



## EVALUATION OF CANADIAN NARWHAL HUNT SUSTAINABILITY WITH RESPECT TO MAKING A CITES NON-DETRIMENT FINDING



Figure 1. Narwhal (*Monodon monoceros*) by R. Phillips.

### Context:

*The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is a legally-binding multilateral environmental agreement that aims to ensure that international trade of species does not threaten their survival in the wild. Narwhal (*Monodon monoceros*) is listed on Appendix II of CITES.*

*Under CITES, an export permit shall only be granted when the Scientific Authority of the State of export has advised that such export will not be detrimental to the survival of the species in the wild. This determination is referred to as a non-detriment finding (NDF) and is not subject to socio-economic considerations. International export is not considered detrimental to the survival of a species in the wild when the products intended for export have originated from a sustainable harvest.*

*This report provides science advice regarding the sustainability of the Canadian narwhal hunt with respect to making a CITES NDF for narwhal.*

*This Science Advisory Report is from the Fisheries and Oceans Canada, Canadian Science Advisory Secretariat, National Marine Mammal Peer-Review Committee advisory meeting of October 17-21, 2011. Additional publications from this process will be posted as they become available on the DFO Science Advisory Schedule at <http://www.dfo-mpo.gc.ca/csas-sccs/index-eng.htm>.*

## SUMMARY

- Scientific surveys conducted in various areas of the Canadian High Arctic from 1996 to 2010 indicate that the summer range of narwhals is vast and there are approximately 90,000 individuals.
- Two narwhal populations are recognized in Canadian waters: the Baffin Bay population and the Northern Hudson Bay population.
- Genetic and contaminant analyses, tracking programs, Traditional Ecological Knowledge (TEK), and scientific research surveys indicate that the Baffin Bay population is comprised of at least four summering aggregations: Somerset Island, Admiralty Inlet, Eclipse Sound, and East Baffin Island. Narwhals are also present in Parry Channel, Jones Sound, and Smith Sound; however there is limited information available regarding their abundance and distribution.
- Recommended harvest levels for each summering aggregation are based on the Potential Biological Removal (PBR) calculation and are presented as Total Allowable Landed Catch (TALC). Recommended harvest levels (TALC) are conservative and if they are respected should allow sustained catches into the future.
- Narwhals are relatively sedentary during the summer and are hunted within their summer range by local communities. However, during the spring and fall migrations Baffin Island communities harvest from a mixture of summering aggregations. To account for this, a model was developed which allocated proportions of the non-summer narwhal hunt among the different Baffin Island summering aggregations.
- The allocation model is not applicable to the Northern Hudson Bay population of narwhals because it is geographically separate from Baffin Bay narwhals. In addition, there is insufficient knowledge to allocate catches of narwhals in Parry Channel, Jones Sound, or Smith Sound to specific communities.
- Preliminary tagging data from 2011 indicates that four narwhals moved from Eclipse Sound to Admiralty Inlet during the summer. Given this new information and the possibility of mixing between the Eclipse Sound and Admiralty Inlet summering aggregations, an analysis using the allocation model was conducted assuming these were one unit. The results of this analysis represent an extremely conservative scenario, and were not substantially different from the original results of the model, providing further support for the overall sustainability of the Canadian narwhal hunt in 2006 through 2010.
- Harvest sustainability for the period 2006 to 2010 was evaluated based on the available information and the results of the retrospective analysis using the allocation model; the conclusions are as follows:
  - There are no conservation concerns with the narwhal hunt from the summering aggregations of Somerset Island, Admiralty Inlet, Eclipse Sound, and East Baffin Island;
  - The narwhal hunt in the Northern Hudson Bay population is unsustainable as landings exceed the recommended TALC; and
  - Owing to the paucity of data available for narwhals in Parry Channel, Jones Sound, and Smith Sound, the sustainability of the narwhal hunt in these areas have not been evaluated.

## INTRODUCTION

The *Convention on International Trade in Endangered Species of Flora and Fauna* (CITES) is a legally-binding multilateral environmental agreement that aims to ensure that international trade of species does not threaten their survival in the wild. In Canada, CITES is implemented through the *Wild Animal and Plant Protection and Regulation of International and Interprovincial Trade Act* (WAPPRITA). Environment Canada is the lead for CITES in Canada; however, Fisheries and Oceans Canada (DFO) is the lead for CITES-related aquatic issues.

Narwhal (*Monodon monoceros*) is listed on Appendix-II of CITES. As is required under Article IV, paragraph 2 of CITES, an export permit shall only be granted when the Scientific Authority of the State of export has advised that such export will not be detrimental to the survival of the species in the wild. This determination is referred to as a non-detriment finding (NDF) and is not subject to socio-economic considerations. Export is not considered detrimental to the survival of a species in the wild when the products intended for export have originated from a sustainable harvest.

This Canadian Science Advisory Secretariat (CSAS) Science Advisory Report provides scientific advice regarding the sustainability of Canadian narwhal harvests with respect to making a CITES NDF. The DFO CITES Scientific Authority will consider this advice in the issuance of an NDF for narwhals harvested in Canadian waters in 2011 and retrospectively for 2010 harvests. In addition, until new, relevant information is available, this scientific advice is considered appropriate to inform future NDF as well.

## ANALYSIS

### **Abundance and Delineation of Narwhal Summering Aggregations**

Scientific surveys conducted in various areas of the Canadian High Arctic from 1996 to 2010 indicate that the summer range of narwhals is vast and there are approximately 90,000 individuals. Past scientific research has focused primarily on determining stock abundance and delineation and has considered Traditional Ecological Knowledge (TEK) where available.

Two narwhal populations are recognized in Canadian waters: the Baffin Bay population and the Northern Hudson Bay population; the latter of which is considered genetically distinct.

Genetic and contaminant analyses, tracking programs, TEK, and research surveys, indicate that the Baffin Bay population is comprised of at least four summer aggregations (i.e. Somerset Island, Admiralty Inlet, Eclipse Sound, and East Baffin Island). Despite preliminary indications of some population structuring, at the present time it is unknown whether any of the Baffin Bay summer aggregations are genetically distinct.

Narwhals are also present in Parry Channel, Jones Sound, and Smith Sound and estimates of narwhal abundance in these areas are currently not available. Narwhals have been observed during summer farther west and north of the Somerset Island summering aggregation. These animals are referred to as “Parry Channel” and the relationship of these animals to other summering aggregations is unknown. In addition, narwhals are present in Jones Sound and are harvested by the community of Grise Fjord. Genetic analyses indicate that narwhals in Jones Sound are genetically different than those in the Somerset Island summering aggregation. Narwhals are also present in Smith Sound and are harvested by Greenland hunters. Little is

known about the relationship of the narwhals in Jones Sound and Smith Sound to the Baffin Bay population, as well as to narwhals in Greenland.

The summering aggregations of narwhals in Canada are shown in Figure 2. Abundance estimates for each narwhal population and summering aggregation, where possible, are provided in Table 1.

### **Rationale for Summering Aggregation Management Approach**

The genetic, contaminant and behavioural differences are the basis for the current working hypothesis for managing narwhals as summering aggregations. This approach is intended to avoid the risk of local depletion and to reflect the temporal and spatial scale of the hunt, and to allow narwhals to be resilient to changing environments.

Management of species by smaller units such as sub-populations or summering aggregations is commonplace for many species, including other cetaceans.



Figure 2. Approximate boundaries of areas where Canadian summering aggregations of narwhals: A - Somerset Island, B - Admiralty Inlet, C - Eclipse Sound, D - East Baffin Island, E - Northern Hudson Bay. Other areas where narwhals are known to occur in summer: F - Parry Islands, G - Jones Sound, H - Smith Sound) [adapted from DFO 2011].

## **Recommended Harvest Levels**

Recommended harvest levels for each summering aggregation are based on the Potential Biological Removal (PBR) method and are presented as Total Allowable Landed Catch (TALC) (Table 1). The PBR and the resulting TALC are the preferred method when data are considered to be insufficient to conduct a full assessment. The PBR takes into account various sources of uncertainty (e.g. imprecision of population size estimates, growth rate, etc.). Summering aggregations of Canadian narwhals often have only a single recent survey to assess population size or data are considered insufficient to estimate population dynamic parameters. Therefore, DFO considers the PBR the acceptable approach to estimate sustainable harvest levels at the present time. As hunting losses are difficult to quantify, average loss rates are applied to the PBR in order to calculate the TALC. Recommended harvest levels (TALC) are conservative and if they are respected should allow sustained catches into the future until there are sufficient data (e.g. via multiple index surveys and catch records) to conduct more detailed population dynamic assessments.

## **Retrospective Harvest Sustainability Analysis (2006-2010)**

An allocation model (Richard, 2011), based on a spatial model of the source and degree of summering aggregation mixtures (Figure 3), was developed to produce solutions that optimize narwhal harvests and minimize the risk of over-exploitation of any one summering aggregation. This model was applied to the four largest summering aggregations of Somerset Island, Eclipse Sound, Admiralty Inlet, and East Baffin Island.

The allocation model is not applicable to the Northern Hudson Bay population of narwhals because it is geographically separate from Baffin Bay narwhals. In addition, there is insufficient knowledge to allocate catches of narwhals in Parry Channel, Jones Sound, or Smith Sound to specific communities.

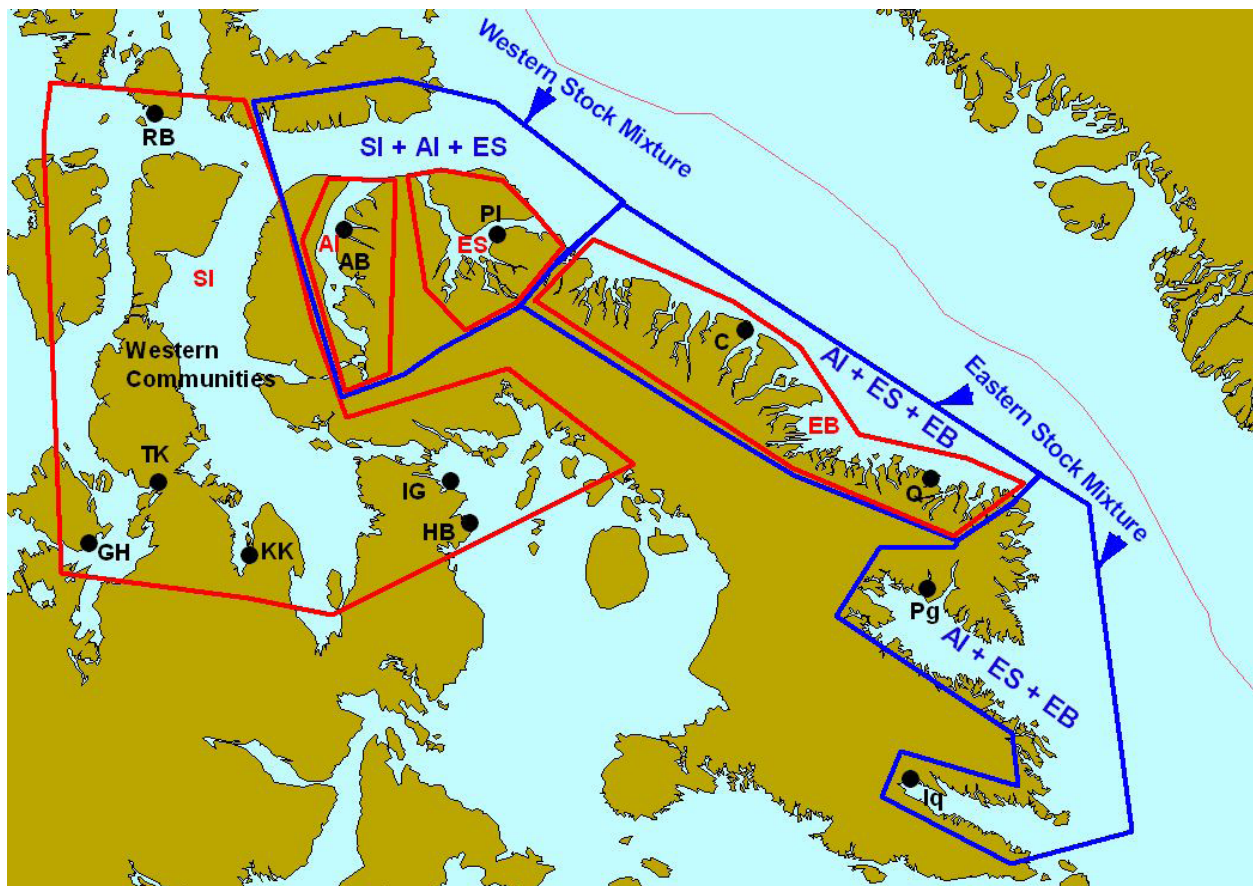


Figure 3. Schematic representation of the Baffin Island narwhal summering aggregations (in red letters: SI: Somerset Island; AI: Admiralty Inlet; ES: Eclipse Sound; EB: East Baffin Island) and of non-summer mixtures (in blue letters). Communities that hunt the summering aggregations are indicated in black letters (RB: Resolute; TK: Taloyoak; GH: Gjoa Haven; KK: Kugaaruk; IG: Igloolik; HB: Hall Beach; AB: Arctic Bay; PI: Pond Inlet; C: Clyde River; Q: Qikiqtarjuaq; Pg: Pangnirtung; Iq: Iqaluit) (Richard, 2011).

The four summering aggregations considered in the allocation model appear to be relatively sedentary in summer and are hunted in their summer range (Figure 3) by local communities as follows.

- The Admiralty Inlet (AI) summering aggregation is harvested by hunters in Arctic Bay (AB);
- The Eclipse Sound (ES) summering aggregation is harvested by hunters in Pond Inlet (PI);
- The East Baffin (EB) summering aggregation is harvested by hunters in Clyde River (C) and Qikiqtarjuaq (Q); and
- The Somerset Island (SI) summering aggregation is harvested by hunters in Resolute (RB; particularly in the Creswell Bay area), the Kitikmeot communities of Gjoa Haven (GH), Taloyoak (TK) and Kugaaruk (KK), and the Northern Foxe Basin communities of Igloolik (IG) and Hall Beach (HB). All six communities are referred to as the “Western Communities” in this paper and their harvest is called the “Western annual catch”.

Outside of the summer, open-water season, Baffin Island communities hunt a mixture of summering aggregations (Figure 3). The proportion of narwhals belonging to any particular summering aggregation in the non-summer harvest period is unknown, but it is assumed to be

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proportional to the size of each aggregation relative to the total number of animals in the mixture. Risk modeling was used to evaluate the sensitivity of the modeling analyses to this assumption.

A retrospective analysis using the allocation model was conducted for Baffin Island narwhal hunts from 2006 to 2010 to determine their sustainability during that period (DFO 2012). Tables 1 and 2 show models inputs and results, respectively, and a summary of the outcomes is provided in Table 4.

Results demonstrate that in all years narwhal catches were sustainable (TALC-TC >0). However, if the unusual mortality due to the 2008 ice entrapment in Pond Inlet was included in the model as “harvest” (rather than natural mortality), then the Admiralty Inlet and Eclipse Sound catches were not sustainable in 2008.

*Table 1. Annual community attribution model inputs for 2006-2010.*

<b>Model Inputs:</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2008*</b>	<b>2009</b>	<b>2010</b>	
1 (W)	136	51	48	48	60	58	
2 (Pg&Iq)	1	4	21	21	0	28	
3 (AB summer proportion)	0.03	0.45	0.64	0.64	0.87	0.70	
4 (PI summer proportion)	0.73	0.86	0.79	0.08	0.45	0.60	
5 (C summer proportion)	0.67	0.52	0.71	0.71	0.08	0.72	
6 (Q summer proportion)	0.99	0.90	0.41	0.41	0.91	0.80	
7 (community total catches)	AB:	130	127	132	132	129	128
	PI:	88	65	70	692	44	62
	C:	43	42	17	17	13	50
	Q:	85	88	80	80	90	89

\* 2008 harvest including the narwhal entrapment in PI

*Table 2. Remainders of the summering aggregation TALCs for 2006-2010.*

<b>Stock</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2008*</b>	<b>2009</b>	<b>2010</b>	<b>mean **</b>
SI	315	438	450	113	450	440	419
AI	191	147	108	-26	104	107	131
ES	128	146	134	-16	197	158	152
EB	6	14	62	62	35	2	24
<b>Total</b>	<b>639</b>	<b>745</b>	<b>754</b>	<b>132</b>	<b>786</b>	<b>707</b>	<b>726</b>

\* 2008 harvest including the narwhal entrapment in PI

\*\* 2006-2010 mean not including the 2008 narwhal entrapment in PI

Preliminary tagging data from 2011 indicates that four narwhal moved from Eclipse Sound to Admiralty Inlet during the summer. Given this new information and the possibility of mixing between the Eclipse Sound and Admiralty Inlet summering aggregations, an analysis using the allocation model was conducted assuming these were one unit. Results did not demonstrate a substantial departure from those presented in Table 2; narwhal catches in all years were sustainable (TALC-TC >0), with only slightly negative results for East Baffin in 2010 (Table 3). Again, if the unusual mortality due to the 2008 ice entrapment in Pond Inlet was included in the model as “harvest” (rather than natural mortality), then the combined Admiralty Inlet and Eclipse Sound catches were not sustainable in 2008.

Table 3. Remainders of the stock TALCs for 2006-2010, assuming that AI and ES are one summering aggregation.

Stock	2006	2007	2008	2008*	2009	2010	mean **
SI	295	428	442	22	444	431	408
AI & ES	127	94	45	-157	96	67	86
EB	4	11	54	54	33	-4	19
Total	426	532	541	-81	573	494	513

\* 2008 harvest including the narwhal entrapment in PI

\*\* 2006-2010 mean not including the 2008 narwhal entrapment in PI

The ice entrapment in Eclipse Sound in 2008 resulted in the additional harvest of 622 narwhals (primarily females and juveniles) and is considered natural mortality. An entrapment event of this magnitude is rarely observed and only one of similar size was reported in Nunavut in the last century (Heide-Jørgensen *et al.*, 2002); this is the only entrapment of this magnitude ever reported in the Eclipse Sound area. The retrospective analysis demonstrates overall stock robustness to the current frequency of entrapment events.

## **Evaluation of the Sustainability of Narwhal Harvests**

Each narwhal summering aggregation was considered individually with respect to evaluating the sustainability of the hunt using available information regarding population estimates, recommended TALC, current quotas/harvest limits, and harvest levels over the past five years (Table 4).

### **Somerset Island**

This summering aggregation is the most abundant, harvests are within the recommended TALC for this summering aggregation, and the outcomes of the retrospective analysis indicate sustainable harvests.

### **Admiralty Inlet**

Narwhals are abundant, harvests are within the recently updated recommended TALC for this summering aggregation, and the outcomes of the retrospective analysis indicate sustainable harvests. This is different than the advice produced in 2010 as new abundance estimates are available and the allocation model was not yet developed.

### **Eclipse Sound**

Narwhals are abundant and harvests have been within the recommended TALC from 2006 to 2010. Considering past harvest levels and the outcomes of the harvest attribution model, narwhal harvests in this summering aggregation are considered sustainable.

### **East Baffin Island**

Narwhals are abundant and the results of the retrospective analysis indicate that harvests are sustainable. This is different than previous advice as the allocation model was not yet developed.

### **Parry Channel, Jones Sound, and Smith Sound**

Harvests from these areas are considered opportunistic, no population estimates exist, and a TALC has not been estimated. The relationship of the Parry Channel narwhals to other summering aggregations is unknown. Narwhals are also present in Jones Sound and are



genetically different than those in the Somerset Island summering aggregation; these whales are harvested by the community of Grise Fjord. In addition, narwhals are also present in Smith Sound and are harvested by Greenland hunters. Little is known about the relationship of the narwhals in Jones Sound and Smith Sound to the Baffin Bay population, as well as to narwhals in Greenland.

#### Northern Hudson Bay

Since no new information was presented, the advice produced in 2010 was not revisited. Previous advice indicated harvests were unsustainable as they exceeded the recommended TALC.

### **Sources of Uncertainty**

- Preliminary discussions with Inuit hunters in Qikiqtarjuaq suggest that a summering aggregation near Home Bay should be considered its own stock; scientific studies have not yet been conducted in this area to substantiate this.
- Applying a PBR calculation to a very outdated survey is undesirable and in some cases this introduces considerable uncertainty; if new survey data are not obtained, at minimum the recovery factor in the model should be reduced from 1.0 to 0.5.

## **CONCLUSIONS**

Based on the information available for the period 2006 - 2010, there are no conservation concerns with respect to the sustainability of the narwhal hunt on the following summering aggregations: Somerset Island, Admiralty Inlet, Eclipse Sound, and East Baffin Island.

Conservation concerns have been identified for the Northern Hudson Bay population as the hunt is considered unsustainable owing to more narwhals landed than the recommended TALC.

Owing to the paucity of data available for the narwhals in Parry Channel, Jones Sound, and Smith Sound, the sustainability of the hunt in these areas has not been evaluated.

The scientific advice provided within this report is based on the best scientific information available and may be used by the DFO CITES Scientific Authority in the issuance of an NDF for narwhals harvested in Canadian waters.

## **OTHER CONSIDERATIONS**

- A comprehensive management plan should be developed and implemented to ensure the Canadian narwhal hunt is sustainable.
  - In particular, an appropriate tracking and tracing mechanism for narwhal tusks should be implemented so that tusks can be confidently associated with specific summering aggregations.
  - If narwhal quotas/harvest levels are distributed and managed based on the summering aggregations (rather than by individual communities) as well as the recommended TALC, local depletions are unlikely.

- Baseline information, including abundance and distribution, should be obtained for narwhals in Jones Sound as they are currently harvested by the community of Grise Fjord.
- Scientific surveys and the collection of additional types of information (e.g. TEK) should be conducted more frequently to improve the confidence in the recommended TALC and the delineation of summering aggregations.

## SOURCES OF INFORMATION

This Science Advisory Report is from the Fisheries and Oceans Canada, Canadian Science Advisory Secretariat, National Marine Mammal Peer-Review Committee advisory meeting of October 17-21, 2011. Additional publications from this process will be posted as they become available on the DFO Science Advisory Schedule at <http://www.dfo-mpo.gc.ca/csas-sccs/index-eng.htm>.

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**APPENDIX**

Table 4. Synopsis of available information for Canadian narwhal summering aggregations.

Summering Aggregation	Last Scientific Survey	Abundance Estimate	Scientific Advice re: Harvest Limits <sup>1</sup>	Current Quota and/or Harvest Limit <sup>2</sup>	Current yearly harvests: 2006 – 2010 (total for all communities)	Harvest Attribution Model Results <sup>3</sup>
Somerset Island	1996	45,358 (SE=15875; CV=25%)	PBR <sup>1</sup> = 681 TALC <sup>1</sup> = 532	Igloolik (25) Kugaaruk (45) Taloyoak (15) Gjoa Haven (15) Resolute (32) Hall Beach (10)	2006 – 136 2007 – 51 2008 – 48 2009 – 60 2010 – 58	Sustainable
Admiralty Inlet	2010	18,049 (CI=11,613- 28,053; CV=23%)	PBR <sup>1</sup> = 299 TALC <sup>1</sup> = 233	Arctic Bay (130)	2006 – 130 2007 – 127 2008 – 132 2009 – 129 2010 – 128	Sustainable
Eclipse Sound	2004	20,225 (SE=7285; CV=36%)	PBR <sup>1</sup> = 301 TALC <sup>1</sup> = 236	Pond Inlet (130)	2006 – 88 2007 – 65 2008 – 70 <sup>4</sup> 2009 – 44 2010 – 62	Sustainable
East Baffin Island	2003	10,073 (SE=3123; CV=31%)	PBR <sup>1</sup> = 156 TALC <sup>1</sup> = 122	Qikiqtarjuaq (90) Clyde River (50) Iqaluit (10) Pangnirtung (40)	2006 – 129 2007 – 134 2008 – 118 2009 – 103 2010 - 167	Sustainable
Northern Hudson Bay	2000 <sup>5</sup>	5053 (SE=2009)	PBR <sup>1</sup> = 73 TALC <sup>1</sup> = 57	Repulse Bay (72) Coral Harbour (10) Chesterfield Inlet (5) Whale Cove (5) Rankin Inlet (10) Cape Dorset (10) Kimmirut (10)	2006 – 89 2007 – 97 2008 – 30 2009 – 199 2010 - 91	N/A
Parry Channel, Jones Sound, & Smith Sound	Have not been surveyed	Unknown	None	Grise Fjord (20)	2006 – 21 2007 – 20 2008 – 23 2009 – 5 2010 - 20	N/A

<sup>1</sup>PBR (Potential Biological Removal) is a method by which the Total Allowable Landed Catch (TALC) is estimated after factoring in hunting loss rates (LR). TALC is derived from the PBR as follows:  $TALC = PBR / (1 - LR)$ . Loss rates are derived from the community-based management reports.

<sup>2</sup>Quotas/harvest limits are listed by communities that are geographically associated with each narwhal summering aggregation and/or population.

<sup>3</sup>Certain narwhal summering aggregations are shared by communities within and also outside of Nunavut during annual migrations. The proportion of migrating narwhals harvested in certain communities in the spring and fall has been calculated and the sustainability of the overall harvest for affected summering aggregations has been determined.

<sup>4</sup>In 2008, an additional 622 narwhals were taken via a humane harvest due to the ice entrapment event.

<sup>5</sup>The Northern Hudson Bay population was surveyed in August 2011 and an updated peer-reviewed population estimate, PBR, and TALC are anticipated in spring 2012.

## FOR MORE INFORMATION

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