reports were assessed based on whether the location of the study was relevant to the BREA study area, and whether the information was relevant to addressing cumulative effects assessment objectives. If the answers to either of these questions were yes, the reports were retained for a more detailed review.

2.1.2.2 Stage 2: Detailed Review of Reports

Reports identified as containing potentially relevant information underwent detailed review to assist with preliminary identification and selection of potential VCs and to glean useful information regarding the selection criteria for indicators. A list of the reports reviewed and a one-page summary of each is provided in Appendix B. The detailed review was not a critique of the design, implementation, interpretation, and/or conclusions of individual reports. Summary findings from these reviews along with information contained in the reports, plus any recommendations, were provided to workshop participants.

The workshop participants agreed that the components of a well-designed cumulative effects framework should comprise:

- Valued components for which there is concern for potential cumulative effects;
- Effects-based assessment to determine existing accumulated environmental state quantification (i.e., elements in the environment such as VCs need to be measured for changes both spatially and temporally);

- Reliable VCs for understanding stressor-response relationships (i.e., stressor-based assessment to predict potential impacts of new development relative to the existing environmental state);
- Thresholds which define critical levels of effect on VCs;
- Good predictive scenario forecasting capabilities (*i.e.*, post-development monitoring to assess the accuracy of impact predictions and to provide an avenue for adaptive management);
- Spatial and temporal dimensions of the assessment; and,
- Decision-making frameworks to link scientific information to public opinion and managerial action.

2.1.3 Identification of VCs and Boundaries

While the overall physical design and implementation of the BREA CEF is difficult to conceptualize, it will provide a tangible management strategy where decisions *made* could be decisions *implemented.* The first step in developing the CEF is to identify the biophysical and human/anthropogenic components (VCs) that are most valued within the defined BREA study area. Given the complexity and level of effort required to establish a CEF, it was agreed that a few key VCs would be selected to establish a CE framework.

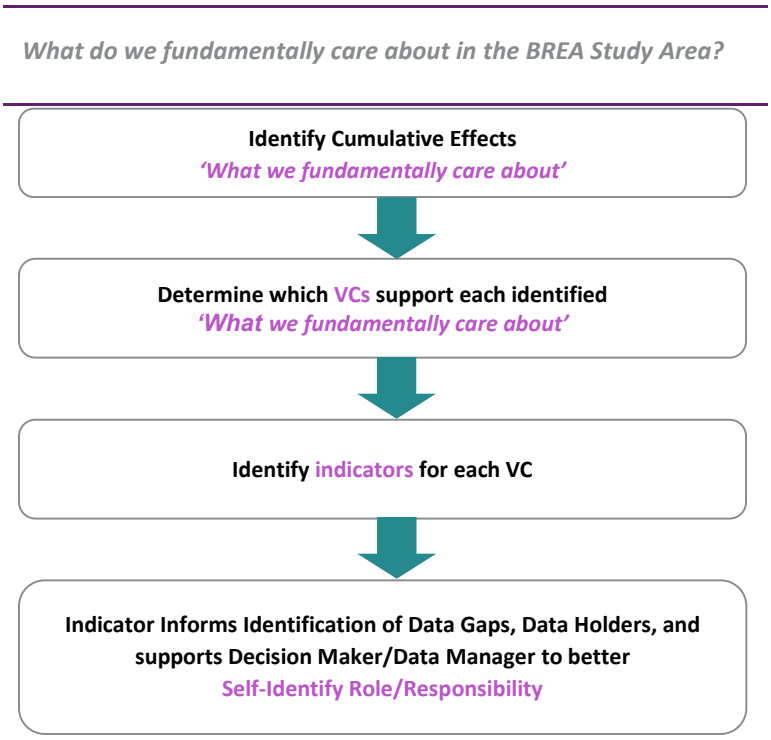
It was noted that the intent of the CEF is to support and integrate with existing regulatory processes and is not intended to slow down or cause undue burden on existing processes.

2.1.4 Fundamental Concerns for the Beaufort Region

In establishing the fundamental concerns for the Beaufort region, the BREA-WG reflected on what is of value and/or what might be considered most valued in the BREA study area.

The next step identified related and appropriate VCs for each “care” element, and finally, identified indicators for each VC. The process is illustrated below:

Figure 2-1. Conceptual Methodology to Determine Study Area VCs and Indicators



The BREA WG initially identified three areas of fundamental concern: communities, economy, and environment. The intrinsic and unique value of the Inuvialuit and their culture was considered to be of major importance and thus cultural vitality was included as a fundamental area of concern. The elements identified for further analysis in the context of the potential impacts of cumulative effects in the BREA study area are as follows (not ranked):

- Healthy Communities
- Economic Vitality
- Environmental Sustainability / Biodiversity
- Cultural Vitality

2.1.4.1 Identification of Long List of VCs

For each of these fundamental "care" or concern elements a comprehensive list of VCs was prepared. These are illustrated in Figures 2.2 – 2.5 on the following pages and are considered to be self-explanatory.

Figure 2-2. VCs for Healthy Communities

Figure 2-3. VCs for Economic Vitality

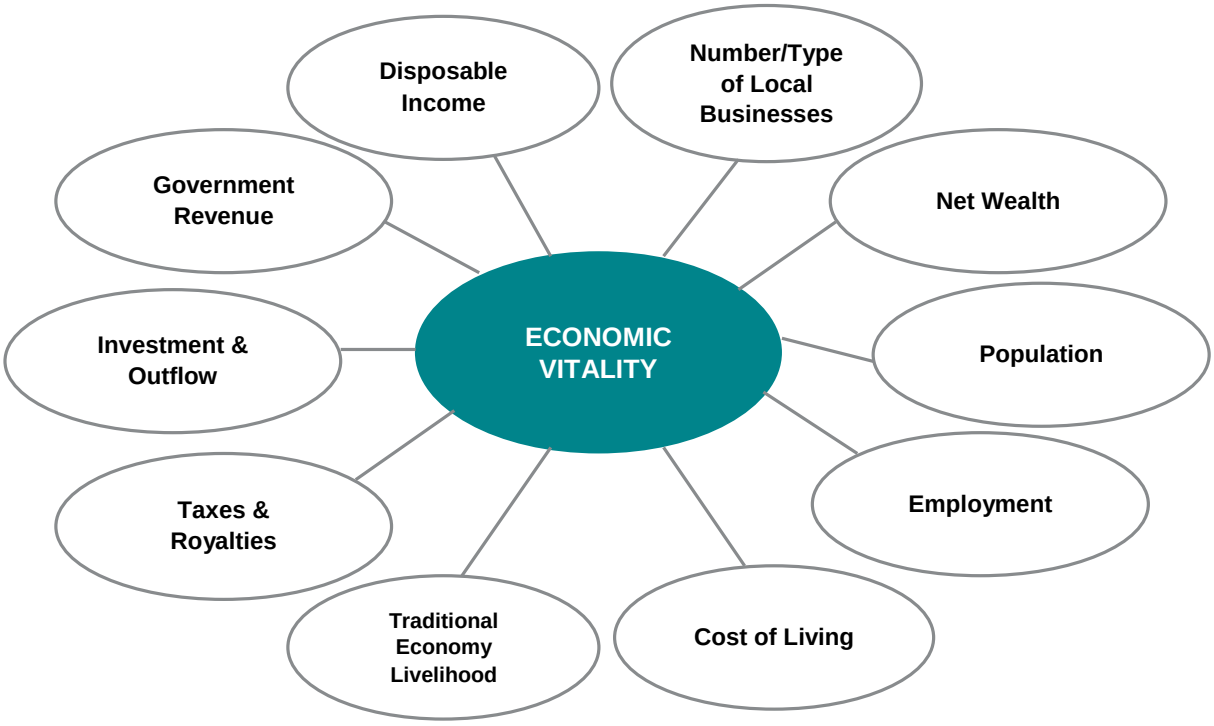


Figure 2-4. VCs for Environmental Sustainability / Biodiversity

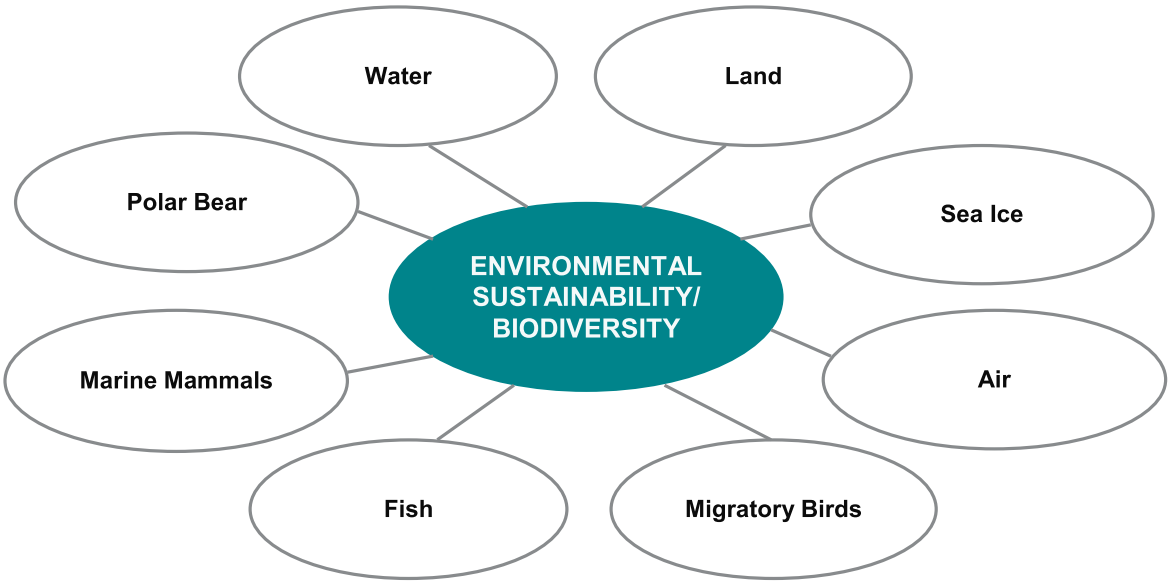
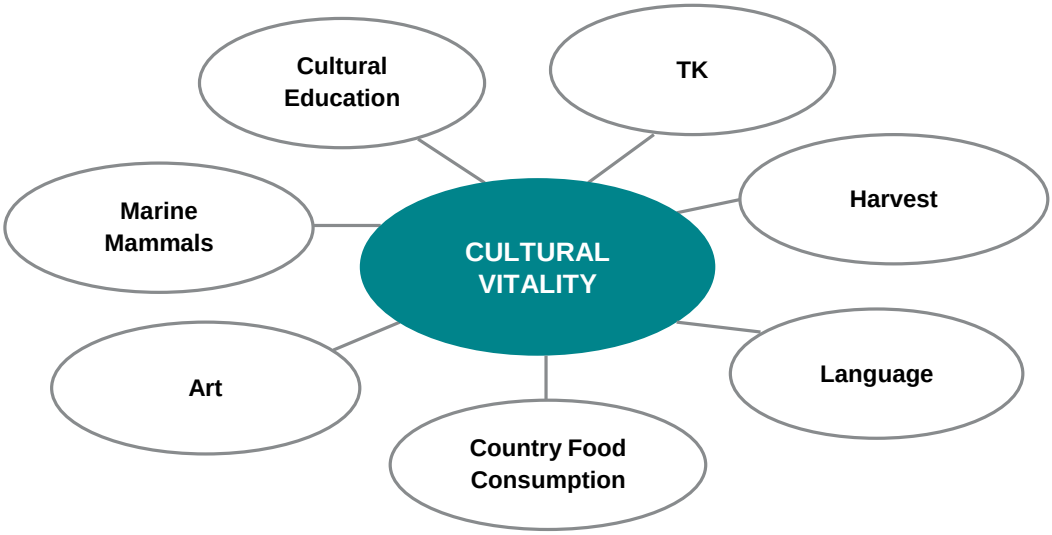


Figure 2-5. VCs for Cultural Vitality



2.2 Selection of Pilot VCs

Selection of VCs to be included in the pilot study was accomplished via a blind voting process guided by the following principles. It was agreed that each VC should be:

- Workable – pragmatic and realistic;
- Relevant to the Inuvialuit;
- Feasible with respect to existing capacity to collect data, continuously monitor parameters, and enforce regulations;
- Cognizant of public perception (which may be at odds with science);
- Designed to address gaps in knowledge or data;
- Designed to capitalize on baseline/existing information;
- Cognizant of technical capacities; and
- Amenable to straightforward management procedures.

Selection of the top three VCs for each care area was reviewed to ensure consensus and allow for adjustment based on the merits and importance of each VC. The three priority VCs selected for each care item are presented in the middle column of Table 2-1.

For the purposes of the pilot study, only one VC per care item would be assessed further. This selection process was conducted by another blind vote and a consensus discussion. The results are shown in the right hand column of Table 2-1.

Some key points presented during the selection of the VCs are listed below:

- While Marine Mammals (*e.g.,* beluga) would be perceived by a wider public as an iconic species that is also of high value to the Inuvialuit, the WG determined that Fish (arctic cod and arctic char) would provide a clearer link to BREA, the region, and the ISR ecosystem with respect to cumulative effects.
- It was agreed that the most representative and appropriate VC for the Cultural Vitality care element was in fact Cultural Vitality.
- Sea Ice was identified as the 'Challenging' pilot VC. There is good rationale for this as there is considerable research and development on sea ice already in progress under the BREA program, and shipping activity in the Northwest Passage is on the rise.

Table 2-1.Top 3 and Pilot Study VCs

Care Item	Top 3 VCs	Pilot Study VC
Healthy Communities	Formal education Employment Health and wellbeing	Formal education
Economic Vitality	Number and type of businesses Employment Disposable income	Employment
Environmental Sustainability & Biodiversity	Marine mammals Fish (arctic cod/ arctic char) Water	Marine Mammal (Beluga) Fish (arctic cod/arctic char)
Cultural Vitality	Cultural Education Traditional Knowledge Language	Cultural vitality

2.2.1 Determination of Indicators

In determining indicators for each pilot VC, a variety of concerns surrounding data collection, access, analysis, assessment, and management were reviewed. Of particular concern was the utility of identifying an indicator if it could not be supported by sufficient existing or 'easily acquired' data.

Tables were developed to list the desired indicators for each pilot VC and identify the parties responsible for data collection and management, policy and decision-making, as well as any examples of the indicator's links to the oil and gas sector. Table 2-2 to Table **2-6** present the indicators for each pilot VC.

Table 2-2. Example Pilot Indicators for Formal Education Valued Component

Indicators	Data Collection and Management	Decision and Policy Makers	Example Link to Oil and Gas Sector
Early Childhood Development (0-K)	GNWT Department of Education, Culture & Employment (GNWTECE) Note: specifically, the GNWTECE's Early Childhood and School Services (ECSS) division	GNWT ECE GNWT ECE-ECSS	1. Foundational skills developed at the early learning stage critical to success of child's learning at subsequent stages which in turn is critical to the success of building a community's capacity/sustainability to fully participate in the potential future oil and gas sector. (Of interest: *GNWT's Framework for Early Childhood Development: Right from the Start)* 2. Potential increased need for Licensed Early Childhood Centres to support oil and gas sector shift-work/dual income employees.

Indicators	Data Collection and Management	Decision and Policy Makers	Example Link to Oil and Gas Sector
Grade 12 Completion	GNWTECE GNWTECE-ECSS	GNWTECE GNWT ECE-ECSS	1. Having a well-educated population is directly linked to developing a vibrant knowledge and skills-based NWT economy which in turn, is critical to the success of building a community's capacity/ sustainability to fully participate in the potential future oil and gas sector. 2. Typically, the oil and gas sector requires candidates for employment to have a minimum of Grade 12 or a college awarded general equivalency diploma (GED).
Professional Development **Technical Certification** **Adult Education Enrolment/Completes**	GNWTECE Community Colleges Training Delivery Organizations Unions Industry	GNWTECE	Having a well-educated population is directly linked to developing a vibrant knowledge and skills-based NWT economy which in turn, is critical to the success of building a community's capacity/ sustainability to fully participate in the potential future oil and gas sector.
Post-Secondary Completion	Statistics Canada Community Colleges Training Delivery Organizations	GNWTECE	Having a well-educated population is directly linked to developing a vibrant knowledge and skills-based NWT economy which in turn, is critical to the success of building a community's capacity/ sustainability to fully participate in the potential future oil and gas sector.
Literacy	GNWT Bureau of Statistics (GNWTBS) Statistics Canada	GNWTECE	Adequate literacy skills are critical to empower NWT residents to become self-reliant and able to fully participate in the labour market including those specific to the oil and gas sector.
Access / Capacity	GNWTECE	GNWTECE	Having a well-educated population is directly linked to developing a vibrant knowledge and skills-based NWT economy which in turn, is critical to the success of building a community's capacity/ sustainability to fully participate in the potential future oil and gas sector.

Table 2-3. Example Pilot Indicators for Employment Valued Component

Indicators	Data Collection and Management	Decision and Policy Makers	Example Link to Oil and Gas Sector
Employment rate (Part Time/Full Time)	Statistics Canada GNWTBS	GNWT	Potential increase in employment opportunities due to increased number of oil and gas jobs.
Type of Job	GNWTBS		Increased opportunity for local employment in the oil and gas sector dependent on job type and capacity of local community to meet the job requirements.
Income (average and by sector)	Statistics Canada GNWTBS	GNWT	Potential for increased income and disposable income from oil and gas related employment.
Participation rate	Statistics Canada GNWTBS	GNWT	Potential increased participation rate by local community, provided capacity is already built/supported. Retention of employees may also be dependent on the support systems provided at the project site.
Employment Insurance Claims	Statistics Canada GNWTBS	GNWT	Potential decrease in the number of claims due to increased employment in the oil and gas sector. Potential increase in claims if the oil and gas sector provides 'seasonal' employment opportunities.
Social Assistance	GNWT Health & Social Services (NWTHSS)	GNWTHSS	Potential decrease in the number of claims due to increased employment in the oil and gas sector.
Number/Type of Local Businesses	Statistics Canada GNWTBS	GNWT	Potential increase in the number and types of businesses. Potential increase for Aboriginal owned and operated businesses.
Number of Job Applications	GNWTBS	GNWT	Potential for increase in the number of job applications provided community capacity meets job requirements.
Employment by Sector	Statistics Canada GNWTBS	GNWT	Potential increase in most if not all employment sectors due to increase in oil and gas sector jobs and potential for increase in community population.

Table 2-4. Example Pilot Indicators for Cultural Vitality Valued Component

Indicators	Data Collection and Management	Decision and Policy Makers	Example Link to Oil and Gas Sector
Language [use]	GNWTBS Statistics Canada	GNWTECE BDEC Aboriginal organizations IRC	Potential for erosion or loss of Aboriginal language due to pressures of dominant language at project sites resulting in decreased use of Aboriginal language.
Traditional Knowledge (TK)	GNWTBS Statistics Canada Joint Secretariat Industry BSPWG	Knowledge holder	Potential for erosion or loss of Traditional Knowledge due to absence from community while working at an oil and gas facility.
Ability to harvest [includes community hunts, equipment, affordability, access to resource]	FJMC Inuvialiat Game Council (IGC) Inuvialiat Regional Corporation (IRC) Industry Regional Organizations	HTC IGC	Potential for increased access with increased disposable income and/or potential for decreased access due to oil and gas infrastructure/impact on ice regime.
Cultural Education [includes Nordic studies, on-the-land programs]	GNWTECE BDEC	GNWTECE IRC	Potential for increased commitment to develop and implement cultural education activities through partnerships with industry and/or through Impact Benefits Agreements.
Country food consumption	GNWTHSS Retail outlets APS/SC Nutrition North (NN) Health Canada (HC) Academia	IRC ICI HC NN NWTHSS	Potential for decreased consumption due to perceived and/or realized threat to country food quality (*e.g.*, toxicity due to proximity of animals to oil and gas operations). Food security threat related to increased potential for oil spill.
Art (includes products, number of artists)	Arts organizations ITI	Art galleries Art co-ops	Potential for increased demand for art by population supporting/employed by oil and gas sector. Potential support from industry through community investment agreements/partnerships.

Table 2-5. Example Pilot Indicators for Fish (Arctic Cod) Valued Component

Indicators	Data Collection and Management	Decision and Policy Makers	Example Link to Oil and Gas Sector
Catch per unit effort (CPUE)	Fisheries and Oceans Canada (DFO)	DFO	Arctic cod is the most commonly captured marine fish (70% of species sampled in the Beaufort Sea during summer) making it a keystone species in the Beaufort Sea food web. It is widely distributed and highly abundant in the system, and is an important food for other fish, beluga and other marine mammals. The risk of an oil spill is considered to be high by the Inuvialuit and has been documented as a risk by the DFO and the Beaufort Sea research community. Risk of the Unknown: Research is underway to better understand how arctic cod are affected by oil and gas dispersants under arctic conditions in order to support both future development of oil spill response and monitoring protocols. Other threats may include those related to decreased spawning habitat due to sea ice retreat related to climate change.
Age Distribution	DFO	DFO	
Health	DFO	DFO	
Size	DFO	DFO	
Spatial/temporal distribution	DFO	DFO GNWTENR	
Migration patterns	DFO	DFO	
Quota / Harvest (landings) or No Quota	DFO	DFO ISR GNWT Environment & Natural Resources (GNWTENR)	Potential threat to fishery due to oil spill.
Number of licenses	DFO	DFO GNWTENR	Canada Signed the Beaufort Sea Integrated Fisheries Management Framework on 17 October 2014. There is no commercial fishing in the Beaufort Sea at this time, however there have been eight application for exploratory fishing licences since 2002. The accord establishes that priority for any new fisheries will be given to small scale Inuvialuit-based operations. Any consideration of larger scale commercial fisheries will depend upon scientific knowledge and understanding of the biological productivity of the Beaufort Sea and of the food chain links to species of importance to the Inuvialuit: Dolly Varden char; arctic char; anadromous whitefish

Indicators	Data Collection and Management	Decision and Policy Makers	Example Link to Oil and Gas Sector
			species; seals; and, whales. Potential commercial fisheries will only be considered in the light of scientifically supportable estimates of surplus and sustainable stocks.
Use	IRCs GNWTENR	GNWTENR	Link to Oil and Gas: Potential for conflict if small scale Inuvialuit-based fishery and/or commercial fishery is established proximate to oil and gas operation. Spill Risk: potentially catastrophic to the Inuvialuit as a people, a culture and a community.

Table 2-6.Example Pilot Indicators for Fish (Arctic Char) Valued Component

Indicators	Data Collection and Management	Decision and Policy Makers	Example Link to Oil and Gas Sector
Catch per unit effort (CPUE)	DFO	DFO	Arctic char occur in the lakes and rivers of the eastern portion of the Beaufort Sea. Arctic char are an important source of food for Paulatuk, Sachs Harbour and Ulukhaktok communities. Oil Spill is considered a high risk by the Inuvialuit and has been documented as a risk by the DFO and the Beaufort Sea research community. The accidental release of hydrocarbons into the marine environment could lead to adult arctic char mortality, reduced health or reduced quality due to tainting. Large releases of hydrocarbons during key periods of arctic char migration may lead to large scale mortality or reduced health levels, which could lead to reproductive failure of one or more age classes. Other potential effects related to oil and gas development may include degradation of stream banks and erosion; reduction of or damage to overwintering areas; habitat loss due to gravel removal, facility siting, and water removal; impediments to migration.
Age Distribution	DFO	DFO	
Health	DFO	DFO	
Size	DFO	DFO	
Spatial/temporal distribution	DFO	DFO GNWTENR	
Migration patterns	DFO	DFO	
Quota / Harvest (landings) or No Quota	DFO	DFO ISR	Potential threat to fishery due to oil spill.

Indicators	Data Collection and Management	Decision and Policy Makers	Example Link to Oil and Gas Sector
		GNWTENR	
Number of licenses	DFO	DFO GNWTENR	Canada Signed the Beaufort Sea Integrated Fisheries Management Framework on 17 October 2014. There is no commercial fishing in the Beaufort Sea at this time, however there have been eight application for exploratory fishing licences since 2002. The accord establishes that priority for any new fisheries will be given to small scale Inuvialuit-based operations. Any consideration of larger scale commercial fisheries will depend upon scientific knowledge and understanding of the biological productivity of the Beaufort Sea and of the food chain links to species of importance to the Inuvialuit: Dolly Varden char; arctic char; anadromous whitefish species; seals; and, whales. Potential commercial fisheries will only be considered in the light of scientifically supportable estimates of surplus and sustainable stocks.
Use	IRC GNWTENR	GNWTENR	Link to Oil and Gas: Potential for conflict if small scale Inuvialuit-based fishery and/or commercial fishery is established proximate to oil and gas operation. Spill Risk: potentially catastrophic to the Inuvialuit as a people, a culture and a community.

3.0 Pilot Valued Components (VCs)

The VCs selected to pilot a cumulative effects framework were used to identify specific indicators which would provide insight into how the VCs area affected by multiple activities and sources. Indicators were determined through analysis of the specific nature of the VC and review of ongoing monitoring and research activities regarding these components.

3.1 Environment- Marine Mammals and Fish

Biophysical VCs are often more closely monitored by government agencies than non-biological VCs. Therefore access to information may appear to be more straightforward; however, in reality this data is affected by many other ecological, social, and/or cultural factors.

3.1.1 Indicators - Marine Mammals

While marine mammals were selected as a Pilot Valued Component, it was determined that the focus for monitoring will be beluga, since it is a primary resource for local harvesters. The life history, ecological role and cultural significance of this species are discussed in the following subsections. Indicators for monitoring beluga are also outlined.

3.1.1.1 Beluga

Belugas are toothed whales (Odontocetes) which, along with the narwal, belong to the family Monodontidae. Belugas occur in arctic and subarctic regions and are closely associated with open leads and polynyas in ice-covered regions (Hazard 1988). They have specific adaptions for living in cold regions near ice (Friedman 2006). They are white, have stocky bodies with a thick blubber layer, a bulbous head, a flexible neck, and do not have a dorsal fin. Also known as white whales, belugas lose their initial gray colour and turn white as they mature

Seven beluga stocks occur in Canada, and one, the Eastern Beaufort Sea (EBS) stock, occurs seasonally within the study area. The Eastern Beaufort Sea stock, considered one of the largest in Canada, is considered healthy and secure (Harwood *et al.* 2002, COSEWIC 2004, Grebmeier *et al.* 2006) and was most recently assessed as stable or increasing (DFO, 2000). In the Eastern Beaufort Sea, adult females, average 3.8 m in length while adult males are a bit longer, averaging 4.3 m in length (Harwood *et al.* 2000). They can weigh up to 2000 kg (Stewart and Stewart 1989). Belugas use echolocation to navigate and find prey, and they vocalize frequently to the extent that they are sometimes called “sea canaries” (Belikov and Bel’kovich 2007).

Within the eastern Beaufort Sea stock, belugas begin to gather in the Mackenzie estuary in early summer for moulting and calving (Richard *et al.* 1997, Finley 1982, Sergeant and Brodie 1969), though some remain throughout the offshore during this period (Norton and Harwood 1985, 1986, Harwood *et al.* 1996). In mid-August to early September, belugas begin to move westward along the Beaufort Sea-Alaskan coastline. They spend autumn and winter in the Bering Sea (Richard *et al.* 1997), before heading back to their

summering grounds. Habitat use of Beaufort Sea belugas has also been shown to vary, with length, sex and reproductive status likely reflecting social structure (Loseto *et al.* 2006).

Belugas feed on fish, though the primary prey species may vary by region (Frost and Lowry, 1981, Heide-Jorgensen and Teilmann, 1994, Dahl *et al.*, 2000; Seaman *et al.*, 1982; Welch *et al.*, 1993). Arctic cod (*Boreogadus saida*) is an important prey species for some populations (Dahl *et al.* 2000, Seaman *et al.* 1982, Welch *et al.* 1993), and the EBS population has recently been confirmed to feed mostly on arctic cod from both near shore and offshore regions (Loseto *et al.* 2009).

Belugas are generally considered to be at or near the top predator in their ecosystem (Hobson et al 2002), but are occasionally preyed up on by polar bears (Smith 1985, Lowry *et al.* 1987, Smith and Sjare 1990) and killer whales (Byers and Roberts 1995). They also occasionally become trapped in ice where they may be killed by polar bears or hunters (Heide-Jørgensen *et al.* 2014, Freeman 1968).

Belugas have long been a primary food resource for the Inuvialuit (Friesen and Arnold 1995) and may be hunted by members of all six ISR communities. They are a source of meat and muktuk. Most of the harvest in the ISR comes from whale concentration areas in Kugmallit Bay, near Kendal Island, and Shallow Bay (FJMC 2013). When the belugas are gathered within and near the Mackenzie River estuary in July, Inuvialuit hunters from Inuvik, Aklavik, and Tuktoyaktuk move to their traditional whaling camps along the coast of the Beaufort Sea, where they stay, along with their families, for the 4-6 weeks duration of the hunt (Fraker *et al.* 1979, Norton and Harwood 1986). Later, as the belugas leave the estuary and travel west near Ulukhaktok (Holman), and Paulatuk, hunters in these communities hunt the belugas as they travel close to the shore, usually in late July and August (Norton and Harwood 1985, Richard *et al.* 1997). Hunters from Sachs Harbour may also harvest beluga when the opportunity arises.

The hunt is co-managed by the Hunting and Trapping Committees (HTCs) from all six ISR communities, the Fisheries Joint Management Committee (FJMC), and Fisheries and Oceans (DFO) (FJMC 2013). Between 1990 and 2000, an average of 111 belugas were harvested annually by hunters from the Inuvialuit communities of the ISR (DFO 2000). From 2000-2012, an average of 96 whales per year were harvested (FJMC 2013). Overall, the harvest appears to be declining over time, and the latest beluga management plan lists three reason why this is so. Firstly, climate change has negatively affected the beluga hunt; secondly, overall harvest effort has decreased, and third, the increased cost of fuel has made travel too expensive for some (FJMC 2103).

There are many measurements that could provide information on the health and status of the beluga population in the Beaufort Sea. However, for the Beaufort Sea CEF to be of any use, indicators must consist of easily- and regularly-obtained types of information. In addition, it is crucial that indicators selected for beluga monitoring have existing baseline data, in order to allow comparison with baseline data to detect changes (Rice and Rochet 2005).

Much beluga data is available from the annual harvest. There is considerable data on harvested whales, as they have been measured and sampled from the three main harvesting areas (Shallow Bay, Kendall Island, Kugmallit Bay) in the Mackenzie Estuary since 1980 (Harwood *et al.* 2015, Strong 1990, Weaver 1991, Harwood *et al.* 2002), and near Paulatuk, NT, since 1989 (Harwood *et al.* 2015). Together this data set represents the longest continuous data set in Canada for any arctic mammal. As the EBS population is healthy and the harvest is expected to continue at a similar level, opportunities for data collection are expected to continue for the foreseeable future (FJMC 2013).

Suggested indicators for belugas in the Beaufort Sea are listed below. Each indicator is discussed in further detail in the following subsections:

- Size of Harvest
- Temporal distribution
- Spatial distribution
- Abundance
- Length
- General condition
- Age
- Sex
- Female reproductive status
- Persistent organic pollutant levels
- Mercury levels

3.1.1.2 Indicators for Beluga

The Indicators selected for beluga monitoring are outlined below. Each of indicator has specific attributes relevant to monitoring this VC.

Size of Harvest

The number of whales harvested each year at each location can give an approximate estimate of the number of whales occurring in each area each year, assuming that factors such as hunting effort or timing of spring ice breakup do not fluctuate significantly between years. This data is collected during the annual beluga harvest in the ISR.

Data on beluga harvesting is also discussed in Cultural Vitality VC, as part of the under the Ability to Harvest indicator.

Temporal Distribution

The timing of both whale sightings and harvests can provide information on when whales arrive in the ISR each summer, and when they leave (seasonal occurrence). Date of harvest is recorded for each whale harvested in the ISR.

Spatial Distribution

The location of both whale sightings and harvests can provide information on where whales are occurring within the ISR, and can providence evidence in changes on distribution patterns. Location of harvest is recorded for each whale harvested in the ISR.

Additionally, research vessels utilizing passive acoustic monitoring (PAM) and/or on-board marine Mammal Observers (MMOs) may be a source of information on spatial distribution of belugas in the Beaufort Sea.

Abundance

The number of whales observed in an area each season can provide a general idea of the number of whales present. Changes in abundance can be linked to population decline, or to changes in whale behaviour affecting spatial and/or temporal distribution. Behavioural changes due to fear or stress could also result in whales surfacing less frequently or farther offshore, making them less likely to be observed by humans.

Length

Length of whales is a simple measurement that can be easily obtained from harvested whales. Length provides an indicator of age (Heide-Jørgensen 1994), however belugas reach their maximum length long before they reach old age. Whale length is also affected by sex (males are longer than females) and the overall nutritional history and health of the whale. The beluga harvest tends to be biased towards longer animals (Strong 1990), while smaller animals are often underrepresented in harvests (Burns and Seaman 1986, Heide-Jørgensen and Teilmann 1994, Harwood *et al.* 2002). It has been suggested that belugas are large enough to be targeted by hunters by the time they are sexually mature at about 6 years of age and a length of about 310 cm (Burns and Seaman 1986).

Harwood *et al.* (2014) reported the detection of a weak but sustained trend of a declining growth rate of belugas sampled in early summer, just after arriving from their Bering Sea wintering areas and the Chukchi/ Beaufort spring migration. However, a previous study (Luque and Ferguson 2009), determined that shifts in north Pacific ecosystem regimes have not affected the growth of belugas in the eastern Beaufort Sea.

General Condition

The overall general condition of a harvested beluga can provide important clues to health, stress levels and feeding history of individual belugas and the population as a whole. In years when prey appears scarce, blubber thickness will be thin, as occurred in 2005. Poorly-fed or stressed whales may also be at increased risk of disease or parasites and females may have lower reproductive rates.

Blubber thickness is a simple measurement that can be easily obtained from harvested whales. Varying seasonally, it can range from approximately 8 cm thick in spring to 30 cm after summer (Huntington 2000). Blubber thickness is routinely measured in harvested whales. Blubber thickness provides an indication of the overall health/body condition of the whale and has been shown to relate to temporary variations in the environment (Boyd 2002, Miller *et al.* 2011, and Williams *et al.* 2013).

Harwood *et al.* (2012) noted that in 2005, the year when male beluga blubber was thinnest, 70% of the adult female ringed seals in neighbouring east Amundsen Gulf failed to ovulate, and seal body condition indices were at their lowest point in two decades, strongly suggesting that food for both belugas and ringed seals (which rely on similar prey) was scarce.

A decrease in the general condition of harvested belugas indicates that something is negatively affecting the health or environment of the whales. General condition of beluga whales is ranked on a qualitative scale from 1 to 4 as part of the annual beluga hunt monitoring program. Data on general condition of whales should be available via monitoring data from the annual beluga hunt.

Age

The age of harvested whales gives an idea of the age structure of the beluga population. Age is biased, however, by the Inuvialuit hunters' preference to harvest larger, older animals, primarily males (Strong 1990, Weaver 1991, Harwood *et al.* 2002). Beluga age is determined by examination of prepared sections of their teeth by an experienced technician. Mandibles are collected after harvest, and the teeth are extracted and prepped for age analysis by an experienced technician, who then uses a microscope to count tooth growth rings. It is generally agreed that belugas form one growth layer (or growth layer group) on their teeth per year (Stewart *et al.* 2007, Robeck *et al.* 2005, Luque *et al.* 2007), with a growth layer group consisting of two adjacent growth layers, one light and one dark (Perrin and Myrick 1980). However, age calculation of belugas can be complicated in older whales with significant tooth wear (Suydam 2009).

Age has been calculated for a considerable portion of the belugas whales harvested since 1980 (Luque and Ferguson 2009). Harwood *et al*. (2001) stated that females sampled from 1988-1994 ranged in age from 0 to 49 years, with a median of 23.5 years, while males ranged from 3 to 57 years, with a median of 24 years. It should be noted that age is not available for all whales harvested, as tooth samples are not always be obtained from harvested whales.

Sex

Determining the sex of individual whales can be helpful in understanding social behaviour, mating systems, and population dynamics of the species. The sex of a beluga can be easily determined after harvest, while it is difficult to determine accurately in wild belugas, unless they are obviously accompanied by a calf.

The sex of harvested belugas gives an idea of the sex ratio structure of the harvested population. Harwood *et al.* (2014) note that the harvest over the past three decades has been strongly biased toward males. This is likely due to the hunters' avoidance of mothers with calves and their preference for larger whales. Between 1980 and 1996, the proportion of females in the harvest averaged 29.3% per year (DFO 2000).

Female Reproductive Status

Though hunters prefer large male belugas, as discussed above in the section on sex it is quite difficult to determine the sex of a beluga unless it is accompanied by a calf. When an adult female is harvested, examination of the uterus, ovaries, and mammary glands can provide information on her reproductive

status (non-pregnant, pregnant, lactating), which can then provide insight into the reproduction rate and overall health of the beluga population.

Data on female reproductive status should exist as part of the monitoring data from the annual beluga hunt. A research paper summarizing this data is in press now (Harwood *et al.* 2015).

Mercury

Mercury is a heavy metal which is known to cause a range of toxic effects in fauna, including behavioural, neurochemical, hormonal, and reproductive changes (Scheuhammer *et al*. 2007). There are no industrial sources of mercury in the Canadian arctic, and its presence is thought to be due to anthropogenic sources from outside of the arctic. The presence of elevated mercury levels in arctic fauna causes serious concerns regarding arctic ecosystem and of the residents who rely on country foods for a substantial part of their diet (Konkel 2015).

Mercury was first reported in belugas in the Canadian arctic in the early 1970s (Bligh and Armstrong 1971, Smith and Armstrong 1975). It has since been shown be accumulating within belugas in the NWT (Loseto *et al*. 2008a, 2008b, 2014). Measurement of mercury in belugas is complicated by several factors. Mercury trends in belugas are the result of complex interactions between mercury deposition and methylation, uptake in food webs and foraging behaviour (Douglas *et al.* 2012). Methylation is the process in which mercury (Hg) is transformed into a highly bioaccumulated neurotoxin known as methylmercury (MeHg). Belugas in the EBS are also known to segregate by size (Loseto *et al.*, 2006), and this is known to affect their diet and mercury levels (Loseto *et al.*, 2008, 2009). Mercury contamination is known to be higher in larger males that feed offshore (Loseto 2008).

Mercury levels also vary between tissues in an individual whale. It is understood that mercury levels in beluga muscle tissue are more representative of the whale's recent diet, while mercury in the liver tends to accumulate over time. Muscle tissue levels can therefore fluctuate in relation to seasonal changes in diet.

The Mercury indicator requires laboratory analysis of tissues and therefore this data requires more effort, expense, and planning to obtain.

Persistent organic pollutants

Persistent Organic Pollutants (POPs) are a group of compounds with a variety of intended uses and sources which have become widespread pollutants in the arctic environment. This category includes polychlorinated biphenyls (PCBs), dioxins (PCDDs) and furans (PCDFs), hexachlorobenzene (HCB), and brominated flame retardants. Many pesticides are also included, such as DDT, Toxaphene, Chlordane, Hexachlorocyclohexane/lindane, Dieldrin, Mirex, and Tributyltin (TBT). These compounds tend to be fat soluble, and so accumulate within blubber, which is vital to the survival of mammals living in arctic regions. They are known to have a range of negative effects on wildlife and humans. Effects include suppression of the immune system, disruption of behaviour and reproduction in birds, fish, and mammals, and effects on

developing nervous systems. They may also affect the liver, cause birth defects and promote cancer (AMAP 1997).

Several POPs have been detected in belugas in the NWT. The study of POP levels in arctic marine mammals is complicated by factors such as age, sex, blubber thickness, nutritional status, collection season, and individual reproductive status, all of which can all have important influences on contaminant concentrations (Muir *et al.* 2000). Tissue samples form a single individual can also vary greatly depending on the tissue type (for example, liver levels are often higher than muscle samples). In addition the harsh environment and remoteness of the arctic causes logistical issues with obtaining and shipping samples. These issues, along with often limited knowledge of species ecological roles, hamper knowledge of POPs in arctic marine mammals.

The POP indicator requires laboratory analysis of tissues and therefore this data requires more effort, expense, and planning to obtain.

3.1.2 Indicators - Fish

While Fish were selected as a Pilot Valued Component, it was determined that the focus for monitoring should be arctic char and arctic cod, since they are important resources for local harvesters as well as important prey for beluga. The life history, ecological role and cultural significance of these species are discussed in the following subsections. Suggested indicators for monitoring arctic char and arctic cod are also outlined.

3.1.2.1 Arctic char

Arctic char (*Salvinelis alpinus)* is a Holarctic species which is common in most of the high Arctic (Hammar 1985). Populations may exhibit landlocked, resident, or migratory life history patterns (Loewen *et al.* 2009, Reist *et al.* 1995), and utilize both freshwater and marine environments seasonally. The most northernmost-occurring fish species, they reach a length of about 55 cm, and can weigh several kilograms. Arctic char are primarily associated with lakes in northwestern North America (Reist and Sawatzky 2010), where most migrate down rivers to take advantage of increased food supply in the marine environment. Anadromous adults and juveniles begin to migrate downstream once the ice breaks up in late spring to early summer (Begoua-Anras *et al.* 1999), though spawning fish may stay in their river all year in a spawning year (Dutil 1986, Kristofferson 2002). They spend up to two months in the sea, before migrating back up their home river in the fall.

Arctic char spawn in freshwater during late September and early October, at about the same time that the winter ice forms. Spawning occurs on gravel bottoms of lakes in fall and the eggs incubate until the following spring. Juveniles may spend up to nine years in the lake before migrating to the ocean (Johnson 1980, cited in Harwood 2013). Adult char do not spawn each year, taking one or two resting years in between spawning years. The eggs incubate within the gravel throughout the winter and the young fish emerge in spring (Hunter 1976).The juveniles remain in freshwater for several years before beginning their annual migration to the sea to feed (Johnson 1980, cited in Harwood *et al.* 2013). Temporal distribution

can also be affected by the sex of the fish. On Baffin Island, an arctic char study found that female fish tended to moved upriver before the males did, although fish of all different size and age migrated upstream simultaneously (Moore 1975).

There are two main arctic char stocks harvested within the ISR, from the Hornaday and Kuujjua River systems (Harwood 2009, Harwood *et al.* 2013). The Hornaday River stock was fished commercially beginning in 1968, however decreases in fish size and harvests led to a closure of the fishery in 1987. The present day Hornaday River fishery is exclusively a food fishery, and has been monitored by the Paulatuk community since 1990. The Paulatuk Char Management Plan was enacted from 1998-2002 to help keep the stock sustainable. The stock is still subject to a high level of exploitation, with the food fishery averaging 2400 char per year over the last decade (Harwood 2009).

Arctic char are carnivorous. In spring and summer they feed on insects, fish eggs, snails and small crustaceans, as well as smaller fish. For the rest of the year they feed on zooplankton, freshwater shrimp and small fish found within their winter freshwater habitat. Capelin is said to be an important summer prey species in coastal marine areas (C. Ruben, pers. com., cited in Harwood 2009).

Arctic char are often considered to be the top predator within their freshwater environments (Rouse *et al.*, 1997, Hammar 1999). Arctic char is a staple subsistence resource to the Inuvialuit on Banks and Victoria islands, namely the communities of Paulatuk, Sachs Harbour and Ulukhaktok. The Hornaday River stock provides an important food source for the community of Paulatuk (Harwood 2009), while the Kuujjua River stock supplies Ulukhaktok residents with fish (Harwood *et al*. 2013). These stock are distinct, and exhibit differing spawning and overwintering behaviours. The Hornaday River stock appears to overwinter within the Hornaday River and its estuary (Harwood and Babaluk 2014) rather than in lakes as most arctic char populations do. Small populations also occur within the Thomsen and Brock Rivers, though neither support any fishing (Stephenson 2010, MacDonell 1988 (cited in Harwood *et al.* 2013)).

As the only freshwater fish with a true circumpolar distribution, which utilizes marine, river, and lake environments, arctic char is considered to be an important biological indicator of climate change in the arctic (Reist *et al.* 2006).

3.1.2.2 Arctic cod

Arctic cod (*Boreogadus saida*) is a circumpolar species which occurs in a range of depths (Scott and Scott 1988). Known as polar cod in other parts of the arctic, arctic cod is a widespread, dominant fish species in the Beaufort Sea (Craig *et al.* 1982, Galbraith and Hunter 1979, Bradstreet *et al.* 1986, Welch *et al.* 1993, Gillispie *et al.* 1997, Hop *et al.* 1997), which is associated with ice-edge habitats. A relatively small species, arctic cod grow to a maximum length of approximately 30 cm (Scott and Scott 1988).

Arctic cod is currently not a commercially-fished species, and so there is no harvest or other fishery-type data available for it. There has been increased research on this species in recent years, however, due to the recognition of the lack of knowledge of this key arctic species. This is being driven by the potential for

increased oil and gas exploration in the Beaufort Sea, as well as current Canadian and American interest in creating a commercial arctic cod fishery in the Beaufort Sea.

Arctic cod are thought to aggregate in large schools in winter, and this was recently documented in Franklin Bay in the Admunsden Gulf (Benoit *et al.* 2008). Studies have shown a strong association between arctic cod aggregations and sea ice (*e.g.,* Bradstreet *et al.* 1986; Lønne and Gulliksen 1989; Gradinger and Bluhm 2004). They spawn in ice-covered regions in winter (Baranenkova *et al.* 1966) near shore (Craig *et al.* 1982, Fevolden and Christiansen 1997) and probably also in deeper water (Benoit *et al.* 2008, Geoffroy *et al.* 2011). Spawning is thought to occur from late November until February in the offshore Beaufort Sea (Craig *et al.* 1982), with the eggs rising to the ice –water interface (Graham and Hop 1995) and hatching under the ice during the winter months (Bouchard and Fortier 2011). Acoustic surveys in the Beaufort Sea have shown that in summer, young arctic cod occur in the upper 100 m of the water column, while older individuals adults (>1 year) are found deeper (200-400 m) on the continental slope (BREA 2014, Benoit *et al.* 2014). In winter the younger polar cod migrate to deeper depths and join the adults.

In the southeastern Beaufort Sea, the arctic cod has been shown to feed mostly on the dominant copepods *Calanus hyperboreus, Metridia longa,* and *C. glacialis* (Benoit *et al.* 2010). Arctic cod itself is an important prey species for arctic seabirds and marine mammals (Welch *et al.* 1992). This species is thought to be responsible for up to 75% of the energy transfer between lower and upper trophic levels in arctic marine ecosystems, and is therefore considered to be a key element of such ecosystems. (Bradstreet *et al.* 1986, Welch *et al.* 1992, Crawford and Jorgenson 1993, Craig *et al.* 1982, Finley and Evans 1983, Hobson and Welch 1992).

Arctic cod are used by Inuvialuit as a source of protein. They are also important because they are a major prey item for marine mammal species hunted by Inuvialuit, such as beluga and ringed seal. Arctic char may also prey on arctic cod in summer.

3.1.2.3 Indicators for Fish

There are many measurements ('indicators') that could provide information on the health and status of the arctic char and arctic cod populations in the Beaufort Sea region. However, for the BREA CEF to be of any use, such indicators must consist of easily- and regularly-obtained types of information. It is also most efficient to select indicators for which baseline data already exists, in order to allow for comparison to that baseline to detect change (Rice and Rochet 2005).

Arctic char has not been fished commercially in the Beaufort Sea region since 1986, and so there is no recent commercial fishery data available for it. However, it is still widely relied upon by Inuvialuit as a dietary staple, and considerable subsistence harvest data is available.

In the marine environment, arctic char are fished off sea-ice in early summer, and via gill nets in late summer. In rivers, they are also netted.

Arctic cod is used as a food source by the Inuvialuit, thought to a lesser degree than arctic char or beluga. They are fished off sea-ice in early summer, and via gill nets in late summer. However, as a marine fish species, no license is required to fish them, and there is no monitoring of the size or location of the harvest. Therefore, the types of data that are available for arctic cod tend to be related to single, short –term studies, rather than longer-term monitoring or harvesting programs.

Suggested indicators for arctic char and/or arctic cod in the Beaufort Sea region are listed below.

- Length
- Weight
- Age
- Sex
- General Condition
- Stomach Contents
- Temporal Distribution (arctic char only)
- Spatial Distribution
- Gonad Weight (arctic cod only)
- Timing of spawning
- Contaminant Levels
- Size of Harvest (arctic char only)
- CPUE (arctic char only)
- Contaminant Levels

Each indicator is discussed in further detail in the following paragraphs.

Length

The length of a fish gives a general idea of the age-class it belongs to, though this is less reliable as fish age and growth rates decrease. Length (not weight) is generally considered to be the most reliable proxy for age, as total weight is highly depending on maturation and feeding status of individual fish. Length is also affected by the nutritional status of the individual. When compared with its age, the length of a fish can provide insight into the growth rate of the individual. Changes in the average age/length ration of a population can indicate that impacts to growth rates.

Both total length (TL) and fork length (FL) of arctic char and arctic cod can be easily measured upon harvest.

There already exists research reports that provide useful baseline data which indicate average lengths of male and female char caught in the Beaufort Sea region (DFO 1999a, DFO 1999b, Harwood 2009, and Harwood *et al.* 2013). Length data is available for a subset of the Hornaday River harvest from 1990-2007 (Harwood 2009), and for a subset of the 1991-2009 Kuujjua River harvest (Harwood *et al.* 2013). An apparent increase in growth rates of arctic char in both rivers has been observed during the past several years (Harwood 2009, Harwood *et al.* 2013). Harwood *et al.* (2015) summarized the trend of increasing body condition in arctic char, which is thought to be influenced by the extent and persistence of sea ice.

Data on average lengths of arctic cod also exist. Craig *et al.* (1982) published useful baseline data indicating average lengths of male and female arctic cod in the Beaufort Sea.

Weight

The weight of a fish, in relation to its length, provides insight into how mature and well-fed the individual is. Decreases in weight/length ratios of a population indicate that members of the population are less nourished than previously were, suggesting that some aspect of the food supply may have changed (prey species, abundance, *etc.*).

The total wet weight of individual arctic cod and arctic char is easily measured upon harvest.

Data on average weight of harvested arctic char at the Hornaday and Kujjua Rivers is available for both the Kuujjua and Hornaday Rivers.

Some data on weight of individual arctic cod should be available from the ArcticNet work conducted by the research laboratory of Louis Fortier at the University of Laval.

Age

Arctic char (from the highly-fished Hornaday River stock) rarely live past the age of 10 (DFO 1999b). The age of arctic char is best determined after harvest by dissecting out their otoliths (the tiny bones in their inner ear) and counting their annual growth rings (Baker and Timmons 1991). Determining the age distribution of harvested arctic char can provide insight into the age structure and year classes represented by the harvested portion of the population. Changes in the age of spawning arctic char can also indicate selective pressures on char to spawn at an earlier or later age.

Arctic cod are relatively short-lived fish, with a usual lifespan of no more than six years. The age of arctic cod can be determined after harvest by dissecting out their otoliths (the tiny bones in their inner ear) and counting their annual growth rings. Determining the age distribution of harvested arctic cod can provide insight into the age structure of the harvested portion of the population.

Age data (calculated via otolith examination) is available for a portion of the harvest from the Hornaday River from 1997- 2007 (Harwood 2009), and for a portion of the Kuujjua River harvest from 1991-2009 (Harwood *et al.* 2013).

Limited arctic cod age data should be available in the scientific literature.

Collection of arctic char and arctic cod otoliths and subsequent aging by an experienced technician can provide data on age of harvested arctic char and arctic cod.

Spatial distribution

In the Canadian arctic, arctic char are generally found in clear-flowing rivers and lakes to the east of the Mackenzie River, though two exceptions exist. (Reist *et al.* 1997, Reist and Sawatzky 2010).

As migratory species, arctic char occur in different habitats at different times of year. Most arctic char stocks overwinter in lakes, with the exception of the Hornaday River stock. A tagging study by Harwood and Babaluk (2014) provided information on seasonal distribution of arctic char within the Hornaday River.

Arctic cod are a widespread circumboreal species, occurring throughout the Beaufort Sea. They are restricted to cold waters and may be displaced northward as warming related to climate change continues. There is some indication that spawning occurs in Steffanson Sound off northern Alaska (Craig *et al.* 1982), but it is currently unknown if the fish migrate to this area to spawn or if spawning occurs in other areas as well.

Changes in spatial distribution of arctic char or arctic cod may be detected if they become unavailable for harvest by Inuvialuit in any of the ISR communities. Changes in location of harvest can indicate changes in habitat suitability or prey availability within a given area.

The location of harvest is easily recorded once a fish is caught. This data exists for arctic char form the Hornaday and Kuujjua Rivers. Data on locations of harvest of arctic char from the Beaufort Sea itself may not be as readily available, though may be available in ISR Community Conservation Plans.

Cod harvest location data should be available from individual Community Conservation Plans prepared by ISR communities.

Sex

When in spawning condition, the sex of adult arctic char is easily determined by external appearance (DFO 1999b). Spawning fish turn orange, red, and often a deep vermilion, and males develop the protruding hooked lower jaw, known as a kype, that is characteristic of salmonids (DFO 1999b). The sex of arctic cod cannot be distinguished by external appearance (Graham and Hop 1995). As a result, individual fish must be dissected to determine their sex.

The sex of arctic char and arctic cod can be easily determined at time of harvest. Sex ratio data for a portion of the total harvest is available for the Hornaday River data from 1990-2007 (Harwood 2009) and from the Kuujjua River data from 1991-2009 (Harwood *et al.* 2013). Data collection continues from both of these populations (L. Harwood, pers comm. 2015).

Arctic cod populations in Canada and elsewhere have often been noted to have skewed sex ratios, with females being more numerous in older age classes (Craig *et al.* 1982, Gillispie *et al.* 1997, Hop *et al.* 1995, Lear 1979, Nahrgang *et al.* 2014). Males appear to reach sexual maturity earlier than females, but then do not live as long, with almost 100% of year 5 age classes being female in one recent Norwegian study (Nahrgang *et al.* 2014).

The impact of development activities, such as initiation of a commercial fishery can lead to changes in male and female populations which can lead to selective pressures leading to fish which mature at a smaller size.

Gonad weight

The gonad weight of a mature fish gives an idea of how much of its energy it is allocating to egg or sperm production. In addition, the size of a fish's gonads in relation to its overall body size provides an indication of the maturity and spawning readiness of the fish.

Collection and weighing of arctic cod gonads relative to their total body weight can provide data on maturity and spawning condition of harvested arctic cod. This type of data is not typically measured when arctic cod are harvested for subsistence purposes, but may occasionally be available from research projects.

Gonad weight is **not** suggested as an indicator for arctic char, as less than 1% of the annual harvest usually consists of spawning fish (Harwood 2009, Harwood *et al.* 2013).

Stomach Contents

The stomach contents of harvested fish provides an indication of what they have recently been feeding on.

Capelin (*Mallotus mallotus*) is considered to be an important prey species for Hornaday River char in the ocean off the Hornaday in summer (DFO 1999b). Harwood and Babaluk (2014) found capelin was dominant in arctic char stomachs in the Hornaday River.

Craig *et al.* (1982) found that the main foods of the arctic cod in nearshore waters were mysids (*Mysis litoralis, M. relicta*), amphipods (*Onisimus glacialis*), and copepods. The diet of arctic cod under ice may also differ from that of offshore fish.

Changes in dominant stomach contents (unrelated to season, which may affect diet) may indicate a shift in the abundance or distribution of main prey items. It has been suggested that as climate change continues, their main prey species may be replaced by more southerly species (Nahrgang *et al.* 2014).

Collection and preservation of fish stomachs upon harvest can allow later identification of pretty items under a dissecting microscope. Identification of prey items can then be made to the lowest possible taxon, depending on the degree of digestion.

Arctic char stomach content data may be available from the Hornaday and Kuujjua River harvests. Arctic cod stomach content data is also available in the scientific literature *(e.g*. Craig *et al.* 1982).

This type of data is not routinely monitored, and this may limit the usefulness of this indicator. However, this type of data may occasionally be available from short-term scientific studies.

Timing of spawning (arctic cod only)

Arctic cod spawn under sea ice during winter (Craig *et al.* 1982, Sameoto 1984, Bradstreet *et al.* 1986). The timing of spawning is affected by water temperature and light regime (Graham and Hop 1995). Warmer

water temperatures are known to cause captive arctic cod to spawn earlier in the season (Graham and Hop 1995).

Craig *et al.* (1982) suggested that the spawning period for arctic cod in the Beaufort Sea between November and February. That study also noted a possible spawning area in Steffanson Sound, off northern Alaska (Craig *et al.* 1982).

The timing of spawning of arctic cod can be estimated by noting when the prevalence of mature gonads in harvested fish is highest. This data can be obtained fairly easily after harvest.

Timing of Spawning is **not** suggested as an indicator for arctic char, as less than 1% of the annual harvest usually consists of spawning fish (Harwood 2009, Harwood *et al.* 2013).

General Condition

The general external physical condition of a fish can give an idea of the general health of the individual. Characteristics such as low weight, small size for age, general appearance, and presence of lesions or parasites can all indicate poor condition due to changes in habitats or prey availability.

This data can be obtained fairly easily after harvest for both arctic char and arctic cod.

Somatic condition (length/weight) data was collected for a portion of the harvest from the Hornaday River from 1997- 2007 (Harwood 2009), and for a portion of the Kuujjua River harvest from 1991-2009 (Harwood *et al.* 2013).

Arctic cod somatic condition data should be available in the scientific literature.

Contaminants

Persistent organic pollutants and mercury are both considered to be contaminants of concern in marine fauna in the Canadian arctic (Braune *et al.* 2005). Both types of contaminants tend to biomagnify in food webs. Several types of contaminants have been detected in arctic char and arctic cod (Hoekstra *et al*. 2003, Campbell *et al.* 2005). As arctic char and arctic cod are both consumed (either directly or indirectly via beluga) by humans, there are concerns about levels of these contaminants in arctic cod.

This type of data is not routinely monitored in arctic char or arctic cod, and this may limit the usefulness of this indicator. However, this type of data may occasionally be available from short-term scientific studies.

Harvest Size (arctic char only)

Knowledge of the degree of harvesting pressure that a stock is subject to can provide information on the resilience and expected future condition of the stock.

Harvest size data is available for the Hornaday stock from 1997- 2007 (Harwood 2009), and from the Kuujjua River from 1991-2009 (Harwood *et al.* 2013).

Annual harvest size data does not appear to be available for arctic cod, so this indicator is not suggested for this species.

CPUE (arctic char only)

The catch-per-unit-effort (CPUE) of a fish stock can indicate changes in stock size, assuming other factors remain unchanged. Changes in other factors such as the magnitude of recruitment, timing of migrations, local environmental conditions and/or changes in fishing methods/locations can all affect CPUE calculations (Harwood 2009).

CPUE data is available for the harvest from the Hornaday River from 1997- 2007 (Harwood 2009), and for the portion of the Kuujjua River harvest from 1991-2009 (Harwood *et al* 2013). CPUE data is not available for arctic cod, so this indicator is not suggested for this species.

3.1.3 Sources of Information

In order to garner a better understanding of marine mammal and fish Valued Components, several sources of information were identified for each of the indicators. Table 3-1 summarizes the indicators and identified sources of information for each Valued Component. A discussion of the role each source of information plays and what information they can provide, along with contact information, is also presented.

Table 3-1. Selected Indicators and Sources of Information for Environmental Valued Components (Marine Mammals and Fish)

Valued Component	Indicators	Confirmed and Potential Sources of Information on Indicators
Beluga	**Size of Harvest**	DFO • Annual Beluga harvest monitoring data • Hendrickson Island Beluga Study • arctic Coastal Ecosystems Study • BREA Marine Fish Study • DFO research reports (published in the scientific literature) • Canadian Science Advisory Secretariat FJMC • Annual Beluga harvest monitoring data • Hendrickson Island Beluga Study • Beluga Management Plan (2013) Scientific literature
	Temporal distribution	DFO • Annual Beluga harvest monitoring data • Hendrickson Island Beluga Study • arctic Coastal Ecosystems Study • BREA Marine Fish Study • DFO research reports (published in the scientific literature) • Canadian Science Advisory Secretariat

Valued Component	Indicators	Confirmed and Potential Sources of Information on Indicators
		FJMC • Annual Beluga harvest monitoring data • Hendrickson Island Beluga Study • Beluga Management Plan (2013) Scientific Literature
	Spatial Distribution	DFO • Annual Beluga harvest monitoring data • Hendrickson Island Beluga Study • Arctic Coastal Ecosystems Study • BREA Marine Fish Study • DFO research reports (published in the scientific literature) • Canadian Science Advisory Secretariat FJMC • Annual Beluga harvest monitoring data • Hendrickson Island Beluga Study • Beluga Management Plan (2013) Inuvialuit Game Council / Hunter and Trappers Committees • Annual Beluga harvest monitoring data National Energy Board • Environmental assessment reports for seismic surveys (PAM data, marine mammal observer data) Polar Data Catalogue Scientific literature
	Abundance	DFO • Annual Beluga harvest monitoring data • Hendrickson Island Beluga Study • Arctic Coastal Ecosystems Study • BREA Marine Fish Study • DFO research reports (published in the scientific literature) • Canadian Science Advisory Secretariat FJMC • Annual Beluga harvest monitoring data • Hendrickson Island Beluga Study • Beluga Management Plan (2013) Inuvialuit Game Council / Hunter and Trappers Committees • Annual Beluga harvest monitoring data Scientific literature
	Length	Inuvialuit Game Council / Hunter and Trappers Committees • Annual Beluga harvest monitoring data Scientific literature
	Age	DFO • Annual harvest data, including Hendrickson Island Beluga Study Scientific literature
	Sex	Inuvialuit Game Council / Hunter and Trappers Committees • Annual Beluga harvest monitoring data Scientific literature
	Female Reproductive Status	DFO Scientific Literature
	General Condition	Inuvialuit Game Council / Hunter and Trappers Committees

Valued Component	Indicators	Confirmed and Potential Sources of Information on Indicators
		• Annual Beluga harvest monitoring data Scientific literature
	Contaminants	DFO • Hendrickson Island Beluga Study AANDC • Northern Contaminants Program • Beaufort Regional Environmental Assessment • Paulatuk Beluga Study Scientific literature
Arctic cod	**Length**	Polar Data Catalogue • ArcticNet studies • BREA Scientific literature
	Weight	Polar Data Catalogue • ArcticNet studies • BREA Scientific literature
	Age	Polar Data Catalogue • ArcticNet studies • BREA Scientific literature
	Sex	Polar Data Catalogue • ArcticNet studies • BREA Scientific literature
	General Condition	Scientific literature Polar Data Catalogue • ArcticNet studies • BREA
	Stomach Contents	Polar Data Catalogue • ArcticNet studies • BREA Scientific literature
	Spatial Distribution	Polar Data Catalogue • ArcticNet studies • BREA DFO • Arctic Coastal Ecosystems Study Scientific literature
	Gonad Weight	Polar Data Catalogue • ArcticNet studies • BREA Scientific literature
	Timing of spawning	Polar Data Catalogue • ArcticNet studies • BREA Scientific literature
	Contaminant Levels	Polar Data Catalogue • ArcticNet studies

Valued Component	Indicators	Confirmed and Potential Sources of Information on Indicators
		• BREA AANDC • Northern Contaminants Program • Beaufort Regional Environmental Assessment Scientific literature
Arctic char	**Length**	DFO • Monitoring Data for Paulatuk arctic char harvest (Kuujjua River Harvest monitoring) • Monitoring Data for Ulukhaktok arctic char harvest (Hornaday River Harvest monitoring) • Arctic Coastal Ecosystems Study FJMC • Monitoring Data for Sachs Harbour arctic char harvest Inuvialuit Game Council / Hunter and Trappers Committees • Hornaday River Harvest monitoring • Kuujjua River Harvest monitoring Scientific literature
	Weight	DFO • Monitoring Data for Paulatuk arctic char harvest (Kuujjua River Harvest monitoring) • Monitoring Data for Ulukhaktok arctic char harvest (Hornaday River Harvest monitoring) • Arctic Coastal Ecosystems Study FJMC • Monitoring Data for Sachs Harbour arctic char harvest Inuvialuit Game Council / Hunter and Trappers Committees • Hornaday River Harvest monitoring • Kuujjua River Harvest monitoring Scientific literature
	Age	DFO • Monitoring Data for Paulatuk arctic char harvest / Kuujjua River Harvest monitoring • Monitoring Data for Ulukhaktok arctic char harvest/ Hornaday River Harvest monitoring • Arctic Coastal Ecosystems Study FJMC • Monitoring Data for Sachs Harbour arctic char harvest Inuvialuit Game Council / Hunter and Trappers Committees • Hornaday River Harvest monitoring • Kuujjua River Harvest monitoring Scientific literature
	Sex	DFO • Monitoring Data for Paulatuk arctic char harvest / Kuujjua River Harvest monitoring • Monitoring Data for Ulukhaktok arctic char harvest/ Hornaday River Harvest monitoring • Arctic Coastal Ecosystems Study FJMC

Valued Component	Indicators	Confirmed and Potential Sources of Information on Indicators
		• Monitoring Data for Sachs Harbour arctic char harvest Inuvialuit Game Council / Hunter and Trappers Committees • Hornaday River Harvest monitoring • Kuujjua River Harvest monitoring Scientific literature
	General Condition	DFO • Monitoring Data for Paulatuk arctic char harvest / Kuujjua River Harvest monitoring • Monitoring Data for Ulukhaktok arctic char harvest/ Hornaday River Harvest monitoring • Arctic Coastal Ecosystems Study FJMC • Monitoring Data for Sachs Harbour arctic char harvest Inuvialuit Game Council / Hunter and Trappers Committees • Hornaday River Harvest monitoring • Kuujjua River Harvest monitoring Scientific literature
	Stomach Contents	DFO • Monitoring Data for Paulatuk arctic char harvest / Kuujjua River Harvest monitoring • Monitoring Data for Ulukhaktok arctic char harvest/ Hornaday River Harvest monitoring • Arctic Coastal Ecosystems Study FJMC • Monitoring Data for Sachs Harbour arctic char harvest Inuvialuit Game Council / Hunter and Trappers Committees • Hornaday River Harvest monitoring • Kuujjua River Harvest monitoring Scientific literature
	Temporal Distribution	DFO • Monitoring Data for Paulatuk arctic char harvest / Kuujjua River Harvest monitoring • Monitoring Data for Ulukhaktok arctic char harvest/ Hornaday River Harvest monitoring • Arctic Coastal Ecosystems Study FJMC • Monitoring Data for Sachs Harbour arctic char harvest Inuvialuit Game Council / Hunter and Trappers Committees • Hornaday River Harvest monitoring • Kuujjua River Harvest monitoring Scientific literature
	Spatial distribution	DFO • Monitoring Data for Paulatuk arctic char harvest / Kuujjua River Harvest monitoring • Monitoring Data for Ulukhaktok arctic char harvest/ Hornaday River Harvest monitoring • Arctic Coastal Ecosystems Study FJMC • Monitoring Data for Sachs Harbour arctic char harvest

Valued Component	Indicators	Confirmed and Potential Sources of Information on Indicators
		Inuvialuit Game Council / Hunter and Trappers Committees • Hornaday River Harvest monitoring • Kuujjua River Harvest monitoring Scientific literature
	Harvest Size	DFO • Monitoring Data for Paulatuk arctic char harvest / Kuujjua River Harvest monitoring • Monitoring Data for Ulukhaktok arctic char harvest/ Hornaday River Harvest monitoring • Arctic Coastal Ecosystems Study Inuvialuit Game Council / Hunter and Trappers Committees • Hornaday River Harvest monitoring • Kuujjua River Harvest monitoring Scientific literature
	CPUE	DFO • Monitoring Data for Paulatuk arctic char harvest / Kuujjua River Harvest monitoring • Monitoring Data for Ulukhaktok arctic char harvest/ Hornaday River Harvest monitoring • Arctic Coastal Ecosystems Study FJMC • Monitoring Data for Sachs Harbour arctic char harvest Inuvialuit Game Council / Hunter and Trappers Committees • Hornaday River Harvest monitoring • Kuujjua River Harvest monitoring Polar Data Catalogue Scientific literature

The following subsections provide a description of each source of information.

3.1.3.1 Fisheries and Oceans Canada (DFO)

Fisheries and Oceans Canada (DFO) is the federal government body tasked with managing Canada's fisheries and safeguard its waters. As listed on its website, DFO:

- supports strong economic growth in our marine and fisheries sectors by supporting exports and advancing safe maritime trade;
- supports innovation through research in expanding sectors such as aquaculture and biotechnology; and
- contributes to a clean and healthy environment and sustainable aquatic ecosystems through habitat protection, oceans management, and ecosystems research.

Relevant Beaufort Sea projects which DFO is or was involved in include:

- Hendrickson Island Beluga Studies
- Arctic Coastal Ecosystems Study (ACES)
- Northern Coastal Marine Studies – NCMS
- ISR Coastal Monitoring Program

- BREA Marine Fishes Project

DFO maintains the following datasets:

Beluga

- Data related to the annual harvest

Arctic char

- Data related to the annual char harvest by residents of Paulatuk and Ulukhaktok

Contact Information:

Canadian Headquarters (Central and Arctic Region)
Fisheries and Oceans Canada
520 Exmouth Street
Sarnia, ON N7T 8B1
Telephone: 519-383-1813 or
Toll-Free 1-866-290-3731
Fax: 519-464-5128

Regional Headquarters
Fisheries and Oceans Canada
Freshwater Institute
501 University Crescent
Winnipeg, MB R3T 2N6
(204) 983-5000

Northwest Territories Offices
Fisheries and Oceans Canada
Suite 301 - Diamond Plaza
5204 - 50th Ave.
Yellowknife, NT X1A 1E2
(867) 669-4900
Fisheries and Oceans Canada
Box 1871
Inuvik, NT X0E 0T0
(867) 777-7500

Fisheries and Oceans Canada
42043 MacKenzie Hwy
Hay River, NT X0E 0R9
(867) 874-5300

3.1.3.2 Fisheries Joint Management Committee

The Fisheries Joint Management Committee (FJMC) was established by DFO in 1986, as required by the Inuvialuit Final Agreement (IFA). As stated on its website, the FJMC's mission is to ensure that the renewable marine, anadromous and freshwater resources of the Inuvialuit Settlement Region are managed

and conserved for the wise use and benefit of present and future generations. This involves three main responsibilities:

1. to assist Canada and the Inuvialuit in administering the rights and obligations related to fisheries under the IFA;
2. to assist the Minister of Fisheries and Oceans in carrying out his responsibilities for the management of fisheries and marine mammals in the Inuvialuit Settlement Region (ISR), and
3. to advise the Minister of Fisheries and Oceans on all matters relating to Inuvialuit and ISR fisheries.

Relevant Beaufort Sea projects which the FJMC is or was involved in include:

- Beluga Monitoring Program (all harvest areas)
- ISR Coastal Monitoring Program
- Annual char harvest in the Hornaday and Kuujuua Rivers

The Fisheries Joint Management Committee maintains the following datasets:

Beluga

- Annual Harvest Data-- Beluga Monitoring Program

Arctic char

- Annual char harvest in the Hornaday and Kuujuua Rivers

Contact Information:
Fisheries Joint Management Committee
P.O. Box 2120, Inuvik, NT, X0E 0T0
Tel: 867 777-2828
Fax: 867 777-2610
fjmc-rp@jointsec.nt.ca
Website: www.fjmc.ca

3.1.3.3 Inuvialuit Game Council

The Inuvialuit Game Council represents the six Hunters and Trappers Committees of the ISR.

The Hunters and Trappers Committees may maintain the following datasets:

Beluga

- Annual Harvest Data for their own community
- Community Conservation Plan for each community

Arctic char

- Annual char harvest for their own community (if applicable)
- Community Conservation Plan for each community

Arctic cod

- Community Management Plan for each community(if relevant)
- Community Conservation Plan for each community

Contact Information:

Inuvialuit Game Council
107 MacKenzie Road
Inuvik, NT
X0E 0T0

Aklavik Hunters and Trappers Committee
P.O. Box 133
Aklavik, NT X0E 0A0
Phone: (867) 978-2723
Fax: (867) 978-2815
ahtc@airware.ca

Inuvik Hunters and Trappers Committee
P.O. Box 1720
Inuvik, NT X0E 0T0
Phone: (867) 777-3671
Fax: (867) 777-2478
inuvikhtc@hotmail.com

Olokhaktomiut Hunters and Trappers Committee
Box 161
Ulukhaktok, NT X0E 0S0
Phone: (867) 396-4808
Fax: (867) 396-3025
ohtc2010@hotmail.com

Paulatuk Hunters and Trappers Committee
Box 39
Paulatuk, NT X0E 1N0
Phone: (867) 580-3004
Fax: (867) 580-3404
phtc@live.ca

Sachs Harbour Hunters and Trappers Committee
Box 79
Sachs Harbour, NT X0E 0Z0
Phone: (867) 690-3028
Fax: (867) 690-3616
sachshunters@yahoo.ca

Tuktoyaktuk Hunters and Trappers Committee
P.O. Box 286
Tuktoyaktuk, NT X0E 1C0
Phone: (867) 977-2457
Fax: (867) 977-2433
tuk.htc@gmail.com

3.1.3.4 Aboriginal Affairs and Northern Development Canada (AANDC)

As stated on their website (www.aadnc-aandc.gc.ca) Aboriginal Affairs and Northern Development Canada (AANDC) supports Aboriginal people (First Nations, Inuit and Métis) and Northerners in their efforts to:

- improve social well-being and economic prosperity;
- develop healthier, more sustainable communities; and
- participate more fully in Canada's political, social and economic development - to the benefit of all Canadians.

AANDC has been involved in the following relevant projects in the Beaufort Sea:

- Beaufort Regional Environmental Assessment (BREA) program
- Northern Contaminants Program (NCP)

3.1.3.5 Polar Data Catalogue

The Polar Data Catalogue is an online repository of research related to both arctic and Antarctic research. It provides metadata and contact information for data sets from these regions. Metadata for both BREA and arctic Net projects, as well as academic projects, are available within it. Data for some projects may also be available.

Metadata and contact information for various projects completed in the Beaufort Sea region is available on the Polar Data Catalogue.

Contact info:
ArcticNet Administrative and Data Coordinator
pdc@arcticnet.ulaval.ca
418.656.2131 x 2411

3.1.3.6 ArcticNET

ArcticNET is a collaborative organization which brings together scientists and managers in the natural, human health and social sciences with their partners from Inuit organizations, northern communities, federal and provincial agencies and the private sector, in order to study the impacts of climate change and modernization in the coastal Canadian arctic.

Metadata and contact information for projects completed under ArcticNET is available on the Polar Data Catalogue.

Contact info:
ArcticNet Inc.
Pavilion Alexandre-Vachon, Room 4081
1045, avenue de la Médecine,
Université Laval
Québec, QC Canada G1V 0A6
T: +1-418-656-5830
F: +1-418-656-2334
E: arcticnet@arcticnet.ulaval.ca

3.1.3.7 National Energy Board

The National Energy Board reviews environmental assessment reports prepared for proposed projects in the Beaufort Sea. These reports may contain baseline data relevant to belugas, arctic cod, and arctic char.

Environmental Assessment reports for projects reviewed by the NEB are available on their website (https://www.neb-one.gc.ca/index-eng.html).

Contact info:
National Energy Board
517 Tenth Avenue SW
Calgary, Alberta T2R 0A8
Telephone: 403-292-4800
Toll free: 1-800-899-1265
Fax: 403-292-5503

3.1.3.8 Scientific Literature

Various studies related to Beluga, Artic cod, and arctic char have been published in the scientific literature. Databases which may provide links to relevant materials are provide below, as well a scientific journals known to have published relevant articles in recent years.

Databases include:

- Inuvialuit Settlement Region Database

- DFO's WAVES
- Google Scholar

DFO/ Fisheries Publications:

- DFO Science Stock Status Reports
- Canadian Stock Assessment Secretariat Research Document

Scientific journals which may publish relevant materials include:

- ARCTIC
- Chemosphere
- Science of the Total Environment
- Canadian Journal of Fisheries and Aquatic Sciences
- Journal of Mammalogy
- Acoustical Physics
- International Whaling Commission
- Aquatic Conservation: Marine and Freshwater Ecosystems
- Journal of the Fisheries Research Board of Canada
- Canadian Bulletin of Fisheries and Aquatic Science
- Polar Biology
- Environmental Chemistry
- Fisheries and Marine Service Technical Report
- Cognitive Science
- Ecological Applications
- Canadian Technical Report of Fisheries
- Fisheries and Aquatic Science
- Journal of Marine Systems
- Oecologia
- Marine Ecology Progress Series
- Molecular Ecology
- Marine Fisheries Review
- Environmental Studies Research Funds
- Cetology
- Canadian Journal of Zoology
- Cetus

University theses may also provide valuable data.

3.1.4 Ongoing Monitoring

Ongoing beluga monitoring is related to the annual beluga harvest by hunters from communities within the ISR. The FJMC is involved in some level of monitoring at all beluga hunt sites (L. Loseto, pers. comm. 2015). The Hendrickson Island study, which includes contaminant assessment, is expected to be an ongoing study.

There is no current arctic cod monitoring occurring and there do not appear to be any plans for arctic cod monitoring in the Beaufort Sea. DFO has conducted fish stock trawl surveys with the vessel Frosti. This initial work has produced some data, but further work is needed to better understand stock status.

Arctic char will continue to be monitored by DFO, FJMC, and local HTCs during the annual harvest in the Kuujuua and Hornaday Rivers.

3.1.5 Ongoing Research Projects

Other potential sources of short- term data related to beluga include a variety of research projects conducted by academic researchers, environmental non-governmental organizations, and private sector groups (or collaborations between these groups). Due to the high profile of belugas internationally, there is considerable attention paid to belugas in academia.

No ongoing research projects focused on arctic char could be found, aside from the annual harvest monitoring. Lois Harwood at DFO will be preparing an article on arctic char stomach contents in the near future (Harwood, pers comm., 2015).

Polar cod research, led by Dr. Louis Fortier of ArcticNet, has been carried out on board the CCGS Amundsen in the Beaufort Sea since 2002, in collaboration with Fisheries and Oceans Canada and BREA. Additional research may occur in future years, though this is presumably dependent on funding.

3.2 Economic - Employment

The employment rate is intrinsically connected to the average economic situation of individuals within a population. Employment is a relationship between two parties where one party (employer) hires the other (employee) to contribute labour, or expertise, to an endeavour and to perform specific duties. The Employee is hired to provide services to a company on a regular basis in exchange for financial compensation and does not provide these services as part of an independent business. Employment differs from a livelihood in that a livelihood refers to any and all means of securing the basic necessities - food, water, shelter and clothing- of life. Employment may be part of a livelihood.

3.2.1 Indicators

Nine indicators were identified to support employment as a valued component:

- Employment rate (Part Time, Full Time);
- Type of Job;
- Income (average and by sector);
- Participation rate;
- Employment insurance claims;
- Social assistance;
- Number/type of local business;
- Number of job applications;
- Employment by sector.

3.2.2 Sources of Information

In order to gain a better understanding of the current employment situation in the ISR, several sources of information were identified for each of the indicators. Table 3-2 summarizes the indicators and identified sources of information. Below is a discussion of the role each source of information plays and what information they can provide.

Table 3-2.Selected Indicators and Sources of Information for Employment

Indicators	Confirmed and Potential Sources of Information
Employment rate (Part Time, Full Time)	Statistics Canada • Aboriginal Peoples Survey • Survey of Employment, Payrolls and Hours (SEPH) GNWT - Bureau of Statistics • Socio-Economic Scan GNWT – Education, Culture and Employment GNWT Mine Industry Socio Economic Agreements (SEAs)
Type of Job	GNWT Bureau of Statistics Statistics Canada • Aboriginal Peoples Survey GNWT – Education, Culture and Employment Hunters & Trappers Committees Inuvialuit Game Council Fisheries Joint Management Committee Joint Secretariat Gwich'in Renewable Resources Board Inuvialuit Regional Corporation/Community Corporations Inuvialuit Cultural Resource Centre Gwich'in Social & Cultural Institute GNWT Arts Program GNWT Arts Council Great Northern Arts Festival Fisheries and Oceans Canada GNWT Department of Environment and Natural Resources GNWT – Education, Culture and Employment : Northwest Territories JobsNorth.ca GNWT Nominee Program: GNWT – Education, Culture and Employment : Northwest Territories & GNWT – Industry, Tourism and Investment & Citizenship and Immigration Canada Partnership GNWT – Education, Culture and Employment : Northwest Territories Aboriginal Skills and Employment Partnership (with Building Inuvialuit Potential Society, Mine Training Society) International Qualifications Assessment Service (IQAS) – GNWT – Alberta IQAS Agreement GNWT – Education, Culture and Employment • GNWT Apprenticeship and Occupational Certification (AOC) Program

Indicators	Confirmed and Potential Sources of Information
	GNWT – Education, Culture and Employment & Human Resources and Skills Development Canada (now Service Canada) Partnership: Targeted Initiative for Older Workers (TIOW) Program GNWT Mine Industry Socio Economic Agreements (SEAs)
Income (average and by sector)	GNWT -Bureau of Statistics Statistics Canada • Aboriginal Peoples Survey Hunters & Trappers Committees Inuvialuit Game Council Fisheries Joint Management Committee Inuvialuit Regional Corporation/Community Corporations
Participation rate	GNWT Bureau of Statistics Statistics Canada • Aboriginal Peoples Survey GNWT – Education, Culture and Employment Hunters & Trappers Committees Inuvialuit Game Council Fisheries Joint Management Committee Inuvialuit Regional Corporation/Community Corporations GNWT Nominee Program: GNWT – Education, Culture and Employment : Northwest Territories & GNWT – Industry, Tourism and Investment & Citizenship and Immigration Canada Partnership GNWT – Education, Culture and Employment : Northwest Territories Aboriginal Skills and Employment Partnership (with Building Inuvialuit Potential Society, Mine Training Society) GNWT Mine Industry Socio Economic Agreements (SEAs)
Employment Insurance Claims	Statistics Canada GNWT Bureau of Statistics
Social Assistance	GNWT Health & Social Services (GNWTHSS)
Number/Type of Local Business	Statistics Canada GNWT Bureau of Statistics Inuvialuit Game Council Hunters & Trappers Committees GNWT – Education, Culture and Employment : Northwest Territories JobsNorth.ca
Number of Job Applications	GNWT Bureau of Statistics
Employment by Sector	GGNWT Bureau of Statistics Statistics Canada GGNWT – Education, Culture and Employment • Northwest Territories Labour Force Survey/Labour Market Review • Northwest Territories Labour Market Development Agreement • Northwest Territories – Beaufort Delta ECE Service Centre - Labour Market Development Agreement • Northwest Territories JobsNorth.ca

Indicators	Confirmed and Potential Sources of Information
	• GNWT Nominee Program: GNWT – Education, Culture and Employment : Northwest Territories & NWT – Industry, Tourism and Investment & Citizenship and Immigration Canada Partnership • Northwest Territories Aboriginal Skills and Employment Partnership (with Building Inuvialuit Potential Society, Mine Training Society) NWT Mine Industry Socio Economic Agreements (SEAs)

The following subsections provide a description of each source of information.

3.2.2.1 GNWT Department of Education, Culture and Employment (GNWTECE)

The GNWTECE is a governmental branch that encompasses many programs and services. The mandate of this department is to invest in and provide for the development of the NWT. Goals include:

- Promoting and enhancing the culture and languages of the people of NWT;
- Ensuring access to learning opportunities for the people of NWT; and
- Ensuring that the people of NWT acquire the knowledge and skills needed to make informed choices.

The GNWT Department of Education, Culture and Employment is broken into several divisions, including:

- Advanced Education;
- Culture and Heritage;
- Education Operations and Development;
- Early Childhood and School Services;
- Income Security;
- ECE Service Centres;
- Official Languages and,
- Employment (Employees and Employers).

Of particular interest to this Project are the programs offered by the Employment Division.

GNWTECE Canada–Northwest Territories Job Fund

The Canada-Northwest Territories Job Fund (formally known as the Labour Market Agreement) expands on the programs and services already offered through the Department of Education, Culture and Employment. The Canada-Northwest Territories Job Fund will support the development of workplace skills and skills development training, and introduces the new Canada-Northwest Territories Job Grant.

The Canada-Northwest Territories Job Grant is an employer-driven approach to help northern residents obtain the skills and training required to fill available jobs. The first annual report with associated results data should be available in 2015.

The NWT Department of Education, Culture and Employment maintains the following datasets:

- NWT Job Futures Program provides lists of occupation and in demand jobs.
- Work place skills and skills development training data – support through the Canada-Northwest Territories Job Fund (formerly known as the Labour Market Agreement) and Job Grant.
- Targeted Initiative for Older Workers.
- Programs to Support Training; Training-on-the-Jo; 3rd Party Career Development; Self-Employment; Persons with Disabilities; Skilled newcomers through the NWT Nominee Program.

Contact Information:
GNWT Department of Education, Culture and Employment
P.O. Box 1320
Yellowknife NT X1A 2L9
Email: ecepublicaffairs@gov.nt.ca
Website: http://www.ece.gov.nt.ca/

Regional Service Centre
Beaufort Delta ECE Service Centre
Department of Education, Culture and Employment
BAG SERVICE #1
INUVIK NT X0E 0T0
Toll Free: 1-855-283-9311
Telephone: (867) 777-7365
Fax: (867) 777-7218

3.2.2.2 Statistics Canada

Under the Statistics Act, Statistics Canada is required to "collect, compile, analyse, abstract and publish statistical information relating to the commercial, industrial, financial, social, economic and general activities and conditions of the people of Canada." Statistics Canada's two main objectives are:

- To provide statistical information and analysis about Canada's economic and social structure; and
- To promote sound statistical standards and practices.

Statistics Canada maintains the following datasets for the communities in the ISR:

- Wages, salaries and other earnings;

Number of Aboriginal persons aged 15 years and over

- In the labour force;
- Employed;
- Unemployed
- Not in the labour force;
- Participation rate;
- Employment rate;
- Unemployment rate;
- By class of worker - not applicable;
- By class of worker – employee;
- By class of worker – self-employed;
- By occupation – not applicable;
- By occupation – management; business, finance & administration; natural and applied sciences; health; education, law and social, community and government services; art, culture, recreation and sport; sales and service; trades, transport and equipment operators; natural resources, agriculture and related production; manufacturing and utilities.
- By North American Industry Classification System (NAICS);
- By Work Activity – number of weeks worked;
- By Full Time and Part Time capacity;
- By Place of Work Status (worked at home; outside Canada; no fixed workplace address)
- Mode of transportation taken to work (car, truck, van – as driver/as passenger)/(public transit, walked, biked, other);
- Shelter costs;
- Income; with and without income;
- By household income;
- By personal income.

Contact Information:
Statistics Canada
Toll Free: 1-800-622-6232
Website: http://www.canada.ca/en/gov/dept/statistics.html

3.2.2.3 GNWT Bureau of Statistics

The GNWT Bureau of Statistics has overall responsibility for the territorial government's statistical program. To fulfill this role, the Bureau of Statistics:

- Develops, interprets and disseminates the economic, social and demographic statistics required by the government;

- Implements statistical programs for territorial government purposes and provides statistical advice and assistance to departments, regional offices and central agencies;
- Coordinates statistical activities within the government to minimize the duplication of statistical effort and to help ensure that the statistics used by the government are current, consistent and accurate; and
- Provides for the continuing and effective representation of territorial statistical interests within the national statistical system.

The NWT Bureau of Statistics maintains the following datasets by community in the ISR:

- 2015 Labour Force Survey, January 2015;
- NWT Labour Force Activity, 2001-2014;
- NWT Employment by Industry and Occupation, 2001 – 2014;
- Labour Force Activity by Province and Territory, 2001 – 2013;
- Community Labour Force Activity, 1986 to 2011;
- Labour Force Activity by Education, 2011;
- Labour Force Activity by Gender and Age, 2006-2011;
- Labour Force Activity by Detailed Industry and Gender, 2011.

Contact Information:
GNWT Bureau of Statistics
Government of the Northwest Territories
P.O. Box 1320
Yellowknife NT X1A 2L9
Telephone: (867) 873-7147
Fax: (867) 873-0275
Website: http://www.statsnwt.ca/

NWT Bureau of Statistics - Community statistical profiles

Aside from supporting users with the NWT Data Portal, the NWT Bureau of Statistics conducts community surveys on Housing, Labour Force Activity and Traditional Activities and Language. Community profiles are available for each of the 33 Northwest Territories' communities. Profiles are updated throughout the year as new data becomes available. A publication containing all communities, regional and geographic summaries are also available.

Statistical Profiles and *Community at a Glance* data are available for every community. Employment specific statistical profiles for each community include data on Income Assistance by Beneficiary, Case and Payment; on Labour Force by Participation Rate, Unemployment Rate,Employment Rate, Employment Profile, Annual Work Pattern; on Personal Income by Total Income, Personal Average Income, Employment Income, % Change in Employment Income, Average Employment Income,

Percent Taxfilers Less than $15,000; Percent Taxfilers More than $50,000; on Family Income by Average Family Income, Percent Families Less than $30,000, Percent Families More than $75,000.

Community at a Glance data provides community employment specific survey data, presented in graph and summary format, on Employment Rates and Labour Force Activity by Population, Gender and Aboriginal/Non-Aboriginal.

Inuvialuit specific data sets for accountability to beneficiaries are available on the NWT Portal. Users can access the NWT Portal and the NWT Bureau of Statistics for employment specific data on Inuvialuit communities. Community specific data includes

- Income Assistance,
- Labour Force Activity,
- Personal Income,
- Family Income and,
- Employment Rates.

Contact Information:
Senior Analyst
NWT Bureau of Statistics
Government of the Northwest Territories
P.O. Box 1320
Yellowknife NT X1A 2L9
Telephone: (867) 920-3226
Email: jill_herbert@gov.nt.ca
Website: http://www.statsnwt.ca

3.2.2.4 GNWT Department of Industry, Tourism and Investment (GNWTITI)

The GNWT Department of Industry, Tourism and Investment's vision is to promote:

- Development that reduces regional and community disparities;
- Working with regional business corporations and other partners to identify new economic opportunities;
- Advancing alternative energy initiatives; and
- Supporting the development of local economies through small businesses and community-based sectors.

The Government of the Northwest Territories Department of Industry, Tourism and Investment (GNWTITI) is responsible for the administration of onshore oil and gas interests in the Northwest Territories, including the Inuvialuit Settlement Region. Interests issued in the offshore are the responsibility of Aboriginal Affairs and Northern Development Canada. GNWTITI has a mandate to

promote economic self-sufficiency through economic diversification, which includes mineral and oil & gas development. GNWTITI is responsible for:

- Petroleum resources policy;
- Petroleum resources exploration and development;
- Intra-territorial pipeline regulation;
- Benefit plans;
- Royalties; and,
- Securities.

As such, it has responsibility for negotiating, overseeing and reporting on Social Economic Agreements (SEAs) on behalf of the territorial government.

3.2.2.5 IRC – NWT Bureau of Statistics Partnership - Inuvialuit Indicators Project & the Inuvialuit Indicators Online Data Portal

The Inuvialuit Indicators Project attempted to measure the achievement of Inuvialuit Final Agreement (IFA) goals; to determine social, cultural and economic impacts from resource development; and, to monitor Inuvialuit and government efforts to improve conditions. The Project reports on twenty years of data sourced from the Inuvialuit Regional Corporation's (IRC) Inuvialuit Indicators Database. The IRC Inuvialuit Indicators Database is an online database that was developed to track Inuvialuit and Inuvialuit community changes over time.

All factors and issues culminated in the IRC Indicators Project. This project involves: reviewing other social, cultural and economic monitoring systems and research in related Arctic/northern contexts; developing relationships with the NWT Bureau of Statistics, Statistics Canada and academia; assembling a baseline of existing data for the Inuvialuit Region and identifying data gaps; and designing an online portal to provide access to and efficient maintenance of baseline data. An Indicators Master File and online portal have been developed. The online portal is available at http://inuvialuitindicators.com.

Long term commitment to both the partnership and the project is further supported by the joint IRC/NWT Bureau of Statistics career position created to develop indicators based on departmental administrative data.

The online Inuvialuit Indicators database includes data on population, education, culture, labour force, wellbeing, income, government and housing indicators. Users can search the database by indicator, (*e.g.*, Labour Force indicators: employment rate, unemployment rate, participation rate, percentage working 26-plus weeks, percentage distribution of skill types in employed population) by Nation/Territory (*e.g.*, Canada/Northwest Territories), by Inuvialuit Region (i.e., Inuvialuit Region, Aboriginal Persons, Inuvialuit/Inuit, Inuvialuit Beneficiaries) and, by Inuvialuit Community (*i.e.*, Aklavik, Inuvik, Paulatuk, Sachs Harbour, Tuktoyaktuk, Ulukhaktok).

Contact Information:
Inuvialuit Regional Corporation
Bag Service #21, Inuvik, NT X0E 0T0
Telephone: (867) 777-7022
Email: jjohnston@irc.inuvialuit.com
Website: http://www.irc.inuvialuit.com

NWT Bureau of Statistics
Government of the Northwest Territories
P.O. Box 1320
Yellowknife NT X1A 2L9
Telephone: (867) 920-3226
Email: jill_herbert@gov.nt.ca
Website: http://www.statsnwt.ca

3.2.2.6 Fisheries and Oceans Canada

Fisheries and Oceans Canada (DFO) is the lead federal body managing Canada's fisheries and protecting its waters. DFO's mission is to ensure:

- Economically Prosperous Maritime Sectors and Fisheries;
- Sustainable Aquatic Ecosystems; and
- Safe and Secure Waters.

To provide for the harvest of fish for food, social or ceremonial (FSC) purposes and related activities, the Minister of Fisheries and Oceans issues communal fishing licences under the Aboriginal Communal Fishing Licences Regulations to Aboriginal groups. Communal fishing licences may specify fishing area, times, species, allocations, methods or other restrictions. Only an individual who has been designated by an Aboriginal group may harvest fish for FSC purposes under the terms of the Aboriginal group's communal fishing licence.

DFO maintains a database and library with publications for harvesting data. The harvest data provides:

- Estimated harvest, selected species as well as other harvested species reported.
- Hunter response, and number of hunters harvesting selected species.

DFO also maintains a list of quota and license data for applicable aquatic species.

Management Plans are also developed by DFO and provide information on each identified aquatic species such as:

- Stock Assessment, Science and Traditional Knowledge;
- Economic, Social and Cultural Importance;
- Governance Process;
- Access and Allocations; and
- Compliance Plan.

Contact Information:
Fisheries and Oceans Canada
Communications Branch
200 Kent Street, 13th Floor, Station 13E228
Ottawa Ontario K1A 0E6 Canada
Telephone: (613) 993-0999
Fax: (613) 990-1866
Email: info@dfo-mpo.gc.ca
Website: http://www.dfo-mpo.gc.ca/

Fisheries and Oceans Canada
PO Box 1871
Inuvik, NT X0E 0T0
Telephone: (867) 777-7500

3.2.2.7 Fisheries Joint Management Committee

The Fisheries Joint Management Committee (FJMC) assists the Minister of Fisheries and Oceans in the management of fisheries, and provides advice on all matters affecting settlement region fisheries (Indian and Northern Affairs Canada 1998). Their mission is to "ensure that the renewable marine, anadramous and freshwater resources of the ISR are managed and conserved for the wise use and benefit of present and future generations" (FJMC 2015).

The FJMC works closely with government agencies, renewable resource user groups in the Inuvialuit communities, and other renewable resource boards in Canada and Alaska which oversee common migratory stocks. In keeping with the co-management philosophy of the IFA, consultation with local

HTCs, the IGC, DFO and other government agencies is an important activity for the FJMC (Indian and Northern Affairs Canada 1998).

The FJMC maintains the following datasets related to ability to harvest in the ISR:

- List of registered fishing licenses.
- Successful fishing areas.
- Stock status reports.
- Fishing and management plans.

Contact Information:
Fisheries Joint Management Committee
PO Box 2120
Inuvik, NT
X0E 0T0
Telephone: (867) 777-2828
Fax: (867) 777-2610
Email: fjmc-rp@jointsec.nt.ca
Website: http://www.fjmc.ca/

3.2.2.8 Gwich'in Renewable Resource Board

The Gwich'in Renewable Resource Board (GRRB) was established to be the main instrument of wildlife, fish and forest management in the Gwich'in Settlement Area. The GRRB in involved in a variety of activities and provides consultation on:

- Limitations of harvest;
- Setting Gwich'in Needs Levels;
- Approvals of management plans;
- Advising the government;
- Making decisions on commercial harvesting; and
- Setting research priorities in the GSA.

The Gwich'in Renewable Resource Board also assists in the development of Management Plans for Wildlife & Habitat as well as Fisheries.

The Gwich'in Renewable Resource Board maintains the following data for communities in the Gwich'in Settlement Area (which includes Inuvik and Aklavik):

- Number of harvesters by community.
- Species harvested.
- Harvest numbers.
- Hunter/trapper observations.

Contact Information:
Gwich'in Renewable Resources Board
PO Box 2240
2nd Floor, Alex Moses Greenland Building
105 Veterans' Way (formerly Distributor Street)
Inuvik, NT X0E 0T0
Telephone: (867) 777-6600
Fax: (867) 777-6601
Email: office@grrb.nt.ca
Website: http://www.grrb.nt.ca

3.2.2.9 Socio-Economic Agreements

In the Northwest Territories (NWT), when an environmental assessment takes place for a major resource development project, the territorial government requires follow-up programs to be put in place in the form of socio-economic agreements (SEAs). The GNWTITI is responsible for negotiating SEAs on behalf of the territorial government.

SEAs set out the commitments and predictions made by the company during its environmental assessment including:

- Employment and business opportunities;
- Cultural well-being and traditional economy;
- Community, family, and individual well-being;
- Net effects on government; and
- Sustainable development.

Socio-economic agreements are in place for the following projects:

- DeBeers Gahcho Kué Project;
- Canadian Zinc Prairie Creek Mine;
- Dominion Diamond (formerly BHP) Ekati Mine;
- Diavik Diamond Mine;
- DeBeers Snap Lake Project; and
- Mackenzie Gas Project.

The purpose of the agreements is to establish the methods and procedures by which:

- Parties will work together to maximize the beneficial opportunities, identify the impacts, and minimize and mitigate the negative socio-economic impacts arising from the projects;

- Parties will work together to facilitate adaptive management in response to the monitoring data collected and reported by the parties in order to continually improve the implementation of the agreements; and
- The implementation of commitments made regarding socio-economic issues arising from the project and the agreements will be monitored by the GNWT.

For example, through the terms of its SEAs, industry may be required to provide annual reports on issues such as employment and spending in the territory. SEA reports outline the mine's activities and include the mine's safety reports (*i.e.,* reportable injuries, time lost), socio-economics (*i.e*., employment by priority group), the mine's recruitment initiatives, spending (total, northern, Aboriginal people), and its operational and training activities.

The NWT Department of Industry, Tourism and Investment maintains the following datasets with respect to the programs they administer:

- List of Program participants.
- Participant communities.
- Program objectives and outcomes.
- Negotiation, implementation and reporting on Social Economic Agreements.

Contact Information:
GNWT Department of Industry, Tourism and Investment
Beaufort Delta Region
2nd Floor Semmler Building
P.O. BOX 2589
Inuvik NT X0E 0T0
Telephone: (867) 777-7196
Fax: (867) 777-7321
Website: http://www.iti.gov.nt.ca

Canadian Zinc Corporation
9926 101 Avenue
Fort Simpson, Northwest Territories
X0E 0N0
Telephone: (867) 695-3963
Website: www.canadianzinc.com

ConocoPhillips Canada
Gulf Canada Square
P.O. Box 130, Station M
401 - 9th Ave SW
Calgary, AB T2P 2H7
Phone: (403) 233-4000
Email: cpcsustainabledevelopment@conocophillips.com
Website: http://www.conocophillips.ca/

De Beers Canada – NWT Projects
300-5120 49th Street
Yellowknife, NT, X1A 1P8
Telephone: (867) 766-7300
E-mail: info@debeerscanada.com
Website: https://www.canada.debeersgroup.com/

Dominion Diamond Corporation
#1102 4920 - 52nd Street
Yellowknife, NT X1A 3T1
Telephone: (867) 669-6100
Website: www.ddc.corp.ca

Imperial Oil Resources Ventures Limited
Exploration Project Manager
Beaufort Sea Exploration Joint Venture
237 Fourth Avenue South West
PO Box 2480, Station "M",
Calgary, AB T2P 3M9
Telephone: (403) 237-2615
Email: sherry.l.becker@exxonmobile.com
Website: http://www.imperialoil.ca/Canada-English/operations_offshore_beaufort.aspx

Rio Tinto - Diavik Diamond Mines (2012) Inc.
PO Box 2498 Stn Main
#300 Northwest Tower
5201 50th Ave. Yellowknife, NT, X1A 2P8
Telephone: (867) 669-6500
Website: http://www.riotinto.com

3.2.2.10 Hunters and Trappers Committees

Each of the six communities that make up the ISR has a Hunters and Trappers Committee (HTC) (Indian and Northern Affairs Canada 1998). Each Hunter and Trappers Committee has a Community Conservation Plan which were prepared in 2008 through a concerted effort between each ISR community, the NWT Wildlife Management Advisory Council and the Joint Secretariat. These plans contain an overview of the current conservation and resource management system in the ISR and describe the strategy to address the following five broad goals:

- To identify important wildlife habitat and seasonal harvesting areas and make recommendations for their management.
- To describe a community process for land use decisions and managing cumulative impacts which will help protect community values and the resources on which priority lifestyles depend.
- To identify educational initiatives for the Inuvialuit of Inuvik and others interested in the area which will promote conservation, understanding and appreciation.

- To describe a general system of wildlife management and identify population goals and conservation measures appropriate for each species of concern in the planning area using the knowledge of community and others with expertise.
- To enhance the local economy by adopting a cooperative and consistent approach to community decision- making and renewable resource management.

Each Hunter and Trappers Committee maintains a list of active and inactive hunters/trappers in the community. Although they support harvest study programs, they do not, however, maintain harvest data (Inuvik Hunters and Trappers Committee 2015, pers. comm.).

Contact Information:
Aklavik Hunters and Trappers Committee
P.O. Box 133
Aklavik, NT X0E 0A0
Telephone: (867) 978-2723
Fax: (867) 978-2815
Email: ahtc@airware.ca

Inuvik Hunters and Trappers Committee
P.O. Box 1720
Inuvik, NT X0E 0T0
Telephone: (867) 777-3671
Fax: (867) 777-2478
Email: inuvikhtc@hotmail.com

Olokhaktomiut Hunters and Trappers Committee
Box 161
Ulukhaktok, NT X0E 0S0
Telephone: (867) 396-4808
Fax: (867) 396-3025
Email: ohtc2010@hotmail.com

Paulatuk Hunters and Trappers Committee
Box 39
Paulatuk, NT X0E 1N0
Telephone: (867) 580-3004
Fax: (867) 580-3404
Email: phtc@live.ca

Sachs Harbour Hunters and Trappers Committee
Box 79
Sachs Harbour, NT X0E 0Z0
Telephone: (867) 690-3028
Fax: (867) 690-3616
Email: sachshunters@yahoo.ca

Tuktoyaktuk Hunters and Trappers Committee

P.O. Box 286
Tuktoyaktuk, NT X0E 1C0
Telephone: (867) 977-2457
Fax: (867) 977-2433
Email: tuk.htc@gmail.com

3.2.2.11 Hydrocarbon Impacts (HI) Database

The Hydrocarbon Impacts (HI) Database is an online database portal where users can access up to 8800 publications and research projects about the environmental impacts, socio-economic effects and regulation of hydrocarbon exploration, development and transportation in northern Canada.

Users can search the HI Database by Record Type (i.e., Publication, Research Project), by Title or Abstract, Subject Code, Geographic Code, Author, Year, and, Report Group. A socio- economic search on employment in the Beaufort geographic region resulted in publications specific to the impacts of offshore oil and gas exploration, the impacts of offshore drilling, the impacts associated with the potential Tuktoyaktuk harbor development, the Tuktoyaktuk all- weather road and, the Beaufort Regional Environmental Assessment (BREA) initiative/project.

The Hydrocarbon Impacts database is maintained for Aboriginal Affairs and Northern Development Canada by the Arctic Science and Technology Information System (ASTIS) at the Arctic Institute of North America, University of Calgary.

Socio-economic data specific to the Beaufort geographic area is available in the form of Publications and/or Research Projects. Data is embedded within the Publications and/or Research Project reports.

Contact Information:
ASTIS Arctic Institute of North America
University of Calgary
Calgary, AB T2N 1N4
Telephone: (403) 220-4033
Email: astis@ucalgary.ca
Website: http://www.aina.ucalgary.ca/hi/

http://inuvialuitindicators.com

3.2.2.12 Inuvialuit Settlement Region Database

The Inuvialuit Settlement Region Database contains descriptions of 12,800 publications and research projects about the Inuvialuit Settlement Region in the Northwest Territories and Yukon. The database is maintained by the Joint Secretariat - Inuvialuit Renewable Resource Committees and the Arctic Science and Technology Information System (ASTIS), and is funded by Shell Canada, MGM Energy, ConocoPhillips Canada and Chevron Canada.

Users can search the online database by record type, title or abstract, subject code (e.g., Government and Socio-economic conditions), geographic code (*e.g.*, Whole ISR or Beaufort Sea), community (*e.g.,* Aklavik), author, year, and research program.

Users can query the Inuvialuit Settlement Region Database by author, year, research program, employment as a subject, government and socio economic condition, 'Whole ISR' and/or Beaufort Sea geographic region and by Inuvialuit community. Search results provide access to publications and research project reports with employment data embedded in the reporting.

Contact Information:
Joint Secretariat - Inuvialuit Renewable Resource Committees
107 Mackenzie Road, Suite 204
PO Box 2120 Inuvik, NT X0E 0T0
Telephone: (867) 777-2828
Email: adminjs@jointsec.nt.ca
Website: http://www.aina.ucalgary.ca/isr/

3.2.2.13 Petroleum and Environmental Management Tool (PEMT)

The Petroleum and Environmental Management Tool (PEMT) is an online geospatial database that displays generalized environmental and socio-economic information for selected Arctic regions to inform decisions about oil and gas exploration and land management. Extensive data is available for the Beaufort Sea and Mackenzie Delta the High Arctic Region and the Eastern Arctic geographic regions. Data is captured and displayed as map layers.

Map layers specific to geo-economic data include petroleum potential, geological uncertainty, and economics of development. The petroleum potential and geological uncertainty layers have been developed and provide a broad base of data. The economics of development layer, which includes those indicators associated with employment, have not been completed and as such, are not currently available.

The PEMT online geospatial database Geo-economic – Economics of Development data layer is in the process of being built therefore is currently unavailable.

Contact Information:

A Petroleum and Environmental Management Tool/Research and Environment
Manager, Research and Environment
Aboriginal Affairs and Northern Development Canada
Northern Petroleum Resources Directorate
Northern Petroleum and Mineral Resources Branch
10 Wellington
Ottawa, ON K1A 0H4
Telephone: (819) 953-3939
Website: http://www.aadnc-aandc.gc.ca/eng/1100100036632/1100100036636

3.2.2.14 Polar Data Catalogue

The Polar Data Catalogue (PDC) is an online database of metadata and data that describes, indexes, and provides access to diverse data sets generated by Arctic and Antarctic researchers. The online PDC has been customized to provide an option for standard Internet speed browsers (*i.e.*, PDC Geospatial Search) and for limited Internet speed browsers (*i.e.,* PDC Lite).

Subscribed users can also access the PDC Metadata and Data Entry portal where they can access raw metadata and/or upload additional data.

A preliminary search on potential sources of employment information specific to the Inuvialuit resulted in access to interview data (audio) on employment in the wage economy, food security, and effects on the traditional economy in Paulatuk NWT, April 2008 to August 2009. Interviews provided oral data on employment, harvesting, dietary patterns and social networks in the Inuvialuit Settlement Region as well as data on participant's perceptions of their experience and relationship with both the wage economy and traditional economy.

The PDC is maintained by the Canadian Cryospheric Information Network in partnership with ArcticNET Incorporated.

Data and metadata on employment in the Inuvialuit Settlement Region and within the Beaufort region is available in a variety of formats including audio. Subscribed users can download metadata and upload new data sets into the Polar Data Catalogue.

Contact Information:
ArcticNet Administrative and Data Coordinator
ArcticNet Inc.
Pavillon Alexandre-Vachon, Room 4081
1045, avenue de la Médecine
Université Laval
Québec, QC G1V 0A6
Project Email: pdc@arcticnet.ulaval.ca
Email: Email: colline.gombault@arcticnet.ulaval.ca
Telephone: (418) 656-2131 x 2411
Website: https://polardata.ca/pdcsearch/

3.2.2.15 Industry

Industry driven data exists however, it is difficult to identify and access. Data summaries are published in private company (*e.g.,* Diavik), industry organization (*e.g*., Mining Matters) and/or industry-government partnership organization (*e.g*., MiHR) annual or progress reports.

The following highlights a few of these organizations with a focus on reported employment- specific data.

Industry-Government Initiative: Mining Industry Human Resources Council (MiHR)

The Mining Industry Human Resources Council (MiHR) is a national sector council for the Canadian minerals and metals industry funded in part by the Government of Canada's Sector Council Program. MiHR collaborates among communities of interest to address emerging human resources opportunities and challenges and partnership with organizations representing mining industry employers; national and provincial mining associations/institutes; national organized labour groups representing workers in mining; federal, provincial and territorial governments; post-secondary education and technical institutions and; Aboriginal and other interest groups.

MiHR Aboriginal Mining Education Forum

Identified issues and barriers related to Aboriginal education and in turn employment, as related to HR management in mining and mineral exploration, and to the economic development of Aboriginal communities (First Nations, Métis and Inuit).

Industry participants included BHP Billiton Canada Inc., Cameco Corporation, De Beers Canada Inc., IAMGOLD Corporation, The Iron Ore Company of Canada (IOC), Noront Resources Ltd., Teck Resources Limited and, Vale Limited. Delegates were involved in a collaborative experience where ideas, information and contacts were shared in the Forging Stronger Pathways to Education and Employment: A Report from the Proceedings of the Aboriginal Mining Education Forum report. While no hard statistics are available in this report, recommendations from the Forum point to a need to either source prior data, collect current data and/or track progress and associated data.

Forum recommendations directly related to employment include commitments to:

- Listen and build customized solutions based on each community's needs;
- Develop connections early among education, industry and communities to inform and support Aboriginal learners in their pursuit of careers in mining;
- Critically examine pre-requisite requirements for post-secondary programs and company recruitment policies that may be systemically creating preventable barriers for education and employment entry; and
- Provide flexible work and educational opportunities that take the family unit into consideration.

It is important to consider tracking MiHR reporting mechanisms and making direct contact with the MiHR to determine if there is data that can be sourced to better understand how communities can better prepare for potential resource development.

MiHR Aboriginal Mining Education Forum
Identified issues and barriers related to Aboriginal education and in turn employment, as related to HR management in mining and mineral exploration, and to the economic development of Aboriginal communities (First Nations, Métis and Inuit).

While no hard statistics are available in this report, recommendations from the Forum point to a need to either source prior data, collect current data and/or track progress and associated data.

Contact Information:
Mining Industry Human Resources Council (MiHR)
260 Hearst Way, Suite 401
Kanata, ON, K2L 3H1
Telephone: (613) 270-9696
Website: http://www.mihr.ca

MiHR – Assembly of First Nations, Other Aboriginal Groups, Educators, Other Industry Partnerships: *Mining Essentials*

Mining Essentials was created through a partnership between MiHR and the Assembly of First Nations, other Aboriginal groups, educators and industry members. Mining Essentials is a 12 week pre-employment training program for Aboriginal peoples to learn essential and work readiness skills required for entry-level career opportunities in the mining industry. The program was created to help companies and communities meet joint hiring and employment targets and increase community capacity to support a local, skilled and empowered workforce. Program delivery incorporates classroom teaching, hands-on experiential learning and traditional Aboriginal teaching methods.

Committee members include: Cambrian College, Cameco Corporation, Agnico-Eagle Mines Limited - Goldex, PDAC - Mining Matters, Inuit Tapiriit Kanatami, the Prince George Nechako Aboriginal Employment and Training Association (PGNAETA), Wabun Tribal Council, Métis National Council, Mine Training Society, Mining Association of Canada, Prospectors & Developers Association of Canada, Native Women's Association of Canada, Yukon Mine Training Society, Aboriginal and Northern Affairs Canada, Natural Resources Canada, Sioux Hudson Literacy Council, Jacobs Consultation & Management Services. De Beers Canada, Corona College, Northwest Community College and GoldCorp.

Mining Essentials tracks the following data:

- Number of participants who have secured entry-level jobs in the mining industry career paths of participants.

Contact Information:
Director of Attraction, Retention and Transition
Mining Essentials Program
260 Hearst Way, Suite 401
Kanata, ON, K2L 3H1
Telephone: (613) 270-9696
Website: http://www.aboriginalmining.ca/en/miningessentials/MiningEssentials.asp

Aboriginal Government – Public Government – Industry Partnership: Mine Training Society

The Mine Training Society (MTS) is a partnership between Aboriginal governments, public government and the mining industry with a mandate to support Aboriginal people and Northerners in finding long-term employment in the mining industry. The Mine Training Society evolved from the Ministerial Ad Hoc Committee created to advise the Minister of Education, Culture and Employment as part of the development of initial diamond mine projects in the NWT. Industry partners include Diavik Diamond Mine Inc., BHP Billiton, De Beers Canada, Dominion Diamond Corporation and Procon Mining and Tunnelling. Approximately 50% of MTS' core funding is supported by the Government of Canada's Aboriginal Skills and Employment Partnership (ASEP) through Human Resources and Skills Development Canada (HRSDC).

Since their inception in 2003, MTS has further evolved as a vehicle for delivering training programs to include the evaluation, training and placing of northerners in mining and mining-related jobs and to provide hands-on mentoring and job coaching throughout their careers. MTS' promotes life-long learning by nurturing their relationships with their clients post-graduation.

The Mining Training Society tracks data on:

- 1900 northern applicants who received individual training and/or career counselling;
- 830 applicants have been placed in 'high-paying and fulfilling jobs' – access data to determine income, occupation, retention, location

Contact Information:
Manager, Career and Employment Support
Mine Training Society
5110 49th Street
Yellowknife, NT, X1A 1P8
Email: ao@minetraining.ca
Telephone: 867-765-0445
Website: http://www.minetraining.ca/

Northern Mine Industry Reporting: BHP Billiton EKATI, Rio Tinto Diavik Diamond Mines & DeBeers

Measuring Success – The Positive Impact of Diamond Mining in the Northwest Territories, 1998-2012 (Tabled Document 61-17(4), March 14, 2013) is a joint briefing paper prepared by BHP Billiton EKATI, Rio Tinto Diavik Diamond Mines and, De Beers that reports on monies and efforts spent to support Northern

and Aboriginal businesses, business development, governments (*e.g.*, infrastructure upgrades, social programming, schools, health care), social investment (*e.g.*, recreation facilities, sports teams, cultural activities), employment for Northerners and, job training for Northerners including specific training and support for Aboriginal persons (BHP Billiton EKATI *et al.* 2013).

Measuring Success maintains data related to:

- Northern Diamond Mine Employment for 2011 at the BHP Billiton EKATI Diamond Mine Site (EKATI), the Diavik Diamond Mine Site (DIAVIK) and the De Beers Snap Lake Mine Site (SNAP LAKE);
- Total Spend by Company to support Aboriginal business, 1996 – 2011;
- Diamond Mine Trainees through the end of 2011 for Trades, Apprentices, Underground Miners;
- NWT Mine Training Society 2004 – 2012 # of applicants assessed, # of applicants who have participated in training and # of applicants employed;
- Number of participants who have secured entry-level jobs in the mining industry,
- Career paths of participants.

Contact Information:
The Mining Association of Canada
275 Slater Street
Suite 1100
Ottawa, ON K1P 5H9
Telephone: (613) 233-9392
Website:http://mining.ca/sites/default/files/documents/MeasuringSuccessDiamondBenefitstoNWTMarch2013.pdf

3.2.2.16 NWT Arts Program

The NWT Arts Program is a marketing initiative established in October 2004 and administered by the Government of the Northwest Territories Department of Industry, Tourism and Investment (GNWTITI). A joint initiative between the Department of Education, Culture and Employment and the Department of Industry, Tourism and Investment, the NWT Arts Program represents all artists of the Northwest Territories (NWT) utilizing the following media:

- traditional arts and fine crafts;
- contemporary arts and fine crafts;
- performing arts;
- literary arts; and

- film and media arts.

The NWT Arts Program maintains the following datasets:

- List of artists by area of the NWT.
- List of artists by product.

Contact Information:

The NWT Arts Program
Department of Industry, Tourism and Investment Government of the Northwest Territories
4th Floor Scotia Centre
Box 1320
Yellowknife, NT X1A 2L9
Toll-Free: 1-877-445-2787
Telephone: (867) 920-6130
Fax: (867) 873-0101
E-mail: nwtarts@gov.nt.ca
Website: http://nwtarts.com/

3.2.2.17 Great Northern Arts Festival

The Great Northern Arts Festival is hosted by the Great Northern Art Society with receives both private and territorial government funding. The Festival's goal is to promote the arts in the NWT. Its main objectives are to:

- Foster the education and training of Northern artists regarding all facets of the creation and business of the arts through the establishment of a Northern Arts Festival;
- Hold, where feasible, workshops and seminars during the year which focus on the above aim;
- Promote Northern artists and guests of the Festival and their artwork, primarily through the organization of non-profit exhibitions at which artists may exhibit and sell their work; and
- Do all things incidental to these purposes.

The Great Northern Arts Festival maintains the following datasets:

- List of artists that participate.
- List of products available by participating artists.

Contact Information:

Great Northern Arts Festival
Executive Director
2nd Floor Midnight Sun Complex
P.O. Box 2921, Inuvik, NT X0E 0T0
Telephone: (867) 777-8638

Fax: (867) 777-2017
Email: gnaf@inuvik.ca
Website: http://gnaf.org/

3.2.3 Ongoing Monitoring

Employment an important socio-political issue and many organizations maintain information on changes to the employment condition of communities, sectors and regions. Furthermore, employment is often used as an important benefit for aboriginal communities under the terms and conditions of regulatory required Impact Benefits Agreements for new development projects (mines, pipelines, *etc.*). As a result both government and industry track employment on an ongoing basis.

3.2.3.1 Aboriginal Aquatic Resource and Oceans Management (AAROM) Program (Fisheries and Oceans Canada)

This program provides funding to qualifying Aboriginal groups to establish aquatic resource and oceans management bodies. The goal of AAROM is to help Aboriginal groups to participate effectively in advisory and decision-making processes used for aquatic resource and oceans management (speaks to "availability of resources").

3.2.3.2 Aboriginal Fund for Species and Risk (AFSAR) Program (Fisheries and Oceans Canada)

Program objectives are (speaks to "availability of resources"):

- Implementation by Aboriginal groups of priority recovery actions for species at risk dealing with the:
  - protection of critical or important habitat;
  - management or restoration of critical or important habitat; and
  - conservation of individuals or populations under particular threat(s).
- Implementation by Aboriginal groups of actions to:
  - support conservation planning for multiple species at the watershed scale
  - support monitoring and assessment;
  - support outreach, education and training; and
  - build capacity of Aboriginal organizations to participate in species at risk processes.

3.2.3.3 Socio-Economic Agreements

As noted in Section 3.2.2.7, when an environmental assessment takes place for a major resource development project, the territorial government asks for follow-up programs to be put in place in the form of socio-economic agreements (SEAs). These SEAs are reviewed during project implementation.

3.2.4 Ongoing or Previous Research Projects/Project-Based Monitoring

3.2.4.1 Inuvialuktun Master-Apprentice Program (Inuvialuit Cultural Resource Centre)

The Inuvialuit Cultural Resource Centre sponsors an Inuvialuktun Master-Apprentice Program which consists of a method of learning a language where a fluent speaker of the language (the Master) teaches a language learner (the Apprentice) through language immersion, for at least 10-15 hours per week. During this time, the Master and Apprentice "live life in the language" by doing everyday activities using only Inuvialuktun. The goal of the Program is to have apprentices increase their fluency in speaking and understanding. More information on this program can be found at: https://www.facebook.com/IRCHumanResources/photos/a.255915134509811.42973.228678227233502/575203592580962/.

3.2.4.2 2011 National Household Survey (Statistics Canada)

Between May and August 2011, Statistics Canada conducted the National Household Survey (NHS) for the first time. This voluntary, self-administered survey was introduced as a replacement for the long census questionnaire, more widely known as Census Form 2B. The NHS was designed to collect social and economic data about the Canadian population. The objective of the NHS is to provide data for small geographic areas and small population groups (http://www12.statcan.gc.ca/nhs-enm/2011/ref/nhs-enm_guide/index-eng.cfm). The 2011 NHS provides Aboriginal labour force data.

3.2.4.3 2012 Aboriginal Peoples Survey (2012 and previous) (Statistics Canada)

The Aboriginal Peoples Survey (APS) is a national survey of First Nations people living off reserve, Métis and Inuit aged six years and over. The 2012 APS represents the fourth cycle of the survey and focuses on the topics of education, employment and health. It also collects information on language, income, housing and mobility. The 2012 APS collected information on the education and employment experiences of First Nations People Living off Reserve, Inuit, and Métis. The 2012 APS also provides the percentage of individuals who reported to have hunted, fished, trapped or gathered in previous 12 months by Inuit Region (Inuit population aged 15 and older) and recorded reasons for hunting, fishing, trapping or gathering.

3.3 Social – Education

Education is the transfer of knowledge, skills, beliefs and habits from one group or generation to another. The following sections define the indicators, sources of information, ongoing monitoring programs and ongoing research projects which have been identified as potentially relevant to monitoring education in the Beaufort Sea region.

3.3.1 Indicators

There are many measurements ('indicators') that could provide information on the state of education in the Beaufort Sea region. However, for the Beaufort Sea CEF to be useful, such indicators must consist of easily and regularly-obtained types of information. It is also most efficient to select indicators for which baseline data already exists, in order to allow for comparison to that baseline to detect change (Rice and Rochet 2005).

Six indicators were identified to permit monitoring of education as a Valued Component:

- Early Childhood Development (0-K);
- Grade 12 Completion;
- Professional Development Cluster includes Technical Certification, Adult Education, Enrolment/Completes;
- Post-secondary Completion;
- Literacy; and
- Access/Capacity.

3.3.1.1 Early Childhood Development (0-K)

Early childhood development (0-K) is generally broken down into two groups:

- early childhood programming - infants and preschool aged children; and
- school services programming - children aged 4 or 5 years and up who are attending Kindergarten to Grade 12.

Foundational skills developed at the early learning stage through to Grade 12 are deemed critical to the success of a child's learning at subsequent stages which in turn are critical to the success of building a community's capacity/sustainability to fully participate in the potential future oil and gas sector. Included in the programming is a commitment to recognize and incorporate health and nutrition as being an essential component to a child's success.

Tracking this indicator is critical to better support student success throughout a child's entire school career.

It is also important to support a community's capacity to provide child care options to support single parent and dual parent family's access to employment opportunities. There may also be a potential

increased need for licensed early childhood centres to support oil and gas sector shift-work and dual income employees.

The Government of the Northwest Territories' Department of Education, Culture and Employment (NWTECE) has identified Early Childhood Development as a priority, critically important for the healthy development of all children [between birth and age 5] in the NWT.

3.3.1.2 Grade 12 Completion

Having a well-educated population is directly linked to developing a vibrant knowledge and skills-based NWT economy which in turn, is critical to the success of building a community's capacity to fully participate in the potential future oil and gas sector. Successful completion of Grade 12 is an indicator to determine performance in meeting this objective.

In order to graduate from Grade 12, more formally referred to as Senior Secondary School Graduation, a student must achieve a grade of 50% or higher for each mandatory course and associated credits. A total of 15 credits in English, 10 credits in Social Studies, 10 credits in Mathematics, 10 credits in Science, 3 credits in Fine Arts, 3 credits in Physical Education, 3 credits in Northern Studies and 5 credits in Career & Technology Studies are required to graduate.

While there has been ongoing standardized testing of students in the ISR, this information does not provide direct evidence of Grade 12 completion. That said, understanding trends in standardized test scores may provide insight into the potential for high school completion.

Given the high dropout rates and low graduation rates of aboriginal students throughout the Northwest Territories, tracking and better understanding this indicator is critical to the success of aboriginal youth and their communities. Typically, the oil and gas sector requires candidates for employment to have a minimum of Grade 12 or a college awarded general equivalency diploma (GED).

In 2013, Inuvialuit Regional Council (IRC) undertook a joint research project with Lakehead University to understand why the educational outcomes of Inuvialuit living in the ISR continued to be far behind regional and national averages and what could be done to change this reality (Berger and Johnston 2014). Given this achievement gap, poor K-12 participation and low attendance rates in both elementary and high school, IRC felt it necessary to execute an analysis of the educational needs and challenges for the Inuvialuit in the ISR, particularly for high school students.

3.3.1.3 Professional Development Education

The Professional Development Education indicator includes technical certification, adult education and related information on enrolment/completions.

Community members throughout the Northwest Territories often lack the skills and the GED equivalency to participate in natural resource development employment sectors. It is important to track this indicator to identify gaps in services and up-grading opportunities for aboriginal community members interested in natural resource development sector jobs. By better understanding the data on this indicator, the community, government and industry can better work together to provide the necessary programming to support employment.

3.3.1.4 Post-Secondary Completion

Post-secondary education is formal learning that occurs after Grade 12 completion. Often delivered at universities, colleges, and institutes of technology, higher education is also available through certain college-level institutions, including vocational schools, trade schools, and other career colleges that award academic degrees or professional certifications (http://en.wikipedia.org/wiki/Higher_education, Last updated 11 March 2015). Developing a skills-based NWT economy is critical to the success of building a community's capacity to fully participate in the oil and gas sector. Post-secondary completion not only improves opportunities to secure employment in the natural resource sectors, it opens doors to opportunities for higher paying jobs. In many cases an aboriginal community member is not able to move past entry-level positions solely due to the fact that they do not have the required certification and/or diploma.

3.3.1.5 Literacy

Literacy includes concepts such as reading different types of printed material, writing, speaking, listening, observation, visual representation, numeracy, use of technology, critical thinking and problem solving. Typically, the oil and gas sector requires candidates for employment to have a minimum of Grade 12 or a college awarded general equivalency diploma (GED). Community members throughout the Northwest Territories often lack the literacy skills to pass the GED. Literacy also becomes an issue when applying for jobs.

Adequate literacy skills are crucial to empower NWT residents to become self-reliant and able to fully participate in the labour market.

3.3.1.6 Access/Capacity

Many communities throughout the NWT have experienced barriers to fully access formal educational programming and require additional capacity to participate in resource development activities. Tracking community access issues and capacity needs is a complex and challenging process, however, where implemented, communities have experience benefits through identifying strengths as well as gaps which can be bridged through improved access to existing programs or through development of community specific programs.

Another barrier to high school completion is that one of the ISR communities only offers schooling up tot Grade 9, while five communities do not provide academic programs which provide access to post-secondary education. For many students, this is a serious obstacle in completing high school.

3.3.2 Sources of Information

In order to garner a better understanding of trends in education levels within the Beaufort Sea region, several sources of information were identified for each of the indicators. Table 3-3 lists the indicators and identified sources of information on these indicators. Below is a discussion of the role each source of information plays and details regarding what information it can provide. The discussion also highlights specific programs that support the selected indicators.

Table 3-3. Selected Indicators and Sources of Information for the Education Valued Component

Indicator	Confirmed and Potential Sources of Information
Early Childhood Development (0-K)	GNWT Education Culture and Employment (GNWTECE) GNWT Health and Social Services (GNWTHSS) GNWT Bureau of Statistics (GNWTBS) Community Driven R&D
Grade 12 Completion	GNWTECE GNWT Bureau of Statistics (GNWTBS) Community Driven R&D
Professional Development ◦ **Technical Certification** ◦ **Adult Education** ◦ **Enrolment/Completes**	GNWTECE GNWT Bureau of Statistics (GNWTBS) Aurora College Out of Territory Universities Training Delivery Organizations Unions Industry Community Driven R&D
Post-Secondary Completion	GNWT Bureau of Statistics (GNWTBS) Statistics Canada Aurora College Training Delivery Organizations Industry Out of Territory Universities Community Driven R&D
Literacy	GNWT Bureau of Statistics (GNWTBS) Statistics Canada Community Driven R&D
Access / Capacity	GNWTECE Out of Territory Universities Industry Community Driven R&D

3.3.2.1 GNWT Department of Education, Culture and Employment

The GNWT Department of Education, Culture and Employment (GNWTECE) is a governmental branch that encompasses many programs and services. The GNWTECE is predominantly responsible for the administration of funding for Education under several Federal and Territorial initiatives. The mandate of this department is to invest in and provide for the development of the NWT. Goals include:

- Promoting and enhancing the culture and languages of the people of NWT;
- Ensuring access to learning opportunities for the people of NWT; and
- Ensuring that the people of NWT acquire the knowledge and skills needed to make informed choices.

The NWTECE consists of several divisions, including:

- Advanced Education;
- Culture and Heritage;
- Education Operations and Development;
- Early Childhood and School Services;
- Income Security;
- ECE Service Centres; and
- Official Languages.

The GNWTECE is responsible for providing early childhood programming, elementary and secondary education, and post-secondary education and training to residents of the Northwest Territories to assist them in developing the skills, knowledge, and ability to be self-reliant and to take full advantage of social and economic opportunities.

Of particular interest to the education valued component are the programs offered by Advanced Education, Education Operations and Development and Early Childhood and School Services. Relevant programs are outlined below.

Grade 12 Completion

Aside from being the responsible authority for administering K-12 curriculum, the GNWTECE is responsible for tracking student success, enrolment and graduation. The majority of the program data is supplied to and sourced from the GNWT Bureau of Statistics.

GNWTECE also supports the *Aboriginal Student Achievement Education Plan*. The purpose is to identify strategic actions to eliminate the achievement gap between Aboriginal and other students.

Right from the Start Program

The GNWTECE has partnered with the GNWT Department of Health and Social Services (GNWTHSS, www.hss.gov.nt.ca) to provide the *Right from the Start* Program to support 'parents, grandparents, caregivers and anyone else shaping a child's early development'. More information is available at www.rightfromthestart.ca.

Programming supported by the *Right from the Start* initiative includes the Canada Prenatal Nutrition Program (CPNP), the Healthy Family Program, Fetal Alcohol Spectrum Disorder Programs, Breastfeeding Programs, Dental/Oral Health Programs, Healthy Eating Programs, Injury Prevention Programs, Maternal and Infant-Child Health Programs, Rehabilitation Services, Respite Programs, Child and Family Resource Centres, Early Childhood Education Training, Family Literacy Programs, the Healthy Children Initiative (HCI), Language Nests, and the Early Childhood Program.

The *Right from the Start* program supports contemporary social networking and sharing of experience by providing direct access to a Facebook page (www.facebook.com/nwtrightfromthestart) where parents

and caregivers from across the NWT can share stories, opinions and information. The *Right from the Start* Facebook page is open to the public which enables a broad community the ability to participate in the discussion and to be aware of any upcoming events, surveys, reporting, *etc.* When tracked, Facebook communities can evolve into indirect data sources.

The NWT Department of Education, Culture and Employment maintains the following datasets:

- List of funding programs.
- List of funding applicants and recipients.
- List of interpreters/translators (approved by the Official Languages Division) by language and location within the ISR.

Contact Information:
GNWT Department of Education, Culture and Employment
P.O. Box 1320
Yellowknife NT X1A 2L9
Email: ecepublicaffairs@gov.nt.ca
Website: http://www.ece.gov.nt.ca/

Regional Service Centre
Beaufort Delta ECE Service Centre
Department of Education, Culture and Employment
BAG SERVICE #1
INUVIK NT X0E 0T0
Toll Free: 1-855-283-9311
Telephone: (867) 777-7365
Fax: (867) 777-7218

Early Childhood Education and Kindergarten Program

In March 2012, a population based measure called the Early Development Instrument (EDI) was used across the NWT for the first time to build an understanding of groups of Kindergarten children's development. The EDI is completed yearly by kindergarten teachers and measures developmental changes and trends for groups of children in the following areas: physical health & well-being, emotional maturity, social competence, language & cognitive development and communication & general knowledge. The EDI does not diagnose individual children. The information from the EDI guides decision-making for programs, services and policy making in the early years and provides schools information to guide planning for children in the primary grades (GNWT ECE 2014).

Future EDI data may further support a better understanding of community capacity which in turn may support a better understanding of potential impacts, cumulative or otherwise, on early learning associated with resource development in the Beaufort Region.

Child Care

The GNWTECE Early Childhood Program is responsible for the development of standards, the regulation of child care services, fee subsidy administration, contributions to child care programs and the development of a territorial child care system.

The GNWTECE provides a list of licensed family day homes and childcare centres and provides data on the number of licensed child care spaces by region and community, including data on the percentage of children aged 0-4 years who are without child care (NWTECE, *NWT Licensed Family Day Homes & Child Care Centres*; NWTECE, *NWT Licensed Day Care Centres and Family Day Homes Information Kit*). Table 3-4 is the data provided in the *NWT Licensed Day Care Centres and Family Day Homes Information Kit for 2015.*

Table 3-4. Licensed Childcare Spaces in the NWT

Community/Region	Total # of Licensed Pre-school and Infant Spaces	Estimated # of 0-4 Year Old Children	% of 0-4 Year Old Children without Access to Licensed Access to Licensed Spaces
Beaufort Delta	222	633	65%
Aklavik	17	53	68%
Fort McPherson	27	59	54%
Inuvik	106	339	69%
Paulatuk	14	30	53%
Sachs Harbour	12	6	0%
Tsiigehtchic	0	19	100%
Tuktoyaktuk	23	89	74%
Ulukhaktok	23	38	39%

(Source: *NWT Licensed Day Care Centres and Family Day Homes Information Kit (2015))*

The NWT Department of Education, Culture and Employment's 2015 *NWT Licensed Day care Centres and Family Day Homes Information Kit* provides data on:

- Licensed childcare spaces in the Northwest Territories by Community/Region;
- Licensed childcare spaces in the Northwest Territories by age (pre-school and infant; 0-4 years;
- Percent of children (0-4 years) who are without access to licensed child care spaces in their community/region.

Contact Information:
GNWT Department of Education, Culture and Employment
P.O. Box 1320
Yellowknife NT X1A 2L9
Website: http://www.ece.gov.nt.ca/early-childhood-school-services/early-childhood/early-childhood-program

Beaufort Delta ECE Service Centre
Department of Education, Culture and Employment
Bag Service #1
Inuvik, NT X0E 0T0
Telephone: (867) 777-7365

3.3.2.2 Aurora College

Aurora College is comprised of three regional campuses as well as Community Learning Centres to provide post-secondary education to 33 communities in NWT. Many of its students are Aboriginal from small, remote communities. Aurora College is committed to supporting the development of Northern society through excellence in education, training and research that is culturally sensitive and responsive to the Northern communities.

Programs offered at the college are broad and include certificates, diplomas and degrees.

Aurora College stores its data on student enrolment, graduation, participation in community and industry partnership initiatives, and participation in partnerships supporting upgrading on the Aurora Registrar Student Record System (SRS). Data is not readily available to the public.

The Aurora College 2012-2013 Annual Report outlined a variety of challenges they are facing including increased competition to recruit students using alternate forms and sources of education (*e.g.*, online and distance education at other post-secondary institutions including universities) and increased inefficiencies with student and program data management and dissemination (Aurora College 2014).

The Aurora College Registrar Student Record System (SRS) is identified as a priority challenge, unable to produce consistently accurate data and metrics. Inefficiencies with the SRS make it difficult to meet reporting obligations of funding partners, such as the Canadian Northern Economic Development Agency (CanNor). Other program areas impacted by this challenge include:

Aurora College School of Business & Leadership; School of Education; School of Health & Human Services; School of Arts & Science

Statistics of the number of students who received training are recorded in the SRS.

Aurora College School of Trades, Apprenticeship & Industrial Training

Many of these programs are delivered in conjunction with community and industry partners. Statistics regarding the number of students who received training are recorded in the SRS.

Aurora College Northern Adult Basic Education (NABE) Program

The NABE Program is a multi-year agreement funded by the CanNor. NABE is designed to improve access to basic skills upgrades, including improved literacy and innumeracy, so that working age adults are better positioned to participate in the labour market. Student graduate statistics are recorded in the SRS.

Contact Information:
Aurora College
50 Conibear Crescent, P.O. Box 1290
Fort Smith, NT X0E 0P0
Toll-Free: 1-866-287-2655
Website: http://www.auroracollege.nt.ca

3.3.2.3 Out of Territory Universities - Aboriginal Transition Year Programs

External post-secondary institutions (*e.g.*, colleges and universities (out of territory; online; satellites), particularly those who offer Aboriginal transition programs (*e.g.,* University of Alberta's Aboriginal Transition Year Program), may also provide data specific to prior learning, enrolment, graduation, drop-out rates. The NWT K-0 curriculum is based on Alberta's model therefore, the Alberta post-secondary Aboriginal transition year programs were targeted.

Contact Information:
Transition Year Program (TYP) Coordinator
Aboriginal Student Services Centre
Transition Year Program
2-400 Students' Union Building
8900 - 114 Street
University of Alberta
Edmonton, Alberta, T6G 2J7

Telephone: (780) 492-5677
Email: stbutler@ualberta.ca
Website: http://www.aboriginalservices.ualberta.ca/

Aboriginal Student Access Program Coordinator
Aboriginal Student Access Program
University of Calgary
2500 University Dr. NW
Calgary, Alberta, T2N 1N4
Telephone: (403) 220-5975

Email: asap@ucalgary.ca
Website: http://www.ucalgary.ca/nativecentre/

Coordinator Native Student Advisor
First Nations' Transition Program
University of Lethbridge
4401 University Drive
Lethbridge, Alberta T1K 3M4
Telephone: Phone: 403-317-2812
Email: elizabeth.ferguson@uleth.ca
Website: https://discover.uleth.ca/first-nations-metis-inuit/first-nations-transition-program.ezc

Coordinator
Chinook Lodge Aboriginal Resource Centre
SAIT – The Southern Alberta Polytechnic
Senator Burns Building
1301-16th Avenue NW
Calgary, Alberta, T2M 0L4
Telephone: (403) 210-4527
Email: angela.grier@sait.ca
Website: http://www.sait.ca/aboriginal-students/chinook-lodge-aboriginal-resource-centre.php

Aboriginal Liaison Coordinator
Encana Aboriginal Student Centre
NAIT - The Northern Alberta Institute of Technology
Room: E121
11762 - 106 Street
Edmonton, Alberta, Canada, T5G 2R1
Telephone: (780) 491-3917
Website: http://www.nait.ca/62131.htm

Dechinta Centre for Research and Learning

The Dechinta Centre for Research and Learning provides a series of credited educational programs through the University of Alberta. In addition they provide Teacher programs and Professional

The Dechinta Centre for Research and Learning maintains the following datasets with respect to cultural education:

- List of Indigenous experts, leading professors, local leaders, and elders involved in the programs.
- Student list.
- Participant communities.

Development programs. The programs provide a unique experience through intense classroom and land-based components. One of the main goals of Dechinta is to offer the opportunity for individuals to learn about the environment, politics and history of Denendeh / NWT from indigenous experts, leading professors, local leaders and elders in a co-teaching environment. They also provide opportunities to engage in hands on aspects of community sustainability (*i.e.,* harvesting and gathering) as well as visit self-governing communities and learn from First Nations leaders the process of negotiating self-government and land claims.

Contact Information:
Dechinta Centre for Research and Learning
P.O. Box 1568
Yellowknife, NT X1A 2P2
Toll-Free: 1-877-388-2874
Toll-Free Fax: 1-877-388-2039
Telephone: (867) 445-1897
Email: dechintaadmin@gmail.com
Website: http://dechinta.ca

3.3.2.4 Training Delivery Organizations

Federal – Provincial – Territorial Multilateral Framework on Early Learning and Child Care

The March 2003 Multilateral Framework on Early Learning and Child Care outlines the agreement made by governments to improve access to affordable, quality, provincially and territorially regulated early learning and child care programs and services.

The objective of this initiative is to further promote early childhood development and support the participation of parents in employment or training by improving access to affordable, quality early learning and child care programs and services.

Public Investments in Early Childhood Education and Care in Canada 2010 provides data specific to the Northwest Territories on:

- Number of children aged 0-12 years;
- Number of children aged 0-12 years with mothers in the paid labour force;
- Workforce participation of mothers by age of youngest child;
- Number of Aboriginal children aged 0-14 years;
- Number and percentage of children aged 0-14 with disabilities;
- Number of children by marital status of families;
- Number of births and EI maternity and parental claims;
- Number of regulated center-based child care spaces by age (infant, preschool, after-school);
- Number of regulated family child care based spaces by age (infant, preschool, after-school);
- Number of children with special needs in regulated child care by space type (full day/part day nursery schools/preschools; stand-alone school-age programs; individual licensed family child care provider; school-based child care centre; pre-school age children; school-age children).

Contact Information:

Early Learning and Child Care
Human Resources and Skills Development
Child and Youth Policy
Fax: 819-934-6631
TTY: 1-800-926-9105
Email: NC-DPE_AGJE-ECD_ELCC-GD@hrsdc-rhdcc.gc.ca
3A-103, Phase 4
140 Promenade du Portage
Gatineau QC, K1A 0J9
Website: http://www.dpe-agje-ecd-elcc.ca

Early Childhood Development
Human Resources and Skills Development
Child and Youth Policy
Fax: 819-934-6631
TTY: 1-800-926-9105
Email: NC-DPE_AGJE-ECD_ELCC-GD@hrsdc-rhdcc.gc.ca
3A-103, Phase 4
140 Promenade du Portage
Gatineau QC, K1A 0J9
Website: www.ecd-elcc.ca

The GNWT Literacy Council was initiated in 1989 and was fully operational in 1994. It is a territory-wide organization that supports and promotes literacy in all official languages of the NWT. The GNWT Literacy Council:

- Offers training and workshops for community-based practitioners;
- Develops and publishes resources and learning materials for various groups;
- Mentors and supports local literacy and essential skills practitioners and their projects;
- Conducts research into issues that affect literacy and essential skills development in the NWT, as well as monitor and share research from other places that impacts work in the region;
- Promotes the value of literacy and essential skills through produced materials and sponsored events;
- Maintains an extensive network of interested stakeholders and partners, and shares information about literacy and essential skills through newsletters and the website;
- Offers fee-for-service plain language design, writing and editing services; and
- Monitors and responds to territorial and national literacy and essential skills policies.

The NWT Literacy Council maintains the following datasets:

- Record of the number of copies of resource materials (*i.e.,* books, information pamphlets, publications) developed and produced by the Council to support literacy in English as well as Aboriginal languages.
- List of the individuals who have received Family Literacy Training and are considered a "Trained Volunteer" who can provide support directly to communities and host literacy events and/or present literacy materials.

Contact Information:
GNWT Literacy Council
PO Box 761
Yellowknife, NT X1A 2N6
Toll Free: 1-866-599-6758
Telephone: (867) 873-9262
Fax: (867) 873-2176
Email: nwtliteracy@nwtliteracy.ca
Website: www.nwtliteracy.ca

Northwest Territories Teachers' Association

The Northwest Territories Teachers' Association (NWTTA) works to promote and advance education in the Northwest Territories by supporting the professional development of teachers across the Northwest Territories. Information is provided through its Newsletters, Information Bulletins (radio and print), website and more recently, through its 2013 research on teacher workloads (Northwest Territories Teachers Association *et al.* 2013).

Understanding Teacher Workloads, A Pan-Northern Teachers' Time Diary Study was initiated to learn more about current impacts of teacher workloads on education throughout the Yukon, Northwest Territories and Nunavut. Study results found that northern teachers are struggling with increasing demands and fewer resources. Understanding that northern teachers' work environments are also children's learning environments, the study findings support an overall improved learning space by supporting wrap around services and interagency support for increasing diverse needs of students; by building time in teacher's day for lesson planning, joint collaboration with colleagues, staff meetings and professional learning; by supporting a flexible curriculum that provides the time, autonomy and capacity to work with community members to develop culturally appropriate and responsive curriculum resources and activities; by supporting alternative approaches to program delivery by rethinking unworkable system (multiple grades, ability levels and increasing diverse student needs) and unsustainable workloads (increased reporting, changing curriculum and evolving assessment requirements) (Northwest Territories Teachers Association *et al*. 2013).

Contact Information:

Northwest Territories Teachers' Association
5018-48th Street; P.O. Box 2340
Yellowknife NT X1A 2P7
Phone: 867-873-8501
Fax: 867-873-2366
Email: nwtta@nwtta.nt.ca
Website: www.nwtta.nt.ca

3.3.2.5 GNWT Bureau of Statistics

The GNWT Bureau of Statistics has overall responsibility for the territorial government's statistical program. To fulfill this role, the Bureau of Statistics (http://www.statsnwt.ca/):

- Develops, interprets and disseminates those economic, social and demographic statistics required by the government;
- Implements statistical programs for territorial government purposes and provides statistical advice and assistance to departments, regional offices and central agencies;
- Coordinates statistical activities within the government to minimize the duplication of statistical effort and to help ensure that the statistics used by the government are current, consistent and accurate; and
- Provides for the continuing and effective representation of territorial statistical interests within the national statistical system.
- Administers the NWT Data Portal to support online public access to tabular and graphic data.

The Government of the Northwest Territories Bureau of Statistics (GNWT-Bureau) is mandated with the responsibility for the government's statistical program. The GNWT-Bureau develops, collects, analyzes and disseminates economic, social and demographic data that is sourced from a variety of programs (*e.g.*, the GNWT-Bureau of Statistic's NWT Community Survey, GNWT Labour Force Survey and Statistics Canada's National Household Survey).

The primary source of data is supported by the GNWT-Bureau's online web-based Data Portal, available at http://www.statsnwt.ca/DataPortal/. The GNWT Data Portal provides a statistical service to public, private and government sectors. Information on highest level of schooling can be specified by age, gender, ethnicity as well as community or community type. School enrolment and the number of graduates are provided by the GNWTECE to the GNWT-Bureau on an annual basis.

Contact Information:

GNWT Bureau of Statistics
Government of the Northwest Territories
P.O. Box 1320
Yellowknife NT X1A 2L9
Telephone: (867) 873-7147
Fax: (867) 873-0275
Website: http://www.statsnwt.ca/
NWT Data Portal Website: http://www.statsnwt.ca/DataPortal/

3.3.2.6 Statistics Canada

Under the *Statistics Act*, Statistics Canada is required to "collect, compile, analyse, abstract and publish statistical information relating to the commercial, industrial, financial, social, economic and general activities and conditions of the people of Canada." Statistics Canada's two main objectives are:

- To provide statistical information and analysis about Canada's economic and social structure; and
- To promote sound statistical standards and practices.

Relevant Statistics Canada datasets include:

Canadian Census of Population (2011 and previous) (Statistics Canada)

The Canadian Census of Population is a national census completed every 5 years and provides demographic and statistical data used to plan public services including health care, education, and transportation, determine federal transfer payments, and determine the number of Members of Parliament for each province and territory. The 2011 Census of Population provides data on highest levels of learning and certification of Aboriginal persons.

2011 National Household Survey (Statistics Canada)

Between May and August 2011, Statistics Canada conducted the National Household Survey (NHS) for the first time. This voluntary, self-administered survey was introduced as a replacement for the long census questionnaire, more widely known as Census Form 2B. The NHS was designed to collect social and economic data about the Canadian population. The objective of the NHS is to provide data for small geographic areas and small population groups (http://www12.statcan.gc.ca/nhs-enm/2011/ref/nhs-enm_guide/index-eng.cfm). The 2011 NHS provides data on attendance, highest level of education acquired, field of study and place of study.

2012 Aboriginal Peoples Survey (2012 and previous) (Statistics Canada)

The Aboriginal Peoples Survey (APS) is a national survey of First Nations people living off reserve, Métis and Inuit aged six years and over. The 2012 APS represents the fourth cycle of the survey and focuses on the topics of education, employment and health. It also collects information on language, income, housing and mobility. The 2012 APS collected information on student enrolment, level of schooling, attendance, absent/skipping/late arrival frequency, number of schools attended, reason for changing schools, exposure to Aboriginal language at school, academic performance, reason, frequency and source of tutoring support, school climate, parent teacher support, support of Aboriginal culture, support for learning at home, parental expectations/aspirations for education, parental planning and savings for education, family education history, extra-curricular school activities, and, post-secondary education experiences. The 2012 APS also provides the percentage of individuals who reported to have hunted, fished, trapped or gathered in previous 12 months by Inuit Region (Inuit population aged 15 and older) and recorded reasons for hunting, fishing, trapping or gathering.

Statistics Canada maintains the following datasets for the communities in the ISR:
Number of Aboriginal persons aged

- 15 years and over;
- 15 to 24 years;
- 25 to 64 years; and
- 35 to 64 years;

By

- by highest certificate, diploma or degree;
- with no certificate, diploma or degree;
- with high school diploma or equivalent;
- with postsecondary certificate, diploma or degree;
- an apprenticeship or trades certificate or diploma;
- a College, CEGEP or other non-university certificate or diploma;
- a University certificate or diploma below bachelor level;
- a University certificate, diploma or degree at bachelor level or above;
- a Bachelor's degree; and
- a University certificate, diploma or degree above bachelor level.

Number of Aboriginal persons aged 15 years and over by major field of study – Classification of Instructional Programs (CIP) 2011

- no postsecondary certificate, diploma or degree.
- Education.
- Visual and performing arts, and communications technologies.
- Humanities.
- Social and behavioural sciences and law.
- Business, management and public administration.
- Physical and life sciences and technologies.
- Mathematics, computer and information sciences.
- Architecture, engineering, and related technologies.
- Agriculture, engineering, and related technologies.
- Agriculture, natural resources and conservation.
- Health and related fields.
- Personal, protective and transportation services.
- Other fields of study.

Number of Aboriginal persons aged 15 years and over by location of study compared with province or territory of residence:

- with no postsecondary certificate, diploma or degree.
- with postsecondary certificate, diploma or degree.
- Location of study inside Canada.
- Location of study same as province or territory of residence.
- Location of study in province or territory outside of residence and,
- Location of study outside of Canada.

Contact Information:
Statistics Canada
Toll Free: 1-800-622-6232
Website: http://www.canada.ca/en/gov/dept/statistics.html

3.3.2.7 Industry

Industry driven data exists; however, it is difficult to identify and access. Data summaries are published in private company (*e.g.,* Diavik), industry organization (*e.g.*, Mining Matters) and/or industry-government partnership organization (*e.g.,* MiHR) annual or progress reports.

The following highlights a few of these organizations with a focus on reported education-specific data.

Mining Industry Human Resources Council (MiHR): Industry-Government Initiative

The Mining Industry Human Resources Council (MiHR, www.mihr.ca) is a national sector council for the Canadian minerals and metals industry funded in part by the Government of Canada's Sector Council Program. MiHR collaborates among communities of interest to address emerging human resources opportunities and challenges and partnership with organizations representing mining industry employers; national and provincial mining associations/institutes; national organized labour groups representing workers in mining; federal, provincial and territorial governments; post-secondary education and technical institutions and; Aboriginal and other interest groups.

MiHR facilitated an *Aboriginal Mining Education Forum* to improve understanding of the issues and barriers related to Aboriginal education, as they apply to HR management in mining and mineral exploration, and to the economic development of Aboriginal communities (First Nations, Métis and Inuit). Industry participants included BHP Billiton Canada Inc., Cameco Corporation, De Beers Canada Inc., IAMGOLD Corporation, The Iron Ore Company of Canada (IOC), Noront Resources Ltd., Teck Resources Limited and, Vale Limited. Delegates collaborated in sharing ideas, information and contacts, which are documented in the *Forging Stronger Pathways to Education and Employment: A Report from the Proceedings of the Aboriginal Mining Education Forum* report. While no hard statistics are available in this report, recommendations from the Forum point to a need to either source prior data, collect current data and/or track progress and associated data.

Forum recommendations directly related to education are listed below:

- Listen and build customized solutions based on each community's needs;
- Develop connections early among education, industry and communities to inform and support Aboriginal learners in their pursuit of careers in mining;
- Examine and improve basic needs essential for education, such as infrastructure, transportation, communication and literacy;

- Critically examine pre-requisite requirements for post-secondary programs and company recruitment policies that may be systemically creating preventable barriers for education and employment entry; and
- Provide flexible work and educational opportunities that take the family unit into consideration.

It is important to consider tracking MiHR reporting mechanisms and making direct contact with the MiHR to determine if there is data that can be sourced to better understand how communities can better prepare for potential resource development.

***Mining Essentials* MiHR – Assembly of First Nations, Other Aboriginal Groups, Educators, And Other Industry Partnership:**

Mining Essentials was created through a partnership between MiHR and the Assembly of First Nations, other Aboriginal groups, educators and industry members. Mining Essentials is a 12-week pre-employment training program for Aboriginal peoples to learn essential and work readiness skills required for entry-level career opportunities in the mining industry. The program was created to help companies and communities meet joint hiring and employment targets and increase community capacity to support a local, skilled and empowered workforce. Program delivery incorporates classroom teaching, hands-on experiential learning and traditional Aboriginal teaching methods.

Committee members include: Cambrian College, Cameco Corporation, Agnico-Eagle Mines Limited - Goldex, PDAC - Mining Matters, Inuit Tapiriit Kanatami, PGNAETA, Wabun Tribal Council, Métis National Council, Mine Training Society, Mining Association of Canada, Prospectors & Developers Association of Canada, Native Women's Association of Canada, Yukon Mine Training Society, Aboriginal and Northern Affairs Canada, Natural Resources Canada, Sioux Hudson Literacy Council, Jacobs Consultation & Management Services. De Beers Canada, Corona College, Northwest Community College and GoldCorp.

It is relevant to track and contact this initiative to determine if the data collected from the Student Application process (*e.g.,* Grade 12 graduation, highest level of schooling, community, Aboriginal beneficiary) is available and comparable to graduate data collected by the GNWT-ECE and other post-secondary training institutes (e.g., University of Alberta's Aboriginal Transition Program, Aurora College).

More information on Mining Essentials is available at:
www.aboriginalmining.ca/en/miningessentials/MiningEssentials.asp

***Mine Training Society*- Aboriginal Government – Public Government – Industry Partnership:**

The Mine Training Society (MTS) is a partnership between Aboriginal governments, public government and the mining industry with a mandate to support Aboriginal people and Northerners in finding long-term employment in the mining industry. The Mine Training Society evolved from the Ministerial Ad Hoc Committee created to advise the Minister of Education, Culture and Employment as part of the development of initial diamond mine projects in the NWT. Industry partners include Diavik Diamond Mine

Inc., BHP Billiton, De Beers Canada, Dominion Diamond Corporation, and Procon Mining and Tunnelling. Approximately 50% of MTS' core funding is supported by the Government of Canada's Aboriginal Skills and Employment Partnership (ASEP) through Human Resources and Skills Development Canada (HRSDC).

Since its inception in 2003, MTS has further evolved as a vehicle for delivering training programs to include the evaluation, training and placing of northerners in mining and mining-related jobs and to provide hands-on mentoring and job coaching throughout their careers. MTS promotes life-long learning by nurturing relationships with clients post-graduation.

MTS has served over 1900 individual northerners with training and/or career counselling, and have placed over 830 of them in high-paying and fulfilling jobs since 2004. It would be of interest to determine if the data collected on applicants, students and graduates by the MTS, the HRSDC and possibly any of the industry partners who support on-site training is available to the public.

Northern Mine Industry Reporting: BHP Billiton EKATI, Rio Tinto Diavik Diamond Mines & DeBeers

Measuring Success – The Positive Impact of Diamond Mining in the Northwest Territories, 1998-2012 (Tabled Document 61-17(4), March 14, 2013) is a joint briefing paper prepared by BHP Billiton EKATI, Rio Tinto Diavik Diamond Mines and De Beers that reports on monies and efforts spent to support Northern and Aboriginal businesses, business development, governments (*e.g.,* infrastructure upgrades, social programming, schools, health care), social investment (*e.g.,* recreation facilities, sports teams, cultural activities), employment for Northerners and, job training for Northerners including specific training and support for Aboriginal persons (BHP Billiton EKATI *et al*. 2013).

Topics reported on include *Northern Diamond Mine Employment for 2011 at the BHP Billiton EKATI Diamond Mine Site (EKATI), the Diavik Diamond Mine Site (DIAVIK) and the De Beers Snap Lake Mine Site (SNAP LAKE),* source data from EKATI, DIAVIK, SNAP LAKE; *NWT Workforce Participation Rate 2001 - 2011* and, *NWT Employment Rate 2001 – 2011*, source data from GNWT Bureau of Statistics; *Total Spend by Company to support Aboriginal business, 1996 – 2011*, source data from EKATI, DIAVIK, SNAP LAKE; *Diamond Mine Trainees through the end of 2011 for Trades, Apprentices, Underground Miners at EKATI, DIAVIK, SNAP LAKE*, source data from EKATI, DIAVIK, SNAP LAKE; *NWT Mine Training Society 2004 – 2012 # of applicants assessed, # of applicants who have participated in training and # of applicants employed*, source data from the Mine Training Society of the NWT.

EKATI, DIAVIK, and SNAP LAKE recognize that while lack of formal education is a primary barrier for Aboriginal people to attaching to the workforce, there are several other challenges to be overcome. Social problems, unaddressed disabilities and difficulties presented by existing criminal records often cause clients to be reluctant to participate in training and applying for employment (BHP Billiton EKATI *et al*. 2013).

The *Measuring Success* document cites low literacy and low levels of education/Grade 12 Completion as significant barriers to post-secondary training and/or promotion within the industry sector. *Measuring*

Success reports that there is a lack of available skilled northern workers due to low literacy. This creates difficulties in training and advancing a greater number of northern employees into senior positions. Literacy and lack of education is most clearly demonstrated by high school students who are unable to pass trades entrance exams, a pre-requisite for apprenticeships. Nearly 50% of Aboriginal residents of the NWT have less than a Grade 12 education (BHP Billiton EKATI *et al*. 2013).

EKATI, DIAVIK and SNAP LAKE further advise that they have demonstrated their commitment to address these barriers by:

- spending approximately $6.6 million in financial and in-kind support committed over three years to the Mine Training Society as part of its Mining the Future proposal, which includes 32 training positions at the Snap Lake Mine and proposed Gahcho Kue Project, 12 training positions at EKATI Diamond Mine and 40 for Diavik Diamond Mine; and
- providing a combined total of $303,000 in scholarships to support students in 2012 alone (BHP Billiton EKATI *et al.* 2013).

EKATI, DIAVIK and SNAP LAKE further report that they have trained thousands of NWT residents in skills that will carry them through long and productive careers in mining or other industries.

It would be of further interest to determine what literacy and Grade 12 completion rate data has been collected by the northern mine industry and to what extent it is available; what geographic area and what beneficiary aboriginal applicants represent.

The *Measuring Success* document by BHP Billiton EKATI *et al*. (2013) is available at: http://mining.ca/sites/default/files/documents/MeasuringSuccessDiamondBenefitstoNWTMarch2013.pdf

3.3.2.8 Community Driven R&D

Aurora Research Institute

The Aurora Research Institute dates back to 1964 and is currently a research division of Aurora College. The mandate of the Institute is to improve the quality of life for NWT residents by applying scientific, technological and indigenous knowledge to solve northern problems and advance social and economic goals. The Aurora Research Institute provides licensing for research to take place in the NWT. A database of licenses with a description of the research initiatives is maintained, however it should be noted that the Institute does not maintain copies of the research conducted nor documents related to the research. A Compendium of Research in the Northwest Territories is published annually and includes the Scientific Report Series (which provides scientific information in a style and language that is easy to understand for the general reader), quarterly reports, technical reports and other documents.

The Aurora Research Institute maintains the following datasets:

- List of research activities in the Northwest Territories for which a permit was obtained.
- Synopses of research initiatives conducted under such permits.
- Contact information of researchers.

Contact Information:
Aurora Research Institute Headquarters
Manager of Scientific Services
P.O. Box 1450
Inuvik, NT X0E 0T0
Telephone: (867) 777-3298
Fax: (867) 777-4264
Email: licence@nwtresearch.com
Website: www.nwtresearch.com

Inuvialuit Regional Council and Lakehead University

Perspectives on Education in the Beaufort Delta, Reporting on Joint Research Project with the Inuvialuit Regional Council and Lakehead University

In 2013, Inuvialuit Regional Council (IRC) undertook research to understand why the educational outcomes of Inuvialuit living in the ISR continued to be far behind regional and national average and what could be done to change this reality. Given this achievement gap, poor K-12 participation and low attendance rates in both elementary and high school, IRC felt it necessary to execute an analysis of the educational needs and challenges for the Inuvialuit in the ISR, particularly for high school students.

In 2013, IRC partnered with Lakehead University, the GNWT Department of Education, Culture and Employment (GNWT ECE), the GNWT Bureau of Statistics (GNWTBS), and the Beaufort Delta Education Council (BDEC), to embark on developing the parameters for research on education in the ISR. In March of the same year IRC was granted approval by the Lakehead University Research Ethics Board to conduct research titled “Education policy analysis and Inuvialuit views of education in the Beaufort Delta”. The IRC reported on this research in their *Perspectives on Education in the Beaufort Delta* document (Berger and Johnston 2014).

The primary objective of this research was to generate detailed data about the education system within the Northwest Territories, specifically on things that influence Inuvialuit educational outcomes, from the perspectives of those closely involved in schooling. A substantial amount of the data for this report came from students and parents currently or recently involved in schools, and from a small sampling of educators within the education system in the Beaufort Delta Region (BDR). Although this research focuses

on the Inuvialuit in the western Arctic, the IRC reports that these findings might be recognizable for communities with similar histories and socio-economic conditions and that other communities might find some of the recommendations in this report to be relevant.

It is difficult to provide a brief summary of the *Perspectives on Education in the Beaufort Delta* report and its findings as the data is rich and the interpretation thereof complex (Berger and Johnston 2014). The level of detail of data and findings is exemplified when reporting that '231 named barriers were coded and tabulated' based on the responses from two open-ended questions that asked Inuvialuit youth to identify barriers that prevented their being successful in high school. It is relevant for future resource development initiatives to incorporate and/or consider the data and findings of this research when determining and planning for potential cumulative effects.

Findings identified five main themes that require alternate support and resources: Mental and Emotional Health and Wellness, Cultural Relevancy, Social Passing, Attendance, and Student-Parent-School Relationships.

Table 3-5 lists the detailed data that was acquired from students, parents and teachers and is presented and supported by detailed and comprehensive summary analysis.

Table 3-5. Beaufort Delta Education Survey Theme and Associated Data Table Title

SURVEY THEME	DATA TABLE TITLE
DEMOGRAPHICS	
Student Demographic	*Communities represented: Tuktoyaktuk, Ulukhaktok, Paulatuk, Inuvik, Sachs Harbour, Aklavik, Community Unknown*
	Ages represented: 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24 or older
	Grade Levels represented: Grades 7 - 12, Graduated; Sunchild, College or Upgrading; Stopped School; No Answer or Indeterminate
Parent Demographic	Cultural Background of Parents of High School Students of Parents of High School Students: *Inuvialuit, Gwich'in, Métis, Other Aboriginal*
	Gender of Parents Surveyed *: Male, Female, Other*
	Parents - Community Representation: *: Tuktoyaktuk, Ulukhaktok, Paulatuk, Inuvik, Sachs Harbour, Aklavik, Community Unknown*
Teacher Demographic	*Cultural Backgrounds of Teachers: Euro-Canadian, Dene, Other (Non-Aboriginal), Other First Nations/Aboriginal, Inuvialuit*
MENTAL AND EMOTIONAL HEALTH	
Student Perspective	School Environment.
	Problems facing students while attending high school.
	Student Employment During the School Year.
	Supports for Getting Through School.
Parent Perspective	Safety, Respect and School Effectiveness.

SURVEY THEME	DATA TABLE TITLE
Teacher Perspective	Social Issues and the Desire to Learn More About Teaching Students Facing Challenging Circumstances.
	Responses Related to Challenges in the Teaching Environment.
	I enjoy my teaching.
	I would encourage others to teach in the Beaufort Delta Region.
CULTURAL RELEVANCY	
Student Perspective	Youth belief in teacher awareness of Beaufort delta region and its peoples' history.
	Youth Feeling About Respect for Culture in School.
	Youth and parents' thoughts about Inuvialuit culture in courses.
Parent Perspective	Decision Making, Comfort, Pride And Culture In Schools.
Teacher Perspective	A strong sense of cultural heritage and identity is important for aboriginal students' success.
	The school where I work welcomes Elders and people from the community to help the school and to enhance student learning.
	I welcome Elders and people from the community to help my class in order to enhance student learning.
	There is enough Aboriginal content in the curriculum.
	The curriculum I teach is relevant to the daily lives of the Aboriginal students I teach.
	A strong sense of Aboriginal cultural heritage and identity is fostered in the school in which I teach.
	A school focus on individual achievement might cause tension for students from a culture that values cooperation.
	Prior to arriving at my current school, my employer ensured I was well versed in the cultural and historical context of the region and community in which I teach.
	During my time teaching I have become well versed in the cultural and historical context of the region and community in which I teach.
	I would like to learn more about local knowledge and culture.
	I would like to learn more about the history of the region and the people who live here.
	If you would like to learn more about the culture and history of the region, how would you most like to learn it?
	I have modified my teaching style for the cultural context of my classes.
	I would like to learn new teaching techniques to do my job better with Aboriginal students.
	I enjoy having cultural experiences different from my own.
SOCIAL PASSING	
Student Perspective	Students' Perceptions Before and After Grade 10.
Parent Perspective	Parents' Feelings About 'Social Passing'.
Teacher Perspective	Enough Time and Help For Struggling Students.
	Learning Disability.

SURVEY THEME	DATA TABLE TITLE
ATTENDANCE AND STAYING IN SCHOOL	
Student Perspective	Students Stated Days Missed Other Than for Illness.
	Reasons You Stopped Going To School.
	Frequency of Thinking of Stopping Attending School This Year.
	Reasons for Thinking About Stopping School.
	Youth in Grade 7-12 Belief About Their Own High School Graduation.
	Youth in Grade 7-12 Belief in Relevance of Current Learning.
	Help Choosing Courses.
	Help Choosing Courses Based on Future Plans.
	Supports in Preparing for After Graduation.
	Parents' Highest Level of School Attendance.
Parent Perspective	Parents' assessment of the number of days their child misses school other than for illness.
	Reasons why a child might think about quitting school.
	Probable Reasons for Staying in School After Thinking of Stopping.
	Parents' perception of student pride in their school.
	Those Who Have Helped Prepare Students for What They Will Do After High School Graduation (Percent represents percent of respondents who chose each possibility).
	Future Plans for taking Courses in the Trades.
	Do future schooling plans include a degree, diploma or certificate at a college or university?
	Do your child's future education or training plans require moving away from the community?
STUDENT-PARENT-SCHOOL RELATIONSHIP	
Student Perspective	Parental Support and Engagement.
Parent Perspective	Parental Contact with School.
	If you thought your child was having difficulty learning, who would you go to for help?
	Parents' Belief in Who is Most Responsible for Their Child Attending School.
	Parents' Belief in Who is Most Responsible for Their Child Doing Well at School.
	Number of hours outside of school your child spends doing homework.
	Teacher Assistance and Physical Environment.
	Reasons for Contact From the School.
	How Schools Contact Parents.
	How Parents Would Like to be Contacted by Schools.
	Parental Engagement With Children's Work Habits and Progress.
	Parents' Highest Level of Academic Attendance.
	Highest Grade Completed By Parents.

Alternate Forms of Reporting Data – Word Cloud

All but one of the data sets was provided in tabular format. In an open-ended question teachers were asked how they would prefer to learn more about the Regions' people and culture. In the spirit of spatial learning and different ways of knowing, the response to the question is first presented below as a 'word cloud' (where the most frequently occurring words are the biggest) (Figure 3-1).

Authentic Data: True Keepers/Holders of Data are the People Themselves

While governments and industry provide a wealth of data, the data acquired and owned by the potentially affected community is more directly relevant and highly valued. This research and report provides an example, and perhaps a template, for other communities throughout the Northwest Territories.

Figure 3-1: If you would like to learn more about the culture and history of the region, how would you most like to learn it? (Source: Perspectives on Education in the Beaufort Delta).

Inuvialuit Regional Corporation and Individual Community Corporations

The Inuvialuit Regional Corporation (www.irc.inuvialuit.com) was established with the overall responsibility of managing the affairs of the ISR as outlined in the Inuvialuit Final Agreement (IFA). The IRC's mandate is to continually improve the economic, social and cultural well-being of the Inuvialuit through implementation of the IFA and by all other available means.

Through a democratic process, Inuvialuit beneficiaries directly control IRC and its subsidiaries. Each Inuvialuit community (Aklavik, Inuvik, Paulatuk, Sachs Harbour, Tuktoyaktuk and Ulukhaktok) has a

community corporation (CC) with elected directors. The directors of the six community corporations elect the Chair/Chief Executive Officer of IRC. The Chairs of each CC, together with the Chair of IRC, form the IRC Board of Directors.

The goals of the IRC are as follows:

- The preservation and growth of the financial compensation flowing from the IFA;
- The distribution of accumulated wealth to beneficiaries;
- The representation and advancement of Inuvialuit interests in areas of external relations including federal, territorial, and municipal governments, circumpolar and other aboriginal organizations, private sector and special interest groups;
- The stewardship of Inuvialuit lands;
- The identification and successful implementation of economic, social, cultural, educational, training and employment programs that benefit Inuvialuit;
- The provision of technical and administrative support to community corporations and beneficiaries; and
- The promotion of rights and benefits accorded to Inuvialuit under the IFA.

The Inuvialuit Regional Corporation and/or individual Community Corporations maintain(s) the following datasets:

- List of economic, social, cultural, educational, training and employment programs undertaken in the communities of the ISR.
- Beneficiaries of distribution payments.

Contact Information:

Acting Chief of Staff and Director of Intergovernmental Relations
Inuvialuit Regional Corporation
Bag Service 21
Inuvik, NT
XOE OTO
Telephone: (867) 777-7040
http://www.irc.inuvialuit.com/

Inuvialuit Regional Corporation
107 Mackenzie Road
Bag Service #21, Inuvik, NT X0E 0T0
Tel: (867) 777-7000
Toll-Free: 1 855 777-7011
Fax: (867) 777-7001

Email: info@inuvialuit.com

Aklavik Community Corporation (ACC)
P.O. Box 119, Aklavik, NT X0E 0A0
Tel: 867.978.2414
Fax: 867.978.2815
Email: accmanager@northwestel.net

Inuvik Community Corporation (ICC)
P.O. Box 1365, Inuvik, NT X0E 0T0
Tel: 867.777.2603
Fax: 867.777.4422
Email: iccmanager@northwestel.net

Paulatuk Community Corporation (PCC)
P.O. Box 92, Paulatuk, NT X0E 1N0
Tel: 867.580.3601
Fax: 867.580.3508
Email: pcc_southwindcapital@hotmail.com

Sachs Harbour Community Corporation (SHCC)
P.O. Box 60, Sachs Harbour, NT X0E 0Z0
Tel: 867.690.3025
Fax: 867.580.3508
Email: shcc_manager@yahoo.ca

Tuktoyaktuk Community Corporation (TCC)
P.O. Box 350, Tuktoyaktuk, NT X0E 1C0
Tel: 867.977.2390
Fax: 867.977.2504
Email: tukcc@netkaster.ca

Ulukhaktok Community Corporation (UCC)
P.O. Box 161, Ulukhaktok, NT X0E 0S0
Tel: 867.396.4701
Fax: 867.396.3284
Email: ulu_community_corp@hotmail.com

Inuvialuit Cultural Resource Centre

The Inuvialuit Cultural Resource Centre (ICRC) began in May 1998 and is currently located in Inuvik. Together with the Inuvialuit Regional Corporation (IRC) it has supported several oral history projects. Its mandate includes:

- Developing a language plan for the Region;
- Creating an Inuvialuktun Language Curriculum;
- Providing Inuvialuktun teachers with resource materials; and
- Preserving and modernizing the language.

Several contacts made during this program indicated that the ICRC is the holder of datasets or knowledge regarding language, cultural education, traditional knowledge transference, and art.

Contact Information:
Inuvialuit Cultural Resource Centre
107 Mackenzie Road, Bag Service #21
Inuvik, NT X0E 0T0
Toll-Free: 1-855-777-7001
Telephone: (867) 777-7000
Fax: (867) 777-7001
Email: info@inuvialuit.com
Website: http://www.irc.inuvialuit.com/

Great Northern Arts Festival

The Great Northern Arts Festival's goal is to promote the arts in the Northwest Territories. The objectives of the Festival are to:

- Foster the education and training of Northern artists regarding all facets of the creation and business of the arts through the establishment of a Northern Arts Festival;
- Hold, where feasible, workshops and seminars during the year which focus on the above aim;
- Promote Northern artists and guests of the Festival and their artwork, primarily through the organization of non-profit exhibitions at which artists may exhibit and sell their work; and
- Do all things incidental to these purposes.

The Great Northern Arts Festival maintains the following datasets:

- List of artists that participate.
- List of products available by participating artists.

Contact Information:
Executive Director
The Great Northern Arts Festival

2nd Floor Midnight Sun Complex
P.O. Box 2921, Inuvik, NT X0E 0T0
Telephone: (867) 777-8638
Fax: (867) 777-2017
Email: gnaf@inuvik.ca
Website: http://gnaf.org/

Gwich'in Social & Cultural Institute

The Gwich'in Social & Cultural Institute (GSCI) was established in the fall of 1993 with a mandate to document, preserve and promote the practice of Gwich'in culture, language, traditional knowledge and values. The objective of the Institute is to conduct research in the areas of culture, language and traditional knowledge so that this body of knowledge will be recorded and available for future generations and the development of programs appropriate for Gwich'in needs. GSCI works with the four communities of Aklavik, Fort McPherson, Inuvik, and Tsiigehtchic.

The Gwich'in Social & Cultural Institute maintains the following datasets for programs they deliver:

- Program enrollment (number of participants).
- Resources utilized.
- Participant communities.
- Program objectives and outcomes.

Contact Information:
The Gwich'in Social & Cultural Institute
Executive Director
Gwich'in Social and Cultural Institute
P.O. Box 30
Fort McPherson, NT X0E 0B0
Telephone: (867) 952-2524
Fax: (867) 952-2238
Email: gsciexecutivedirector@learnnet.nt.ca
Website: http://www.gwichin.ca/

3.3.3 Ongoing Monitoring

3.3.3.1 GNWT Department of Education, Culture and Employment- Early Childhood and School Services

Aboriginal Student Achievement Education Plan

The Aboriginal Student Achievement Education Plan's vision is to ensure that NWT Aboriginal people be encouraged and supported to learn and retain their Aboriginal culture and language while also gaining western learning.

Aboriginal Languages Literacy Program

The Aboriginal Languages Literacy Program provides financial assistance to community organizations to develop and deliver local projects that will help people increase their literacy levels and raise awareness of the importance of literacy in the aboriginal languages of the NWT.

In the NWT, literacy is linked to language, social context and cultural identity. Literacy includes concepts such as: reading different kinds of printed material, writing, speaking, listening, observation, visual representation, numeracy, use of technology, critical thinking and problem solving. Literacy development is encouraged in the 11 official languages of the NWT.

Through the Aboriginal Languages Literacy Program, contributions are provided to official Aboriginal language communities to support the preservation, maintenance, enhancement and revitalization of their languages and for community based literacy programs. The focus of this funding initiative is on community and family literacy, and on developing Aboriginal language resources.

Eligible projects contribute to enhancing literacy and generate resources that can be used by others. Examples of Aboriginal language literacy projects include: Aboriginal language curriculum development; Aboriginal language compact discs and/or applications; oral history projects; and dictionary projects.

3.3.3.2 Statistics Canada

Relevant programs conducted by Statistics Canada are discussed in the previous section. The following programs by Statistics Canada are expected to continue:

- Canadian Census of Population (2011 and previous) (Statistics Canada)
- 2011 National Household Survey (Statistics Canada)
- 2012 Aboriginal Peoples Survey (2012 and previous) (Statistics Canada)

3.3.3.3 NWT Department of Health and Social Services (NWTHSS)

NWTHSS collaborates with NWTECE on early childhood education programs. Details are provided in the previous section.

3.3.4 Ongoing Research Projects/ Project-based Monitoring

3.3.4.1 Northwest Territories Teachers' Association

As noted above, the NWT TA routinely undertakes research to better understand how teaching methods can be employed to enhance the learning experience for students in the Beaufort Region as well as in the wider region.

3.3.4.2 Inuvialuit Regional Council

The IRC has undertaken joint research with extra-territorial universities to better understand educational issues in the Beaufort Region.

3.3.4.3 Gwich'in Science Camps (Gwich'in Social and Cultural Institute)

Offers senior high school students the opportunity to learn Gwich'in traditional knowledge and western scientific knowledge while living on the land. They are ten day camps that allow students to earn school credits, work with Gwich'in Elders and professionals in the fields of biology, geography and anthropology, and learn about the area's natural and human history (Gwich'in 2015).

3.3.4.4 Environmental Education Projects (Gwich'in Renewable Resources Board)

Informing youth, other Gwich'in beneficiaries and the general public about co-management of renewable resources in the GSA is an important part of the Board's activities. The Board has initiated several programs to help youth learn about renewable resources and encourage them to pursue careers in environmental fields.

Programs include:

- School Environmental Programs;
- Student Trainee Programs;
- Nature Day Program; and
- Other Educational Programs.

3.4 Culture - Language, Traditional Knowledge, and Cultural Education

The cultural vitality of a community can be defined as the community's ability to create, support, and incorporate culture and cultural activities in everyday life (Jackson *et al.* 2006). The following sections define the indicators, sources of information, ongoing monitoring programs, and ongoing research projects/ project-based monitoring which have been identified to describe cultural vitality.

3.4.1 Selected Valued Components and Indicators of Cultural Vitality

Six Valued Components have been selected to monitor Cultural Vitality:

- Language;
- Cultural Education;
- Traditional Knowledge;
- Ability to Harvest;
- Country Food Consumption; and
- Art.

Each Valued Component is discussed in the following subsections.

3.4.1.1 Language

Language is often seen as the embodiment of a people's unique cultural wisdom (UNESCO 2003). In order to assist in the preservation and revitalization of local languages, several indicators were identified to provide a global view of language vitality in the region. These include:

- Availability of newsletters/ newspapers in local language;
- Availability of media programs (radio/TV) in local language;
- Road signage in local language;
- Local language program in schools; and
- Requirements for and use of translators/ interpreters.

The significance and relevance of each indicator is discussed below.

Availability of newsletters/ newspapers in local language

Newspapers and newsletters are a cost efficient means of providing local, regional and national information on relevant political, educational and cultural topics. While providing important information about what is happening in their community, it also assists in maintaining or enhancing literacy levels.

Availability of media programs (radio/TV) in local language

Media programs broadcasted on the radio, TV and now over the internet, are a vital outlet in providing content which reflects local pride and heritage to a broader audience spaced over a large area. It enables Aboriginal people to share their stories in their own words. This has for effect the increased usage of local languages, cultural education and a means of showcasing Aboriginal art in various forms.

Road signage in local language

The presence of road signage in the local language is important as many residents do not speak English. In addition it demonstrates a commitment to the protection of each Aboriginal language in the NWT.

Local language program in schools

Children are the future and it is imperative they be taught local Aboriginal languages if these languages are to persist. Schools are an ideal venue to teach local children their community's language as local elders and frequent speakers can interact with students. It is a vital means of ensuring the continuation of Aboriginal languages which is an integral part of Aboriginal cultures.

Requirements for and use of translators/ interpreters

Translators/ interpreters enhance communication by conveying information accurately from one language to another. There are eleven official Aboriginal languages in NWT and the usage of translators/ interpreters plays an important role by allowing locals to understand what is happening in their community and be able to communicate their thoughts and opinions as well as share information.

3.4.1.2 Cultural Education

Cultural education can be defined as the promotion of cultural knowledge, creativity and intercultural understanding through formal education (Putz-Plecko 2008). Cultural education commences in grade

school and continues into post-secondary education. It is also conducted through cultural awareness training, as well as through specific educative studies and programs promoting local cultures.

Cultural Education Programs

Programs developed by the Government of Northwest Territories (GNWT), universities/ colleges and other organizations are vital to the success of educating a broad audience about the cultures of Aboriginals in NWT. It is often through these structured programs that people can acquire or enhance their understanding of the rich and dynamic culture and heritage of the Aboriginal communities of NWT.

Aboriginal cultural awareness training

Aboriginal cultural awareness training assists participants in understanding cross-cultural perspectives and shows how working with Aboriginal Peoples can enhance political/ business objectives. This specific type of training is generally aimed at government employees or businesses. It is an important means of promoting cooperation and collaboration between non-Aboriginal and Aboriginal peoples.

3.4.1.3 Traditional Knowledge

Traditional knowledge is a holistic transference of teachings and experiences passed on from one generation to the next. It encompasses knowledge of the land, language, culture and rules governing the use of resources. It is often difficult to document the sharing of traditional knowledge as it is often handed down from previous generations through oral tradition and is considered part of a way of life (Alaska Native Science Commission 2015, Fedirechuk *et al.* 2008). When attempting to quantify this transference of traditional knowledge; programs that document traditional knowledge sharing, contact with local councils and determining the number of people living a subsistence lifestyle are often utilized.

The following identified indicators highlight means of understanding how traditional knowledge is shared:

Programs documenting traditional knowledge sharing

Programs by definition are generally run by government departments or organizations with a goal and a plan to ensure the success of the program. Programs are key to documenting traditional knowledge sharing as they provide direct access to information and generally provide substantial results.

Data on traditional knowledge sharing

Data regarding traditional knowledge can be obtained in many different ways by many different organizations or individuals. Data can consist of statistics, studies, or annual reports describing activities and events occurring in each community. This information plays a vital role in better understanding on if and how traditional knowledge is being shared.

Number of people living a subsistence lifestyle

Individuals that live a subsistence lifestyle typically have a greater knowledge of traditional skills and the natural environment in which they live, compared to individuals living non-subsistence lifestyles. By noting the trend in number of people living subsistence lifestyles, one can see if traditional knowledge is being lost.

3.4.1.4 Ability to Harvest

A key indicator to cultural vitality is a group's ability to harvest. Harvesting or gathering of country food for primarily domestic consumption plays a vital role in food security, nutrition and culture (Thompson 2005, Usher *et al.* 2003). Traditional harvesting activities include hunting, trapping, and fishing, in addition to gathering plants for food and medicine and harvesting natural materials for fuel and construction/art materials. Harvesting of wildlife, fish, and plants is conducted at all times of the year to meet aboriginal needs for food, social and ceremonial purposes (Legal Services Society 2013). In order to get a more fulsome image of a group's ability to harvest the following is identified:

- Accessibility of resources for harvesting;
- Documentation of equipment used and affordability; and
- Records of community hunts.

Accessibility of resources for harvesting

Access to resources is a critical component of the ability of hunters and gatherers to harvest food. Accessibility in this context includes identifying the lands where resources reside, the quantities of resources available on those lands, and the ease of access to those lands (*i.e.,* distance, seasonal constraints, presence of barriers, *etc.*).

Documentation of equipment used and affordability

The documentation of equipment used can provide information regarding the usage of traditional tools versus modern-day technologies. This can provide important information on the usage of traditional skills and the potential of transference of traditional knowledge. Affordability is also a key concern, as a person's ability to harvest may be limited by their ability to purchase the necessary equipment to pursue hunting and/or gathering activities.

Records of community harvests

Records of community hunts provides a direct source of information regarding a community's ability to harvest.

3.4.1.5 Country Food Consumption

Consumption of country food is closely linked to the transference of traditional knowledge and the ability to harvest; however; it also takes into consideration perceived and/or realized threats to the quality of the resource. The consumption of country food is an integral component of food security, nutrition and culture (Thompson 2005, Usher *et al.* 2003). Data is available through various provincial, regional and local sources to determine the extent and level of country food consumption in various northern communities.

Country food consumption

Looking closely at data that indicates which foods, the quantities, and when the food is consumed provides valuable information on country food consumption. This data directly provides the information to better understand how the consumption of country food impacts community's health and culture.

3.4.1.6 Art

Aboriginal art is an integral part of traditional life and is considered to be a process, movement and experience. It encompasses all facets of life and varies not only in genre, style, theme, imagery and function, but also from region to region and period to period (Trépanier 2008). One means of analysing the art indicator is by determining the number of available products and artists.

Available products and number of artists

The availability of products and the number of artists is a direct way to measure the diversity and numbers of artists practicing in NWT. This information plays an important role in understanding what areas require more funding to promote Aboriginal art and how the community as a whole is doing.

3.4.2 Sources of Information

In order to gain a better understanding of cultural vitality, several sources of information were identified for each of the indicators. Table 3-6 summarizes the indicators and identified sources of information. Below is a discussion of the role each source of information plays and what information they can provide.

Table 3-6. Selected Indicators and Sources of Information for Cultural Vitality VCs

Selected Valued Component	Indicator	Confirmed and Potential Source of Information
Language	Availability of newsletters/ newspapers in local language	Inuvialuit Communications Society Inuvialuit Cultural Resource Centre Northern News Service
	Availability of media programs (radio/TV) in local language	Native Communications Society of the NWT Inuvialuit Communications Society Aboriginal Peoples Television Network Inuit Broadcasting Corporation Canadian Broadcasting Corporation
	Road / community signage in local language	GNWT Department of Transportation Hamlet/Community Councils
	Local language program in educational institutions (*i.e.,* schools)	GNWT Department of Education, Culture and Employment Beaufort Delta Divisional Educational Council Aurora College
	Requirements for and use of translators/ interpreters	GNWT Department of Education, Culture and Employment Industry Canada
Cultural Education	Cultural education programs	GNWT Department of Education, Culture and Employment Beaufort Delta Divisional Educational Council Inuvialuit Cultural Resource Centre Gwich'in Social & Cultural Institute GNWT Department of Industry, Tourism and Investment Dechinta Centre for Research and Learning

Selected Valued Component	Indicator	Confirmed and Potential Source of Information
		Inuvialuit Regional Corporation/Community Corporations
	Aboriginal cultural awareness training	GNWT Department of Human Resources
Traditional Knowledge	Programs documenting traditional knowledge sharing	Inuvialuit Cultural Resource Centre Gwich'in Social & Cultural Institute
	Data on traditional knowledge sharing	Inuvialuit Cultural Resource Centre Gwich'in Social & Cultural Institute
	Number of people living a subsistence lifestyle	GNWT Bureau of Statistics Statistics Canada • Aboriginal Peoples Survey Inuvialuit Game Council Hunters & Trappers Committees Fisheries and Oceans Canada GNWT Department of Environment and Natural Resources
Ability to Harvest	Accessibility of resources for harvesting	Hunters & Trappers Committees Inuvialuit Game Council Fisheries Joint Management Committee Joint Secretariat GNWT Bureau of Statistics Statistics Canada • Aboriginal Peoples Survey Gwich'in Renewable Resources Board Fisheries and Oceans Canada Inuvialuit Regional Corporation/Community Corporations
	Documentation of equipment used and affordability	Hunters & Trappers Committees Joint Secretariat
	Records of community hunts	Hunters & Trappers Committees
Country Food Consumption	Country food consumption	GNWT Department of Environment and Natural Resources GNWT Bureau of Statistics Statistics Canada • Aboriginal Peoples Survey Nutrition North Canada
Art	Available products and number of artists	Inuvialuit Cultural Resource Centre Gwich'in Social & Cultural Institute GNWT Arts Program GNWT Arts Council Great Northern Arts Festival

3.4.2.1 GNWT Department of Education, Culture and Employment

The GNWT Department of Education, Culture and Employment is a governmental branch that encompasses many programs and services. The mandate of this department is to invest in and provide for the development of the NWT. Goals include:

- Promoting and enhancing the culture and languages of the people of NWT;
- Ensuring access to learning opportunities for the people of NWT; and
- Ensuring that the people of NWT acquire the knowledge and skills needed to make informed choices.

The GNWTECE is divided into several divisions and include:

- Advanced Education;
- Culture and Heritage;
- Education Operations and Development;
- Early Childhood and School Services;
- Income Security;
- ECE Service Centres; and
- Official Languages.

Of particular interest to this Project are the programs offered by the Early Childhood and School Services, Culture and Heritage and Official Languages Divisions.

The GNWTECE is predominantly responsible for the administration of funding under several Federal and Territorial initiatives (GNWTECE 2015).

The NWT Department of Education, Culture and Employment maintains the following datasets:

- List of funding programs.
- List of funding applicants and recipients.
- List of interpreters/translators (approved by the Official Languages Division) by language and location within the ISR.

Contact Information:

NWT Department of Education, Culture and Employment
P.O. Box 1320
Yellowknife NT X1A 2L9
Email: ecepublicaffairs@gov.nt.ca
Website: http://www.ece.gov.nt.ca/

Regional Service Centre

Beaufort Delta ECE Service Centre
Department of Education, Culture and Employment
BAG SERVICE #1
INUVIK NT X0E 0T0
Toll Free: 1-855-283-9311
Telephone: (867) 777-7365
Fax: (867) 777-7218

3.4.2.2 Statistics Canada

Under the *Statistics Act*, Statistics Canada is required to "collect, compile, analyse, abstract and publish statistical information relating to the commercial, industrial, financial, social, economic and general activities and conditions of the people of Canada." Statistics Canada's two main objectives are:

- To provide statistical information and analysis about Canada's economic and social structure; and
- To promote sound statistical standards and practices (Statistics Canada 2015).

Statistics Canada maintains the following datasets for the communities in the ISR:

- Aboriginal languages as mother tongue, home language and language of work.
- Knowledge of Aboriginal languages for the population in private households.
- Ability to speak and to understand an Aboriginal language by ability rating (only a few words, with effort, relatively well or very well).
- Importance of speaking and understanding an Aboriginal language.
- Frequency of exposure to an Aboriginal language at home and outside the home.
- Language(s) first learned at home in childhood.
- Intergenerational language transmission.
- Age of the speakers.
- Number of individuals who reported to have hunted, fished, trapped or gathered in previous 12 months by Inuit Region (Inuit population aged 15 and older) and
- Recorded reasons for hunting, fishing, trapping or gathering.

Contact Information:
Statistics Canada
Toll Free: 1-800-622-6232
Website: http://www.canada.ca/en/gov/dept/statistics.html

3.4.2.3 GNWT Bureau of Statistics

The GNWT Bureau of Statistics has overall responsibility for the territorial government's statistical program. To fulfill this role, the Bureau of Statistics:

- Develops, interprets and disseminates those economic, social and demographic statistics required by the government;

- Implements statistical programs for territorial government purposes and provides statistical advice and assistance to departments, regional offices and central agencies;
- Coordinates statistical activities within the government to minimize the duplication of statistical effort and to help ensure that the statistics used by the government are current, consistent and accurate; and
- Provides for the continuing and effective representation of territorial statistical interests within the national statistical system (GNWT Bureau of Statistics 2015).

The NWT Bureau of Statistics maintains the following datasets by community in the ISR:

- Number of individuals who reported that they "Hunted & Fished";
- Number of individuals who reported that they "Trapped;
- Number of individuals who reported that they "Produced Arts & Crafts";
- Number of Households Consuming Country Food (obtained through hunting and fishing); and
- Number of Aboriginals that Speak an Aboriginal Language (as recorded in 1984, 1989, 1994, 1999, 2004, and 2009).
- 2002 Regional Employment & Harvesting Report.

Contact Information:

GNWT Bureau of Statistics
Government of the Northwest Territories
P.O. Box 1320
Yellowknife NT X1A 2L9
Telephone: (867) 873-7147
Fax: (867) 873-0275
Website: http://www.statsnwt.ca/

3.4.2.4 Hunters and Trappers Committees

Each of the six communities that make up the ISR has a Hunters and Trappers Committee (HTC) (Indian and Northern Affairs Canada 1998). Each Hunter and Trappers Committee has a Community Conservation Plan which were prepared in 2008 through a concerted effort between each ISR community, the NWT Wildlife Management Advisory Council and the Joint Secretariat. These plans contain an overview of the current conservation and resource management systems in the ISR and describe the strategy used to address the following five broad goals:

- To identify important wildlife habitat and seasonal harvesting areas and make recommendations for their management;
- To describe a community process for land use decisions and managing cumulative impacts which will help protect community values and the resources on which priority lifestyles depend;

- To identify educational initiatives for the Inuvialuit of Inuvik and others interested in the area which will promote conservation, understanding and appreciation;
- To describe a general system of wildlife management and identify population goals and conservation measures appropriate for each species of concern in the planning area using the knowledge of community and others with expertise; and
- To enhance the local economy by adopting a cooperative and consistent approach to community decision-making and renewable resource management.

Each Hunter and Trappers Committee maintains a list of active and inactive hunters/trappers in the community. While HTCs support and participate in harvest study programs, they do not, however, specifically maintain harvest data (Inuvik Hunters and Trappers Committee 2015, pers. comm.).

Contact Information:

Aklavik Hunters and Trappers Committee
P.O. Box 133
Aklavik, NT X0E 0A0
Telephone: (867) 978-2723
Fax: (867) 978-2815
Email: ahtc@airware.ca

Inuvik Hunters and Trappers Committee
P.O. Box 1720
Inuvik, NT X0E 0T0
Telephone: (867) 777-3671
Fax: (867) 777-2478
Email: inuvikhtc@hotmail.com

Olokhaktomiut Hunters and Trappers Committee
Box 161
Ulukhaktok, NT X0E 0S0
Telephone: (867) 396-4808
Fax: (867) 396-3025
Email: ohtc2010@hotmail.com

Paulatuk Hunters and Trappers Committee
Box 39
Paulatuk, NT X0E 1N0
Telephone: (867) 580-3004
Fax: (867) 580-3404
Email: phtc@live.ca

Sachs Harbour Hunters and Trappers Committee
Box 79
Sachs Harbour, NT X0E 0Z0
Telephone: (867) 690-3028

Fax: (867) 690-3616
Email: sachshunters@yahoo.ca

Tuktoyaktuk Hunters and Trappers Committee
P.O. Box 286
Tuktoyaktuk, NT X0E 1C0
Telephone: (867) 977-2457
Fax: (867) 977-2433
Email: tuk.htc@gmail.com

3.4.2.5 Fisheries Joint Management Committee

The Fisheries Joint Management Committee (FJMC) assists the Minister of Fisheries and Oceans in the management of fisheries, and provides advice on all matters affecting settlement region fisheries (Indian and Northern Affairs Canada, 1998). Their mission is to "ensure that the renewable marine, anadramous and freshwater resources of the ISR are managed and conserved for the wise use and benefit of present and future generations" (FJMC 2015).

The FJMC works closely with government agencies, renewable resource user groups in the Inuvialuit communities, and other renewable resource boards in Canada and Alaska which oversee common migratory stocks. In keeping with the co-management philosophy of the IFA, consultation with local HTCs, the IGC, DFO and other government agencies is an important activity for the FJMC (Indian and Northern Affairs Canada 1998).

The FJMC maintains the following datasets related to ability to harvest in the ISR:

- List of registered fishing licenses.
- Successful fishing areas.
- Stock status reports.
- Fishing and management plans.

Contact Information:

Fisheries Joint Management Committee
PO Box 2120
Inuvik, NT
X0E 0T0
Telephone: (867) 777-2828
Fax: (867) 777-2610
Email: fjmc-rp@jointsec.nt.ca
Website: http://www.fjmc.ca/

3.4.2.6 Fisheries and Oceans Canada

Fisheries and Oceans Canada (DFO) is the lead federal body managing Canada's fisheries and protecting its waters. As stated on their website, DFO's mission is to ensure:

- Economically Prosperous Maritime Sectors and Fisheries;
- Sustainable Aquatic Ecosystems; and
- Safe and Secure Waters.

To provide for the harvest of fish for food, social or ceremonial (FSC) purposes and related activities, the Minister of Fisheries and Oceans issues communal fishing licences under the Aboriginal Communal Fishing Licences Regulations to Aboriginal groups. Communal fishing licences may specify fishing area, times, species, allocations, methods or other restrictions.

Only an individual who has been designated by an Aboriginal group may harvest fish for FSC purposes under the terms of the Aboriginal group's communal fishing licence.

DFO maintains a database and library with publications for harvesting data. The harvest data provides:

- Estimated harvest, selected species as well as other harvested species reported.
- Hunter response, and number of hunters harvesting selected species.

DFO also maintains a list of quota and license data for applicable aquatic species.

Management Plans are also developed by DFO and provide information on each identified aquatic species such as:

- Stock Assessment, Science and Traditional Knowledge;
- Economic, Social and Cultural Importance;
- Governance Process;
- Access and Allocations; and
- Compliance Plan.

<u>Contact Information:</u>

Fisheries and Oceans Canada
Communications Branch
200 Kent Street, 13th Floor, Station 13E228
Ottawa Ontario K1A 0E6 Canada
Telephone: (613) 993-0999
Fax: (613) 990-1866
Email: info@dfo-mpo.gc.ca
Website: http://www.dfo-mpo.gc.ca/

Fisheries and Oceans Canada
PO Box 1871
Inuvik, NT X0E 0T0
Telephone: (867) 777-7500

3.4.2.7 GNWT Department of Environment and Natural Resources

The GNWT Department of Environment and Natural Resources (GNWTENR) works collaboratively with Aboriginal and municipal governments, federal and territorial departments, boards and agencies to "promote and support the sustainable use and development of natural resources and to protect, conserve and enhance the NWT environment for the social and economic benefit of all residents." This includes:

- Working collaboratively with Aboriginal governments, communities and the public to protect our environment and ensure the wise and sustainable use of our resources.
- Management and regulatory authority for on-shore waters, wildlife species, wildlife habitat and forests in the Northwest Territories.
- Assessing, monitoring and mitigating impacts of development on our forests, water, wildlife and wildlife habitat.
- Negotiating, and implementing, transboundary water agreements with neighbouring jurisdictions.
- Supporting and promoting the use of alternative energy sources, such as biomass, solar, wind and geothermal, and energy conservation in communities.

The GNWTENR is responsible for:

- Conservation, Assessment and Monitoring;
- Environment;
- Forest Management;
- Water Resources; and
- Wildlife (GNWTENR 2015).

The NWT Department of Environment and Natural Resources holds data under the GNWT Licensing Information System (LISIN), Resident Hunter Surveys, and Outfitter Report Forms for number of people who hunt and fish recreationally or for subsistence in NWT ecozones.

Contact Information:

NWT Department of Environment and Natural Resources
Inuvik Region
P.O. Box 2749
Shell Lake, NT X0E 0T0

Telephone: (867) 678-6650
Fax: (867) 678-6659
Email: judy_francey@gov.nt.ca
Website: http://www.enr.gov.nt.ca/

3.4.2.8 Inuvialuit Game Council and Joint Secretariat

The Inuvialuit Game Council (IGC) became incorporated in April 1983 and represents the Inuvialuit interest in wildlife. Part of the Council members' duties are to review wildlife research proposals from the Canadian Wildlife Service (CWS) and the renewable resource departments of both territorial governments for projects within the settlement region. In addition, they set funding priorities for these and other projects related to wildlife and the environment (Indian and Northern Affairs Canada 1998).

The Joint Secretariat was established in 1986 by the Inuvialuit, GNWT and federal government to provide support services to the wildlife and environmental institutions of public government and to the Inuvialuit Game Council (IGC). The Secretariat administers funding for these institutions and provides administrative and technical support and functions as the focus for all information about their activities. It also performs the library and data collection duties of the Research Advisory Council (Indian and Northern Affairs Canada 1998).

The IGC are active on local, regional, national and international levels. In 1986, the IGC conducted a comprehensive ten year harvest study called the Inuvialuit Harvest Study. The IGC was also instrumental in the revival of Inuvialuit traditions such as the hunting of bowhead whales which resulted in the successful landing of two whales (1991 and 1996) (Snow 2009).

The IGC and Joint Secretariat maintain a record of the Inuvialuit Harvest Study and subsequent harvest programs completed in the ISR.

The IGC and Joint Secretariat collect and maintain the following data as part of harvest studies:

- Number of harvesters by community.
- Species harvested.
- Harvest numbers.
- Hunter/trapper observations.

Contact Information:
Inuvialuit Game Council
Resource Management Coordinator
107 MacKenzie Road #204,
Inuvik, NT X0E 0T0
Telephone: (867) 777-2828
Fax: (867) 777-2610
Email: tech-rp@jointsec.nt.ca

3.4.2.9 Inuvialuit Cultural Resource Centre

The Inuvialuit Cultural Resource Centre (ICRC) began in May 1998 and is currently located in Inuvik. Together with the Inuvialuit Regional Corporation (IRC) it has supported several oral history projects. Its mandate includes:

- Developing a language plan for the Region;
- Creating an Inuvialuktun Language Curriculum;
- Providing Inuvialuktun teachers with resource materials and
- Preserving and modernizing the language (ICRC 2015).

Several contacts made during this program indicated that the ICRC is the holder of datasets or knowledge regarding language, cultural education, traditional knowledge transference, and art.

Contact Information:
Inuvialuit Cultural Resource Centre
Manager
107 Mackenzie Road, Bag Service #21
Inuvik, NT X0E 0T0
Toll-Free: 1-855-777-7001
Telephone: (867) 777-7000
Fax: (867) 777-7001
Email: info@inuvialuit.com
Website: http://www.irc.inuvialuit.com/

3.4.2.10 Prince of Wales Northern Heritage Centre (GNWTECE)

Under the Culture and Heritage Division of the GNWTECE, the Prince of Wales Northern Heritage Centre is a museum and archives facility that displays documents and objects that reflect the heritage of the Northwest Territories. Staff provides technical, logistical and financial support to individuals and organizations involved in cultural activities and the arts in the NWT. In addition, the education staff develops and presents a variety of educational programs for all ages and prepares educational materials regarding NWT heritage (Prince of Wales Northern Heritage Centre 2015).

The Prince of Wales Northern Heritage Centre maintains the following datasets:

- Number of visitors to the museum and archives.
- Database of articles and exhibits at the museum.
- List of documents available at the archives.
- Records of presentations and educational materials delivered.

Contact Information:

Prince of Wales Northern Heritage Centre

GNWT Department of Education, Culture and Employment
4750 48th Street, P.O. Box 1320
Yellowknife, NT X1A 2L9 Canada
Telephone: (867) 873-7551
Fax: (867) 873-0205
Email: pwnhc@gov.nt.ca
Website: http://www.pwnhc.ca/

3.4.2.11 GNWT Arts Program

The GNWT Arts Program is a marketing initiative established in October 2004 and administered by the Government of the Northwest Territories Department of Industry, Tourism and Investment. A joint initiative between the Department of Education, Culture and Employment and the Department of Industry, Tourism and Investment, the GNWT Arts Program represents all artists of the Northwest Territories (NWT) active in:

- traditional arts and fine crafts;
- contemporary arts and fine crafts;
- performing arts;
- literary arts; and
- film and media arts (NWT Arts 2015).

The NWT Arts Program maintains the following datasets:

- List of artists by area of the NWT.
- List of artists by product.

Contact Information:

The GNWT Arts Program
Department of Industry, Tourism and Investment Government of the Northwest Territories
4th Floor Scotia Centre
Box 1320
Yellowknife, NT X1A 2L9
Toll-Free: 1-877-445-2787
Telephone: (867) 920-6130
Fax: (867) 873-0101
E-mail: nwtarts@gov.nt.ca
Website: http://nwtarts.com/

3.4.2.12 GNWT Arts Council

The GNWT Arts Council was established in August 1985 as an advisory board to the Government of the Northwest Territories. The mandate is to promote the arts in the Northwest Territories with the Arts Council providing recommendations to the Minister of Culture and Communications on financial awards

for artistic purposes, and on issues and policies associated with the arts and artists (GNWT Arts Council 2015).

The NWT Arts Council maintains the following datasets:

- List of artists in the NWT who have received funding and their craft.

Contact Information:
The GNWT Arts Council
Community Programs Office
GNWT Education, Culture & Employment
PO Box 1320
Yellowknife, NT X1A 2L9
Toll-Free: 1-877-445-2787 ext. 3 or 5
Telephone: (867) 920-6370
Fax: (867) 873-0205
E-mail: boris_atamanenko@gov.nt.ca or karen_wright-fraser@gov.nt.ca
Website: http://www.nwtartscouncil.ca/

3.4.2.13 Great Northern Arts Festival

The Great Northern Arts Festival goal is to promote the arts in the Northwest Territories. Their objectives are to:

- Foster the education and training of Northern artists regarding all facets of the creation and business of the arts through the establishment of a Northern Arts Festival;
- Hold, where feasible, workshops and seminars during the year which focus on the above aim;
- Promote Northern artists and guests of the Festival and their artwork, primarily through the organization of non-profit exhibitions at which artists may exhibit and sell their work; and
- Do all things incidental to these purposes (Great Northern Arts Festival 2015).

The Great Northern Arts Festival maintains the following datasets:

- List of artists that participate.
- List of products available by participating artists.

Contact Information:
Executive Director
The Great Northern Arts Festival
2nd Floor Midnight Sun Complex
P.O. Box 2921, Inuvik, NT X0E 0T0
Telephone: (867) 777-8638

Fax: (867) 777-2017
Email: gnaf@inuvik.ca
Website: http://gnaf.org/

3.4.2.14 Gwich'in Social & Cultural Institute

The Gwich'in Social & Cultural Institute (GSCI) was established in the fall of 1993 with a mandate to document, preserve and promote the practice of Gwich'in culture, language, traditional knowledge and values. The objective of the Institute is to conduct research in the areas of culture, language and traditional knowledge so that this body of knowledge will be recorded and available for future generations and the development of programs appropriate for Gwich'in needs. GSCI works with the four communities of Aklavik, Fort McPherson, Inuvik, and Tsiigehtchic (Gwich'in Social & Cultural Institute 2015).

The Gwich'in Social & Cultural Institute maintains the following datasets for programs they deliver:

- Program enrollment (number of participants).
- Resources utilized.
- Participant communities.
- Program objectives and outcomes.

Contact Information:
The Gwich'in Social & Cultural Institute
Executive Director
P.O. Box 30
Fort McPherson, NT X0E 0B0
Telephone: (867) 952-2524
Fax: (867) 952-2238
Email: gsciexecutivedirector@learnnet.nt.ca
Website: http://www.gwichin.ca/

3.4.2.15 Inuvialuit Game Council and Joint Secretariat

The Inuvialuit Game Council (IGC) became incorporated in April 1983 and represents the Inuvialuit interest in wildlife. Part of the Council member's duties are to review wildlife research proposals from the Canadian Wildlife Service (CWS) and the renewable resource departments of both territorial governments for projects within the settlement region. In addition, they set funding priorities for these and other projects related to wildlife and the environment (Indian and Northern Affairs Canada 1998).

The Joint Secretariat was established in 1986 by the Inuvialuit, GNWT and federal government to provide support services to the wildlife and environmental institutions of public government and to the Inuvialuit Game Council (IGC). The Secretariat administers funding for these institutions and provides administrative and technical support and functions as the focus for all information about their activities. It also performs

the library and data collection duties of the Research Advisory Council (Indian and Northern Affairs Canada 1998).

The IGC are active on local, regional, national and international levels. In 1986, the IGC conducted a comprehensive ten year harvest study called the Inuvialuit Harvest Study. The IGC was also instrumental in the revival of Inuvialuit traditions such as the hunting of bowhead whales which resulted in the successful landing of two whales (1991 and 1996) (Snow 2009).

The IGC and Joint Secretariat maintain a record of the Inuvialuit Harvest Study and subsequent harvest programs completed in the ISR.

The IGC and Joint Secretariat collect and maintain the following data as part of harvest studies:

- Number of harvesters by community.
- Species harvested.
- Harvest numbers.
- Hunter/trapper observations.

Contact Information:

Inuvialuit Game Council
Resource Management Coordinator
107 MacKenzie Road #204,
Inuvik, NT X0E 0T0
Telephone: (867) 777-2828
Fax: (867) 777-2610
Email: tech-rp@jointsec.nt.ca

3.4.2.16 Aurora Research Institute

The Aurora Research Institute dates back to 1964 and is currently a research division of the Aurora College. The mandate of the Institute is to improve the quality of life for NWT residents by applying scientific, technological and indigenous knowledge to solve northern problems and advance social and economic goals (Aurora Research Institute 2015). The Aurora Research Institute provides licensing for research to take place in the NWT. A database of licenses with a description of the research initiatives is maintained, however it should be noted that the Institute does not maintain copies of the research conducted nor documents related to the research. A Compendium of Research in the Northwest Territories is published annually and includes the Scientific Report Series (which provides scientific information in a style and language that is easy to understand for the general reader), quarterly reports, technical reports and other documents.

The Aurora Research Institute maintains the following datasets:

- List of research activities in the Northwest Territories for which a permit was obtained.
- Synopses of research initiatives conducted under such permits.
- Contact information of researchers.

Contact Information:
Aurora Research Institute Headquarters
Manager of scientific Services
P.O. Box 1450
Inuvik, NT X0E 0T0
Telephone: (867) 777-3298
Fax: (867) 777-4264
Email: licence@nwtresearch.com
Website: www.nwtresearch.com

3.4.2.17 Aurora College

Aurora College is comprised of three regional campuses as well as Community Learning Centres to provide post-secondary education to 33 communities in NWT. Many of its students are Aboriginal from small, remote communities. Aurora College is committed to supporting the development of Northern society through excellence in education, training and research that is culturally sensitive and responsive to the Northern communities.

Programs offered at the college are broad and include certificates, diplomas and degrees. The Aboriginal Language and Cultural Instruction Program is designed to train individuals to work as Aboriginal language instructors in NWT schools, teaching Aboriginal languages and culture courses. The program is a mixture of Aboriginal language immersion courses and teaching methodologies courses related specifically to teaching Aboriginal languages. The courses offered through Aurora College are technical in nature and would not provide data to support valued components selected for Cultural Vitality (Aurora College 2015).

Contact Information:
Aurora College
50 Conibear Crescent, P.O. Box 1290
Fort Smith, NT X0E 0P0
Toll-Free: 1-866-287-2655
Website: http://www.auroracollege.nt.ca

3.4.2.18 Dechinta Centre for Research and Learning

The Dechinta Centre for Research and Learning provides a series of credited educational programs through the University of Alberta. In addition they provide Teacher programs and Professional Development programs. The programs provide a unique experience through intense classroom and land-

based components. One of the main goals of Dechinta is to offer the opportunity for individuals to learn about the environment, politics and history of Denendeh / NWT from indigenous experts, leading professors, local leaders and elders in a co-teaching environment. They also provide opportunities to engage in hands on aspects of community sustainability (*i.e.,* harvesting and gathering) as well as visit self-governing communities and learn from First Nations leaders the process of negotiating self-government and land claims (Dechinta Centre for Research and Learning 2015).

The Dechinta Centre for Research and Learning maintains the following datasets with respect to cultural education:

- List of Indigenous experts, leading professors, local leaders, and elders involved in the programs.
- Student list.
- Participant communities.

Contact Information:

Dechinta Centre for Research and Learning
P.O. Box 1568
Yellowknife, NT X1A 2P2
Toll-Free: 1-877-388-2874
Toll-Free Fax: 1-877-388-2039
Telephone: (867) 445-1897
Email: dechintaadmin@gmail.com
Website: http://dechinta.ca

3.4.2.19 GNWT Literacy Council

The GNWT Literacy Council began in 1989 and was fully formed in 1994. It is a territorial-wide organization that supports and promotes literacy in all official languages of the NWT. The GNWT Literacy Council:

- Offers training and workshops for community-based practitioners;
- Develops and publishes resources and learning materials for various groups;
- Mentors and supports local literacy and essential skills practitioners and their projects;
- Conducts research into issues that affect literacy and essential skills development in the NWT, as well as monitor and share research from other places that impacts work in the region;
- Promotes the value of literacy and essential skills through produced materials and sponsored events;
- Maintains an extensive network of interested stakeholders and partners, and shares information about literacy and essential skills through newsletters and the website;
- Offers fee-for-service plain language design, writing and editing services; and
- Monitors and responds to territorial and national literacy and essential skills policies (GNWT Literacy Council 2015).

The NWT Literacy Council maintains the following datasets:

- Record of the number of copies of resource materials (i.e., books, information pamphlets, publications) developed and produced by the Council to support literacy in English as well as Aboriginal languages.
- List of the individuals who have received Family Literacy Training and are considered a "Trained Volunteer" who can provide support directly to communities and host literacy events and/or present literacy materials.

Contact Information:
GNWT Literacy Council
PO Box 761
Yellowknife, NT X1A 2N6
Toll Free: 1-866-599-6758
Telephone: (867) 873-9262
Fax: (867) 873-2176
Email: nwtliteracy@nwtliteracy.ca
Website: www.nwtliteracy.ca

3.4.2.20 Beaufort Delta Education Council

The Beaufort-Delta Education Council is the most northerly school board in the Northwest Territories with all eight communities and nine schools located north of the arctic Circle. The BDEC serves approximately 1800 students in the region, is responsible for about 200 administrators, teachers and support staff, and oversees a budget of approximately $24 million. The BDEC's mission is to *strengthen partnerships to build thriving school communities which embrace and deliver culture-based education by providing tools and resources for student success* (Beaufort-Delta Education Council 2015).

Several attempts were made to contact the BDEC regarding potential cultural education programs within the educational system in the ISR, however a response has yet to be received.

Contact Information:

Beaufort-Delta Education Council
Superintendent
Bag Service No.12,
Inuvik, Northwest Territories, Canada,
X0E 0T0
Telephone: (867) 777-7136
Fax: (867) 777-2469
Website: http://www.bdec.nt.ca/

3.4.2.21 Northern News Service

The Northern News Service has provided newspaper service for 61 northern communities since 1945. In 1999, the Northern News Service evolved into two separate publications, each serving its respective territory (NWT and Nunavut). In addition, the Yellowknifer, Deh Cho Drum, Inuvik Drum and Kivalliq News serve regional interests in both territories. Newspapers produced and available throughout the NWT are available in the English and Inuktitut languages. The Inuvik Drum is available in the Inuvik and Deh Cho areas and is produced only in English (Northern News Service 2015). The Northern News Service maintains a list of subscriptions and distribution as well as data on visits to the on-line site.

The Northern News Service maintains the following datasets:

- Subscription lists by community.
- Record of visits to internet website.

Contact Information:

Northern News Service
P.O.Box 2820
Yellowknife NT X1A 2R1
Telephone: (867)873-4031
Fax: (867)873-8507
Email: nnsl@nnsl.com
Website: http://www.nnsl.com

3.4.2.22 Inuvialuit Regional Corporation and Individual Community Corporations

The Inuvialuit Regional Corporation was established with the overall responsibility of managing the affairs of the ISR as outlined in the Inuvialuit Final Agreement (IFA). The IRC's mandate is to continually improve the economic, social and cultural well-being of the Inuvialuit through implementation of the IFA and by all other available means (IRC, 2015).

Through a democratic process, Inuvialuit beneficiaries directly control IRC and its subsidiaries. Each Inuvialuit community (Aklavik, Inuvik, Paulatuk, Sachs Harbour, Tuktoyaktuk and Ulukhaktok) has a community corporation (CC) with elected directors. The directors of the six community corporations elect the Chair/Chief Executive Officer of IRC. The Chairs of each CC, together with the Chair of IRC, form the IRC Board of Directors (IRC 2015).

The goals of the IRC are as follows:

- The preservation and growth of the financial compensation flowing from the IFA;
- The distribution of accumulated wealth to beneficiaries;
- The representation and advancement of Inuvialuit interests in areas of external relations including federal, territorial, and municipal governments, circumpolar and other aboriginal organizations, private sector and special interest groups;

- The stewardship of Inuvialuit lands;
- The identification and successful implementation of economic, social, cultural, educational, training and employment programs that benefit Inuvialuit;
- The provision of technical and administrative support to community corporations and beneficiaries, andThe promotion of rights and benefits accorded to Inuvialuit under the IFA (IRC 2015).

The Inuvialuit Regional Corporation and/or individual Community Corporations maintain the following datasets:

- List of economic, social, cultural, educational, training and employment programs undertaken in the communities of the ISR.
- Beneficiaries of distribution payments.

Contact Information:

Inuvialuit Regional Corporation
107 Mackenzie Road
Bag Service #21, Inuvik, NT X0E 0T0
Tel: (867) 777-7000
Toll-Free: 1 855 777-7011
Fax: (867) 777-7001
Email: info@inuvialuit.com
Website: http://www.irc.inuvialuit.com/

Aklavik Community Corporation (ACC)
P.O. Box 119, Aklavik, NT X0E 0A0
Tel: 867.978.2414
Fax: 867.978.2815
Email: accmanager@northwestel.net

Inuvik Community Corporation (ICC)
P.O. Box 1365, Inuvik, NT X0E 0T0
Tel: 867.777.2603
Fax: 867.777.4422
Email: iccmanager@northwestel.net

Paulatuk Community Corporation (PCC)
P.O. Box 92, Paulatuk, NT X0E 1N0
Tel: 867.580.3601
Fax: 867.580.3508
Email: pcc_southwindcapital@hotmail.com

Sachs Harbour Community Corporation (SHCC)
P.O. Box 60, Sachs Harbour, NT X0E 0Z0

Tel: 867.690.3025
Fax: 867.580.3508
Email: shcc_manager@yahoo.ca

Tuktoyaktuk Community Corporation (TCC)
P.O. Box 350, Tuktoyaktuk, NT X0E 1C0
Tel: 867.977.2390
Fax: 867.977.2504
Email: tukcc@netkaster.ca

Ulukhaktok Community Corporation (UCC)
P.O. Box 161, Ulukhaktok, NT X0E 0S0
Tel: 867.396.4701
Fax: 867.396.3284
Email: ulu_community_corp@hotmail.com

3.4.2.23 Industry Canada

Industry Canada is a department within the Government of Canada whose mission is to foster a growing, competitive and knowledge-based Canadian economy. This is done by:

- improving conditions for investment;
- improving Canada's innovation performance;
- increasing Canada's share of global trade; and
- building an efficient and competitive marketplace (Industry Canada 2015).

Industry Canada maintains the Canadian Company Capabilities database, which provides:

- A searchable list of company profiles (including the Translation and Interpretation Services (54193) directory which provides a list of translators/interpreters in NWT).

It should be noted that the database does not provide a full list of companies in the industry.

Contact Information:

Industry Canada
C.D. Howe Building
235 Queen Street
Ottawa, Ontario K1A 0H5
Toll-Free: 1-800-328-6189
Telephone: (613) 954-5031
Fax: (613) 954-2340
Website: http://www.ic.gc.ca

3.4.2.24 GNWT Department of Transportation (GNWTT)

Created in 1989, the GNWT Department of Transportation (GNWTT) aims to provide an integrated transportation system in NWT that meets the social, economic and political needs of Northern residents. Their mandate is to plan, design, construct or reconstruct, acquire, operate and maintain public transportation infrastructure in the NWT. This includes community airports, docks and the highway system. The GNWTT also regulates and licenses individuals and vehicles operating in NWT. Currently the GNWTT is responsible for:

- 2,200 kilometres of all-weather highway;
- 1,635 kilometres of publicly constructed winter roads;
- four ferry and ice crossings; and
- 27 community airports (GNWTT 2015).

The NWT Department of Transportation maintains an inventory of signage for which they are responsible in the Inuvialuit Settlement Region. Information regarding the signage includes dimensions of the signage, details, as well as pictures. In addition, the inventory indicates whether a specific sign is in English, French and/or Aboriginal language.

Contact Information:

GNWT Department of Transportation
A/Head of Technical Services
4501 50 Avenue, P.O. Box 1320
Yellowknife, NT X1A 2L9
Telephone: (867) 873-7666
Direct Telephone: (867) 873-7587
Fax: (867) 873-0288
Website: http://www.dot.gov.nt.ca

3.4.2.25 GNWT Department of Industry, Tourism and Investment (GNWTITI)

The GNWTITI's vision is to promote:

- Development that reduces regional and community disparities;
- Working with regional business corporations and other partners to identify new economic opportunities;
- Advancing alternative energy initiatives; and
- Supporting the development of local economies through small businesses and community-based sectors.

The GNWTITI administers and/or provides support for a number of projects in the ISR pertaining to cultural vitality (of particular note for Cultural Vitality: NWT Arts Program and "Take a Kid Trapping" Program (GNWTITI 2015).

The GNWT Department of Industry, Tourism and Investment maintains the following datasets with respect to the programs they administer:

- List of Program participants.
- Participant communities.
- Program objectives and outcomes.

Contact Information:

GNWT Department of Industry, Tourism and Investment
Beaufort Delta Region
2nd Floor Semmler Building
P.O. BOX 2589
Inuvik NT X0E 0T0
Telephone: (867) 777-7196
Fax: (867) 777-7321
Website: http://www.iti.gov.nt.ca

3.4.2.26 Gwich'in Renewable Resources Board

The Gwich'in Renewable Resource Board (GRRB) was established to be the main instrument of wildlife, fish and forest management in the Gwich'in Settlement Area. The GRRB is involved in a variety of activities and provides consultation on:

- Limitation of harvest;
- Setting Gwich'in Needs Levels;
- Approvals of management plans;
- Advising the government;
- Making decisions on commercial harvesting; and
- Setting research priorities in the GSA.

The Gwich'in Renewable Resource Board also assists in the development of Management Plans for Wildlife & Habitat as well as Fisheries (GRRB 2015).

The Gwich'in Renewable Resource Board maintains the following data for communities in the Gwich'in Settlement Area:

- Number of harvesters by community.
- Species harvested.
- Harvest numbers.
- Hunter/trapper observations.

Contact Information:

Gwich'in Renewable Resources Board
PO Box 2240
2nd Floor, Alex Moses Greenland Building
105 Veterans' Way (formerly Distributor Street)
Inuvik, NT X0E 0T0
Telephone: (867) 777-6600
Fax: (867) 777-6601
Email: office@grrb.nt.ca
Website: http://www.grrb.nt.ca

3.4.2.27 Nutrition North Canada

Initiated in 2011, Nutrition North Canada is a Government of Canada subsidy program to provide Northerners in isolated communities with improved access to perishable nutritious food. Nutrition North Canada subsidizes a variety of perishable and nutritious food (fruit, vegetables, milk, eggs, meat and cheese) as well as country foods commercially processed in the North (arctic char, musk-ox and caribou) shipped by air to eligible communities. Eligible communities lack year-round surface transportation (no permanent road, rail or marine access) and have used Food Mail (the department's previous northern transportation subsidy program). All ISR communities with the exception of Inuvik are eligible for full subsidies (Nutrition North Canada 2015).

Nutrition North Canada maintains data for the following:

- Amount of subsidies received (perishable food shipments, transportation, country or traditional food) by community.
- Community food prices through the Revised Northern Food Basket program run by Aboriginal Affairs and Northern Development Canada.

Contact Information:

Nutrition North Canada
Advisory Board
25 Eddy Street, 14th Floor,
Gatineau, QC K1A 0H4
Fax: (819) 953-9309

Email: nncadvisoryboard@aadnc.gc.ca
Website: http://www.nutritionnorthcanada.gc.ca/

3.4.2.28 Inuvialuit Communications Society

The Inuvialuit Communications Society produces print and video content from Canada's western arctic, reflecting the lives and traditions of the Inuvialuit people. Currently, they produce a magazine (Tusaayaksat) four times a year, which is distributed to Inuvialuit subscribers. It is also sold on newsstands in Inuvik. Published primarily in English, it also features some content in the Inuvialuktun language. In addition, the Inuvialuit Communications Society produces three television series, Tamapta, Suaangan, and Uumatimnin, respectively. The series are based in the communities of the Inuvialuit Settlement Region, focusing on Inuvialuit stories, traditions, culture and way of life. Much of the programming appears on the Aboriginal People's Television Network (Inuvialuit Communications Society 2015).

The Inuvialuit Communications Society maintains the following datasets:

- Magazine subscription lists by community.
- Newsstand magazine sales records.
- Viewership data for television programming.

Contact Information:

Inuvialuit Communications Society
PO Box 1704
Inuvik, NT X0E 0T0
Telephone: (867) 777-2320
Fax: (867) 777-2744
Email: ics@northwestel.net
Website: https://inuvialuitcommunicationssociety.wordpress.com

3.4.2.29 Native Communications Society of the NWT

The Native Communications Society of the NWT includes radio and television broadcasting, delivering Aboriginal language services to 33 different communities and three diamond mines, as well as into Alberta and Nunavut. NCS Productions Ltd. is a production company that caters to video and film production, and houses a small stock of rental equipment and provides video services for educational institutions, industry, government, tourist companies, Native development corporations, community organizations, and families or individuals. CKLB Radio programming is provided in English as well as Aboriginal languages and focuses on Aboriginal issues, interests, cultures and lifestyles, including a broad range of music genres, Aboriginal music, regional news and unique radio specials (Native Communications Society of the NWT 2015).

The Native Communications Society of the NWT maintains the following datasets for CKLB Radio:

- Listenership data (list of receptor communities).
- Audience statistics/numbers.

Contact Information:

Native Communications Society of the NWT
Executive Assistant
4901 48th St.
P.O. Box 2193
Yellowknife, NT X1A 2P6
Telephone: (320) 295-7683
Email: admin@ncsnwt.com
Website: http://www.ncsnwt.com

3.4.2.30 Aboriginal Peoples Television Network

Launched September 1, 1999, the Aboriginal Peoples Television Network (APTN) is the first and only national Aboriginal broadcaster in the world, with programming by, for and about Aboriginal Peoples. The APTN Programming department develops, commissions, and acquires distinctive Aboriginal content reflecting aboriginal pride and heritage. The mission is to enable Aboriginal people to share their stories and convey them to a domestic and international audience.

APTN is available in approximately 10 million Canadian households and commercial establishments with cable, direct-to-home satellite (DTH), telco-delivered and fixed wireless television service providers. With 84% of its content originating from within Canada, APTN broadcasts are 56% English, 16% French and 28% Aboriginal languages. Programming includes children's animation, youth, cultural and traditional programming, music, drama, news and current affairs, as well as live coverage of special events and interactive programming (APTN 2015).

The APTN maintains the following dataset:

- Viewership data for television programming.

Contact Information:

Aboriginal Peoples Television Network
339 Portage Ave.
Winnipeg, MB R3B 2C3
Toll-Free: 1-888-330-2756
Telephone: (204) 947-9331
Fax: (204) 947-9307
Email: info@aptn.ca

Website: http://aptn.ca

3.4.2.31 Inuit Broadcasting Corporation

The Inuit Broadcasting Corporation produces shows about Inuit people of Nunavut in Inuktitut. Programming focuses on children, musicians, politicians, issues and other pertinent subjects related to Inuit communities in Nunavut. Although the IBC programs are not produced in the NWT, it should be noted the programs are aired on the APTN, and therefore available to the people in the ISR communities (IBC 2015).

The IBC maintains the following datasets:

- Viewership data for television programming.

Contact Information:

Inuit Broadcasting Corporation
Iqaluit (Production Uplink)
P.O Box 700
Iqaluit, NT XOA OHO
Telephone: (867) 979-6231
Fax: (867) 979-5853
Email: info@inuitbroadcasting.ca
Website: http://www.nac.nu.ca/

3.4.2.32 Canadian Broadcasting Corporation (CBC)

CBC began in 1920 as a radio station created to provide and protect Canadian content. In 1958 CBC began its first radio broadcasts in Northern Canada. In 1972, with the advent of the Anik series of satellites, Inuktitut and English radio programming became accessible to most Eastern arctic communities (CBC 2015). Currently, CBC North is the name for CBC's radio and television service for northern communities. There are a series of radio and television programs available with aboriginal content in both English as well as official Aboriginal languages. These include:

- Radio Programming:
  - Northwind (hosted from an Inuvik studio), The Trailbreaker, and Trail's End (English)
  - Denesuline Yatia (Chipewyan)
  - Le Got'She Deh (North Slavey)
  - Nantaii (Gwich'in)
  - Qulliq, Sinnaksautit, Tausunni, and Tuttavik (Inuktitut)
  - Tide Godi (Tlicho (Dogrib))
  - Tusaavik (Inuvialuktun)
  - Dene Yati – All aboriginal languages

- Television Programming:
  - CBC News Northbeat – English
  - Igalaaq – Inuktitut (airs in Nunavut)

There is also online news and programming available through CBC North as well as CBC Aboriginal with the information available in both English and French formats (CBC North 2015).

The CBC maintains the following datasets:
- Listenership data for radio programming.
- Viewership data for television programming.

Contact information
CBC/Radio-Canada Corporate Communications
Box 160,
Yellowknife, N.W.T.
X1A 2N2
Telephone: (867) 920-5400
Website: http://www.cbc.ca/news/canada/north

3.4.3 Ongoing Monitoring

Ongoing monitoring is an essential part of understanding the dynamics currently underway in the cultural vitality of the ISR. The following is a list of present ongoing monitoring projects.

3.4.3.1 Gwich'in Environmental Knowledge Project (GEKP)

The GRRB is currently running the Gwich'in Environmental Knowledge Project (GEKP). The goal of this project is to record and map Gwich'in Elders' knowledge (GRRB 2015). This collected local knowledge provides information about the area's ecosystems. This information can then be used to generate better informed wildlife management plans, conservation strategies, as well as land and water use licensing procedures. The Gwich'in Traditional Knowledge is accessible to GRRB Board staff, community members as well as other researchers through a database and published materials. The developing database contains all recordable information and the published books focus on local Gwich'in ecological knowledge.

3.4.3.2 Community-Based Ecological Monitoring

The GRRB is partnered with the Arctic Borderlands Ecological Knowledge Co-op in a Community-Based Ecological Monitoring project. The goal of this program is to record, synthesize and communicate local knowledge about the environment (Gwich'in Renewable Resources Board 2015). Annually, the Program hires local residents to interview community members about their observations and concerns of fish, berries, caribou, unusual animal sightings, weather conditions and other aspects of the environment and community. The interview questions, annual results and reports are available through the Arctic Borderlands Ecological Knowledge Co-op.

3.4.3.3 The GNWT Department of Environment and Natural Resources

The GNWTENR has several programs which include:

- Barren-ground Caribou;
- Boreal Caribou;
- Bears;
- Fishing;
- Fur Bearing Animals;
- Hunting;
- Moose, Muskoxen and Sheep;
- NWT Cumulative Impact Monitoring Program;
- Small Mammal and Hare Surveys;
- Traditional Knowledge;
- Trapping;
- Tundra Science and Culture Camp;
- Wildlife;
- Wildlife Research; and
- Wood Bison

These programs focus on management strategies and promoting traditional knowledge and practices. More detail may be available at: http://www.enr.gov.nt.ca/programs.

3.4.3.4 Harvest Studies

Due to the significant importance of wildlife resources (country food) to northern communities, each community maintains information about the status of their harvesting activities. This information provides the insight necessary for allocation and monitoring and to support community management of their resources. Not all the information in the community studies is easily accessible or in a common format between communities.

Gwich'in Harvest Study Report was prepared for a harvest study completed over the period of 1995 to 2004 in the Gwich'in Settlement Area communities which includes Aklavik and Inuvik. The report details harvest data by communities over the period of 1995 to 2004.

There is a potential for the IGC and Joint Secretariat to conduct another community-based harvest monitoring program over a shorter timeframe (two to three years) in order to provide a current snapshot of harvest data (J. Lam 2015, pers. comm.).

3.4.3.5 Aboriginal Fund for Species at Risk (AFSAR) Program (Fisheries and Oceans Canada)

The Aboriginal Fund for Species at Risk (AFSAR) program was developed and is run by DFO. Like the AAROM program, the ultimate goal of AFSAR is to ensure that Aboriginal groups participate effectively in the advisory and decision-making processes used for species at risk. Objectives of this program include:

- protection of critical or important species at risk habitat;
- management or restoration of critical or important species at risk habitat;
- conservation of individuals or populations under particular threat(s);
- supporting conservation planning for multiple species at the watershed scale;
- supporting monitoring and assessment;
- supporting outreach, education and training; and
- building capacity of Aboriginal organizations to participate in species at risk processes.

3.4.4 Ongoing or Previous Research Projects/Project-Based Monitoring

3.4.4.1 GNWT Department of Education, Culture and Employment - Official Languages division

Another important division of the GNWT Department of Education, Culture and Employment is the Official Languages division (GNWTECE 2015). Like Early Childhood and School Services, the Official Languages provides several important language programs. These include:

- Aboriginal Languages Month;
- Aboriginal Languages Plan;
- Aboriginal Languages Broadcasting Contributions Program;
- Community Broadcasting Grant Program;
- Aboriginal Languages Communities Program; and
- Aboriginal Languages Literacy Program.

Aboriginal Languages Month

The promotion and use Aboriginal languages every day in everyday activities is essential for the survival of the Aboriginal Languages and the cultural vitality of the communities in NWT. Consequently the month of March has been designated Aboriginal Languages month. This provides an opportunity for residents of NWT to celebrate the richness of language and culture.

Aboriginal Languages Plan

There are several official Aboriginal languages in NWT and the Aboriginal Languages Plan is central to showcasing the importance of the GWNT working with the Aboriginal communities. Citizens, language speakers, language communities and the GNWT is responsible for the use, development and revitalization of Aboriginal languages. Priorities are to be set by each language community to meet each of their particular needs, with support and advice available by the GWNT when required.

Aboriginal Languages Broadcasting Contributions Program

In order to ensure the production and distribution of radio and television programming and press release in the NWT Aboriginal languages, funding is provided to Aboriginal Broadcasting organizations. Legislative Assembly approves these contributions based on the availability of resources and the demonstrated need of each organization. The Canada-NWT Cooperation Agreement for French and Aboriginal Languages in the NWT determines the maximum amounts for the contribution. It should be noted that annual core funding is provided to the Native Communications Society of the NWT (NCS) and the Inuvialuit Communication Society (ICS).

Community Broadcasting Grant Program

The operation costs of community broadcasting organizations in the NWT is partly paid for by the Community Broadcasting Grant Program. For every dollar raised locally by a community broadcasting organization, the Department of Education, Culture and Employment will match that contribution with five dollars in grant money. Annually, $6,000 is the maximum grant a community broadcasting organization can receive.

Aboriginal Languages Communities Program

The Aboriginal Languages Communities Program was established in 2000. Since that time, regional Aboriginal organizations or their designate that represent an official Aboriginal language have entered into annual contribution agreements with the Department of Education, Culture and Employment. Language proposals received from their member communities as well as the development, review and implementation of strategic language plans are the basis for funding allocation. Through this method Aboriginal organizations can continue to manage and be held accountable for language funding to their region. The acquisition, maintenance and revitalization of Aboriginal languages in the communities is the primary purpose of this program.

Aboriginal Languages Literacy Program

Language, social context and cultural identity are all closely linked to NWT literacy. Literacy in the NWT context refers to locals' ability:

- to read and write various kinds of printed material;
- to speak and listen;
- to observe and understand visual representations;
- in numeracy;
- to use technology; and
- to think critically and solve problems.

The Aboriginal Languages Literacy Program was designed to provide financial assistance to community organizations to:

- develop and deliver local projects to increase literacy levels; and
- raise awareness on the importance of literacy in all eleven NWT aboriginal languages.

Contributions are provided to official Aboriginal language communities by the Aboriginal Languages Literacy Program, to support the "preservation, maintenance, enhancement and revitalization of their languages and for community based literacy programs". Community and family literacy as well as the development of Aboriginal language resources is at the heart of this funding initiative. Eligible projects are required to demonstrate literacy improvement and create usable resources.

Examples of Aboriginal language literacy projects include: Aboriginal language curriculum development; Aboriginal language compact discs and/or applications; oral history projects; and dictionary projects.

3.4.4.2 Inuvialuit Pitqusiit Inuuniarutait: Inuvialuit Living History (Various Partners)

The Inuvialuit Pitqusiit Inuuniarutait: Inuvialuit Living History project was produced in collaboration with the Smithsonian Institution's arctic Studies Center, the Department of Canadian Heritage's Museums Assistance Program, Parks Canada's Western Arctic Field Unit, and other project partners. It initially began in 2009 by raising funds to allow a small group of Inuvialuit Elders, traditional experts, and educators to Washington for a week-long workshop to view the collection. As a result of the interest generated by the small group and media outlets, a much broader outreach program was developed.

The project currently consists of a website that provides on-line access to a significant but little-known collection of over 300 cultural objects and nearly 5,000 natural history specimens located at the Smithsonian Institution. These objects and specimens were collected by Roderick MacFarlane, a Hudson's Bay trader, from the Inuvialuit living in the Anderson River area in the 1860s. In addition, the project provides lesson plans for elementary and high school students that highlight Inuvialuit traditional knowledge and the history of the Anderson River region as pathways for learning about items in the collection.

The ultimate goal of this project is "to create a website that can become an archive of documentation of community activities and other resources related to ongoing educational and cultural programs related to the MacFarlane Collection" (http://www.inuvialuithistory.com/).

3.4.4.3 Nunamin Illihakvia: Learning from the Land (Ulukhaktok Community Corporation)

The "Nunamin Illihakvia: Learning from the Land" is a cultural education program developed by the Ulukhaktok Community Corporation in partnership with researchers from McGill University, the University of Guelph, and the University of the Sunshine Coast with funding provided by Health Canada and Canadian Institutes of Health Research. The objective of the program is to support the transmission of traditional knowledge, skill sets and values important to the Inuvialuit vitality. The project brings together young Inuit adults with experienced hunters, sewers and elders to learn subsistence skills for winter hunting (IRC 2015, Ford 2015).

3.4.4.4 Aboriginal Cultural Awareness Training (GNWT Department of Human Resources)

The GNWT Department of Human Resources provides Aboriginal Cultural Awareness Training to GNWT employees with information and context for the communities and regions of NWT. Its content is northern specific and provides historical information on government and Aboriginal relationships. The training is specific for GNWT employees but available for viewing by the general public (http://www.hr.gov.nt.ca/resources/aboriginal-cultural-awareness-training).

3.4.4.5 Inuvialuktun Master-Apprentice Program (Inuvialuit Cultural Resource Centre)

The Inuvialuit Cultural Resource Centre sponsors an Inuvialuktun Master-Apprentice Program. The program requires a Master (a fluent speaker of Inuvialuktun) to teach an Apprentice (Inuvialuktun learner), Inuvialuktun for at least 10 to 15 hours per week through language immersion. During this time, everyday activities are conducted where both the Master and Apprentice speak only in Inuvialuktun. The program goal is to have apprentices increase their fluency in speaking and understanding Inuvialuktun. More information may be available at:

https://www.facebook.com/IRCHumanResources/photos/a.255915134509811.42973.228678227233502/575203592580962/

3.4.4.6 Gwich'in Science Camps (Gwich'in Social & Cultural Institute)

The Gwich'in Social & Cultural Institute runs Gwich'in Science Camps. This program offers senior high school students the opportunity to learn Gwich'in traditional knowledge and western scientific knowledge while living on the land. The program consists of ten day camps that allow students to earn school credits, work with Gwich'in Elders and professionals in the fields of biology, geography and anthropology, in addition to learning about the area's natural and human history (Gwich'in Social & Cultural Institute 2015).

3.4.4.7 Language Immersion Camps (Gwich'in Social & Cultural Institute)

The Gwich'in Social & Cultural Institute runs Language Immersion Camps. This program allows fluent Gwich'in speakers to explain traditional skills to Gwich'in children far from town life where English is the predominant language. This allows the children in learning traditional skills in Gwich'in (Gwich'in Social and Cultural Institute 2015).

3.4.4.8 Environmental Education Projects

The GRRB runs several environmental education projects (Gwich'in Renewable Resources Board, 2015). The goal of these projects and programs is to help youth learn about renewable resources and encourage them to pursue careers in environmental fields.

Available programs include:

- School Environmental Programs;

- Student Trainee Programs;
- Nature Day Program; and
- Other Educational Programs

3.4.4.9 Inuvialuit Cultural Resource Centre

Past projects undertaken by the ICRC (ICRC 2015) include:

- Indigenous Language Conference;
- Summer Language and Cultural Camps;
- Community Language Programs;
- Elder Database Development with translations and recordings;
- Language Teacher Training and Language Program Development;
- Production of classroom materials for language teachers;
- Development of an Inuvialuit Culture and History Program, Grades 1 to 6; and a teaching kit with books, videos and traditional tools;
- Publishing of the new Siglit Dictionaries; and
- Publishing of "Reindeer Days Remembered"

3.4.4.10 Community Harvesters Assistance Program

The GNWTITI provides annual funding assistance through the Community Harvesters Assistance Program to Local Wildlife Committees for distribution to their respective memberships (GNWTITI 2015). This is in recognition of the economic value and inherent challenges in traditional harvesting. This program assists in defraying a portion of capital and operating costs of their harvesting activities.

3.4.4.11 Genuine Mackenzie Valley Fur Program

The Genuine Mackenzie Valley Fur (GMVF) Program developed by the GNWTITI allows NWT trappers direct access to the international fur auction market for fur harvested in the NWT (NWTITI 2015). Also, in partnership with other harvesting jurisdictions and the private sector, the Program actively markets and promotes fur at international venues.

3.4.4.12 'Take a Kid Trapping' Program

The "Take a Kid Trapping Program" was developed by the GNWT Department of Industry, Tourism and Investment to support cultural education within communities of the ISR (GNWTITI 2015). This program is designed to introduce youth in the NWT to the Traditional Harvesting practices of hunting, trapping, fishing and outdoor survival. This program is delivered to schools and Aboriginal organizations in collaboration with the GNWT Department of Municipal and Community Affairs (GNWT MCA) and GNWTENR.

3.4.4.13 Canadian Census of Population (2011 and previous)

The Canadian Census of Population is a national census completed every five years and provides demographic and statistical data used to plan public services such as health care, education, transportation; determine federal transfer payments; and determine the number of Members of Parliament for each province and territory. The 2011 Census of Population provides data on Aboriginal languages as mother tongue and home language for the total population as well as data on other language vitality factors such as intergenerational language transmission, the age of the speakers and language of work (Statistics Canada 2015).

3.4.4.14 National Household Survey (2011)

For the first time, in 2011, Statistics Canada conducted the National Household Survey (NHS) between the months of May and August (Statistics Canada 2011). This survey was introduced as a replacement of Census Form 2B (the long census questionnaire). The NHS is a voluntary and self-administered survey designed to collect economic and social data about Canadians. NHS's objective is to provide data for small geographic areas and small population groups (Statistics Canada 2011).

The 2011 NHS provides data on Aboriginal languages as mother tongue, home language and language of work, as well as data about knowledge of Aboriginal languages for the population in private households. Language data for the Aboriginal population are available only from the NHS. The 2011 NHS also provides data on other language vitality factors such as intergenerational language transmission, the age of the speakers and language of work (Statistics Canada 2011).

3.4.4.15 Aboriginal Peoples Survey (2012 and previous)

The Aboriginal Peoples Survey (APS) is a national survey of First Nations people living off reserve, Métis and Inuit aged six years and over (Statistics Canada 2015). To date there have been four surveys conducted. The 2012 APS focused on education, employment and health but also collected information on language, income, housing and mobility.

The 2012 APS collected information on:

- ability to speak and to understand an Aboriginal language by ability rating (only a few words, with effort, relatively well or very well);
- importance of speaking and understanding an Aboriginal language; and
- frequency of exposure to an Aboriginal language at home and outside the home and language(s) first learned at home in childhood.

The 2012 APS also provides the percentage of individuals who reported to have hunted, fished, trapped or gathered in previous twelve months by Inuit Region (Inuit population aged 15 and older) and recorded reasons for hunting, fishing, trapping or gathering.

3.4.4.16 Early Childhood and School Services

The GNWT Department of Education, Culture and Employment is a very large department which consists of several divisions. These divisions encompass many programs and services needed within the GNWT structure (GNWTECE 2015). One such division is the Early Childhood and School Services. The Early Childhood and School Services is committed to excellence in education through the on-going improvement of teaching and the learning processes. With respect to cultural vitality and the language indicator, the Aboriginal Student Achievement Education Plan and Language Nests stand out as two significant programs provided by this division.

The Aboriginal Student Achievement Education Plan was developed to ensure that NWT Aboriginal people are encouraged and supported to learn and retain their Aboriginal culture and language while also gaining western learning. The Language Nests is an immersion-based approach to Language development. Through the promotion of language skills of community Elders, children, parents and grandparents, this program facilitates language learning. To date, there are more than twenty Language Nests across the NWT with each of the official Aboriginal Languages represented.

3.4.4.17 Culture and Heritage

The Culture and Heritage Division of the GNWTECE is a key player in several of the cultural programs and activities in NWT (NWTECE 2015). This division is principally in charge of the conservation of NWT collections, exhibits, and archives. They are also involved in community programs and education services to promote knowledge of the culture and heritage of NWT. The following is a few of the main programs linked to the cultural vitality of NWT.

Community Culture Programs

Under the Community Culture Program, the Prince of Wales Northern Heritage Centre administers funding for the “promotion and preservation of cultural identity and the enhancement of traditional cultures in the NWT”. Depending on circumstances, funding is also available for NWT based cultural events and projects and oral traditions projects.

All community-based NWT-registered organizations, local governments, band councils and individuals in all regions are eligible to apply for financial assistance for projects that contribute to the preservation, promotion and enhancement of the cultures of the NWT.

Geographic Place Names Program

The NWT Cultural Places Program is in charge of the geographical names of features and places in the NWT. The Program coordinates official recognition for place name changes, placing special emphasis on the recognition of Aboriginal language place names.

Program staff work with NWT communities to research and identify places and geographic features suitable for official status in the NWT. Program staff help provide researchers the correct spelling of geographic names and providing the historical information associated with the names.

Minister's Cultural and Heritage Circle

The Minister's Cultural and Heritage Circle is a program created to provide recognition to individuals and organizations that have contributed to the preservation and promotion of arts, cultures and heritage in NWT. This program builds awareness about the importance of "promoting, protecting, preserving and celebrating our unique culture, heritage and ways of life."

Eligible recipients include:

- Youth Category;
- Individual Category;
- Elders Category;
- Group Category; and
- Minister's Choice Award.

4.0 Cumulative Effects (CE) Framework

4.1 Approach to Framework development

While there are many potential sources of biophysical and human environment data for the Beaufort Sea region, operationalizing the Framework may require only a few to fully meet CE monitoring needs. Determination of key data sources will depend on further work of the WG and operational experience.

While compiling research reports and academic journal materials on cumulative effects monitoring and management, and subsequent research after the workshop to identify sources of information for the selected pilot Valued Components, it became apparent that several administrative and operational factors exist that will affect the design and implementation of a cumulative effects framework. These include:

1. The fact that no single information source exists with sufficient information to monitor the cumulative effects on the individual pilot VCs, but that there are diverse sources of information which can collectively provide information on many of the VCs;
2. The lack of routine monitoring activities that can provide a continuous time-series data for the pilot VCs;
3. The existence of many research activities that provide useful information for one or more of the selected VCs; and
4. The high level of commitment amongst participating Working Group organizations towards advancing a Cumulative Effects Framework.

Each of the above factors can significantly affect the nature and approach to the development and implementation of a Cumulative Effects Framework.

4.1.1 Significant Information Sources

Collection of information on indicators for pilot Valued Components substantiates earlier observations reported by the National Research Council respecting access and availability of environmental data for the Beaufort Sea. There is no- single organization or agency which compiles and maintains data on any of the selected Valued Components. In 2012, it was noted by the National Research Council that "*Over the years, a significant amount of environmental data has been collected in the Beaufort Sea, but it is widely scattered. Searching for the best available datasets is often difficult. Downloading, extracting and visualizing the information from various sources and file formats is even more challenging and time consuming*" (http://www.aadnc-andc.gc.ca/eng/1330363956729/ 1330364008273).

The reasons for the lack of centres with comprehensive VC data for Beaufort Region may include the lack of ongoing resource management planning and management activities for large scale resource harvesting or extraction in this region, and/or the fact that the Beaufort is a relatively undeveloped region compared to other marine jurisdictions in southern Canada.

Information needed to understand the cumulative effects on the pilot VCs does, however, exist across many governmental, community and academic organization which maintain information related to their

operations and activities. Often this information is available to be shared but the nature and format may differ from one organization to another, thus making data interpretation difficult across the varying platforms used for analysis.

4.1.2 Routine monitoring activities

One particularly important aspect of data requirements for cumulative effects monitoring and management is the continuity of the data time series. Data should be available in sufficiently appropriate intervals to ensure changes in VCs can be determined in a manner that is consistent with decision-making processes which can mitigate effects. It is apparent from the existing data and data collection activities for the selected pilot VCs that this type of data are available for only a few of the various identified indicators.

Furthermore, within routine monitoring activities there is often a significant delay between data collection and data analysis, which can undermine the usefulness of information required for timely decision-making for cumulative effects management. Many routine monitoring programs collect large quantities of data and metadata; however the human resource capacity necessary to compile and analyse the data is often limited. This can result in a lag of more than a year before information can be used as evidence to detect minor perturbations in environmental conditions. This issue is compounded by the fact that research and monitoring activities in the harsh climate and remoteness of some sites in the Beaufort Region involve careful planning and expensive travel and mobilization costs which limit the potential for short-term ad-hoc monitoring activities or research.

Without routine monitoring programs already in place, it will be important for the CEF to build upon existing information and to identify where to best focus routine data collection efforts to provide cost effective results. Incomplete information can result in ill-informed interpretation of environmental conditions, thus subjecting environmental management decision-making to inaccurate perception and shifting baseline syndrome. This can have significant consequences on resource management planning and new project development.

4.1.3 Academic Research

Canadian governmental and academic researchers consider arctic research, particularly in the Beaufort Region, as a priority due to the international attention of the region on issues related to climate change, marine mammals, indigenous issues, and resource development. Accordingly, there are numerous research reports which provide information on specific topics of individual researcher interest.

Results from research by government scientists is usually contained in departmental reports, but it can often be published in academic journals. Research conducted by academic researchers is most often reported in academic journals, and depending on the financial support for the research, can also be found in industry reports. Industry researchers' work is often found in industry reports (including Environmental Assessments and regulatory monitoring reports) but can also be found in academic journals.

4.1.4 Government and Stakeholder Commitment

At present, no single agency has overall responsibility for the oversight and implementation of cumulative effects monitoring and management activities in the Beaufort region. Furthermore, considering the diverse and complex nature of the information needed for cumulative effects management, it is unreasonable to expect that any one agency could be effectively tasked with this responsibility. Development and implementation of a Beaufort Sea CEF will require coordination and communication between multiple institutions and agencies which have an interest or mandate to collect information on specific aspects of the VCs. This will require considerable political will on the part of individuals in order to develop networks between the various information sources needed to effectively monitor and manage cumulative effects.

Development of a CE framework will likely involve governmental agencies, non-governmental organizations, community organizations, Inuvialuit, project proponents, and other stakeholders. The creation of the BREA CE WG has itself been a positive step in this process. The members represent many of the organizations identified as a source of information for the pilot VC indicators. Members were also familiar with the work of other organizations so they were easily able to direct researchers to other information sources outside their particular organization.

The commitment to efforts to identify information sources for VC indicators demonstrated by the BREA WG is an example of the political will needed for the continued development of a CE framework.

4.2 Framework Development – information access and sharing

Knowing which organizations and which researchers are involved in collecting and storing information on the various indicators of the environmental, social and economic condition of the VCs in the Beaufort region is only the first step in establishing the framework. Understanding the diversity of organizations and programs and how these organizations relate or interact is important in enabling cost-efficient cumulative effects monitoring. Linking organizations and researchers already engaged in research and monitoring activities for common purpose of information sharing may establish a foundation for the cumulative effects framework.

The schematic of the organizational network in Figure 4.1 does not portray the direct communicative links between organizations. For example, the Polar Data Catalogue does not communicate with the Fisheries Joint Management Committee through DFO, and similarly DFO does not communicate with the Inuvialuit Game Council through the FJMC. The schematic does, however, illustrate two important matters with respect to Cumulative Effects information: the range and diversity of organizations involved with some aspect of information relevant to understanding cumulative effects for each selected pilot Valued Components, and that there are few organizations involved with several aspects of research and reporting on more than one of the Valued Components. Of particular note, a few organizations are involved in research and data management that is relevant to more than one of the four broad themes respecting

the human and biophysical environment in the Beaufort region (healthy communities, environmental sustainability/biodiversity, economic vitality, and cultural vitality). These organizations include:

- the GNWT Department of Education, Culture and Employment;
- the Department of Fisheries and Oceans;
- the Fisheries Joint Management Committee;
- the Inuvialuit Regional Council;
- the Inuvialuit Game Council;
- the NWT Department of Health and Social Services;
- the Gwich'in Social and Cultural Institute;
- Aurora College;
- the NWT Bureau of Statistics; and
- Statistics Canada.

The above organizations should be included in the further development of the CEF as they could be useful conduits in compiling information from other sources in the Framework.

At the onset of the BREA project, it was noted that an important and preliminary step in the evolution of the capacity for cumulative effects monitoring and management in the Beaufort Region is the implementation of a CEF. Based upon the review and analysis of current programs and administrative structures involved with the selected VCs, it is clearly understood that CE monitoring or management framework must be built upon a network of clearly defined information sources. The information sources involved in the CEF should specifically support knowledge and understanding of the state and condition, as well as changes to, the VCs identified. The Framework should facilitate decision-makers' access to complete and timely data and information pertinent to the VC indicators.

Information access and management across organizations can be complicated when the sources of information are the responsibility of organizations and agencies that have varying approaches to data collection, use and management. For example, data collected for determination of resource condition (health of the natural resource) may not be easily interpreted or used by those responsible for matters related to employment in the resource sector (*i.e.,* fisheries stock data and fisheries employment data). Furthermore, data sharing can be difficult when data is collected by different types of users with different technical skills and education. Information used in some disciplines requires specific training and use of subject-specific terminology. This highlights the importance of collaboration between technical experts to assist in understanding and interpreting information from different sources for a common purpose.

Figure 4.1 Cumulative Effects Framework - Information Network

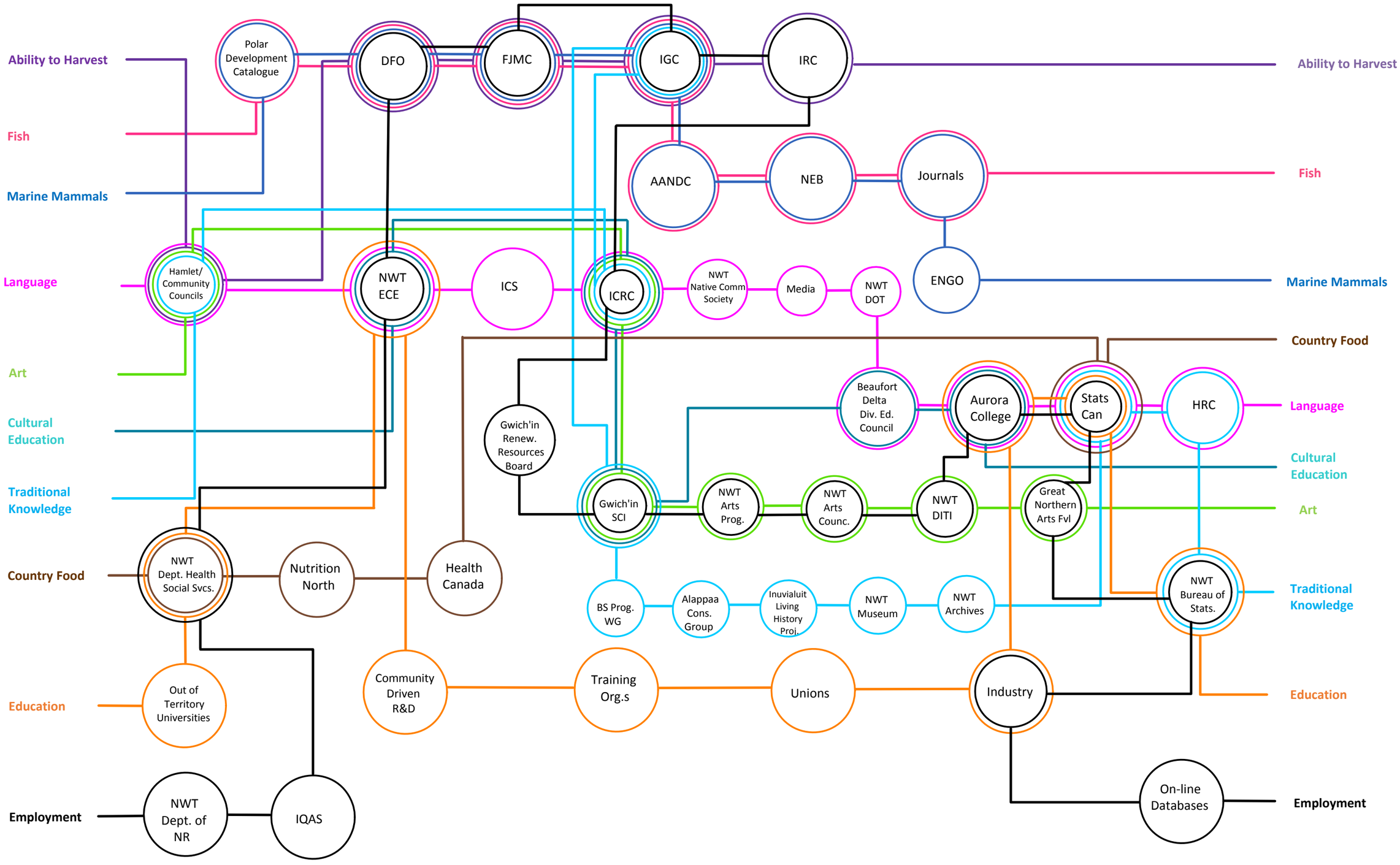


Figure 4.1 illustrates the diversity of the network needed to provide information on the selected Valued Components. This information network provides insight into the nature of the CEF. Some organizations have potential roles in the CE monitoring and management of multiple Valued Components, while others can provide useful support to the cumulative effects monitoring of one or two VCs. This provides better understanding of how to advance a formal CEF and ensure active participation of those organizations involved as information sources for multiple VCs as the foundation for the CEF.

4.3 Framework decision-making processes

Establishing an information network as the foundation for a Cumulative Effects framework for the Beaufort region is the first step in the development and evolution of a Cumulative Effect management system. The ultimate goal of a well-defined framework for supporting management and mitigation of Cumulative Effects is to ensure that that the required information is accessible to decision makers.

There is no one agency with overall responsibility for the management of Cumulative Effects in the Beaufort Region, and as a result decision-making relevant to CE management will require collaboration between several departments/agencies. Management of cumulative effects should involve all of relevant parties responsible for the causes, mitigation, and responses to these effects. As a result, cumulative effects management should include decision-making authorities from the regulatory agencies responsible for the management of the VCs exhibiting cumulative effects, as well as representatives from the projects which have contributed to these effects. Therefore, it is likely that the Cumulative Effects Management decision-making will rest with agencies tasked with assessment of Projects, and the proponents of those projects. That said, the participating organizations and agencies involved with the CEF (Figure 4.1) can play an important role in the CEF. This includes the provision of the information necessary to make informed decisions, and the provision of recommendations to the appropriate Regulatory Agency for CE management.

At this time, the parties involved in effecting CE management decisions for oil and gas projects will include the National Energy Board and, in the Inuvialuit Settlement Region, in accordance with the NEB's *Filing Requirements for Offshore Drilling in the Canadian Arctic* (NEB 2014), the Environmental Impact Screening Committee and the Environmental Impact Review Board, as well as the project proponents. Other possible partners in decision-making may include NWTECE, NWTHSS, IRC, DFO, TC, NRCan, and DND, depending on the VC and the specific nature of the CE. Preliminary CE management decisions should be included in the regulatory approval, and include, at a minimum, requirements for sharing data on pilot VCs within the CE Framework, and responsibilities to report on activities that may impact the VCs to the relevant members of the CE Framework. The CE Framework should then be responsible for reporting observations/findings to the appropriate regulators and project proponents in an open and transparent manner that supports collaborative decision-making.

4.3.1 Timetable for decision making

The effectiveness of the decision-making process can depend on both *who* is involved and *when* they are involved. It is therefore important to consider both an annual timetable for the Framework activities and project timetables related to CE management decision-making.

As noted above, information sharing and monitoring is an important consideration in CE monitoring and management. Therefore, at the onset of a new project, , regulatory agencies should include clear direction on what VC-related information should be monitored and reported on by project proponents, as part of the approvals process. This should include a specific timetable for reporting this information in relation to key project events and activities. The information required should include baseline information for each VC, as well as schedules for updating and reporting information on these VCs. Reporting requirements for monitoring data should remain a responsibility of the project proponent until after project closure.

The CE Framework should adopt a regular annual timetable to meet to review and discuss compiled VC CE monitoring data. Up to this point, the work and meetings of the BREA CE WG have been related to the BREA program needs. These meetings have had no defined annual CE monitoring and management purpose. Moving forward in the implantation of the CE Framework, the participants in the Framework should meet annually to review VC information collected and compiled from the previous year. This meeting should take place at or near the beginning of the fiscal year to ensure information can be reviewed and recommendations provided to regulators. The timing of approvals will enable actions requiring additional field work to be included in proponent and agency work plans for the year, and budgetary considerations for participation in the CE Framework will be known.

Each project should be considered during the Annual Framework meeting. However, depending upon the extent of cumulative effects identified, subsequent meetings of the Framework members, regulators, and project proponents may be required to review information and determine remedial mitigative actions which may be necessary to limit further advancement of negative cumulative effects, or to promote positive CE.

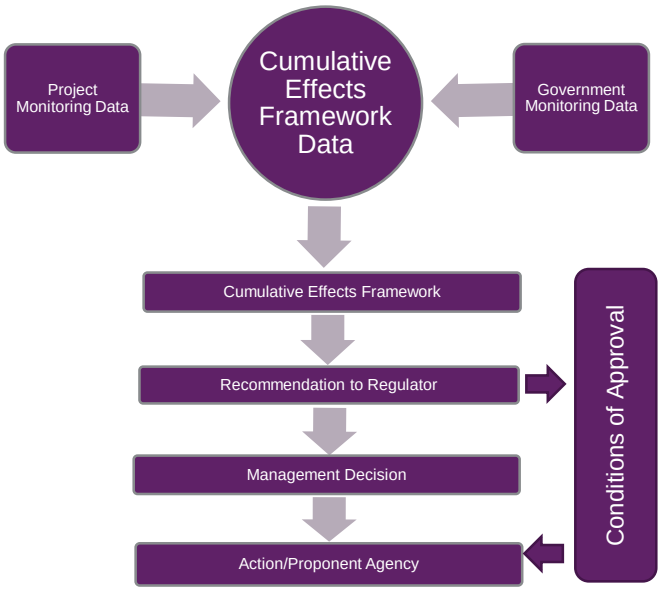


Figure 4-2. CE Management Decision-making Flow Chart

5.0 Recommendations

Based on the results of the workshop, in which the pilot VCs were selected, and subsequent review of completed and ongoing research and monitoring activities by the various government (federal, territorial, and Inuvialuit), academic and industry agencies, AMEC offers the following recommendations to the BREA CE WG.

5.1 Recommendation 1

Considerable work is needed to establish a coordinated framework for the monitoring and management of cumulative effects in the Beaufort region. Initial work to identify Valued Components representative of the four themes of human and biophysical environmental concern (healthy communities, environmental sustainability/biodiversity, economic vitality, and cultural vitality) has been helpful in identifying critical issues and logical approaches to the development of the Cumulative Effects Framework.

This work has been coordinated by the BREA CE WG, as part of a process that has considerably advanced the knowledge and understanding of environmental conditions and processes in the Beaufort region. Without the concerted efforts of the BREA Program, it is unlikely that any other initiative could have undertaken the work of the BREA CE WG.

Continued development of a Cumulative Effects Framework can best be undertaken through small pragmatic steps which can maintain the political will and provide useful information and advice on cumulative effects management.

Recommendation 1

It is recommended that efforts be made to continue the work of the BREA Cumulative Effects Working Group. The Working Group can play a pivotal role in coordination of information exchange and oversee the continued development and implementation of a Beaufort Regional Cumulative Effects Framework.

5.2 Recommendation 2

It is unlikely that new programs will be initiated in the current fiscal climate; however, some cost effective measures can be undertaken to enhance access and availability of information useful for cumulative effects monitoring. With oversight from the BREA CE WG, efforts should be made to compile and document results from the many academic research reports and data-sets held by the organizations and agencies. To this end, and for the specific purpose of development and implementation of the Cumulative Effects Framework for the pilot VCs, the BREA CE WG should seek to include among its membership representatives from organizations whose work is relevant to more than one of the pilot VCs. These organizations include:

- the NWT Department of Education, Culture and Employment;
- the Inuvialuit Game Council;
- the NWT Department of Health and Social Services;
- the Gwich'in Social and Cultural Institute;
- Aurora College; and
- the NWT Bureau of Statistics and Statistics Canada.

Recommendation 2

The BREA Cumulative Effects Working Group should be expanded to include representatives from those organizations involved with data collection, storage, and reporting on multiple Valued Components.

5.3 Recommendation 3

The process of CE management must build upon the authorities of existing environmental management agencies as the CE Framework continues to develop. As a result, CE management decisions should be founded upon existing regulatory processes while there is continued advancement of the information framework required to make informed decisions about cumulative effects. Accordingly, the environmental regulatory agencies (NEB, CEAA, EISC and EIRB) should work collaboratively with other departments and agencies (federal, territorial, and Inuvialuit) to advance the CE Framework.

As part of this process, consideration should be given to including requirements for monitoring of VCs and conditions for CE mitigation in regulatory approvals. This will provide clarity to project proponents regarding the purpose of CE Framework and CE management responsibilities.

The CE Framework will provide the mechanism through which data and information can be provided, along with management recommendations, to the appropriate regulatory agency for consideration, final approval and action.

Recommendation 3

The CE Framework should provide support to existing environmental Regulatory Agencies (NEB, CEAA, EISC and EIRB) in making informed decisions. These Agencies should consider including CE monitoring and mitigation requirements for the target VCs as a condition of Approval for each new Project.

5.4 Recommendation 4

Ongoing and fluid communication between parties involved in the CEF is essential to the successful development of an effective framework. Efforts should be made to have regular meetings/teleconferences between organizational representatives involved with compilation of information related to the indicators of the pilot VCs. At this point, this should involve four different groups representing the four pilot VCs, one group each for:

- environmental (including fish and whales);
- economic (employment);
- social (education); and
- cultural (including language, traditional knowledge, cultural education, and country food consumption).

Meetings and teleconferences can be augmented with routine newsletters, email correspondence, social media and web-based surveys directed to the various organizations and agencies identified as nodes in the information framework. Web-based surveys can enable information exchange and provide a means of compiling information and facilitating reporting across the framework.

Recommendation 4

A concerted effort should be made to enhance communication between organizations with a common interest or involvement in collection and compilation of information related to the various Valued Components. The approach to communication and tools used should be multifaceted, involving face to face meetings, teleconference meetings, email correspondence, newsletters, social media, and web-based surveys. This should be undertaken separately for each of the four pilot VCs.

5.5 Recommendation 5

The task of sharing data and information between various organizations involved in cumulative effects monitoring can increase the workload of already-stressed human resources within these organizations. This is particularly true for local community-level organizations that maintain small workforces and often rely on volunteers. The form and type of information generated by different organizations is further complicated by the fact that it is not readily interpretable by others. Therefore, efforts to streamline and facilitate information sharing can greatly enhance the effective participation of all organizations, and assist in determining the extent and relevance of gaps in data needed to fully understand environmental conditions. As noted above, information gaps, either as a result of incomplete monitoring or absence of technical capacity, can subject cumulative effects management to misconception (shifting baseline syndrome). Information exchange can benefit from standardized protocols to guide data sharing by all

parties. Use of simple reporting forms to standardize how annually collected data about various indicators is shared can greatly improve information exchange across the network, and build the inter-annual data necessary for cumulative effects monitoring and management.

The BREA CE WG should take responsibility for the review of the most recent data, including raw biophysical and socio-economic data and metadata. Data forms should include information on the most recent data collected to ensure insights gleaned from current data can provide information on trends which may assist in fully understanding cumulative effects. This will ensure the application of the precautionary principle[4] in CEs management decision-making.

Recommendation 5

Representatives from the BREA CE WG should oversee the development of data sharing forms and promote the use of these forms by organizations involved in routine collection of data and information regarding the pilot VC indicators. The Forms should be simple and enable easy transfer of basic information between organizations on an ongoing basis. These forms should be distributed widely to ensure broad use by all organizations, potentially as digital forms.

5.6 Recommendation 6

The monitoring and management of cumulative effects requires a well-structured process which includes all of the relevant and appropriate organizations and agencies involved with data collection and with responsibility for regulatory environmental decision-making. Effecting management is also dependent on timely decision-making. To this end, organizational representatives involved with the CE Framework should meet annually to discuss and review data and information compiled over the previous year, and formulate appropriate advice and recommendations to the appropriate regulatory agencies (*i.e.* NEB, CEAA, EIRB, *etc.*) for final decisions regarding CE management actions.

Meetings should be regularly scheduled with at least one meeting being held at or near the beginning of the fiscal year to ensure budgetary considerations are understood for the CE Framework participants, and, in the case of biophysical VCs, to enable sufficient time for decisions to be communicated prior to field season.

[4] The precautionary principle is an approach to risk management that has been developed in circumstances of scientific uncertainty, reflecting the need to take prudent action in the face of potentially serious risk without having to await the completion of further scientific research. The most broadly accepted definition of the Precautionary Principle is Principle #15 of the June 1992, Declaration of the Rio Conference on Environment and Development, which reads:
"In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."

Recommendation 6

Representatives from the BREA CE WG should meet annually at the beginning of the fiscal year to review information compiled for the previous calendar year and provide recommendations to Regulatory agencies regarding CE management actions in the upcoming year.

5.7 Recommendation 7

Based on the above recommendations, the BREA CE WG should coordinate the preparation and distribution of annual reports on the state of each VC. To this end, funds should be sought to engage a data coordinator to facilitate this process for each pilot Valued Component. This work is not intended to duplicate the work of ArcticNet or the Polar Data Catalogue, but instead to prepare a plain language report on the historical and current condition of the indicators identified for each pilot VC.

This activity can provide full-time seasonal work for youth educated and interested in working in environmental management.

Recommendation 7

The BREA Cumulative Effects Working Group should identify the financial support (public and private sector) necessary to hire data collection coordinators who will be tasked with collecting and compiling academic research reports and governmental reports containing information specific to the identified VC indicators. Furthermore, the BREA CE WG should designate one member organization to secure the funding and facilitate hiring of the data coordinator for each VC.

5.8 Recommendation 8

The VCs identified for pilot CE monitoring and management by the BREA CE WG were selected to provide representative VCs for the short-term purpose of developing the CE Framework. It is important that all VCs be the subject of CE Management in the long term. As such, additional VCs should be phased-in to the work of the BREA CE WG and added to the overall CE Framework. By taking a phased approach to inclusion of additional VCs, and continued development of the CE Framework, CE monitoring and management activities can be advanced without creating a burden on the BREA CE WG, enabling the Framework to evolve in a manner that will minimize potential problems with data overload in the early stages.

These efforts should involve the full participation of stakeholder groups in determining additional priority VCs for consideration.

Recommendation 8

Representatives from the BREA CE WG should, in consultation with stakeholder groups, identify additional VCs for inclusion in further development of the CE Framework. These VCs should be added to ensure smooth and continued development of the CE Framework.

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APPENDIX A

List of Previous Beaufort Sea Projects

The following list of projects influenced the development of the current BREA program. Descriptions of these projects were obtained from the BREA website (http://www.beaufortrea.ca/resources/).

Beaufort Sea Strategic Regional Plan of Action (2004–2008)

The Beaufort Sea Strategic Regional Plan of Action (BSStRPA) was jointly developed by parties representing a broad range of interests in the North, including governments, industry, the Inuvialuit and other Northerners. The aim of BSStRPA was to plan for and ensure a general state of preparedness to manage the potential outcome from induced oil and gas development in the Beaufort Sea from the proposed Mackenzie Gas Project. Information is available on the BSStRPA website.

Beaufort Sea Integrated Ocean Management Plan (IOMP)

The Integrated Ocean Management Plan for the Beaufort Sea was developed in 2009 to formalize a common vision for the Beaufort Sea Large Ocean Management Area. The plan builds on the knowledge of initiatives such as the Beaufort Sea Strategic Regional Plan of Action (BSStRPA) and Inuvialuit Community Conservation Plans. It incorporates social, cultural economic and ecosystem values expressed by communities, and tackles issues related to onshore and offshore petroleum exploration. It represents an inclusive method of managing ocean resources and spaces, intended to facilitate effective ocean management. The Beaufort Sea Integrated Ocean Management Plan can be found online.

Beaufort Region Environmental Assessment Monitoring Program (1990–1994)

The Beaufort Region Environmental Assessment Monitoring (BREAM) Program was established to provide the technical basis for a comprehensive environmental research and monitoring program for oil and gas activities in the Beaufort Sea. The Program combined and coordinated the efforts of the Beaufort Environmental Monitoring Program and the Mackenzie Environmental Monitoring Program and involved governments, industry, Northern Aboriginal and co-management organizations. Additional information is available on the Arctic Institute of North America's Arctic Science and Technology Information System Hydrocarbon Impacts website.

Beaufort Environmental Monitoring Program (1983–1988)

The Beaufort Environmental Monitoring Program (BEMP) was established as a research and planning ancillary to Northern Oil and Gas Action Plan. The aim of the BEMP was to advance government preparedness for oil and gas development. The program assessed the potential environmental effects of oil and gas development in the Beaufort Sea. BEMP projects are available on the Arctic Institute of North America's Arctic Science and Technology Information System Hydrocarbon Impacts website.

APPENDIX B

List of Reports reviewed for Workshop, with Summaries

Selected Articles Reviewed for BREA

1. AXYS. (2002). Cumulative Effects Assessment in the Inuvialuit Settlement Region: A guide for Proponents. 59 pp.

2. Buchanan, R. A., Cook, J. A. and Mathieu, A. (2003). Environmental effects monitoring for exploration drilling. Environmental Studies Research Funds ESRF-018. 182 pp.

3. Cobb, D., Fast, H., Papst, M., Rosenberg, D., Rutherford, R., Sareault, J., Reg., A. (2008). Beaufort Sea large ocean management area: ecosystem overview and assessment report. Fisheries and Oceans Canada, Central and Arctic Region, Freshwater Institute. 199 pp.

4. Doelle, M., Bankes, N. and L. Porta, (2013). Using Strategic Environmental Assessments to Guide Oil and Gas Exploration Decisions: Applying Lessons Learned from Atlantic Canada to the Beaufort Sea. Review of European, Comparative and International Environmental Law, 22(1), 103–116.

5. Fidler, C. and Noble, B. (2012). Advancing strategic environmental assessment in the offshore oil and gas sector: Lessons from Norway, Canada, and the United Kingdom. Environmental Impact Assessment Review, 34, 12–21.

6. Kavik-Axys Inc. (2002). Cumulative Effects Assessments in the Inuvialuit Settlement Region: Current and Potential Capability. 69 pp.

7. Johnson, D., Lalonde, K., McEachern, M., Kenney, J., Mendoza, G., Buffin, A. and Rich, K. (2011). Improving cumulative effects assessment in Alberta: regional strategic assessment. Environmental Impact Assessment Review, 31(5), 481–483.

8. Dillon Consulting Ltd., and Salmo Consulting Inc. (2005). Beaufort Delta Cumulative Effects Project.263 pp.

9. Noble, B., Ketilson, S., Aitken, A. and Poelzer, G. (2013). Strategic environmental assessment opportunities and risks for Arctic offshore energy planning and development. Marine Policy, 39, 296–302.

10. Paulic, J., Papst, M., Cobb, D., (2009). Proceedings for the identification of ecologically and biologically significant areas in the Beaufort Sea Large Ocean Management Area. 54 pp.

11. Regehr, E. V., Hunter, C. M., Caswell, H., Amstrup, S. C. and Stirling, I. (2010). Survival and breeding of polar bears in the southern Beaufort Sea in relation to sea ice. Journal of Animal Ecology, 79(1), 117–127.

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13. Stephenson, S.A., and L. Hartwig (2009). The Yukon North Slope Pilot Project: An Environmental Risk Characterization using a Pathways of Effects Model. Can. Manuscr. Rep. Fish. Aquat. Sci. 2896: vi+57p.

14. Spaling, H. and Smit, B. (1993). Cumulative environmental change: conceptual frameworks, evaluation approaches, and institutional perspectives. Environmental Management, 17(5):587–600

15. Hartwig, L. (2009). Mapping traditional knowledge related to the identification of ecologically and biologically significant areas in the Beaufort Sea.

16. Moore, S. E., Reeves, R. R., Southall, B. L., Ragen, T. J., Suydam, R. S. and Clark, C. W. (2012). A new framework for assessing the effects of anthropogenic sound on marine mammals in a rapidly changing Arctic. BioScience, 62(3), 289–295.

17. Aboriginal Affairs and Northern Development Canada (2013). Northwest Territories Cumulative Impact Monitoring Program and Nunavut General Monitoring : Highlights for 2011-2012.

18. Stirling, I. and Derocher, A. E. (2012). Effects of climate warming on polar bears: a review of the evidence. Global Change Biology, 18(9), 2694–2706.

19. Dubé,M., P. Duinker, L. Greig, M. Carver, M. Servos, M. McMaster,B. Noble, H. Schreier, L. Jackson, and K. R. Munkittrick (2013). A Framework for Assessing Cumulative Effects in Watersheds: An Introduction to Canadian Case Studies. Integrated Environmental Assessment and Management — Volume 9, Number 3—pp. 363–369

20. Sadler, B. (1990). An Evaluation of the Beaufort Sea Environmental Assessment Panel Review. Hull, Quebec: Federal Environmental Assessment Review Office.

21. Dubé, M., and Munkittrick, K. (2001). Integration of effects-based and stressor-based approaches into a holistic framework for cumulative effects assessment in aquatic ecosystems. Human and Ecological Risk Assessment, 7(2), 247-258.

22. Greig, L. A., Duinker, P. N., Everitt, R. R., and Pawley, K. (2003). Scoping for cumulative effects assessment. Prepared for Indian and Northern Affairs Canada Environment Directorate, Whitehorse, Yukon Territory. ESSA Technologies Ltd., Richmond Hill, Ontario.

23. North/South Consultants Inc. and Inuvialuit Cultural Resource Centre (2003). Ecological Assessment of the Beaufort Sea-Beluga Management Plan- Zone 1 (a) as a Marine Protected Area of Interest. Prepared for the Beaufort Sea Integrated Management Planning Initiative Working Group. 77 pp.

24. Community Of Tuktoyaktuk, Wildlife Management Advisory Council (NWT), and Joint Secretariat (2008). A Plan For The Conservation And Management Of Renewable Resources And Lands Within The Inuvialuit Settlement Region In The Vicinity Of Tuktoyaktuk, Northwest Territories. 169 Pp.

25. Community Of Inuvik, Wildlife Management Advisory Council (NWT), and Joint Secretariat (2008). A Plan to Provide Guidance Regarding the Conservation and Management of Renewable

Resources and Lands within the Inuvialuit Settlement Region in the Vicinity of Inuvik, Northwest Territories. 149 Pp.

26. Impact Economics. (2014). Measuring the Effects of Major Projects in the Inuvialuit Settlement Region. 28 pp.

27. Klostermann, J., Breeksema, W., Valeeva, N., Ingram, V., Wageningen University and Research Centre – Alterra. 2014. Socio Economic Indicators for the Arctic from a Local Point of View. 67 pp.

28. Thomas, D.J. (1992). Considerations in the Design of Effects Monitoring Strategies: Beaufort Sea Case Study. Environmental Studies Research Funds Report No, 118. Calgary. 54 pp.

29. International Finance Corporation (World Bank Group). 2013. IFC Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets. 102 pp.

30. Beaufort Sea Strategic Regional Plan of Action (BSStRPA) Steering Committee (2008). Beaufort Sea Strategic Regional Plan of Action (BSStRPA). 47 pp. + Appendices.

31. LTLC Consulting and Salmo Consulting Inc. (2013). Updated Oil and Gas Exploration and Development Activity Forecast – Canadian Beaufort Sea 2013-2028. 44 pp.

32. Beaufort Sea Partnership. 2009. Integrated Ocean Management Plan for the Beaufort Sea: 2009 and beyond. 57 pp.

33. Antoniuk, T., S. Kennett, C. Aumann, M. Weber, S. Davis Schuetz, R. McManus, K. McKinnon and K. Manuel. (2009). Valued Component Thresholds (Management Objectives) Project. Environmental Studies Research Funds Report No. 172. Calgary, AB. 164 pp.

Report Number	Report Title	Publication Year	Location
1	**Cumulative Effects Assessment in the Inuvialuit Settlement Region** *Citation: AXYS. (2002). Cumulative Effects Assessment in the Inuvialuit Settlement Region: A guide for Proponents. 59 pp*	2002	Inuvialuit Settlement Region

Summary

A guide for proponents conducting CEAs as part of project descriptions for proposals in the Inuvialuit Settlement Region. Defines VECs as resources or environmental features that: 1) are important to local human populations; 2) have national or international profiles; or 3) will be of future importance in evaluating the impacts of development or human actions and in focusing management or regulatory policy if they are altered from their existing status (see Beanlands and Duinker 1983). Important VECs include Air, Noise, Groundwater, Fish and Aquatic Habitat, Soils and Terrain, Vegetation, Terrestrial wildlife, Marine mammals, Traditional Use, Socioeconomic, Other Land Use. Stresses that VECs are best selected through consultation with local community and government organizations (summarized in Section 2.2). Describes a "best practices" approach to the assessment of a project's potential contribution to cumulative environmental effects.

Applicability to BREA

This document advises proponents of development projects on issues to consider when conducting CEA in the ISR. It discusses issues specific to project sites, sets boundaries/criteria for VEC selection, and discusses thresholds.

Recommendations (if any)

Recommend using community consultation within IRS to ensure selection of appropriate VECs as indicators for CEM..

Report Number	Report Title	Publication Year	Location
2	**Environmental effects monitoring for exploration drilling** *Citation: Buchanan, R. A., Cook, J. A. and Mathieu, A. (2003). Environmental effects monitoring for exploration drilling. Environmental Studies Research Funds ESRF-018. 182 pp.*	2003	NS, NFLD

Summary

This report focuses on effects caused specifically by oil and gas exploration drilling that will likely contribute to cumulative effects in the Beaufort Sea region. A community engagement exercise resulted in a list of issues related to drilling activities that could be sources of negative environmental effects, and implied that relevant VECs included benthos, scallops, deep sea corals, birds, fish, water quality, marine mammals, and fisheries.

Applicability to BREA

Drilling is a site-specific activity that occurs for a finite time period with a known start date. From an effects monitoring point of view, drilling could act as a specific element of Cumulative Effects that could be tracked and included in management of Cumulative effects as an indicator/contributing factor of cumulative effects.

Recommendations (if any)

All new OG projects should be included in monitoring of indicator VECs.

Report Number	Report Title	Publication Year	Location
3	**Beaufort Sea Large Ocean Management Area: Ecosystem Overview and Assessment Report** *Citation:Cobb, D., H. Fast, M.H. Papst, D. Rosenberg, R. Rutherford and J.E. Sareault (Editors). 2008. Beaufort Sea Large Ocean Management Area: Ecosystem Overview and Assessment Report. Can. Tech. Rep. Fish. Aquat. Sci. 2780: ii-ix + 188 p.*	2008	Beaufort Sea

Summary

This document provides descriptions of environmental and ecological conditions in the Beaufort Sea Large Ocean Management Area (LOMA). Volume 1 provides an ecosystem overview and discussion of status and trends. It also describes geologic processes (coastal and marine geology, surficial geology and processes), oceanographic systems (atmosphere/ocean exchange, physical oceanography, physical-chemical properties of seawater (biological systems (plankton, benthic, fish, marine mammal, marine bird communities) and ecosystem relationships (physical–biological linkages, biological interactions – ecosystem structure and dynamics) in the Beaufort Sea LOMA. Volume 2 provides an ecosystem overview and discussion of trends. It summarizes areas of concerns as well as impacting activities and stressors. Volume I provided a description of the structure and function of the Beaufort Sea ecosystem, and identified gaps in information and knowledge concerning that ecosystem. Volume II identified areas and species known to be of particular importance to the ecosystem, which included areas and species with no protection, as well as areas and species already protected, or proposed for protection.

Applicability to BREA

This report provides an overview of geological, oceanographic, and biological systems and assessment in the Beaufort Sea LOMA. It identifies areas of concern, discusses impacting activities and stressors. It also identifies ecological knowledge gaps, human uses and impacts of human uses on the system, in order to aid in the development of broader integrated management projects.

Recommendations (if any)

This report provides useful background data on potential VECs for the BREA CEM.

Report Number	Report Title	Publication Year	Location
4	**Using Strategic Environmental Assessments to Guide Oil and Gas Exploration Decisions: Applying Lessons Learned from Atlantic Canada to the Beaufort Sea** *Citation: Doelle, M., Bankes, N. and Porta, L. (2013). Using Strategic Environmental Assessments to Guide Oil and Gas Exploration Decisions: Applying Lessons Learned from Atlantic Canada to the Beaufort Sea Review of European, Comparative and International Environmental Law, 22(1), 103–116.*	2013	Offshore Nova Scotia SEA applied to the Beaufort
Summary			
The paper mainly deals with general legal and regulatory frameworks rather than specifically looking at individual VECs. It does however, speak to the lack of aboriginal engagement in SEAs and project specific EAs, something which ought to be addressed in development of BREA CEM framework. There was some mention of looking at Species at Risk as an example of a VEC, but that is where the paper is lacking.			
Applicability to BREA			
The paper concludes that a well-designed SEA could have positive applications for regional use within BREA (particularly as the exploration and subsequent recovery extends from the shallow water of the Mackenzie delta to the deeper shelf regions of the Beaufort Sea. The paper mainly deals with general legal and regulatory frameworks rather than specifically looking at individual VECs. It does however, speak to the lack of aboriginal engagement in SEAs and project specific EAs, something which ought to be addressed in development of BREA CEM framework.			
Recommendations (if any)			
Continued discussion with researchers and decision makers in other regions may provide useful access to new approaches to CEM.			

Report Number	Report Title	Publication Year	Location
5	**Advancing strategic environmental assessment in the offshore oil and gas sector: Lessons from Norway, Canada, and the United Kingdom**. *Citation: Fidler, C. and Noble, B. (2012). Advancing strategic environmental assessment in the offshore oil and gas sector: Lessons from Norway, Canada, and the United Kingdom Environmental Impact Assessment Review, 34, 12–21*	2012	Norway, Canada, USA

Summary

The authors interviewed 20 EA practitioners, regulators, and people involved in SEA in three countries. They discuss the uses and approach to SEA in these three jurisdictions. The interviews covered SEA in the context of objectives, purpose, timing participation, tiering, coordination, alternatives, cumulative effects, system-wide learning and influence on decision making.

The results demonstrate that SEA can help inform and increase the efficacy and efficiency of project-based assessment in the offshore sector, though stronger coordination between higher and lower tiers would increase SEA's ability to influence planning and development decisions in decision making.

Applicability to BREA

SEA could be beneficial to managing Beaufort Sea oil and gas development.

Need broader approach to SE issues, Recommend multi-sectoral approach in offshore areas to effectively deliver benefits of SEA and ensure appropriate planning for onshore effects of offshore development. Direct tiering and Terms and Conditions for project-specific developments and regional monitoring programs

SEA requires clear coordination between upper and lower tiers, or decisions on offshore development will continue to be made in a restrictive environment and SE context.

Recommendations (if any)

The use of SEA should be considered in the Beaufort Sea prior to offshore oil and gas development.

Report Number	Report Title	Publication Year	Location
6	**Cumulative Effects Assessments in the Inuvialuit Settlement Region: Current and Potential Capability**. Kavik-Axys Inc. (2002). REF	2002	Inuvialuit Settlement Region

Summary

This report specifically discusses the Current and Potential Capability of performing and managing Cumulative Effects Assessments in the Inuvialuit Settlement Region. They highlight some very useful tools that can be used in CEA in the region, but they do caution that CEA has not really been conducted satisfactory in other jurisdiction (at the time of the report development). They also point out that this region may have unique issues related to limited opportunities for monitoring for CEA (such as monitoring VECs), because of the remoteness of the region and the relatively low density population. They do however point out that in order for successful CEA of the area, it would be better conducted by sharing responsibilities across a range of participants (HTC, federal and territorial government. The report also documents quite well in some detail of the past and projected future developments in the region (although it is now outdated so would be better to review the latest NWT economic developments plans, *etc*.). The report also outlines which regulatory agencies are responsible for project development in the area, but with the recent CEAA changes (now CEAA 2012), these will be somewhat dated too. This report (like others we have reviewed) points to common themes that we should incorporate into BREA CEA framework. For example, choosing appropriate VECs, deciding on spatial and temporal boundaries for monitoring changes (CEA), deciding on which agencies or stakeholder groups could / should conduct monitoring and what general tools are available.

Applicability to BREA

This report (like others we have reviewed) points to common themes that we should incorporate into BREA CEA framework. For example, choosing appropriate VECs, deciding on spatial and temporal boundaries for monitoring changes (CEA), deciding on which agencies or stakeholder groups could / should conduct monitoring and what general tools are available. Before we select a short list of VEC species for inclusion in the CEA framework we should review the latest species management plans for the area (e.g. Beluga MP) in concert with discussions HTC participants. There would be little point in selecting an indicator species with very little baseline information. They also have some useful information on selection of thresholds for VECs (very important when we make determinations of CEA. For BREA we could refer to the summary list of technical tools in the report (Appendix 1) and screen out those that do not apply in the Beaufort Region. It is assumed that many will still apply though.

Recommendations (if any)

The technical tools in this report provide useful insights into VEC selection for CEM.

Report Number	Report Title	Publication Year	Location
7	**Improving cumulative effects assessment in Alberta: regional strategic assessment.** *Citation: Johnson, D., Lalonde, K., McEachern, M., Kenney, J., Mendoza, G., Buffin, A. and Rich, K. (2011). Improving cumulative effects assessment in Alberta: regional strategic assessment. Environmental Impact Assessment Review, 31(5), 481–483.*	2011	Alberta, Canada

Summary

This report aims to improve cumulative effects assessment (CEA) and support cumulative effects (CE) management. Regional Strategic Assessment (RSA) is a subclass of SEA which is "fit for purpose" and has broad applicability. It focuses on CE in high level strategies, addressing them at the earliest possible opportunity and at spatial and temporal scales in which they occur and can initially be best managed. The Albertan government is developing a regional framework to better manage Cumulative effects resulting from development in their province. A key component is for regional planning to lay a primary foundation for Cumulative effects management in the future. Regional Strategic Assessment will offer significant advantages if it is integrated into the planning process. RSA is the most promising option to improve cumulative effects assessment and support management of effects. The environmental assessment (EA) system currently in place focuses on environmental impact assessment (EIA) of large industrial projects, which gather lots of data which is then mothballed. EAs tend to be strong on biophysical assessment, but weak and inconsistent on socioeconomic issues. EAs are generally unable to adequately address CEA.

A conceptual RSA process is being developed for Alberta., comprised of five steps:
1) development of reference framework for RSA,
2) scoping of regional baseline,
3) development of a regional baseline,
4) analysis of alternative scenarios and identify management strategies, and
5) CEA for each scenario.

Applicability to BREA

This report applies directly to improving assessment and management of cumulative effects.

Recommendations (if any)

Analysis should be based on VECs that are core to regional vision and outcomes and will require a thorough understanding of regional environmental stressors, impact pathways and measurable indicators strongly correlated to VEC conditions.

Report Number	Report Title	Publication Year	Location
8	**Beaufort Delta Cumulative Effects Project** *Citation: Dillon Consulting Limited and Salmo Consulting Inc. (2005), Beaufort Delta Cumulative Effects Project Environmental Studies Research Funds Report No. 155, Calgary, 263 p.*	2005	Beaufort Delta

Summary

The study incorporated the following four components:
1. Identifying suitable Valued Components and associated cumulative effects indicators based on a review of relevant literature and information from the Beaufort Delta region;
2. Documenting the current state of each indicator and identifying candidate thresholds, carrying capacity, and/or Limits of Acceptable Change for each environmental and social indicator;
3. Convening a workshop of key stakeholders and agencies to provide feedback on the approach and the proposed suite of cumulative effects tools; and
4. Preparing a report describing the Valued Components, recommended indicators, candidate thresholds, carrying capacity, and/or Limits of Acceptable Change, and documenting the current state of each indicator.

The overall objectives of the ESRF Beaufort Delta Cumulative Effects Project were to identify a suite of candidate environmental and social Valued Components, appropriate indicators, and management thresholds that are of practical assistance in assessing and minimizing adverse cumulative effects in the region. These were developed as components of an integrated cumulative effects framework incorporating socially derived Tiered Thresholds and Limits of Acceptable Change. This framework was recommended to supplement the existing Beaufort Delta regulatory and resource management institutions and initiatives, and to reflect known regional values and concerns.

Applicability to BREA

This report had a very similar goal as BREA, for a subset of the Beaufort Sea (the Beaufort Delta). It provides a good overview of the existing environment in the Beaufort Delta region and identified biological and socioeconomic VCs, candidate indicators and thresholds/limits of acceptable changes for each. It also summarized Valued Components identified in various other reports for the same region.

Recommendations (if any)

No applicable recommendations.

Report Number	Report Title	Publication Year	Location
9	**Strategic environmental assessment opportunities and risks for Arctic offshore energy planning and development** *Citation: Noble, B., Ketilson, S., Aitken, A. and Poelzer, G. (2013). Strategic environmental assessment opportunities and risks for Arctic offshore energy planning and development. Marine Policy, 39, 296–302*.	2013	ISR, BS

Summary

There is increased recognition of the need for advanced upstream impacts assessment and decision making to plan for energy development. Strategic Environmental Assessment (SEA) remains undeveloped offshore in comparison to project-based EIA and is uncharted territory in Canada's Arctic. This paper examines stakeholder perceptions of opportunities and risks of SEA for oil and gas development in Beaufort Sea. The authors state that it is unfortunate that government and industry remain skeptical about SEA in Arctic, despite the recognized need for improved EA process.

SEA could result in increased regulatory efficiency, better regulatory baselines, and planning practices, and opportunity to assess for cumulative effects, more management for project-based assessment and greater certainty for stakeholders. Risks include foregoing anticipated development opportunities, loss of flexibility in decision-making, adding more bureaucracy, and the uncertainties of a novel approach.

Applicability to BREA

Advance a more regionally relevant and strategically –oriented EA framework to plan for and manage impact of Arctic energy development.

Recommendations (if any)

The CE monitoring should be incorporated into the SEA framework.

Report Number	Report Title	Publication Year	Location
10	**Proceedings for the identification of ecologically and biologically significant areas in the Beaufort Sea Large Ocean Management Area** *Citation: Paulic, J., Papst, M., Cobb, D., (2009). Proceedings for the identification of ecologically and biologically significant areas in the Beaufort Sea Large Ocean Management Area. Can. Manuscr. Rep. Fish. Aquat. Sci. 2865: ii + 46 p.*	2009	Beaufort Sea Large Ocean Management Area (LOMA)

Summary

Representatives from Fisheries and Oceans Canada (DFO) were tasked to collect ecological data to identify Ecologically and Biologically Significant Areas (EBSAs) in the Beaufort Sea Large Ocean Management Area (LOMA) based on holding two workshops. One was with the scientific community (mostly federal government scientists) and one that brought together local community representatives, federal and territorial government departments, and co-management partners. Similar to our study the workshops were held to: 1) discuss the process of selecting EBSAs; 2) to discuss its application in the Beaufort Sea; and 3) to attempt, for the first time in the Canadian Arctic, to apply the EBSA process. Each candidate area was then put through the National Evaluation Framework for EBSAs. The evaluation process for candidate areas produced 10 EBSAs. These results were published in the Beaufort Sea Ecosystem Overview and Assessment Report (Cobb et al. 2008 – which has been reviewed by BC as document #3 in our study). Therefore, there will be some overlap / agreement in project team findings.

Applicability to BREA

The process of selecting Ecologically and Biologically Significant Areas (EBSAs) in the Beaufort Sea Large Ocean Management Area (LOMA) was conducted in a similar manner to which we hope to select key VECs for our CEA framework for the same region. For example, 2 workshops were help, the first with experts in ecology and biology related to the area and most delegates were from the federal government (similar to the working group members of BREA), then once an initial list of EBSAs had been suggested at this first workshop, then the 'list' was further refined by holding a second workshop with local community members from the hunters and trappers committees (HTCs). In this regard the format of input from stakeholders is similar and consisted with other approaches used in the Beaufort Region. Another similar applicable component of this report is that the EBSAs were selected based on important and sensitive species which live, migrate or breed within the EBSAs. The list of important species (recognized by both government scientists and members from HTCs) could be useful for us to refer to when developing our own BREA CEA framework. The list of species used in this report are found on P26 of the report.

Recommendations (if any)

It is recommended that key VECs identified should be compared to the list on P26 of this report, to ensure that it is consistent with species or ecosystems that are considered as important by local communities and / or the scientific community.

Report Number	Report Title	Publication Year	Location
11	**Survival and breeding of polar bears in the southern Beaufort Sea in relation to sea ice.** *Citation: Regehr, E. V., Hunter, C. M., Caswell, H., Amstrup, S. C. and Stirling, I. (2010). Survival and breeding of polar bears in the southern Beaufort Sea in relation to sea ice. Journal of Animal Ecology, 79(1), 117–127*	2010	Southern Beaufort Sea

Summary

Female polar bear survival, female breeding, and cub survival all decrease with the increasing number of ice-free days in the Arctic. Loss of sea ice leads to negative impacts for ice-dependent polar bears, thought to be due to nutritional stress due to decreased feeding time available for bears, which end up spending more time on multi-year ice or on land.
This paper also discusses the effects of climate warming on ringed seals. Polar bears face increasing potential for conflicts in warming Arctic as industrial activity increases. South Beaufort Sea is generally ice free from July to September typically, but this period is increasing.

Applicability to BREA

Polar bears are a likely VEC, and appear to be declining already.

Recommendations (if any)

Consider polar bears as a VEC for the BREA CEA framework.

Report Number	Report Title	Publication Year	Location
12	**Reactions of bowhead whales, *Balaena mysticetus*, to seismic exploration in the Canadian Beaufort Sea.** *Citation: Richardson, W. J., Würsig, B. and Greene Jr, C. R. (1986). Reactions of bowhead whales, Balaena mysticetus, to seismic exploration in the Canadian Beaufort Sea. The Journal of the Acoustical Society of America, 79(4), 1117–1128*	1986	SE Beaufort Sea
Summary			
This study tested the reaction of bowhead whales to noise on 21 occasions. They found no detectable avoidance from underwater noise pulses. There was a suggestion of subtle changes in other behaviors consistent with stronger and closer noise. The reaction varied by whale also. When tested with full scale seismic noise, whales began to orient away at 7.5 km distance. They were displaced by about 2 km. The reactions were slightly stronger than to conventional vessels. Bowheads react to intense pulses by interrupting normal activities moving away. This reaction begins at about 7.5 km.			
Applicability to BREA			
Bowheads exhibit avoidance reactions to seismic pulses > 160 dB re;1µPa. Seismic surveys will occur more frequently the in Beaufort Sea as oil and gas exploration activities increase. Bowheads are an important species and are a likely candidate as a VEC for the BREA CEA framework.			
Recommendations (if any)			
Consider selecting bowhead whales as a VEC for the BREA CE framework.			

Report Number	Report Title	Publication Year	Location
13	**The Yukon North Slope Pilot Project: an environmental risk characterization using a pathways of effects model.** *Citation: Stephenson, S. A., Hartwig, L., (2009). The Yukon North Slope Pilot Project: an environmental risk characterization using a pathways of effects model. Can. Manuscr. Rep. Fish. Aquat. Sci. 2896: vi+57p.*	2009	Yukon North Slope/ Canadian Arctic

Summary

Pathways of Effects (PoE) are a graphic representation of the predicted relationships between human activities and the impacts they can produce within ecosystems. Understanding these relationships helps to identify how to mitigate the effects. Moreover, understanding where cumulative effects are likely to occur helps in characterizing the environmental and planning assessment to help managers decide how best to regulate certain activities.

A series of PoE models were developed as part of a pilot project for the Yukon North Slope in the Beaufort Sea to determine what activities might have a potentially negative effect on valued or vulnerable components of the ecosystem. Part of the purpose of this pilot was to see how these models worked in "real life" and to determine if PoE might be a useful tool which could be used to help manage some activities in the Beaufort Sea.

Project Identified: **VECs**

1. Dolly Varden, Water Quality, Bowheads, Beluga, Other fish and Shellfish, Seals, Ice

Potential Activities

2. Marine Transportation, Fishing- Subsistence and commercial, Oil and Gas- Exploration and Exploitation, Tourism- large-scale and small scale

Pressures

3. Contaminants, Invasive species, Biota removal, Habitat Alteration and degradation, Ship strikes, Fuel/oil spills, Noise, Gear Loss

Socio-Economic Dependencies = same as Activities

Assessment of the created models suggests that the largest potential threats to the Yukon North Slope may come from oil and gas development (both exploration and exploitation). Transportation, especially if it does increase due to more use of the Northwest Passage or increased tourism, brings with it other possible risks. Additional activities we examined were found to have far fewer risks associated with them. Ultimately, however, even high risk activities can be permitted if enough care is taken in their planning and execution.

Applicability to BREA

This pilot study showed the usefulness of the Pathways of Effects method to display the potential threats from proposed activities and therefore could be used as a valuable tool to assist marine planning by industry, stakeholders, managers and co-managers. It also shows how Pathways of Effects can be the basis of an essential analysis role as a precursor for risk assessment. Pathways of Effects is therefore a central tool in risk management and can be used to inform the decision making process in environmental assessments and marine management.

Recommendations (if any)

Pathways of Effects modeling is a potentially useful way of determining potential effects on VECs. Once VECS are selected, PoE could be used to determine potential effects on VECs.

Report Number	Report Title	Publication Year	Location
14	**Cumulative environmental change: conceptual frameworks, evaluation approaches, and institutional perspectives.** *Citation: Spaling, H. and Smit, B. (1993). Cumulative environmental change: conceptual frameworks, evaluation approaches, and institutional perspectives. Environmental Management, 17(5), 587–600*	1993	

Summary

This report reviews the conceptual framework of cumulative environmental change and describes analytical and institutional approaches to CEA. A causal model is a common approach, though frameworks vary their emphasis on various components. Two approaches to CEA are discussed, the scientific and planning oriented. These are not competing approaches but have a different interpretation of CEA scope. Report compares institutional and legislative response to CEA in Canada and the USA. Canada appears to be following the US example

Causal model components. Cause/Source of changes lead to process of change, which leads to result of effects.

Outlines types of CE -Analysis or Planning?

Three main components of some conceptual frameworks

1) Perturbations
2) System structure and [processes
3) Effects

The authors also noted the concept of “destruction by insignificant increments”

Applicability to BREA

This report discusses CEA frameworks, evaluation approaches and institutional perspectives and defines terminology related to CEA in four categories. It also says that both scientific and planning approaches to CEA are required. The role of the planner is to take advantage of science to ensure decisions are made on best data sets. Continued institutional and legislative adjustments to EIA process are likely as CEA processes mature.

Recommendations (if any)

Ensure best available science is used for BREA. This helps to identify VECs for monitoring. VECS for which data collection is incomplete or inconsistent may not be suitable.

Report Number	Report Title	Publication Year	Location
15	**Mapping traditional knowledge related to the identification of ecologically and biologically significant areas in the Beaufort Sea.** *Citation: Hartwig, L., (2009). Mapping traditional knowledge related to the identification of ecologically and biologically significant areas in the Beaufort Sea. Can. Manuscript Rep. Fish. Aquat. Sci. 2895: iii+25p.*	2009	Beaufort Sea
Summary			
Traditional knowledge was collected during the process of identifying Ecologically and Biologically Significant Areas (EBSAs) in the western Arctic to complement existing science. Data was collected from 6 Inuvialuit Settlement Region (ISR) communities. Fish and mammal data were used to help determine EBSA locations. Traditional knowledge proved valuable where scientific data was lacking. The author created overlap maps with data. Important areas were most often found around the Tuktoyaktuk peninsula and Husky Lake Areas (near settlements). The author also noted that the quality of the information gained depends on expertise of provider. There were some issues with confusion regarding species common names.		
Applicability to BREA			
This study occurred in the Beaufort Sea region, and is relevant to future studies and VEC consultation in the area			
Recommendations (if any)			
No applicable recommendations.			

Report Number	Report Title	Publication Year	Location
16	**A new framework for assessing the effects of anthropogenic sound on marine mammals in a rapidly changing Arctic.** *Citation: Moore, S. E., Reeves, R. R., Southall, B. L., Ragen, T. J., Suydam, R. S. and Clark, C. W. (2012). A new framework for assessing the effects of anthropogenic sound on marine mammals in a rapidly changing Arctic. BioScience, 62(3), 289–295.*	2012	A framework study for assessing the effects of anthropogenic sound on marine mammals that is pan-Arctic in scope

Summary

The paper mainly focuses on the impacts of sound from activities in the Arctic considered in isolation of one another, which precludes any meaningful analysis of cumulative impacts from multiple sources. The authors propose a new assessment framework that is based on the acoustic habitats that constitute the aggregate sound field from multiple sources (natural and manmade), compiled at spatial and temporal scales consistent with the known ecology of Arctic marine mammals (*e.g.*, seasonal occurrence *etc*.).

Applicability to BREA

The paper concludes that a well-designed framework for assessing the cumulative effects of anthropogenic sound on marine mammals should be based on developing an acoustic-habitat framework, which summarizes natural and anthropogenic sound sources by region and period; maps sound fields generated by each source; merges sound field maps to depict the overall acoustic habitat and highlight areas in which cumulative effects are likely to occur; lists marine-mammal species and all proposed offshore activities by region and period (predictive in nature); and summarizes behavioral ecology for marine-mammal species by region and season and map distribution, relative abundance, and ecologically important areas (e.g., those used for feeding, breeding and migration). In summary, the acoustic-habitat framework must (a) overlay acoustic-habitat maps with maps of marine-mammal distribution patterns, relative abundance, and ecological importance and (b) identify areas or periods of concern and data gaps, including limitations on the understanding of sound sources and propagation, as well as the behavioral ecology of potentially affected marine mammals.

The study has some very good recommendations, including: (i) discussion with Arctic subsistence hunters (which will be conducted in Inuvik), as there are concerns that anthropogenic sound will displace marine mammals and thereby restrict hunting access to these animals for food and cultural identity (ii) the authors also propose an approach to monitor Arctic marine noise based on sounds from multiple sources which are mapped and integrated with information about the distribution, density, movement patterns, and ecology of marine mammals to estimate where and when they are likely to be most at risk from sound-generating activities. These recommendations could be incorporated into the report.

Recommendations (if any)

Marine mammals should be considered as a VEC since they represent culturally, economically, and environmentally significant components that due to these factors can be easily monitored.

Report Number	Report Title	Publication Year	Location
17	**Northwest Territories Cumulative Impact Monitoring Program and Nunavut General Monitoring : Highlights for 2011-2012.** *Citation: Aboriginal Affairs and Northern Development Canada (2013). Northwest Territories Cumulative Impact Monitoring Program and Nunavut General Monitoring : Highlights for 2011-2012. 36 pp.*	2013	NWT and NU

Summary

The report summarizes six Cumulative Impact Monitoring Programs (CIMPs) and Nunavut ecosystemic and socio-economic General Monitoring Plan (NGMP)-funded projects. It explains the responsibilities of northern territories and province, both led by ANNDC, established to meet the legal requirements for environmental monitoring to improve effectiveness and coordination of such. It discusses Valued Components (VCs) and indicators utilized by each of the six main projects summarized, which were::

- Modeling Cumulative Effects on a Summer Range of the Bathurst Caribou Herd: a Demonstration Project *(VC= Barren-ground Caribou)*
- Biological Monitoring and Assessment of Fish Populations With a Focus on Lake Trout in Great Bear Lake (*VC*= Fish quantity and fish quality, fish habitat)
- A Watershed Approach to Monitoring Cumulative Impacts of Landscape Change *(VC*=Water, snow, ice and permafrost, fish, vegetation)
- Community-Based Monitoring of Ice-Breeding Seals and Polar Bear Feeding in the Gulf of Boothia *(VC* =Marine ecosystem, sea ice, seals (ringed and bearded), polar bear, health and well-being/food security, traditional activities and skills, and economic activity)
- Enhanced Health Information Collection and Health Monitoring *(VC* =Demographics, Health and Well-Being, Food Security, Housing)
- Monitoring Educational and Professional Success Amongst Inuit of Nunavut Who Have Registered in a Post-Secondary Program *(VC*=Education and training, employment, economic activity)

The report assesses Program development progress, and outline priorities. It also provides a complete list of all projects undertaken by each group.

Applicability to BREA

This report discusses current projects relevant to a number of potential VECs in the Beaufort Sea region**.**

Recommendations (if any)

Consideration as potential VECs should be given to barren-ground caribou, fish (lake trout), landscape changes, seals and polar bears, human health data collection and monitoring, post-secondary education.

Report Number	Report Title	Publication Year	Location

18	**Effects of climate warming on polar bears: a review of the evidence**. *Citation: Stirling, I. and Derocher, A. E. (2012). Effects of climate warming on polar bears: a review of the evidence. Global Change Biology, 18(9), 2694–2706.*	2012	Arctic

Summary

This report summarizes the evidence that loss of sea ice negatively affects long term survival of polar bears. It stresses the importance of ringed seal pups and effects of earlier ice breakup on polar bears, Earlier spring breakup of ice leads to longer fasting periods, decreased body condition, decreased access to denning areas, fewer and smaller subs, decreased cub survival as well as decreased survival of other age classes and subpopulation decline, Effects appear first in the more southern populations. Bear's body condition decreases, they seek alternative food sources, which leads to increased conflict between bears and people. Bears will be gone from southern ranger by midcentury at current rate of population decline. Overall, the long term viability is uncertain. At least 8 of 10 subpopulations are currently declining due in part to warming.

Applicability to BREA

Polar bears are a likely candidate as a VEC for the CE management framework.

Recommendations (if any)

Polar bears should be considered as a VEC for the CE management framework.

Report Number	Report Title	Publication Year	Location
19	**A Framework for Assessing Cumulative Effects in Watersheds: An Introduction to Canadian Case Studies** *Citation: Dubé, M., P. Duinker, L. Greig, M. Carver, M. Servos, M. McMaster, B. Noble, H. Schreier, L. Jackson, and K. R. Munkittrick .2013. A Framework for Assessing Cumulative Effects in Watersheds: An Introduction to Canadian Case Studies . Integrated Environmental Assessment and Management — Volume 9, Number 3—pp. 363–369*	2013	A framework study that includes watershed case studies from across Canada

Summary

The paper mainly deals with developing a framework for assessing cumulative effects (CE) in watersheds across Canada. Although the VECs are somewhat different, the discussions around a well-developed CEA framework (and their short comings) remain valid for our BREA study.

Applicability to BREA

The paper concludes that a well-designed CEA should have the following components: (i) accumulated state quantification (i.e., elements in the environment such as VECs need to be measured for changes both spatially and temporally), (ii) reliable VECs for understanding stressor-response relationships, (iii) also a well-designed CEA should be able to have good predictive scenario forecasting capabilities. The elements described in this paper would be something which ought to be addressed in development of BREA CEM framework. The BREA CEM framework will also benefit from recommendations made in this study and be able to incorporate - core values (VECs), indicators (again VECs), thresholds for VECs, and the use of consistent terminology.

The study has some very good scholarly text that introduces what CEA actually is, how it was developed, and why and also why Canada is lagging behind other jurisdictions. In short we will be able to incorporate some of the descriptive text in our own introduction. The authors also propose the use of consistent terminology which can be easily adopted.

Recommendations (if any)

VEC selection should consider those components that represent core values, are easily monitored, and which have well-defined/ known thresholds.

Report Number	Report Title	Publication Year	Location
20	**An Evaluation of the Beaufort Sea Environmental Assessment Panel Review** *Citation: Sadler, B. (1990). An Evaluation of the Beaufort Sea Environmental Assessment Panel Review. Hull, Quebec: Federal Environmental Assessment Review Office.*	1990	Beaufort Sea

Summary

The report mainly focuses on the Evaluation of the Beaufort Sea Environmental Assessment Review process (EARP) with respect to the then anticipated growth of O andG development and associated transportation development in the region. Although it is now a dated report, it does highlight the potential impacts of multiple projects (i.e., cumulative effects). Although VECs are not really discussed in any detail there were mention of potential impacts to traditional subsistence living of indigenous peoples, against the backdrop of hydrocarbon production

Applicability to BREA

The report does highlight the importance of monitoring for cumulative effects, but considering the age of the report and the lack of predictive developments (in 1990), the findings are not particularly relevant and have been superseded by more recent documents.

Recommendations (if any)

No applicable recommendations.

Report Number	Report Title	Publication Year	Location
21	**Integration of Effects-Based and Stressor-Based Approaches into a Holistic Framework for Cumulative Effects Assessment in Aquatic Ecosystems** *Citation: Monique Dubé and Kelly Munkittrick (2001). Integration of Effects-Based and Stressor-Based Approaches into a Holistic Framework for Cumulative Effects Assessment in Aquatic Ecosystems. Human and Ecological Risk Assessment: An International Journal, 7:2, 247-258, DOI: 10.1080/20018091094367*	2001	An Holistic Framework for Cumulative Effects Assessment in Aquatic Ecosystems across Canada

Summary

This older paper mirrors some of the conclusions and ideas for developing a framework for addressing a CEA of aquatic ecosystems (Dube et al., 2013). For example, this paper proposes effects based and stressor based approaches into a holistic framework for assessing cumulative effects (CE) in watersheds across Canada. The authors various approaches that can be conceptually incorporated into a holistic cumulative effects assessment framework. They suggest that key framework components should include: (1) an effects-based assessment to determine existing accumulated environmental state, (2) a stressor-based assessment to predict potential impacts of new development relative to the existing environmental state, (3) post-development monitoring to assess the accuracy of impact predictions and to provide an avenue for adaptive management, and (4) decision-making frameworks to link scientific information to public opinion and managerial action. Some of the concepts remain valid for our BREA study

Applicability to BREA

Similar to the more recent Dube *et al.* (2013) study, the authors suggest that key framework components should include: (1) an effects-based assessment to determine existing accumulated environmental state, (2) a stressor-based assessment to predict potential impacts of new development relative to the existing environmental state, (3) post-development monitoring to assess the accuracy of impact predictions and to provide an avenue for adaptive management, and (4) decision-making frameworks to link scientific information to public opinion and managerial action. Some of the concepts remain valid for our BREA study.

Recommendations (if any)

The selection of VECs should include scientific advice and public opinion. As a result, final selection of indicators VECs and CEM management framework should involve public consultation.

Report Number	Report Title	Publication Year	Location
22	**Scoping for cumulative effects assessment** *Citation : Greig, L. A., Duinker, P. N., Everitt, R. R., and Pawley, K. (2003). Scoping for cumulative effects assessment. Prepared for Indian and Northern Affairs Canada Environment Directorate, Whitehorse, Yukon Territory. ESSA Technologies Ltd., Richmond Hill, Ontario.*	2003	Scoping for Cumulative Effects Assessment in a Yukon context (Yukon wide)

Summary

Although this document is geared toward scoping for CEA in the Yukon, it provides a useful analogue for the Beaufort region. Common themes appear throughout this document (similar to other CEA frameworks in other jurisdictions. For example, key considerations during CEA scoping should include: (i) the valued ecosystem and cultural components (VECCs) for which there is concern for potential cumulative effects; (ii) the set of human-induced stresses that may contribute to cumulative effects; (iii) how cumulative effects are thought to arise (i.e. the pathways through which various activities can affect the VECCs of concern; (iv) the thresholds which define critical levels of effect on VECCs; (v) the spatial and temporal dimensions of the assessment; and (vi) the approach to the analysis. The paper provides guidance on scoping cumulative effects assessments in two forms. First a discussion of key concepts which underlie cumulative effects assessment. A good understanding of these concepts is critical to successful scoping and analysis of cumulative effects. Second, the guide offers specific guidance on important considerations within a series of steps that define a framework for scoping.

Applicability to BREA

Although this document is geared toward scoping for CEA in the Yukon, it provides a useful analogue for the Beaufort region. Some of the concepts remain valid for our BREA study. Of particular note in this scoping study, the authors recommended having a clear understanding of potential project developments in the near future (i.e., accurate forecasting). So in that regard, the projected future NWT economic outlook should also be considered...http://www.iti.gov.nt.ca/sites/default/files/economicoutlook2014report.pdf

Assuming 'measurable' Valued Ecosystem and Cultural Components (VECCs) can be identified in the workshops, these concepts could be incorporated in to BREA study. For example, choosing appropriate- VECC indicators, Indicator measurability, define boundaries of study area, make good predictive estimates of future developments.

Recommendations (if any)

VEC selection should consider VECC, identification of human activities that can be vectors of stress, pathways of effects, and defined thresholds.

Report Number	Report Title	Publication Year	Location
23	**Ecological Assessment of the Beaufort Sea Beluga Management Plan- Zone 1(a) as a Marine Protected Area of Interest** *Citation: North/South Consultants Inc. and Inuvialuit Cultural Resource Centre (2003). Ecological Assessment of the Beaufort Sea-Beluga Management Plan- Zone 1 (a) as a Marine Protected Area of Interest. Prepared for the Beaufort Sea Integrated Management Planning Initiative Working Group. 77 pp.*	2003	Beaufort Sea

Summary

This paper provides an ecological assessment of the Beaufort Seas Beluga Management Plan – Zone 1(a) as an Area of Interest (AOI) under consideration for Marine Protected Area (MPA) designation. It provides an overview of environmental and ecological information relevant to the region, and discusses the ecological merits and significance of the AOI, including it special features, biodiversity, productivity, and biomass, significant species present, their status, and ecological requirements, environmental status and known stressors for threats. It also discusses meeting the purposes of MPAs under the oceans Act and of other marine protection legislation. It then discusses alternatives to the protection of the area as an MPA, and possible management strategies, regulations, monitoring and research inside the MPA. It also provides a detailed ecological assessment of the AOI using the MPA evaluation criteria.

Applicability to BREA

This PAPER provides a detailed ecological assessment of an area of the Beaufort Sea. It also discusses several potential VEC species occurring in the area (belugas, polar bears, bowhead whales, seals, seabirds).

Recommendations (if any)

Belugas, bowheads, and polar bears should be considered as VECs.

Report Number	Report Title	Publication Year	Location
24	**A Plan for the Conservation and Management of Natural Resources and Lands within the Inuvialuit Settlement Region in the Vicinity of Tuktoyaktuk, Northwest Territories** *Citation: Community Of Tuktoyaktuk, Wildlife Management Advisory Council (NWT), and Joint Secretariat (2008). A Plan for the Conservation and Management of Natural Resources and Lands within the Inuvialuit Settlement Region in the Vicinity of Tuktoyaktuk, Northwest Territories Tuktoyaktuk Community Conservation Plan. 169 Pp.*	2008	Tuktoyaktuk and regions with the Inuvialuit Settlement Region

Summary

The Tuktoyaktuk Hunter and Trappers Committee (HTC) was responsible for initiating the review of the Tuktoyaktuk Inuvialuit Community Conservation Plan which contains a brief description of the current conservation and resource management system in Tuktoyaktuk and surrounding Inuvialuit Settlement Region. The plan describes the strategy to address five broad goals specifically for the Tuktoyaktuk sub-region:

1. To identify important wildlife habitat and seasonal harvesting areas and make recommendations for their management. This is mainly addressed through the review of special designated lands within the Tuktoyaktuk sub-region. For examples, each special area is discussed and the types of traditional hunting activities are listed then in turn the types of development activities are listed which are prohibited.
2. To describe a community process for land use decisions and managing cumulative impacts which will help protect community values and the resources on which priority lifestyles depend.
3. To identify educational initiatives for the Inuvialuit of Tuktoyaktuk and others interested in the area which will promote conservation, understanding and appreciation.
4. To describe a general system of wildlife management and identify population goals and conservation measures appropriate for each species of concern in the planning area using the knowledge of community and others with expertise. This is achieved through reviewing individual species management plans (e.g., Beluga, Caribou, and Polar Bear), and then listing the latest research on a given species and where applicable, state what the estimated populations are for that species in a given sub-region.
5. To enhance the local economy by adopting a cooperative and consistent approach to community decision making and renewable resource management.

Applicability to BREA

The report forms a great starting resource for understanding the important special designated lands within the Tuktoyaktuk sub-region. This will be more evident from discussion with the Tuktoyaktuk HTC at the Inuvik workshop. It also helps understand what future development activities can and cannot take place in the area. The report also summarizes many of the species management plans that may need to be reviewed when drawing up a short list of VEC species, although it is work noting that these are only summaries and we should ultimately focus on the original documents for the species (of interest) management plans.

Recommendations (if any)

Effort should be placed on proper reference to the types of activities permitted or prohibited in each of the special designated lands. This will help AANDC and proponents better understand how CE from future planned activities can potentially impact the region as a whole. References herein may help with sourcing relevant information for species management plans and could be reviewed.

Report Number	Report Title	Publication Year	Location
25	**A Plan to Provide Guidance Regarding the Conservation and Management of Renewable Resources and Lands within the Inuvialuit Settlement Region in the Vicinity of Inuvik, Northwest Territories** *Community Of Inuvik, Wildlife Management Advisory Council (NWT), and Joint Secretariat (2008). A Plan to Provide Guidance Regarding the Conservation and Management of Renewable Resources and Lands within the Inuvialuit Settlement Region in the Vicinity of Inuvik, Northwest Territories* *149 Pp.*	2008	Inuvik and regions with the Inuvialuit Settlement Region

Summary

The Inuvik HTC was responsible for initiating the review of the Inuvik Inuvialuit Community Conservation Plan contains a brief description of the current conservation and resource management system in Inuvik and surrounding Inuvialuit Settlement Region. The plan describes the strategy to address five broad goals specifically for the Inuvik sub-region:

1. To identify important wildlife habitat and seasonal harvesting areas and make recommendations for their management. This is mainly addressed through the review of special designated lands within the Inuvik sub-region. For examples, each special area id discussed and the types of traditional hunting activities are listed then in turn the types of development activities are listed which are prohibited.
2. To describe a community process for land use decisions and managing cumulative impacts which will help protect community values and the resources on which priority lifestyles depend.
3. To identify educational initiatives for the Inuvialuit of Inuvik and others interested in the area which will promote conservation, understanding and appreciation.
4. To describe a general system of wildlife management and identify population goals and conservation measures appropriate for each species of concern in the planning area using the knowledge of community and others with expertise. This is achieved through reviewing individual species management plans (e.g., Beluga and Polar Bear), and then listing the latest research on a given species and where applicable, state what the estimated populations are for that species in a given sub-region.
5. To enhance the local economy by adopting a cooperative and consistent approach to community decision making and renewable resource management.

Applicability to BREA

The report forms a great starting resource for identifying the important special designated lands within the Inuvik sub-region. This will be more evident from discussion with the Inuvik HTC at the Inuvik workshop. It also helps understand what future development activities can and cannot take place in the area. The report also summarizes many of the species management plans that may need to be reviewed when drawing up a short list of VEC species, although it is work noting that these are only summaries and we should ultimately focus on the original documents for the species (of interest) management plans.

Recommendations (if any)

The BREA CEA framework should refer to the types of activities permitted or prohibited in each of the special designated lands. This will enhance understanding of how CE from future planned activities can potentially impact the region as a whole.

Report Number	Report Title	Publication Year	Location
26	**Measuring the Effects of Major Projects in the Inuvialuit Settlement Region** *Citation: Impact Economics. (2014). Measuring the Effects of Major Projects in the Inuvialuit Settlement Region. 28 pp.*	2014	Inuvialuit Settlement Region

Summary

The focus of this report was to validate an implementable set of socio-economic indicators that can be applied by the Inuvialuit Regional Corporation (IRC) to assess impacts and benefits associated with resource development in the Inuvialuit Settlement Region (ISR). Through the lens of the proposed Mackenzie Valley Pipeline (MVP) Project, this report considers the exploration boom of the late 1990's through 2012 and the associated Socio-Economic Impact Assessment (SEIA) to better understand how the Project proposed to assess socio-economic change and in fact impacted the wellness (social, cultural and cumulative economic growth) of the community.

A primary challenge of the MVP SEIA was to develop a set of Valued Components (VC's) that matched the growing community concerns regarding the size and scope of the Project. This was conducted in an effort to tie the Project activities to the development of the affected communities, yet insufficient direction was provided on how these VC's would be measured. The attempt to tie the Project to the overall wellbeing of the community resulted in a confusing assessment that left the community without an overall understanding of how to improve their situation apart from its link to the Project.

This challenge is rooted in the notion that communities may see major projects as the direct means to solving their development issues. Within the constraints of the current regulatory process, a gap has been identified between benefits that a project can provide and the change that communities need. A major project should not answer all social, cultural and economic concerns – it should provide a means to improve the wellbeing of a community by bringing choices. There are many ways for these choices to be presented to communities though a point is reached where the responsibility shifts to the community itself and its stakeholders (i.e., territorial and federal governments) to make choices that improve socio-economic conditions.

Environmental assessments should establish a set of VC indicators that a project can have direct influence over as practical, measureable metrics of impact (i.e., per capita household income, ratio of students completing post-secondary education, etc.). A mechanism should also be established to assess how a project would influence to broader community issues (i.e., social inclusion, human capacity, etc.) whereby a larger group of stakeholders works to establish the community objectives for development and uses the project as an input into the development process. How this can be orchestrated remains open for discussion.

Applicability to BREA

This report reviewed recent large scale project influence related to socio-economic conditions in the ISR. Developing a better understanding of the SEIA challenges in this review is intended to support future assessments in the Beaufort Sea through identified project- and community-specific indicators, enhanced knowledge regarding future large scale economic growth, and ultimately offers communities knowledge on where they can benefit and how they might respond to positive and negative effects.

Recommendations (if any)

The premise of the report was to identify practical measurable indicators to assess how projects could influence community socio-economics while separating this affect from overall community wellbeing. An example of successful socio-economic monitoring is seen in the mandated Socio-Economic Reporting Agreements signed between the NWT government and three operating diamond mines that stipulate statistics that must be collected and which provides useful data for understanding local effects. A copy of the Agreements should be reviewed and a similar process implemented for future resource development SEIAs in the Beaufort Sea Region - this will expand upon the success of this process as well as contribute to use of a consistent set of socio-economic indicators and future mitigation measures.

The issue of overall wellbeing of a community should be addressed through a multi-stakeholder process where the goals of a community's development are understood with project impacts feeding as an input to the more broad development process. This would require guidance from government on how regulatory authorities should assess effects of a project as well as accepting a role in the development goals of a community.

Report Number	Report Title	Publication Year	Location
27	**Socio Economic Indicators for the Arctic from a Local Point of View** *Citation: Klostermann, J., Breeksema, W., Valeeva, N., Ingram, V., Wageningen University and Research Centre – Alterra. 2014. Socio Economic Indicators for the Arctic from a Local Point of View. 67 p*		

Summary

The focus of this report is on Socio-Economic Impact Assessments (SEIAs) and on creating a set of indicators for impact assessment from the view of local populations. The region of focus is the Arctic and for the purposes of this report the definition used is that of the Arctic Human Development Report (AHDR, 2004) inclusive of political and administrative units. When discussing communities, it the people living in these communities that is referred to versus the administrations and/or municipalities. The methodology included a literature review followed by a series of interviews with six Dutch companies and six representatives of the local community and regulators.

With a beginning in the early 1990's strategic environmental assessment (SEA) legislation grew rapidly throughout the world. Currently, there is consensus on the fact SEA that can take many forms and that there is no coherent framework in place for implementation. The three basic principles include public participation, transparency and good quality information. A component of the SEA could be a SEIA whose goal it is to understand potential impacts and rank the variables with consultation from all stakeholders and with a focus on local characteristics to determine the measurable elements of focus. In defining the role of indicators in a SEIA, the literature review makes three distinctions; change, impacts, and indicators. Changes can lead to impacts on a community – indicators track trends in human development.

In the Arctic environment, studies by the Nordic Council showed three domains important for the viability of communities; 'contact with nature', fate control', and 'retention of cultural identity'. Many categories of indicators have been proposed for use in the Arctic and the Nordic Council distilled these down to a subset of indicators that were measurable and specifically applicable to the Arctic – infant mortality, net-migration, consumption/harvest of local foods, per capita household income, ratio of students successfully completing post-secondary education, and language retention. A more fulsome list of Arctic-specific indicators has been provided in this report matching both problems with indicators, and solutions with indicators (Nordic Council (2010), Ozkan and Schott, 2013). The Inuvialuit Indicators Project is a current initiative designed to evaluate existing indicators for ongoing validity and to develop and test new indicators – to date the Nordic Council indicators have been used in the Inuvialuit region.

Applicability to BREA

Although not specific to the Beaufort Sea Region, this report distilled a measurable set of socio-economic indicators specific to life in the Arctic. This list ties together the associated problems and solutions as well as identification of data gaps and would be a valuable resource for project- and community-specific indicator selection in the Beaufort Sea region.

Recommendations (if any)

In terms of further research on the development of indicators, this report notes that:

• During the interview part of the project, perceptions from the local people and a representative of the Arctic Council showed very different pictures of the study area (Russia). Understanding the root of this perception difference would be valuable.

• Much research has been done and much legislation is in place in the Arctic though it may be restricted to certain users due to limited translation. Cooperative relationships with those advancing this research (i.e., Russia) may help to more easily distribute the information.

• Follow the global politics as large stakeholders in the Arctic can influence future economic activities as well as governance, security, etc.

Report Number	Report Title	Publication Year	Location
28	**Considerations in the Design of Effects Monitoring Strategies: Beaufort Sea Case Study** *Citation: Thomas, D.J. (1992). Considerations in the Design of Effects Monitoring Strategies: Beaufort Sea Case Study. Environmental Studies Research Funds Report No, 118. Calgary. 54 pp*	1992	Beaufort Sea

Summary

This document was developed in 1992 and walks the reader through the process for the development of an effects monitoring program. The Beaufort Sea was used as a case study in the report.

This report would best serve an end-user looking to develop a scientifically defensible monitoring program versus it usefulness for supporting the identification of VEC's for potential future resource development in the Canadian Beaufort Sea Region.

Applicability to BREA

The premise of the report is applicable in terms of developing the rationale for monitoring and ensuring regulatory and multi-stakeholder acceptance of the selected monitoring design and meaningful interpretation of the metrics.

Recommendations (if any)

Of the five recommendations noted in the conclusion of this study, the relevance for the BREA are best captured in the recommendations to (1) ensure data gaps are filled prior to incorporating an indicator into a monitoring program (2) ensure stakeholders reach an a priori agreement on the threshold for acceptable levels of environmental disturbance.

Report Number	Report Title	Publication Year	Location
29	**IFC Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets** *Citation: International Finance Corporation (World Bank Group). 2013. IFC Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets. 102 p*	2013	

Summary

As noted in Report #26 (Measuring the Effects of Major Projects in the Inuvialuit Settlement Region), the debate continues about whether assessing cumulative effects is best managed under existing EIA and SEIA processes or whether or as a separate process – there is no single accepted process. The primary message of this current report relates to the value of a six step Rapid Cumulative Impacts Assessment (RCIA) – a desk exercise enabling the proponent to understand whether its activities are likely to affect the viability or sustainability of selected VEC's. Given the challenges of emerging markets (i.e., lack of baseline data, government capacity, uncertainty of developments, etc.), the proponent should ensure they engage stakeholders as early as possible and document the rationale for each important decision made in their process.

In line with the RCIA, a proponent needs to understand not only the cumulative impacts for the area but their contribution to the impacts with a system to mitigate those impacts. In a project level assessment (ESIA) the indicators selected will assess incremental change with a VEC whereas in a RCIA/CIA, the resultant condition of the VEC is assessed.

Applicability to BREA

The conclusion of this report states that regional frameworks should be established to assess cumulative impacts associated with development. The framework should bring:

- a transparent mechanism for information disclosure
- establish regional threshold for VEC condition
- make available information of states and trends of VEC condition
- make available information regarding impacts of existing developments
- possibly provide regional modeling tools, and
- develop regional framework for impact mitigation and monitoring

Recommendations (if any)

Ensure that the VEC indicators selected are suitable for determining the regional VEC condition (CIA) versus incremental impact (ESIA). Incorporate a review of Appendix A in the VEC selection which outlines typical indicators in the context of both incremental and conditional change

Report Number	Report Title	Publication Year	Location
30	**Beaufort Sea Strategic Regional Plan of Action (BSStRPA)** *Citation: Beaufort Sea Strategic Regional Plan of Action (BSStRPA) Steering Committee. 2008. Beaufort Sea Strategic Regional Plan of Action (BSStRPA). 47 p. + Appendices.*	2008	Beaufort Sea

Summary

This document is a strategic plan of action developed by a multi-agency stakeholder group under the guidance of the BSStRPA Steering Committee. The Plan of Action (or BSStRPA) is the result of a concerted effort over a period of 2 years by the Inuvialuit, federal and territorial governments, co-management bodies, and industry to identify key issues associated with oil and gas activity in the planning region and the actions needed to address them. The document describes the 23 issues, 32 recommendations, and 50 specific actions organized under three main themes ("Improving Regulatory Efficiency and Effectiveness"; "Optimizing Benefits and Mitigating Environmental, Social and Cultural Impacts"; and "Planning for Uncertainty"). These issues/recommendations/actions resulted from a review in which concerns around potential offshore exploration and development activities were expressed, discussed and briefly analyzed. The recommendations put forth in the BSStRPA are intended to contribute to sustainable development in the region and to help prepare for increased activity levels.

Applicability to BREA

"Inuvialuit will develop a system of indicators (in collaboration with government) to measure resource development impacts in the Inuvialuit Settlement Region (ISR). The indicators should be used for ongoing measurement of the impacts of resource development" and "Inuvialuit Regional Corporation (IRC) should conduct ongoing monitoring of effects using the indicators and should notify the other BSStRPA partners of significant changes or issues so that mitigative action can be taken. IRC will take the lead in meeting with each government department or agency to determine what each may be able to contribute in meeting the Inuvialuit objectives" were put forth as two of the 32 recommendations in the BSStRPA.

Recommendations (if any)

Determine the progress of the specific actions put forth under the above-noted recommendations (i.e., status of an agreement for the measuring of social, cultural and economic conditions based on agreed to indicators, data sharing, and monitoring mechanisms as well as implementation of the Mackenzie Gas Project Impact Plan).

Report Number	Report Title	Publication Year	Location
31	**Beaufort Regional Environmental Assessment - Updated - Oil and Gas Exploration and Activity Forecast- Canadian Beaufort Sea 2013-2028** *Citation: LTLC Consulting and Salmo Consulting Inc. 2013. Updated Oil and Gas Exploration and Development Activity Forecast – Canadian Beaufort Sea 2013-2028. 44 p.*	2013	Beaufort Sea

Summary

This document provides an updated general description of potential oil and gas exploration and development activities in the Beaufort Sea over the period of 2013 to 2028. It provides a current forecast of industry activity that can be used when assessing priorities, scope, and timing of Beaufort Sea research as well as assist in the understanding of implications of BREA research findings. The document provides a history of the oil and gas industry in the Mackenzie Beaufort Region; descriptions of exploration and development methods/structures/activities; overview of offshore industry activity cycles; as well as predicts Beaufort Sea oil and gas activity to 2028 based on certain assumptions.

Applicability to BREA

The document attempts to predict oil and gas activity in the Beaufort Sea to 2028. This document would serve well for determining areas of impact and where future research should likely focus. In turn, this would contribute to/assist in determining appropriate indicators / VECs.

Recommendations (if any)

The author indicates that history has clearly shown that factors affecting the outlook for oil and gas activity in the Beaufort Sea can change dramatically over relatively short timeframes and that if the forecast presented in the document is to be relied upon for future planning, it should be revisited on a regular basis to ensure the underlying assumptions (described in Section 4.1.2 of the document) remain valid.

Report Number	Report Title	Publication Year	Location
32	**Integrated Ocean Management Plan for the Beaufort Sea: 2009 and beyond** *Citation: Beaufort Sea Partnership. 2009. Integrated Ocean Management Plan for the Beaufort Sea: 2009 and beyond. 57 p.*	2009	Marine Portion of the Inuvialuit Settlement Region (ISR)

Summary

The Beaufort Sea Integrated Ocean Management Plan (IOMP) sets forth objectives and strategies to facilitate integrated planning among all Beaufort Sea resource users and managers. The Beaufort Sea IOMP is organized around four/six thematic goals (Governance, Economic, Cultural, Social, Traditional and Local Knowledge, and Ecosystem). The report references both 6 goals and 4 goals whereby Cultural, Social, and Economic are lumped together). There are 24 objectives, each with strategies and actions identified to initiate transition toward IOMP implementation. The Plan also identifies parties responsible ('Partners') for the administration of the identified actions.

Applicability to BREA

Some actions put forth (such as: "Track and report marine traffic"; "Model the impacts of climate change on species and the human communities that rely upon them"; "Prepare economic development plan(s) for the LOMA (Large Ocean Management Area)"; "Develop community monitoring projects"; "Evaluate various growth scenarios and infrastructure needs for sectors, such as oil and gas or tourism that are expected to expand"; "Make TK and LK readily available to Science"; "Carry out physical, desktop and TK surveys to determine location (of rare and unique habitats) within the LOMA", etc.) may provide results that could contribute to BREA.

Recommendations (if any)

Determine the progress of actions put forth under the Economic, Cultural, Social, TK and LK, and Ecosystem Goals (primarily those listed above).

Report Number	Report Title	Publication Year	Location
33	**Valued Component Thresholds (Management Objectives Project) - Environmental Studies Research Funds (Report 172)** *Citation: Antoniuk, T., S. Kennett, C. Aumann, M. Weber, S. Davis Schuetz, R. McManus, K. McKinnon and K. Manuel. 2009. Valued Component Thresholds (Management Objectives) Project. Environmental Studies Research Funds Report No. 172. Calgary, AB. 164 p.*	2009	Northwest Territories

Summary

This report is a study on "Valued Component Thresholds" relevant to the onshore oil and gas industry in the Northwest Territories. The report provides a list of valued components that could be affected by hydrocarbon activities and include Air Quality, Water Quality and Quantity, Sensitive Features and Habitats, Focal Wildlife Species, Focal Fish Species, Traditional Culture and Land Use, Community Well-Being, and Economy and Business. The report describes/details indicators that could be used and evaluated for decision-making purposes. A process for establishing management objectives is described with Woodland Caribou used as an example. The report also provides a suggested process that may advance application of scientific background on Valued Component and threshold/objectives with respect to cumulative effects management ("Cumulative Effects Curve").

Applicability to BREA

The report provides some good information in terms of why certain Valued Components were selected as well as provides some fundamental guidance on determining indicators, thresholds, and management objectives for the Valued Components. It is important to note that the Valued Components selected relate to onshore activities which may be easier to monitor, however some good fundamental data in Valued Component selection is provided as well as how they can be monitored and evaluated against management objectives.

Recommendations (if any)

Candidate Valued Components, indicators, and management objectives for offshore hydrocarbon activities were provided in Dillon and Salmo (2005) (Dillon Consulting Limited and Salmo Consulting Inc. 2005. Beaufort Delta Cumulative Effects Project. Prepared for Environmental Studies Research Funds.

APPENDIX C

List of Contacts

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