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Canadian Science Advisory Secretariat (CSAS)

Proceedings Series 2022/043

National Capital Region

Proceedings of the National Marine Mammal Peer Review Committee (NMMPRC): November 2020 Biannual Meeting

Meeting dates: November 16-20, 2020
Location: Virtual Meeting

Chairpersons: Garry Stenson and Véronique Lesage
Editor: Christine Abraham

Fisheries and Oceans Canada
200 Kent Street
Ottawa, ON K1A 0E6

May 2023

Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

Published by:

Fisheries and Oceans Canada
Canadian Science Advisory Secretariat
200 Kent Street
Ottawa ON K1A 0E6

http://www.dfo-mpo.gc.ca/csas-sccs/
csas-sccs@dfo-mpo.gc.ca

ISSN 1701-1280
ISBN 978-0-660-45932-5 Cat. No. Fs70-4/2022-043E-PDF

Correct citation for this publication:

DFO. 2023. Proceedings of the National Marine Mammal Peer Review Committee (NMMPRC): November 2020 Biannual Meeting; November 16-20, 2020. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2022/043.

Aussi disponible en français :

MPO. 2023. Compte rendu du Comité national d'examen par les pairs sur les mammifères marins (CNEPMM) : Réunion semestrielle de novembre 2020; du 16 au 20 novembre 2020. Secr. can. des avis sci. du MPO. Compte rendu 2022/043.

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SUMMARY

The National Marine Mammal Peer Review Committee (NMMPRC) holds at least one annual meeting to conduct scientific peer-review of marine mammal research. Meetings provide the opportunity for collaborative review of scientific results by marine mammal experts from Fisheries and Oceans Canada (DFO) and with participation from other (non-DFO) organizations. Following NMMPRC peer-review and approval, scientific results are used to provide sound scientific advice for the management and conservation of marine mammals in Canada.

ABUNDANCE ESTIMATES OF SPERM WHALES AND DALL'S PORPOISES BASED ON TOWED ARRAY ACOUSTIC DATA FROM THE 2018 PACIFIC REGION INTERNATIONAL SURVEY OF MARINE MEGAFAUNA (T. DONIOL-VALCROZE, L. NICHOL, B. WRIGHT, J. PILKINGTON, R. ABERNETHY, E. FERGUSON AND T. NORRIS)

Rapporteur: X. Bordeleau

DISCUSSION

The committee noted the many challenges associated with acoustically detecting individuals within a group, with important implications on abundance estimates. The committee requested that this specific issue be discussed in details in the document. The authors also suggested the addition of figures on the group sizes of both species of interest.

The committee noted the seemingly high reliance on auto-detectors for this study and suggested that more information be included regarding detector configurations (as related to signal to noise ratio) to better understand detectors' performance and missed call rate and facilitate results interpretation. It was also noted that the inclusion of information about the criteria used to define vocalization quality would be a valuable addition to the document. For future work, it was also suggested that perhaps more information be collected to eventually develop correction factors for this dataset (e.g. weather/sea-state correction for detectability).

Both the authors and the committee agreed on the many challenges/knowledge gaps associated with the directionality of echolocation clicks (e.g. not always perceptible by the hydrophones depending on the angle of the animals) as well as how animals might respond when a ship approaches.

The committee requested that information be added to the document regarding the intentional shut down of the depth sounders during the survey which was done to avoid interference with the hydrophones and induce potential behavioural changes.

For Dall's porpoise, the authors were unable to produce an acoustic-based correction factor using the current dataset, nor an acoustic abundance estimate at this stage. An abundance estimate based on visual surveys already exists, and the committee felt that adding a second uncertain estimate would only cause confusion. The authors were also unable to compare visual and acoustic survey abundance estimates due to the uncertainty in the spatial resolution of acoustic detection and the inability to distinguish the individuals of a group. The two abundance estimates could not be combined to obtain a fully corrected estimate, as there were too many knowledge gaps/uncertainties at this stage (e.g. identifying duplicates). The committee agreed that due to uncertainties in the acoustic estimate, the visual estimate should be used.

For sperm whales, the authors were unable to produce an acoustic-based correction factor. However, they produced an acoustic abundance estimate. The committee requested that the minimum abundance estimate for this species be based on a strip transect survey design (uniform distribution estimate) using a 2000 m perpendicular distance cut-off, and they should only include a textual justification to support this strip-width based on previous data (but not including new data/figures). It was possible to also define sperm whale distribution based only on acoustic detections. The committee recommended that a map be produced (including bathymetry if possible) showing the locations of both acoustic and visual detections. This figure should be presented in the SAR along with a short text description to facilitate its interpretation. Inshore lines in the figure should not be in red since there was no acoustic monitoring (so using a third colour).

ESTIMATED POPULATION ABUNDANCE AND SUSTAINABLE YIELD FOR NORTHERN HUDSON BAY NARWHAL (MONODON MONOCEROS) (BROOKE A. BIDDLECOMBE AND CORTNEY A. WATT)

Rapporteur: C. Matthews

DISCUSSION

Following the presentation, questions were raised about potential negative biases in the two earliest (1982 and 2000) of the four survey estimates to which the model was fit, a topic that would remain the focus of much of the discussion for the rest of the week. Asselin and Ferguson (2013) performed a comparative analysis of the four surveys included in the modelled series, and showed these earlier surveys may have underestimated actual abundance by a factor of up to 2.5. Later discussions by the committee would clarify that this was due to the fact that both the 1982 and 2000 survey estimates did not account for perception bias, and the 1982 survey was performed and analyzed as a strip design, which assumes that all narwhals within a defined strip width from the aircraft are observed, despite the fact that detectability declines with increasing distance from the aircraft. Clarification was sought as to how these negative biases in the two earliest surveys influenced the steep growth rate indicated by the model fit. The authors also pointed out that the earlier surveys also covered a smaller area than the two most recent surveys, excluding areas of the Northern Hudson Bay (NHB) narwhal range where the later surveys estimated ~1500 narwhals (Wager Bay). It was acknowledged that negative biases in the earlier surveys would cause the model to estimate a steeper population increase.

It was also questioned whether the estimated low starting population size and subsequent rapid population increase was plausible, given that there are no independent data or anecdotal information suggesting such a population increase, nor any reason to suspect that the population would have been depleted as indicated. Several committee members with expert knowledge agreed there was not a heavy commercial harvest of the NHB narwhal population, and there is no indication that this population had been severely depleted. Influx of narwhals from other areas was offered as one potential explanation for the increase, as the 2018 survey spotted animals on the very southern limit of the surveyed area. Movements from the Baffin Bay population/Somerset stock could also be a possible explanation for higher estimates of the two more recent surveys. A recent paper in Marine Mammal Science indicates that photographic and visual surveys can produce comparable abundance estimates of narwhals; it was suggested that photographic surveys conducted around the time of the 1982 visual survey could therefore be added to the modelled series to increase certainty in the earlier estimates. However, these photographic surveys, even if systematic in coverage, covered a small area and were therefore excluded from Asselin and Ferguson's (2013) comparative analysis (so adjusted estimates for those surveys do not exist).

It was noted that perception bias can be as high as 30+ percent, and therefore must be considered. However, because perception bias is dependent on survey conditions and observers, it is not straightforward to retroactively correct previous surveys (f the large difference – 10 vs 35% – in perception bias between the 2011 and 2018 surveys). It was agreed, however, that this bias cannot be ignored and that it might be possible to adjust the earlier surveys by a value agreed upon by the committee. An issue was raised that detection probabilities for those surveys were estimated using different types of detection functions; this issue was discussed at the previous meeting in Ottawa (February 2020) when it was decided that it makes sense to analyze each survey based on the best-fit model to the data from that survey (although it was acknowledged that recent developments in analysis methods, such as fitting gamma detection functions, may produce different results). It was noted that this issue will be encountered repeatedly as we improve our surveys, and that development of some error or adjustment factor(s) to incorporate directly into our population models would be a better solution than re-analysis of old surveys to current standards. There was general agreement that it would be preferable to adjust older survey estimates up rather than new surveys down, simply for that fact that it will be very difficult to explain to the communities why the committee would decrease recent abundance estimates. The idea of adjusting stochastic error in the model instead of directly adjusting the negatively biased 1982 and 2000 surveys to incorporate more uncertainty was discussed.

Discussion then turned to the model itself, focusing on parameter estimation and model diagnostics. Specific questions focused in particular on how values and distribution of theta and lambda were selected and evaluated, including sensitivity results. It was clarified that the value and distribution of the struck and lost (S&L) parameter was based on community-specific S&L information available for Naujaat. There was concern that using initial model runs to revise priors might bias results, but several committee members noted that this is common practice. Some participants expressed concerns that lambda was allowed to range possibly to unrealistically high values (0-8 %), and suggested lambda instead could be assigned a narrower range, a skewed beta distribution, or even be fixed.

The committee agreed that the text in the paper should not comment on sustainability of the harvest, and should instead focus more on the probability of decline rather than on catch level (i.e., reverse of how currently presented). It was noted that a 30% probability of decline is considered moderate, not low, and that potential biological removal (PBR) itself has an inherent possible 5% rate of decline, and so should be compared to a modeled 5% decline. The committee agreed that text singling out appropriate harvest levels should be removed and instead should refer to the table that summarizes the different scenarios.

A discussion then went on as to what could be done to resolve issues with the survey estimates to which the model was fitted. It was suggested that a side group convene on a way forward and report back to the committee later in the meeting. The side group met and outlined various options to address these issues, including:

- Re-calculating recent survey estimates without perception bias;
- Arbitrarily inflating the CV around the two earliest survey estimates to reflect lower confidence; however, it was confirmed that the model pooled CVs across all surveys, and so increasing CVs on the first two surveys would not have the desired effect;
- Dropping the oldest (1982) survey and including just the recent ones analyzed using distance methods;
- Incorporating perception bias into the earliest surveys and assigning them a larger uncertainty using the range of the two most recent surveys;
- Fitting the model to just the surface estimates (it was noted, however, that this would not deal with negative bias imparted by the strip analysis of the 1982 survey, nor would it address the negative bias due to smaller areas covered in the earlier surveys).

The following general approach was decided:

- Adjust the earlier survey estimates for perception bias using available adjustment factors from the two more recent surveys,
- Correct for the strip vs distance analysis via comparison of same-survey data analyzed both ways (Asselin and Ferguson 2013), and
- Decide how/whether the different areas covered by the different surveys can be accounted for.

Day 2 started with a presentation by authors, which outlined how each of these issues could be addressed based on survey adjustments and preliminary model runs performed overnight. First, the 1982 and 2000 surveys were adjusted using the average perception bias of the two most recent surveys, and their CV was also increased in the model run. Several scenarios for reanalyzing new surveys using strip analysis or old survey using distance analysis were presented. These included an in-depth presentation of Asselin and Ferguson's (2013) comparison of same-survey data (from the 2011 survey) analyzed using the various approaches, which produced ratios that essentially served to adjust the earlier survey estimates to '2011 equivalents' (i.e., make the different surveys comparable). It was noted that this paper had been peer-reviewed and approved by the committee. Three options for dealing with different areas were offered: 1) excluding surveys with different coverage from the others in the series, 2) including them but with acknowledgement of uncertainty due to the different areas surveyed, and 3) including them with adjustment. However, option 3 required assumptions about narwhal density being similar in different areas over decades (change in sea ice, predator density, as well as density of the narwhal population itself are all factors that would invalidate such an assumption). There was a general support from the committee for option 2.

Following general discussion about the impact of these adjustments on the preliminary model runs, including a slower growth rate with a drop in lambda, the co-chairs reiterated that final model runs would incorporate earlier surveys adjusted using the ratios present in Asselin and Ferguson (2013) with new prior values and distributions. The group provided the co-authors with agreed priors and ranges for the final model runs.

The authors continued discussion of the final model runs by outlining some disagreement among committee members at to whether the ratios provided in the Asselin and Ferguson (2013) paper explicitly accounted for perception bias. It was confirmed that Asselin and Ferguson (2013) compared survey estimates produced using mark-recapture distance sampling (MRDS) of dual-platform observer data (allowing for calculation of perception bias) from the 2011 survey with the same data restricted to just one of the two original observers (i.e., a single observer platform analyzed using conventional distance sampling (CDS), which does not allow for calculation of perception bias). In comparing estimates derived using two methods, the ratio thus incorporates any differences due to perception bias, and additional correction outside of applying the published ratios (Asselin and Ferguson, 2013) is therefore not necessary. It was pointed out, however, that the published ratios are based on the 2011 survey, which happened to have a low perception bias (10-11%). If the perception bias calculated for the 2011 survey is uncharacteristically low (it was low relative to the 2018 survey), the ratios based on comparative analysis of the 2011 survey data would be negatively biased.

Updated model runs incorporating the adjusted survey estimates following Asselin and Ferguson (2013) were presented. This generated additional discussion about starting population size and parameterization of the updated model, particularly with respect to the ranges of the priors. There was a lengthy discussion about whether lambda max and theta should be fixed or allowed to range. It was suggested to run more models with different values of theta to gauge how uncertainty in its value ultimately impacted catches and advice. This discussion highlighted the need for a possible research document in the future that would outlines procedures for selecting priors of model parameters.

There was consensus on the acceptance of model 25 as the best model for providing advice. The committee's attention then turned to provision of advice, with some members expressing their discomfort about PBR suggesting higher catches than the model-based approach. On this latter point, there was a lengthy discussion and recognition that PBR and the model-based risk assessment may not address the same management objective and that this distinction should be clearly expressed both in the Research Document and in the Scientific Advice. Chairs reminded the committee that the model approach is used for populations considered to be data-rich, while PBR based on the last survey estimate is the default option for data-poor stocks. PBR can also be based on the model-estimated current abundance for populations for which there is high confidence in that estimate (i.e. it is robust to the model assumptions), which offers an improvement over survey-based estimates of PBR because they incorporate more of the data than the last survey estimate. The Chairs asked the committee whether the NHB narwhal can be considered to be data-rich, even though four point-estimates of abundance exist, vital rates and population growth parameters (e.g., theta or lambda) have not been independently estimated. They reiterated that the committee have been asked specifically whether confidence in the model is sufficient to provide model-based advice. The committee debated the degree of confidence in the model, and agreed that the 2019 abundance estimate from the model was robust to changes in input parameters, and could be used for calculating PBR. However, committee members were generally not as confident in model projections into the future, although some committee members expressed sufficient confidence in the model to warrant provision of advice based solely on the risk-based table of probabilities linking probability of population decline over the next 10 years to various harvest removals. At this point, the Chairs addressed confusion expressed by some committee members at the apparent discrepancy in stating less than full confidence in the model, yet nevertheless providing model-based advice; it was explained that we can have uncertainty in the trajectory of the model (and hence avoid the risk-based probabilities based on model forecasts), while having high confidence in the model-estimated current abundance (hence providing PBR-based advice based on it rather than the most recent survey estimate).

Considerable debate also centered around setting the value of the recovery factor in the calculation of PBR. Some committee members favored following the guidelines decided upon in 2016, which is a recovery factor of 1 for an abundant and increasing population. However, other members expressed concern that the modelled population trend is uncertain due to uncertainty in adjusted estimates of the earlier surveys, and therefore proposed the recovery factor be set at a more conservative 0.75. It was pointed out that if confidence in the increasing population trajectory estimated by the model was high enough to warrant a recovery factor of 1, then confidence in the model should also be high enough to support provision of advice based on model trajectories under different harvest scenarios. The committee therefore agreed to a recovery factor of 0.75 in the calculation of PBR based on the 2019 abundance estimated by the model.

The committee advised that the authors should present only models 24 and 25, with reference to the results from a number of models in an assessment of model sensitivity to different parameterization. With respect to advice, it was decided that both the model-based probabilities of decline under various harvest scenarios and the model-based estimate of PBR would be provided in the Science Advisory Report.

APPENDIX A – TERMS OF REFERENCE

NATIONAL MARINE MAMMAL PEER REVIEW COMMITTEE (NMMPRC): NOVEMBER 2020 BIANNUAL MEETING

National Peer Review - National Capital Region

November 16-20, 2020
Virtual meeting

Chairperson: Garry Stenson and Véronique Lesage

Context

The National Marine Mammal Peer Review Committee (NMMPRC) holds at least one annual meeting to conduct scientific peer-review of marine mammal research. Meetings provide the opportunity for collaborative review of scientific results by marine mammal experts from Fisheries and Oceans Canada (DFO) and with participation from other (non-DFO) organizations. Following NMMPRC peer-review and approval, scientific results are used to provide sound scientific advice for the management and conservation of marine mammals in Canada.

Topics

Specific Terms of Reference for each topic are as follows:

1. Pacific Region International Survey of Marine Megafauna (PRISMM)

Context

Several marine mammal species on the west coast of Canada are reported as by-catch in fisheries and aquaculture. A provision of the US Marine Mammal Protection Act (MMPA) will require Canada, as an exporter of fish products, to provide population estimates and rates of incidental mortality from fisheries operations by January 1, 2022. However, abundance estimates in Canadian Pacific waters are lacking for most cetacean species, especially for the offshore areas, or are too old to meet MMPA requirements. These species are not covered by current census programs and therefore must be assessed using a dedicated survey. Systematic surveys with the specific goal of estimating abundance of marine mammal species over the entire range of Canadian jurisdiction have been made in Atlantic Canada in 2007 and 2016 and in the Central Arctic in 2013, but never in Canadian Pacific waters.

To meet the US MMPA requirements, DFO Science completed a large-scale marine megafauna survey of Canadian Pacific (inshore and offshore) waters in July-August 2018. The results of the visual sightings during this survey and abundance estimates for some species) were presented to the NMMPRC in February 2020. However, it was not possible to estimate abundance of sperm whales from the visual sightings data.

A towed acoustic array was used to complement visual observation and offer 24-hour per day coverage, thus maximizing the use of available ship time, even at night and in mediocre weather conditions. This array can provide additional detections of rare and long/deep-diving species that are not readily observed using traditional methods, such as sperm and beaked whales, and can help identify small cetacean species. In addition, for species that have been detected both visually and acoustically in sufficient numbers (e.g., Dall’s porpoises and sperm whales), these data can be used as a double-platform experiment to calculate correction factors for animals missed by either survey method.

Objectives

- For Dall’s porpoise, to calculate an acoustic-based correction factor and abundance estimate, which will be compared to the abundance estimate calculated in February 2020 which was based on visual-only sightings. We will also evaluate whether it is possible to combine visual and acoustic-based abundance estimates to obtain a fully corrected estimate based on both sources of data.
- For sperm whales, an insufficient number of visual detections were made during the survey to calculate an abundance estimate in February 2020. Therefore, we will provide a correction factor, abundance estimate, and distribution based only on acoustic detections.

Expected Publications

- Research Document
- Science Advisory Report

2. Northern Hudson Bay Narwhal - Sustainable Harvest Advice

Context

Narwhal are listed on Appendix II of the Convention on International Trade in Endangered Species (CITES). CITES requires updated science and a documented management approach to show sustainable narwhal management. A non-detriment finding (NDF) from a DFO Scientific Authority is required to export narwhal products internationally. The Nunavut Agreement also requires a valid conservation basis on which to limit Inuit harvest. A Nunavut Wildlife Management Board (NWMB) decision will be required if a change in the current level of Total Allowable Harvest (TAH) is recommended. Hunters will be affected if they have to reduce their harvest in accordance to the TAH. Therefore Fisheries Management is requesting DFO Science provide a table of probabilities that the stock will decline in 10 years under a range of harvest scenarios (from 0-100% probability of decline) for presentation to Inuit co-management organizations for a future NWMB decision.

Inuit subsistence harvests of Northern Hudson Bay (NHB) narwhal (*Monodon monoceros*) occur mainly in the Kivalliq Region of Nunavut, with smaller subsistence harvests in four Qikiqtaaluk Region communities (Sanirajak, Igloolik, Cape Dorset and Iqaluit) and in Inuit communities along Hudson Strait within the Nunavik Marine Region (Nunavik, Northern Quebec).

The NWMB established a TAH for NHB narwhal in 2012, informed by DFO aerial surveys conducted in 2011 (DFO 2012). The TAH, adjusted to account for hunting loss, was presented as a Total Allowable Landed Catch (TALC) of 157 NHB narwhals. Ten (10) NHB narwhal are allocated to Inuit of Nunavik and the balance, allocated among Nunavut communities by the Regional Wildlife Organizations (RWO). An aerial survey in 2018 estimated 19,200 (95% CI = 11,300–32,900) narwhal in the NHB narwhal population. With the addition of this abundance estimate, a model-based approach will be reviewed and advice regarding whether sustainable harvest advice can be generated from the model for future requests for NWMB decision.

Objectives

- To determine whether a model-based approach is suitable for providing sustainable harvest advice for the NHB narwhal population, and if so, should the model-based approach take priority over the Potential Biological Removal (PBR) threshold determined from the 2018 aerial survey estimate for NHB narwhal.
- To provide information on the probability that the stock will decline in 10 years under a range of harvest scenarios (from 0-100% probability of decline).

Expected Publications

- Research Document
- Science Advisory Report

3. Genetic identification of Eastern Hudson Bay beluga stocks

Context

In 2004, COSEWIC designated the Eastern Hudson Bay (EHB) beluga population as Endangered. A three-year subsistence harvest management plan was established by the Nunavik Marine Region Wildlife Board in 2014, and renewed in 2017; this plan expired in 2020, at which time an interim plan was put in place to ensure that subsistence harvesting of beluga by Nunavik Inuit is managed under a Total Allowable Catch (TAC) regime which takes into account the relative proportion of this stock in the regional hunt. As populations cannot be discriminated visually, this proportion is estimated using genetic analyses of skin samples obtained from hunters.

The latest genetic analyses classified catches from the Nunavik as either from EHB or Western Hudson Bay (WHB) populations. Genetic characteristics of these reference populations were identified using a short or a long version of a sequence of mitochondrial DNA (mtDNA) and samples from July and August from 1982 to 2015. A genetic mixture analysis using the Statistics Program for Analyzing Mixtures was then realized to estimate the proportion of Nunavik catches attributed to one of the two reference populations.

With the recent advances in genetic research, development of specialized software and additional sampling, it is possible to re-examine the capacity of the longer mtDNA sequences to identify more reference populations to improve the classification of catches to reference populations in the eastern Arctic area. The improved approach will also provide uncertainty estimates for the classification to the reference population of annual catches from Nunavik. Samples acquired in 2019 will be used for comparative purposes between previous and new approaches of classification.

Objectives

To define biological units using a genetic marker and novel statistical approaches, and to compare two genetic mixture analyses to estimate proportions of reference populations from hunting specimens.

Expected Publications

- Research Document
- Science Advisory Report

Expected Participation

- DFO (Ecosystems and Oceans Science, Species at Risk, Fisheries and Harbour Management sectors)
- Academia or Academics
- Stakeholders
- Other invited experts

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