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SURVEY INDEX OF THE NORTHERN HUDSON BAY NARWHAL STOCK, AUGUST 2008

Narwhal by R. Phillips.

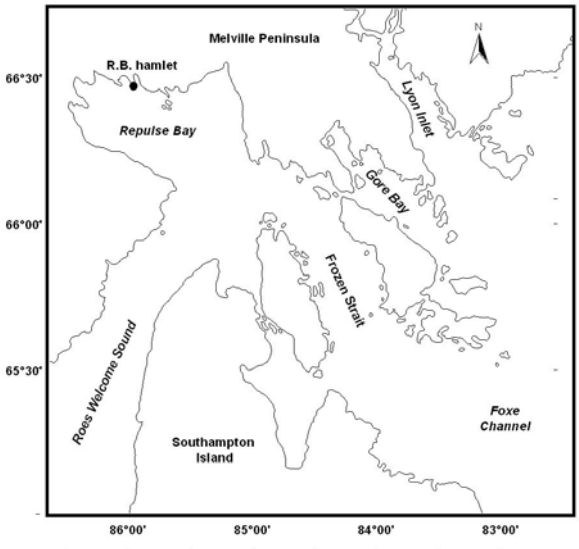

Figure 1: This narwhal stock aggregates in the survey area between Repulse Bay, Frozen Strait and Lyon Inlet in August.

Context :
The Northern Hudson Bay narwhal stock size was previously indexed by aerial photographic surveys of the summering aggregation area in 1984 and 2000. Fisheries and Oceans Canada (DFO) Science conducted an index survey of the Northern Hudson Bay summer aggregation area in August 2008 to allow a full assessment of the stock. This science advice document reports on the numbers of narwhals estimated to be visible at the surface in the area surveyed and discusses the implication of the results.

SUMMARY

- The index estimate obtained from the 21-22 August 2008 survey was 610 narwhals (95% CI: 377 - 988).
- This estimate is less than half of the index survey estimates obtained in 1984 and 2000 so it is plausible that the population has declined.
- If so, the decline may have resulted from increased hunting mortality and killer whale predation.
- However, several factors may have affected the estimate including ice cover, camera precision, survey altitude and possible movement of narwhals out of their range, but the importance of these factors is unknown.
- A full assessment using population indices and the catch history should be done to inform the future co-management of this stock.
- A new survey should be done in the near future to add to the series of indices, revisit issues of survey bias, and improve parameter estimates of population dynamics.

INTRODUCTION

The Northern Hudson Bay narwhal population is most aggregated in Repulse Bay, Frozen Strait, and Lyon Inlet in August. These locations represent the survey area where indices of its population size have been obtained from aerial photographic surveys conducted in the early 1980s (Richard 1991) and in 2000 (Bourassa 2003). To extend the series of indexing surveys, DFO conducted a new survey in August of 2008. A systematic survey was flown on 21 and 22 August 2008 with a medium-format digital camera oriented at an oblique angle facing north. The survey was flown at altitudes between 1800 and 3000 ft, depending on cloud height.

ANALYSIS

Methods

The methods used to calculate the population indices are derived from Kingsley *et al.* (1985) and are detailed more fully in Richard (In press). The count of narwhals and image areas were summed over the images for each transect to obtain a mean density of narwhals for the survey area, when multiplied by the total survey area provided an estimate of the total number of narwhals at or near the surface.

Results

An index of 610 narwhals (95% CI: 376 - 989) was obtained from the 21-22 August 2008 survey. That index is smaller than those obtained for the August photo surveys of 1984 and 2000, which numbered 1,355 (95% CI: 910-2,100) (Richard 1991) and 1,778 (95% CI: 1,688-2,015) (Bourassa 2003).

Sources of Uncertainty

Several survey conditions could have affected the results. The first hypothesized effect is that the number of sightings was reduced due to the heavier than usual pack ice in Frozen Strait where narwhals are known to aggregate. Nevertheless, several sightings were made in the portion of Frozen Strait with the heaviest pack ice so it is not clear without further study to what degree ice cover affected visibility.

The second hypothesized effect is that a portion of the population was not in the survey area during the surveys because they were displaced or held away by killer whales. While plausible, killer whales have been present in the survey area in the past, and there is no evidence of any large scale displacement of narwhals out of the survey area. It therefore remains unclear to what extent killer whales influenced the distribution of narwhals and this survey index.

A third hypothesized effect is that the digital photos did not allow detection of narwhals as readily as large-format film photos. In the past, surveys were conducted using a large-format film camera, the cost of which has become prohibitively expensive. In addition, whether the film was correctly exposed could not be determined until it was developed, well after the survey was conducted. The plan had been to conduct the survey with two medium format digital cameras at an angle to cover both sides of the track line. Unfortunately, one of the camera lenses broke prior to the survey and could not be replaced. Consequently, a single digital camera was used. To increase coverage of the single camera, and in an effort to partially compensate for the loss

of the second camera, the survey was flown at higher altitude. Despite this, image resolution was thought to be sufficiently clear to allow detection of narwhals at the surface in open water but may have affected the detection of narwhals that were just below the surface or partially hidden by ice floes. This hypothesis cannot be verified without thorough experimentation. If image resolution was a problem,, then visual identification of narwhals in areas of greater pack ice coverage within the survey area, especially in Frozen Strait, may have been reduced. Consequently, it is not entirely clear if this survey has been able to index the whole Northern Hudson Bay narwhal population.

CONCLUSIONS AND ADVICE

Despite the potential biases, the population index is a fraction of what it was in 1984 and 2000 which may reflect an actual decline in population size.

The NHB narwhal population has been subject to significant harvest by Repulse Bay and other communities of the Kivalliq and south Baffin over the past decade. In 2008, DFO developed a different approach to determine sustainable rates of harvest for populations with limited survey data. Using the Potential Biological Removal (PBR) method and resulting Total Allowable Landed Catch (TALC) for NHB narwhal resulted in a new recommended TALC of 57 (DFO 2008). This is a lower rate of harvest than had been previously recommended although it has not yet been implemented. Over the past decade, the total landed catches of NHB narwhal were well above the new TALC. Another factor which could also be contributing to population decline is increased killer whale predation (Higdon and Ferguson 2009). A large harvest combined with greater killer whale predation could therefore be responsible for the observed decline in the population index.

Several survey-related biases may have affected the estimate including ice cover, camera precision, survey altitude and possible movement of narwhals out of their range but the importance of these factors is unknown.

A model of the dynamics of the population is needed to determine if this new survey index is likely given the catch history on the stock and past survey indices. It would also be advisable to conduct a new survey, preferably during a year with normal or low ice cover, to test whether this one was in fact affected by visibility conditions due to ice.

SOURCES OF INFORMATION

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