

**SUBMISSION TO THE
NUNAVUT WILDLIFE MANAGEMENT BOARD**

FOR

Information: X

Issue: Continued update from DFO Science Program: summer field work in Nunavut, 2013 and upcoming winter field work in 2014.

Background: In the past, Fisheries and Oceans Canada (DFO) Science provided an update on the Emerging Fisheries Program and other Science programs currently operating in Nunavut e.g. Narwhal Aerial Survey, Offshore Trawling Survey. It was requested that DFO Science update the board on field work outcomes from the 2013 field season. Since September, all field work from the summer has concluded and we have been able to compile initial summary reports for many of the projects to present to the NWMB. Summaries for the following projects were presented at the NWMB's December meeting: 1) Arctic Char Stock Assessment in Cumberland Sound; 2) Orcas of the Canadian Arctic: August 2013 research in Pond Inlet, NU; 3) Bowhead whale tagging and genetic Mark-Recapture project in Foxe Basin and Cumberland Sound 2013; and 4) High Arctic Cetacean Survey

Since the December meeting, more updates have been completed and we are presenting them in this briefing note:

- 1) BIOTA sea-ice program in the high Arctic
- 2) Cambridge Bay Arctic Char Research: Fishery Independent Surveys, Weir Enumeration and Tagging
- 3) High Arctic Cetacean

Additionally, DFO Science would like to update the NWMB on winter field work in 2014:

- i) Arctic Char Stock Assessment Research in Cumberland Sound- winter 2014

Sea-Ice BIOTA (Biological Impacts of Trends in the Arctic)
Dr. Christine Michel, DFO, Winnipeg

The Sea-ice Biological Impacts of Trends in the Arctic (BIOTA) project continued in 2013 to investigate how changing climate and ice conditions will impact the distribution and growth of ice algae in the productive Canadian Arctic Archipelago. The results will help understand changes in sea-ice communities and how they will impact animals and food webs that depend on them.

The 2013 field season was very successful with sampling occurring at 22 stations. BIOTA is the most extensive study of sea-ice ecosystems in the

Archipelago with a total of 105 stations sampled since the project started in 2010. Recent work has shown that the highly productive ice algae have distinct regional differences and can impact the diversity of other microorganisms in the water. In 2014 we would like to assess the impact of the iceberg near Resolute Bay on surrounding sea-ice communities.



Figure 1) Picture showing the dense ice algae community at the bottom of first-year sea ice in the Canadian Arctic Archipelago. The majority of algae in sea ice can be found in the bottom layer, where conditions are favorable for their growth.

Cambridge Bay Arctic Char Research: Fishery Independent Surveys, Weir Enumeration and Tagging
Les Harris, DFO, Winnipeg

Summary

The purpose of this research is to collect fishery independent biological information/samples from Arctic char harvested in the Cambridge Bay area and operate a weir at the Halovik River for the purpose of enumerating the upstream run while tagging up to 2000 Arctic char. Despite the long commercial history in the Cambridge Bay region, virtually all the current data available on this fishery has come from a fishery-dependent, commercial plant sampling program. As such, the majority of biological information on which stock assessments are conducted, and on which present management decisions based, has typically only considered biological/catch information of commercially harvested fish which typically over represents larger and

older individuals. Therefore, data that accurately represent all sizes and ages are lacking from most of these fisheries or this information is outdated.

In recent years, however, consistent fishery-independent surveys have been important for collecting biological data from Arctic char to compliment that collected as part of the plant sampling program. Combined, these data will be important for providing estimates of abundance/biomass and potentially resolve sustainable harvest levels. Furthermore, although fishery-independent data are recently becoming available again, accurate enumerations of abundance of Arctic char in commercial waterbodies are nearly 30 years outdated. Abundance estimates or weir enumerations are a vital component for resolving sustainable harvest levels and validating current stock assessment models for Arctic char in the region. Through this proposed research, we intend to address some of these knowledge gaps, all of which are identified in the 5-year plan for this fishery.

The objectives of our current Arctic char research program in Cambridge Bay are to (1) collect fishery independent biological information/samples from Arctic char harvested in the Cambridge Bay area, specifically from the Halovik (30 Mile) and Jayko rivers (2) collect catch and effort information that will be valuable for understanding how harvest levels are impacting current populations as these data may potentially be used as an index of abundance for these fisheries (3) collect tissue samples that will potentially be used for future assessments of population structure in Cambridge Bay Arctic char (4) operate a weir at the Halovik River to enumerate the upstream run of Arctic char in this system (5) tag up to an additional 2000 Arctic char for future mark-recapture estimates and to update information on movements for this species in the region and (6) provide an estimate of abundance using mark-recapture methodology incorporating data from recaptured Arctic char that were tagged in 2013.

2013 Summary of Field Work

The Halovik River (30 Mile) was sampled from August 22-26, 2013. In total, 175 Arctic char were captured, 93 of which were males and 62 of which were females. Arctic char at this location ranged in fork length from 274 mm to 905 mm for males and 414 mm to 814 mm for females. Round weight ranged from 187 g to 7450 g for males and from 850 g to 6150 g for females. The majority of Arctic char captured in 2013 were in resting condition. Additionally, six Least cisco (*Coregonus sardinella*) were also captured.

Assessments and analyses of the fishery independent data collected from the Halovik River will continue. These data will be added to the time series collected for this system and a full assessment of stock health will be performed subsequent to five years of data collection. Samples for parasite and genetic assessments are also being organized and contracts for age determination are in progress. All of the above described data will be used to assess trends in stock health (i.e., compared to previous years of fishery-independent sampling) as well as for comparison to those data collected as part of the plant sampling program. Subsequent to five years of data collection, a Regional Advisory Process (RAP) can take place to make recommendations with respect to the sustainability of current commercial quotas for these waterbodies.

Additionally, a weir was constructed on August 8th, 2013 and operated until September 8th, 2013. During this time approximately 3000 Arctic char were enumerated (data entry is still ongoing), some of which were harvested in the commercial fishery. For the majority of enumerated fish fork length was recorded. Additionally, for a few of the fish, we were also able to record weight and collect otoliths for aging. Additionally, 1000 Arctic char were Floy-tagged and recaptures next year may be used to provide a population estimate using mark-recapture methods. Additionally, recaptures will be important for updating information.

Importance of This Work

Ultimately, these results will be used to provide advice to DFO Fisheries Management and the Nunavut Wildlife Management Board on the sustainability of harvest levels for Cambridge Bay Arctic char. These inputs will be essential to the evaluation of fisheries management strategies and integrated fishery management plans. As with most Arctic char fisheries in the Canadian Arctic, the Cambridge Bay fishery is recognized as a data-poor fishery and the results obtained from this work will immediately build on our knowledge of the biology, vital rates, abundance and harvest of Arctic char in the Cambridge Bay area. Subsequently, these fishery-independent data and catch and effort information can then be used in future assessments of Cambridge Bay Arctic Char relying on trend analyses and in quantitative stock assessment aimed at resolving precautionary limit reference points (LRPs). Abundance data gained from the weir assessment and the mark-recapture estimate at the Halovik River will be important for validating current stock assessment models applied for this fishery. All told, these data will be important for informing fisheries management as to the sustainability of these populations as part of upcoming assessments on these fisheries.

High Arctic Cetacean Survey

Dr. Kevin Hedges, DFO, Winnipeg,

HIGH ARCTIC CETACEAN SURVEY POST-SURVEY SUMMARY: Fisheries and Oceans Canada's 2013 High Arctic Cetacean Survey was completed between August 1 and August 26. The three survey teams flew for a combined total of 241 hours and surveyed the majority of the planned areas, covering the entire summering range of Baffin Bay narwhal stocks. Poor weather conditions towards the end of the month prevented the teams from completing Smith Sound, Barrow Strait, Lancaster Sound and Foxe Basin. Overall, the survey was extremely successful and represents DFO's largest scale assessment of cetacean populations in the Canadian Arctic.

RATIONALE

The purpose of the large-scale aerial survey conducted in the Canadian High Arctic in August 2013 was to obtain new abundance estimates of the Baffin Bay narwhal population and the Eastern Arctic-West Greenland bowhead whale population. The last estimates were approximately 10 years old and known to be incomplete, given the broad range of both populations. Never before has a survey endeavoured to count all of the Canadian Baffin Bay narwhal stocks during the same summer. We also wanted to obtain for the first time an estimate for the putative stock around Ellesmere Island. With

this information we will be able to improve the PBR estimates used for management advice.

The primary target species of the 2013 survey was the narwhal since it is more heavily hunted, and since there are pressing management and export issues related to that hunt. The bowhead whale was the secondary target species because it is of international concern and no precise abundance estimate of the Eastern Canada-West Greenland population is currently available. There is considerable overlap between the ranges of the two species in August and thus important areas for bowhead could be covered by the narwhal survey design. Therefore, an attempt was made to cover the remainder of the bowhead range. Other species surveyed included beluga, walrus, killer whales, and seals.

SURVEY DESIGN & METHODOLOGY

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.

LOGISTICS & OBSERVER TRAINING

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.

HIGH RESOLUTION CAMERA SET-UP

In addition to visual observations, the three aircrafts collected continuous photographic records below the aircraft using dual oblique cameras pointing downwards towards either side of the track line. The digital camera system was comprised of two Nikon digital cameras mounted in a special frame and aimed through the belly window in the rear of the aircraft. These geo-referenced images will be used to generate separate abundance estimates and will provide another means to estimate the proportion of whales missed by observers. They will also allow the recovery of missing sighting angles from observers, and positive identification of whale species within the frames.

COMMUNITY INVOLVEMENT

Nunavut communities were involved at every step of the survey process. A visit was made to Grise Fiord in 2012 to collect local information on narwhal movements and distribution around Ellesmere Island, and four community members participated in a reconnaissance survey of the identified areas. Traditional knowledge on narwhal and bowhead whales all around Baffin Island was used in conjunction with previous surveys and satellite telemetry data to design the flight plans and determine the best timing for the 2013 survey.

During the survey, each of the plane crews included one Inuk as part of the four observers recording sighting data. Moreover, HTO members from each community visited by the three aircraft (Resolute Bay, Arctic Bay, Pond Inlet, Clyde River, Kugaaruk, Taloyoak, Hall Beach and Pangnirtung) had the opportunity to fly with the plane during surveys taking place close to that community.

STRATA SEQUENCE, WEATHER & ICE CONDITIONS

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 aircrafts 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 at surveying each stratum in a day or two. 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. 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).

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. 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.

Somerset Island stock

Strata of the Somerset Island stock were given the second highest priority ranking. 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. 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.

East Baffin

The eastern coast of Baffin Island was surveyed by one aircraft over a 2-week period. 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.

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 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.

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Arctic Char Stock Assessment Research in Cumberland Sound- winter 2014 **Zoya Martin, DFO, Iqaluit**

Continuation of ongoing Stock Assessment Research on Arctic Char in Cumberland Sound is proposed for 2014. DFO Science is planning on collecting Fisheries

Independent Data from four (4) stocks this winter. Details of the field work including: collection methods, sample sizes, hiring of local assistants and distribution of fish carcasses was all presented to the NWMB at the June 2013 meeting in Rankin Inlet. Below is the attached sampling schedule that was designed with and approved by the Pangnirtung Hunters and Trappers Association (PHTO):

Naulinarvik (PG008)	Feb 14 - Feb 21
Anaktuajuit (PG010)	Feb 21 - Feb 28
Ijarvung (PG003)	March 2 - March 9
Iqalugaarjuit S (PG027)	March 9 - March 17

Travel to and from the sites, along with fish capture and sampling at each location takes about 4 -5 days. To account for delays (e.g., weather) we allow for up to 7 (seven) days per field camp per location. This research is a priority for the community and the PHTO is an active partner. The Stock Assessment Research in Cumberland Sound is consulted on and discussed at a minimum of two (2) meetings annually between DFO and the PHTO.

This research is meant to provide data to allow DFO Science to provide Stock Assessment Reports on these locations. As per the protocol each Stock Assessment requires a minimum of 5 (five) years of good quality data.

Conclusion:

The information provided in this briefing note is provided as a progress update and should not be taken as advice from Science. All research presented here will provide advice in the future through formal DFO processes including reports and primary publications. Additionally, all communities involved with the research projects will be provided updates from the lead researchers (Principal Investigators or Head Biologists) over the next few months.

Consultations:

DFO Central & Arctic Region and Eastern Arctic Area

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