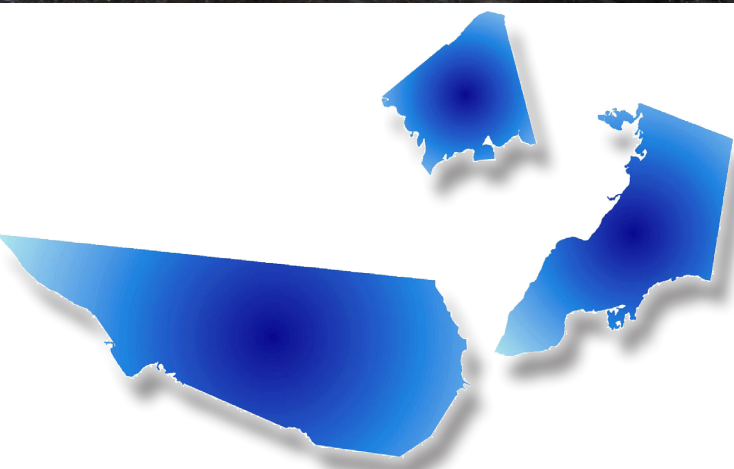




Pêches et Océans  
Canada

Fisheries and Oceans  
Canada



# TARIUM NIRYUTAIT

## MARINE PROTECTED AREAS

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## MONITORING PLAN

Canada 





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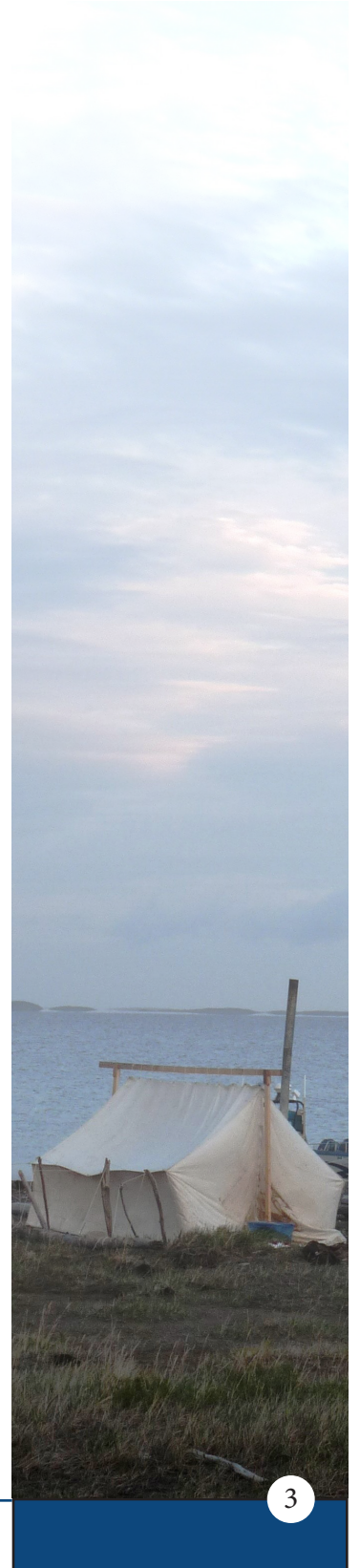


# Tarium Niryutait Marine Protected Area

## Monitoring Plan in support of the Tarium Niryutait Marine Protected Area Management Plan

Fisheries and Oceans Canada &  
Fisheries Joint Management Committee

2013



## Acknowledgements

The Tarium Niryutait Marine Protected Area (TNMPA)<sup>1</sup> monitoring plan has been made possible because of the hard work and enthusiastic participation by community members of the Inuvialuit Settlement Region (ISR), scientists from Federal and territorial governments, members of the Fisheries Joint Management Committee (FJMC), and members of the Inuvialuit Game Council (IGC). These people attended numerous meetings and workshops, and participated in the development of and selection process for indicators, protocols, and strategies in support of the conservation objective of the TNMPA. Many of the ongoing community-based harvest studies and ecosystem monitoring programs were instrumental in guiding this monitoring plan.

We remember and pay tribute to the 20 years of scientific contributions in the ISR, and enthusiastic support in the early stages of development of the TNMPA monitoring plan of Mr. Steve Solomon, Geological Survey of Canada, who passed away in 2011.

<sup>1</sup> See Appendix A for a list of acronyms used in the monitoring plan.



## Executive Summary

The TNMPA was designated in 2010 under Canada's Oceans Act (1996)<sup>2</sup> (enacted January 31, 1997). The objective of the TNMPA is: **to conserve and protect beluga whales and other marine species, their habitats, and their supporting ecosystem.** The TNMPA is jointly managed by Fisheries and Oceans Canada (DFO) and the FJMC. A management plan has been developed, and one of the six-year priority action items identified is the development and implementation of a monitoring plan. Monitoring of appropriate indicators allows managers to assess the effectiveness of regulations and other management activities in meeting their Marine Protected Area (MPA) conservation objective(s). The TNMPA monitoring plan provides a framework for such monitoring, and the plan includes: a description of roles and responsibilities; selection of indicators and sampling protocols; sampling and/or data gathering; information management and analysis; sample archiving; and reporting on the state of the TNMPA.

The monitoring plan supports the goals and objectives of the Beaufort Sea Beluga Management Plan (BSBMP) (FJMC 2001), and respects the principles and spirit of the *Inuvialuit Final Agreement* (IFA) (1984)<sup>3</sup>, including: co-management; community-based approaches to monitoring; and the integration of western science and traditional knowledge sources of information. The monitoring plan uses an ecosystem-based approach, which is consistent with the holistic view held by the Inuvialuit towards their environment, and is consistent with the *Oceans Act* and Integrated Oceans Management (IOM) principles (ecosystem-based management, sustainable development, the precautionary approach, conservation, shared responsibility, flexibility, and inclusiveness).

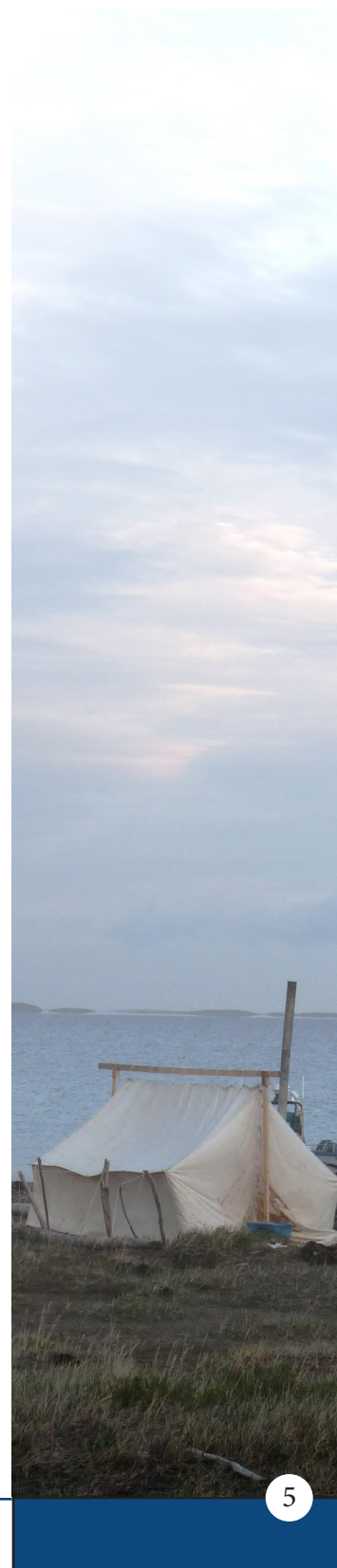
As with the TNMPA management plan, the monitoring plan will follow a six-year cycle, at the end of which time a formal scientific and community review will be conducted, and modifications to the plan made as required. There are five basic activities in the first six year cycle: selection of indicators, planning, implementation, reporting, and review (in 2018).

Three types of indicators are outlined in the monitoring plan: ecological, socio-economic, and governance. Monitoring will focus on ecological indicators in support of the conservation objective. Monitoring of ecological indicators is also most challenging to implement in a harsh remote Arctic setting like the Beaufort Sea, and in a geographical area where limited ecological baselines exist. Collaborations between scientists and local hunters and trappers have resulted in successful community-based monitoring (CBM) programs, which will continue to monitor core indicators on beluga, fish, and other parts of the ecosystem.

The TNMPA was selected over other conservation options as the mechanism to achieve a balance between conservation of the ecosystem and a desire by Inuvialuit for economic development in the ISR. Thus, socio-economic indicators are monitored to track the success of achieving the desired balance. Governance indicators are important to assess performance and adequacy of existing institutional structures to manage the TNMPA.

2 *Oceans Act* (1996): <http://laws-lois.justice.gc.ca/eng/acts/O-2.4/>. (Accessed January 26, 2012.)

3 Inuvialuit Final Agreement (1984): <http://www.irc.inuvialuit.com/publications/pdf/Inuvialuit%20Final%20Agreement.pdf>. (Accessed January 30, 2012.)



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# 1. Introduction

The TNMPA, situated in the Canadian Beaufort Sea Large Ocean Management Area (LOMA) of the ISR (Fig. 1), was designated in 2010 under Canada’s *Oceans Act* 1996 (enacted January 31, 1997). The objective of the TNMPA is to conserve and protect beluga whales and other marine species, their habitats, and their supporting ecosystem. The TNMPA is jointly managed by DFO and the FJMC. A management plan for the TNMPA has been developed (DFO and FJMC 2013). One of the six-year priority action items identified in the TNMPA management plan is the development and implementation of a monitoring plan.

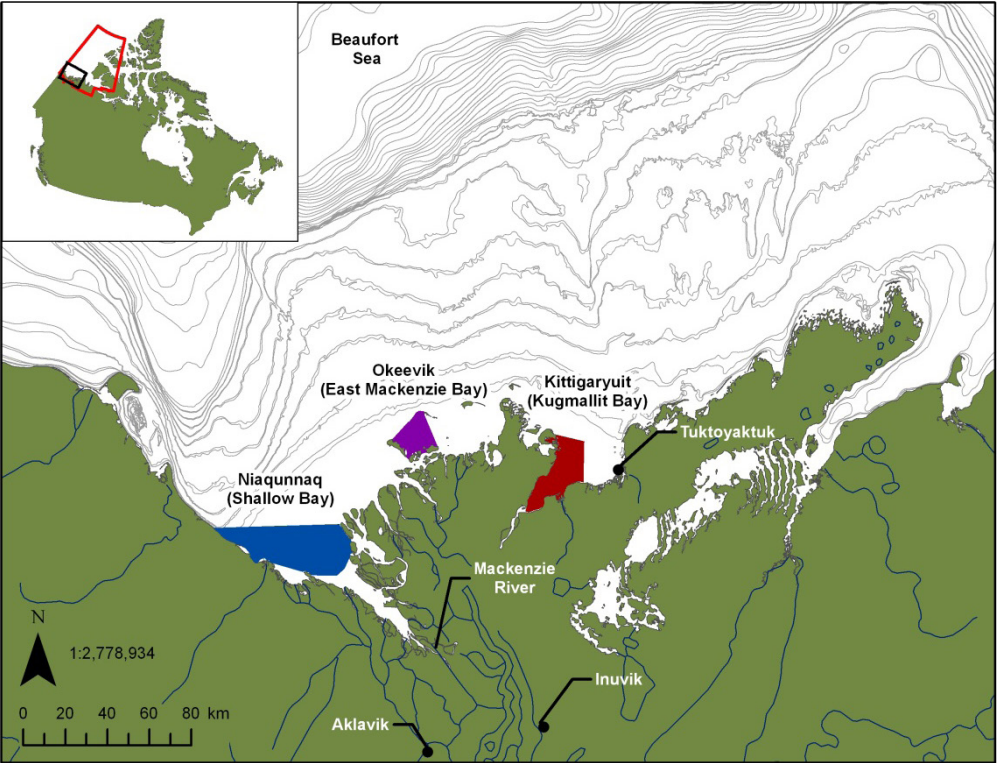
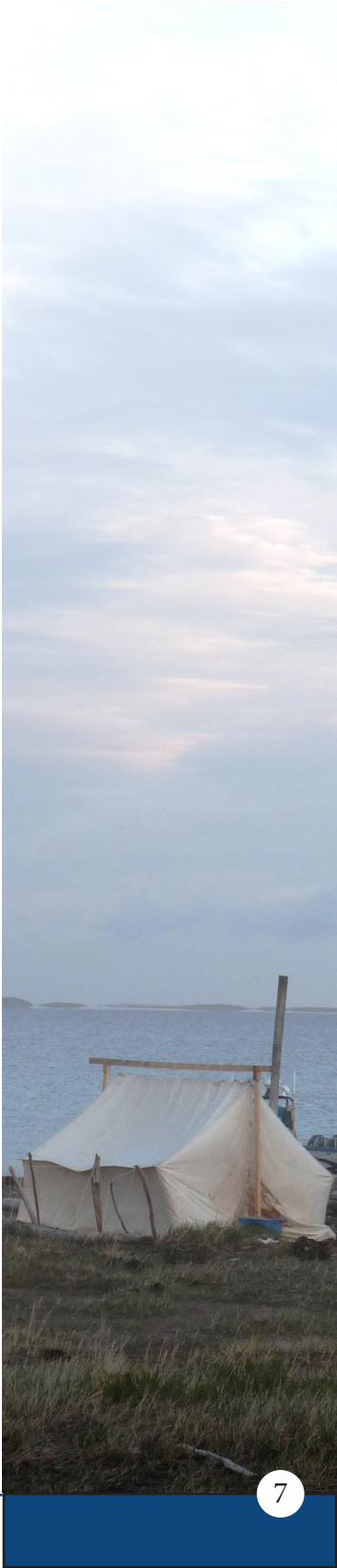


Figure 1. TNMPA areas indicated by the blue (Niaqunnaq), purple (Okeevik), and red (Kittigaryuit) shaded areas within the ISR (indicated by red lines within inset map).

Monitoring of appropriate indicators allows managers to assess the effectiveness of regulations and other management activities in meeting their MPA conservation objective(s). The TNMPA monitoring plan provides a framework for such monitoring, and the plan includes: a description of roles and responsibilities; selection of indicators and sampling protocols; sampling and/or data gathering; information management and analysis; sample archiving; and reporting on the state of the TNMPA.



Photo credit: Blythe Browne



## 2. Monitoring as a Key Component of the TNMPA Management Plan

The TNMPA monitoring plan is one of the key components of the TNMPA management framework (DFO and FJMC 2013). The monitoring plan follows the guidance provided in DFO (2009). This MPA practitioner's guide outlines the various roles and responsibilities within DFO and other MPA advisory bodies, which may be established for the purposes of implementing regulatory and non-regulatory activities, including this monitoring plan.

Like the TNMPA management plan, the monitoring plan supports the goals and objectives of the BSBMP (FJMC 2001), and respects the principles and spirit of the IFA, including: co-management; community-based approaches to monitoring; and the integration of western science and traditional knowledge sources of information. The monitoring plan uses an ecosystem-based approach, which is consistent with both the holistic view of the Inuvialuit towards their environment, and the Oceans Act and IOM principles (ecosystem-based management, sustainable development, the precautionary approach, conservation, shared responsibility, and flexibility and inclusiveness).

The FJMC is the co-management body established by the Minister of Fisheries and Oceans in 1986 as a result of the IFA. The FJMC assists in administering the rights and obligations related to fisheries in the ISR. It also sets priorities for scientific research related to fisheries resources. The FJMC, Communities of the ISR, and DFO finalized the BSBMP in 1991 (third amendment in 2001, FJMC 2001), with the purpose of maintaining responsible and effective management of Beaufort Sea beluga whales. Research on and monitoring of beluga are priorities for the FJMC. All aspects of the TNMPA monitoring plan will be managed jointly between DFO and the FJMC as a logical extension of the successful arrangement of co-management and research in support of beluga. Specific roles and responsibilities are defined by a Letter of Agreement (LOA), as described within the TNMPA management plan (DFO and FJMC 2013).

## 3. TNMPA Monitoring Plan

The TNMPA monitoring plan is intended to be a living document. As with the TNMPA management plan, the monitoring plan will follow a six-year cycle, at the end of which a formal scientific and community review will be conducted, and the plan modified as required. There are five basic activities in the first six-year cycle (Fig. 2). These steps are: selection of indicators, planning, implementation, reporting, and review (in 2018).





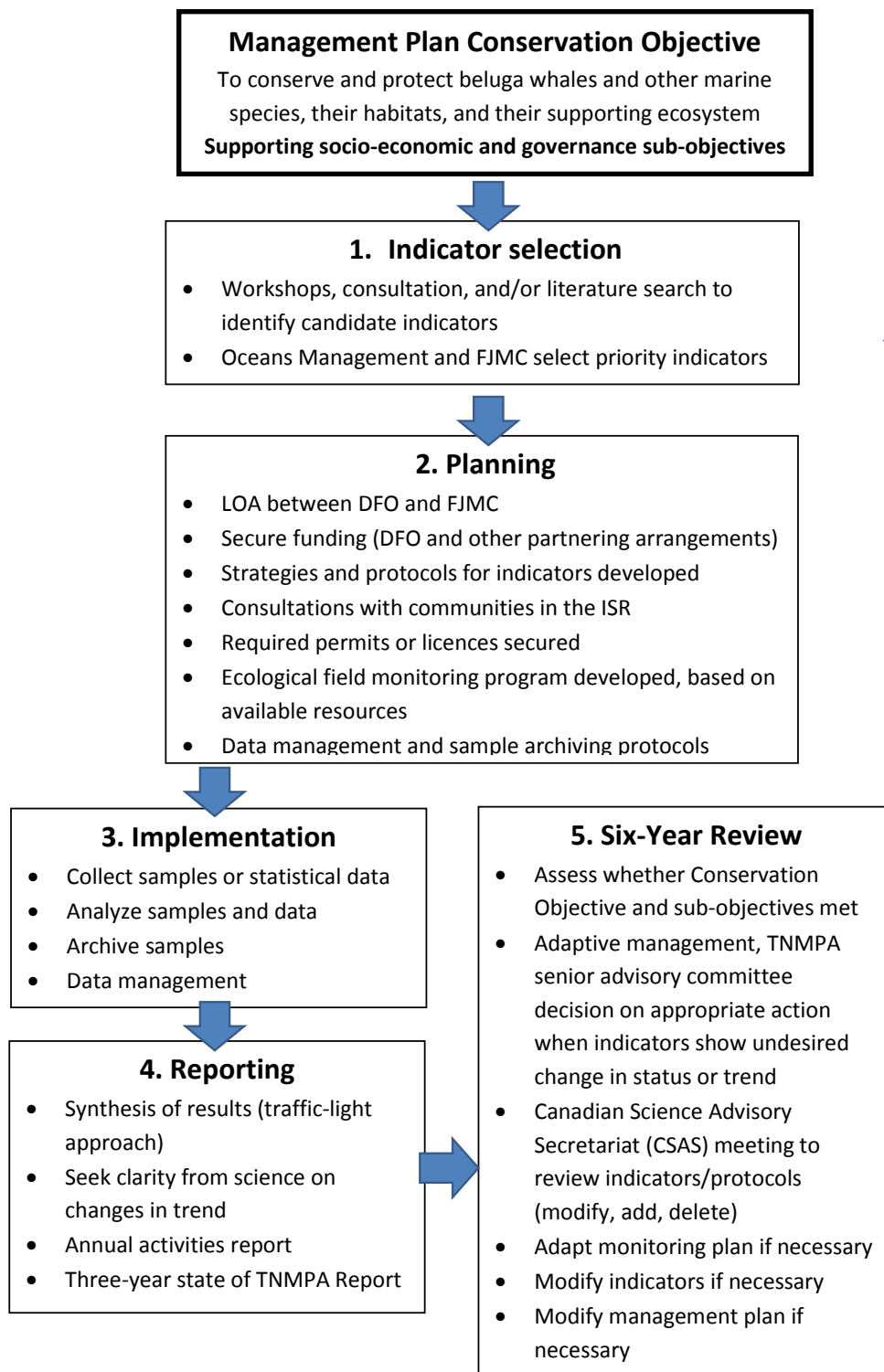
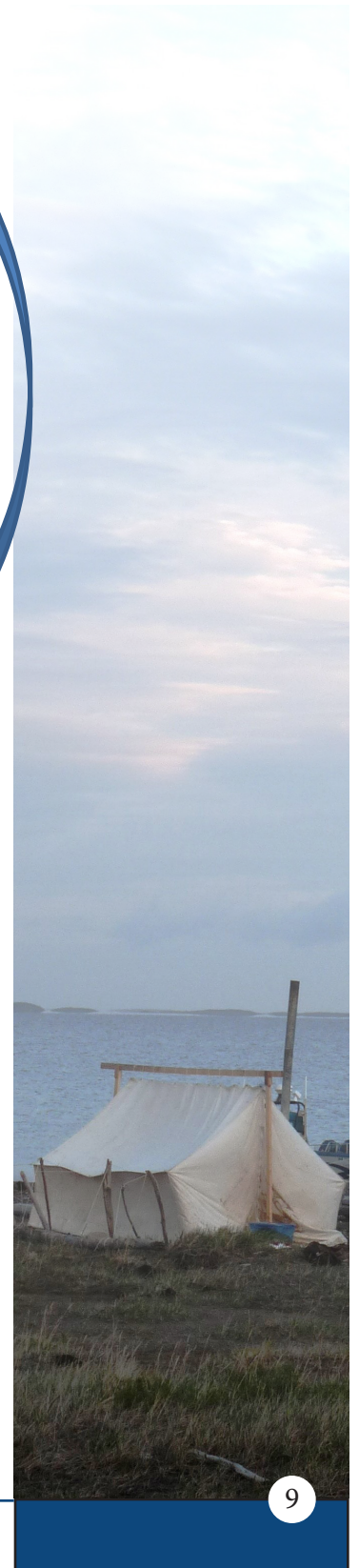


Figure 2. Steps in the development and implementation of the TNMPA monitoring plan.



### 3.1. Selection of Indicators

There is a wealth of literature pertaining to indicators. Simply stated, indicators are variables that are measured or observed repeatedly and consistently over time from which to draw conclusions on existing conditions and measure changes or trends over time. Indicators measure the extent to which a program or initiative, in this case the TNMPA, is meeting its objectives. In the context of the TNMPA, the three main functions of indicators



Photo credit: Blythe Browne

are: simplification of more complex situations, quantification and qualification of state or trends based on thresholds/limits, and communication of complex information in a simple set of metrics. Indicators are powerful tools in the feedback to a management plan as an early warning signal about an emerging issue, or in providing managers with a concise measure for education and awareness. It is appropriate to monitor ecological, socio-economic, and governance indicators to assess whether the conservation objective (Fig. 2) and supporting socio-economic and governance sub-objectives of the TNMPA are being met.

The approach for selecting ecological indicators has received much attention internationally (Rice and Rochet 2005, Tallis et al. 2010). Monitoring of ecological indicators is also most challenging to implement in a harsh remote Arctic setting like the Beaufort Sea, and in a geographical area where limited ecological baselines exist. The TNMPA was selected over other conservation options as the mechanism to achieve a balance between conservation of the ecosystem and a desire by Inuvialuit for economic development in the ISR, so socio-economic indicators will be monitored to track the success of achieving the desired balance. By monitoring a suite of indicators, it is not only possible to understand the impact of the TNMPA on protecting beluga whales and their habitat through regulation of human activities, but it is also possible to understand the impact of the TNMPA on economic well-being in the ISR. Governance indicators are important to assess performance and adequacy of existing institutional structures to manage the TNMPA.

#### 3.1.1 Ecological Indicators

Ecological indicators reflect the state of the ecosystem at a point in time. Repeated observations of the indicators over a period of time informs on trends in the state of the ecosystem (both internal and external to the TNMPA area). They can be used to describe the state of the ecosystem in relation to some stressor (e.g., climate change), or they can be used to compare actual conditions within the TNMPA against targets for desired ecological conditions, and to which direct management actions can be taken (e.g., noise levels resulting from anthropogenic activities). The TNMPA was established mainly as a conservation tool, so ecological indicators are a key component of the monitoring plan to ensure that the conservation objective is being met. Most of the monitoring funding established by the TNMPA implementation fund will be targeted to ecological monitoring, with a heavy reliance on community-based monitoring. The ecological indicators selected will be linked directly to management measures of the TNMPA regulations and its conservation objective.





A request for science engagement in the selection of indicators was anticipated during the process of establishing the TNMPA, and it was anticipated that participation by communities in some aspects of the monitoring program would be likely. Numerous scientific and community workshops were held in the ISR over several years to discuss conservation objectives, indicators, and science gaps (e.g., Cobb et al. 2004, Ayles and Papst 2007). These workshops discussed many of the concepts around ecosystem-based approaches to management. The inclusion of both Inuvialuit traditional knowledge and science strengthened the outcomes of those gatherings. Many of the indicators discussed at these workshops fed directly into the process of final indicator selection.

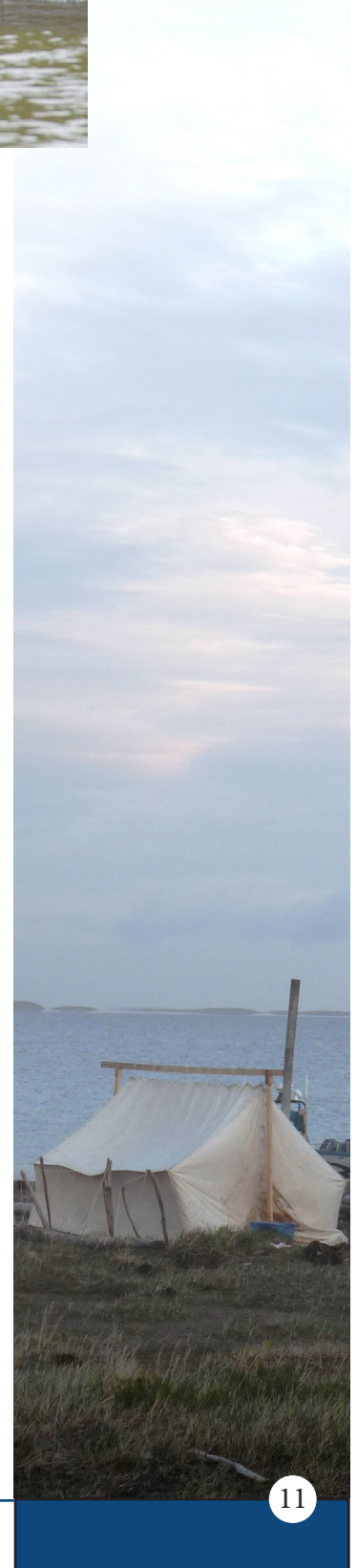


Following designation of the TNMPA, a series of DFO CSAS meetings were held in response to a request by Oceans Management Branch to develop scientifically defensible indicators, protocols, and strategies for monitoring in support of the TNMPA (DFO 2010, 2013). This multi-step process resulted in final lists of 82 candidate indicators, which were placed into one of six categories based on a breakdown of the main conservation objective into categories for which specific indicators could be identified and evaluated. These categories were not transformed into statements or sub-objectives during the CSAS meetings, but the following statements in parentheses could be inferred based on the intent expressed at the meetings:

1. ecosystem structure (maintain ecosystem structure within the bounds of natural variation),
2. ecosystem function (maintain ecosystem function within the bounds of natural variation),
3. population structure of key species, including beluga and anadromous fish (maintain populations of key species within the bounds of natural variation),
4. health of key species (maintain health of key species),
5. physical and chemical environment (maintain physical and chemical environment within the bounds of natural variation), and
6. noise and other physical stressors (minimize noise disturbance and conserve habitat).

The 82 candidate indicators were assessed and prioritized based on their ability to:

- relate directly to beluga abundance and well-being,
- build on research and monitoring efforts already underway,
- monitor several indicators through a single program,
- be relatively easy to measure,
- be non-invasive to target species, and/or
- involve local communities in monitoring.





Each of the indicators was assessed based on a working research document (Higdon 2012), and additional expert knowledge and experience. Many of the suggested indicators have been monitored for a number of years as part of the community-based beluga harvest study and other DFO Science programs in the Beaufort Sea, and the protocols and strategies from these programs have already been established. These sources together formed a list of priority indicators that DFO Science recommended for monitoring in the TNMPA (Table 1).



Photo credit: Emily Choy

The indicator categories were selected based on sound science; however, some of them may not have been formally evaluated for their direct application within the TNMPA. A dedicated TNMPA monitoring program has yet to be established, and some of the protocols have only recently been tried for the TNMPA, so scientists identified a number of uncertainties associated with the identified protocols and strategies (DFO 2013):

- Natural variability of the Beaufort Sea and the TNMPA ecosystem results in high uncertainty associated with all indicator categories. The protocols should be designed with natural variability in mind and may require a number of seasons of measurement to provide sufficient statistical power to detect statistically significant changes to assess trends.
- There are issues with monitoring highly migratory species. A number of key focal species are only present in the Mackenzie River estuary for part of the year. It is difficult to determine the cause of changes in the TNMPA when changes have occurred outside the TNMPA. Management will need to be aware of changes

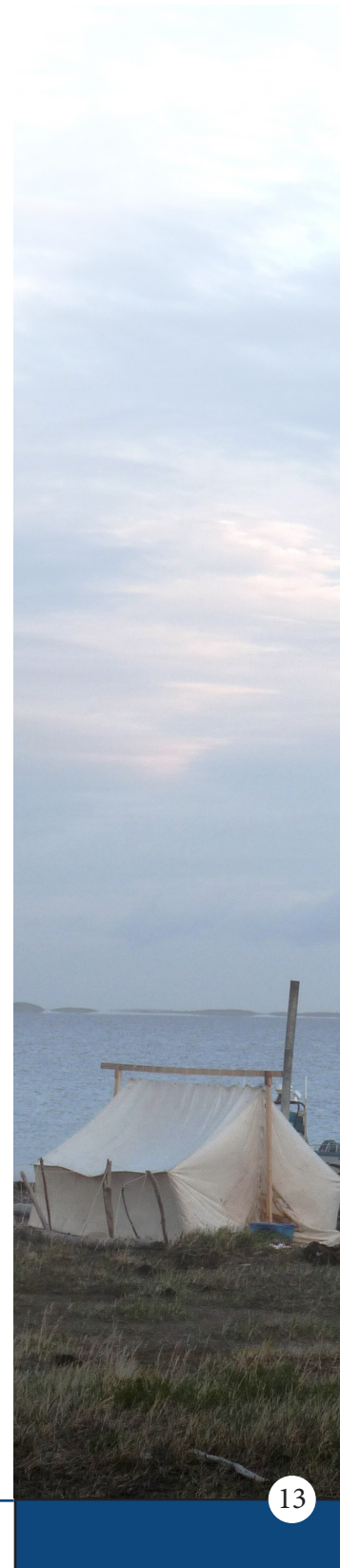


that occur in areas outside the TNMPA.

- Most data sources are the result of studies that were not designed as monitoring protocols (the Arctic Coastal Ecosystem Study is the exception), so their use in this context requires explicit interpretation to ensure their applicability and accuracy.
- Data collection and assessment are generally seasonally limited and, therefore, do not represent all of the processes occurring within the TNMPA.

Thus, it is premature to establish targets, thresholds, or limits to acceptable change in some of these indicator categories. Several years of data collection and/or data analysis within the first cycle of the monitoring plan should provide a sufficient baseline to establish adequate ranges of variability and enable the setting of desired limits. Once the bounds of natural variability are known, these targets or thresholds will, in turn, trigger a management action or the planning of more intensive sampling to further understand the mechanisms behind any changes.

The Science advice report (DFO 2013) discussed the fact that there are many complexities associated with understanding the TNMPA and its focal species (Fig. 3), in part because of globally induced ecosystem stressors such as climate change and long-range transport of contaminants, but also because most species are highly migratory and are susceptible to changes elsewhere during their annual cycle. For example, beluga aggregate within the TNMPA in the summer, migrate through the Chukchi Sea, and overwinter in the Bering Sea. During their spring migration back to the Beaufort Sea, they use offshore habitats associated with sea ice and deep water prior to returning to coastal TNMPA areas in summer.



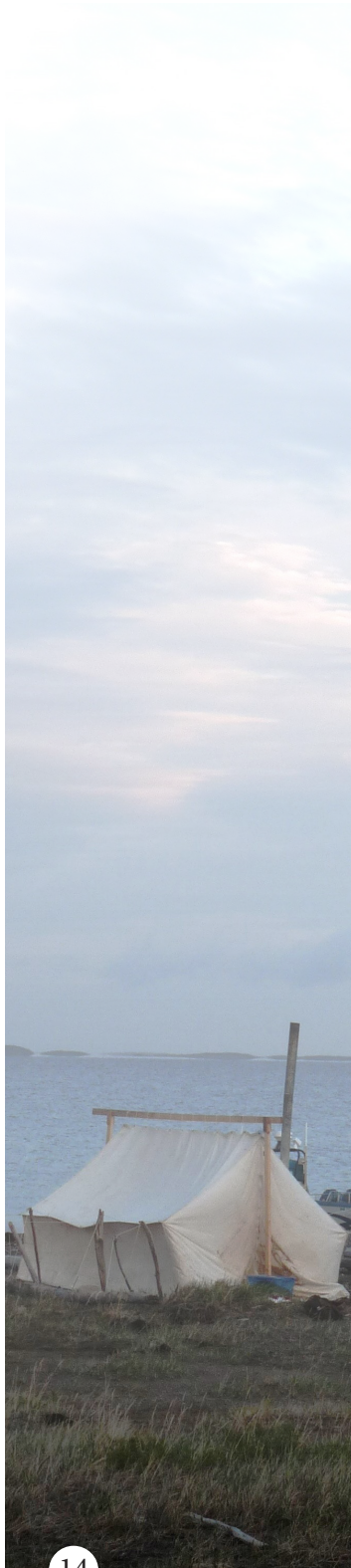


Table 1. Ecological indicators for the TNMMPA monitoring program (summarized from DFO 2010 and Loseto et al. 2010). (Note: The number of indicators used in the TNMMPA program will depend on resources and funds.)

Indicator Category	Indicator or Sub-category	Indicators Currently Used or Suggested for Monitoring	Strategy for Monitoring	To be used in State of the TNMMPA Report	Supporting Data for TNMMPA	Current Understanding of Status <sup>1</sup>	Current Understanding of Trends <sup>2</sup>
Ecosystem Structure and Function	Biodiversity	Number of species in TNMMPA	Desktop Analysis	✓		✓	
		Unusual Species	Hunters/monitors reporting	✓			✓
		Stable isotopes	Collections from CBM		✓	✓	
Population structure of key species	Trophic structure	Catch Per Unit Effort (CPUE) (or total number harvested)	Beluga harvest studies	✓			✓
		Date of first arrival/peak/last whales	Harvester notes	✓		✓	
	Beluga	Size, age, sex structure	Beluga monitoring	✓			✓
		Annual aerial surveys	Aerial surveys/remote sensing		✓	✓	
		Distribution within TNMMPA	Aerial surveys or hunters	✓		✓	

<sup>1</sup> Current Understanding of Status means we can report on the indicator at its current state or level; however, we do not have trend data at this time.

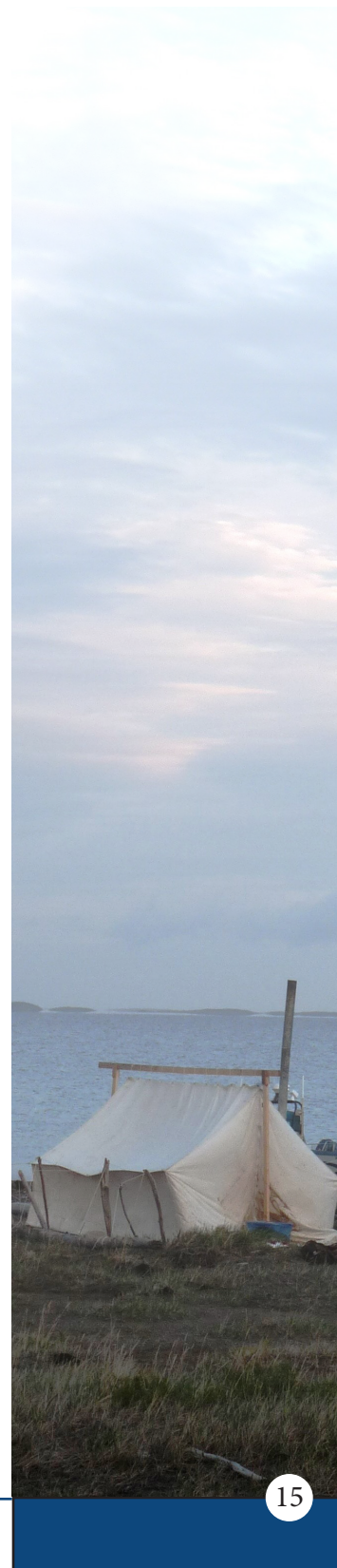
<sup>2</sup> Current Understanding of Trends means we already have the data that allow us to report on a trend over a number of sample periods.

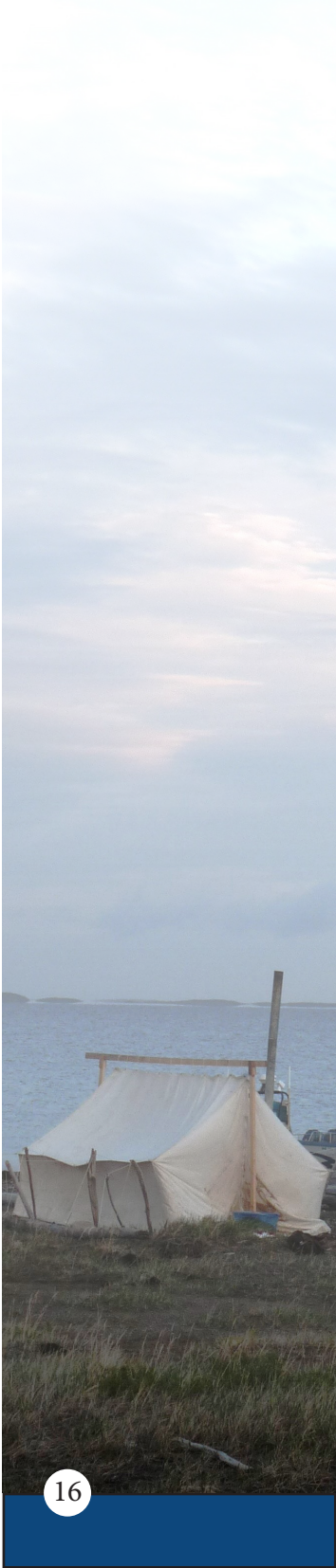


Indicator Category	Indicator or Sub-category	Indicators Currently Used or Suggested for Monitoring	Strategy for Monitoring	To be used in State of the TNMMPA Report	Supporting Data for TNMMPA	Current Understanding of Status <sup>1</sup>	Current Understanding of Trends <sup>2</sup>
Health of key species	Fish	CPUE (or total number harvested)	CBM	✓		✓	
		Size, age, sex structure	CBM	✓		✓	
		Blubber thickness	Beluga monitoring	✓			✓
	Beluga	Lipids	Beluga monitoring		✓	✓	
		Fatty acids	Beluga monitoring		✓	✓	
		Chronic stress impacts	Beluga monitoring		✓	✓	
		Mercury in muscle	Beluga monitoring	✓			✓
		Diseases/parasites/abnormalities	Beluga monitoring (hunter notes)	✓			✓
		Length/weight relationships	Beluga monitoring	✓		✓	
		Mercury in muscle length/weight relationship	CBM	✓		✓	
	Fish		CBM		✓	✓	
			CBM			✓	

1 Current Understanding of Status means we can report on the indicator at its current state or level; however, we do not have trend data at this time.

2 Current Understanding of Trends means we already have the data that allow us to report on a trend over a number of sample periods.





Indicator Category	Indicator or Sub-category	Indicators Currently Used or Suggested for Monitoring	Strategy for Monitoring	To be used in State of the TNMMPA Report	Supporting Data for TNMMPA	Current Understanding of Status <sup>1</sup>	Current Understanding of Trends <sup>2</sup>
Physical and chemical	Fish	Fatty acids	CBM (fisher notes)	✓	✓	✓	
		Disease/parasites/ab-normalities				✓	
	Ice Phenology	Ice distribution and timing of break up	Environment Canada (EC)		✓		✓
	Oceanography	Mackenzie River flows	EC		✓		✓
		Temperature/salinity-chlorophyll- <i>a</i>	CBM		✓	✓	
Anthropogenic noise	Physical Habitat	Bathymetry	Natural Resources Canada (NRCan), CBM		✓		
		Substrate texture	NRCan, CBM		✓		
		Coastline erosion	NRCan, CBM		✓		✓
		Number of vessels transiting TNMMPA	Canada/Canadian Coast Guard	✓			✓

1 Current Understanding of Status means we can report on the indicator at its current state or level; however, we do not have trend data at this time.

2 Current Understanding of Trends means we already have the data that allow us to report on a trend over a number of sample periods.



Changes in the health of these ecosystems could affect the health of these whales. Contaminants from global sources may bioaccumulate in and have health effects on beluga. Anadromous fishes migrate through the TNMPA en route to and from coastal rivers and lakes of the ISR, the Mackenzie River, and rivers of the Yukon North Slope and are, thus, influenced by conditions in these systems.

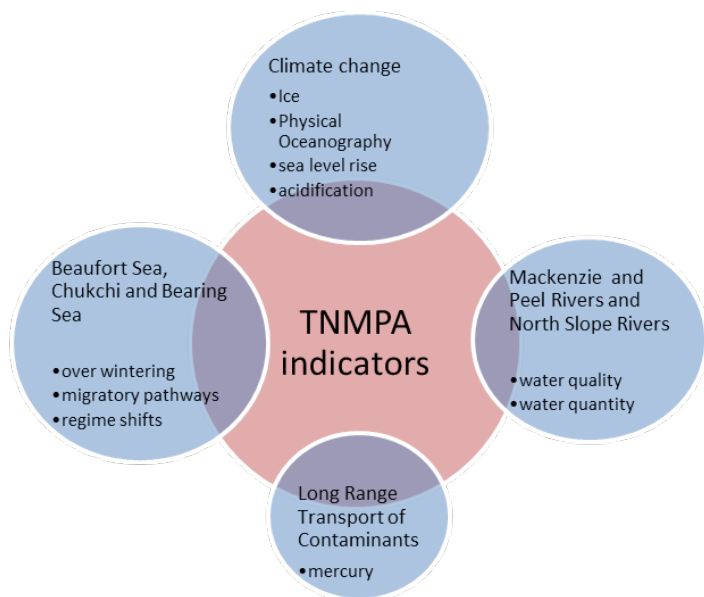
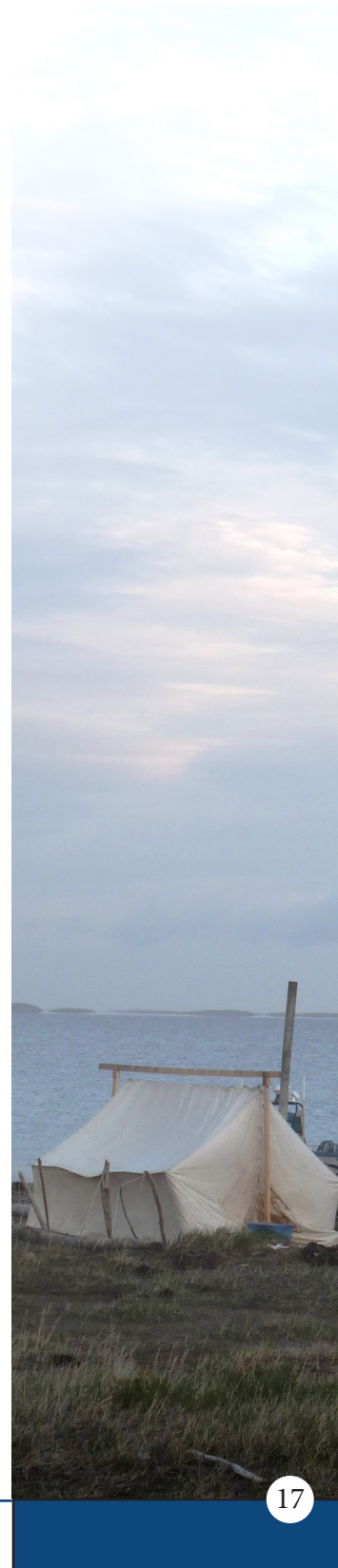


Figure 3. Diagram showing the connectivity between TNMPA indicators or key focal species and other ecosystems. “FS” indicates the interaction of ecosystems within and outside of the TNMPA with key focal species.

Thus, scientists participating in the CSAS indicators meeting recommended other ecological indicators that have been incorporated into the current list (DFO 2010). Some of these indicators are currently being monitored within and outside of the TNMPA in conjunction with other programs. Beluga health indicators are being monitored through the collaborative efforts of DFO, FJMC, and the Northern Contaminants Program. These health indicators include: beluga gender, size, and age structure; levels of nutrition and condition of belugas (blubber thickness), lipids, blood constituents, and chronic-stress indicators such as hormonal levels and oxidative by-products;

and concentrations of contaminants. New methods, including stable isotope analysis and fatty acids analysis of beluga tissues, will provide insight into major shifts in food webs and trophic dynamics in the Beaufort Sea. Clearly, participation by DFO Science in these existing core monitoring programs should be continued, and linked with the TNMPA monitoring program. The monitoring program involving ecological indicators should be

Photo credit: Blythe Browne



adaptable as new methods and approaches to monitoring are developed. Annual TNMPA meetings between DFO Science, the FJMC, and the Oceans Management Branch should allow for new and innovative approaches to be considered.

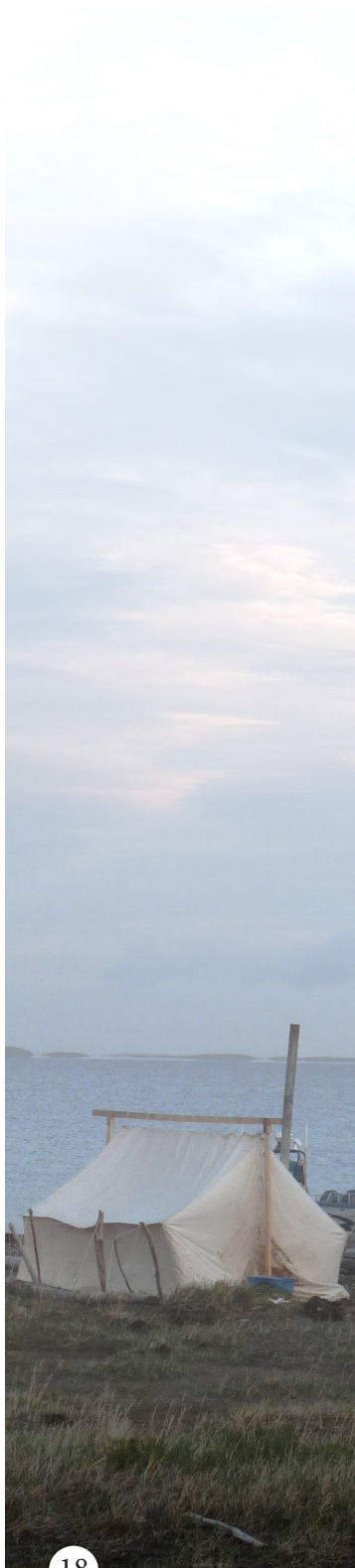
### *3.1.2. Socio-economic Indicators*

Socio-economic indicators reflect the state of the human component of the TNMPA (e.g., economic activity, human use). These indicators help to measure the extent to which management is successful in regulating human pressures in a way that supports the conservation objective and sustains quality of life, including food security and health of the food resource for those associated with the TNMPA, while ensuring sustainable socio-economic benefits. Socio-economic indicators allow the TNMPA managers to demonstrate the socio-economic value of the TNMPA area and its resources, and assess the costs and benefits of the TNMPA in the context of traditional and sustainable livelihoods.

Socio-economic indicators were not dealt with during the DFO CSAS meetings. However, within the socio-economic assessment for the TNMPA (Kavik-Axys 2003), and the socio-economic overview and assessment (Beaufort Sea Partnership Social, Cultural and Economic Working Group 2008), there are two broad categories for which indicators can be selected and monitored: economic and cultural integrity. Activities and data relevant to these socio-economic indicators are led by other agencies or other sectors within DFO. Many of these agencies are part of the Beaufort Sea Partnership, so it will be feasible to access these data as signatories of the IOM Plan. For example, the Environmental Impact Screening Committee and the National Energy Board (NEB) will receive applications for future development of current holdings within the TNMPA or of surrounding marine areas; DFO Fisheries Protection branch will review development proposals in and adjacent to the TNMPA, and will ensure that activities exempted from the TNMPA regulations mitigate against harmful alteration of habitat that supports harvested species within the TNMPA. These data will be useful to track economic development and potential environmental stressors in and near the TNMPA. At the request of the Oceans Management Branch, DFO Conservation and Protection Branch will plan for compliance monitoring with respect to human use within the TNMPA through regular inspections, and the number of violations of the regulations will be an indicator of threats or stressors to the TNMPA. Table 2 provides a partial list of candidate socio-economic categories, indicators, and strategies and protocols. These indicators will be further refined and finalized by the TNMPA managers during the six-year cycle. Once established, it is anticipated that these socio-economic indicators will be consistent with DFO national indicators.

### *3.1.3. Governance indicators*

Governance indicators measure the performance, in terms of efficiency, effectiveness, and economy, of governance structures and tools established for the management of the TNMPA. Governance indicators are based on the management roles and responsibilities established under the LOA in the management plan (DFO and FJMC 2013). Performance indicators will follow national Oceans Management guidance, will be finalized by the TNMPA managers before the six-year review, and will allow evaluation of the extent to which each of the priority actions has been achieved. Further positive impact of the establishment of the TNMPA can be demonstrated by greater public awareness and education. A suggested approach to governance indicators is presented in Table 3. A number of governance categories, with supporting strategies and indicators, have been selected to assess how well the TNMPA is performing with respect to governance, awareness, and education, contributing to broader marine protected initiatives, and broad engagement with other agencies or sectors within DFO. At the end of the first six-year cycle, there will be an assessment of the degree to which each of the categories has been achieved or implemented.





## 3.2. Planning and Implementation of Monitoring Activities

### 3.2.1. Roles and Responsibilities

One of the key elements in the implementation of the TNMPA monitoring program is the LOA between DFO and FJMC (DFO and FJMC 2013). The LOA spells out the roles and responsibilities in implementing the monitoring program, including: securing core funding and additional funding through partnership agreements; consultations prior to and following field programs; information management systems; and reporting to local stakeholders, industry, broader government, environmental organizations, and international meetings. Within DFO, Science sector, Conservation and Protection Branch, Fisheries Protection Branch, and Oceans Management Branch will each have a role to play in the ongoing planning, implementation, and review of the monitoring program. Oceans Management Branch of the Inuvik office will coordinate these activities on behalf of DFO.

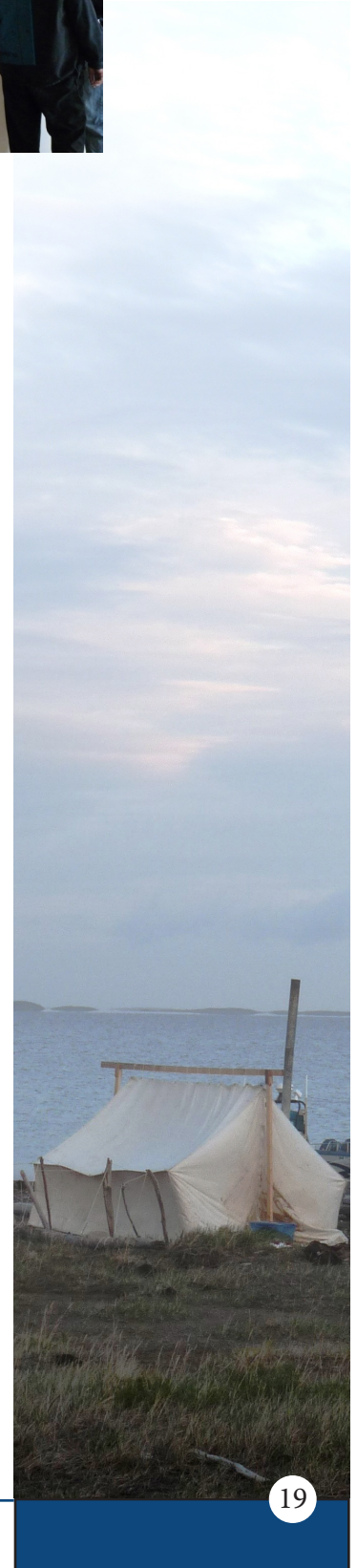
DFO and FJMC are responsible for a number of constituents of the monitoring plan, depending on the availability of resources within each co-management agency and under terms of the LOA between DFO and FJMC.

DFO is responsible for:

- day-to-day coordination of the monitoring program within DFO sectors and with other non-DFO agencies as required to collect data related to the selected indicators;
- providing long-term core monitoring implementation funding to FJMC;
- identifying a DFO representative on the TNMPA senior advisory committee;
- identifying a dedicated TNMPA manager to work with FJMC on day-to-day activities;
- conducting scientifically defensible monitoring of core indicators (directly linked to TNMPA regulations);
- maintaining a data management and sample archive system;
- conducting research in support of the TNMPA monitoring plan as recommended by FJMC;
- linking the TNMPA monitoring program to other ISR initiatives (e.g., BSP, Beaufort Regional Environmental Assessment, Cumulative Impacts Monitoring Program, and Arctic Borderlands Ecological Knowledge Co-op);
- planning for Conservation and Protection compliance monitoring in support of the TNMPA regulations;
- maintaining a TNMPA website and a link to FJMC and BSP websites; and
- collecting socio-economic data and analysis from appropriate agencies (e.g., DFO branches, NT Government, NEB, and Statistics Canada).



Photo credit: Blythe Browne



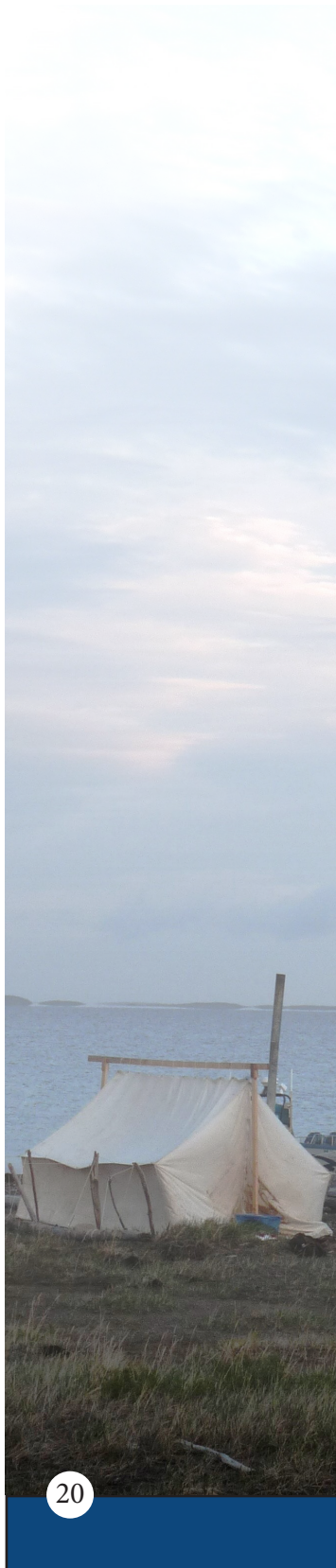
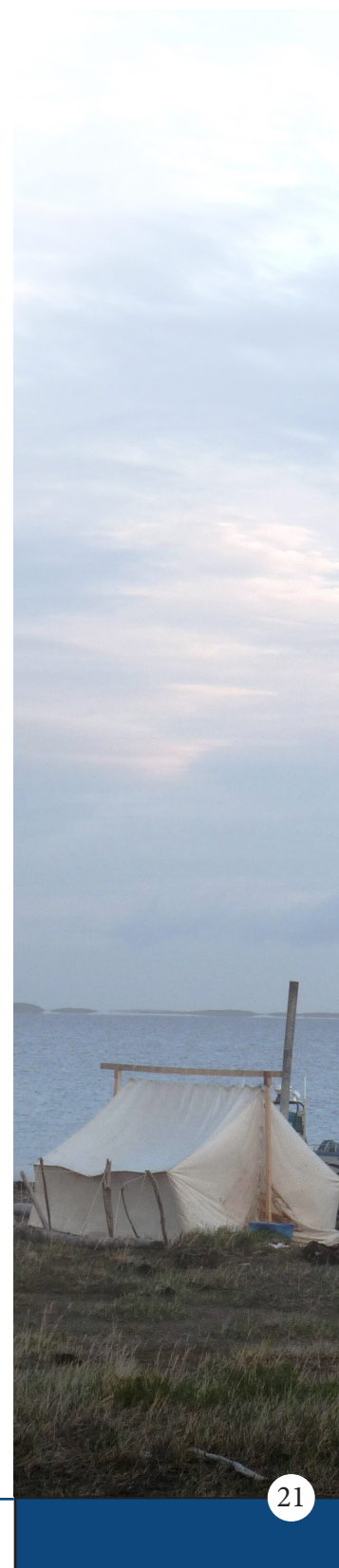


Table 2. Socio-economic indicators for the TNMMPA monitoring plan. (Note: The number of indicators monitored will depend on resources and funds.)

Category	Indicator Category	Indicator or Metric to Measure	Strategy/Protocol
Economic	Hydrocarbon development	<ul style="list-style-type: none"> <li>Annual number of new applications for hydrocarbon development in or around the TNMMPA (and fiscal investment)</li> </ul>	<ul style="list-style-type: none"> <li>Monitor exempted hydro carbon activities</li> <li>Monitor NEB applications</li> </ul>
	Tourism	<ul style="list-style-type: none"> <li>Annual number of ecotourism companies in the ISR and income generated for ecotourism specifically related to the TNMMPA</li> <li>Number of requests to Hunter and Trap Committees (HTCs) for ecotourism in TNMMPA</li> </ul>	<ul style="list-style-type: none"> <li>Monitor trends in demand for ecotourism activities through or over the TNMMPA as an indicator of national or inter national interest in the TNMMPA</li> </ul>
	Transporting	<ul style="list-style-type: none"> <li>Annual number of vessels transiting the TNMMPA</li> </ul>	<ul style="list-style-type: none"> <li>Monitor trends in volume of shipping via regular shipping route or supply to Significant Discovery Licences (SDLs)</li> </ul>
	Harvesting	<ul style="list-style-type: none"> <li>Annual number of beluga whales and other species harvested per area and community</li> </ul>	<ul style="list-style-type: none"> <li>Monitor trends in subsistence harvest of whales and other species in the TNMMPA, and continue community-based beluga harvest studies</li> </ul>
	Employment related to TNMMPA	<ul style="list-style-type: none"> <li>Number of person-years of employment directly supporting TNMMPA for monitoring, surveillance, logistic, and administrative support</li> </ul>	<ul style="list-style-type: none"> <li>Encourage employment of Inuvialuit in all activities related to the TNMMPA</li> </ul>



Category	Indicator Category	Indicator or Metric to Measure	Strategy/Protocol
Economic	Fisheries Act applications, Canadian Environmental Protection Act (CEPA) applications	<ul style="list-style-type: none"> <li>Annual number of Fisheries Protection applications for letter of advice or authorization related to development in the SDLs (dredging, pipeline installation)</li> <li>Annual number of applications for disposal at sea under the CEPA for ocean dumping</li> <li>Number of TNMMPA DFO Conservation and Protection patrols</li> <li>Number of violations of TNMMPA regulations</li> <li>Percent of harvesters by community</li> </ul>	<ul style="list-style-type: none"> <li>Monitor number of reviews of exempted activities</li> <li>Monitor number of fines issued by DFO Conservation and Protection Branch</li> <li>Monitor number of requests for permits under CEPA for ocean dumping</li> </ul>
Cultural Integrity	Use of TNMMPA areas for subsistence harvesting		<ul style="list-style-type: none"> <li>Promote cultural importance of TNMMPA and monitor trends in use by harvesters from North west Territories (NT) statistics</li> </ul>
	Consumption of country foods	<ul style="list-style-type: none"> <li>Percent of households consuming country foods</li> <li>Annual kg of beluga and other species consumed</li> </ul>	<ul style="list-style-type: none"> <li>Track statistics produced by NT on diet and consumption of country food by each community</li> </ul>
	Perception of health of the TNMMPA marine ecosystem by Inuvialuit harvesters	<ul style="list-style-type: none"> <li>Number of positive or negative responses as to whether the TNMMPA is a healthy marine ecosystem</li> </ul>	<ul style="list-style-type: none"> <li>Support existing programs that monitor opinions of cultural and spiritual importance of the TNMMPA (e.g., Arctic Borderlands Ecological Co-op interview)</li> </ul>



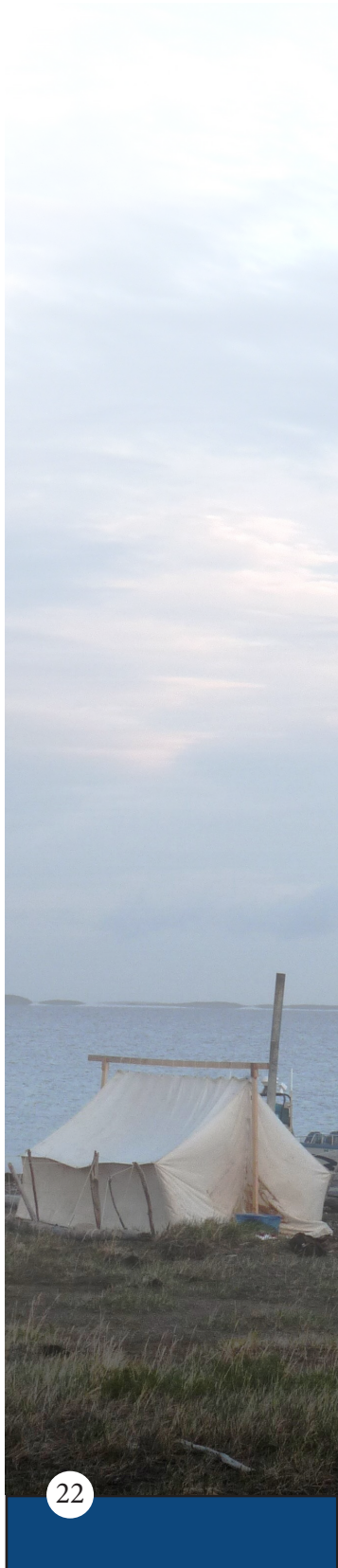


Table 3. Governance indicators for the TNMMPA (2013–2018).

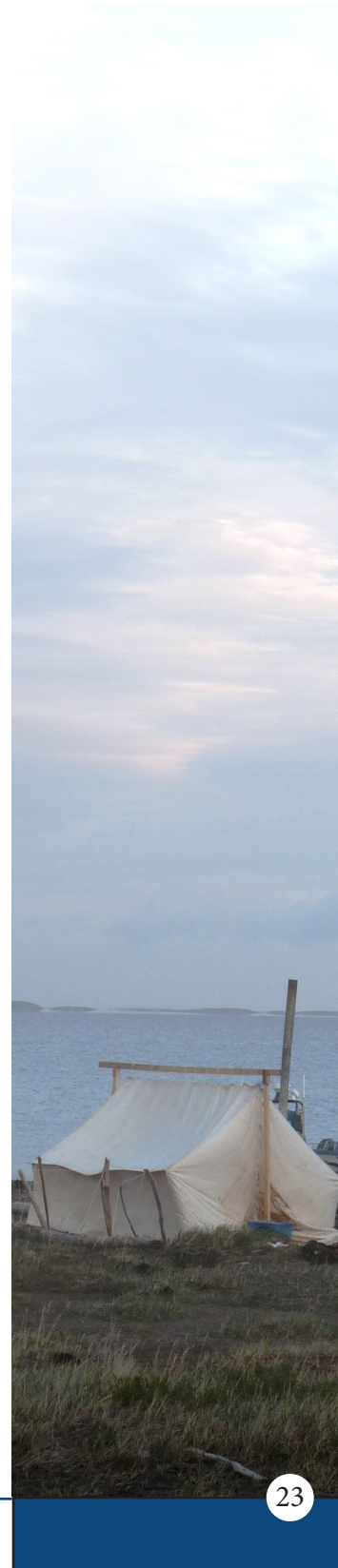
Governance Category	Strategy to Achieve Governance Category	Indicator to Measure	Progress (2018) <sup>1</sup>
1. Institutional management structures established and functioning	<ul style="list-style-type: none"> <li>• Complete draft management plan</li> <li>• Consult with stakeholders</li> <li>• Finalize plan</li> <li>• Hold quarterly TNMMPA management meetings</li> <li>• Secure funding to implement the management plan</li> </ul>	<ul style="list-style-type: none"> <li>• Number of management meetings as percentage of workplans</li> <li>• Percentage of invited key stakeholder groups attending collaborative meetings</li> <li>• Percentage of collaborative meetings with quorum</li> </ul>	
2. Increased awareness, education, and outreach related to the TNMMPA and its conservation objective	<ul style="list-style-type: none"> <li>• Community consultations, meetings with industry, government, and non-governmental organizations (NGOs)</li> <li>• Attend and promote at scientific and management conferences</li> <li>• DFO Conservation and Protection Branch involvement in awareness</li> </ul>	<ul style="list-style-type: none"> <li>• Number of stakeholder meetings to discuss TNMMPA regulations</li> <li>• Number of visits to TNMMPA page on the Beaufort Sea Partnership (BSP) website</li> <li>• Number of education/outreach events within the ISR</li> <li>• Number of visits to local schools to talk about the TNMMPA</li> <li>• Number of local, regional, and national news reports about the</li> </ul>	
3. Contributing to national “network of MPAs”	<ul style="list-style-type: none"> <li>• Attend national DFO MPA networks meetings</li> <li>• Collaborate with other departments to align governance at multiple scales</li> <li>• Adaptive management of MPAs</li> </ul>	<ul style="list-style-type: none"> <li>• Number of network meetings per year attended by regional Oceans staff</li> <li>• Degree of inclusion of TNMMPA in consideration of national and international networks</li> </ul>	

1 Progress of Governance Category (should be accompanied by narrative): 0 = not initiated; 1 = initiated, ongoing; 2 = accomplished.



Governance Category	Strategy to Achieve Governance	Indicator to Measure	Progress (2018) <sup>1</sup>
4. Contributing to broader national and international Arctic monitoring programs	<ul style="list-style-type: none"> <li>Applying and influencing protocols and approaches of Canadian Biodiversity Monitoring Program</li> <li>promoting TNMMPA at international Arctic monitoring meetings</li> </ul>	<ul style="list-style-type: none"> <li>Number of indicators and protocols from TNMMPA adopted by national and international Arctic monitoring programs</li> <li>Number of monitoring workshops attended where TNMMPA approach is profiled</li> </ul>	
5. Engagement with other DFO sectors	<ul style="list-style-type: none"> <li>CSAS meetings to select ecological indicators</li> <li>Assess socio-economic indicators</li> <li>Consultation</li> <li>Finalize monitoring plan and initiate monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Number of meetings annually with Science; Fisheries Management; Fisheries Protection, Policy, and Economics; Species at Risk</li> <li>Number of CSAS requests for Science advice on TNMMPA monitoring</li> <li>Number of Science projects approved by FIMC related to TNMMPA</li> </ul>	
6. Six-year review of management plan and monitoring plan	<ul style="list-style-type: none"> <li>Advisory body will be established to develop formal review process</li> </ul>	<ul style="list-style-type: none"> <li>Number of stake holders engaged in six-year review of TNMMPA</li> </ul>	

1 Progress of Governance Category (should be accompanied by narrative): 0 = not initiated; 1 = initiated, ongoing; 2 = accomplished.

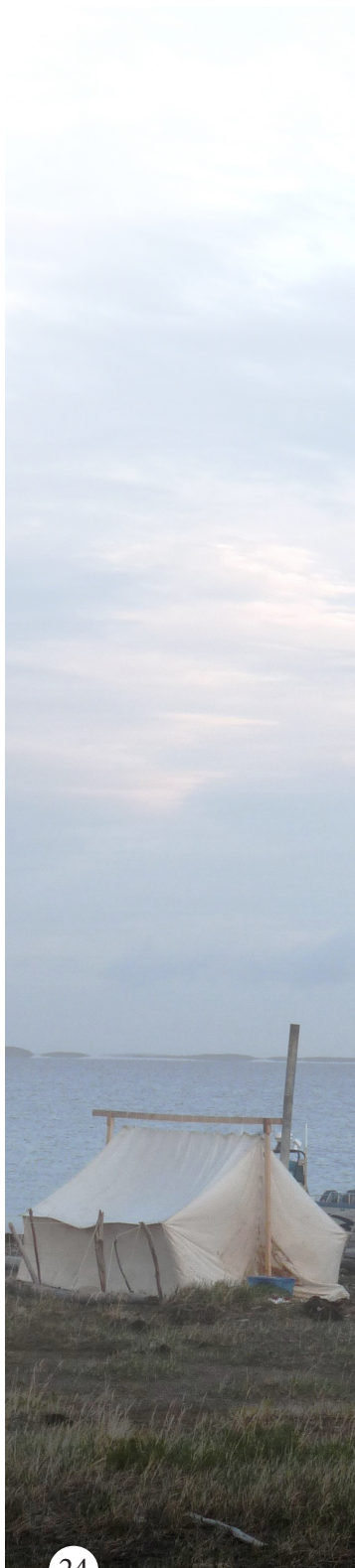


FJMC is responsible for:

- identifying an FJMC representative on the TNMPA senior advisory committee;
- identifying a TNMPA manager to support the TNMPA and represent FJMC at meetings related to monitoring;
- representing the Inuvialuit and Canada perspectives regarding the TNMPA monitoring program during community, national, and international meetings;
- leading annual community TNMPA consultations in conjunction with regularly scheduled FJMC community visits;
- continuing to update and manage all aspects of the BSBMP in areas outside of the TNMPA, and maintaining a link between the BSBMP and the TNMPA; and
- continuing to gather beluga harvest data within the ISR to determine long-term trends in use of the beluga in the TNMPA areas.

DFO Oceans Management Branch and FJMC will jointly:

- meet annually to discuss the TNMPA monitoring program, at which time they will confirm monitoring of a core set of ecological indicators, and discuss and agree on funding allocations;
- meet with scientists to hear their findings from the current-year monitoring program, and discuss significance of findings, issues regarding the monitoring program, and confirm priorities and intentions for monitoring in the next fiscal year;
- develop and measure socio-economic and governance indicators;
- conduct annual community consultations about the TNMPA, linked to the schedule of the FJMC where possible;
- attend ISR meetings (e.g., IGC, Inuvialuit Regional Corporation [IRC], BSP) to provide updates;
- review science proposals related to the TNMPA as a result of an annual call for proposals. Scientists will make presentations at the annual DFO/FJMC meetings in January, and will discuss the monitoring program, sources of funding, and requests for funding from the TNMPA monitoring implementation fund;
- provide advice and support to scientists regarding consultations with appropriate community members, and coordinate involvement of community members in monitoring; and
- coordinate the DFO Inuvik office and FJMC resource person to assist scientists with logistics in establishing monitoring camps, and transport of equipment and field personnel to and from camps as time and resourcing allow.





### 3.3. Information and Sample Management Systems

Maintaining information management and sample archive systems is a critical part of the TNMPA. DFO Oceans Management Branch is responsible for maintaining the TNMPA information management system. This system will maintain information that has been:

- fully analyzed by scientists ;
- checked for quality assurance/quality control by the scientists; and
- synthesized into meaningful reports summarizing the status and trends or other aspects of ecological indicators relevant to management of the TNMPA.

The fully synthesized scientific findings, along with meta-data (information about the raw data), pertaining to the TNMPA monitoring information will be housed in the TNMPA information management system in the DFO Inuvik office.

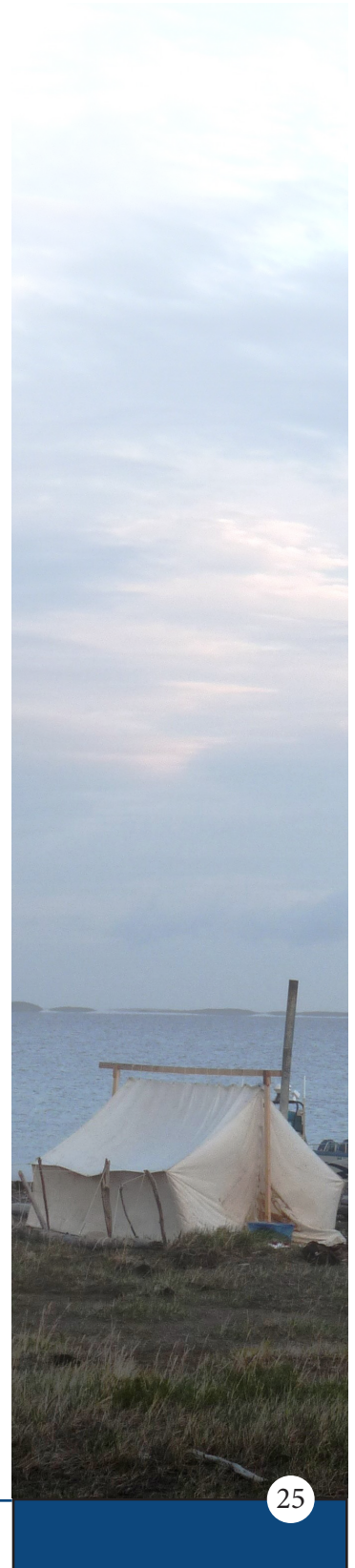
Biological and physical samples (frozen and preserved) will be archived at the Freshwater Institute, Winnipeg, using DFO's current sample storage protocols. Any requests for sample sharing will be directed to the scientist in charge of the samples to determine if they can or cannot be shared.

Ecological findings will be complemented by socio-economic findings. These status and trends findings will be derived from analyses of the socio-economic data, much of which are collected by other agencies (e.g., Statistics Canada, NT Government Statistics).

### 3.4. Reporting and Communication

Reporting the results of a monitoring program is a high priority for TNMPA managers. Information should be provided to all stakeholders in a transparent, easily understood, and timely fashion. Reporting of the monitoring program will take place on a number of fronts, at a number of time scales, and at different levels of data synthesis. At a minimum, it is anticipated that the following reporting will occur:

- an annual TNMPA activities report will be produced by the TNMPA managers. This report will be distributed to communities and ISR organizations during annual consultation meetings. It will provide a summary of monitoring activities, meetings, and conferences that are held or attended to discuss and promote the TNMPA, and community consultations held during the past year;
- a State of the TNMPA Report will be produced in non-technical language every three years. This report will contain information on status and trends of indicators. It will summarize a number of indicators and provide information on whether they are changing, and the extent to which they are changing;
- annual reporting requirements by DFO regional Oceans Management Branch to national DFO MPA managers related to progress in the implementation of the TNMPA management plan;
- reports by DFO Oceans Management Branch to other government departments, industry, and NGOs through the BSP and other inter-departmental meeting venues. There will be a link to the BSP website dedicated to the TNMPA;
- reports by DFO and FJMC to Inuvialuit organizations such as the IGC, community



HTCs, and the IRC at periodic meetings; and

- reports by scientists of their findings to DFO Oceans Management Branch and FJMC during annual FJMC/DFO meetings, to northern communities, the IGC and other funding and partnering agencies. Scientists will also present their scientific results in peer-reviewed journals, and at conferences and workshops focussed on MPAs, ecosystems, and indicators.

Different approaches to communicate findings will be used. For example, managers need information that synthesizes, in a concise manner, complex scientific data, and ultimately enables them to make informed and scientifically defensible management decisions. A frequently applied communication tool to simplify scientific information is commonly referred to as the “traffic light” approach. This approach has been developed for MPAs from Baja California to the Bering Sea by the Commission for Environmental Cooperation (CEC 2011). In this approach, the colors indicate the state of the TNMPA indicator, and the symbol indicates the trend and direction of the indicator (Fig. 4). This approach will be developed and tested over the six-year time frame of the monitoring plan.

#### Current Conditions

- Current conditions are rated on a 6 point scale
  - Superior
  - Good
  - Fair
  - Poor
  - Critical
  - Unknown



Table 3 Standardized Statements for Characterizing Trends

Statement	Score
Conditions appear to be changing at a rate that will lead to an improved state within five years.	Rapidly improving
Conditions are improving.	Improving
Within the bounds of normal variation, no consistent changes are anticipated from either anthropogenic or other sources.	Stable
Conditions are degrading.	Degrading
Conditions appear to be changing at a rate that will lead to a degraded state within five years.	Rapidly degrading
There is insufficient information to establish a basis for the trend, or data are highly variable and trends cannot be distinguished.	Undetermined

	Good (condition)		Critical (condition)
	Stable (trend)		Degrading (trend)

Figure 4. Example of the “traffic light” approach to reporting on status and trends of indicators (from CEC 2011).



## 4. Six-year Review of Monitoring Program

A similar process to the formal six-year review of the TNMPA management plan will be established for a review of the TNMPA monitoring program. The TNMPA monitoring program review should occur after the TNMPA management plan review in the event that adaptive management is necessary. Prior to year six, DFO and FJMC TNMPA management and the TNMPA senior advisory body will develop a formal review process to assess the adequacy of the monitoring program in providing the quality of information required to



Photo credit: DFO Staff

determine if the conservation objective is being met. The senior advisory body will decide on the appropriate management action, based on a noticeable change in an indicator. If requested by DFO Oceans Management Branch, DFO Science will hold a CSAS meeting to review the ecological monitoring program and evaluate the indicators and protocols that were used during the first six years. Outcomes of the CSAS meeting will be provided to DFO Oceans Management Branch and FJMC

so they can make necessary modifications to the TNMPA monitoring plan.

## 5. Literature Cited

Ayles, B. and M. Papst. 2007. Science needs for the Tarium Niryutait Marine Protected Area: Workshop report. Fisheries Joint Management Committee 2007–02. FJMC, Inuvik. 67 p.

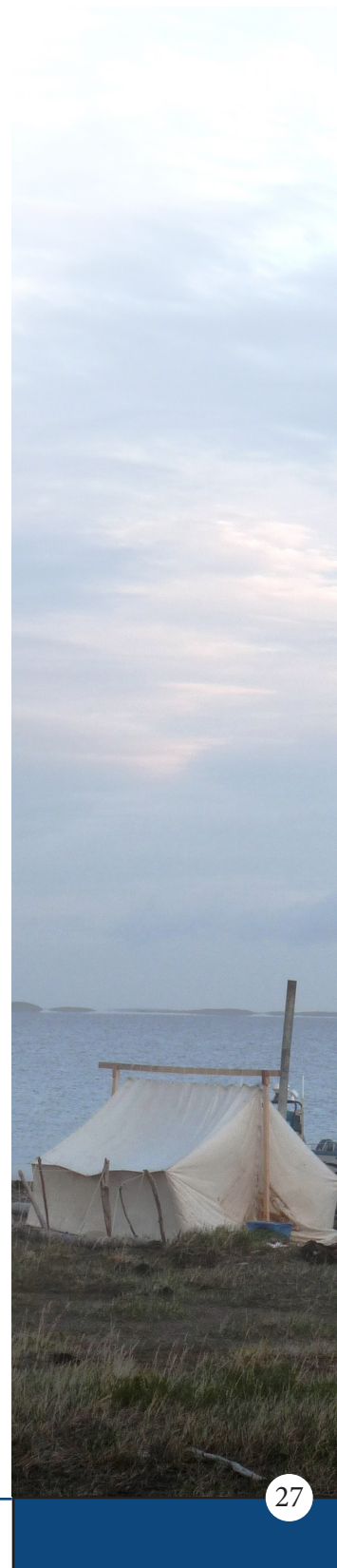
Beaufort Sea Partnership Social, Cultural and Economic Working Group. 2008. Social, cultural and economic overview and assessment report for the Beaufort Sea Large Ocean Management Area. Planning Office, Fisheries and Oceans Canada, Inuvik. 132 p.

CEC (Commission for Environmental Cooperation). 2011. A guide for ecological scorecards for Marine Protected Areas in North America. 50p. [http://www.cec.org/Storage/98/9685\\_Marine\\_scorecard\\_en.pdf](http://www.cec.org/Storage/98/9685_Marine_scorecard_en.pdf). (Accessed January 2013.)

Cobb, D., B. Ayles, and J. Mathias. 2004. Marine environmental quality workshop report. Fisheries Joint Management Committee 2004–3. FJMC, Inuvik. 39 p.

DFO (Fisheries and Oceans Canada). 2009. Oceans Act Marine Protected Areas policy and operational framework: A practitioner's guide. Version 1. DFO, Ottawa. 103 p.

DFO (Fisheries and Oceans Canada). 2010. Proceedings for the Central and Arctic Regional Science Advisory Process to select indicators for the Tarium Niryutait Marine Protected Area (TNMPA); 30–31 March and 13 April 2010, Winnipeg. DFO Canadian Science Advisory Secretariat Proceedings Series 2010/03: 26 p. Science Advisory Secretariat Science Advisory Report 2012/061: 12 p.



DFO (Fisheries and Oceans Canada). 2013. Monitoring protocols and strategies for selected indicators in the Tarium Nirjutait Marine Protected Area (MPA). DFO Canadian Science Advisory Secretariat Science Advisory Report 2012/061: 12 p.

DFO and FJMC (Fisheries and Oceans Canada and Fisheries Joint Management Committee). 2013. Tarium Nirjutait Marine Protected Area. Management plan. DFO and FJMC, Winnipeg and Inuvik. 57 p.

FJMC (Fisheries Joint Management Committee). 2001. Beaufort Sea Beluga Management Plan. FJMC, Inuvik. 28 p.

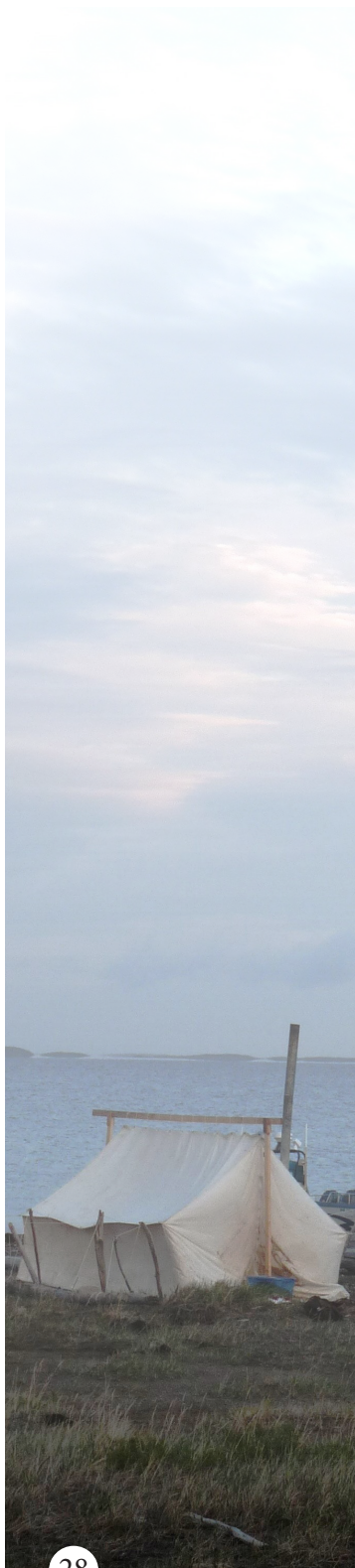
Higdon, J. 2012. Monitoring protocols and strategies for the Tarium Nirjutait Marine Protected Area (MPA). Priority indicators. DFO Canadian Science Advisory Secretariat Research Document 2012/113: iii + 30 p.

Kavik-Axys Inc. 2003. Socio-economic assessment of the proposed Beaufort Sea MPA. Fisheries and Oceans Canada, Inuvik. 81 p.

Loseto, L., T. Wazny, H. Cleator, B. Ayles, D. Cobb, L. Harwood, C. Michel, O. Nielsen, J. Paulic, L. Postma, P. Ramlal, J. Reist, P. Richard, P.S. Ross, S. Solomon, W. Walkusz, L. Weilgart and B. Williams. 2010. Information in support of indicator selection for monitoring the Tarium Nirjutait Marine Protected Area (TNMPA). DFO Canadian Science Advisory Secretariat Research Document 2010/094: vi + 45 p.

Rice, J.C. and M.J. Rochet. 2005. A framework for selecting a suite of indicators for fisheries management. International Council for the Exploration of the Sea, Journal of Marine Science 62: 516–527.

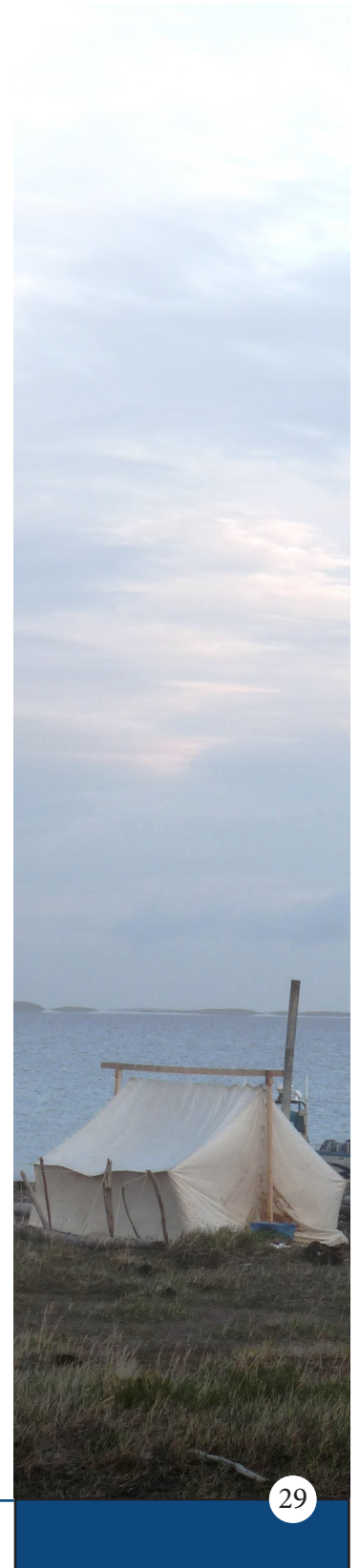
Tallis, H.A., P.S. Levin, M. Ruckelshaus, S.E. Lester, K.L. McLeod, D.L. Fluharty, and B.S. Halpern. 2010. The many faces of ecosystem-based management: Making process work today in real places. Marine Policy 34:340–348.

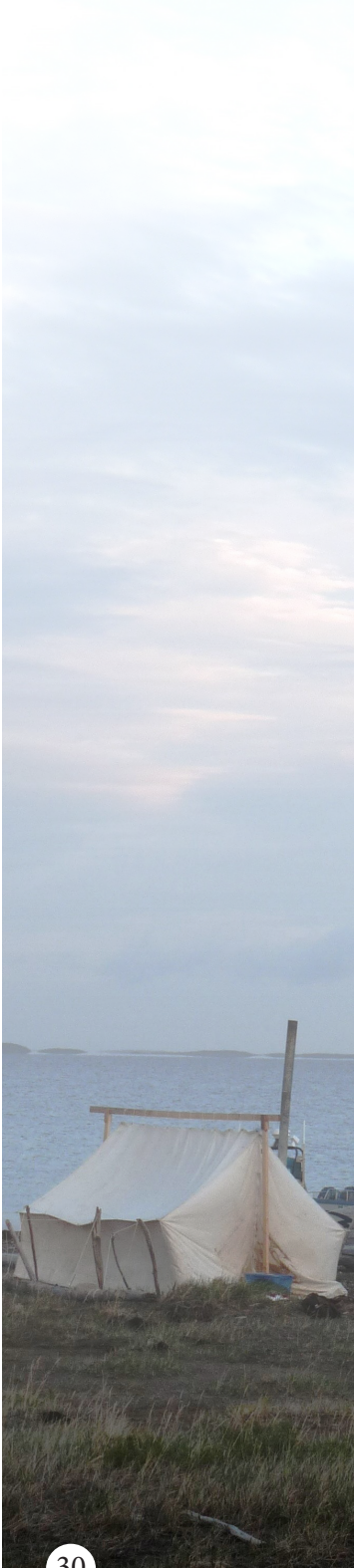




## *Appendix A. List of Acronyms used in the TNMPA monitoring plan.*

BSBMP	Beaufort Sea Beluga Management Plan
BSP	Beaufort Sea Partnership
CBM	Community-Based Monitoring
CEPA	Canadian Environmental Protection Act
CPUE	Catch Per Unit Effort
CSAS	Canadian Science Advisory Secretariat
DFO	Fisheries and Oceans Canada
EC	Environment Canada
FJMC	Fisheries Joint Management Committee
HTC	Hunter and Trapper Committee
IFA	Inuvialuit Final Agreement
IGC	Inuvialuit Game Council
IOM	Integrated Oceans Management
IRC	Inuvialuit Regional Corporation
ISR	Inuvialuit Settlement Region
LOA	Letter of Agreement
MPA	Marine Protected Area
NEB	National Energy Board
NGO	Non-Governmental Organization
NRCan	Natural Resources Canada
NT	Northwest Territories
SDL	Significant Discovery Licence
TNMPA	Tarion Niryutait Marine Protected Area









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