Stock definition of belugas and narwhals in Nunavut

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# Context

The Nunavut Wildlife Management Board (NWMB), in its review of advice provided by DFO Science on Total Allowable Harvest (TAH) for Nunavut beluga and narwhal stocks, has asked DFO to provide clarification on its rationale for providing science advice on the basis of known summering stock aggregations rather than at the population level. The NWMB also asked for clarification about various terms used (e.g., population, stock, sub-stock, management unit) and for an update on the current stock identity of belugas harvested by hunters from Iqaluit and Kimmirut.

# مەمەنكىلەد

56025500°C CSAJ&U AA5070JC ۹۶٬۶۵۲٬۹۵۶ (۵٬۴۵) ۵۵،۶۶٬۶۵۲ کرخ۵۶٬۹۸۰ ۵٬۰۶۰ دع۶۰ دغکار ΔΔΥΓΡΟς αλασο Ͻᠻ៸ᡆᢓᡣ᠋᠋ᢀ᠖᠊᠋᠋ᠣ᠋ᠣᢀ᠘ᡔ᠘᠆᠋᠌ᢂᡔ᠘ Jeflarej 5021200°C 4020dc P.Deorbere dusorLighte DLtcn2tdbdc ጋየረՐፈንበσ ለፈረራ ውሲዎና Ρεβργεος μερασε (με) Ρωασερε, δηαευμε, δηαευτε. ACTC ADE CAPE «Pe\_b% a Ababb of Δ ababb of Δ ababb ριγριγ

The term "stock" generally refers to a resource unit: a group of animals that are subject to hunting. The biological definition of a population is a reproductively-isolated group of animals. Stocks defined here may or may not be populations in that sense but they are geographically segregated groups subject to hunting. The term "sub-stock" was used by the Scientific Working Group of the Joint Commission on Conservation and Management of Narwhal and Beluga (JCNB) and the North Atlantic Marine Mammal Commission (NAMMCO) to subdivide the previously known "Baffin Bay Narwhal" stock into smaller management units to reflect information on the "sub-stocks" seasonal segregation. It essentially means "stock". This analysis refers only to management "stocks", keeping in mind that some of these stocks may or may not be "populations" in the biological sense.

**۵۹ ۵-۵۵ «۵۷ ۵-۵۵ ۵-۵۵ کار ۲**۹ ϽϚႱჼϧͼͷϹϷϞͼͽϧͶͼͽϧΫ <u>ϟ</u>ϼϽ<u>Δ</u>ͼϼϲϼ;· ϼϧϥŲϲ Ϸ<u>Ϣͼ</u>ͽΩΫ ۹₀۲۹⊂۲۹ ር<sub>6</sub>σ⊂ ¿የ⊳ን**۲**¿₀ሀ₀ዓϲ ⊳ሚ<sub>6</sub>Ⴍ<sub>%</sub>Ⴑჾъ مەعلەھ مارد، <u>ምንናሀ⊳ሪףሀ∟ግሪ</u> ۲۵۹۹ ۹Ue»۲۹۹ ک۵۰۶۵ کوره ۹۵۹ ۹Ue ۵۵-۵۰ موجه که جوجه دار که **۲۰۹۰ ۲۰۵ ۵۴۵ ۵۴۵ ۵۴۵ ۵۴ ۵۲ ۲۰**۲ ۵۴ ۵۴ ۵۴ ۵۴ ͻϼϥϽϩϷϹϷϿϥͽϩϷͺϩϷϽϧϒϩϷϤͽ እሮሚንያር **ዸጋንት** ይፈገሪ የደረቆ የሆራግሪ የወይ የሆራግሪ د-``د؛ ◊۵⊳د؛ ◊۵۵ د- دوسی ۵۷ ۵۲-۱۵ የ**ርጋ** ሀንጉም (ትላሚህ ፈተርጋ ۹۰۹۰۹۵ ۵۰ ۳۵۲ ۲۹۹ ۹۷ ۹۷ ۵۲۵۹۲ <sup>،</sup> د۲۵۹۵ ۵۲۵ ۲۵ ۲۶ ۲۶ ϽႱϲϧຩϲ∝ **ϧ**Ͷͼͽϼϥϧϧϲ ϧϝϧϧϧϥϧϲͺϿϧϧϧϔϲͽϲ **᠃ە۩ڡ؞**ڶ؇ؚۮۦΔᡄ؞ٛ٢ۮ؞ ؇٥٩ؗڔٵڡۛۮ ؼ؋ڂڡ **"ԵՈՉ**℀Ն*ե*՛Հ" ϹͼͲ ͼϧϹͼͻϿϘͼͽ ϷͼϷϷϞͼϷϽϭ ΔϲΓϧϷϽΔͼͼϥϭ;ͼ ϭϧͽͼ϶ͼ

Factors such as demographic and life history variability, habitat patchiness, environmental change, genetic substructuring and adaptability may result in temporally- or spatiallystructured populations. It is possible to have localized depletions or extinctions if these factors are not considered when harvesting occurs. It is important to choose the definition of stock to suits the management goal. In this case, avoiding local depletion is one such goal, particularly for hunting communities that rely on a predictable seasonal occurrence of animals for their subsistence. This goal also promotes the conservation of genetic diversity which may result from adaptation to local conditions. An example of the depletion of a local beluga stock is the Ungava Bay stock, which has been severely depleted, perhaps eradicated, by commercial whaling.

Δၨ៰**;**<u></u>ϲϧ<sub>ᢞ</sub>ρϲ ϥϽ<sub>ͼ</sub>ϷͺΓϷͽϲ ፟ዻልናጋጮረL፞፝፝፝ኇኯዸር፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟ ባሩ/ኦቃሀዉ<sub>ም</sub>ሀፍ ነት ۹۰۹۶۶۲ مور ۹۲۲ کار ۹۸۶ مورد از ۲۹۶۹ مورد ۲۹۶۹ مورد ۲۹۶۹ مورد ۲۹۶۹ مورد ۲۹۶۹ مورد مورد مورد مورد مورد مورد مورد م ♦♦∪لـﻪد الاههامهعدکد ط۲۹۱مها۲۵۵ ୶୳୷⊳<sub>ଡ଼</sub>୷୲୵ୄ୰ଢ଼ ▷∿ሁረቦ∿ቦᅆႭჄና ▷Lላና ▷ጔᅆ፞፞፞፞ፚዽ፞ና **ϒϹ**ჼb**₽**ჼዉ**Ⴂ**ዎჼ<sup></sup> Δϲ<sub>°</sub>ዮͿϲ ΔΓ∇ϲ ۵۲۹٬۵۰۵۵۵ که ۵۹ که ۵۲٬۹۵ **ላጋበ**ነይናሮሆስ ወይላይ በ σ;ᡄ<sub>ͼ</sub>ϧ⋃ℯσʹϧ·Ͻ<u></u> ⊲⊳୯<sub>ϲ</sub>υΩ<sub>Γ</sub>Τ<sub>δ</sub> ጋናしሊንታር. ርኖኆኇ፫, ር୭dላ ഛୁ፫▷ና ᠈᠆᠋ᢣ᠙᠋᠆ᠵ᠙᠋᠆᠘ᢞᡅᢩ᠉᠆ᡱ᠑ᢟᢂ ጋናႱ**ռ**♭⊵-⊃⊄՝ ۷⊃⊲₀ጋLթ ⊲₀חסק,כטקס, סס⊂₀ס **ላ**ኦ**ዾ**ሲቦ**ዎ**<sup>ሴ</sup>ር ላይ<sup>ъ</sup>ር ላይ<sup>ъ</sup>ር ላይ<sup>ъ</sup>ር ላይ ϪLͽʹϹͼϼͽϪϲϹϧϽϤͼϼϲϧͽ ጋ**ዮሮ**▷በ<sup>ኣ</sup>ኣጭ ወ逊ር▷σ∿ቦር ወﻮሮ▷< ٬۹۳٬۹۵٬۹۵٬۹۵٬۹۵٬۹۵٬۹۵٬۹۵٬۹۵٬ Ϸ≗ኈႱ≪Ϸ< ΔLኈՐϹ ·ዖϲ\_」ႱኈՐႽ **ڡۥٵ**ۮ٥ۥڗ؞ڔ٦٢٩؞ۅؗ ڡؠٵۮ٥٦٦<sub>ه</sub>؞٫٥٩٩۵۵ ᠈ᡆᢕᢀᢄ᠘᠆ᡐ᠘᠘᠘

∕مر<sub>ح</sub>باک⊳⊳ک

## ANALYSIS Methods

- 1) Studies of the seasonal range of the species in Nunavut and adjacent waters by documenting local and written reports of their occurrence;
- 2) Appearance and behavioural differences of animals from different areas of Nunavut and adjacent waters.
- 3) Studies of genetic and contaminant differences of animals from different parts of Nunavut and adjacent waters.
- 4) Tracking animals, using satellitelinked transmitters, to estimate their seasonal range and delimit areas of aggregations.

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# Results

### Beluga Stocks

The combination of the above-mentioned data sources has allowed the identification of six beluga stocks (A: Eastern Beaufort Sea; B: Eastern High Arctic-Baffin Bay; C: Cumberland Sound; E-D-F: Western-Northern-Southern Hudson Bay; G: James Bay; H: Eastern Hudson Bay) in Nunavut.

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م ۹۷ مولام ۲۹۹۹ کوم ۱۹۹۹ کوم Ͻ**ϧϞ**ϲϭϧ ͽυሪδΩ-متفحيهابالهم ۹٬۶٫<sub>۵</sub>۵٬۹۵٬ ۵۵٬۹۵٬۹۵٬۹۹ ͼϼϲͺͻႱͽϲͼ ۵۹۵۵۵۵۵۰ ۵۵۹۵ (۵: **٥٩٢ م. ۲. ۲. ۲. ۲. ۲. ۲. ۲. ۲. ۲. ۲. <°σ<sup>ናь</sup>Ͻ< ΔL&°**υ: b-υ-L: ርረ⊳ንንረፈሪ (ህምቦፊን በር **ርረ⊳ኑ,ጘፈፈ< ‹bc\_\_p**.c.): ወ: **ታΔ<sup>L</sup>\ <Δ: \**: **ዾ**፝፞ዾርረዾኦነጘላ<) ወዋ<sub>ው</sub>< ϪϹͽϲϽϲ

Beluga stocks: A- East Beaufort Sea, B- Baffin Bay, C- Cumberland Sound, D- Northern Hudson Bay, E- Western Hudson Bay, F-Southern Hudson Bay, James Bay. <u>ΔL<sup>3</sup>U: <:</u> d<sup>5</sup>b<sub>1</sub>C<sup>2</sup>.<sup>4</sup>. ν(c<sup>3</sup>U) ΔL<sup>3</sup>U: <: d<sup>5</sup>b<sub>1</sub>C<sup>2</sup>.<sup>5</sup>P<sup>6</sup>bC<sup>2</sup>.<sup>5</sup> ΔL<sup>3</sup>U: C: <<sup>e</sup>σ<sup>5</sup>b<sup>5</sup> ΔL<sup>3</sup>U: b-U-L: Λ<sup>3</sup>U<sup>5</sup>-D<sup>4</sup><sup>6</sup><sup>6</sup>-σ<sup>6</sup>b<sup>5</sup> ΔL<sup>3</sup>U: b-U-C<sup>2</sup>D<sup>5</sup><sup>3</sup><sup>4</sup><sup>4</sup></sub> (Λ<sup>3</sup>U<sup>6</sup><sup>6</sup>-σ<sup>6</sup><sup>5</sup>C<sup>2</sup>D<sup>5</sup><sup>3</sup><sup>4</sup><sup>4</sup></sub> C<sup>2</sup>D<sup>5</sup><sup>3</sup><sup>4</sup><sup>4</sup><sup>5</sup> (Λ<sup>3</sup>U<sup>6</sup><sup>6</sup>-σ<sup>6</sup><sup>5</sup>C<sup>2</sup>D<sup>5</sup><sup>3</sup><sup>4</sup><sup>4</sup></sub>) C<sup>2</sup>D<sup>5</sup><sup>3</sup><sup>4</sup><sup>4</sup><sup>4</sup></sub>) ΔL<sup>3</sup>C<sup>2</sup>C<sup>3</sup>



The stock harvested by hunters from Iqaluit is not known for certain, but is thought to be the Western-Northern-Southern (WNS) Hudson Bay beluga stock (E-D-F), to whom they are most similar genetically. 

## **Results** Narwhal Stocks

Stock definition in Nunavut narwhals is not as clear as it is for belugas. Tracking results offer the best indication of geographic segregation in summer and, in the case of the Northern Hudson Bay stock, yearround. There is also some evidence from genetics and contaminants of stock partitioning in High Arctic narwhals. On that basis, five Nunavut narwhal stocks are identified (A: Somerset Island; B: Admiralty Inlet; C: Eclipse Sound; D: East Baffin Island; E: Northern Hudson Bay) and three more (F: Parry Channel; G: Jones Sound; H: Smith Sound) are hypothesized to exist based on the fact that narwhals have been sighted or hunted in these areas in summer and also because other stocks are sedentary during the same season.

## **Υερύες** Σήςς Ρυσσηγία

٬۹۲٦٬۵۵۶٬۹۹٬۲۹٬۲۹٬۹۹٬ የPULL ጋሀዲስ የሰባ ላስ የሰባ ላሳ የሰባ ላሳ የ ላወን ብሪ ግሪ ገር የባለ መስት የ መስት በ **Ͻ**ʹ└ᡄᡄᠧᢣ᠋ᡔᢣᢋᡆ᠘ᢑ᠂ᡆᡕᢩᡕᡗᡄ᠋ᡣᢧᢋ᠋ᡕ مےم۷۰۶۹۲۲۲۹۶ م۵۰۵۹ *᠆*᠘ᡖᢐ᠆᠕ᡪᢣᢩᡁᢄᠴ᠕᠈ᢣᡁᢧ᠕ᡔᠣ᠙᠘ᡒ **ხ**Ⴖ**ჲ**ኈႱ*Ⴣ*ჺ ‹ძჺႮჂ< Ⴢ<u>Ⴡ</u>ႺႰႱჾჿ Ͻᢟ᠈᠋᠘ᡬ᠆ᠴ᠋᠘ᡬ᠆ᡆ᠕ᡬ᠆᠘᠘ ϽႱ**ϲϲͺϼ**Ϣϧϧϧϧϧϧϧϧϧϧϧϧϧϧ (**Ϥ**: ΔΡϚ**ϞϷ< ˤ**ΡΡˤϷϹኈ<code>Ⴑ</mark>: <: Δ<ΛϤ᠈ϟ<</code> ՟Ե∿Ր<sup>ւ</sup>թ⊃վ⊃<sub>Ն</sub>Ր։ Lշ⊂⊳< Ϲ៸ϷϧͽͱʹϷ;ͺϷ;ͺϤͱϽͺ ϘΓϧϞ <u> ۵۹٬۳۵٬ ۲۵٬۹۹٬ ۲۵٬۳</u> ۵Lኈレ) Δረ۲LՆ۶۵۲۲۰ ርብ›ላዾውይህን አይግራወረጉ Cdbbechailer Pade ለነፋር⊳ሆ∈⊃≏ ⊲∖₅∟ር ጋቦናċ ՟፲ማሪያዮሪታም የግግሮ ምርም የግግር ማይት የ

Narwhal stocks: A- Somerset, B-Admiralty, C- Eclipse, D- East Baffin, E-Northern Hudson Bay, F – Parry Island, G- Jones Sound, H – Smith Sound. <u>Ͻͺϳͺ;ͺͼͺϷͺͶͼͽͺͿͺϳͼ</u> : Ϥ: ΔΡϚϒϷ ͼϼϼͼϷϹͽͺͿ: <: ΔʹϒϤͽϟʹ ϷͽϹͼϷͺϿϤͺϿͽͺͿ: Ϲ: ΓͼͶϹϹϲϷʹ ϹϒϷϧͽͺͿ; Ϸ: Ϥϧϳʹ ΔϹͼϹϲϿʹ ϹϹϷϧͽͺͿ ϷϤϲͼϭϥ ΔϹͽϹ; Γ: ϤϷϒΔͼϽʹ ΔϹͽͺ ϲ: ϒͼͼϣϤϭϗϷʹΔϹͽ



#### Sources of Uncertainty

The stock definitions are provisional since they are based on an incomplete state of knowledge, particularly for narwhal stocks, for which information is equivocal in some cases and all but absent in others. There is uncertainty about the beluga stock present in Frobisher Bay during the summer months. These stock definitions can be altered if any new information changes these conclusions.

#### مـــم، ۱۵٫۹۵۵۹ م.۵۵

Č٥d٩ ٩٩٩٩ **ጋ**ዮነር⊲ጋሀ<sub>°</sub>ር< ݡݙᡄᢎ᠋ᢂᡶᡕᠧ᠕ᢐᡷᢕᠸᢏ <sup>ϳ</sup>ʹϧϷϽϲͳϫʹϿͽϧϲϽϲͽ ͽͻͻϧϧϯϧϥϤϲͽϽͼͽϚͷϤϧ ع`بار ملحمه کو ٬٩دےلکْ<sup>c</sup> ۵۵۹٬۰۵۲ م **CP94 26% 45%** ۵٫۵۹٬۵۵ م۰۵٬۵۰ **ϤϞϧ**ͺͽϲͺϒϹϩϷͼϧႱϲϽϲ CpqdcDde ۹۰مەمەد ۹۶۵ ۹۰% مەربە ۹۵۶-۹۵۵ ۲۵۹۹ والمه ጋቦቦታኈቦና ፈናኈቦቦፈሁኣኣና ግሀየኑውባኑዋር «ገጋዉ **ϞͼϷϲϽͼ**Ϸͻϖ معمهدهم

#### Conclusions

The use of summering stocks as management units as we have done here is considered precautionary. As mentioned above, it is possible to have localized depletions or extinctions if this consideration is not taken into account when harvesting occurs. Even with information that is preliminary and based on small samples, by adopting as many stock units as are suggested by this information, co-managers reduce the risk of over-exploitation. For example, overexploitation could occur if smaller stocks are assumed to be part of a larger- and wider-ranging stock, when in fact they are segregated for all or part of the year and have some annual site fidelity to specific areas.

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۹۵۹٬۹۳۵ ۵۵٬۹۵۶ ۵۵٬۹۵۷ ۵۵٬۹۵۷ **ՉԻՇշՍԳՐ⅂շ Ճր**վչթԿՇշՍթ ᠕ᡣᢀᢀᢀᢀ᠕᠘᠘᠘ فدلاحمه معرفه بالمعالية بالمعاد بالمعالية بلمعالية بالمعالية بلمعالية بلمعالية بلمعالية بالمعالية بالمعالية بالمعالية بالمعالية بالمعالية بالمعالية بلمعالية بالمعالية بالمعالية بالمعالية بلمعالية معالية بلمعالية معالية معالي معالي ممالي معمالي معاليم معالية معمالي معاليمعالية معلما مما ۵،۹۹۲۲۵ ،۹۹ ۵۲۵ ۵۲۰ ۵۹ ۵۲۰ ۵۹ <u>ک</u>دیاد میادخد،۵۵۹ههکه ۵۹ه ک ጋሁትላህሪ ୵୭੶୷৽₽₽₽₽₽₽₽ کوریا∿و⊲ د∍∪دیا <u>የየአትሪሀንዲምሪ ላን አሁራት የቀን የ</u> **ϷͼϷͻϧϧͺϭͻυϷͺʹͺ**ϷϽϧϧͼϼυυ<sub>ϲ</sub>Ͻϲ <u></u>ΡΓϧϲ ᠗᠊᠗᠆ᢀᢙᢛᢕ᠋᠘᠆᠘᠘᠆᠕᠆᠖᠆᠖ ۸۶۰٬۶۰ ۵۲٬۳۰ مرک<sup>ی</sup> ۲۵٬۵ ΓΡοσιολας ρυσια ϪϲՐϧϷαϟϹϟϷͿͶͽͺϤͽϹϿͼϳͽ;Ͻͼ ⊳∿لاد⊃۲ م2٬۲۵۵ و د∂د ۹۰۹<sub>۵</sub>۹۹۲۲ موم ب<sub>ا</sub>۳۲۲ کا۲۹۵ ΔϲΔͼϥͽϧϿͼϼϲ Ϥ;ϲϽͺ ϘϲͽϧͼϿ 

