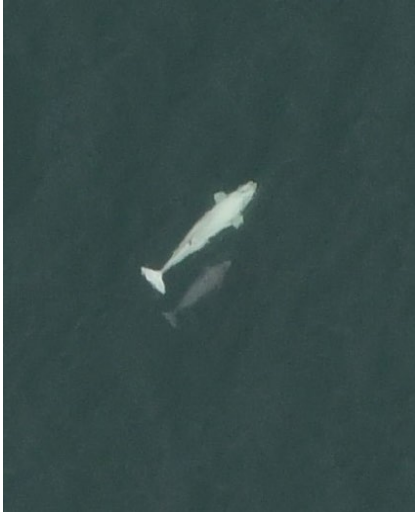




EASTERN BEAUFORT SEA BELUGA (*DELPHINAPTERUS LEUCAS*) POPULATION ABUNDANCE ESTIMATE IN 2019



Aerial photograph of beluga whales from the Eastern Beaufort Sea population taken during the 2019 survey. Credit: DFO.

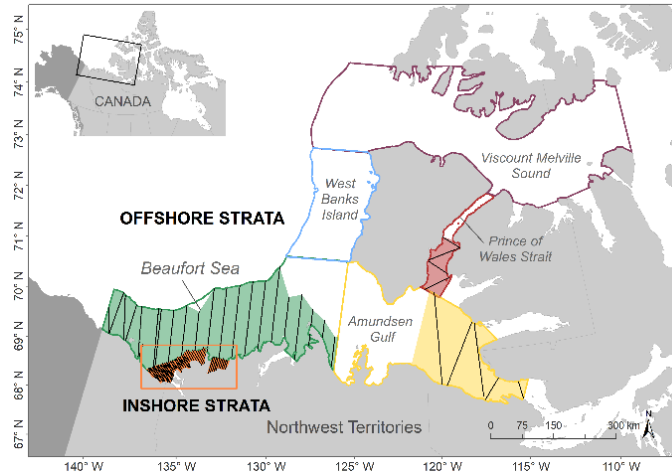


Figure 1. Map of the planned (colored contour) and realized (shaded polygons) strata and transects flown (black lines) from the 2019 aerial survey of the Eastern Beaufort Sea beluga population.

Context:

The Eastern Beaufort Sea (EBS) beluga (*Delphinapterus leucas*) population summers in Canadian waters, where it is co-managed by Fisheries and Oceans Canada (DFO) and the Fisheries Joint Management Committee (FJMC).

The EBS beluga population abundance was last assessed from an aerial survey of the Beaufort Sea Shelf, west Amundsen Gulf, and Mackenzie Estuary in July 1992, which resulted in a population estimate of ~ 40,000 individuals after correction for availability bias. This estimate was considered an underestimate because it did not cover the entire known distribution of the EBS beluga population. In 2017, a stock assessment meeting of the Canadian Science Advisory Secretariat concluded that a new population estimate was needed. Upon request from DFO Fisheries Management, FJMC and the Inuvialuit Game Council, a new aerial survey was co-designed and conducted in July 2019, attempting to cover the entire summer distribution of EBS beluga in Canada.

In addition, National Oceanic and Atmospheric Administration (NOAA) conducted an aerial survey in August 2019 to estimate bowhead whale abundance. Although not the primary goal of the survey, beluga sightings were also recorded in the offshore areas and can potentially be used to provide an improved abundance estimate for the EBS beluga population.

This Science Advisory Report is from the Updated Eastern Beaufort Sea Beluga (*Delphinapterus leucas*) Population Abundance Estimate, October 2022 meeting held on October 25 and 27, 2022. Additional publications from this meeting will be posted on the [DFO Science Advisory Schedule](#) as they become available.

SUMMARY

- The Eastern Beaufort Sea (EBS) beluga population abundance was last assessed in July 1992. However, there is new evidence indicating that the EBS beluga distribution extends beyond the area covered by the 1992 survey.
- Visual and photographic surveys were conducted from July 21 to August 2, 2019 to provide an updated abundance estimate in Canadian waters. The surveys were co-designed with Inuvialuit to include all areas identified as potentially within the range of EBS beluga.
- Due to poor weather during 2019, survey coverage was incomplete. In particular, large portions of the survey design were not completed despite tag data and other lines of evidence indicating beluga presence.
- To account for belugas that were missed during the survey because they were underwater, surface and dive data collected concurrently from tagged belugas were used to estimate adjustment factors.
- An estimated abundance of 38,500 belugas (95% CI = 20,700–71,300) was obtained within the survey area after adjusting for belugas that were submerged or missed by observers. Using this estimate and a recovery factor of 1, the Potential Biological Removal (PBR) was calculated as 588 belugas.
- Due to low survey coverage, the abundance estimate for the population and associated PBR are negatively biased and should be considered underestimates.
- A United States National Oceanic and Atmospheric Administration (NOAA) aerial marine mammal survey conducted in August 2019 covered offshore areas but did not cover the entire EBS beluga distribution. Although a beluga abundance estimate can be obtained from this survey, it was not included in this assessment as survey data were still being analysed.
- The EBS population assessment took a collaborative approach with Inuvialuit that engaged participation in the study design, field implementation/execution and the interpretation of findings for the final assessment.

BACKGROUND

The Eastern Beaufort Sea (EBS) beluga population winters in the Bering Sea and migrates to their summering ground in the Canadian Beaufort Sea and Amundsen Gulf. The abundance of this population was last assessed in 1992 and resulted in an estimate of 39,300 belugas (95% CI = 30,600–48,300; rounded to the nearest hundred). The 1992 survey was considered to be an underestimate because it did not cover the entire summer range of the population based on information from subsequent telemetry studies. An aerial survey was conducted in the summer of 2019 to provide an updated abundance estimate for this population and was supported by a concurrent satellite tagging program to develop a correction factor for availability bias.

ANALYSIS

An aerial survey was conducted from July 21 to August 2, 2019. The survey was designed to replicate the 1992 survey coverage and also included new areas (east of Amundsen Gulf and throughout Prince of Wales Strait) based on telemetry studies and following the consultations with Inuvialuit. The survey estimate was based on visual observation and aerial photography.

Due to challenging weather and heavy ice conditions in the northern portion of the survey, only part of the planned survey strata was covered. The offshore waters of the Beaufort Sea, eastern Amundsen Gulf, and southern Prince of Wales Strait comprised the offshore survey strata and were visually surveyed. The Mackenzie Estuary, Kugmallit Bay and Shallow Bay strata comprised the inshore strata and were covered by aerial photography. However, western Amundsen Gulf, northern Prince of Wales Strait, West Banks Island and the Viscount Melville Sound could not be surveyed (Figure 1).

A distance sampling analysis was conducted to estimate the density of belugas at the surface in the offshore areas. A double platform analysis was run to correct for belugas under the plane that were missed by marine mammal observers. In the inshore areas, counts of belugas in aerial photographs were used to estimate beluga densities at the surface. Surface abundance estimates were adjusted for belugas that were not visible (i.e., diving), known as ‘availability bias’. An availability bias adjustment factor was calculated based on the diving behaviour of eight belugas equipped with satellite tags in 2018 and 2019, and the time belugas were in view for the visual observers during the 2019 survey.

The total estimated number of belugas for the surveyed areas was of 38,500 (95% CI = 20,700–71,300, CV = 0.327). The Potential Biological Removal (PBR) was calculated using a recovery factor of 1 and resulted in a PBR of 588 belugas.

Sources of Uncertainty

Due to weather conditions, limited flying time led to incomplete survey coverage (Figure 1). Other sources of information (telemetry data, local observations) indicate that belugas were present in areas that were not surveyed. It was not possible to estimate the proportions of belugas in the areas not covered by the 2019 survey, especially given that most of the missing areas had not previously been surveyed. Therefore, only a portion of the EBS beluga population was surveyed and the abundance estimate from this survey is considered an underestimate.

The availability bias adjustment factor used for this survey was based on the diving behaviour of eight male belugas equipped with satellite transmitters in 2018 and 2019 from a single capture location. For this study, we assumed that the behaviour of the tagged belugas was representative of the belugas observed during the 2019 aerial surveys. However, beluga diving behaviour is known to vary by sex, habitat and behaviour, and females with calves are likely to spend more time at the surface than males. As a result, the availability bias adjustment likely resulted in a positive bias in the abundance estimate.

In addition, the availability adjustment factor in this study was based on individual beluga diving behaviour and does not account for the fact that belugas were encountered in groups during the visual survey. There is uncertainty on synchronicity of the diving behaviour of belugas within a group. It is likely that belugas from the same group do not dive in perfect synchrony and, as a consequence, the availability adjustment factor used resulted in a positive bias of the abundance estimate.

The estimate of total abundance was based on the sum of the abundances of the strata surveyed over a period of 13 days and in a discontinuous order. We assumed that the movement of belugas among strata was random, which would produce unbiased abundance estimates. However, we did not assess whether directed movements among strata occurred during the survey period. In addition, the inshore areas were surveyed at the start of August when belugas are known to leave the Mackenzie Estuary and disperse offshore. It is not clear how these factors could have biased the survey estimate.

Environmental changes in the Canadian Beaufort Sea likely resulted in changes in beluga distribution and grouping patterns in 2019 compared to previous survey years. In particular, 2019 was an anomalously warm year based on the timing of spring sea ice break-up, sea surface temperature and local hunter observations. The year 2019 was also marked by unusually high mortalities of marine animals in the Canadian Beaufort Sea. Lastly, storms in the inshore areas resulted in high wave activity and displacement of beluga from the Mackenzie Estuary during the time of the survey.

CONCLUSIONS AND ADVICE

The updated abundance estimate from the 2019 EBS beluga survey is 38,500 belugas (95% CI = 20,700–71,300, CV = 0.327). The associated Potential Biological Removal (PBR) is estimated at 588 beluga. Since the survey coverage was incomplete, the abundance estimate and associated PBR are considered underestimates.

These findings should be applied with caution due to the unknown effects on beluga distribution from the documented anomalous environmental conditions in the Canadian Beaufort Sea during summer 2019.

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SOURCES OF INFORMATION

This Science Advisory Report is from the regional peer review on Updated Eastern Beaufort Sea Beluga (*Delphinapterus leucas*) Population Abundance Estimate, October 2022 held on October 25 and 27, 2022. Additional publications from this meeting will be posted on the [Fisheries and Oceans Canada \(DFO\) Science Advisory Schedule](#) as they become available.

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