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October 29 – November 2, 2012

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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.

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SUMMARY

The National Marine Mammal Peer Review Committee (NMMPRC) holds an annual meeting to conduct scientific peer review of marine mammal issues. This approach gives the opportunity to bring together experts on marine mammals from Fisheries and Oceans Canada (DFO) with specific contributions from non-DFO experts to ensure high quality review of the scientific results and to provide sound scientific advice as the basis for the management and conservation of marine mammals in Canada. When time permits, this annual meeting is also an opportunity to review ongoing research projects and provide feedback or guidance to the scientists involved. This year, the papers reviewed included topics pertaining to grey/harp/ringed seals, California/steller sea lions, walrus, narwhal, beluga, killer whales, and blue whales. In addition to these Proceedings, several Research Documents and Science Advisory Reports will be published as a result of the meeting.

The meeting was held at the Coast Bastion Hotel (Nanaimo, B.C.) from October 29 – November 2, 2012. The participants invited to this meeting included individuals from DFO (Ecosystems & Ocean Science, Ecosystems & Fisheries Management, Canadian Science Advisory Secretariat, Species at Risk); National Oceanic and Atmospheric Administration (NOAA); University Of British Columbia (Fisheries Center); University of Prince Edward Island; Alberta Innovates; Nunavut Tunngavik Inc.; Nunavut Wildlife Management Board; Nunavik Marine Region Wildlife Board; and Makivik Corporation. A list of participants can be found in Appendix III.

SOMMAIRE

Chaque année, le Comité national d'examen par les pairs sur les mammifères marins (CNEPMM) organise une réunion dans le cadre de laquelle des pairs procèdent à un examen scientifique des questions touchant les mammifères marins. Cette approche donne l'occasion de réunir des experts sur les mammifères marins de Pêches et Océans Canada (MPO), avec la participation particulière d'experts qui ne sont pas du MPO, ce qui permet d'assurer un examen de qualité supérieure des résultats scientifiques et d'offrir des avis scientifiques solides à servir de base pour la gestion et de la conservation des mammifères marins au Canada. Lorsque le temps le permet, les participants à cette réunion annuelle en profitent également pour examiner les projets de recherche en cours et fournir des commentaires ou des directives aux scientifiques qui y participent. Cette année, les documents passés en revue portent sur des sujets tels que les phoques gris/annelés/du Groenland, les otaries de Californie/de Steller, le morse, le narval, le béluga, l'épaulard et le rorqual bleu. En plus de ce compte rendu, plusieurs documents de recherche et avis scientifiques seront publiés à la suite de la réunion.

La réunion a eu lieu à l'hôtel Coast Bastion de Nanaimo, en Colombie-Britannique, du 29 octobre au 2 novembre 2012. Les participants invités comprenaient des employés du MPO (Sciences des écosystèmes et des océans, Gestion des écosystèmes et des pêches, Secrétariat canadien de consultation scientifique, Espèces en péril), de la National Oceanic and Atmospheric Administration (NOAA), de l'Université de la Colombie-Britannique (Centre des pêches), de l'Université de l'Île-du-Prince-Édouard, des entreprises Alberta Innovates et Nunavut Tunngavik Inc., du Conseil de gestion des ressources fauniques du Nunavut, du Conseil de gestion des ressources fauniques de la région marine du Nunavik et de la Société Makivik. Une liste des participants se trouve à l'annexe III.

INTRODUCTION

The meeting Chair, Dr. Don Bowen, from the Science Sector of Fisheries and Oceans Canada (DFO), welcomed participants to the science advisory meeting. The Chair did a round table of introductions of meeting participants (Appendix III). The Chair provided a brief overview of the DFO Canadian Science Advisory Secretariat (CSAS) Science Advisory Process. The Chair then reviewed the objectives of the meeting, Terms of Reference (Appendix I), and Agenda (Appendix II). In addition, the Chair reviewed the expected science advisory outputs of the meeting: Science Advisory Reports; Proceedings; and Research Documents. Working papers were presented and reviewed during the meeting.

PAPERS PRESENTED

WP_1A: A DISCUSSION OF THE PRECAUTIONARY APPROACH AND ITS APPLICATION TO ATLANTIC SEALS

(M. Hammill, G. Stenson)

Abstract

The Precautionary Approach (PA) aims to outline clear rules for management actions in response to changes of the resource with respect to different thresholds to ensure conservation of the species. The commercial harvest of Atlantic Seals is managed under a PA framework that was developed at the request of Fisheries Management and implemented with the support of industry in 2003. Science was requested by Fisheries Management to:

1) Determine an appropriate Limit Reference Point that can be set at a fixed level (possibly reviewed periodically).
2) Determine the minimum harp seal population size that can maintain an ongoing (i.e. 15 years) sustainable harvest of 100K, 200K, 300K and 400K, while maintaining a probability of 85%, 90% and 95% of staying above the Limit Reference Point (LRP).

Different methods of setting the limit reference point were reviewed. Some methods fixed the LRP at a specific number while others used relative values. Setting fixed values can be problematic if environmental conditions change or if population estimates are updated as a result of new data or changes in the assessment methods. Changes in the estimates of harp seal abundance illustrate how our perception of a population can change. This can results in a change in status of the population with no actual change in abundance. Relative levels require an appropriate reference level for comparison. A population of approximately 5.3 million seals was estimated to be necessary to sustain an annual catch of 100,000 with a 95% likelihood of remaining above the limit reference point if reproductive rates do not change while 4.7 million are required if we assume that they will increase as the population declines. A larger minimum population size is needed to support a larger harvest; a lower population size is needed if the probability of respecting the management objective is reduced.

Discussion

The participants agreed that N_{loss} should not be considered as N_{lim} as serious or irreversible harm could likely occur above this level because environmental conditions are different now than they were in the years following the low population level estimated in the 1970s.

The estimated N_{lim} or N30 in the research document is relative to maximum population estimate of 7.3 million animals based on recent model runs (assuming density dependence and updated reproduction rates). The previous population estimate of 8.3 million animals was calculated using the previous model (assuming exponential growth (WP_1b)).

N_{lim} varying between years has been criticized by management and the industry. There was a discussion about the possibility of using historical maximum abundance estimates rather than recent maximum abundance estimates as proxy of carrying capacity (K) to reduce fluctuations in our estimates of K and therefore prevent the fluctuation of reference points. There were concerns, however, about the uncertainty related to the estimation and use of historical maximum abundance estimates. Using a unique historical maximum abundance estimates as proxy of K would present the same limits as using fixed reference levels.

Using fixed limit levels has two disadvantages: it is hard to identify a precise level, and as new data and analyses methods are used in the assessment of a population, changes in the estimated abundance estimate, even without real changes in the population, may trigger unnecessary management measures. Therefore, it was agreed that N_{lim} should be estimated as a proportion of K or number at maximum sustainable yield (NMSY) or other metric of the population, rather than be estimated as a fixed value.

The proposition of using a multi-year population assessment offers a compromise between using annual changes in reference levels and fixed reference levels. The reference levels could remain constant between periodic surveys and would only be revisited once in every cycle of the multi year assessment (i.e. 4 to 5 years for harp seals). Yearly changes in total allowable catch (TAC) levels could be provided based on multi-year reference levels and on the monitoring of other parameters than population abundance.

The formulation of the request for advice suggests that management might be done considering only N_{lim}. Concerns were expressed that managing a stock at levels below MSY may not follow the precautionary principle as population may be unstable below these levels. It was pointed out that managing a stock to the limit of meeting the criteria of not exceeding the N_{lim} is likely to fail meeting this criterion over a long-term period unless uncertainty is considered in the estimation of this N_{lim}. N_{lim} is set as a proportion of K and we have assumptions and uncertainty associated with the estimation of K. This uncertainty should be considered when setting the N_{lim} and the text should mention how uncertainty was considered. However it was pointed out that some uncertainty was considered as management advice is provided with an estimated risk of falling below the N_{lim}, e.g. 15%, 10% or 5%. The use of a higher proportion of MSY or K to set N_{lim} is one solution to consider uncertainty. The current use of N30, or the equivalent of 50% of MSY, are higher than 40% of MSY recommended in the DFO guidelines, and therefore recognizes some uncertainty in the estimation of population dynamics and in the associated estimation of K and MSY.

It was noted that the N_{lim} proposed is consistent with international practices and the approach seemed appropriate to everyone.

Concerns were raised that the harvest scenario results presented could be optimistic, as survival rates could also change with density, similarly to changes assumed for reproductive rates.

Concerns were raised that the model could only predict irreversible harm if the population reached zero and that negative growth rates should be allowed, at least for periods of time. It was noted that irreversible harm is used in the original precautionary approach documents, but it has now been changed to “serious harm”. It was indicated that in the current model, irreversible harm occurs when harvest exceeds production.

The estimation of K will likely change as new survey results will become available. With surveys on a multi-year assessment regime (e.g. every five years) these changes will only be detected over a long time period.

It was therefore recommended that all this uncertainty be highlighted and considered if management decisions are taken to aim for high sustainable harvests (e.g. 400K), or to accept higher risk of falling below N_{lim}. It was pointed out that there is uncertainty associated with all the models, but taking a high harvest on a population represents a real change in this population, and therefore selecting lower harvest levels or accepting lower risk which represent a more conservative approach is recommended.

The identification of a minimum population size that could support a minimum harvest level is a concept that could be extended to arctic species, for which Basic Needs Levels (BNL) estimation could be used as the minimum harvest levels required.

The document deals with harp seals but the application of this PA framework becomes more difficult for data-poor species or for species for which it is difficult to obtain some parameters of population dynamics (e.g. narwhals are difficult to age). The use of information from related species can be applied and modified as information becomes available. The use of Potential Biological Removal (PBR) is one solution for data-poor species.

WP_1B: ESTIMATING CARRYING CAPACITY AND POPULATION TRENDS OF NORTHWEST ATLANTIC HARP SEALS, 1952-2012

(M.O. Hammill, G.B. Stenson, T. Doniol-Valcroze, A. Mosnier)

Abstract

A population model was used to examine changes in the size of the Northwest Atlantic harp seal population between 1952 and 2012. The model incorporated information on reproductive rates, reported removals, estimates of non-reported removals and losses through bycatch in other fisheries to determine the population trajectory. The model was fit to eleven periodic estimates of pup production from 1952 to 2008, and to annual pregnancy rate data collected between 1954 and 2012. Pup production declined throughout the 1960s reaching a minimum 1971, and then increased to a maximum in 2008. Estimated pup production in 2012 is 1.5 million animals (95% CI=1.1-2.2 million). The total estimated population size in 2012 is 7.3 million (95% CI=6.1 to 8.4 million). Different formulations were used to describe future population trends. If the harvest rates in Greenland and future reproductive rates are fixed, then an annual harvest of 300,000 animals would respect the management objective. If future catches in Greenland and future reproductive rates are both linked to changes in population

size then annual harvests of up to 400,000 animals would respect the management objectives. The effect of variable harvest levels was also examined. Ice conditions, reproductive rates and removals in the Greenland harvest continue to be important factors affecting the dynamics of this population.

Discussion

The authors were asked how they chose objective functions to optimize. For example, in each of the measures, the authors have processing error and sampling error rolled up together, but you don't want to penalize the sampling error. It was suggested that the authors think more about this weighting scheme.

In reference to Fig. 2 in the document, there was concern about n=5 rule which says if you have at least 5 females in any given year, then you can estimate age-specific pregnancy rate. By using n=5 you are enhancing the variability of the data artificially. If you used [n=20?] you would get rid of a lot of this enhanced noise, so it may be worth using a higher cut-off for proportion?

There was concern about the variation in pup production at the end of the time series. The authors replied that this is driven by variable reproductive rates, and is also associated with late –term abortions.

WP_2A: ASSESSMENT OF CURRENT AND ALTERNATIVE METHODS FOR KILLING YOUNG GREY SEALS (*HALICHOERUS GRYPUS*) DURING COMMERCIAL HARVEST

(P.-Y. Daoust, C. Caraguel, H. Fenton, M.O. Hammill, L.D. Roy, J. Spears)

Abstract

A small commercial hunt for 5-7 weeks old grey seals (*Halichoerus grypus*) occurs intermittently around the Canadian Maritime provinces and may expand in the near future. We sought to better understand and, where possible, improve the harvesting methods of this hunt. We compared the use of the regulation club and the regulation Canadian hakapik to effectively crush the skull of these animals under field conditions. Both tools achieved this purpose, resulting in rapid, if not immediate, death of the animals, but we detected a weak indication that the club requires fewer blows than the hakapik to crush the skulls. We also tested the efficacy of the .17 HMR (Hornady Magnum Rimfire) rifle cartridge, an ammunition of low energy but high velocity, to quickly kill seals of this age at close range with a shot to the head. All 12 animals studied under controlled conditions and 40 of 45 (88.9%) animals studied under field conditions died immediately from a single shot. We believe that the latter proportion can be increased further with simple modifications to the method used during the field study and that the .17 HMR rifle cartridge can be an effective tool to quickly kill young grey seals during a commercial hunt, as a possible substitute to the use of the club or hakapik.

Discussion

It was asked, with the comparison of the grey and harp seal skulls, the authors reported standard errors for data from both sides of the skulls that seemed to be too large for the sample size - this should be checked for the final version of the document.

WP_2B: COMPARISON OF THE THICKNESS OF THE CALVARIUM BETWEEN YOUNG GREY (*HALICHOERUS GRYPUS*) AND HARP *(PAGOPHILUS GROENLANDICUS*) SEALS

(C. Caraguel, P.-Y. Daoust, F. de Bie)

Abstract

Young harp seals (*Pagophilus groenlandicus*) have traditionally been hunted along the Canadian Atlantic coast, and regulations are now in place to ensure that this hunt meets adequate standards of animal welfare. These young seals are killed by a blow to the head from a hakapik or a club or by a bullet to the head. A hunt for young grey seals (*Halichoerus grypus*), using similar methods, occurs intermittently on a smaller scale around the Canadian Maritime provinces. However, field observations suggest that the skull of young grey seals is substantially thicker than that of young harp seals. The results of this study confirm these field observations and suggest the need for further research when adapting the current hunting methods for young harp seals to grey seals.

Discussion

It was suggested that more research is needed in the future to determine if sex differences exist.

WP_2C: FORCE NEEDED TO EFFECTIVELY FRACTURE SKULLS OF GREY AND HARP SEAL BEATERS USING A HAKAPIK

(L.D. Roy, E. Jenson, M. Hiltz)

Abstract

The impact force needed to fracture the skull of 6 grey seal young of the year, 9 harp seal young of the year and 3 adult harp seals was examined. The force required to crush adult skulls was greater than that required to crush the skulls of young of the year. Mean velocity resulting in effective blows (damage rating 3 and 4) was 21.44 m/s (n=4) for harp seal young of the year and 27.04 m/s (n=3) for grey seal young of the year. The effective blow velocity was lower for harp seal than grey seal beaters, but differences were not significant due to small sample sizes. Based on a 17.68 m/s velocity that result in an effective blow (damage rating of 3) to a harp seal beater head, effective blows can be delivered by sealers to harp seal beaters on a sustained all day basis. Based on a 24.60 m/s velocity that result in an effective blow (damage rating of 3) to a grey seal beater head, it is less likely that effective blows can be delivered on a sustained all day basis. These recommendations need to be taken with caution as sample sizes were low and we did not test the sustainability of produced velocities.

Discussion

No substantive discussion or concerns regarding data interpretation, analyses or conclusions. Only questions of clarity were raised.

WP_3: RINGED SEAL ABUNDANCE IN JAMES BAY AND EASTERN HUDSON BAY IN SPRING 2011 AND 2012

(J.F. Gosselin, M.O. Hammill, S.H. Ferguson, T. Doniol-Valcroze)

Abstract

Not provided.

Discussion

It was suggested that the authors use local "sun time" instead of UTC (etc.). Clock and sun times may be quite different when a survey is conducted at the western edge of a time zone such as in this case.

There was concern that the diligent selection of sighting curves could produce spurious levels of confidence in the precision of the Effective Strip Width (ESW) since so many sighting curves have been fit to so many combinations of observer and ice conditions; not suggesting another approach be used, but that the authors be cautious about the resultant standard error estimates.

It was suggested that the authors incorporate all the sources of influence (substrate, survey methods) on the density estimates for different strata.

WP_4A: LONG-TERM CHANGES IN GREY SEAL VITAL RATES AT SABLE ISLAND ESTIMATED FROM POPAN MARK-RESIGHTING ANALYSIS OF BRANDED SEALS

(C. den Heyer, W. D. Bowen, J. I. McMillan)

Abstract

Populations facing resource limitation are expected to exhibit changes in vital rates, such as reduced juvenile survival, delayed maturation and reduced adult survival. Population growth rate of grey seals at Sable Island, Nova Scotia has been monitored from 1963 to 2010 by estimating pup production. Recently, the rate of increase in pup production has slowed to 4%/yr from 13%/yr prior to 1997. Periodically between 1969 and 2002, more than 7000 grey seals were uniquely branded at weaning. Sighting of branded grey seals has been conducted annually from 1983 to 2012 by means of 3-7 weekly censuses of the breeding colony. Here we use mark-resighting analysis of branded females to estimate

i) juvenile survival (weaning to age 4),
ii) adult survival and
iii) age-specific pupping probabilities (ages 4 to 14).

Two groups of cohorts (1985-89 and 1998-2002) were analyzed separately to test for temporal changes in vital rates using the sightings of the previous group of cohorts to help estimate the probability of sighting. Sightings from 1987 to 1999 of the 1980s cohorts and from 2000 to 2012 of the recent cohorts provided estimates of juvenile survival and average age first birth. The estimates of capture probability (p) from the POPAN model provide a lower bound for average reproductive rates at 53 to 78 %. Estimated average apparent survival rates of adult females were 0.95 and 0.97 for the 1980s and the 1998-2002 cohorts, respectively. Estimated probabilities of average age of first birth (over ages 4 to 14 yr) did not change over time. However, apparent juvenile survival decreased from 0.78 in the 1980s cohorts to 0.33 in the recent cohorts.

Discussion

No substantive discussion or concerns regarding data interpretation, analyses or conclusions. Only questions of clarity were raised.

WP_4B: NORTHWEST ATLANTIC GREY SEAL POPULATION TRENDS, 1960-2012

(M.O. Hammill, W.D.Bowen, C. den Heyer)

Abstract

A model of Northwest Atlantic grey seal population dynamics was fitted to available pup production and reproductive rate data to provide estimates of the Canadian component of the Northwest Atlantic grey seal population from 1960-2012. In previous assessments, the population model estimated a common adult and juvenile mortality rate for the whole population and separate carrying capacities for each herd. For the 2012 assessment, the model was fit to each of the three breeding colonies separately, resulting in separate estimates of pup production, total population size, adult and juvenile mortality and environmental carrying capacity. The 2012 total population of each herd was 262,000 (95% CI 219,000 -332,000), 20,000 (95% CI=17,000-23,000), and 66,000 (95% CI=48,000-87,000) for the Sable, Coastal Nova Scotia and Gulf of St Lawrence herds respectively. In 2012, total pup production was estimated as 75,000 (95% CI=63,000-97,000) animals, with a total population of 348,000 (95% CI=283,000-443,000). Taking into account changes in modeling approaches the population has increased slightly. Total removals should not exceed 36,700 animals if YOY comprise 95% of the harvest or 19,900 animals if YOY comprised 50% of the harvest. Higher harvests are possible, but with increased risk of falling below the limit reference level and subsequent population collapse. Further work is needed on how reproductive rates are incorporated into the herd specific models, as well as the treatment of removals from each area, particularly on the Scotian Shelf area.

Discussion

There were two main points that resulted in substantial discussion on this paper. First, if recent Gulf reproductive rates are assumed to apply to both the Gulf and to Sable Island, then estimates of Sable Is. pup production from the model are not consistent with the trend in minimum estimates of fecundity from the mark-recapture estimates from Sable and the general observations of the trend in pup numbers on the Island. The Committee agreed that the solution was to generate a time series of estimates from Sable Island using the robust analysis. The authors will do this and present the updated results in a revised draft.

Second, there was concern regarding the rather poor fit to the data overall. More specifically, the Committee agreed that the authors should compare the two models with the same data so that differences in the models can be accounted for before attempting to evaluate the influence of new data on model fits and parameter estimates. The authors agreed and will present the updated results in a revised draft.

WP_5A: RESULTS OF FOXE BASIN WALRUS SURVEYS: 2010-2011

(R. Stewart, J. Hamilton, B. Dunn)

Abstract

Through periods of August and September of 2010, and 2011 a project was undertaken to enumerate walrus in Foxe Basin. These animals comprise a portion of the Central Arctic walrus population. Satellite-linked radio transmitters were deployed in 2010 (11) and 2011 (23) prior to concurrent boat and aerial surveys. Based on previous observation and close consultation with the Hunters and Trappers Associations in Hall Beach and Igloolik, surveys were designed to capture the maximum number of walrus on land. The surveys covered all known and suspected walrus haulout sites in Foxe Basin, along with most of the coastline and islands. Survey crews captured digital imagery of walrus on land and in the water. These were used for counting and generation of a Minimum Counted Population (MCP). Using the satellite tag data adjustments were made to account for animals submerged at the time of the survey. Weather, ice conditions and walrus concentrations varied greatly each year making for varied estimates of numbers. This document presents a preliminary population estimate for the Northern and Central Foxe Basin walrus stocks.

Discussion

No substantive discussion or concerns regarding data interpretation, analyses or conclusions. Only questions of clarity were raised.

WP_5B: COMPILATION OF WALRUS POPULATION ESTIMATES FOR THE CALCULATION OF TAH

(R. Stewart, J. Hamilton)

Abstract

DFO Science was asked for advice on sustainable harvest levels for seven stocks of walrus in the Canadian Arctic. No data are available for one stock (south and east Hudson Bay stock) but recent surveys allow calculation of total allowable removal (TAR) levels for the other six stocks. The Potential Biological Removal (PBR) method has been adopted by DFO Science to recommend sustainable levels of removal from marine mammal populations for which there is little information, termed data poor. The results of recent walrus surveys included estimates of the Minimum Counted Population (MCP), as well as adjusted abundance estimates derived

using different factors for availability and detectability. The MCP and adjusted abundance estimates were used to estimate levels of TAR (Total Allowable Removal) using the PBR method, noting that all of the estimates are considered negatively biased. The resulting TAR estimates were then compared to recorded landed harvest levels over the last 25 years (about one walrus generation) without adjustments for reporting accuracy or struck-and-lost estimates. For the high Arctic walrus population, it was not possible to partition harvest to the three component stocks but the overall estimated TARs exceeds currently reported landed harvests in Canada. For the central Arctic walrus population, the TAR estimates for the Foxe Basin stocks straddle the lower 95% confidence limit of recent harvest levels, indicating a need for better survey coverage in estimating abundance, and better information on current removals from all sources. Only a small portion of the range of the Hudson Bay-Davis Strait stock has been surveyed, and calculated TAR levels suggest that the local harvest is sustainable. The central Arctic population as a whole lacks sufficient data for a meaningful population estimate and subsequent advice on TARs. Stocks within both the high Arctic and the central Arctic walrus populations are shared with Greenland, and continued collaboration and exchange of harvest data is warranted.

Discussion

A reviewer asked if it is possible to estimate minimum population size based on historical harvest patterns. The author said that historical catch records, for both commercial and subsistence hunts, will be reported in a paper in the upcoming North Atlantic Marine Mammal Commission (NAMMCO) scientific publication on walrus. Those data could be used for back-calculating estimates of historical abundance and population trajectories.

The author presented several different ways for adjusting the Minimum Counted Population (MCP) values to produce estimates of current population size. The Committee asked which method he prefers. The author replied that the one that relies on the percentage of tags dry at the time of the survey is most reliable because it is straightforward and takes care of environmental covariates although it depends on having a number of tags deployed at the time of the survey that are representative of the population.

Tables 3-5 show CVs for the adjusted MCPs. The author said the CVs are probably artificially low. Reviewers discussed and suggested better methods for estimating variance on the proportion of tags dry. Instead of using a measure of the variance of proportions, one recommended approach would use the variance around the distribution of proportions. The data will be re-analyzed using the binomial variance estimator for small samples.

The N_{min} values used to calculate PBR were either the MCP or with N_{min} calculated from the adjusted MCP and its CV. The author noted that there is an error term on the adjustment factor but not on the actual counts. Reviewers pointed out that the value(s) of N_{min} used should be one(s) for which there is a high degree of confidence that at least that number of animals are present. In some pinniped studies, the number counted has been used for N_{min}. There was some concern expressed with using the lower 80th percentile when it is higher than MCP because there is a large component of variance missing thus the minimum population could be overestimated.

A recovery factor (FR) of 0.5 was used in the calculation of PBR. Reviewers noted that an FR of 1 is used in the United States only when a population is known to be increasing. In Canada, decisions have not yet been made about what FR values to apply to marine mammal stocks depending on the circumstances. The Committee thought that an FR of 0.5 or 1.0 could be used, depending on the stock, as long as the rationale was clear.

Participants discussed the choice of R_{max} value in the calculation of PBR. The author used R_{max} values of 0.04 as a theoretical estimate and 0.07 which was empirically derived from a rapidly-growing population of Pacific walrus. The two R_{max} values also provided the upper and lower limits for the range of PBR values presented. The author said the default R_{max} value of 0.12 for pinnipeds is reasonable for species that reproduce every year but is an overestimate for walrus which breed every three years. Reviewers noted that Chivers (1999) had used an Rmax of 0.08 for walrus in Alaska and there is no fundamental difference in the biology of Pacific and Atlantic walrus. They also pointed out that there is considerable precaution built into the PBR calculation (e.g., the use of N_{min}) and direct counts are a classic version of N_{min}. For these reasons they recommended the author only use the published R_{max} value for walrus (i.e., 0.08) in his PBR calculations.

The request for advice is for current levels of walrus abundance and sustainable harvest. The estimates of abundance presented in the document likely underestimate actual stock size. In spite of the uncertainties, the Committee agreed that the best estimates of stock size (i.e., the adjusted MCPs), and their corresponding Potential Biological Removal (PBR) values which permit comparison with the available data on recent harvest levels, should be presented in the Research Document and Science Advisory Report.

WP_6A: ABUNDANCE ESTIMATE OF EASTERN HUDSON BAY BELUGA, SUMMER 2011

(J.F. Gosselin, T. Doniol-Valcroze, M.O. Hammill)

Abstract

The management of beluga whales hunted around Nunavik relies on the estimation of abundance of summering stocks, including the endangered eastern Hudson Bay stock.

Systematic aerial line-transect surveys to estimate abundance of beluga whales were conducted in James Bay and eastern Hudson Bay from 19 July to 18 August 2011. The flights followed east-west lines with a spacing of 18.5 km in all strata except in the central portion of eastern Hudson Bay, a high coverage area where spacing was reduced by half, i.e. 9.3 km. Unlike in previous years, this stratum could not be surveyed twice because of unfavorable weather conditions.

A total of 232 beluga clusters were detected between perpendicular distances of 190 m and 2970 m from the track line. When fitted to the ungrouped perpendicular distance data, the hazard-rate model (AIC = 3306.43) was selected over the half-normal model (AIC = 3308.99) and yielded an effective strip half width of 765 m. Abundance estimates were corrected for availability of diving animals but nor for observer perception bias.

A total of 173 beluga groups with an average size of 3.38 (CV 15.7%) were detected on 4,182 km of lines in James Bay providing a surface abundance index of 7,154 (CV 26.9%). No animal was seen over the 995 km surveyed in the low coverage area of eastern Hudson Bay. There were 63 beluga groups detected on the survey of the high coverage area of eastern

Hudson Bay (6,684 km), with an average size of 3.21 (CV 37.2%), resulting in a surface abundance index of 1,434 (CV 47.1%).

The abundance estimate for James Bay, after correcting for submerged beluga, was 14,967 (CV 29.9%, 95% CI: 8,384 – 26,775). Correcting for submerged animals and adding the count from Little Whale River resulted in an abundance estimate of 3,354 beluga whales (CV 48.9%, 95% CI: 1,199 – 7,509) in eastern Hudson Bay.

This is the sixth visual systematic survey of James Bay eastern Hudson Bay. Differences in the surface abundance indices among years illustrate the challenges of estimating the abundance of small populations with clumped distributions.

Discussion

It was noted that there was a low CV observed in 1985 due to a transect method used in that year. The difference in the estimated CV is mainly explained by the difference in the survey method used (the CV comes entirely from the correction factor for diving whales). There is a missing 'true error'. It was suggested that the authors might want to fit a common sightings curve to census methods that use the same methods to determine the population trend, rather than the method they used. The authors responded that they could do this (combine the detection curve for a given survey and extend to several surveys). This would reduce positively correlated errors associated with the sightings curve that would need to be incorporated into the model.

It was suggested that the authors obtain a number more specific to the EHB population for the correction factor in the future. The authors responded that yes indeed, there are good reasons to investigate this further (e.g. water is more turbid and shallower than James Bay so the diving behaviour of the animals may be quite different).

It was suggested that the authors provide a figure that shows the percentage occurrence of each cluster/group size.

It was asked, with regards to the lines in the upper part of the high density area that could not be surveyed – by not surveying that area, would the 2011 estimate be biased upward, or did the authors extrapolate the density to make it more comparable to other years? It was suggested that the authors mention something about why the estimate provided for this year is not likely to be biased.

WP_6B: POPULATION MODELLING AND HARVEST ADVICE UNDER THE PRECAUTIONNARY APPROACH FOR EASTERN HUDSON BAY BELUGA (*DELPHINAPTERUS LEUCAS*)

(T. Doniol-Valcroze, J.F. Gosselin, M.O. Hammill)

Abstract

Subsistence harvest of beluga whales by Nunavik communities is directed towards a mixture of several stocks, including the depleted Eastern Hudson Bay stock (EHB). According to harvest statistics, the 2012 hunt consisted of 86 beluga killed near Sanikiluaq (Belcher Islands), 12 in

the eastern Hudson Bay, 10 in Ungava Bay and 208 in Hudson Strait in the spring. We assumed the full TAT of 56 whales was taken in the fall in Hudson Strait.

We incorporated recently updated information on stock structure and the results of the 2011 aerial surveys into a population model. Genetic variation at mtDNA loci was used to assess the contribution of each summering stock to the harvest and how these contributions vary spatially and seasonally. The model was fitted to survey estimates using Bayesian methods. The estimated stock size in 1985 was 3,801 animals with a 95% CI of 2,395–6,388. The lowest abundance point was estimated for the year 2001 at 3,014 individuals (95% CI 2,138–4,331), with a 2012 abundance of 3,222 individuals (95% CI 1,897–5,356). At current harvest levels, the stock abundance seems to exhibit slow growth over the last few years. The model estimated struck-and-lost at 41.4% (95% CI 11–77%) and growth rate at 2.75% (95% CI -0.65 to +6.15%).

According to the model, removing 62 EHB animals per year for 10 years would have a 50% probability of causing a decline in the stock relative to its 2012 estimate. Limiting the harvest of EHB animals to 28 animals would reduce the probability of decline to 25%. Conversely, a harvest of 104 EHB beluga would have a 75% probability of leading to stock decline. In the absence of harvest, the probability of decline is 9%. A spring/summer harvest in Hudson Strait, with no harvest in the eastern Hudson Bay arc would have the lowest impact on the EHB stock, followed by a fall harvest in Hudson Strait only, again with no harvest allowed in the arc (Fig. 8b). If harvesting does occur in eastern Hudson Bay, then numbers taken in Hudson Strait must be reduced to obtain the same probability of increase, but the size of this reduction will depend on whether hunting occurs in the spring/summer or in the fall.

The model was used to estimate the probability of reaching a recovery target of 70% of the historical stock size under a precautionary approach framework. Projections over the next 25 and 50 years show that, at current harvest levels (~50 EHB beluga per year), there is a 16% probability of reaching the recovery target of 8,750 individuals after 25 years. After 50 years, this probability increases to 37%. Even in the absence of harvest, the probabilities of reaching the target are only 31% after 25 years and 64% after 50 years. However, uncertainty about the historical stock size, current carrying capacity and density-dependent mechanisms place important limitations on our ability to make long-term predictions regarding the recovery of the EHB stock.

Discussion

It was noted that when the authors did forward projections, the estimates never got very high. Did you assume that you are doing large surveys? If doing large surveys, you would reduce your confidence intervals – the authors should capture in the discussion that there was no other way to do this.

It was noted that an estimate of N_{max} must be resolved. If the authors do not want to use the historical value for N_{max}, they should stress that the value used for the last 20 years is not appropriate, and take it off the table.

WP_6C: A FRAMEWORK TO INCORPORATE AND QUANTIFY RISKS OF IMPACTS ON MARINE MAMMAL POPULATIONS FROM SHIPPING NOISE OR SHIP STRIKES: A CASE STUDY USING THE MARY RIVER IRON MINE PROJECT

(J. Lawson, V. Lesage)

Abstract

The abundance and distribution of marine mammal populations is influenced by a variety of factors, including ice structure and presence, resource availability, reproductive success, predator distribution, or more generally, mortality risks. While mortality incorporates natural and anthropogenic sources, for most managed populations the latter metric has focused on population losses due to hunting effort. Recently, anthropogenically-related, non-harvest removals are being considered for managed marine mammal populations, such as the role of climate change as a population-level factor that might reduce carrying capacity and/or increase mortality. More "proximal" negative consequences to marine mammal populations could arise from human activities that cause displacement by industrial activities and associated noise, vessel strikes, or introduction of new predators or other invasive species. During DFO's assessment of Baffinland's Mary River Iron Mine Project, which will involve unprecedented levels of marine shipping and icebreaking in the Arctic, it was clear that the potential for interaction between project activities and marine mammals exists throughout the year. There is currently no national approach as to how impacts should be evaluated by DFO Science, which may lead to a perception of inconsistency and unfairness in the reviews. In this context, there is a pressing need to develop a national approach to impact assessment, threshold setting, and monitoring standards, and to develop a set of guidelines for the industry outlining the information needed for adequate impact assessment, and proposed methodologies for evaluating impacts. In this document, we describe the background information pertaining to marine mammal risks from exposure to vessel noise or ship strikes, and we use the Mary River Iron Mine project as a case study when outlining a more general framework to quantify risks of impacts on marine mammal populations from shipping noise or ship strikes. The method we have used in this document to assess impacts of shipping noise could be extended to encompass other types of anthropogenic noise sources, including pulsed or non-pulsed sources.

Discussion

It was suggested that the Department test this approach on projects happening in other regions, and to ensure that issues faced by other regions are incorporated into this framework as this approach is further developed and refined.

An important issue is the effectiveness of mitigation measures proposed. For example, for one project on the west coast, the proponent is suggesting that slowing their ships down to 8-10 knots will mitigate any harm/risk to cetaceans, although there is no concrete evidence to back this up. They are also suggesting a variety of methods to improve detection and avoidance of animals such as passive acoustic monitoring techniques and infrared detection, which are methods that have not proven to work. It would be good to try to build and use a framework like this as a tool to encourage studies on the effectiveness of mitigation measures.

It was suggested that the authors use a different term/acronym other than “Total Allowable Harm” (TAH) - some may interpret the acronym “TAH” as “Total Allowable Harvest” (as will be the case in Nunavut).

WP_7: DISTRIBUTION, DENSITIES, AND ANNUAL OCCURRENCE OF INDIVIDUAL BLUE WHALES (*BALAENOPTERA MUSCULUS*) IN THE GULF OF ST. LAWRENCE, CANADA FROM 1980-2008

(C. Ramp, R.Sears)

Abstract

This document describes the distribution of individually identified blue whales (*Balaenoptera musculus*) in the Gulf of St. Lawrence (GSL), Canada. Data were collected by the Mingan Island Cetacean Study (MICS) from 1980 to 2008. The aim of this project was to provide additional information for designating blue whale critical habitat as required under the Canadian *Species at Risk Act*. Data from photo-identification surveys yielding over 13,000 blue whale sightings were used to identify the distribution and densities of blue whales in the northwestern section of the GSL. Surveys focused on the area west of 63ºW and included opportunistic sightings from collaborators. Daily first sightings of individually identified blue whales were used to calculate encounter rates and sightings per unit of effort in each region. The largest concentrations of blue whales were found in the lower St. Lawrence Estuary, around the eastern tip of the Gaspé Peninsula, along the north shore of the Jacques-Cartier Passage, and in the waters adjacent to Sept-Îles. Several changes in blue whale distribution were observed over the course of the study period. A major shift occurred in 1992/1993, when blue whales abandoned the Jacque-Cartier Passage. The GSL is a major summer feeding ground for blue whales and they occur predominantly along the productive coasts. In general, blue whales can be observed almost anywhere in the north-western GSL. In some areas, for example along the north shore of the Gaspé Peninsula, blue whales seem to pass through on their way to and from the lower St. Lawrence Estuary. The areas with highest blue whale densities and longest residency times included the north shore of the lower St. Lawrence Estuary and the eastern tip of the Gaspé Peninsula between Rivière-au-Renard and Percé. The northern banks of the Jacques-Cartier passage were important in the years prior to 1994. Although blue whales come mainly to the GSL to feed in summer, they can occur year-round. The number of sightings tended to increase throughout the summer season, peaking in late August and early September; however, regional differences were apparent. The first peak in sightings occurred in June/July when blue whales were observed off of the Gaspé Peninsula, while sightings in the lower Estuary drove the main peak in August/September. A total of 402 blue whales have been identified in the GSL since 1980 and a maximum of 32% of these were sighted in any given year. Blue whales were observed an average of only two days per season (occurrence), with an average occupancy of 22 days. The low numbers of re-sightings within years suggest that blue whales in the GSL are highly mobile.

Discussion

The Committee discussed the value of updating or removing the map that shows opportunistic blue whale sightings off the east coast of Canada outside the Gulf (Figure 2). The map is somewhat misleading because the number of sightings represented by each dot is not indicated. For example, a reviewer noted that one particular dot on the map represents a group of over sixty blue whales sighted during a seismic survey and another dot represents a group of almost forty. Additionally, the sightings shown are only a fraction of all available sightings for the region. However, this document will feed into the process to develop advice related to critical habitat so the map has some usefulness. It was agreed that the map should remain in the document accompanied by a clear statement that the data presented are incomplete and qualify what these data do or do not represent (i.e., it is not a review of all available data or literature). Boundaries of the study area within the Gulf of St. Lawrence should also be added to the map.

The authors used the word “migration” to describe broad-scale movements of blue whales outside the study area, as well as to describe “migration corridors” linking foraging areas within the study area. It was recommended that the latter be referred to as “movement corridors” to make the discussion clearer.

For clarity, the author was asked to present the names of months in all the graphs that show seasonal patterns (i.e., Figures 21-26).

The authors identified that the Mingan area was important habitat for blue whales in the 1980s and early 1990s but later was almost completely abandoned. Someone could interpret this to mean the area no longer contains suitable habitat. The Committee recommended revising the text to simply say that it is no longer used. The author reported that the distribution of blue whales appeared to have been impacted by the collapse of cod stocks but there are insufficient prey data available for the area to confirm exactly what happened. The Committee noted that the declining use of the Mingan area raises the possibility that there are other parts of the Gulf that have not been considered important areas but which may have been historically. Therefore, although the sighting database covers many years it may not represent all habitats used in the Gulf. The author agreed that blue whales can shift their distribution relatively quickly.

The author clarified that the sizes of circles shown in Figure 8 represent the number of sightings, and not group size. As it is not critical to identify the precise locations of sightings, the Committee thought the figure would be clearer if jitter was introduced (i.e., nudge the sighting locations) to spread individual sightings farther apart.

Figure 17 shows the frequency of capture for identified blue whales. The Committee asked the author to include another graph that shows the distribution of years between sightings (i.e., time lags) for individual whales, to help to document fidelity over time.

The Committee noted that Jeff Higdon compiled a database of historical catches of bowhead whales. It might be worth checking to see if his database also contained historical information for blue whales. The author had looked at records from one whaling station but found few blue whale sightings.

The last paragraph on page 12 contained several recommendations for future work. The Committee recommended moving it to the end of the document where it could be used to reiterate limitations of the data.

WP_8: INFORMATION IN SUPPORT OF THE IDENTIFICATION OF CRITICAL HABITAT FOR TRANSIENT KILLER WHALES (*ORCINUS ORCA*) OFF THE WEST COAST OF CANADA

(Ford, J.K.B., E. Stredulinsky, G.M. Ellis)

Abstract

Mammal-eating transient killer whales off Canada's Pacific coast are listed as Threatened under the *Species-at-Risk Act*. A Recovery Strategy for transient killer whales was prepared by DFO in 2007, but insufficient information was available to identify critical habitat in that document. Here, we present an assessment of the habitat requirements of West Coast Transient (WCT) killer whales in order to provide the basis for the identification of critical habitat for this population. For this assessment, we used an archive of photo-identifications of individual WCT whales collected during 3528 encounters between 1958 and 2011. Based on frequency of occurrence, distribution, and social association patterns, we defined a core population of 304 individuals identified during 2988 encounters between 1990 and 2011, and used this dataset to analyze movement and habitat use patterns. WCT killer whales are highly mobile and range over the entire BC coast throughout the year. WCT whales forage for marine mammal prey in all marine habitats, primarily in close proximity to coastlines. We describe the biophysical functions, features, and attributes of this habitat, most of which involve feeding and adequate abundance and distribution of prey. We propose critical habitat based on a bounding box approach that includes marine waters up to 3 nautical miles (5.56 km) from shore. This area would encompass the locations of over 90% of all encounters and predation documented since 1990. Examples of activities likely to destroy critical habitat are described.

Discussion

It was noted that there is a problem with uneven effort, and it may be worth considering this issue further. The BCCSN (at the Vancouver aquarium) is presently trying to wrestle with this by getting more information from observers of sightings.

It was noted that harbour seal pups are an important part of the diet, but predation is unlikely to be detected (easy to pick off with little surface disturbance). Consequently the authors may be under-representing the importance of this species as prey. The authors confirm they may be underestimating the importance of seals in diet and have little or no idea of age class distribution of kills.

There was concern that the authors have defined spatial boundaries of important habitat; perhaps it would be more appropriate to provide advice on general areas/features of important habitat and then let policy determine the actual location or spatial boundaries of critical habitat? The authors will re-examine the wording.

There was also concern regarding bounding the whole coast out to 3nm of shore. Given that population now growing at a certain rate, would the whole coast be required to maintain this growth rate? How large would an activity have to be to destroy the critical habitat, with respect to the population recovery objectives that the Recovery Strategy lists? The authors don't know the carrying capacity (K) of the population, but prey abundance is not sufficient to calculate K because you also need to consider the spatial distribution of the prey as per resource depression. The Chair indicated these are important resource management questions and should be addressed, but not during this peer-review process.

There was concern raised regarding the categories of peripheral and core groups and whether the distinction is related to effort. The authors agreed that effort may be impacting these definitions, but this is the best they can do with the data they have. It was suggested that the authors provide better arguments for the distinction between core and peripheral groups, including uncertainty. For example, distance classes shown in Figure 3 are not equal, which is somewhat misleading. Also in relation to the 3nm buffer, it would be useful to see a cumulative plot to see how many of the peripheral and core animals would fall in versus fall out. The authors did include the summary statistic (90% of WCT core encounters fall within) but did not show it on a graph.

There was some discussion regarding what the minimal designation represents; it was suggested that the authors document a bit more what the animals may be doing besides foraging. Predation is based on visual observations, so results would be biased to coastal observations, and this should be acknowledged in the paper.

When testing between peripheral and core using depth distance to shore, it was suggested that the authors use the Kolmogorov–Smirnov (KS) test (as it will include the distributional difference) rather than Mann Whitney. The authors did run both and will switch reported stats (the KS results were highly significant).

It was also suggested that the authors might be able to get effort seasonally (e.g. Figure 15); the authors will consider this further.

The results presented in Table 1 need a little more discussion. The authors have defined core animals that are well known, but there are also ~200 peripheral animals that use some part of this area.

The committee suggested that the authors change terms from core/peripheral to something like inshore/offshore, or frequently encountered/infrequently encountered. “Core” implies important versus “peripheral” implies unimportant. The authors should also describe how corridors are included in important habitat areas.

WP_9: STATUS OF SEA LIONS (*EUMETOPIAS JUBATUS* AND *ZALOPHUS CALIFORNIANUS*) WINTERING IN BRITISH COLUMBIA

(P. Olesiuk)

Abstract

This report examines the status of sea lions wintering in British Columbia. California sea lions (*Zalophus californianus*) breed off the coast of California and Mexico during May- August and only a few stragglers occur in B.C. during summer months. Non-breeding California sea lions (primarily subadult and adult males) disperse widely, and in the 1960s the species began to appear regularly off southern Vancouver Island. Animals arrive in B.C. in September- October and depart in April-May, with mean residency of 6.5 months. Aerial surveys for California sea lions have focused on southern Vancouver Island, where the species is most abundant. Survey counts (December-February) increased dramatically during the 1970s and early 1980s, from

less than a hundred in the early 1970s to a peak count of 4,478 in 1984. Although the species has continued to expand its range northward, counts off southern Vancouver declined from an average of 2,646 (range 1,518-4,478) in the 1980s to 1,580 (range 1,185-1,901) in the 2000s ($R^2=0.373$; $F_{1,18}=10.7$; $P=0.004$). The declines occurred mainly along the southwest coast of Vancouver Island, whereas numbers wintering in the Strait of Georgia have remained high and shown no trend ($R^2=0.089$; $F_{1,18}=1.8$; $P=0.202$). The reason for the declines are not known, but could be related to: 1) declines in herring stocks, a key prey species, on the west coast of Vancouver Island; 2) predator control kills and entanglements at salmon farms; or 3) increased competition from Steller sea lions, which have steadily increased in abundance off southern Vancouver Island ($R^2=0.642$; $F_{1,22}=39.5$; $P<0.001$). In the most recent province-wide winter sea lion survey in B.C. during 2008-2010, a total of 1,806 California sea lions were counted, 84.2% of which occurred off southern Vancouver Island. Corrections to account for animals that were at sea and missed during surveys are not available for California sea lions, but if haulout patterns are similar to Steller sea lions, which share many of the same haulouts and forage on similar prey, total winter abundance of California sea lions on the B.C. coast could be on the order of 6,300 animals.

Steller sea lions breed and occur year-round in B.C. Surveys have usually been conducted during the summer breeding season to monitor trends in pup production and the breeding population. Province-wide winter surveys (December-January) were conducted in 1971, 1976 and 2008-2010 to assess seasonal shifts in distribution and abundance. The surveys indicated a distinct seasonal shift in distribution, with the proportion of animals on rookeries declining from 60-65% in summer to 10-15% in winter, the proportion of animals on winter haulouts increasing from 1-3% in summer to 43-61% in winter, and the proportion of animals on year-round haulouts remaining relatively stable at 32-40% in summer and 47-24% in winter. Winter counts were similar in magnitude to counts made in the pre- or proceeding summer, which had previously been interpreted as indicating that seasonal abundance of Steller sea lions was fairly stable, but that breeding animals shifted from rookeries in summer to winter haulouts in winter (Bigg 1985). However, recent studies using satellite telemetry indicated that Steller sea lions spend more time foraging and less time hauled out during winter months, and diurnal haulout patterns were not as synchronized during winter, such that a lower proportion of animals would have been hauled out and counted during winter surveys. An assessment of the effects of environmental conditions on haulout patterns indicated that sea lions were less inclined to haul out during inclement weather (ANOVA; $F_{7,18,208}=138.4$; $P<0.0001$) that is more prevalent during winter, but the effect was too small to account for the seasonal differences in the proportion of animals hauled out during winter and summer surveys. Adjusting for seasonal differences in haulout patterns, it was estimated that abundance of Steller sea lions in B.C. waters increases by on the order of 150-220% between summer and winter. Based on the 2008-2010 winter survey, it was estimated that 48,000 (95% CI 37,300- 58,700) Steller sea lions winter in B.C., compared with summer abundance estimates of 26,400 (95% CI 22,700-30,100) and 31,900 (95% CI 27,200-36,700) in 2008 and 2010 respectively. It is hypothesized the increase is due to an influx of breeding animals that are displaced northward from rookeries in Oregon by migrating California sea lions, and that disperse from the large rookery on Forrester Island situated just north of the B.C. – Alaska border. To test this hypothesis, a survey was conducted in October 2012 to document dispersal patterns of breeding animals (as indicated by young-of-the year). The survey indicated the majority of breeding animals had moved off rookeries, and as indicated by the distribution of young-of-the year, had moved to nearby year-round and winter haulouts [detailed results to be added in a later draft].

Discussion

It was noted that there are two points regarding dramatic shifts: 1) the dynamics of the animals themselves and 2) dynamics of the prey. The potential impact of environmental influxes on marine ecology and prey species should perhaps be considered more by fisheries scientists. The authors agreed that this message should be captured in the SAR, and that they need to highlight the anomalies and what is more typical about the numbers and trends.

There was concern regarding why the correction factors are so different for the different surveys. The authors explained that this is due to the seasonal differences in haulout patterns – missing more animals during daylight hours in the winter so corrections are higher in the winter. However, there is a lack of confidence in the abundance estimate of the fall 2012 survey, and the authors are unsure how to interpret these results. The counts are an observation of what was there, so the authors should include this data (the fall survey). Perhaps a corrected winter haulout pattern could be used

It was suggested to present the data as counts without any correction; this likely more accurately represents the trends in what is happening in the population (this will work for the stellar sea lions, but may not work for California sea lion).

The authors asked what should be done for California sea lions and the calculation for PBR. The request asks for abundance; but the count data should not be represented as the abundance estimate. A raw count can be given but a statement needs to be made that a large number of animals are being missed because no correction factor is being applied.

WP_10A: A RE-ANALYSIS OF NORTHERN HUDSON BAY NARWHAL SURVEYS CONDUCTED IN 1982, 2000 AND 2011

(N.C. Asselin, S.H. Ferguson)

Abstract

Long-term monitoring of the abundance of wildlife populations is partly hindered by changes in methodologies as new techniques and equipment are developed. The Northern Hudson Bay (NHB) narwhal population was surveyed in the early 1980s, 2000, 2008 and 2011. The three estimate methodologies (from the 1980s, 2000 and 2011) varied in terms of spatial extent, data collection, and analysis. The 2011 visual survey data was re-analysed using the methods of the visual surveys in 1982 and 2000. The ratios of the 2011 abundance results to those that would have been obtained using the methods from 1982 and 2000 were calculated. The 1982, 2000, and 2011 analysis methods, when applied to the 2011 survey data, yielded surface estimates of 1737 (95% C.I. 1002-3011), 1945 (95% C.I. 1089-3471) and 4452 (95% C.I. 2707-7322) narwhals, respectively. The ratios of the 2011 to the 1982 and 2000 surface estimates were 2.56 and 2.29, respectively. These ratios provide an understanding of the large variation associated with different analysis methods on abundance estimates. Results can assist in determining trends in the NHB narwhal population while accounting for changes in methodologies over time.

Discussion

Two items were discussed and identified by the Committee to improve the paper:

1) The calculated ratios between 2011 and 2000: what do the ratios mean, why they were calculated and what does that tell us?

2) The document would benefit from the interpretation of the ratios, effects of the methodologies as it relates to Kingsley's paper (Updated stock-dynamic model for the northern Hudson bay narwhal population based on 1982-2011 aerial surveys) and the effect of truncation.

WP_10B: UPDATED STOCK-DYNAMIC MODEL FOR THE NORTHERN HUDSON BAY NARWHAL POPULATION BASED ON 1982-2011 AERIAL SURVEYS

(M.C.S. Kingsley, N.C. Asselin, S.H. Ferguson)

Abstract

The Northern Hudson Bay narwhal population was assessed from aerial photographic surveys of summer aggregations in 1984, 2000, 2008, and 2011. The August 2011 survey provided information necessary for a full assessment of the population. A stock dynamic model using Bayesian methods and run on the OpenBUGS platform was developed in 2010 based on surveys up to 2008. Here, we update this model with the 2011 survey results and using adjustments for different survey methods (Asselin and Ferguson WP_10a) to assess the population size indices updated with the catch history to inform management of this population. To minimize differences due to the changes in methods, the 2011 data was re-analysed as though it had been collected and recorded using the recording methods of 2000. The valid information on stock dynamics comes from the differences between the 1982–84 surveys and those flown in 2000 and 2011. The dynamics of the population was modelled as a constant growth rate and limits to population growth at high numbers were not considered. In the present document, catch was the only mortality considered, and loss rates were considered to have the same distribution over the whole period. Three survey treatment options were run. Assuming that the re-analysis of the 2011 data gives results that are comparable with earlier visual surveys, the population has a growth rate just under 2% a year and can support landed catches up to 100/year. The population trajectory has been more or less flat since the late 1990s with mean landed catches since then about 110 a year; the odds of any decrease in numbers are estimated at 48% over 10 years. The estimated probability that the population will decline increases with time, even for catch levels that are associated with a slightly increasing population, because of the rising uncertainty of projections into the future. The results from this modelling exercise are uncertain and do not provide reliable estimates of future sustainable catches and further surveys are required. We conclude that management should continue to use Potential Biological Removal (PBR), rather than the risk-based approach reported in this document, until more surveys are undertaken.

Discussion

No substantive discussion or concerns regarding data interpretation, analyses or conclusions. Only questions of clarity were raised.

WP_12: APPLYING THE PRECAUTIONARY APPROACH TO MARINE MAMMAL HARVESTS IN CANADA

(G. Stenson, M. Hammill, S. Ferguson, R. Stewart, T. Doniol-Valcroze)

Abstract

In establishing harvest levels, resource management requires tradeoffs among conservation, economic and political concerns. The Precautionary Approach brings scientists, resource managers and stakeholders together to identify clear management objectives and to agree on population benchmarks that would initiate certain management actions when these benchmarks are crossed. A conceptual framework for applying the precautionary approach to marine mammal harvests is outlined. For a data-rich species, precautionary and conservation reference levels are proposed. When a population falls below the precautionary reference level, increasingly risk-averse conservation measures are applied. A more conservative, risk-averse approach is required for managing data-poor species. The framework has been implemented for the management of commercial seal harvests in Atlantic Canada.

Discussion

It was suggested that consideration needs to be given to what one is trying to do with marine mammal stocks before trying to fit them all under one management scheme. An objective needs to be clearly defined in order to develop an appropriate management approach for any population or species. However, this is an issue that cannot be easily resolved. The objective that managers presented to Science was to “develop a precautionary approach for the management of marine mammals that will allow us to maintain a healthy population”. No target or reference limits were provided from which to work from. We must therefore identify reference points with some caution around them, without a clear understanding of what is considered acceptable risk. Perhaps the authors could consider writing a harvest strategy with specific objectives outlined, and then develop a PA framework under the objectives of that harvest strategy.

It was noted that a confounding problem is that these types of approaches are being developed based solely on biological data when managers are making decisions based on factors other than biological ones (such as socioeconomic drivers). Perhaps the approach developed should consider these non-biological drivers.

It was noted that a component that is missing from the proposed approaches is the use of aboriginal traditional knowledge (ATK). Perhaps ATK can be used to help increase knowledge of some of these data-poor species and should be considered when determining reference levels.

The authors should also consider that the harvest levels determined for some aboriginal marine mammal harvests may sometimes be well above the “basic needs level” (BNL), which may promote unnecessary harvesting. The BNL should also be considered when determining harvest levels.

As we get into applying the PA to different species, we need to address the issues outlined in the presentation. As a department, we are being asked to develop allowable harm for a lot of different species. We need to determine if we want to try and develop one common approach to follow.

WP_13: ACOUSTIC MONITORING OF CETACEANS ON THE SCOTIAN SLOPE

(H. Moors)

Abstract

DFO Maritimes Region has been conducting acoustic monitoring studies along the eastern Scotian Slope for the past few years, primarily to investigate habitat use and behavior of Endangered Scotian Shelf northern bottlenose whales. Additionally, we have been helping develop automated detectors for multiple species, density estimation techniques and other software for the analysis of acoustic data. Much effort has also been put towards developing relationships with industry and other government partners to support longer-term acoustic projects in the region. The purpose of this talk is to inform the group about cetacean-related work being done by the Ecosystems Management Branch and Science Branch of DFO Maritimes Region.

Discussion

No substantive discussion or concerns regarding data interpretation, analyses or conclusions. Only questions of clarity were raised.

APPENDIX I: TERMS OF REFERENCE

Annual Meeting of the National Marine Mammal Peer Review Committee (NMMPRC)

National Peer Review - National Capital Region

October 29 - November 2, 2012
Nanaimo, B.C.

Chairperson: Don Bowen

Introduction

The National Marine Mammal Peer Review Committee (NMMPRC) holds an annual meeting to conduct scientific peer-review of marine mammal issues. This meeting provides the opportunity for collaborative review of scientific results by marine mammal experts from Fisheries and Oceans Canada (DFO) and from other (non-DFO) organizations. Following NMMPRC review and approval, scientific results are used to provide sound scientific advice for the management and conservation of marine mammals in Canada. When time permits, this annual meeting is also an opportunity to review ongoing research projects and provide feedback or guidance to the scientists involved.

Topics

1. **Harp seal harvest advice**

Context: Harp seals, *Pagophilus groenlandicus*, are the most abundant pinniped in the northwest Atlantic with an estimated maximum population size in 2008 of 8.3 million animals (DFO 2012). The Canadian and Greenland hunt for Northwest Atlantic harp seals is the largest marine mammal harvest in the world. Since 2003, the Canadian commercial harp seal harvest has been managed under an Objective Based Fisheries Management (OBFM) approach which incorporates the principle of the Precautionary Approach. Under this approach, precautionary reference levels are identified and are associated with pre-agreed management actions that are to be enacted if the population is estimated to decline further (DFO 2003). Under the current OBFM plan, the management objective is to set harvests that will ensure an 80% probability (L20) that the population will remain above the Precautionary Reference Point (PRP; N70; 70% of the maximum observed population). The Limit Reference Point (LRP), for this population, also known as a “conservation reference level” has been set at N30 (30% of the maximum observed population).

Ecosystems and Fisheries Management (EFM) is currently considering revising the objectives of the Atlantic Seal Management Plan. EFM has asked Science to consider alternatives to the current LRP (see below), and also to evaluate the impacts of various harvest levels using a range of probabilities of risk associated with dropping below the LRP.

In evaluating the impacts of different harvest levels on the population, reported harvests by Canadian and Greenland hunters, losses due to animals struck but not landed or reported bycatch in fishing gear, changes in reproductive rates, and unusual mortality due to poor ice conditions are taken into account.

Objectives: To evaluate the following:

1. Determine an appropriate Limit Reference Point that can be set at a fixed level (and reviewed periodically – frequency to be determined).
2. Determine the minimum population size that can maintain an ongoing (i.e. for 15 years) sustainable harvest of 100K, 200K, 300K and 400K, while maintaining a probability of 85%, 90% and 95% of staying above the Limit Reference Point.

Working papers: Two working papers will be presented for peer-review.

Expected Publications: Two Research Documents and one Science Advisory Report are expected.

2. Humane killing methods: grey seals

Context: The recent increase in the North Atlantic Grey Seal population has resulted in an increasing interest in hunting activities, primarily for juvenile seals located off Eastern Cape Breton and in the Northumberland Straight. Due to observations that grey seal skulls are thicker than similarly-aged harp seal skulls, questions have been raised regarding whether hunting tools currently allowed under the Marine Mammal Regulations meet Canada's humane hunting requirements when used on grey seals. The effectiveness of current tools (mainly the club) on juvenile grey seals, as well as the potential for using .17 HMR calibre ammunition at close range, will be assessed.

Objectives: To (1) review the effectiveness of the .17 HMR calibre rifle to kill grey seals humanely, and (2) evaluate the differences in skull thickness and force required to crush harp seal and grey seal skulls.

Working papers: Three working papers will be presented for peer-review.

Expected Publications: Three Research Documents and one Science Advisory Report are expected.

3. Ringed seal abundance in James Bay and eastern Hudson Bay

Context: Ringed seals are harvested by the Inuit of Nunavik in all of the communities in the Eastern Hudson Bay area. There is currently no monitoring of harvests in place and there is a lack of available scientific information. It would be useful to establish a baseline for ringed seals in this area and determine if the population is considered healthy or requires monitoring and review.

Objectives: To evaluate the abundance or population density of ringed seals in the South-east Hudson Bay and James Bay area. In addition, if possible, to determine a population target for ringed seals and a maximum yearly harvest limit to either maintain or reach this target within 10 or 20 years.

Working papers: One working paper will be presented for peer-review.

Expected Publications: One Research Document and one Science Advisory Report are expected.

4. Grey seal harvest advice

Context: There is a small commercial hunt for grey seals in the Gulf of St. Lawrence and along the Eastern Shore. Due to logistical difficulties, no commercial hunt has occurred on Sable Island; this is unlikely to change, as the designation of Sable Island as a National Park includes a prohibition of commercial activities on the Island. Grey seals are occasionally a nuisance to commercial fisheries and some are killed under the authority of Nuisance Seal Licences. They are an important host for the seal/cod worm (*Pseudoterranova decipiens*), which also infect many groundfish species, and must be removed during processing. Grey seals are also considered by industry to be affecting the recovery of some depleted fish stocks, and to damage fishing gear. The status of the population was recently assessed in 2010.

Grey seals are managed under the Objective Based Fisheries Management (OBFM) approach for Atlantic seals which was implemented in 2003. Under this approach, populations are classified as ‘Data Rich’ or ‘Data Poor’ depending on certain data criteria. As of 2007, grey seals were considered to be ‘Data Rich’.

Under the current OBFM, the management objective is to set harvests that will ensure an 80% probability (L20) that the population will remain above the Precautionary Reference Point (PRP; N70; 70% of the maximum observed population). The Limit Reference Point (LRP), for this population, also known as a “conservation reference level” has been set at N30 (30% of the maximum observed population).

Ecosystems and Fisheries Management (EFM) is currently considering revising the objectives of the Atlantic Seal Management Plan. EFM has asked Science to consider alternatives to the current LRP (see below), and also to evaluate the impacts of various harvest levels using a range of probabilities of risk associated with dropping below the LRP.

Objectives: For each age class scenario below, determine the maximum harvest that could be taken from the grey seal population with probabilities of 0, 5, 10 and 15% of falling below the LRP (LRP is roughly equivalent to current N30).

1. Age composition comprised of 97% young of the year, 3% animals aged 1+ years, and
2. Age composition comprised of 50% young of the year, and 50% animals aged 1+ years

Working papers: Two working papers will be presented for peer-review.

Expected Publications: Two Research Documents and one Science Advisory Report are expected.

5. Foxe Basin walrus estimates

Context: In 2007, Ecosystems and Fisheries Management (EFM) requested Science advice concerning the Total Allowable Harvest (TAH) levels for each of the walrus stocks found within the Nunavut Settlement Area, as requested by the Nunavut Wildlife Management Board (NWMB). In 2008, Science produced a Research Document evaluating the existing information (Stewart 2008), but concluded that due to lack of information on stock estimates, it was not possible to provide the advice as requested. In 2009, 2010 and 2011 EFM requested abundance estimates and sustainable harvest advice for Foxe Basin and Baffin Bay walrus (Baffin Bay, West Jones Sound and Penny Strait-Lancaster Sound stocks). In 2012, EFM requested the same information for Hudson Bay-Davis Strait walrus. This information is needed to finalize draft Integrated Fisheries Management Plans for these stocks, and/or for NWMB consideration in establishing harvest limits (TAH and Basic Needs Level). Population abundance estimates and sustainable harvest advice are now available for Foxe Basin walrus. For other walrus stocks the Potential Biological Removal method may now be applicable to provide sustainable harvest advice to the NWMB.

Objectives: To evaluate abundance estimates for Foxe Basin walrus and provide Potential Biological Removal estimates for all walrus stocks in Nunavut.

Working papers: One working paper will be presented for peer-review.

Expected Publications: One Research Document and one Science Advisory Report are expected.

6. Abundance estimate of eastern Hudson Bay (EHB) beluga

Context: The Inuit harvest of beluga in the Nunavik Marine Region is of utmost importance in terms of their culture, tradition and subsistence. The current beluga management plan promotes the conservation of the Eastern Hudson Bay and Ungava beluga populations but is up for review in 2012-2013 based in part on the scientific information obtained. The results of the latest survey conducted would be useful in determining the status of these two populations.

This information is necessary to the development and implementation of a beluga management plan in the Nunavik Marine Region. This will be completed with the collaboration of the Nunavik Marine Region Wildlife Board and the Regional Nunavimmi Umajutvijiit Katajuaqatigininga.

Objectives: To address the following:

1. Evaluate the abundance of the Eastern Hudson Bay (EHB) beluga population under the precautionary approach and the impact of current harvest levels.
2. Recommend a recovery population target under the precautionary approach and provide scenarios which include the maximum number of EHB beluga whales that can be hunted each year and still provide for recovery within 25 and 50 years.
3. Determine the maximum number of belugas from the EHB population that can be harvested while maintaining a 25%, 50% and 75% chance of population increase and taking into account the season and area of the hunt.

Working papers: Three working papers will be presented for peer-review.

Expected Publications: Two Research Documents and one Science Advisory Report are expected.

7. Distribution and densities of blue whales in the estuary and Gulf of St. Lawrence

Context: The northwest Atlantic population of blue whale was listed as endangered under SARA in January 2005. The legal obligation of developing a Recovery Strategy for the species was met in November 2009. At that time, it was determined that it was not possible to identify the Critical Habitat of blue whales, a failure which triggered the obligation to improve knowledge on critical habitat to proceed to minimal designation in 2014.

Current knowledge on blue whale distribution and habitat use is limited and based mainly on summer observations of blue whales in the estuary and north-western Gulf of St. Lawrence area, a small part of the distribution area of this species. Most of the past research effort has been made by the Mingan Island Cetacean Study (MICS) group, a non-government organization. DFO has funded the MICS to analyse their data on blue whale seasonal distribution and habitat use and prepare a report which could eventually feed into the next exercise for identification of blue whale Critical Habitat. A thorough review of the quality of the data, analyses and conclusions is needed to ensure future designation of critical habitat is based on sound science.

This assessment is therefore a necessary step in the action planning process in order to provide the best available information regarding identification of Critical Habitat(s) for blue whales as required under the *Species at Risk Act* (SARA).

Objectives: To review the quality of the data, analyses and conclusions as to the seasonal distribution and habitat use by blue whales.

Working papers: One working paper will be presented for peer-review.

Expected Publications: One Research Document is expected.

8. Information relevant to the identification of Critical Habitats of transient killer whales (*Orcinus orca*) in British Columbia

Context: This assessment is a necessary step in the action planning process in order to provide the best available information regarding identification of critical habitat(s) for Transient Killer Whales as required under the *Species at Risk Act*.

Objectives:

1. Recommend the geo-spatial extent of habitat required to meet the identified recovery objective for Transient Killer Whales in British Columbia.
2. Identify the functions, features and attributes of this habitat based on the best available information.
3. Describe any additional information and studies, if any, required to clarify or refine critical habitat for this species.

Working papers: One working paper will be presented for peer-review.

Expected Publications: One Research Document and one Science Advisory Report are expected.

9. Status of Steller sea lions (*Eumetopias jubatus*) and California sea lions (*Zalophus californianus*) wintering in British Columbia

Context: An assessment of British Columbia sea lion distribution and abundance outside the summer breeding season has not been conducted to date. Preliminary sea lion surveys in 2009/10 outside the breeding season indicate a large influx of Steller sea lions into British Columbia waters. The lack of information on sea lion distribution and abundance outside the breeding season make it difficult to assess impacts (spatially and temporally) on commercially and recreationally important fish stocks (e.g. salmon, herring, hake, rockfish, lingcod and eulachon).

Objectives: To determine the status (recent population trends, shifts in distribution and seasonal changes in abundance) of California and Steller sea lions in British Columbia outside the breeding season (i.e. autumn, winter and spring).

Working papers: One working paper will be presented for peer-review.

Expected Publications: One Research Document, one Science Advisory Report update (Steller sea lion), and one new Science Advisory Report (California sea lion) are expected.

10. Northern Hudson Bay narwhal – assessment of a standardized aerial survey time series, and its use in stock-dynamic modelling of narwhal hunt sustainability

Context: Central and Arctic Resource Management requested an updated population estimate and sustainable harvest recommendation for the Northern Hudson Bay (NHB) narwhal population. A visual survey was flown in August 2011 from which an abundance estimate and Total Allowable Landed Catch recommendation were calculated (Asselin et al. 2012). Direct comparison of the 2011 survey results with those from previous surveys was not possible due to differences in survey methods. Correction factors have now been developed and applied to the surveys to make them comparable. A stock-dynamic model previously developed for the NHB population has been updated to include the new and corrected survey data. The purpose of this model is to evaluate population trend and the sustainability of, and risk levels associated with, different harvest levels.

Objectives: To evaluate validity of the methods used to develop correction factors for the surveys to make them comparable, and to evaluate population trend based on corrected NHB narwhal survey data, and evaluate sustainability of, and risk levels associated with, different harvest levels.

Working papers: Two working papers will be presented for peer-review.

Expected Publications: Two Research Documents and one or two Science Advisory Reports are expected.

11. Information on two killer whale strandings in northern Hudson Bay, 2009 and 2011 (Matthews, Cory; Ferguson, Steve; Higdon, Jeff; Petersen, Stephen; Watt, Cortney; Muir, Derek; Raverty, Stephen; Nielsen, Ole; Tomy, Gregg; Wang, Xiaowa)

Paper withdrawn.

12. Application of the PA approach developed for seals to all marine mammals

Context: Canada has domestic and international commitments to implement the Precautionary Approach (PA) into its decision-making framework for fisheries. This commitment is driven primarily by the 1997 Oceans Act, the 2003 guiding principles for the application of precaution to science-based decision making in the federal government, and the United Nations Agreement. The necessity for developing appropriate management approaches also applies to land-claims, where there are provisions for the development of an effective management framework that respects the principles of conservation (e.g. Nunavut Land Claims Agreement section 5.1.5).

DFO is currently undertaking extensive discussions to develop and implement PA-based management frameworks for all marine species. A management approach that respects the PA framework has been developed for Atlantic seals (Hammill and Stenson 2002).

Objectives: To initiate a discussion for the development of a PA framework that could be applied nationally to all marine mammals.

Working papers: One working paper will be presented for peer-review.

Expected Publications: No additional documents are expected.

13. Acoustic monitoring of cetaceans on the Scotian Slope

Context: DFO Maritimes Region has been conducting acoustic monitoring studies along the eastern Scotian Slope for the past few years, primarily to investigate habitat use and behaviour of Endangered Scotian Shelf northern bottlenose whales. Additionally, we have been helping develop automated detectors for multiple species, density estimation techniques and other software for the analysis of acoustic data. Much effort has also been put towards developing relationships with industry and other government partners to support longer-term acoustic projects in the region. The purpose of this talk is to inform the group about cetacean-related work being done by the Ecosystems Management Branch and Science Branch of DFO Maritimes Region.

Objectives: The main objectives are to:

1. Provide the group with an update on cetacean research efforts by DFO Maritimes Region.
2. Discuss possible collaborations/partnerships.

Working papers: One working paper will be presented for peer-review.

Expected Publications: No additional documents are expected.

Participation:

The following is a list of groups invited to participate in the meeting:

- Fisheries and Oceans Canada (DFO) (Science, Species at Risk, Ecosystems and Fisheries Management, Canadian Science Advisory Secretariat)
- National Oceanic and Atmospheric Administration (NOAA)
- University Of British Columbia (Fisheries Center)
- University of Prince Edward Island
- Alberta Innovates
- Nunavut Tunngavik Inc.
- Nunavut Wildlife Management Board
- Nunavik Marine Region Wildlife Board
- Makivik Corporation

References

Asselin, N.C., Ferguson, S.H., Richard, P.R. and Barber, D.G. 2012. Results of narwhal (*Monodon monoceros*) aerial surveys in northern Hudson Bay, August 2011. DFO. Can. Sci. Advis. Sec. Res. Doc. 2012/037. iii + 23 p.

DFO. 2012. Current Status of Northwest Atlantic Harp Seals, (*Pagophilus groenlandicus*). DFO. Can. Sci. Advis. Sec. Sci. Advis. Rep. 2011/070.

DFO. 2003. Overview of the Atlantic Seal Hunt 2003 - 2005. Fisheries and Oceans Canada, Fisheries Management, Ottawa, Ontario, Canada.

Hammill, M. and Stenson, G. 2002. Application of the Precautionary Approach and Conservation Reference Point to the Management of Atlantic Seals: A Discussion Paper. DFO. Can. Sci. Advis. Sec. Res. Doc. 2003/067 iii + 17 p.

Stewart. 2008. Can We Calculate Total Allowable Harvests for Walrus Using Potential Biological Removal? DFO. Can. Sci. Advis. Sec. Res. Doc. 2008/025. iv + 13 p.

APPENDIX II: AGENDA

Meeting of the National Marine Mammal Peer Review Committee

October 29- November 2, 2012
Coast Bastion Inn
Nanaimo, B.C.

Chairperson: Don Bowen

Daily schedule plan as follows, but allow for some flexibility:
Start: 0830
Break: 1030-1045
Lunch: 1200-1330
Break: 1500-1515
End: 1700-1730

DAY 1 – Monday October 29

Time allowed (min)	Paper #	Title	Rapporteur
15	n/a	Welcom and instructions for participants, rapporteurs, etc. (D. Bowen)	n/a
120	WP_8	Information relevant to the identification of Critical Habitats of Transient Killer Whales (*Orcinus orca*) in British Columbia (Ford, J.K.B., E. Stredulinsky, G.M. Ellis)	Linda Nichol
45	WP_12 (info only)	Applying the Precautionary Approach to Marine Mammal Harvests in Canada (G. Stenson, M. Hammill, S. Ferguson, R. Stewart and T. Doniol-Valcroze)	Linda Nichol
30	WP_10a	A re-analysis of northern Hudson Bay narwhal surveys conducted in 1982, 2000 and 2011 (Natalie C. Asselin and Steven H. Ferguson)	Stefan Romberg
Lunch 12:00-13:30			
90	WP_10b	Updated stock-dynamic model for the Northern Hudson Bay narwhal population based on 1982-2011 aerial surveys (Michael C.S. Kingsley, Natalie C. Asselin and Steven H. Ferguson)	Stefan Romberg
30	WP_2b	Comparison of the thickness of the calvarium between young grey (*Halichoerus grypus*) and harp (*Pagophilus groenlandicus*) seals (C. Caraguel, P.-Y. Daoust, and F. de Bie)	Lianne Postma
45	WP_2a	Assessment of current and alternative methods for killing young grey seals (*Halichoerus grypus*) during commercial harvest (P.-Y. Daoust, C. Caraguel, H. Fenton, M.O. Hammill, L.D. Roy, and J. Spears)	Lianne Postma
30	WP_2c	Force needed to effectively fracture skulls of grey and harp seal beaters using a hakapik (L.D. Roy, E. Jenson and M. Hiltz) - via teleconference	Lianne Postma

DAY 2 – Tuesday October 30

Time allowed (min)	Paper #	Title	Rapporteur
45	SAR_2	Advice regarding grey seal humane killing methods (P.Y. Daoust)	n/a
60	WP_1a	A Discussion of the Precautionary Approach and its Application to Atlantic Seals (M. Hammill, G. Stenson)	JF Gosselin
60	WP_1b	Northwest Atlantic Harp Seals: Population Trends, 1952-2012 (M. Hammill, G. Stenson)	Linda Nichol
Lunch 11:30-13:00			
45	WP_6a	Abundance estimate of eastern Hudson Bay beluga, summer 2011 (JF Gosselin, T Doniol-Valcroze, MO Hammill)	Hilary Moors
90	WP_6b	Population modelling and harvest advice under the precautionnary approach for eastern Hudson Bay beluga (*Delphinapterus leucas)* (T Doniol-Valcroze, JF Gosselin, MO Hammill)	Hilary Moors
60	WP_6c (info only)	A model to examine potential marine mammal mortality from ship strike and ship avoidance in the Arctic (J. Lawson)	Hilary Moors

DAY 3 – Wednesday October 31

Time allowed (min)	Paper #	Title	Rapporteur
120	WP_9	Status of Steller sea lions (*Eumetopias jubatus*) and California sea lions (*Zalophus californianus*) wintering in British Columbia (P. Olesiuk)	Lianne Postma
90	WP_4a	Long-term changes in grey seal vital rates at Sable Island estimated from POPAN mark-resighting analysis of branded seals (den Heyer, C., W. D. Bowen, J. I. McMillan)	Erika Thorleifson
Lunch 12:00-13:30			
60	WP_4b	Northwest Atlantic Grey Seal Population Trends, 1960-2012 (M.O. Hammill, W.D.Bowen, C. den Heyer)	Erika Thorleifson
60	SAR_9a	Population Assessment: Steller sea lion (*Eumetopias jubatus*) - SAR update	n/a
60	SAR_9b	Population Assessment: California sea lion (*Zalophus californianus*) - new SAR	n/a

DAY 4 – Thursday November 1

Time allowed (min)	Paper #	Title	Rapporteur
60	SAR_1	Harp seal SAR	n/a
60	WP_3	Ringed seal abundance in James Bay and eastern Hudson Bay in spring 2011 and 2012 (Gosselin JF, Hammill MO, Ferguson SH, Doniol-Valcroze T)	Jack Lawson
90	SAR_6	Beluga SAR	n/a
Lunch 12:00-13:30			
30	WP_5a	Results of Foxe Basin walrus surveys: 2010-2011 (R. Stewart, J. Hamilton, and B. Dunn)	Holly Cleator
30	WP_5b	Compilation of walrus population estimates for the calculation of TAH (R. Stewart and J. Hamilton)	Holly Cleator
120	WP_7	Distribution, densities, and annual occurrence of individual blue whales (*Balaenoptera musculus*) in the Gulf of St. Lawrence, Canada from 1980-2008 (C. Ramp and R.Sears)	Holly Cleator

DAY 5 – Friday November 2

Time allowed (min)	Paper #	Title	Rapporteur
120	SAR_8	Killer whale SAR	n/a
60	SAR_5	Walrus SAR	n/a
Lunch 12:00-13:30			
30	SAR_3	Ringed seal SAR	n/a
90	SAR_4	Grey seal population SAR	n/a
30	WP_13 (info only)	Acoustic monitoring of cetaceans on the Scotian Slope (H. Moors)	Christine Abraham

APPENDIX III: MEETING PARTICIPANTS

Name	Affiliation
Joan McDougall	DFO
John K Ford	DFO
Paul Cottrell	DFO
Peter Olesiuk	DFO
Linda Nichol	DFO
Sean MacConnachie	DFO
Sheila Thornton	DFO
Jake Schweigert	DFO
Holly Cleator	DFO
Jason W. Hamilton	DFO
Lianne Postma	DFO
Steve Ferguson	DFO
Rob Stewart	DFO
Christine Abraham	DFO
Stefan Romberg	DFO
Erika Thorleifson	DFO
Don Bowen	DFO
Simon Nadeau	DFO
Hilary Moors	DFO
Veronique Lesage	DFO
Mike Hammill	DFO
Thomas Doniol-Valcroze	DFO
Jean-Francois Gosselin	DFO
Garry Stenson	DFO
Jack Lawson	DFO
Simon Nadeau	DFO (for Transient Killer Whale Section – by teleconference)
Patt Hall	DFO (for walrus – by teleconference)
Allison McPhee	DFO (for walrus – by teleconference)
Anna Magera	Nunavut Wildlife Management Board
Christian Ramp	Mingan Island Cetacean Study
David Lee	Nunavik Tunngavik Inc.
Earl Jenson	Alberta Innovates
Gabriel Nirlungayuk	Nunavik Tunngavik Inc.
Lance Barrett-Lennard	University of British Columbia
Michael Kingsley	Indep
Michelle Hiltz	Alberta Innovates
Peter Boveng	NOAA
Pierre Yves Daoust	University of Prince Edward Island
Stephen Raverty	University of British Columbia