SUBMISSION TO THE

NUNAVUT WILDLIFE MANAGEMENT BOARD

FOR

Information: **Decision: X**

Issue: Modification to existing Total Allowable Harvest levels for Baffin Bay Narwhal Stocks and Narwhal in Jones and Smith Sounds, Nunavut and Approval of the Narwhal Flexible Quota System

Background

In August 2013, Fisheries & Oceans Canada (DFO) conducted the first within season aerial survey of the six Canadian narwhal summer aggregations in the high Arctic: Somerset Island stock, Admiralty Inlet stock, Eclipse Sound stock, East Baffin Island stock in the Baffin Bay population; and the Jones and Smith Sounds stocks near Grise Fiord (Figure 1). DFO Science used the results of this survey to estimate the abundance of narwhal and calculate Total Allowable Landed Catch (TALC) recommendations for each of these stocks (Table 1). In general, the 2013 abundance estimate for the Canadian high Arctic narwhal is higher than previous estimates with the exception of the Eclipse Sound stock, which saw a decrease of almost half from the previous 2004 survey (Tab 1- Abundance estimates of narwhal stocks in the Canadian High Arctic in 2013).

Science advice was also received on the sustainability of the "*flexible quota system*" that has been used on an interim basis since 2013. This flexible quota system allows for the carry-over of unused TAH to be used in the subsequent hunting season.

The science advice indicates that the flexible TAH system and tag transfer policy currently being used for narwhal is sustainable, as long as the total hunting mortality over the five-year period does not exceed five times the annual Potential Biological Removal (PBR) level (Tab 2- Sustainability of a Flexible System of Total Allowable Annual Catches of Narwhals).

Narwhal are designated as Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). They are also listed on Appendix II of the Convention on International Trade in Endangered Species of Flora and Fauna (CITES) and a non-detriment finding (NDF) from the DFO Scientific Authority is required to obtain a CITES Export/Re-export permit for international trade of narwhal products from Canada. There is currently a standing positive NDF for all narwhal stocks in Canada.

Based on the lower 2013 abundance estimate for the Eclipse Sound narwhal stock, the existing Total Allowable Harvest (TAH) of 236 would need to be reduced to 134, in line with the new TALC advice, for the DFO Scientific Authority to issue a positive NDF finding for this stock and therefore maintain the ability to internationally export narwhal products harvested from the Eclipse Sound stock.

Community consultations on the Science advice for narwhal management

DFO conducted consultations with potentially affected Inuit on management options to implement the new science advice and the flexible quota system. The consultation process had two components: (1) in-person consultations with the communities of Arctic Bay, Pond Inlet, Clyde River and Qikiqtarjuaq April 18-22, 2016; and (2) written consultations with the remaining communities that harvest from the Baffin Bay, Jones and Smith Sounds narwhal stocks, as well as the Kitikmeot and Qikiqtaaluk Wildlife Boards.

DFO was seeking input on:

1. Proposed TAH modifications, specifically, ***to modify the existing TAHs for the Baffin Bay and Jones and Smith Sounds narwhal Management Units based on the 2013 survey results***; and
2. The formal implementation of the "narwhal flexible quota system" and tag transfer policy phase II (Tabs 2 and 3).

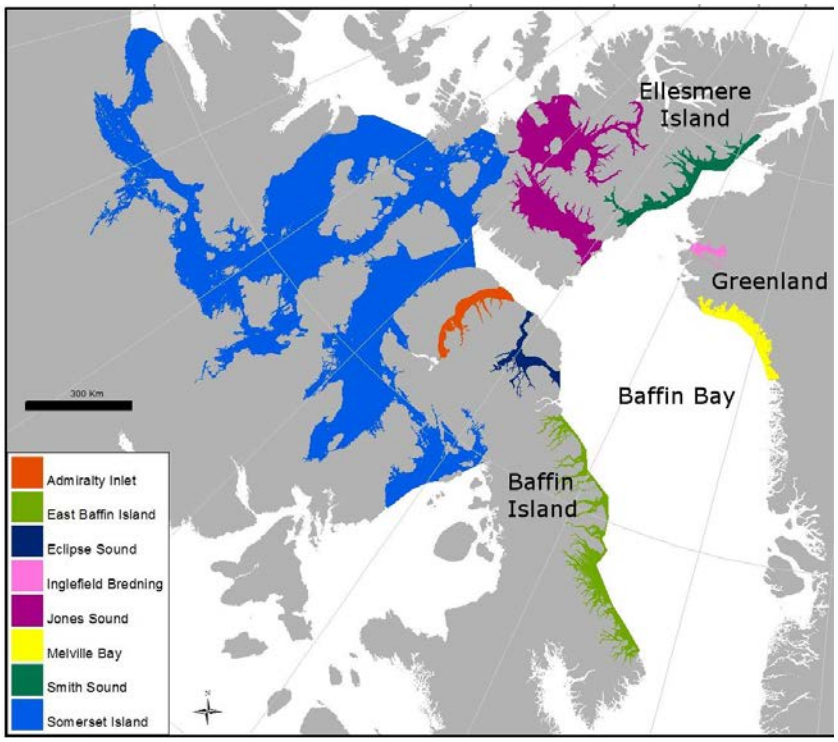

Figure 1. Map of High Arctic narwhal summer aggregations (source: NAMMCO/SC/21-JCNB/SWG/14-05).

Table 1. New Total Allowable Landed Catch (TALC) science recommendations for narwhal stocks based on the 2013 aerial survey results (CSAS SAR June 2015) in comparison to the current Total Allowable Harvests (TAH).

Narwhal Stock	Management Unit	Current TAH*	New TALC (TAH) Recommendations
Somerset Island	SI	532	**658**
Admiralty Inlet	AI	233	**389**
Eclipse Sound	ES	236	**134**
East Baffin Island	EBI	122	**206**
Unassigned	Jones Sound	50**	**76**
Unassigned	Smith Sound		**77**

* established by the NWMB in 2013 and approved by the Minister of DFO
** while there is no TALC, the Minister did approve a Total Allowable Harvest (quota) of 50 for both areas combined.

<u>In-Person Consultation Results</u> (included a meeting with the HTO and a public meeting in each community)

Modification of the TAH:

- The communities of Arctic Bay, Clyde River and Qikiqtarjuaq appeared to be in general support of the proposed TAH modifications for Admiralty Inlet and East Baffin Island narwhal stocks.
- The community of Pond Inlet did not support the recommended TAH modification for the Eclipse Sound stock.
    - The HTO suggested that the decrease in the abundance estimate for Eclipse Sound was a result of ship traffic, whales moving all over the place (including to Western Nunavut communities), and difficulty in counting submerged whales.
    - The community stated that the numbers of narwhal vary from year to year.
    - The HTO explained that there was a lot of movement by narwhal between Admiralty Inlet and Eclipse Sound and suggested that if the count had been done at a different time of year it is possible that there would have been a decrease in Admiralty Inlet and an increase in Eclipse Sound abundance estimates.
    - The HTO wanted to maintain the status quo (i.e. the TAH that was established in 2013) for a period of five years.

Implementation of the Narwhal Flexible Quota System:

- The were no concerns raised about implementation of the flex quota system from the communities of Arctic Bay and Pond Inlet;
- There appeared to be support for implementation of the flex quota system from the communities of Clyde River and Qikiqtarjuaq.

Implementation of Tag Transfer Policy Phase II:

- There were no concerns raised about implementation of tag transfer phase II from the communities of Arctic Bay and Pond Inlet;
- There appeared to be support for implementation of tag transfer policy phase II from the communities of Clyde River and Qikiqtarjuaq subject to support from QWB and DFO.

CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora)

- *Arctic Bay, Clyde River, and Qikiqtarjuaq:* There were no concerns raised about these points during both the community and HTO meetings.
- *Pond Inlet:* The HTO said that Inuit are less concerned about selling narwhal products internationally and more interested in harvesting for food.

A full report on the consultation results can be found in TAB 4.

Written Consultation Results

DFO invited other affected HTO and community members to participate in the written consultation process by providing comments or concerns on the proposed TAH modifications and implementation of the flex quota system, by May 31, 2016 (Tab 5). The communities participating in the written consultations harvest from narwhal stocks where DFO is recommending an increase in the TALC/TAH.

DFO will provide additional information on the written consultation results at the NWMB's June 2016 meeting

Proposed changes to the current narwhal management regime

Changes to the current narwhal management regime are being proposed for the conservation of narwhal stocks and populations and to ensure that Inuit harvesting is restricted only to the extent necessary to achieve conservation purposes. This will provide for sustainable harvesting activities and the retention of associated economic opportunities. In addition, the formal implementation of the flex quota and tag transfer system will provide harvesters, HTOs and RWOs increased flexibility in harvest allocations and utilization.

Recommendations:

DFO is requesting approval from the NWMB on the following:

- Modify the existing TAHs for the Baffin Bay and Jones and Smith Sounds narwhal Management Units based on the 2013 survey results identified in Table 1 (NLCA s 5.2.33(d)).

- Formally approve the Narwhal Flexible Quota System and Tag Transfer Policy Phase II (NLCA s.5.2.33(k)).

The goal is to have a final decision approved by the DFO Minister and ready for implementation for the 2017 harvest season

TAB 1 – DFO Science Advice- Abundance estimates of narwhal stocks in the Canadian High Arctic in 2013.
TAB 2 – DFO Science Advice- Sustainability of a Flexible System of Total Allowable Annual Catches of Narwhals.
TAB 3 – Narwhal flexible quota system
TAB 4- Consultation Results – "What We Heard" Document
TAB 5- Written Consultation Letter

Submitted by:

Resource Management, Central & Arctic Region
Fisheries & Oceans Canada

Date: May 13, 2016

Fisheries and Oceans Canada | Pêches et Océans Canada
Ecosystems and Oceans Science | Sciences des écosystèmes et des océans

Central and Arctic Region

Canadian Science Advisory Secretariat
Science Advisory Report 2015/046

ABUNDANCE ESTIMATES OF NARWHAL STOCKS IN THE CANADIAN HIGH ARCTIC IN 2013

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

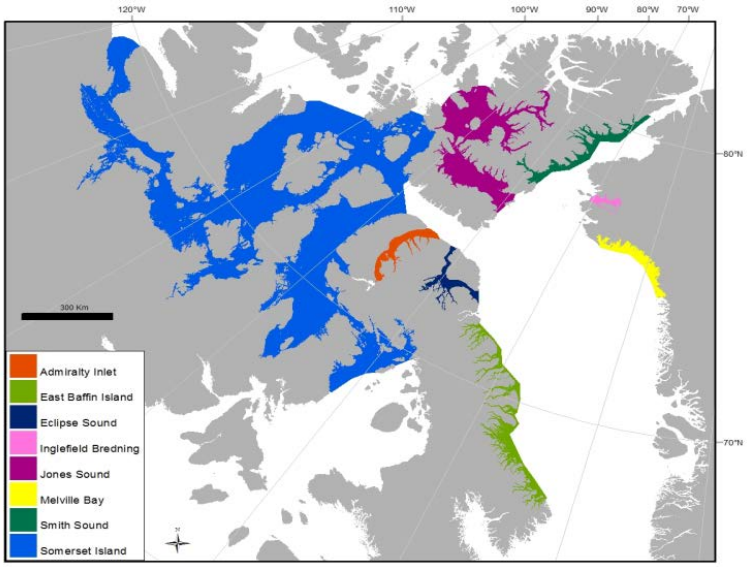

Figure 1. Map of the six Canadian narwhal summer aggregations as well as two aggregations in Greenland recognized as part of the Baffin Bay population by the Canada-Greenland Joint Commission on Conservation and Management of Narwhal and Beluga (source: NAMMCO/SC/21-JCNB/SWG/14-05).

Context:

In August 2013, a series of aerial surveys were conducted for the four recognized Canadian stocks of the Baffin Bay narwhal population as well as the putative Jones Sound and Smith Sound stocks. For the first time, abundance estimates for all of these stocks were made in the same year.

The Nunavut Wildlife Management Board (NWMB) establishes Total Allowable Harvest levels for narwhals in the Nunavut Settlement Area. Fisheries and Oceans Canada (DFO), in close collaboration with co-management partners, has implemented an Integrated Fisheries Management Plan for narwhals. DFO Ecosystems and Fisheries Management Sector asked for advice on sustainable harvest based on the 2013 surveys for the Nunavut narwhal summering stocks. This science advisory report presents information on the updated abundance estimates and advice on sustainable narwhal harvest based on the Potential Biological Removal method.

This Science Advisory Report is from the October 20-24, 2014 annual meeting of the National Marine Mammal Peer Review Committee (NMMPRC). Additional publications from this meeting will be posted on the DFO Science Advisory Schedule as they become available.

December 2015

SUMMARY

- An aerial survey was conducted for six narwhal summering aggregations (hereafter referred to as stocks) in the Canadian High Arctic in August 2013. This is the first time that a survey counted all of the Canadian High Arctic narwhal stocks during one summer, and the first time for narwhals in Jones Sound and Smith Sound. The total estimate for the Canadian High Arctic was 141,909 (Coefficient of Variation, CV by stock ranged from 20 to 65%) narwhals.
- This survey combined two abundance estimation methods that were summed to produce an estimate of total abundance:
  1) spatial modelling was used to estimate densities in narrow fiords; and
  2) mark-recapture distance sampling was used to estimate narwhal density from line transects elsewhere.
- Total abundance estimates include a correction for perception bias (caused by observers missing narwhals present at the surface) estimated from duplicated sightings between the primary (front) and secondary (rear) observers.
- Abundance estimates were also corrected for availability bias (to account for the fraction of time diving whales are visible near the surface) computed from the percentage of time satellite-tagged narwhals spent within 2 meters of the surface (or 1 meter in fiords with murky waters). The correction for availability bias was 2.94 (and 4.53 in fiords of East Baffin Island).
- Stock specific abundances rounded to 500 were 12,500 for Jones Sound, 16,000 for Smith Sound, 50,000 for Somerset Island, 35,000 for Admiralty Inlet, 10,500 for Eclipse Sound, and 17,500 for East Baffin Island for a total of 142,000 narwhal in the Canadian High Arctic.
- Assuming fidelity of narwhals to six specific summering stocks and based on the abundances estimated in 2013, the Total Allowable Landed Catch (TALC) advice for the six summering stocks are 76 for Jones Sound, 77 for Smith Sound, 658 for Somerset Island, 389 for Admiralty Inlet, 134 for Eclipse Sound, and 206 for East Baffin Island for a total of 1,540 narwhals per year. If narwhals from the Eclipse Sound and Admiralty Inlet areas are considered as belonging to a single unit, the TALCs cannot simply be summed. The TALC advice for a combined unit would be 542 narwhals.
- Allocation of the catch to communities should be done in a way that accounts for the seasonal hunts of mixed stocks.

INTRODUCTION

In Canada, the Baffin Bay narwhal population is currently managed as four summering stocks, each represented by a different geographic aggregation, i.e., Somerset Island (SI), Admiralty Inlet (AI), Eclipse Sound (ES) and East Baffin Island (EB). A number of narwhal aerial surveys were conducted by DFO in the eastern Canadian Arctic from 1975 to 2011 to estimate the abundance of different stocks within the Baffin Bay population (DFO 2012, Doniol-Valcroze et al. 2015a). Most of the previous abundance estimates were known to be incomplete. Narwhals are also known to occur elsewhere in the Canadian High Arctic during summer (e.g., Parry Islands, Cambridge Bay), but no narwhal surveys have been conducted in these areas. In 2013, two narwhal aggregations provisionally identified as Jones Sound and Smith Sound stocks were

surveyed. No previous survey has counted all of the known High Arctic narwhal stocks during one summer.

Narwhals summering in the Eastern Canadian Arctic are designated as Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and are a priority fishery for DFO. Narwhal are listed on Appendix II of the Convention on International Trade in Endangered Species (CITES), and a non-detrimental finding (NDF) decision from the DFO Scientific Authority is required to obtain a CITES Export/Re-export permit to export narwhal products internationally. Harvested narwhals from Canadian management units are considered ineligible for international trade if the harvest exceeds the Total Allowable Landed Catch (TALC) recommendation for a population. Under CITES requirements, updated science and a documented management approach are required to confirm sustainable narwhal management to allow for international trade.

This Canadian Science Advisory Secretariat (CSAS) Science Advisory Report provides updated scientific advice regarding TALC levels for each of the Baffin Bay narwhal stocks, and for narwhals in Smith and Jones Sounds.

ANALYSIS

Survey methods

The survey was designed to cover the six known summering stocks of narwhal (Figure 1) in the Canadian High Arctic simultaneously (Doniol-Valcroze et al. 2015b). Narwhal are thought to exhibit strong site fidelity to their summering grounds. However, recent evidence suggests that limited mixing between summering areas does occur (Dietz et al. 2001, Heide-Jørgensen et al. 2002, Watt et al. 2012). Thus, the survey covered all six areas within one month using three aircraft to avoid double counting. Priority was given to Jones Sound, Smith Sound and Somerset Island areas because no previous surveys had been done in Jones Sound and Smith Sound in August and the Somerset Island abundance estimate was 17 years old.

Each stock range was divided into several strata (Figure 2), based on geographic boundaries as well as expected densities of narwhals inferred from past surveys. When such information was not available, traditional Inuit knowledge and/or observations from a reconnaissance survey flown in 2012 were used to determine survey strata. Survey transects were regularly spaced and oriented in a direction perpendicular to the longest axis of the stratum (Figure 2). A combination of parallel line transects and zig-zag transects was used to survey small areas with expected high narwhal densities (parallel lines) and large areas with expected low densities (zig zag). An effort was made to survey each stratum within 1-2 days.

Narwhals tend to aggregate in deep fiords when the ice melts in the summer (Dietz et al. 2001). Because most fiords are narrow, have complex shape and can be steep-walled, they cannot be surveyed using line transect methods and thus, standard distance sampling estimation methods cannot be applied. Therefore, separate survey and analytical methods were developed for the fiord strata (Doniol-Valcroze et al. 2015a) with each fiord considered a primary sampling unit and abundance estimated for each separately.

The survey was designed as a double-platform experiment with independent observation platforms at the front (primary) and rear (secondary) of the survey aircraft. Each of the three survey aircraft was assigned a team of four observers, and each observer was assigned a specific bubble window for the duration of the survey. The two observers stationed on the same side of the aircraft were visually and acoustically isolated to ensure independence of their detections. Each of the three survey teams included a trained Inuit observer, and when surveys

were conducted close to a community, participation of a local hunter was encouraged. Overall, Inuit groups were intimately involved with survey planning and design.

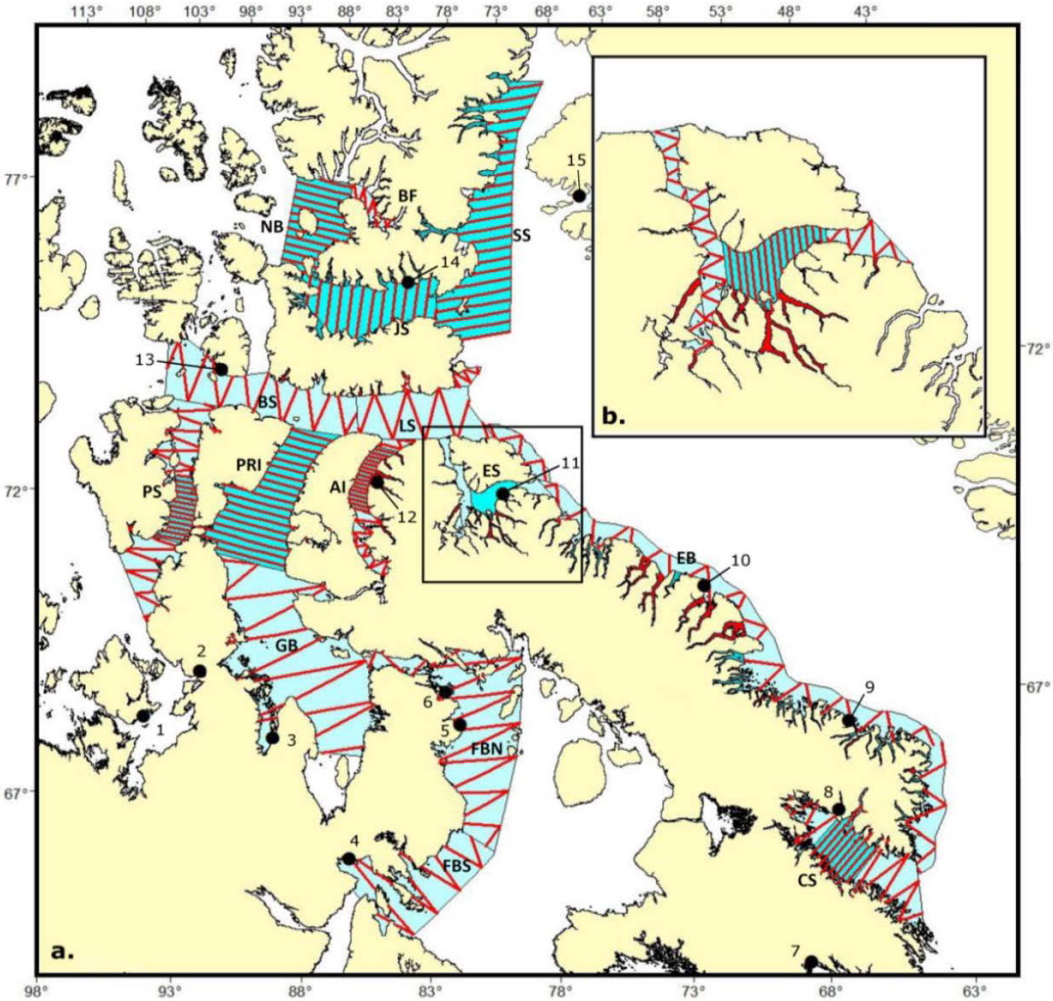

Figure 2. a.) Map of planned survey strata (blue polygons), transect lines (red lines), and fiord strata (red areas). AI: Admiralty Inlet. BF: Baumann Fiord. BS: Barrow Strait. CS: Cumberland Sound. EB: East Baffin Island. ES: Eclipse Sound. FBN: Foxe Basin North. FBS: Foxe Basin South. GB: Gulf of Boothia. JS: Jones Sound. LS: Lancaster Sound. NB: Norwegian Bay. PRI: Prince Regent Inlet. PS: Peel Sound. SS: Smith Sound. Communities (black dots): 1. Gjoa Haven; 2.Taloyoak; 3. Kugaaruk; 4. Repulse Bay; 5. Hall Beach; 6. Igloolik; 7. Iqaluit; 8. Pangnirtung; 9. Qikiqtarjuaq; 10. Clyde River; 11. Pond Inlet; 12. Arctic Bay; 13. Resolute; 14. Grise Fiord; 15. Qaanaaq (Greenland). b.) inset : zoom of the Eclipse Sound stratum (boxed area).

Observers recorded sightings on a hand-held recorder indicating the time at which a group of narwhal was first seen and the time at which the group was abeam of the aircraft. Additional information was recorded with the following priority:

1) number of narwhals in a group (defined as two or more narwhals within one or a few body lengths of each other and oriented in the same direction),
2) perpendicular distance to sighting; and
3) other variables (direction of movement, presence of young, number of tusks).

The position and altitude of the aircraft was recorded every 2 seconds.

Statistical analysis

Distance sampling methods were used to estimate the density of narwhals within the surveyed area. These methods assume that the probability of detecting a narwhal is a function of the distance from the track line. However, observers can miss narwhals present at the surface. Thus, a perception bias must be estimated (Marsh and Sinclair 1989). A mark-recapture method on duplicated sightings by two observers on the same side of an aircraft was used to estimate the perception bias (Laake and Borchers 2004). The identification of duplicate sightings is not obvious and a novel data-driven approach was developed to sort single and duplicate sightings made during the 2013 survey (Pike and Doniol-Valcroze 2015). While most previous studies used ad-hoc methods and arbitrary threshold for this task, the method used in this study was based on four weighted covariates.

A detection function was computed using perpendicular distance of all sightings (duplicates were removed) in all strata. Akaike Information Criteria were used to select the best-fitting detection function (Buckland et al. 2001) and associated environmental covariates (Marques et al. 2007) including ice cover, cloud cover, sea state and glare.

For the fiord strata, density and abundance were estimated using spatial modeling (Doniol-Valcroze et al. 2015a). The number of narwhals seen in surveyed segments of each fiord was modeled using Generalized Additive Models. The variables included in the models were distance from shore and distance from the mouth of the fiord. The best model for each fiord was selected based on maximum likelihood and used to predict the abundance of narwhals across the entire fiord. Density estimates were computed by dividing predicted abundance by the total area of the fiord. Total abundance for all fiord strata was computed by averaging the densities of all fiords weighted by their respective area, and multiplying it by the total area of all fiords in a given stratum.

Narwhals that were not at the surface of the water at the time of the survey could not be seen by observers causing an availability bias (Marsh and Sinclair 1989). Thus, the number of narwhals counted in the survey must be corrected for availability. Experiments with model narwhals showed that they could be detected on planes when they were within 2 m of the surface (Richard et al. 1994). However, in some fiords with murky waters, we assumed narwhal could only be detected down to 1 m. Based on data from 24 narwhals fitted with satellite tags near the communities of Arctic Bay and Pond Inlet every August from 2009 to 2013, narwhals spend 31.4 ± 1.1% of their time within 2 m of the surface, and 20.4 ± 0.8% within 1 m (Watt et al. 2015).

The Potential Biological Removal (PBR) method (Wade 1998), corrected to include hunting losses (i.e., animals that are struck and lost), was used to calculate the recommended TALC:

$$TALC = \frac{PBR}{LRC}$$

where,

$$PBR = 0.5 \times R_{max} \times N_{min} \times F_r$$

The hunting loss rate correction (LRC) was equal to 1.28 (Standard Error, SE=0.15, Richard 2008). R_{max} , the maximum rate of increase for the stock, was set to 0.04 (the default value for cetacean when unknown, Wade 1998). N_{min} is the 20th percentile of the log-normal distribution of N. The recovery factor for the population (F_r) was set at 0.5 for the Jones Sound and Smith Sound stocks (to account for uncertainty in stock structure and narwhal movements), and at 1.0 for the other stocks (value suggested for large populations).

Results

The timing of the ice break-up in the northern parts of the survey range during the summer of 2013 affected the timing and coverage of portions of the survey areas. Nevertheless, all stocks were completely surveyed with the exception of Smith Sound. The global average group size was 2.76 (CV 3.8%), and stratum-wide mean group sizes ranged from 1 to 3.08. Figure 3 shows the location of the individual sightings of narwhal groups. The estimated abundances for each stock are given in Table 1. The total corrected estimate for the Canadian High Arctic narwhal population was 141,909 narwhals (including 7,038 narwhals estimated in fiords). The weighted correction factor used was equal to 2.94 (CV 3.4%). This value, based on the recommended instantaneous correction factor of 3.18, is for survey strata occurring in clear waters (Watt et al. 2015) and was weighted for an average observer search time of 4.3 seconds. From these abundance estimates, the combined TALC for the Baffin Bay population was 1,540 narwhals. TALC for each summering stock is given in Table 2.

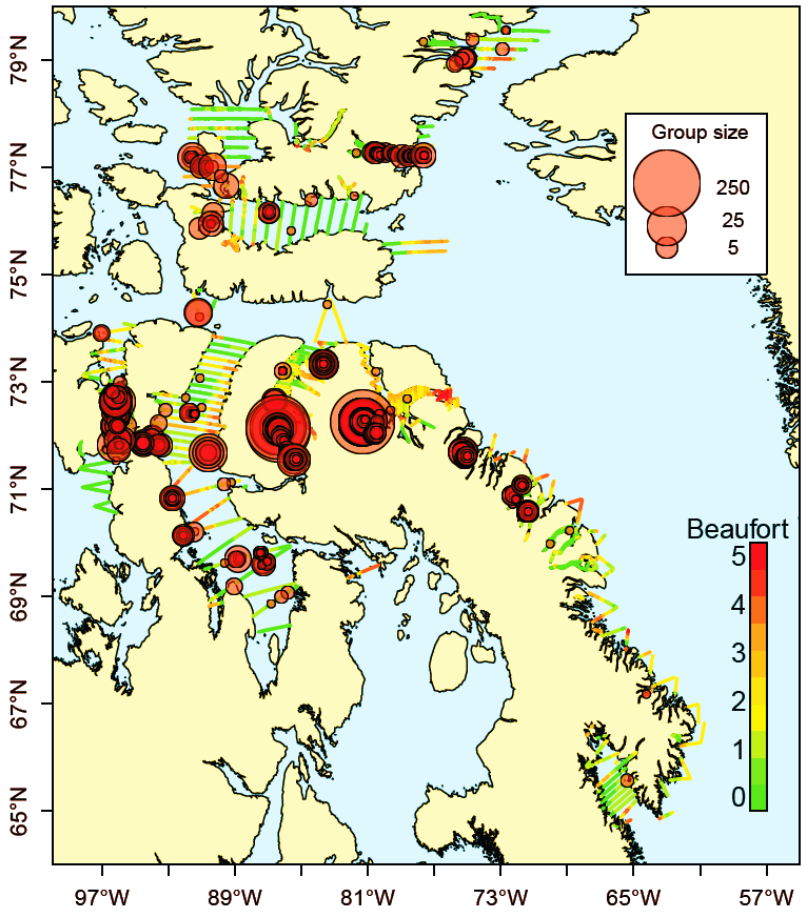

Figure 3. Unique sightings of narwhal groups made during the 2013 High Arctic Cetacean Survey (red circles). Lines represent transects flown with color scale showing Beaufort conditions.

Table 1. Area surveyed, survey coverage, narwhal sightings (surface abundance), and corrected abundance estimates by summer stock. The weighted correction factor used was 2.94 (CV 3.4%), except in East Baffin Island fiords where it was 4.53 (CV 3.8%).

Stock / Stratum	Area (km^2)	Percentage surveyed	Surface abundance	Abundance (corrected)	CV
Jones Sound	35,357	13%	4,316	12,694	0.33
Smith Sound	40,669	4%	5,563	16,360	0.65
Somerset Island	115,309	9%	16,921	49,768	0.20
Admiralty Inlet	9,419	26%	11,915	35,043	0.42
Eclipse Sound	8,459	26%	3,566	10,489	0.24
East Baffin Island	53,510	8%	3,799	17,555	0.35
Combined AI+ES	17,878	26%	15,481	45,532	0.33

Table 2. Total allowable landed catch (TALC) for the six Canadian summer stocks of narwhals in the Canadian High Arctic. The recovery factor (Fr) was set at 0.5 for the Jones Sound and Smith Sound stocks to account for uncertainty in stock structure and narwhal movements. Fr of 1.0 was set for the other stocks as suggested for large populations with additional stock assessment information.

Summer Stock	N_{min}	TALC
Jones Sound (/Fr=0.5)	9,714	76
Smith Sound (/Fr=0.5)	9,897	77
Somerset Island	42,081	658
Admiralty Inlet	24,895	389
Eclipse Sound	8,564	134
East Baffin Island	13,214	206
TOTAL	108,365	1,540
Combined AI + ES	34,716	542

Sources of Uncertainty

- An accurate abundance estimate of a population requires that the entire distribution range must be surveyed (Buckland et al. 2001). The summering range of narwhals in Smith and Jones Sounds is currently not well understood. For the Somerset Island stock, we chose not to survey the extreme western and southern parts of their distribution. We assumed these areas are used following ice melt in the core areas of Peel Sound and Prince Regent Inlet. Narwhals also occupy areas where they are not hunted and outside of the survey area (e.g., Parry Channel region). However, we assume they occur at low densities and would not impact community TALC.
- Narwhal sightings were extremely clustered in Eclipse Sound and Admiralty Inlet which increased uncertainty around the estimate (CVs) and could introduce bias.
- Although a pooled TALC is provided for AI and ES, connectivity between these stocks remains a source of uncertainty. There have been no new analyses to confirm new stock

structure. Future research is required to assess connectivity between the two stocks and is particularly relevant given the industrial activity and increased shipping occurring in the region.

- For the Jones Sound stock, relatively large numbers of narwhals were found in Norwegian Bay. Only a few narwhals were seen in the Jones Sound stratum itself, which is where most of the hunting takes place due to proximity to the community of Grise Fiord.
- Smith Sound could not be surveyed completely because of unfavorable weather conditions. The density estimate is based on relatively few lines in the northern part of the stratum, and therefore it cannot be extrapolated to the entire stratum. Instead, the density estimate was extrapolated to the area of the survey effort only. This resulted in an estimate that is more precise, but should be considered a minimum estimate of narwhal abundance in Smith Sound. We anticipate that this stock will be further sub-divided once more information is available on movements. The relationship between Smith Sound narwhals, the four recognized Baffin Bay stocks and the Inglefield Bredning stock in Greenland is unclear.
- The proportion of sightings made by both front and rear observers was relatively low during this survey, resulting in a low detection probability and a large precision bias correction. Surveys with low detection probability result in higher abundance estimates than surveys with high detection probability. Because the number of duplicate sightings between observers was relatively low the estimates from this survey might have been inflated.

CONCLUSIONS

This survey provided current abundance estimates for four Baffin Bay narwhal stocks in Canadian waters that improved their precision and resulted in new PBR estimates for each stock. Also, the first summer abundance estimates have been calculated for narwhals in the Smith Sound and Jones Sound areas. Concurrent, long-term telemetry studies of diving behaviour were critical to obtaining estimates of availability bias. Abundance estimates also were improved by implementing new analysis techniques to address specific challenges associated with narwhal use of fiords.

SOURCES OF INFORMATION

This Science Advisory Report is from the October 20-24, 2014 annual meeting of the National Marine Mammal Peer-Review Committee (NMMPRC). Additional publications from this meeting will be posted on the DFO Science Advisory Schedule as they become available.

Buckland, S.T., Anderson, D.R., Burnham, K.P., Laake, J.L., Borchers, D.L., and Thomas, L. 2001. Introduction to Distance Sampling. Oxford: Oxford University Press.

DFO. 2012. Advice on total allowable landed catch for the Baffin Bay narwhal population. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2012/021.

Dietz, R., Richard, P.R., and Acquarone, M. 2001. Summer and Fall Movements of Narwhals *(Monodon monoceros)* from Northeastern Baffin Island towards Northern Davis Strait. Arctic, 54(3): 244–261.

Doniol-Valcroze,T., Gosselin, J.-F., Pike, D., and Lawson, J. 2015a. Spatial modelling of narwhal density in fiords during the 2013 High Arctic Cetacean Survey (HACS). DFO Can. Sci. Advis. Sec. Res. Doc. 2015/059.

Doniol-Valcroze, T., Gosselin, J.-F., Pike, D., Lawson, J., Asselin, N., Hedges, K., and Ferguson, S. 2015b. Abundance estimates of narwhal stocks in the Canadian High Arctic in 2013. DFO Can. Sci. Advis. Sec. Res. Doc. 2015/060.

Heide-Jørgensen, M., Dietz, R., Laidre, K., and Richard, P. 2002. Autumn movements, home ranges, and winter density of narwhals *(Monodon monoceros)* tagged in Tremblay Sound, Baffin Island. Polar Biol. 25: 331–341.

Laake, J.L., and Borchers, D.L. 2004. Methods for incomplete detection at distance zero. *In* Advanced Distance Sampling. Edited by S. T. Buckland, D.R. Anderson, K.P. Burnham, J.L. Laake, D.L. Borchers, and L. Thomas. Oxford Univeristy Press, Oxford. p. 108–189.

Marques, T., Thomas, L., Fancy, S.G., Buckland, S.T., and Handel, C.M. 2007. Improving estimates of bird density using multiple-covariate distance sampling. The Auk. 124: 1229–1243.

Marsh, H., and Sinclair, D. 1989. Correcting for visibility bias in strip transect aerial surveys of aquatic fauna. J. Wildl. Manag. 53(4): 1017–1024.

Pike, D., and Doniol-Valcroze, T. 2015. Identification of duplicate sightings from the 2013 double-platform High Arctic Cetacean Survey. DFO Can. Sci. Advis. Sec. Res. Doc. 2015/034. v + 22 p.

Richard, P.R. 2008. On determining the Total Allowable Catch for Nunavut odontocete stocks. DFO Can. Sci. Advis. Sec. Res. Doc. 2008/022. iv + 12 p.

Richard, P.R. 2010. Stock definition of belugas and narwhals in Nunavut. DFO Can. Sci. Advis. Sec. Res. Doc. 2010/022. iv + 14 p.

Richard, P.R., Weaver, P.A., Dueck, L.P., and Barber, D.G. 1994. Distribution and numbers of Canadian High Arctic narwhals (*Monodon monoceros*) in August 1984. Meddelelser om Grønland - Bioscience. 39: 41–50.

Wade, P. R. 1998. Calculating limits to the allowable human caused mortality of cetaceans and pinnipeds. Marine Mammal Science. 14: 1–37.

Watt, C.A., Orr, J., LeBlanc, B., Richard, P., and Ferguson, S.H. 2012. Satellite tracking of narwhals (*Monodon monoceros*) from Admiralty Inlet (2009) and Eclipse Sound (2010-2011). DFO Can. Sci. Advis. Sec. Res. Doc. 2012/046. iii + 17 p.

Watt, C.A., Marcoux, M., Asselin, N.C., Orr, J.R., and Ferguson, S.H. 2015. Instantaneous availability bias correction for calculating aerial survey abundance estimates for narwhal (*Monodon monoceros*) in the Canadian High Arctic. DFO Can. Sci. Advis. Sec. Res. Doc. 2015/044. v + 13 p.

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Central and Arctic Region

Canadian Science Advisory Secretariat
Science Advisory Report 2015/006

SUSTAINABILITY OF A FLEXIBLE SYSTEM OF TOTAL ALLOWABLE ANNUAL CATCHES OF NARWHALS (*Monodon monoceros*)

Narwhal (Monodon monoceros) by R. Phillips.

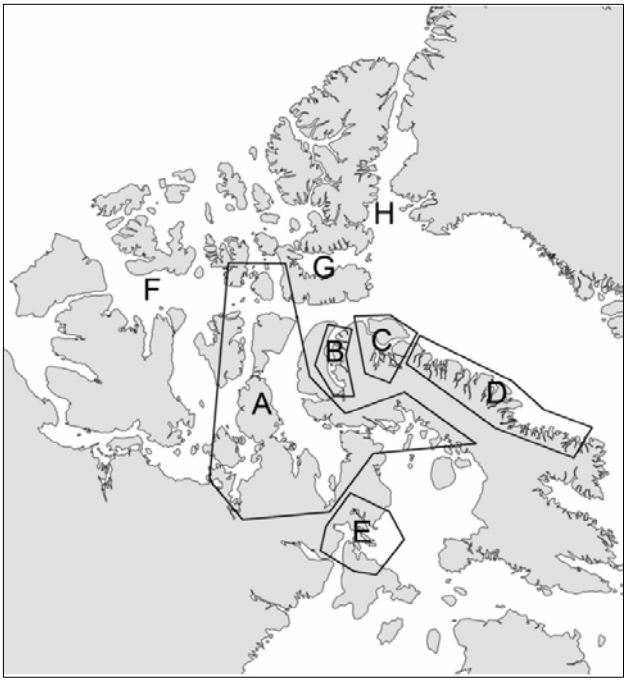

Figure 1. Approximate areas where Canadian summering aggregations of narwhals occur: A - Somerset Island, B - Admiralty Inlet, C - Eclipse Sound, D - East Baffin Island, E - Northern Hudson Bay. Other areas where narwhals are known to occur in summer: F - Parry Islands, G - Jones Sound, H - Smith Sound) [adapted from DFO 2011].

Context

There are presently five recognized narwhal summering stocks in the Canadian Arctic: Somerset Island, Admiralty Inlet, Eclipse Sound, East Baffin Island, and Northern Hudson Bay (Fig.1 A-D). Hunts on these narwhal stocks are managed by setting an annual Total Allowable Landed Catch (TALC) for each stock for a five-year period. The TALC is based on a Potential Biological Removal (PBR) estimate calculated for each stock, minus estimated hunting losses (i.e., struck and lost). The present analysis is in response to requests by Resource Management (RM) for peer reviewed science to address the questions of sustainability of a flexible TALC system for narwhals. There are also narwhals summering in Jones Sound, Smith Sound and the Parry Islands water (Fig. 1 F-H). Their stock definition and status is uncertain but advice given here would apply once assessments allow the setting of total allowable land catch limits.

April 2015

Canada

SUMMARY

- There is a desire on the part of Inuit to have a "flexible quota system" management provision implemented in narwhal hunts, similar to what was employed under Community Based Management (CBM) of narwhal in Nunavut, i.e., to carry-over (credit) unused Total Allowable Landed Catch (TALC) for use in the subsequent hunting season or to borrow (debit) from the following years' TALC for use in the current hunting season
- Results of a deterministic model to investigate the robustness of a flexible TALC system clearly indicate that, for the scenarios investigated, such a management approach is sustainable, as long as the total hunting mortality over the five year period does not exceed five times the annual PBR.
- Key assumptions of the deterministic model are:
    a. birth and death rates are constant,
    b. PBR is updated every ten years with new abundance estimates,
    c. Hunting loss is a constant fraction of TALC, and
    d. flexible hunting limits are adhered to by all and landed catches are reported exactly (i.e., no implementation errors).
- Process error model results, which account for some variability of birth and death rates, showed a greater risk of the population becoming depleted under certain credit or debit scenarios but the risk was similar to the base scenario run for comparison where no debit or credit was applied.
- Better estimates of hunting loss rates would increase confidence in model results. These model results do not account for impacts of large ice entrapment mortality. These are rare events and have been the subject of previous science advice. A more detailed assessment of population trend would be warranted were there evidence of deterministic environmental effects on narwhal birth and death processes.

INTRODUCTION

There are presently five recognized narwhal summering stocks in the Canadian Arctic: Somerset Island, Admiralty Inlet, Eclipse Sound, East Baffin Island, and Northern Hudson Bay. Hunts on these narwhal stocks are managed by setting an annual Total Allowable Landed Catch (TALC) for each stock that remains constant for a five-year period. The TALC is based on a Potential Biological Removal (PBR) estimate calculated for each stock, minus estimated hunting losses. The present analysis is in response to requests by Resource Management (RM) for peer reviewed science to address the questions of sustainability of a flexible TALC system for narwhals.

Question 1: Is it sustainable if Arctic Bay and Pond Inlet exchange their unused spring and fall Marine Mammal Tags for use by either community during their migratory (spring/fall) narwhal hunts? The same question was also posed for Clyde River and Qikiqtarjuaq.

Question 2: Harvest credit (or carry-over) in a five year period:

a. Is 100% carry-over for one year sustainable?
b. What % carry-over for one year is sustainable?
c. What % cumulative carry-over is sustainable over consecutive years (up to five years)?

Question 3: Harvest debit (or borrow-back) in a five year period:

a. Is 100% borrowing from the following year sustainable once in a five year period?
b. What % borrowing from the following year is sustainable?
c. Can the total five consecutive years' total allowable catch be allocated to each year, in a five year period, any way the hunters choose as long as the sum of the five-years of catch does not exceed that total?

Question 4: How sustainable would a hunting mortality of five times the total allowable catch if applied to any one year of a five year period?

ASSESSMENT

Question 1: This question was addressed by previous science advice (Richard 2011). In short, the two communities in question,

a. Arctic Bay and Pond Inlet, or
b. Clyde River and Qikiqtarjuaq, are hunting from the mixed stocks in spring and fall and therefore are taking from the same stocks' TALCs.

Consequently, the harvest credits are transferable between Arctic Bay and Pond Inlet, or between Clyde River and Qikiqtarjuaq without invalidating previous advice on the sustainability of the affected stocks.

The remaining four questions required new analyses. They were performed using a variant of the Wade (1998) PBR robustness trial method, where a proportion of the PBR for a stock was either carried over (credited) to the subsequent year to make-up for a low catch year or borrowed (debited) from the next year if a given year's catch was higher than the annual PBR. Several scenarios were modelled in deterministic projections for 100 years, as in Wade (1998), varying start populations from 5,000 to 15,000 and recovery factors from 0.5 to 1. The details of the simulations are given in Richard and Young (2015).

In all cases, more than 95% of projected populations reached sizes in excess of the Maximum Net Productivity Level. The results of these simulations of flexible catch limits did not depart much from the base models, where no credits or debits were exercised.

The same simulations were done with an added parameter for process error, i.e., a parameter simulating variation in population dynamics (Richard and Young 2015). This process error, arbitrarily set at 0.05, to reflect our belief that narwhals do not have highly variable population dynamics, resulted in more variable results for debit or credit scenarios than the deterministic runs, but none of scenario results were significantly worse than the results of base models without debits or credits.

These results indicate that a system of flexible Total Allowable Landed Catches is sustainable, as long as the total hunting mortality over each five-year period does not exceed five times the PBR for that period. The modelling results also show that the choice of a fixed recovery factor of 1 does not significantly increase the risk to sustainability of credit or debit scenarios.

Sources of Uncertainty

The above conclusions are based on models with some important assumptions. The first is that TALCs are a constant fraction of total hunting mortality, i.e., that hunting losses are constant and very similar to what was used to provide TALC advice for narwhal stocks (0.28 from Richard 2008). Hunting losses may in fact vary from area to area, from season to season and with different hunting methods. Unfortunately, we have insufficient data at present to determine

those variations and apply them in modelling. Nevertheless, the PBR method has been shown to be robust to under-estimates of actual hunt mortality (Wade 1998).

Second, we assume that sources of human-induced narwhal mortality other than total hunting mortality (landed catch and hunting loss) are negligible. We have no reason to believe otherwise at present.

Third, we assume that flexible hunting limits are adhered to by all and that landed catches are reported exactly, that there are no implementation errors. Presently, we know of no reason to believe that narwhal landed catches are not reported accurately, but there have been no independent studies to verify this assumption. Perhaps this concern is moot as the latest records of narwhal catches (DFO) indicate that landed catches are, in many cases, lower than TALCs.

The models do not take into account the impact of rare ice-entrapment mortality, nor do they include environmental effects that might negatively impact birth and death processes in narwhal populations. Large ice entrapments are rare but can have a significant short-term impact on population trend. Science advice on one such entrapment event can be found in DFO (2012). Environmental impacts on birth and death processes in narwhal populations are unknown at present but, should there be evidence of long-term negative effects, more detailed narwhal population assessments would be needed.

CONCLUSIONS

These results are encouraging for the implementation of flexible TALCs, as they show little additional risk to the narwhal stocks from implementation of flexible TALCs. If a flexible TALC system is implemented, the five-year total landed catch should not exceed five times the annual TALC for each stock.

SOURCES OF INFORMATION

This Science Advisory Report is from the October 20-24, 2014 Annual Meeting of the National Marine Mammal Peer Review Committee (NMMPRC). Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

DFO. 2011. Advice regarding the genetic structure of Canadian narwhal (*Monodon monoceros*). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2011/021.

DFO. 2012. Effect of 2008 ice entrapment on the Eclipse Sound narwhal total allowable landed catch. DFO Can. Sci. Advis. Sec. Sci. Resp. 2012/020.

Richard, P.R. 2008. On determining the Total Allowable Catch for Nunavut odontocete stocks. DFO Can. Sci. Advis. Sec. Res. Doc. 2008/022: iv + 12 p. (Erratum September 2008).

Richard, P.R. 2011. Allocation model for landed catches from Baffin Bay narwhal stocks. DFO Can. Sci. Advis. Sec. Res. Doc. 2011/056: iv + 27 p. (Erratum December 2011)

Richard, P.R., and Young, R. 2015. Evaluation of the sustainability of a flexible system of total allowable annual catches of narwhals (*Monodon monoceros*). DFO Can. Sci. Advis. Sec. Res. Doc. 2015/006. iv + 13 p.

Wade, P.R. 1998. Calculating limits to the allowable human-caused mortality of cetaceans and pinnipeds. Mar. Mamm. Sci. 14: 1-37.

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*MPO. 2015. La durabilité d'un système de limites flexibles de captures de narvals (*Monodon monoceros*). Secr. can. de consult. sci. du MPO, Avis sci. 2014/006.*

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Marine mammal tag transfer policy and five-point narwhal quota carry-over rule

<u>Phase One</u>[1]: Marine Mammal Tag transfers for narwhal harvesting when stocks are not mixed[2].

The purpose of Marine Mammal Tag transfers is to assist Regional Wildlife Organizations (RWOs) to:

1. Cover off over-harvest of a Community Harvest Limit (CHL) by allowing the exchange of unused Marine Mammal Tags between communities within the management unit, during the current narwhal harvesting year

2. Plan for, and allow, transfers of Marine Mammal Tags between communities within a management unit, during the current narwhal harvesting year, to maximize harvests in response to year to year variance in narwhal availability.

3. When there are not enough unused Marine Mammal Tags available for exchange, reconcile over-harvests within the management unit by reducing the following year's allocation and harvest from the community that over-harvested

General provisions of Phase One:

1. Following the establishment of a Total Allowable Harvest Level (TAH) and Basic Needs Level (BNL) for each narwhal stock/population and the establishment of corresponding management units based on known summering areas, the BNL for each stock/population will be allocated annually, by the RWO to the Hunter and Trappers Organizations (HTO), in each management unit. The allocation will be in the form of Community Harvest Limits. Depending on whether or not a community harvests from mixed migratory stocks, each community will receive either an All-Season Community Harvest Limit, or a Summer-Season and Migratory-Season Community Harvest Limit. The number of Marine Mammal Tags a community receives will correspond to its Community Harvest Limit(s) (All- Season, Summer-Season and Migratory-Season).

2. A valid Marine Mammal Tag is required to hunt a narwhal.

3. Individual Marine Mammal Tags may only be used to land one narwhal.

4. Marine Mammal Tags may only be used in the harvest season for which they were issued. At the end of the season, any unused tags expire and cannot be used in subsequent years.

5. The transfer of Marine Mammal Tags is not permitted between management units.

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[1] These basic transfer provisions will be amended/expanded as required to reflect DFO Science advice on incorporation of mixed stock transfer in phase two and to reflect DFO Science advice on incorporation of a flexible quota system to the tag transfer policy in phase three (see figure 1).

[2] In the four Baffin Bay management units, stocks are not mixed when whales are in their summering areas. In the Northern Hudson Bay management unit, the stock is not mixed throughout the entire year

6. Transfers of Marine Mammal Tags are subject to RWO(s) pre-approval.

7. Marine Mammal Tag transfers between communities in a management unit are allowed for harvesting when stocks are not mixed, for the purposes identified above (i.e. to cover off an individual community's over-harvest, to maximize harvests or to reconcile over-harvests within the management unit) subject to pre-approval by the RWO(s).

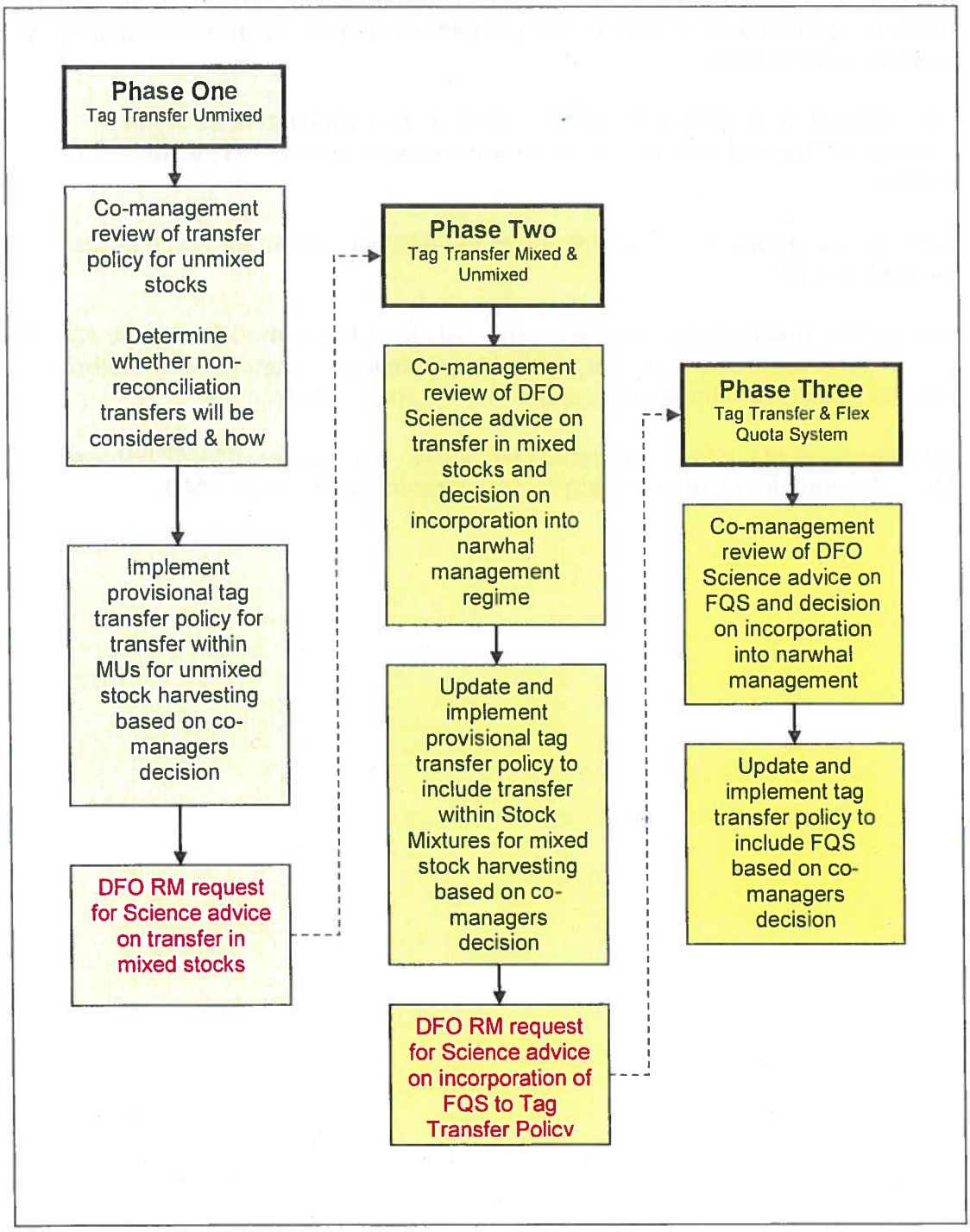
8. Marine Mammal Tag transfers cannot occur once the sum of the Community Harvest Limit(s) (All-Season, Summer-Season) for that management unit in any given harvest season is reached.

9. Marine Mammal Tag transfers cannot occur during the Migratory-Season in any management unit.

10. In the event that insufficient Marine Mammal Tags are available within a management unit for harvest reconciliation, community over-harvests will be reconciled with a compensatory reduction in that HTO's annual Community Harvest Limit (All-Season, Summer-Season) by the RWO for the next narwhal harvest season.

11. Requests for Marine Mammal Tag transfers for any other purposes (e.g. cross-species tag transfers or barters for wildlife products) will be forwarded to the NWMB by the RWO for the management unit for decision on a case-by-case basis as per their authority under NLCA s.5.2.33 (k). Such requests can only be considered if the transfer does not jeopardize the conservation status of the stocks or populations of wildlife in question and does not violate the terms of the management regimes governing the specific wildlife species in question.

Figure 1. Flow chart depicting steps in a progressive, evidence based approach to development and implementation of a harvest tag/licence transfer policy for the 2013 narwhal fishery in the Nunavut Settlement Area. The chart delineates the steps required rather than the time sequence for the process.



Five-point narwhal quota carry-over rule

1. All unused quota for a given harvest season within MU is carried-over for use in the subsequent harvest season. (i.e. summer to summer; migratory to migratory; all season to all season)

2. Carried-over quota (MMT) is applied first to any narwhal harvests in the subsequent harvest season before current season quota (MMT) is applied to harvest.

3. Carried-over quota expires at the end of the harvest season for which it was carried-over into.

4. The system resets to zero whenever the TAH for a MU is modified by the NWMB (i.e. unused quota in a MU prior to the TAH modification cannot be carried-over into the subsequent harvest season under the "new" TAH)

5. All other rules of tag transfer Phase I still apply. No transfer of MMT between MUs. No transfer of summer MMT with migratory MMT within a MU.

BAFFIN BAY NARWHAL TOUR – APRIL 2016 – WHAT WE HEARD

CONTEXT

The narwhal fishery in the Nunavut Settlement Area (NSA) is co-managed by Fisheries and Oceans Canada (DFO), the Nunavut Wildlife Management Board (NWMB), Regional Wildlife Organizations (RWOs), and Hunter and Trapper Organizations (HTOs), in accordance with the Nunavut Land Claims Agreement (NLCA), the *Fisheries Act* and its regulations, and in some communities, by local HTO hunting rules (or by-laws).

The Narwhal Integrated Fisheries Management Plan (Management Plan), developed jointly with Inuit, summarizes the main objectives for sustainable narwhal co-management in the NSA, and the measures that are used to achieve these objectives. The Management Plan also sets out the role of each of the co-management partners in ensuring that narwhal harvest levels are sustainable, and that products destined for export comply with both domestic and international trade requirements.

Co-management organizations work together on an on-going basis to provide for the conservation of narwhal stocks and populations and facilitate the implementation of a management regime consistent with the NLCA to demonstrate sustainable harvesting activities.

In August 2013, the Department of Fisheries & Oceans (DFO) conducted a series of aerial surveys designed to cover the six known summering stocks of narwhal in the Canadian High Arctic simultaneously. DFO Science used these survey results to estimate the abundance of narwhal and calculate Total Allowable Landed Catch (TALC) recommendations for each of the stocks. The Science advice was published in December 2015.

In 2015 DFO Science advice was also published regarding the tag transfer policy Phases II and III. Phase II provides for simple transfers of migratory Marine Mammal Tags between Arctic Bay and Pond Inlet, and between Clyde River and Qikiqtarjuaq who **do** harvest from mixed narwhal stocks. Phase III provides for a "flexible" quota system whereby all communities can carry-over an unused portion of their Marine Mammal Tags to use for narwhal harvesting in the next harvest year (these carry-over tags must be used first as they expire after one year).

On October 30th 2015, representatives from NWMB, Nunavut Tunngavik Incorporated (NTI), and DFO met by conference call to discuss a way forward in developing a management response to the new narwhal survey abundance estimates. There was general agreement-in-principle to strike an initial steering committee of representatives from NWMB, NTI, and DFO to begin development and evaluation of various management options consistent with the new DFO science advice and to develop a consultation plan for affected Inuit communities.

The steering committee will ultimately submit an application for NWMB evaluation under the NLCA decision making process. On January 20th and 21st 2016 the steering committee held a strategic planning meeting to develop and evaluate some management options, as well as collaborate on the development of a consultation plan.

The narwhal steering committee agreed to collaboratively consult with Inuit on management options developed at the strategic planning meeting.

The consultation process included two components: (1) in-person consultations with the communities of Arctic Bay, Pond Inlet, Clyde River and Qikiqtarjuaq from April 18-22, 2016; and (2) written consultations with the remaining communities that harvest from the Baffin Bay stocks and from the Jones and Smith Sounds stocks. The Kitikmeot and Qikiqtaaluk Wildlife Boards will also be included in these consultations.

In February 2016, DFO invited HTO representatives from the four Baffin Bay narwhal hunting communities, i.e. Ikajutit (Arctic Bay), Mittimatalik (Pond Inlet), Nangmautaq (Clyde River), and Nattivak (Qikiqtarjuaq) and their RWO (Qikiqtaaluk Wildlife Board) to attend a consultation meeting in each community. Each HTO meeting was followed by a public meeting, in order to review the new DFO Scientific advice for Baffin Bay narwhal stocks, and explore narwhal management options and implications for 2016 and beyond. DFO's responsibilities under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) with respect to issuing export permits for narwhal tusks and products were also discussed.

Consultation meetings were well attended, approximately 20-25 participants attended public meetings in each community. At all meetings, participants were encouraged to share their views, provide comment, express any concerns they may have and share expertise related to the topics discussed. Community members and harvesters shared Inuit and local knowledge and expertise related to narwhal management and harvesting. The report summarizes "what we heard" during the April 2016 consultation meetings.

Topic	DFO Information – "What We Said" [1]	Inuit Knowledge - "What We Heard" (separated by the community in which it was heard)
CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora)	-narwhal are currently listed on Appendix II -a non-detriment finding (NDF) decision from the DFO Scientific Authority is required to obtain a CITES Export/Re-export permit to export narwhal products internationally -harvested narwhals from Canadian management units are not eligible for international trade if the harvest exceeds the Total Allowable Landed Catch (TALC) recommendation for a population -Scientific Authority review and NDF decision are expected in 2016 following consultations	*Arctic Bay, Clyde River, and Qikiqtarjuaq:* • There were no concerns raised about these points during both the community and HTO meetings. *Pond Inlet:* • The HTO said that Inuit are less concerned about selling narwhal products internationally and more interested in harvesting for food.
Tag Transfer Policy Phase II	-science advice published in 2015 -it is sustainable to exchange unused Arctic Bay and Pond Inlet migratory tags -it is sustainable to exchange unused Clyde River and Qikiqtarjuaq migratory tags	*Arctic Bay and Pond Inlet:* • There were no concerns raised about implementation of tag transfer phase II during the community and HTO meetings. *Clyde River:* • There were some questions asked related to the clarification about which communities could exchange tags under this policy. • There was interest in exploring this policy and a request for some support from DFO on how to implement it. *Qikiqtarjuaq:* • There was interest in exploring this policy further.
Tag Transfer Policy Phase III (i.e., Flex-Quota System)	-science advice published in 2015 -a flex-quota system for narwhal is	*Arctic Bay:* • There were no concerns raised about implementation of the flex quota

	sustainable	system during the community and HTO meetings. *Pond Inlet and Qikiqtarjuaq:* • There appeared to be general support for a flexible tag system. *Clyde River:* • There was support for a flex-quota system due to the advantages for the community.
Baffin Bay Aerial Survey 2013 – abundance estimates and TALC recommendations	-science advice published in December 2015 -the 2013 Baffin Bay total abundance estimate is higher than previous estimates – approximately 141,900 -the survey produced the first abundance estimates for Jones Sound and Smith Sound -new estimates for Eclipse Sound and Admiralty Inlet suggest a change in narwhal distribution and/or stock uncertainty -2013 abundance estimates and TALC recommendations for each stock	*Arctic Bay:* • There were no concerns raised about these points during both the community and HTO meetings. *Pond Inlet:* • The HTO pointed out that narwhal are increasing as more and more ships travel to the North. • The increasing number of ships has caused later migrations by narwhal, which led to the entrapment in 2015. • Narwhal migrate near Milne Inlet every year to feed and they migrate back out in the fall. • The HTO and community had lots of questions about the survey methods, correction factors, and the ability to count small whales from the planes. • The HTO suggested that the decrease in the abundance estimate for Eclipse Sound was a result of ship traffic, whales moving all over the place (including to Western Nunavut communities), killer whale presence, and difficulty in counting submerged whales. • The HTO specifically pointed out that the decreased count was not a result of Inuit overharvesting in the Eclipse Sound area. • The community stated that the numbers of narwhal vary from year to year. • The HTO also explained that there was a lot of movement by narwhal between Admiralty Inlet and Eclipse Sound. If the count had been done at a different time it is possible that there would have been a decrease in Admiralty Inlet and an increase in Eclipse Sound. • Elders try to conduct their own surveys and explained that Baffinland is also

		causing negative effects on the wildlife near their community. Underwater devices were also identified as having a detrimental effect on the marine life in Eclipse Sound. • The community pointed out that narwhal dive and remain submerged for over two hours when planes pass over. *Clyde River:* • The HTO and community had lots of questions about the survey methods, number of observers, and correction factors. *Qikiqtarjuaq:* • The community had lots of questions about the survey methods and design.
Management Option and Considerations	-modify Total Allowable Harvests (TAHs) for all management units to reflect 2013 survey TALC advice -Considerations: a) stocks would continue to be managed based on most current science advice (meets CITES commitment); b) current NDF status and ability to export internationally would be retained for all stocks; c) focus is on current data rather than trend data over time; and d) restricts harvesting in Eclipse Sound by lowering the TAH.	*Arctic Bay:* • There were no concerns raised about these points during both the community and HTO meetings. *Pond Inlet:* • The HTO wanted to maintain the status quo (i.e., the Total Allowable Harvest that was established in 2013) for a period of five years. • The HTO and community discussed the importance of using marine mammals for food and the negative impact that a quota reduction would cause for them. • The HTO and community strongly disagreed with reducing the quota for the Eclipse Sound Management Unit. • The community pointed out that it would be inconvenient to reduce the quota when there are so many narwhal in Baffin Bay and the fact that not all tags are being used annually. • The community was disappointed that DFO planned to share the science recommendations to reduce the Eclipse Sound quota with the NWMB. • The community was disappointed that DFO would recommend a quota reduction for Eclipse Sound based on one year of data. • Pond Inlet should be compensated if they lose tags.

		Clyde River and Qikiqtarjuaq: • There was support for implementing the new science recommendations.
Future Science Considerations	-a Canada/Greenland Joint Commission on Conservation and Management of Narwhal and Beluga (JCNB) Model is being developed -the model is more robust and accounts for harvesting of narwhal by Greenland -the model is tentatively scheduled for review at the National Marine Mammal Peer Review (NMMPR) Meeting in Fall 2016 -Science is also developing some research options or ideas in partnership with Hunters and Trappers Organizations (HTOs) to consider linkages between Admiralty Inlet and Eclipse Sound Narwhal Stocks – survey/tagging.	*Arctic Bay:* • There were no concerns raised about these points during both the community and HTO meetings. *Pond Inlet:* • Some community members explicitly stated that they wanted a rigorous five-year research project conducted prior to modifying the current quota for the Eclipse Sound Management Unit. Multiple surveys should be conducted prior to making a recommendation. • The HTO asked DFO to have a closer look at the utility of the Baffinland research information on narwhal from the Eclipse Sound area. • The HTO and community discussed a group of narwhal from Greenland that were seen in the Eclipse Sound area last summer. These narwhal were different and easier to catch. • The community speculated that offshore exploration adjacent to Greenland caused narwhal to get scared off the Greenland shores and move into the Eclipse Sound area last year. • The community asked for more justification and reasoning prior to lowering their quota. • The community requested that more *Inuit Qaujimajatuqangit* is incorporated and referenced in the science work. The community also suggested including the help of hunters to conduct research. • There were some concerns raised about satellite tagging and the effects it has on the whales. Whales are not edible after being tagged. • The community asked for some additional research on diseases in marine mammals. • The NWMB identified some funding opportunities for the collection of *Inuit Qaujimajatuqangit*. The NWMB also told the public about their *Inuit Qaujimajatuqangit* Coordinator who could help collect the information.

		Clyde River: • There was some interest in developing a satellite tagging project to better understand the movement of narwhal in the Clyde River area. • The NWMB identified some funding options for satellite tagging work in the Clyde River area. • There was general support to conduct tagging studies in the area and one community member said that it can be a good thing when it is done correctly. *Qikiqtarjuaq:* • There was interest expressed in developing a satellite tagging project in the Home Bay area, which according to local knowledge is an area that is filled with narwhal every summer. • Greenland information should be incorporated into narwhal management. • The HTO asked for more involvement of Inuit in research studies. • The NWMB identified some funding options for satellite tagging work in the Home Bay area.
NWMB and Co-Management Process	-it is anticipated that the NWMB will hold a public hearing -communities and HTOs will be able to provide additional input into that process	*Arctic Bay:* • Safety issues during the hunt were voiced during the community meeting. NWMB explained that they could limit harvesting to provide for public safety. *Pond Inlet:* • The NWMB and QWB explained the hearing process that would include everybody and give people/organizations an opportunity to have additional input. • The HTO explained their interest in having elders share their knowledge as part of the NWMB process. • The HTO explained that tags should not be lowered based on estimates and that proper channels and partners need to be involved prior to making these types of decisions.

		Clyde River: • There were no concerns raised these points during both the community and HTO meetings. *Qikiqtarjuaq:* • There was some discussion and acknowledgement of the process that would need to be followed during both the community and HTO meetings.
Harvest Allocation Workshop	-we expect to hold a second harvest allocation workshop in fall or winter 2016/17 -HTOs will be invited and it will be important for them get input from their respective communities regarding summer catch proportions -HTOs authority to set summer and migratory seasons was also discussed	*Arctic Bay:* • Ice break up is happening later. Seasons should be modified. • Summer tags are getting used earlier in the season and the fall migratory season is dangerous for hunters. • Concerns were raised about the seasons and boundaries for the management units. *Pond Inlet:* • Spring breakup varies from year to year, which makes it difficult to use seasonal tags. *Clyde River:* • The migration patterns of narwhal vary from year to year. • The community expressed an interest in providing input into the harvest allocation workshop. • There were come concerns raised by the community and HTO about the use of seasonal tags; however, there was an appreciation expressed for the explanation that was provided by DFO staff. *Qikiqtarjuaq:* • The community expressed some concerns about the seasons and dates. There was interest in having more input into the selection of the seasonal dates and tag allocations.

Other		*Arctic Bay:* • The HTO and community raised concerns about the length of time it takes to get a found tusk tag. • Interest was voiced by the HTO about assignment of rights options to a non-beneficiary with respect to narwhal harvesting. • The HTO requested more presence and support by DFO in the community during main narwhal harvesting periods. • The HTO asked about being more involved in the tusk certification process (i.e., possibility of tusk certification being completed by the HTO). *Pond Inlet:* • One HTO delegate shared his observations of narwhal in 1994 near Milne Inlet. At the time there was lots of ice and the narwhal pods swam in the same direction into the Pond Inlet area for three days straight. He counted at least 3000 narwhal in five minutes. *Clyde River:* • There was some interest expressed about exploring the possibility of having a narwhal sport hunt option. *Qikiqtarjuaq:* • Narwhal are born in the Home Bay area and they return there every year. • There was lots of discussion about preserving narwhal for their future generations. • The HTO also expressed the importance of respecting the fishing closure in the Baffin Bay narwhal overwintering area.
	[1] see copies of presentations for further detail	

Fisheries and Oceans Canada | Pêches et Océans Canada

April 28, 2016

To:

James Qillaq, Chairperson Qikiqtaaluk Wildlife Board	Simon Qingnaqtuq, Chairperson Kitikmeot Regional Wildlife Board
Jaypetee Akeeagok, Chairperson Iviq (Grise Fiord) HTO	James Qitsualik, Chairperson Gjoa Haven HTA
Philip Manik Sr., Chairperson Resolute HTO	Sam Tulurialik, Chairperson Taloyoak HTA
Noah Mosesee, Chairperson Pangnirtung HTO	Columban Pudjuarjok, Chairperson Kurairojuark (Kugaaruk) HTA
Joshua Kango, Chairperson Amaruq (Iqaluit) HTO	Bobby Greenley, Chairperson Ekaluktutiak (Cambridge Bay) HTA
Igloolik HTO David Aqqiaruq, Chairperson	Larry Adjun, Chairperson Kugluktuk HTA
Manasie Naullaq, Chairperson Hall Beach HTO	

Subject: Proposed Modification of Existing TAHs for Baffin Bay, Jones and Smith Sounds Narwhal Stocks

In August 2013, Fisheries & Oceans Canada (DFO) conducted the first within season aerial survey of the six Canadian narwhal summer aggregations in the high Arctic: Somerset Island stock, Admiralty Inlet stock, Eclipse Sound stock, East Baffin Island stock in the Baffin Bay population; and the Jones and Smith Sounds stocks near Grise Fiord (Figure 1). DFO Science used the results of this survey to estimate the abundance of narwhal and calculate Total Allowable Landed Catch (TALC) recommendations for each of these stocks (Table 1). In general, the 2013 abundance estimate for the Canadian high Arctic narwhal is higher than previous estimates.

DFO is conducting consultations with potentially affected Inuit on management options to implement the new science advice. The consultation process has two components: (1) in-person consultations with the communities of Arctic Bay, Pond Inlet, Clyde River and Qikiqtarjuaq April 18-22, 2016; and (2) written consultations with the remaining communities that harvest from the Baffin Bay, Jones and Smith Sounds narwhal stocks.

DFO is seeking the input from your HTO and community on:

1. Proposed TAH modifications, specifically, ***to modify the existing TAHs for the Baffin Bay and Jones and Smith Sounds narwhal Management Units based on the 2013 survey results***. For the majority of communities, this would result in an increase in the TAH; and
2. The formal implementation of the "narwhal flexible quota system."

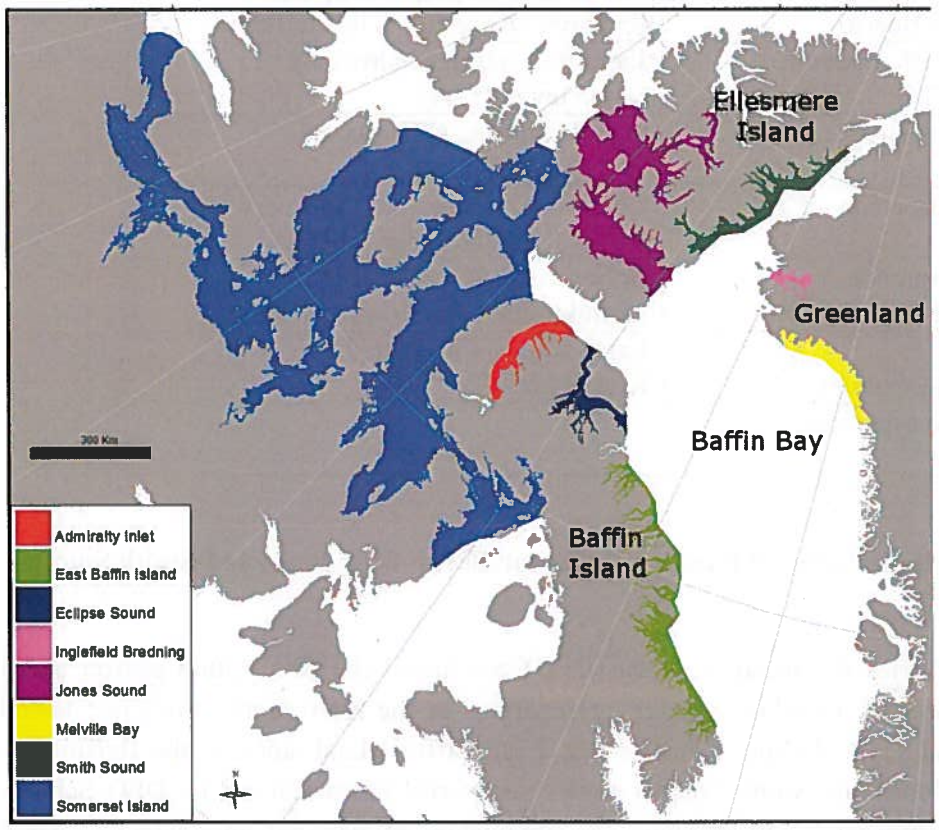


Figure 1. Map of High Arctic narwhal summer aggregations (source: NAMMCO/SC/21-JCNB/SWG/14-05).

Table 1. 2013 survey results including stock abundance estimates, Total Allowable Harvest (TAH) and Total Allowable Landed Catch (TALC) from the 2013 aerial survey (CSAS SAR June 2015) and most recent estimates and current TALCs.

Narwhal Stock	Management Unit	Current TAH	New TALC (TAH) Recommendations
Somerset Island	SI	532	**658**
Admiralty Inlet	AI	233	**389**
Eclipse Sound	ES	236	**134**
East Baffin Island	EBI	122	**206**
Unassigned	Jones Sound	50*	**76**
Unassigned	Smith Sound		**77**

*while there is no TALC, the Minister did approve a Total Allowable Harvest (quota) of 50 for both areas.

Science advice has also been received on the sustainability of the *"flexible quota system"* that has been used on an interim basis since 2013. This flexible quota system allows for the carry-over of unused TAH to be used in the subsequent hunting season, or to borrow from the following years' TAH for use in the current hunting season.

The science advice indicates that the flexible TAH system and tag transfer policy currently being used for narwhal is sustainable, as long as the total hunting mortality over the five-year period does not exceed five times the annual Potential Biological Removal (PBR) level. For detailed information on the science advice and the flexible quota/tag transfer policy, please see the attached documents.

Following consultations, DFO will summarize the feedback for inclusion in a Request for Decision package that will be submitted and presented to the Nunavut Wildlife Management Board (NWMB). The Request for Decision will be to modify the existing TAHs for the Baffin Bay and Jones and Smith Sounds narwhal Management Units based on the 2013 survey results and feedback from consultations. It is important to note that communities and HTOs will have additional opportunities to provide input into the NWMB process as per the Nunavut Land Claims Agreement. The goal is to have a final decision approved by the DFO Minister and ready for implementation for the 2017 harvest season.

Through this letter, ***we invite your HTO and community members to participate in this written consultation process by providing your comments or concerns on the proposed TAH modifications and implementation of the flex quota system, by May 31, 2016*** (see below for email, fax and address options). We can also make ourselves available to participate in a conference call to further discuss this information, if you choose.

If you have questions, comments, or require further information, please contact me directly.

Allison McPhee
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Attachments: (1) *Abundance Estimates of Narwhal Stocks in the Canadian High Arctic in 2013. Canadian Science Advisory Secretariat. Science Advisory Report 2015/046. (English and Inuktitut); (2) Sustainability of a Flexible System of Total Allowable Annual Catches of Narwhals. Canadian Science Advisory Secretariat. Science Advisory Report 2015/006; (3) Marine mammal tag transfer policy and five-point narwhal quota carry-over rule*

c.c.: Jason Akearok, Chief Executive Officer, Nunavut Wildlife Management Board
Peter Kydd, Director of Wildlife Management, Nunavut Wildlife Management Board
Paul Irngaut, Director of Wildlife & Environment, Nunavut Tunngavik Inc.
Scott Gilbert, Regional Director- Fisheries Management, Department of Fisheries and Oceans Canada
Larry Dow, Director Northern Operations, Department of Fisheries and Oceans Canada
Jason Mikki and Jackie Price, Coordinators, Qikiqtaaluk Wildlife Board
Eva Ayalik, West Kitikmeot Regional Coordinator
Ema Qaggutaq, East Kitikmeot Regional Coordinator