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Proceedings of the RAP Meeting on Hudson Bay/Foxe Basin Bowhead

17-18 June, 1999
Iqaluit, Nunavut

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February 2000

Canada

TABLE OF CONTENTS

Abstract 3

Résumé 3

ᓯᕗᓂᐊᓂ ᐅᓂᒃᑳᖅᑕᐅᔪᑦ 3

Introduction 4

Hudson Bay/Foxe Basin Bowhead SSR 4

- Background 4
- Species Biology 5
- The Hunt 5
- Industry Perspective 5
- Stock Delineation 5
- Stock Size 6
- Stock Trend 6
- Sustainable Hunting Rate 6
- Sources of Uncertainty 8
- Outlook 8
- Other Considerations 9
- Management Considerations 9

Final Comments 9

References 10

Annex 1. Agenda 11

Annex 2. Participants 13

Annex 3. Comments by External Reviewer 14

Annex 4. Response of Reeves and Wade to the Proceedings 19

Abstract

This document reports on a Regional Advisory Process (RAP) meeting on the Hudson Bay/Foxe Basin Bowhead stock held in Iqaluit, Nunavut, 17-18 June 1999. Meeting participants discussed a draft Stock Status Report (SSR), supporting documents and presentations by participants. Comments on the draft SSR from an external reviewer are also appended. The participants favoured the two-stock hypothesis for eastern Arctic bowhead. Northern Foxe Basin was identified as a calf aggregation area. The Inuit participants offered information suggesting that the stock is recovering. The meeting participants agreed, based on the Potential Biological Removal approach, that a harvest level of one bowhead every two years is safe. The proceedings of this meeting were used to revise the SSR of the stock. The external reviewer's comments on the proceedings are provided in an appendix.

Résumé

Ce document rapporte les discussions tenues durant une réunion de Processus d'examen régional (PER) sur le stock de baleines boréales de la baie d'Hudson et du bassin Foxe, réunion du 17-18 Juin 1999 à Iqaluit, Nunavut. La discussion des participants à la réunion a porté sur le rapport d'état de ce stock (RES) et sur des documents de support et des présentations effectuées par des participants. Le rapport comprend aussi en annexe des commentaires fournis par un réviseur externe. Les participants ont fait part de leur support pour l'hypothèse voulant qu'il y a deux stocks dans l'est de l'Arctique. Le nord du bassin Foxe a été identifié comme un lieu d'aggrégation de veaux de baleines boréales. Les participants inuits ont fourni de l'information qui suggère que le stock est en voie de récupération. Les participants à la réunion se sont entendus pour conclure qu'un niveau de chasse de une baleine boréale aux deux ans est durable. Le compte-rendu de cette réunion a été utilisé pour réviser le RES de ce stock. Les commentaires du réviseur externe sur ce compte-rendu sont fournis en annexe.

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Introduction

A Regional Advisory Process (RAP) meeting to discuss the Hudson Bay/Foxe Basin Bowhead stock was held in Iqaluit, Nunavut, on 17-18 June 1999. A draft Stock Status Report (SSR) on Hudson Bay/Foxe Basin Bowhead was the focus of the meeting. Prior to the meeting, the draft SSR was translated into Inuktitut and distributed to community participants through the Hunters and Trappers Organizations. The agenda of the meeting is itemized in Annex 1. Participants are listed in Annex 2. Comments of an independent researcher who reviewed the draft SSR and Research Documents but could not attend the meeting are in Annex 3.

The agenda was reviewed and adopted as presented, with provisions for an initial caucus between hunter participants and the NWMB Chair. Participants agreed that further caucuses could be held as needed. Opening remarks were made by the Chair of the meeting who provided the background to and outlined the nature of the discussions to be held during the meeting. The Chair of the meeting presented background information on the Regional Advisory Process (RAP) describing the nature of the RAP, the roles of DFO and other RAP participants and the resulting products of the RAP.

Community and NWMB participants raised concerns about representation at the meeting because the Repulse Bay representative had been unable to attend and neither of the two relevant Regional Wildlife Organizations (RWOs) was represented. It was agreed that documents coming out of the meeting would be broadly distributed for comments and would be sent to both RWOs. DFO indicated that the final version of the SSR would attempt to reflect changes discussed and agreed to in the meeting as well as this broader review. The Chair also clarified that SSRs are living documents, in the sense that they can be updated as new information becomes available.

The following is a summary of comments and suggestions made section by section as the draft SSR was reviewed by the RAP participants.

Hudson Bay/Foxe Basin Bowhead SSR

Background

The general species description in the ‘Background’ section was discussed. Participants agreed that the text should specify that the endangered listing is that of COSEWIC and should spell out COSEWIC. Based on comments by the external reviewer (Annex 3) and the Mitchell and Reeves (1982) paper, it was agreed that 1951 is probably a relatively accurate date for the end of commercial whaling (Annex 3). DFO participants suggested using the word population instead of stock. The genetics data outlined in the Maiers et al. (1999) Research Document suggests that Hudson Bay/Foxe Basin (HB/FB) bowheads are a separate breeding population from whales in Cumberland Sound. It was agreed that the circumpolar distribution should be described as being discontinuous or disjunct. The NWMB pointed out that the McLaren and Davis

(1982) surveys suggests that wintering locations may include eastern Hudson Bay and that this should be reflected in the SSR.

Species Biology

During this discussion, participants agreed that references to bowheads over 20 m should be included and to confirm that these specimens were Bering/Chukchi/Beaufort whales rather than eastern arctic animals. It was noted that there are no data from Nunavut on calving intervals. It was also noted that the smallest females with calves observed in Foxe Basin were of similar size to the ones measured in the Bering/Chukchi/Beaufort stock. One participant suggested that reference be made to the relative value of biological information derived from hunted samples compared to aerial. There was also discussion about methods that have been used to estimate the ages of bowheads. It was agreed that all methods suggest that bowheads live a long time (more than 100 years).

The Hunt

The external reviewer had suggested that "Sanctioned" hunt should be changed to "licensed" hunt. Keith Hay indicated that traditional knowledge does not report any catches between 1975 and 1994 but there were strandings that were often attributed to killer whales. One of the community representatives indicated that two bowheads were harvested near Hall Beach in the two years prior to 1963 and that three bowhead carcasses were found beached.

Industry Perspective

Participants discussed the relevance of this section. It was noted that the hunt is not an industry but it was suggested that there should be a section giving the resource user perspective. One participant also suggested that the perspective of the tourism and whale-watching sectors should be represented.

Stock delineation

The draft 'Stock delineation' section was discussed and L. Maiers presented genetic results in support of this section. Participants noted that there are no samples from North Baffin and the possibility remains that North Baffin bowheads could be related to the northern Foxe Basin animals. Also, few samples are available from Hudson Bay. Nevertheless, the genetic results offer evidence of stock separation between the Foxe Basin animals and those sampled in Cumberland Sound and in the Beaufort Sea. This evidence supports the two stock hypothesis for Nunavut bowhead but it was considered premature to conclude that Cumberland Sound whales are representative of all Davis Strait bowheads. Participants suggested that high arctic bowheads could be genetically different from Cumberland Sound bowheads so additional work on stock structure is still needed. The external reviewer also raised this point, that there could be more than 2 stocks in the eastern Canadian arctic. It was

agreed that, in this section of the SSR, the geographic locations where the whales were sampled and not the stock names should be used when comparing results.

Stock Size

The draft 'Stock size' section was reviewed. S. Cosens explained that the numbers presented, 270 and 75, are estimates from summer aggregation areas only and not from the total population summering range. She also emphasized that the accuracy of a count is affected by diving animals that are below the water surface and cannot be seen and resting animals at the surface that are difficult to see. In conclusion, these are minimum estimates, not total population numbers. Nevertheless, participants noted that these numbers were higher than the often quoted 'tens" of animals that this population was thought to number. Some participants felt that surveys should be done in mid-July when local people see many bowheads feeding along the ice edge. S. Cosens explained that the choice of August surveys was made because probably not all the bowheads would have migrated into the aggregation areas by July. While results presented suggested that N. Foxe Basin was the main aggregation area for females with calves and juveniles, local participants reported that there are also frequent observations of calves in Northern Hudson Bay (also IBKS).

Stock trend

In reference to stock trend, local participants noted that Foxe Basin people rarely saw bowheads 40 years ago but that they are regularly seeing them now. The NWMB participants noted that their traditional ecological knowledge (TEK) study suggests that more whales are being seen now than during the 1960s in Foxe Basin. In Northern Hudson Bay, the perceived increase in bowhead numbers has occurred since the 1970s.

Participants concluded that estimated initial pre-whaling stock sizes should be given to give perspective to the present day estimates. A pre-exploitation stock size of 575. has been estimated (see Woodby and Botkin,1993, in The Bowhead Whale, The Society for Marine Mammalogy, Special Publication 2). The current estimated numbers using the main summering areas are more than 50% of the estimated pre-exploitation stock size.

An NWMB participant pointed out that calculations of pre-exploitation stock size assume that there is interchange between northern Foxe Basin and northwestern Hudson Bay. If there is no interchange, then estimates of pre-exploitation stock sizes would be incorrect and would apply only to N.W. Hudson Bay. Other participants suggested that the decline in sightings around northern Foxe Basin (until the 1960s), where commercial whaling did not occur, supports the idea that bowheads using these two areas belong to the same stock.

Sustainable hunting rate

The draft section on 'sustainable hunting rate' was reviewed. Participants asked for an explanation of the Potential Biological Removal (PBR) approach. S. Innes outlined the

rationale behind the approach: how the PBR is calculated and its proposed application to the Hudson Bay/Foxe Basin bowhead whale population. Consensus was reached that this was a useful tool for estimating a sustainable hunting rate.

S. Innes summarized the possible outcomes of estimating PBR for the HB/FB population (Table 1). Calculated levels depend on whether bowheads in northern Foxe Basin and Hudson Bay are treated as belonging to the same stock or as belonging to separate stocks. Estimated safe harvest levels also depend on the status of the stock. The method incorporates a recovery factor that S. Innes varied according to three possible status designations (endangered: 0.1; unknown or threatened: 0.5; population at optimum sustainable population size: 1.0).

Table 1. Summary of Potential Biological Removals calculated for the HB/FB bowhead population.

Stock defin.	endangered	unknown or threatened	optimum sustainable population (OSP)
Foxe Basin separate	0.5/yr or 1 in 2 years	2.5 /yr	4.9/yr
Hudson Bay separate	0.1/yr or 1 in 10 years	0.6 /yr	1.1/yr
Foxe Basin/ Hudson Bay	0.6/yr or 1 in 2 years	3.1 /yr	6.2/yr

NWMB and local participants proposed the adoption of the Foxe Basin/Hudson Bay and the ‘unknown’ or ‘threatened’ options. They proposed therefore to recommend a sustainable hunting rate of 3 per year. DFO participants were not comfortable with this proposal because interchange between Hudson Bay and Foxe Basin bowheads has not been confirmed. Furthermore, it was noted that any change in status could only be done through the COSEWIC process. Participants agreed that the NWMB should request a COSEWIC review of the endangered status of bowheads of Nunavut. A suggested sentence to be added was:

> "Using the PBR method (Wade 1998) for an endangered stock, a safe harvest level of 0.6 whales/yr or 1 whale in 2 years was recommended. However, recent information on stock size suggests that endangered status may no longer fit this stock, and the status of the stock needs to be re-assessed".

Consensus was reached to use this proposed wording. Community participants wanted to be sure that their disapproval of the 'endangered' status and their view that the stock should be delisted would be clearly noted in the SSR. They also indicated that northwestern Hudson Bay and northern Foxe Basin should be treated as belonging to the same stock. One participant pointed out that the adult males and non-nursing females, not present in northern Foxe Basin had to be somewhere and northwestern

Hudson Bay was a likely location. The NWMB pointed out that in the final report of the Inuit Bowhead Knowledge Study Report, there will be maps showing probable migration routes. These probable routes link northwestern Hudson Bay and northern Foxe Basin, further supporting the idea that whales using these two summering areas belong to the same stock.

All participants agreed that the NWMB should request a review by COSEWIC of the status of Nunavut bowhead whales, given the new information available that suggested an increase in numbers during at least the last three decades and DFO's stock numbers that are 50% of the estimated initial population size. It was hoped that future stock identification research would clarify the issue of whether there are one or more stocks in Nunavut and that new information could be incorporated into an updated SSR.

Sources of uncertainty

The draft 'Sources of uncertainty' section was reviewed. S. Cosens emphasized that the aerial surveys do not estimate total stock size because some surfaced animals are missed and other animals are below the surface and, finally, some animals were probably outside of the survey area. Participants noted that 80% of the estimate for Foxe Basin consists of juveniles so there must be adults somewhere else. Even the estimate of 75 for northwestern Hudson Bay may underestimate the number of adults needed to produce the number of juveniles present in northern Foxe Basin. S. Cosens concluded that these biases lead to underestimates of population sizes. She also noted that questions about the validity of the strip width used for the strip census estimate raise the possibility that some numbers used to calculate the population estimate could have been over-estimated. She clarified that this bias is small compared to the afore-mentioned biases that underestimate whale numbers.

Participants noted that the issue of stock identity (i.e.: relatedness of Foxe Basin and Hudson Bay bowheads) remains. They further noted that lack of information on high arctic bowheads and their possible relationship with Foxe Basin bowheads are additional sources of uncertainty in assessing the stock. There was further discussion about relationships among northern Foxe Basin and northwestern Hudson Bay whales but new points were not raised.

Community participants confirmed the importance of traditional hunting to Inuit in Nunavut. These views are summarized in the Resource User Perspective. Community participants repeated their view that the endangered status of this stock should be removed.

Outlook

The draft 'outlook' section was reviewed. S. Cosens emphasized that the Inuit Bowhead Knowledge Study suggests that bowhead whale numbers are recovering. K. Hay recommended that this section give details, dates and numbers of when numbers started to increase, drawn from the NWMB Inuit Bowhead Knowledge Study.

The external reviewer suggested that monitoring calf production might be a useful way of tracking changes in the status of this stock.

Other considerations

Meeting participants discussed other factors that might affect bowhead whale numbers. Local participants noted that killer whales have been seen both in Foxe Basin and northwestern Hudson Bay. More sightings of killer whales have been made in northwestern Hudson Bay than in northern Foxe Basin. Community participants indicated that there have been a few sightings around Igloolik. The NWMB indicated that the Inuit Bowhead Knowledge Study reports killer whale attacks on bowheads. There was discussion about the role killer whales might play in causing strandings of bowheads. Dead whales are sometimes found but the cause of death usually cannot be determined but Inuit often say that it was caused by killer whales. Participants thought that killer whale attacks may cause some of this mortality. Participants also noted that ice entrapment could also be a factor causing some mortality.

Management considerations

The draft 'management considerations' section was discussed. Attention was given to the possible impact of hunting in northern Foxe Basin where the adults are likely to be nursing females. Community participants suggested that the SSR should state that Inuit wish to hunt bowheads "unaccompanied" by calves.

The impact of shipping was also discussed but it was agreed that the impact is probably negligible at present. The current environmental assessment process screens activities that could impact on bowheads in the summering areas.

Final comments

Participants agreed that the revised SSR and the proceedings of this meeting would be translated and sent to the NWMB, the HTOs and the regional wildlife organizations representing Foxe Basin and N. Hudson Bay. The proposed timeline would be:

1) send the documents for review by mid-August;
2) send comments back to DFO by mid-September.

The documents would also be considered at the next NWMB meeting in Repulse Bay on 23 August.

The meeting Chair thanked participants for their hard work. Many thanks were also extended to Rebecca Mike who had volunteered to do the simultaneous translation of the meeting when the contracted interpreters failed to show up. The meeting was adjourned.

References cited

Maiers, L.D., de March, B.G.E., Clayton, J.W., Dueck, L.P. and Cosens, S.E. 1999. Genetic variation among populations of bowhead whales summering in Canadian waters. Canadian Stock Assessment Secretariat Research Document 99/xx.

McLaren P.L. and Davis, R.A. 1982. Winter distribution of arctic marine mammals in ice-covered waters of eastern North America. Unpublished report prepared by LGL for Petro-Canada Exploration, Inc., Calgary, Alberta, xiii + 151 pages.

Mitchell, E.D. and Reeves, R.R. 1982. Factors affecting abundance of bowhead whales *Balaena mysticetus* in the eastern Arctic of North America, 1915-1980. Biological Conservation 22: 59-78.

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

Annex I
Agenda for the Hudson Bay/Foxe Basin Bowhead RAP meeting
Chaired by Pierre Richard
June 17-18, 1999
Parnaivik Board Room, Iqaluit, Nunavut

9:00 Opening Prayer

9:05 Review and Adoption of Agenda

9:15 Introduction **Pierre Richard**
- i) Background of Stock Assessment Process
- ii) Roles and responsibilities (DFO and participants)
- iii) Approval process and results of RAP
- iv) General Remarks on the approach for this review

10:15 Coffee

10:30 Presentation + discussion draft SSR **Susan Cosens, All**
- Background
- Species Biology
- The Hunt

12:00 Lunch

1:00 Continue discussion of draft SSR **All**
Resource Status - stock delineation
- stock trend

3:00 Coffee

3:15 Sources of Uncertainty **All**

5:00 Adjourn

Friday, June 18

9:00	Opening prayer	
9:05	Other considerations	**All**
9:30	Management Considerations	**All**
10:00	Coffee	
1015	Continue discussion about Management Considerations	**All**
11:30	Final comments and discussion	**All**
12:00	Meeting adjourned	

Annex 2
Participants at Hudson Bay/Foxe Basin
Bowhead RAP workshop

B. Kovic	(Nunavut Wildlife Management Board)
R. Mike	(Nunavut Wildlife Management Board, Interpreter of Workshop)
W. Nakoolak	(Coral Harbour Hunters and Trappers Organization)
J. Palluq	(Igloolik Hunters and Trappers Organization)
A. Kipsigak	(Hall Beach Hunters and Trappers Organization)
S. Cosens	(Fisheries and Oceans Canada, Winnipeg)
S. Innes	(Fisheries and Oceans Canada, Winnipeg)
L. Maiers	(Fisheries and Oceans Canada, Winnipeg)
P. Richard	(Fisheries and Oceans Canada, Winnipeg, Chair of Workshop)
G. Williams	(Nunavut Tunngavik Incorporated, Iqaluit)
K. Hay	(Nunavut Wildlife Management Board)
C. Filion	(Nunavut Wildlife Management Board)
R. Reeves	(Okapi Wildlife Associates)

Annex 3

Comments by external reviewer on the draft SSR prior to the workshop

Under background, 1st para. - "currently listed as endangered" - by whom, what authority? The IUCN currently lists the species as "Lower Risk: conservation dependent". Lower Risk means that the species "does not satisfy the criteria for any of the categories Critically Endangered, Endangered or Vulnerable." Conservation dependent means that the species is "the focus of a continuing taxon-specific or habitat-specific conservation program targeted towards the taxon in question, the cessation of which would result in the taxon qualifying for one of the threatened categories above [Critically Endangered, Endangered, Threatened] within a period of five years."

Of course, there is no reason at the moment to get into the details of the debate about the IUCN categories or criteria. My only point is that, in my view, it is important for you to specify here that the species is listed as endangered by the Committee on the ... (should spell out; don't assume that readers will know what COSEWIC stands for). I realize that your audience, from your point of view, is Canadian only. I always try to read something like this from an international (and IWC-influenced) perspective, so these things matter (to me).

2nd para.: Insert "mainly" after "summers" - obviously bowheads occur in many other parts of Hudson Bay, and even occasionally Hudson Strait, in "summer".

Also in the 2nd para., I strongly disagree that you should be looking for "the wintering ground" of this stock. There is little doubt that the whales overwinter in more than one "ground". In fact, you may never find a single area that can be described as "the wintering ground" of this stock

3rd para., Inuit were involved in commercial whaling in Hudson Bay into the early 20th C., as Comer's journal (W.G. Ross, ed., 1984) makes clear.

Note that the name was Hudson's Bay Company not Hudson Bay Company.

I am endlessly puzzled by the ways material that I have published gets interpreted. I guess it says a lot about my communication skills. Why did you pick the year 1930 to say that Inuit whaling in association with the HBC ended? In Mitchell/Reeves (1982, p. 63) reference is made to a hunt at Seahorse Point in 1934, and on p. 64 a kill at Lyon Inlet in 1940. As I keep trying to explain, the documentation needs to be interpreted for what it is - just the notes and jottings of people who happened to be places at particular times, and then happened to record what they saw and heard. The

quote from Sutton & Hamilton on p. 66 of Mitchell/Reeves tells the story: "Other whales have doubtless been seen and killed since the establishment of the Post in 1924, but I do not happen to have data concerning them." We then offer our own judgment about the nature of our compilation: "We ... suspect that considerably more whaling activity has taken place than we can document; our data no doubt are heavily biased in favour of areas and periods for which literate informants were present."

I stand by those observations and therefore caution you (and Stu) that it is not responsible (or scientific) to use the data in Mitchell/Reeves as though they represent a complete record of bowhead whaling between 1915 and 1980. We did not ever imply that they did.

One reasonable interpretation of the data in Mitchell/Reeves (1982, Table 1) is that the apparently high level of activity in the 1920s and apparent decline in the 1930s are both artifacts of reporting. Specifically, note that Sutton and Hamilton's book was published in 1932, and it was a key source. Also, HBC journals just happened to be available for the 1920s in the areas where bowhead whaling was encouraged. Until one has really checked carefully, one should not conclude that whaling activity stopped in the 30's. Also, I think it is fair to assume that any whaling through at least the 1950s would have involved the sale of at least some of the products to the HBC.

Note that on p. 37 of Reeves and Mitchell (1990) we refer to two or three kills at Southampton Island in the 1940s, which were not included in the Mitchell/Reeves table. I tripped over the sources in the Public Archives while looking for something else. My search for data has been sporadic and miscellaneous, and the results should always be interpreted as a kind of lower end of the confidence interval - i.e. there was at least this much whaling, not there was this much whaling, period. Note that in the paper with Heide-Jorgensen published in 1996 on West Greenland, two more kills are noted for the Davis Strait stock that were not included in Mitchell/Reeves (Table 1). Again, please always bear in mind that the records of bowhead kills before the last few years (?) were not systematically recorded. Therefore, they don't mean what some people seem to think they do.

Final paragraph of the Background section:

1st sentence - why ignore the 1994 kill?

For two reasons I have a big problem with the 2nd to last sentence. First, the whole idea of managing a hunt for animals in any population, much less one this small, on the basis of past kill levels is extremely flimsy, esp. when later in the document reference is made to the PBR formula (a

painstakingly developed, risk averse procedure) as though it is now serving as the basis for management of this bowhead hunt. Second, my diatribe above is intended to point out (once again) that you cannot use the catch history - incomplete as it is - along with qualitative judgments about recent population trends (traditional knowledge) to come up with a credible management formula. But more on that later.

Page 2 of SSR, under The Hunt:

The term "sanctioned" is ambiguous. Much (most?) of the hunting before 1979 was "unsanctioned". As we mentioned on pp. 69-70 of Mitchell and Reeves (1982), and see pp. 397-98 of Reeves and Mitchell (1985 - RIWC 35:387-404), there was a permit/licensing system in place from 1951 or so. I'm pretty sure that the hunting in N. Foxe Basin in 1964-71, Repulse Bay and Coral Harbour in the 1970s and Igloolik in 1976 was not "sanctioned". By the way you state it here, the reader is led to conclude that it was.

In the middle of this section, reference is made to there being a regular hunt. It was my understanding, based on Stu's PVA exercise, that the hunt in 1996 was authorized as a one-time "symbolic" event. Of course, I am not surprised that it is now being described as an ongoing and regular event.

Under "Stock Size" - your statement that the two estimates "appear to be additive". As I recall, there was a lot of uncertainty and confusion about the NW Hudson Bay survey's distance-from-trackline estimates. In fact, I remember being confused as to whether this was a strip or line transect survey (or some kind of hybrid?).Also, it seems presumptuous to assume that the distribution would be the same between years - esp. when you have hypothesized considerable interannual variation in calf production and thus, by inference, occupation by adult females of the "nursery" ground. This is a wobbly way to estimate numbers.

Although you admit the possibility under "Uncertainties" of positive bias (in the 1994 estimate) due to underestimation of distance from trackline, you ignore that possibility here under "Stock Size". As for the amount of availability bias, see my later comments re: possible differences in dive behavior between classes of bowheads.

Your parenthetical query about calves: I think it would be useful to have the historical data (e.g. Table 2 in Reeves and Mitchell 1990) re-examined for dates, localities, and size/sex of whales. I'm pretty sure that this exercise would demonstrate that adult females and young whales were more widely distributed than your photogrammetry work has indicated thus far.

At the end of this section, your observations about segregation sound remarkably similar to the situation in the Baffin Bay/Lancaster Sound

region - perhaps it is worth noting that here and citing Finley (1990)?

Stock Trend -

Well, you wouldn't really expect traditional knowledge to supply an "estimate" in the sense you mean it here, would you? It would make more sense to just state that elders and hunters have reported seeing more ....

Sustainable Hunting Rate -

As discussed above, I do not accept the validity of Stu's approach. Also, I am bothered by the implicit assumption that all anyone is interested in is replacement yield in evaluating "sustainability". No one seems to have the slightest interest in population recovery. I trust that you intend, possibly during the meeting in Iqaluit, to discuss at length the suitability of using the PBR algorithm and that you will show clearly in the resultant draft of the SSR the various parameter values chosen (and why). I note with interest that PBR for the North Atlantic right whale, with a min. abundance estimate of 295, was calculated as 0.4 in 1997 (Waring et al. 1997).

Sources of Uncertainty:

Your reference to the possibility that animals beyond 600 m were counted made me go back to the paper and look at your methods. I agree with your conclusion that "a more rigorous survey is needed". In fact, rereading your descriptions of how you collected and analyzed the data made me wonder whether it would be more appropriately precautionary (and surely every scientist would agree that any assessment of a whale population thought to number only in the mid hundreds or so, at most, should be precautionary) to use your alternative central estimates of 150-170 rather than 250-280 as your "best" estimates of "surface" animals.

Outlook:

The first sentence is hopelessly vague, and thus misleading. Surely "the past" needs to be qualified somehow. Judging by the history of commercial whaling vs the present-day occurrence in NW Hudson Bay (Roes Welcome etc.), anyone would have to agree that there are fewer bowheads today than there were "in the past".

Your finding about calf production is extremely important. In fact, monitoring of calf production is probably the best way to assess this population through time.

Other Considerations:

Have you checked the review paper by Reeves and Mitchell (1988) on killer whales in the eastern Canadian Arctic? We found very little evidence that killer whales are present in Hudson Strait, Hudson Bay, and Foxe Basin. In fact, I find it interesting that you have some scarred and mutilated tails in the "Hudson Bay" bowhead population. If the incidence is more than a few individuals, I would become suspicious about what we think these bowheads are doing. Maybe they spend a part of their lives in more 'exposed' areas where killer whales are more common - e.g. Lanc. Sd, Davis Strait, Labrador Sea?

Management Considerations:

What would you want to protect the summering habitat from? Besides motor boat and ship traffic?

Looking at your Fig. 1 of the SSR I am troubled by the summer concentration marked in Cumberland Sound. I wonder if you should not be thinking about a much more complicated stock structure than just 2 stocks. The Maiers et al. paper, which I will comment on later below, is really using only the Cumb. Sd sample to represent the Davis Strait-Baffin Bay stock. But if there is a summer concentration in Cumb. Sd, perhaps those whales winter in the Labrador Sea while animals from Baffin Bay move down into Davis Strait for the winter. These summer concentrations may each be a stock unit of some kind - at least I think people should open their minds to the possibility ....

Annex 4
Response of Reeves and Wade to the Proceedings
(commented by Richard P.R., S. Cosens and S. Innes, DFO Winnipeg 12 Oct. 1999)

Stock Trend

There still appears to be a major misunderstanding as to what the estimates of 'pre-exploitation stock size' really mean. Meeting participants have already noted two of the problems in these estimates: the lack of good evidence of stock identity and the uncertainty about limits of distribution for different stocks. Other major problems are the incompleteness of the catch history and the absence of any quantitative data on the population size at the end of the era of intensive whaling. The utility of the estimates produced originally by Mitchell (1977) and later by Reeves and Mitchell (1990) and Woodby and Botkin (1993), all converging on values in the range of 450-575 for the aggregate Hudson Bay-Foxe Basin "stock,"was to show that there were *at least* a certain number of whales present in these areas when commercial whaling started. As Woodby and Botkin (1993) repeatedly emphasize, the estimates are *minima* and should not be used incautiously as though they were derived from good data on removals, biological parameters, and quantitatively derived benchmark abundance values. If the whales in this region are in fact a reproductively and demographically isolated population (a hypothesis that cannot be ruled out by the available genetic and other data), then an initial population size of only 450-600 would make them naturally rare and intrinsically vulnerable to extinction based on stochastic considerations alone. However, given the nature and amount of uncertainty in both the data and the underlying assumptions for the "pre-exploitation stock size" estimates, it is unreasonable and incautious to assess percent recovery using such estimates as though they were "best" estimates of initial stock size.

<u>Comments:</u> It is agreed that estimates of initial population size are minima and the text of the SSR has been changed to reflect this. The estimates of present population size are also minima. The committee wanted the comparison to emphasize that the oft-quoted "low tens" of bowheads left in the stock does not reflect present knowledge and that the present population size, even if underestimated, is not a small fraction of the often-quoted minimum initial population size. The issue of vulnerability to extinction by stochastic events has been examined by DFO (natality, mortality, environment and killer whales) and concluded that small populations (~ 40 whales) could sustain a single removal without altering their probability of extinction due to demographic stochastic events (Innes, S. 1996. Population Viability Analysis for Bowhead Whales (Balaena mysticetus) in the Nunavut Settlement Area. Report to the National Marine Mammal Peer review Committee. 14 p.). In these simulations some small populations when extinct. However, populations of two hundred whales did not go extinct under even moderate catches (i.e., 3 adult females per year). A recent study presented at the IWC in 1999 also stated that, for populations on the order of 300 animals,

"demographic stochasticity had minor effects on population trajectories unless harvest rates approached the intrinsic rate of increase". (Breiwick, J.M. and D.P. DeMaster. 1999 Exploratory Type 3 Fishery Simulations IWC SC/51/AWMP8 9 p.).

Sustainable Hunting Rate

It is interesting, and in some ways gratifying, that the PBR approach has been judged a "useful tool for estimating a sustainable hunting rate." As everyone should realize, the PBR concept was developed within the U.S. context where a Marine Mammal Protection Act (and the many studies associated with its interpretation, implementation, and amendment) provide a theoretical and legal framework for ensuring that all marine mammal populations are maintained at "optimal" levels. In Canada, no clear statement appears, anywhere, of the relevant management goals. Adoption of the PBR approach is consistent with the generally *ad hoc* nature of marine mammal conservation and hunt management in Canada. However, as Wade (1998:25) cautions, this approach was not designed for managing the direct exploitation of small populations. As he states: "... for populations of extremely low abundance, any human-caused mortality needs to be evaluated in the context of how much it might increase the risk of extinction for the population...." It is clear that although the authorization of 1 landed, 2 struck in Repulse Bay in 1996 was initially presented and justified as a one-time event, the intention is to move rapidly toward an authorization of 1, 2, or even 3 landed whales per year (meaning 4-6 strikes?) to be taken from this stock. Whereas in the U.S., PBR management takes place within an elaborate (and costly) overall national commitment to stock monitoring and assessment, no similar commitment seems to exist in Canada. Without it, use of PBR should be made in an ultra-precautionary manner, in our view.

*<u>Comments:</u> It is not clear to us that there is any difference is between human-induced mortality caused by accidental netting, boat collisions or hunting. A death is a death and the consequences to the population are the same. The history and rational behind the evolution of PBR was summarized to the committee. The value of the PBR approach is that it is precautionary. It uses conservative estimates of stock size, and modifiers to an expected maximum net productivity based on the status of the stock. It was agreed that the endangered status of this stock required the use of only the lower estimate of PBR. This estimate allows for only 1/10th of the expected maximum net productivity to be removed. That is only 0.2% of a stock size estimate that incorporates an adjustment for sampling uncertainty. Both the work by Innes (1996) and, Breiwick and DeMaster (1999) have been useful in defining what "*extremely low abundance" *means in bowhead whale numbers*.

Sources of Uncertainty

It is unclear why, given the relatively casual manner in which distances seem to have been estimated, the positive bias caused by inaccurate strip width estimation is dismissed as "small" compared with the negative biases caused by availability and detection concerns.

<u>Comments:</u> To clarify, the workshop participants noted that the downward biases caused by a lack of correction for diving and a lack of estimate for animals present in parts of the stock range outside of the survey area was probably in excess of double the estimate compared to the upward bas caused by an inaccurate strip width which might cause an overestimate by less than 50%. While this potential bias was noted by reviewers and addressed by the authors of Cosens et al. (1996) the authors are not convinced that the strip width was incorrectly recorded. There were several other areas of uncertainty that were addressed during the RAP. The most important were the definition of stock (i.e., the huntable animals) and that the age structure of the surveyed population has too many immature animals for the number of adult whales seen.

Management Considerations

The suggestion that hunters use only the presence or absence of an accompanying calf to decide whether to kill a whale should be reconsidered. In the case of the Bering-Chukchi-Beaufort population, the IWC Scientific Committee has consistently urged that non-adult whales be selected for. In other words, hunters are encouraged to hunt animals in the 30-35 foot range. There are several good reasons for this. From a biological point of view, it reduces the likelihood of taking individuals that are contributing to reproduction - e.g. pregnant females. Also, assuming that natural mortality rates of younger animals are higher than those of older animals (almost certainly true), hunting mortality of the former is more likely to replace, rather than add to, natural mortality. Finally, from a practical point of view, the killing, handling and processing of smaller whales is generally more efficient and less wasteful (see, for example, the papers by McCartney and Braham in "Hunting the Largest Animals," 1995).

In general, we believe that this bowhead population should be managed for recovery, not just maintenance of its present size and distribution. The sparsity of observations in Roes Welcome Sound and NW Hudson Bay, in spite of considerable survey coverage at the appropriate season (see not only Cosens and Innes 1999, but also Richard 1991 and Richard et al. 1990), is troubling. These were the commercial bowhead whaling grounds (see Ross 1974; Reeves and Mitchell 1990), and no evidence has been brought forward to show that the species has recovered there. Why is this?

<u>Comments</u>: The suggestion that harvesting should preferably target immature animals has been incorporated into the Stock Status Report with a sentence paraphrasing the rationale given above. On the suggestion that bowheads should be managed for recovery, it is important to note that the PBR approach for both "endangered" and "unknown" status stocks allows recovery. A conservation plan with a 'recovery' objective is being prepared. With respect to the comments that few bowheads were seen by surveys of Roes Welcome Sound, an inspection of Ross (1974, in litt.) suggests that the lack of bowheads in Roes Welcome Sound is

consistent with the seasonal distribution of whaling records. With respect to recovery, the Nunavut Wildlife Management Board's Bowhead Traditional Knowledge Study provides strong evidence that the numbers of bowhead whales seen by hunters has more than doubled in the last 20 to 30 years, depending on the community, within this stock's range (Hay pages). While this is support that the stock is recovering, it is not support that the stock has recovered to its pre-commercial-exploitation population size and distribution.

Randall Reeves
Paul Wade

20 September 1999