

NWRT Final Project Report

1. NWRT Project Number:
3-13-28
2. Project Title:
Aerial survey to estimate the abundance of the Baffin Bay narwhal population
3. Project Leader:
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4. Summary:
An aerial survey was conducted in the Canadian High Arctic in August 2013 to obtain new abundance estimates for the Baffin Bay Narwhal and Eastern Arctic-West Greenland Bowhead Whale populations. Three planes flew a combined total of ~240 hours and surveyed most planned areas. Data analyses have begun; a preliminary analysis will be completed in March 2014 and final population estimates will be available in spring 2015.
5. Project Objectives:
The survey was conducted as planned without changes in the overall objectives or strategy. Weather conditions prevented all areas from being completely surveyed, but all high priority Narwhal areas were surveyed. Smith Sound, Fox Basin and outer Cumberland Sound were not completely surveyed because of weather. Each survey team consisted of three DFO staff and one or two trained Inuit observers. Representatives from local communities were invited to join the survey crews and individuals from Resolute Bay, Arctic Bay, Pond Inlet, Clyde River, Kugaaruk, Taloyoak, Hall Beach and Pangnirtung joined the survey at some point.
6. Materials and Methods:
Strata of high narwhal density areas were covered using systematic parallel transects with greater coverage (7-15%) than had been done in the past. Areas with lower densities of narwhals were covered with zigzag transects. The aerial survey was flown at an altitude of 1,000 feet using three deHavilland Twin Otter 300 aircraft, each equipped with four bubble windows (left and right front, left and right rear) and a large belly window. Four observers were stationed at the windows, with a fifth team member acting as a navigator and camera operator. Sighting data were collected by two observers stationed on each side of the aircraft using line transect survey methods. The data from fore and aft observers on the same side of the aircraft will be used as a means to estimate a correction factor for potential perception bias by comparing sighting rates. This will allow us to estimate the proportion of sightings missed by observers.

The fifteen team members gathered at the Polar Continental Shelf Program base in Resolute on August 1st and began preparing the three planes for the survey. During the first two days, all observers were given extensive training sessions to familiarize them with the protocols and prepare them for data collection. These sessions included classroom presentations, on-the-ground training and practice flights around Resolute, which also allowed testing of on-board equipment.

7. Project Schedule:

Output or step	Start date (dd/mm/yyyy)	End date (dd/mm/yyyy)	Person days
Planning and organization	01/04/2013	01/07/2013	1200
Aerial survey	15/07/2013	31/08/2013	390
Data analysis	01/09/2013	06/30/2014	540
Science advice	01/09/2014	31/03/2015	40

8. Preliminary Results/Discussion:

Dates for the survey were established based on the short window of relatively ice-free waters in the Arctic Archipelago and the timing of narwhals aggregating on their summering grounds (i.e., before end-of-summer movement amongst areas is believed to occur). All three survey aircraft were initially based in Resolute. The first two days were scheduled for gear set-up and observer training, including test flights. The sequence of stratum coverage was designed to survey areas in order of priority, weather permitting. In an effort to avoid the effect of potential significant movements of narwhals between areas, attempts were made to survey each stratum in one or two days. For large or remote areas, this often required the use of more than one aircraft (e.g., the large Prince Regent Inlet stratum was surveyed in one day using all three planes simultaneously).

The 2013 summer was characterized by a late ice break-up, which placed additional constraints on the timing of surveys. At the beginning of the survey period, several areas were still completely (Norwegian Bay, Peel Sound) or partially (Jones Sound, Barrow Strait) covered with ice. Contingency days were planned to allow for poor weather conditions (with a ratio of two bad days for each good day). In the end, the aircraft were able to survey in adequate conditions for about 40% of the time (Table 1). Weather conditions deteriorated towards the end of the survey period. Some areas were characterized by poor weather (strong wind and thick fog) during the entire month (e.g., Smith Sound).

Table 1. Sequence of survey completion. Blue cells indicate a day during which a stratum was flown, while red cells indicate that poor weather conditions prevented the plane from surveying that day (with the name of the community where the plane was based given in brackets).

Date	Aircraft 1	Aircraft 2	Aircraft 3
2013-08-01	preparation (Resolute)	preparation (Resolute)	preparation

			(Resolute)
2013-08-02	preparation (Resolute)	preparation (Resolute)	preparation (Resolute)
2013-08-03	weather (Resolute)	weather (Resolute)	weather (Resolute)
2013-08-04	Smith Sound	Smith Sound	Smith Sound
2013-08-05	Peel Sound	Peel Sound	Peel Sound
2013-08-06	weather (Resolute)	weather (Resolute)	weather (Resolute)
2013-08-07	weather (Resolute)	weather (Resolute)	weather (Resolute)
2013-08-08	Norwegian Bay	Norwegian Bay	Norwegian Bay
2013-08-09	Prince Regent Inlet	Prince Regent Inlet	Prince Regent Inlet
2013-08-10	Jones Sound	Jones Sound	transfer to Clyde River
2013-08-11	weather (Resolute)	weather (Arctic Bay)	East Baffin
2013-08-12	weather (Resolute)	Admiralty Inlet	East Baffin
2013-08-13	weather (Resolute)	weather (Arctic Bay)	weather (Clyde River)
2013-08-14	weather (Resolute)	weather (Arctic Bay)	transfer to Pangnirtung
2013-08-15	Gulf of Boothia	weather (Arctic Bay)	East Baffin
2013-08-16	Gulf of Boothia	weather (Arctic Bay)	weather (Pangnirtung)
2013-08-17	weather (Kugaruk)	Admiralty Inlet	East Baffin
2013-08-18	weather (Kugaruk)	Eclipse Sound	East Baffin
2013-08-19	weather (Kugaruk)	Eclipse Sound	weather (Pangnirtung)
2013-08-20	weather (Kugaruk)	weather (Arctic Bay)	Cumberland Sound
2013-08-21	weather (Hall Beach)	weather (Arctic Bay)	weather (Pangnirtung)
2013-08-22	weather (Hall Beach)	weather (Resolute)	weather (Pangnirtung)
2013-08-23	weather (Hall Beach)	weather (Resolute)	Cumberland Sound
2013-08-24	weather (Hall Beach)	weather (Resolute)	weather (Pangnirtung)
2013-08-25	weather (Resolute)	weather (Resolute)	East Baffin
2013-08-26	Jones Sound	Jones Sound	weather (Pangnirtung)

STRATA COVERAGE

North Water stock

The strata believed to constitute the main aggregation areas of the putative North Water stock were given the highest level of priority (Fig. 3). However, heavy ice conditions imposed some

delays. Norwegian Bay was flown in good weather, but its northern part and several of its fiords were still frozen. Narwhals were observed in its southern half. Jones Sound and its fiords were flown in excellent conditions in a single day. Few narwhals were observed, however. Grise Fiord community members confirmed that narwhals arrived late this year. Consequently, efforts were made to fly Jones Sound again at a later time, despite deteriorating weather. It was finally flown again on the last day of the survey (Aug. 26), although with stronger wind conditions than desirable. Fog and strong winds prevented complete coverage of Smith Sound. Several of the eastern Ellesmere fiords could be surveyed, however, and large numbers of narwhals and belugas were observed in Mackinson Inlet in particular.

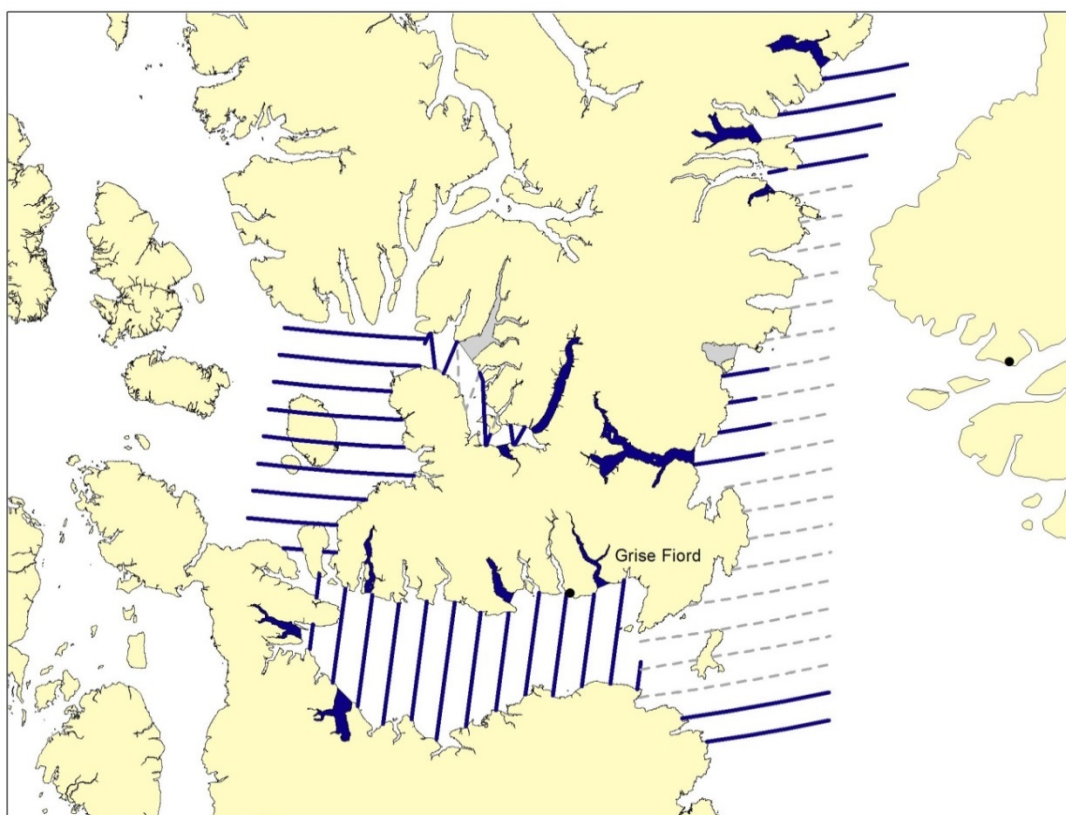


Figure 3. North Water stock survey completion. Grey dashed lines: planned transects. Blue lines: surveyed transects. Grey areas: planned fiords. Blue areas: surveyed fiords.

Somerset Island stock

Strata of the Somerset Island stock were given the second highest priority ranking (Fig. 4). By using all three aircraft simultaneously, both Peel Sound and Prince Regent Inlet were each surveyed in a single day. The Gulf of Boothia was covered a week later over a 2-day period. Narwhals and bowhead whales appeared to be aggregated at the southern end of Prince Regent Inlet and in the northern part of the Gulf of Boothia. Despite heavy ice cover, numerous narwhals were observed in the central, high-density area of Peel Sound.

Admiralty Inlet & Eclipse Sound

Because some narwhal movements between Admiralty Inlet and Eclipse Sound were previously documented by satellite telemetry, these two strata needed to be surveyed in quick succession. Admiralty Inlet was surveyed in two days, with a 4-day break in between due to bad weather (Fig. 5). Eclipse Sound was covered immediately afterwards, in two successive days. Narwhals were found to be aggregated in the southern ends of both areas, close to shore or within fiords, with a high degree of clumping. This behaviour, which could have been exacerbated by several factors (e.g., prey distribution and presence of killer whales) may decrease the precision of the estimates.

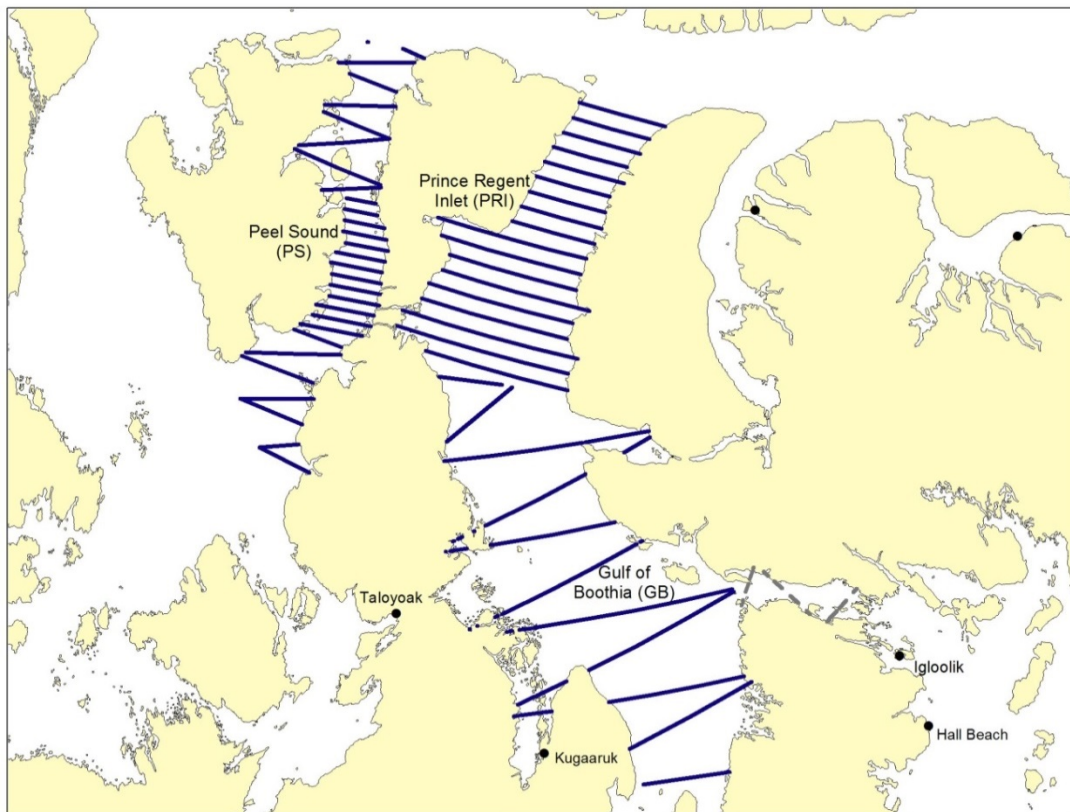


Figure 4. Somerset Island stock survey completion. Grey dashed lines: planned transects. Blue lines: surveyed transects. Grey areas: planned fiords. Blue areas: surveyed fiords.

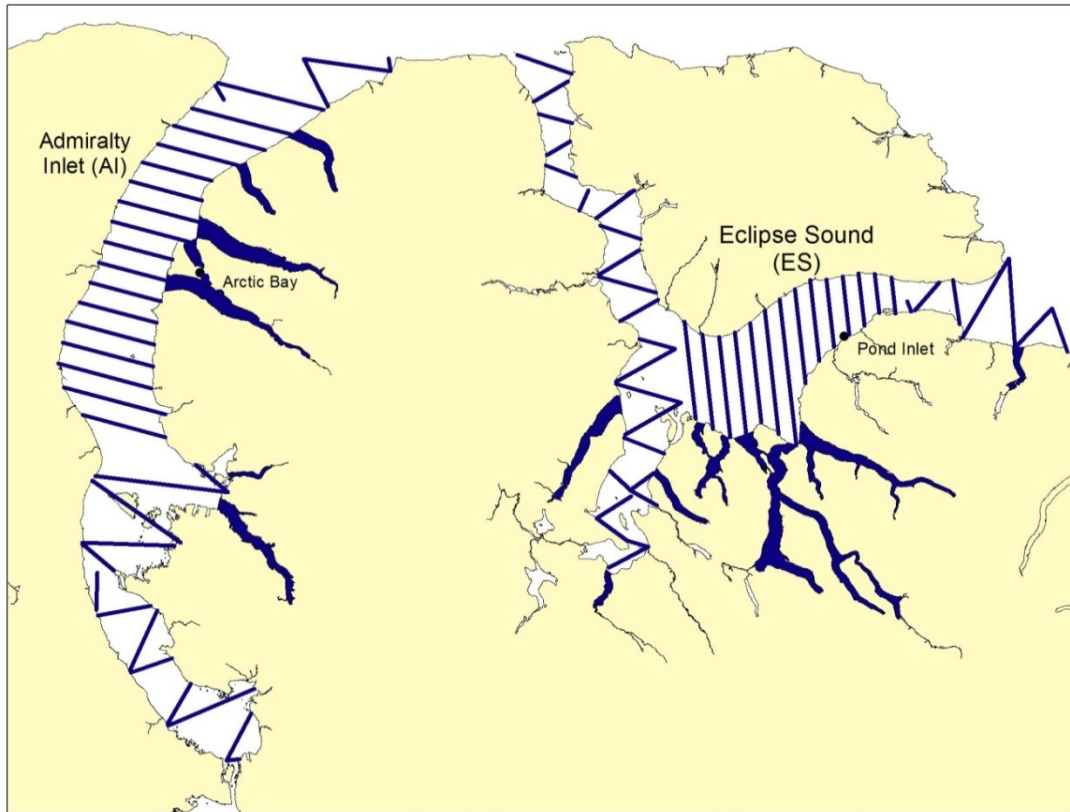


Figure 5. Admiralty Inlet and Eclipse Sound stock survey completion. Grey dashed lines: planned transects. Blue lines: surveyed transects. Grey areas: planned fiords. Blue areas: surveyed fiords.

East Baffin

The eastern coast of Baffin Island was surveyed by one aircraft over a 2-week period (Fig. 6). Strong winds made it difficult to survey the offshore portion of the area and numerous attempts were necessary. In the end, about 90% of the planned transect lines were surveyed, and all planned fiords except one. Narwhals were seen predominantly in the fiords of the north-western half of the stratum.

Bowhead strata

Several key areas for bowhead whales coincided with narwhal summer aggregation sites and thus were surveyed at the same time (i.e., Prince Regent Inlet, Gulf of Boothia, Admiralty Inlet, Eclipse Sound, and East Baffin Island). Cumberland Sound and Northern Foxe Basin had been added during survey planning specifically to improve the abundance estimate of bowhead whales. Cumberland Sound was surveyed at the end of August, with only the southern end of the low density area not covered because of weather conditions. Numerous bowhead whales were seen in the central portion, particularly in Kingnait fiord. Foxe Basin, however, could never be surveyed due to weather conditions, despite a full week of attempts. The Barrow Strait and Lancaster Sound areas were given lower priority and could not be surveyed due to weather constraints.

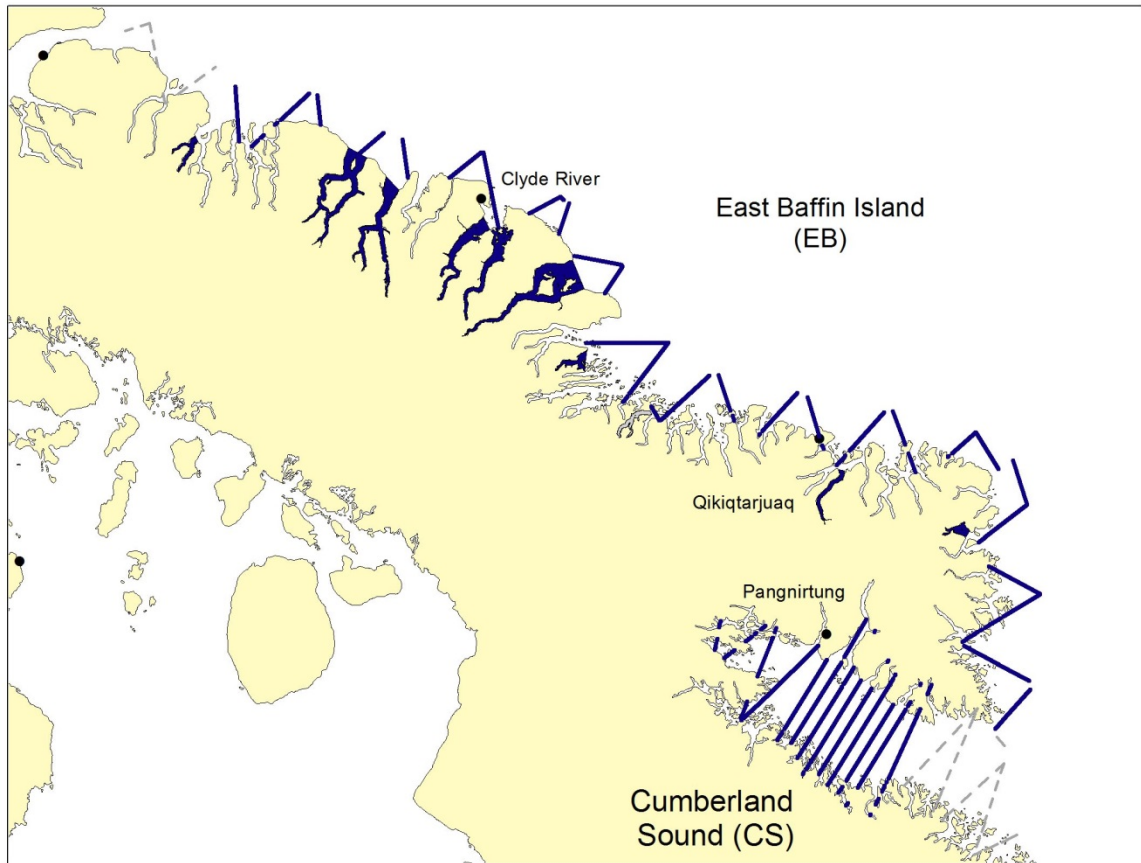


Figure 6. East Baffin stock and Cumberland Sound survey completion. Grey dashed lines: planned transects. Blue lines: surveyed transects. Grey areas: planned fiords. Blue areas: surveyed fiords.

FUTURE ANALYSES

In fall of 2013, processing of the survey data has begun. Data processing steps include data assembly and verification, as well as using photographs to verify uncertain sightings and counts of large groups that were observed in fiords. In early 2014, the pre-analysis phase will involve assessing duplicate sightings amongst observers, time-in-view calculations, and plotting whale sightings. Additional analyses will be undertaken to improve the accuracy of the stock assessments, including re-analysing dive times from telemetry data to improve availability adjustments (e.g. sightings made in fiords rather than offshore). Separate projects will develop conventional and citizen science (see box) approaches to analyzing the thousands of photographs to come up with an independent abundance estimate.

An initial assessment of the survey results will be completed in Spring 2014. A complete assessment and primary publications will be completed in 2014-2015.

9. Reporting to communities/resource users:

Community / HTO	Before research	During research	Completion of research
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Arctic Bay	January 2013	August 2013	May 2014
Clyde River	January 2013	August 2013	May 2014
Gjoa Haven	January 2013	August 2013	May 2014
Grise Fiord	January 2013	August 2013	May 2014
Hall Beach	January 2013	August 2013	May 2014
Igloolik	January 2013	August 2013	May 2014
Iqaluit	January 2013	August 2013	May 2014
Kugaaruk	January 2013	August 2013	May 2014
Kugluktuk	January 2013	August 2013	May 2014
Pangnirtung	January 2013	August 2013	May 2014
Pond Inlet	January 2013	August 2013	May 2014
Qikiqtarjuaq	January 2013	August 2013	May 2014
Resolute Bay	January 2013	August 2013	May 2014
Taloyoak	January 2013	August 2013	May 2014