

Winter photographic aerial survey of beluga whales (*Delphinapterus leucas*) in Cumberland Sound

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Cumberland Sound

by

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ABSTRACT

Stewart, J.B., Gillespie, M., Etooangat, B., Lapierre-Poulin, F., Sherbo, B., and Watt, C.A. 2026. Winter photographic aerial survey of beluga whales (*Delphinapterus leucas*) in Cumberland Sound. Can. Tech. Rep. Fish. Aquat. Sci. 3799: v + 13 p.
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A photographic aerial survey was flown from 28 February to 2 March 2023 to assess the winter abundance and distribution of beluga whales (*Delphinapterus leucas*) in Cumberland Sound. A total of 9,331 images were collected covering an area of over 4,700 km² and were manually read for beluga whale detections. One beluga whale was detected along the southwestern coast, along the Cumberland Peninsula, which is within the previously hypothesized wintering distribution extent. Extensive ice was encountered throughout the survey and changed within and across survey days, likely making the surveyed habitat unsuitable for beluga whales. This paper provides updated information about the winter abundance and distribution of beluga whales within Cumberland Sound. The absence of whales observed within Cumberland Sound in winter suggests additional areas, potentially regions outside the Sound, should be surveyed more extensively in future surveys.

RÉSUMÉ

Stewart, J.B., Gillespie, M., Etooangat, B., Lapierre Poulin, F., Sherbo, B., and Watt, C.A. 2026. Winter photographic aerial survey of beluga whales (*Delphinapterus leucas*) in Cumberland Sound. Can. Tech. Rep. Fish. Aquat. Sci. 3799: v + 13 p. <https://doi.org/10.60825/fdeh-wc82>

Entre le 28 février et le 2 mars 2023, un relevé photographique aérien a été effectué afin d'évaluer l'abondance et la répartition hivernales des bélugas (*Delphinapterus leucas*) dans le détroit de Cumberland. Au total, 9 331 images ont été recueillies, couvrant une superficie de plus de 4 700 km². Un béluga a été observé le long de la côte sud-ouest, près de la péninsule de Cumberland, qui se trouve dans la zone d'hivernage présumée précédemment identifiée. Un couvert de glace extensif a été observé tout au long du relevé et a évolué au cours du relevé, rendant probablement l'habitat étudié impropre pour les bélugas. Cet article présente une mise à jour de l'abondance et de la répartition hivernales des bélugas dans le détroit de Cumberland. L'absence de bélugas observés dans le détroit de Cumberland suggère que d'autres zones, potentiellement situées en dehors du détroit, devraient être inventoriées de manière extensive lors de futurs relevés.

INTRODUCTION

Beluga whales (*Delphinapterus leucas*) make annual migrations from coastal summering estuaries to open water polynyas in the winter (COSEWIC, 2016). Due to their strong fidelity to summering estuaries, beluga whale abundance and distribution surveys are typically carried out during summer months (e.g., Matthews et al., 2017; Watt et al., 2021; Sauvé et al. 2025). However, relatively little is known about beluga whale abundance and distribution in their wintering grounds in Canada (albeit for the St. Lawrence beluga whale population (Harvey et al. 2025)). Overwintering habitat is believed to be selected for the presence of consistent open water areas which limits ice entrapment risk (Heide-Jørgensen et al., 2002; Richard & Stewart, 2009), the presence of prey species (Hauser et al., 2018), and mating opportunities (Kilabuk, 1998). Thus, overwintering areas are considered critical habitat for beluga whale populations (DFO, 2024). Monitoring the use and understanding the significance of critical habitat is especially important in establishing recovery strategies for beluga whale populations under conservation concern (Richard & Stewart, 2009).

The Cumberland Sound (CS) beluga whale genetic population (Parent et al. 2023, Watt et al. 2023, Montana et al. 2024) is classified as endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC, 2020). Population abundance has declined, primarily attributed to extensive commercial harvest from the late 1860s through 1940s (COSEWIC, 2020), from >5,000 whales in 1923 (Mitchell and Reeves, 1981) to a modelled estimate of 1,090 (95% CI: 617 – 1,864) whales in 2018 (DFO, 2019; Watt et al. 2021) with a current limited subsistence harvest contributing to a continued decline. As such, identifying and monitoring the use of seasonal critical

habitat is required for current and future CS beluga whale management efforts (DFO, 2024).

Beluga whales in the CS population are believed to be year-round residents of CS (Richard & Stewart, 2009). Beluga whales congregate in the north end of the sound during summer months, primarily in Clearwater Fiord, and migrate southward to open water polynyas near the mouth of the sound during the winter. Aerial surveys, tracking data, and traditional knowledge indicate beluga whales congregate in a large polynya along the southeast coast of the sound in the winter, along the Cumberland Peninsula (Brown & Fast, 2012; Kilabuk, 1998; Richard & Stewart, 2009) (Figure 1). Beluga whales only utilize this area in winter months where whales are generally observed to be fatter, leaving this area in the spring and returning in the fall, suggesting its significance as a primary foraging area for CS beluga whales (Stewart et al., 1995). The polynya may also be an important mating area since beluga whales calve in the summer in Clearwater Fiord (Kilabuk, 1998) and are therefore assumed to mate in approximately May (Brodie 1971). Thus, this overwintering area has been identified as critical habitat for CS beluga whales (DFO, 2024). Information on CS beluga whale wintering distribution from aerial surveys and tracking data were last collected in the area in 2003 and 2009 respectively (DFO, 2024; Richard & Stewart, 2009). Given the increasing unpredictability of winter sea ice formation associated with a changing Arctic ecosystem (Hauser et al., 2017; O’Corry-Crowe et al., 2016), updated information on the abundance and distribution of beluga whales in critical overwintering habitat in CS is warranted. In addition, the Pangnirtung Hunters and Trappers Organization suggested that the CS beluga whales may be more easily surveyed when congregated in the

winter polynya. In summer surveys the whales are found to aggregate in Clearwater Fiord, but a portion are also detected outside Clearwater Fiord in the greater CS area (Watt et al. 2021).

The objective of this study was to assess beluga whale overwintering abundance and distribution within CS using a photographic aerial survey.

METHODS AND RESULTS

A photographic aerial survey was flown between 28 February and 2 March 2023 to assess the winter distribution and abundance of CS beluga whales (Figure 1). Survey flights were conducted from a DeHavilland Twin Otter (DH-6) fitted with a ventral camera port. Flights were flown at an approximate altitude of 610 m (2,000 ft) with a target ground speed of 185 km/hr (100 knots). The camera system consisted of two Nikon D850 cameras next to each other (acting as replicates for redundancy in case one camera failed) fitted with a 25 mm lens oriented at nadir (90° angle pointing straight down) capturing an image every 3 seconds resulting in approximately 20 – 30% front overlap between images. Each image had an approximate ground sampling distance of 10.6 cm/pixel based on target altitude and speed and captured an area of roughly 0.51 km² (0.88 x 0.58 km). Four visual observers were present during flights to aid in detection, species identification, and operate camera equipment. Survey flights planned to follow systematic zig-zag transect lines starting from Pangnirtung Fiord southward spanning the sound in a roughly east-west direction until the limits of the polynya were identified, and then a full coverage survey was planned within the polynya; however, when heavy ice conditions were encountered (i.e., no open water) on the first day the zig-zag transects were not flown and reconnaissance surveys were flown to find open-

water (Figure 1). Reconnaissance surveys were also flown just outside the mouth of CS along the eastern coast of Baffin Island (Figure 1). Flights were altered depending on ice conditions; if vast amounts of complete ice coverage were encountered while on flight path, surveys continued at the next transect or flights were altered to follow along the floe edge, ice leads and cracks, or to find open water. Images were taken throughout all reconnaissance and exploratory flights.

We collected 2,020 images on 28 February, 4,426 images on 1 March, and 2,885 images on 2 March, imaging over 4,700 km². Cloud cover, white caps, and sun glare did not obscure analysis of any images. Extensive open water was observed at the mouth of CS in Baffin Bay during the 28 February survey. The north and south coast of the sound were surveyed where there were limited open water areas, and no beluga whales were observed. On 1 March, much of the open water observed the previous day was completely covered in ice. Transects were flown along the eastern coast northward from the mouth of CS in an east-west direction spanning the entire Sound. Further into CS, transects were cut short by extensive ice coverage; however, one narwhal was observed in an ice crack, but not captured in imagery. Transects resumed where open water areas were observed earlier in the day but were now found to be ice-covered. One beluga whale was observed in an open-water lead along the eastern coast of Cumberland Peninsula near the mouth of CS and it was detected in the photographs (Figures 2 and 3). A reconnaissance flight over Frobisher Bay was flown on 2 March where extensive areas of open water were observed. Four bowhead and one walrus were visually observed in Frobisher Bay. The survey in CS followed a similar path as that taken on 28 February, and no whales were observed. Post-survey, images were

read manually by one experienced reader (J. Stewart) in QGIS (3.40.7) so that detections could be georeferenced, and the single detection was confirmed by C. Watt (Figure 3).

DISCUSSION

The results of the photographic survey suggest that CS beluga whale overwintering habitat may not center around the southeast polynya to the same extent as previously hypothesized. Past observations of beluga whales utilizing the southeast polynya were based on the tracks of two tagged whales and the locations of relatively few observed whales (approximately 30 in 2000 and 13 in 2003) from aerial surveys (Richard & Stewart, 2009). However, beluga whales were observed in this region across multiple winters (surveys in 2000 and 2003, and one satellite tag from each of 2000 and 2006) and the beneficial features associated with the polynya, such as lower entrapment risk, and foraging or mating opportunities, suggested it to be an important winter habitat for CS beluga whales (Richard & Stewart, 2009). However, it is possible that only a portion of the CS beluga whales used this area as previous information is limited. The location, size, and presence of the polynya is also not expected to be static due to winds, ocean currents, and winter severity (DFO, 2024). Rapidly forming or changing ice increases the risk of entrapment which is a major source of beluga whale mortality; although large ice entrapments are not common in CS, they have occurred previously (Kilabuk, 1998; Richard & Stewart, 2009).

The area covered in our survey did not seem suitable for beluga whales given the variability in ice coverage we observed in only three survey days. However, it is possible that the beluga whales were changing their distribution in CS as a result of the highly

varying ice conditions and therefore were missed in the survey; however, surveyors in the planes did not think this environment would be suitable for a large aggregation of beluga whales generally due to its unpredictability (B. Etooangat pers. comm.). The lack of beluga whales observed in our survey could also suggest a change in primary overwintering habitat for CS beluga whales. It is possible that CS beluga whales may overwinter further south at the mouth of Frobisher Bay (Brown & Fast, 2012) and beluga whales were observed in Frobisher Bay amongst ice floes during seal surveys on 22 March 2024 (at least 20 whales), 22 March 2026 (3 whales), and 25 March 2026 (2 beluga whales) (P. Goulet and C. Hamilton, pers. comm.); however, beluga whales were not observed during reconnaissance flights in this area in 2023 despite the extensive open water. There is also evidence that a small portion of the CS population overwinters in Hudson Strait, mixing with Hudson Bay beluga whale populations (Parent et al., 2023). Conditions may have changed enough in CS that Hudson Strait is now the primary wintering area or CS beluga whales may migrate to these alternate wintering areas only in years with unpredictable ice conditions in CS.

We cannot rule out that we may have missed beluga whales inside CS but outside the survey lines flown; however, our survey does suggest that the wintering distribution of beluga whales within CS may have changed or may change annually with ice conditions. This study provides updated information on the winter distribution of beluga whales within CS and emphasizes the dynamic sea ice conditions found in CS in winter. The absence of whales observed within CS suggests additional areas outside the sound should be surveyed more extensively in future surveys, or other methods, such as

satellite tagging of whales in CS, should be used to identify potentially new wintering regions.

This winter survey was conducted in response to a request by the Pangnirtung Hunters and Trappers Organization as it was suggested that CS beluga whales may be congregated in the winter polynya and therefore more easily surveyed than in the summer. Unfortunately we were unable to locate a aggregated group of beluga whales in this survey; however, it is still useful for the community to know that this wintering area is dynamic and may not be suitable for surveying beluga whales. Additionally, if the whales overwinter in areas with other beluga whale populations, such as Hudson Strait, it would not be ideal to survey them at this time since populations of beluga whales cannot be distinguished in aerial surveys.

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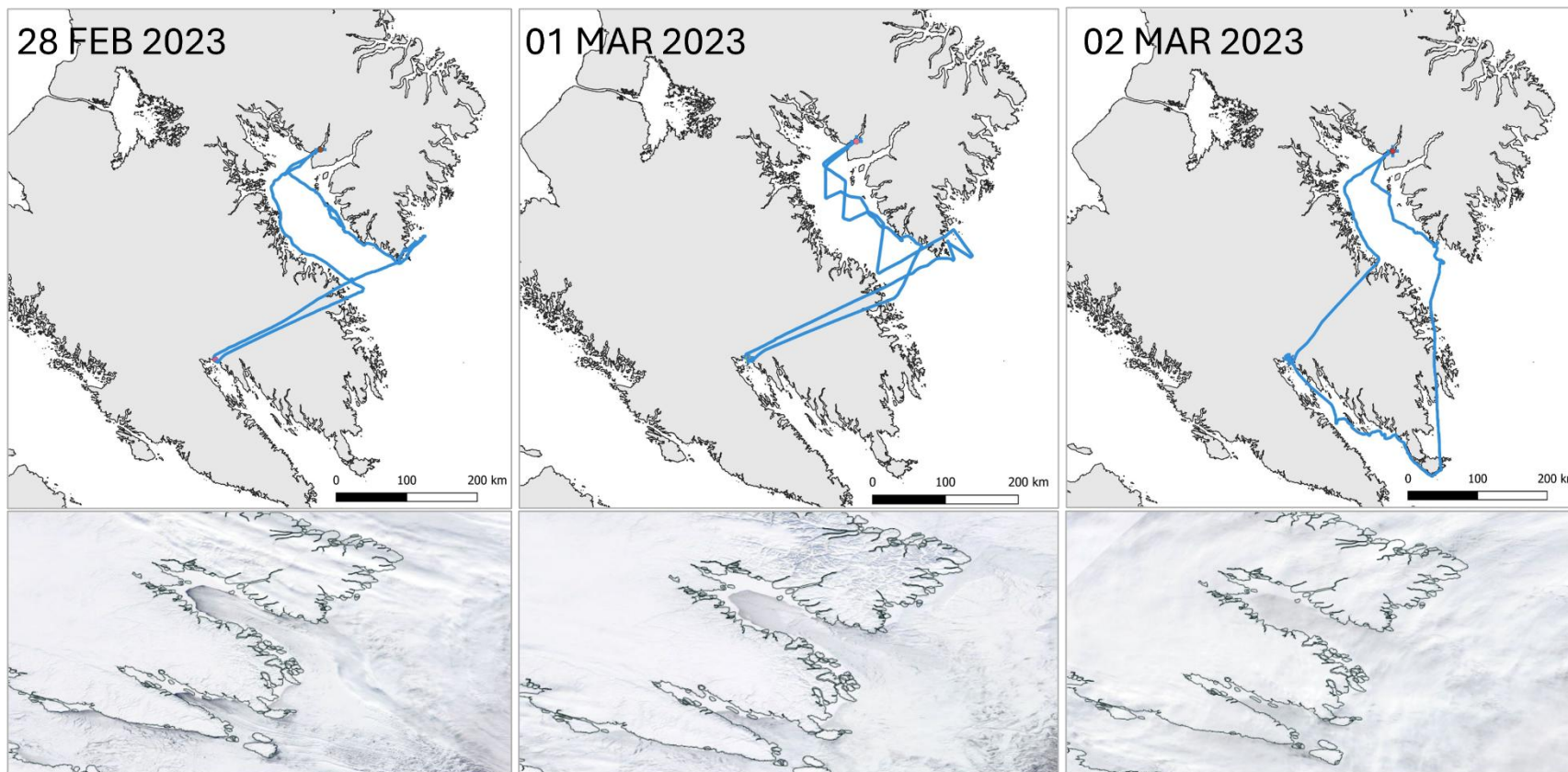


Figure 1. Realized survey tracks (blue line) for photographic surveys flown from 28 February to 2 March 2023 within Cumberland Sound. Lower panels show ice conditions from NASA Worldview for each day (we acknowledge the use of imagery from the Worldview Snapshots application (<https://wvs.earthdata.nasa.gov>), part of the Earth Science Data and Information System (ESDIS)).

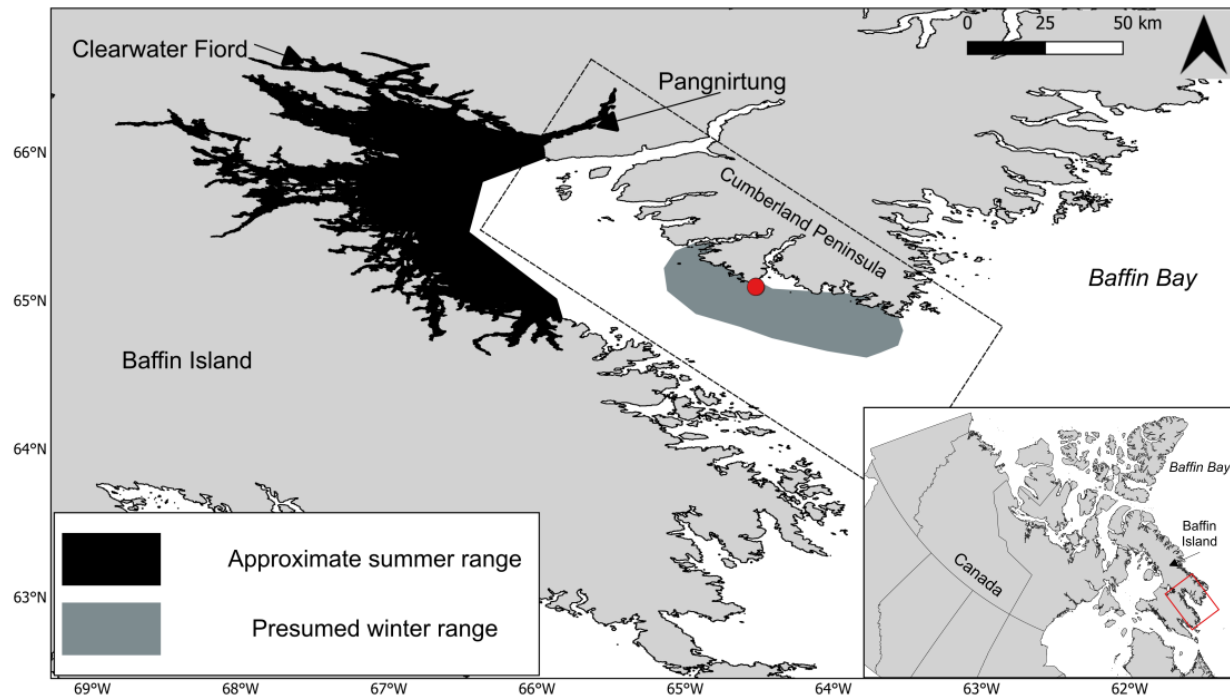


Figure 2. Location of a beluga whale (point) observed in photographic surveys flown from 28 February to 2 March 2023 within Cumberland Sound. The black rectangle is the approximate coverage of the photographic survey. The inset highlights the location of Cumberland Sound (red rectangle) in the Canadian Arctic.

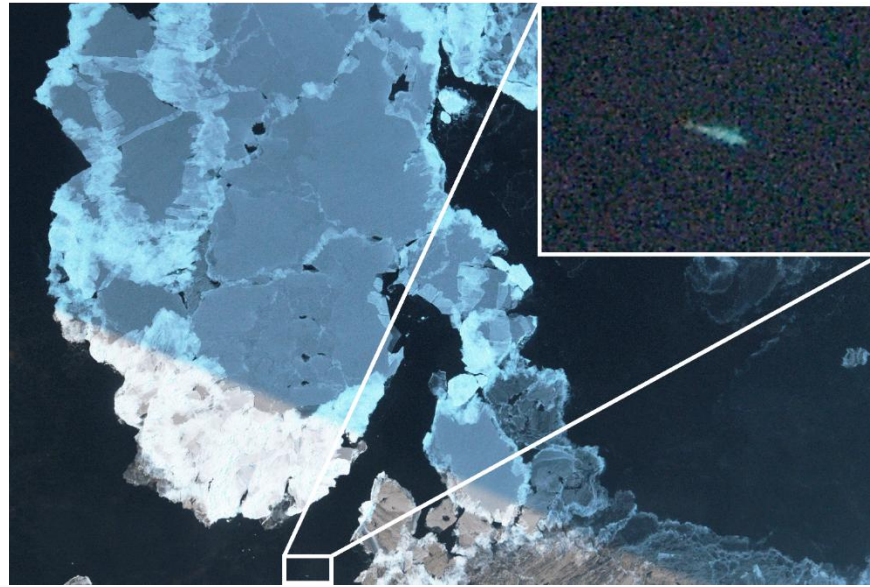


Figure 3. Photograph of the single beluga whale observed in a photographic survey on 1 March 2023 within Cumberland Sound.