Foxe Basin Polar Bear Project
2009 Interim Report

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EXECUTIVE SUMMARY (available in Inuktitut translation)

This report summarizes progress on the Foxe Basin Polar Bear Project from November 2008 to November 2009.

Springtime fieldwork was conducted in the Foxe Basin polar bear management zone or subpopulation (FB) in April 2009. The purpose of this work was to 1) evaluate the usefulness of springtime aerial surveys for abundance estimation of polar bears; and 2) retrieve dropped satellite collars; and 3) search for RFID tags. We ultimately retrieved all collars that dropped off bears on land (11). Nine had dropped off bears because a manufacturer's malfunction and 2 had slipped off because they were fit too loose. We determined that a springtime aerial survey on ice would be much less efficient and provide less-accurate information compared to an autumn aerial survey in FB. The springtime work was plagued with poor sighting probability and a low encounter rate, as there is low polar bear density across a large expanse of available habitat; we flew 17,000 km and sighted 16 polar bears. In contrast, during the autumn when the vast majority of bears are on land in FB, low topography land results in high sighting probability, and the concentration of polar bears on land increases encounter rates. In spring 2009, we relocated zero of the 32 RFID tags available (1 RFID tag had already been harvested) during 31 helicopter hours.

The main objectives of the autumn 2009 field season were to 1) conduct a comprehensive aerial survey for population estimation of polar bears in FB; and 2) deploy 25 satellite collars on polar bears in the FB for research on population delineation and habitat ecology. Initial plans were to conduct a mark-recapture study for estimation of population parameters (annual survival, abundance and status); the GN did not permit this project in 2008 and 2009, because of concerns from some communities regarding the immobilization of polar bears. As a result, estimation of annual survival, population status and a total allowable harvest (TAH), based on formulae dictated in the Polar Bear Research and Management Memoranda of Understanding with Nunavut communities, are no longer objectives of the Foxe Basin Polar Bear Project.

Autumn fieldwork was conducted from 13 August to 2 October 2009 on the Hudson Bay shore of Nunavik (northern Quebec), islands in Hudson Strait, northern Hudson Strait west of Kimmirut, the Foxe Peninsula, all islands, coastal regions in Foxe Basin proper, south to Chesterfield Inlet. We based out of the communities of Puvirnituq, Ivujivik, Salluit, Kimmirut, Cape Dorset, cabins at Nikku and Bray islands, Igloolik, Repulse Bay, Chesterfield Inlet and Coral Harbour. We deployed satellite collars on 24 adult females and satellite ear tag on 1 adult male. Biological samples and measurements were collected from all immobilized polar bears. The distribution of 2009 collars complements the 2007 and 2008 distribution, resulting in a geographically representative sample of information to be used for population delineation and habitat analyses.

In the autumn of 2009, we also completed a comprehensive land-based aerial survey throughout FB. We employed a combination of coastal 'contour' and inland transects, as well as total counts on a sample of small islands. We covered approximately 50% of the coast during our contour transects. Because polar bears concentrate along the coast during the late

summer, ice-free season, we divided the ‘inland’ study area into high density (land within 5 km of the coast), low density (land 5 - 15 km from the coast), and very low-density (land 15 – 50 km from the coast) strata. Strata delineation was based on satellite tagging data collected in Foxe Basin during 2008 – 2009. We allocated our sampling effort such that transects were concentrated in the high density, coastal stratum. Sampling protocols enabled us to collect both distance sampling and double observer (sight-resight) data from the helicopter platform. During the 7-week survey period, we flew more than 40,000 km (including ferries) across FB. We recorded 814 bears, including 616 independent (i.e., adult and subadult) bears. Analyses, which will include comparison among multiple analytical techniques, are in progress. We anticipate obtaining a population estimate for FB in spring 2010 and will recommend technique modifications for the 2010 aerial survey in FB.

An original intent of the Foxe Basin Polar Bear Project was also to test and develop Radio Frequency Identification (RFID) ear tags. These tags could be used to reduce the need to recapture animals during mark-recapture studies; the intent was to develop research techniques that are more acceptable to the Inuit public. We intended to deploy 300 RFID tags, a sample size sufficient, due to the relative to the abundance of polar bears in FB, to ascertain the retention and detection of the tags. However, we were only able to deploy 55 tags in 2008 and 2009, because the mark-recapture portion of the research was cancelled. In 2009, we had the ability to search for the 32 tags deployed in 2008. Our tests indicate that RFID tags are detectable at 4 km at 1,000 ft above-ground-altitude (AGL) or 1 km at 400 ft AGL. We relocated 6 of the 31 tags. Three tags were found to be firmly attached to ears, with no infection (1 in the harvest, 2 during 2009 survey activities); 2 remaining tags were shed and located during autumn field effort in 2009. We deployed an additional 23 RFID tags on all adult, subadult and yearling polar bears captured, in 2009.

In 2008 – 2009 we continued analysis using satellite collar and ear tag location information to explore polar bear movements and multi-scale habitat selection. At the landscape scale we conducted a preliminary analysis of habitat selection based on the sea ice concentration, age and floe size as described by the Canadian Ice Service maps. This will be the first analysis of this type completed for polar bears that live in seasonal sea ice populations, where ice does not remain in summer months. Significant progress was made in developing a new method for quantifying fine-scale habitat selection by using SAR imagery of sea ice; SAR imagery is available during dark months and on days with cloud cover. This method will have application throughout the Arctic and will be useful for many sea ice dependent species. We present these preliminary analyses in this report.

We present movement metrics for both male and female polar bears for 2008 – 2009: home range size; movement rates; and distance travelled. In this second year of study we observed geographic differences in home range sizes of FB bears using Hudson Bay and Foxe Basin, effects of small islands on movements during the open-water season, and sex differences in movements. Interestingly, we found that females with cubs travelled further than the four adult males that we tagged in 2008.

Existing collections (Igloolik Oral History Project, Parks Canada Oral History Project, Hudson Bay Program) of *Inuit Qaujimajaiugangit* (IQ) were reviewed in 2006 and 2007 but little information about polar bear habitat use and distribution was found. We collected new IQ on polar bear habitat use in 2009 from elders and hunters across FB in 33 individual interviews and 2 focus groups.

INTRODUCTION

The Department of Environment (DOE) of the Government of Nunavut (GN) is responsible for the management and conservation of polar bear (*Ursus maritimus*) populations within its jurisdiction. This responsibility is outlined in the Nunavut Land Claims Agreement (NLCA, 1993). Further, the federal government entrusts the Nunavut Territory and other polar bear jurisdictions within Canada with the fulfillment of the International Agreement of the Protection of Polar Bears and their Habitat, ratified in 1974. This task traditionally involves periodic population inventories, which are comprised of geographic delineation and estimation of demographic parameters including birth and death rates, population size and status. With this information, the GN recommends the Total Allowable Harvest (TAH) for the population to the Nunavut Wildlife Management Board (NWMB). In addition, under the NLCA, the GN is required to manage wildlife under the *principles of conservation*; climate change and its consequences for polar bears has been highlighted as a conservation concern, and therefore a substantive part of the Foxe Basin Polar Bear Project includes research on polar bear habitat ecology. Finally, as indicated in the NLCA (1993), our research and management system must take into consideration unique perspective and traditional knowledge of the Inuit; our project incorporates significant efforts to systematically collect *Inuit Qaujimajaiugangit* (IQ) of polar bears in FB.

The Foxe Basin polar bear management zone or subpopulation (FB; Figure 1) has received relatively little recent research attention (Lunn et al. 1987, Taylor et al. 1990, Taylor et al. 2006b). No population boundary delineation using satellite telemetry (Taylor et al. 2001) has occurred and demographic rates have not been estimated. FB is currently defined as bounded in the south by northern Hudson Bay, western Baffin Island, the Fury and Hecla Straits and the Melville Peninsula and covers approximately 1.1 million km^2. Seven communities in Nunavut (Kimmirut (10), Cape Dorset (10), Igloolik (10), Hall Beach (8), Repulse Bay (12), Chesterfield Inlet (8) and Repulse Bay (12)) harvest polar bears from FB (TAH in parentheses). Polar bears in FB are also harvested by communities in Nunavik (northern Quebec; Puvirnituq, Akulivik, Ivujivik and Salluit) at a combined range of 0 – 7 polar bears per year from 1997-2005. The harvest in Quebec is neither regulated nor consistently monitored.

The mean population size for polar bears in FB from 1989 to 1994 was estimated to be 2,197 ± 260 SE (Taylor et al. 2006b). In recent years, local knowledge in Nunavut indicated an increase in polar bear numbers, resulting in an increase in the 2005 Nunavut TAH from 97 to 106 polar bears, which was considered sustainable with a population estimated at 2,300 bears.

Population Delineation and Inventory

The Foxe Basin Polar Bear Project includes several components to address the management mandate for polar bears in FB. Science-based population delineation will assist in the recommendation of distribution of harvest quotas across the Hudson Bay complex. Hitherto, boundary delineation of polar bear subpopulations has used satellite information collected from adult females, because the circumference of necks of adult males is too large to wear collars. Advancements in technology show promise (E. Born, personal communication; Peacock et al. 2008) for a satellite ear tag (Mikkel Vellum Jensen, Denmark and Wildlife Computers Inc., USA) to collect data on male polar bear movement. Our data from five male polar bears will be used in addition to the data on female movement for delineation and habitat analyses.

A second crucial part of population inventory for the establishment of TAH is a population inventory, which traditionally encapsulates estimation of population size, birth and death rates (Peacock 2009). With these demographic figures, we can then use population viability analyses (PVA) to estimate population growth rate, or status (stable, increasing, decreasing) of the population. TAH has historically been set to maximize harvest opportunities for the Inuit of Nunavut, and is set such that the population is managed to be stable. In order to maximize harvest, the mark-recapture method has been used to estimate precise (confident) and accurate (low bias) population parameters (Taylor et al. 2002, Taylor et al. 2006a, 2008, 2009). In 2008 and 2009, the DOE did not permit a mark-recapture study due to community concerns regarding the physical capture of polar bears. As such, we will not be estimating survival rates in or status of FB. We recommend that the DOE investigate alternative measures to establish a science-based TAH.

There is broad support within the DOE, NWMB and communities for wildlife research, which does not involve chemical immobilization of wildlife. In deference to *Inuit Societal Values,* we are developing and have implemented a less-invasive aerial survey method for population estimation of polar bears. In 2008 we conducted a pilot study to outline the methods (McDonald et al. 1999, Buckland et al. 2001, Peacock et al. 2008) needed for the aerial surveys. Here we report on the comprehensive 2009 aerial survey.

We also report summary zoological statistics of polar bears caught during the Foxe Basin Polar Bear Project as part of the population delineation and habitat ecology projects, as it is likely that no more capture will occur in FB for the foreseeable future. We provide summarized data on recruitment and body metrics, which can be used for comparisons to different timeframes and other subpopulations, and possibly in a PVA. Finally, a proposed objective of the Foxe Basin polar bear project was to develop the use of RFID technology to reduce the need to recapture polar bears in mark-recapture studies. We had proposed to deploy 300 RFID tags, a sample size sufficient to determine retention rates, given the large size of the polar bear population in FB. Here we report on the progress of a much-reduced initiative, in which 55 RFID tags have been deployed.

Habitat Ecology

The GN DOE must manage polar bears in the context and uncertainty of climate change, given their mandate under the NLCA (1993). The effects of climate change have been manifested in decreased survival and natality, and declines in body condition of polar bears in southern (SH) and western Hudson Bay (WH; Stirling et al. 1999, Derocher et al. 2004, Stirling et al. 2004, Obbard et al. 2007) and the Beaufort Sea (Regehr et al. 2006, Rode et al. in press). The changes in demographic rates in western Hudson Bay have resulted in a decrease from 1200 to 935 bears over the last 20 years (Lunn et al. 1997, Regehr et al. 2007). The decrease in population size and health is most often attributed to changing ice conditions (Stirling et al. 1999, Regehr et al. 2007). Polar bears and their prey are dependent on the sea ice and thus are vulnerable to climate change. The potential effects of reductions in sea ice on polar bears are many: survival; reproductive success; increased energy expenditures and distribution. Using the field effort associated with population delineation we propose to address seasonal movement and ice habitat selection of polar bears.

Sea ice extent, thickness and duration have been declining throughout the Canadian Arctic (Serreze and Rigor 2006, IPCC 2007, Parkinson and Cavalieri 2008). The effects of changing habitat availability, increasing habitat fragmentation, timing of freeze-up and breakup, proportions of annual and multi-year sea ice on ice dependent species are of increasing concern (Blum and Gradinger 2007, Laidre et al. 2008, Durner et al. 2009). The sea ice extent of Hudson Bay and Foxe Basin and the duration of ice season have declined; the declines are attributed to climate change (Gough et al. 2004, Gagnon and Gough 2005, Moore 2006, Stirling and Parkinson 2006). Further, we have documented a change in polar bear ice habitat in Foxe Basin from 1979 to 2006 (Sahanatien and Derocher 2007). Future climate change effects on polar bear habitat, distribution and populations are projected to be most pronounced in regions of seasonal sea ice (Baffin Bay (BB), Davis Strait (DS), FB, WH and SH; Derocher et al. 2004, Amstrup et al. 2007).

Here we report on our progress on our studies on changes in FB sea ice over the past 25 years, sea-ice habitat modeling of polar bears and movement studies of polar bears in FB.

Inuit Qaujimajaiugangit

In the Foxe Basin Polar Bear Project we are using Inuit knowledge, *Inuit Qaujimajaiugangit* (IQ), in several important ways. Generally and informally, we use local knowledge and IQ to design our studies, implement fieldwork and interpret results. More specifically, we are incorporating IQ or Traditional Ecological Knowledge (TEK) from interviews into our habitat modeling and to stratify our aerial surveys. In terms of our habitat modeling, we are addressing the relationships of polar bear movement to sea ice conditions using both TEK and science (see section on habitat ecology). Sea ice habitat conditions experienced by polar bears will change with climate warming, potentially negatively affecting population status and Inuit harvest levels. A new approach for incorporating TEK in research will be explored by using TEK to inform, create and compare 3rd-order habitat selection models. Foxe Basin and Hudson Bay oral history collections and reports of TEK of polar bears were reviewed and little information related to sea ice habitat, habitat use, and movements were found. Thus, we found it necessary to collect new IQ as a part of the Foxe Basin Polar Bear Project.

PROJECT OBJECTIVES

I. **Population Delineation.** To geographically delineate the Foxe Basin polar bear population (2007 - 2013).

II. **Population Inventory.** (2009 – 2011).

   a. estimate population size using physical mark-recapture and aerial survey

WE REPORT ONLY ON PROGRESS REGARDING THE AERIAL SURVEY, AS MARK-RECAPTURE WAS NOT PERMITED

   b. develop an effective aerial survey method for population estimation

   c. provide quantitative comparative assessment of the two methods for population estimation

AS MARK-RECAPTURE WAS NOT PERMITTED, THIS OBJECTIVE WILL NOT BE MET

   d. estimate survival and recruitment

AS MARK-RECAPTURE WAS NOT PERMITTED, THIS OBJECTIVE WILL NOT BE MET

   e. estimate population status (trend)

AS MARK-RECAPTURE WAS NOT PERMITTED, THIS OBJECTIVE WILL NOT BE MET

   f. determine Total Allowable Harvest (TAH)

AS MARK-RECAPTURE WAS NOT PERMITTED, THIS OBJECTIVE WILL NOT BE MET UNTIL NEW GUIDELINES ARE CREATED FOR DETERMINING TAH WITHOUT STATUS INFORMATION.

III. **Habitat Ecology.** To investigate movement and habitat selection of Foxe Basin polar bears as related to ice conditions (2007 – 2013).

IV. **Inuit Qaujimajaiugangit.** To collect and include IQ in the development of the habitat ecology and aerial survey studies and interpretation of the results (2007 – 2011).

METHODS AND RESULTS

I. POPULATION DELINEATION

To geographically delineate FB, we will use data gathered from 2007 – 2012 from polar bears tagged with satellite transmitters from 2007 – 2009. In 2007, 10 GEN III ARGOS/GPS (Telonics, Inc.) collars were deployed on female polar bears in southern FB. In 2008, we deployed 26 satellite collars (GEN IV ARGOS/GPS) on adult females and 4 satellite ear tags (M. Vellum SPOT 5 tag and Wildlife Computers) on adult males in northern and eastern FB (Peacock et al. 2008). In both years, satellite collars performed poorly (30 of 36 failed prematurely) due to a manufacturer's defect involving spring tension in the CR2-A release mechanism. In the spring and autumn of 2009, we retrieved 11 collars to help the manufacturer determine the source of the malfunction; the remaining collars likely dropped into ice/water. We received 25 new collars (GEN IV and refurbished GEN III), at no cost, and deployed 24, in addition to one additional satellite ear tag, in the autumn of 2009. The satellite collars are all still functioning and are programmed to drop off in 2012.

In 2009, 67 polar bears (Table 1, Figure 2) were captured and immobilized for deployment of satellite collars (24) and an ear tag. However, bears were also immobilized if they were 1) dependent young of adult females; 2) were in close proximity to immobilized adult females and therefore posed a threat to the focal bear; or 3) were close to the field camp on Bray Island. One collar slipped off an adult female within 1 week, and this collar was redeployed on another female. Bears were immobilized with palmer (adults and subadults) or pneu-darts (cubs-of-the year (COY) and yearlings) with a pneu-dart gun from a Bell 206L helicopter using Telozol (tiletamine hydrochloride and zolazepam hydrochloride), at a concentration of 250 mg/ml and administered at approximately 5mg/kg. The following data and samples were collected: axillary girth; zygomatic breadth; straight-line length; a vestigal premolar tooth (aging); ear puncture (DNA); hair samples (heavy metals); claw tip (stable isotopes); and a fat sample (fatty acid analysis). Other information collected included sex, field age, and body condition. We marked captured bears with ear tags and lip tattoos.

After all data are collected (by 2012) analysis on population delineation of FB will commence. Delineation using cluster-analysis (Taylor et al. 2001) will incorporate all satellite data, and satellite data from polar bears captured in the neighbouring Gulf of Boothia (GB; Taylor et al. 2009), SH (provided by M. Obbard, Ontario Ministry of Natural Resources) and WH (provided by A. Derocher, University of Alberta). Final results will be available in 2013. Initial graphics of the extents of home-ranges of all adult female collared to date (Figures 3 – 5) show that in general polar bears wander within the current boundaries of FB, although do use northern Hudson Bay during the winter and spring.

II. POPULATION INVENTORY

Population biology

All physical and genetic marks (from ear samples) placed on polar bears from 2007 – 2009 can be used in potential mark-recapture-recovery modeling in the future to estimate polar bear population size and survival in FB. In total, there were 168 capture events of polar bears from 2007 – 2009; 162 individuals were new captures, and 6 recaptures. In 2008, one adult female polar bear (with 2 COY) was caught in Hudson Strait near Markham Bay, who was originally captured in the Davis Strait management zone (DS), in eastern Hudson Strait. In 2009, another adult female (with 2 unmarked yearlings) was captured on Nottingham Island, was also originally caught in DS, in eastern Hudson Strait. In 2009, two adult females (including 2 tagged 2-year-olds of one of the females) were recaptured, having been caught originally in FB in 2008. No bears were caught in FB from WH or SH management zones. Thus there are 162 physical marks in the FB subpopulation, and approximately 80 additional genetic marks from the 2008 the biopsy-marking pilot study (genetic samples have been sent to Wildlife Genetics International; data is housed at the Wildlife Research Section in Igloolik, NU). As of November 2009, 1 bear marked during in FB from 2007 – 2009 has been harvested.

In 2009, we searched approximately 17,000 km in the spring and 40,000 km in the fall with the receiver enabled to detect radio-frequency identification (RFID) tags deployed in 2008. We detected 4 of 32 available RFID tags (i.e., those deployed in 2008 minus 1 harvested in January 2009; this one was affixed to the polar bear and showed no sign of infection). Two RFID tags were still attached to polar bear ears, and showed no signs of infection. The two other RFID tags were detected but no polar bear was found; we assume the RFID tag had dropped (one on eastern Prince Charles Island, one on eastern Rowley Island). In 2009, all bears (except for COY) that were immobilized were fitted with a RFID tag in the right ear ($n = 23$). Appendix 1 shows the fate of 55 RFID tags deployed in 2008 and 2009.

Summary body measurements of polar bears captured in FB from 2007 – 2009 are presented in Table 2; axillary girth is presented on an annual basis for COY and encumbered females (Table 3). Mean COY litter sizes (Table 3) in the sample of captured polar bears in 2008 and 2009 respectively were 1.63 (0.13, SE) and 1.64 (0.15). Interestingly, the mean COY litter size of the much larger sample observed during the aerial survey was smaller at 1.57 (0.06). These litter sizes are much larger than those observed recently in a fall-time study in Davis Strait (DS; Peacock 2009), where mean COY litter size from 2005 – 2007 was 1.49 (0.15). Of note, we captured mothers with 2-year-olds (and a 3-year-old in 2007), and captured or observed 4 triplet litters (2 COY, 2 yearlings) in FB; neither triplet litters nor significant occurrences 2-year-olds accompanying mothers were captured or observed in DS (Peacock 2009). Most bears captured in 2008 and 2009 in FB had evidence of marine-mammal feeding on fur. In 2009, ice floes were present in FB throughout the summer and fall.

In 2009, we found two bears that were shot and left on the land. On 23 September, one subadult male (19.7 cm zygomatic breadth) was found on western Mansel Island (62.05, -79.34) near an arctic char river, heavily used by people. An adult female was found dead on 5 September on Rowley Island (69.06, -78.63). Both bears were in good condition and neither had been scavenged. Approximately 2 km from the adult female was a yearling being consumed by two adult male polar bears. These bears should come off the FB quota for 2009 – 2010.

Aerial survey development and population estimation

In autumn 2008, we conducted a pilot study in FB to determine sighting probabilities and methods appropriate for an aerial survey of polar bears on land (S. Stapleton, unpublished data; Peacock et al. 2008). In 2009, we completed a comprehensive aerial (helicopter-based) survey of FB from August 15 to September 29. Polar bears concentrate on land during the ice-free season in FB; we used a combination of coastal 'contour' transects (roughly parallel to the coastline) and inland transects to survey mainland portions of FB and all very large islands (islands > 35 km in width such as Prince Charles and Coates islands). During coastal transects, we flew approximately 200 m inland of the shoreline, and counted bears out to about 500 m on the inland side of the aircraft, thus sampling a swath of about 700 m. Because polar bears generally concentrate along the shore during the late summer, inland transects were oriented perpendicular to this coastal density gradient (Buckland et al. 2001). We further divided the study area into multiple strata based on proximity to the coastline: a high density stratum, including land within 5 km of the coast; a low density stratum, including land 5 – 15 km from the nearest coastline; and a very low density stratum, including land 15 – 50 km from the nearest coastline. Satellite telemetry data collected in Foxe Basin during 2008 – 2009 were used to delineate these strata and define the inland extent of the study area (data gathered from satellite-collared individuals indicated that FB bears very rarely venture more than 50 km from any coast). All inland transects were spaced at 10 km intervals, and we allocated sampling effort such that transects were concentrated along the coast and in the high-density stratum. We surveyed approximately 50% of the coastline with contour transects, and maintained a ratio of 4 : 2 : 1 for inland transects extending 5, 15, and 50 km inland, respectively. For islands < 35 km wide (e.g., Rowley, Bray, and the Spicer Islands), we extended transects across the width of the islands and pooled these regions into the 'Large Island' stratum. We also surveyed a sample of very small islands as well as ice floes remaining in Bowman Bay, near Igloolik, and in the Hecla and Fury Straits.

Surveys were conducted from a Bell 206B Long-Ranger at an average airspeed of 150 km/hr (93 mi/hr) and an above-ground level (AGL) altitude of approximately 120 m (400 ft). We will use a combination of two approaches to estimate the number of bears that were not seen within the surveyed areas: sight-resight (e.g., McDonald et al. 1999) and distance sampling (Buckland et al. 2001). For sight-resight, observers seated in the front and rear of the aircraft functioned as separate, independent teams; bears could be seen by the front, back, both, or neither team. Comparing detections made by one team versus both teams yields individual detection probabilities for each team, a combined detection probability for both teams (i.e., the probability that at least one team spots a bear), and therefore an estimate of the bears present but not seen by either team. We note that observers in the rear of the aircraft have a blind spot directly beneath the helicopter. We simultaneously collected data to measure the distance off the transect line of each sighting to facilitate distance sampling analyses (Buckland et al. 2001). To obtain these metrics, polar bear locations were recorded with a GPS and perpendicular distances measured in a GIS (Marques et al. 2006). Since sighting distances decrease with increasing distance from the aircraft, the number of bears not observed at varying distances from the flight path can be estimated by fitting a curve (detection function) to the sighting distances (distance sampling). We additionally collected demographic data, including sex and age-class and a body condition index (Stirling et al. 2008), as well as weather and topographic data, which may impact sighting probabilities.

During the nearly 7-week survey period, we flew more than 40,000 km across FB (Figure 6). We sighted 816 polar bears, including 616 independent (i.e., adult and subadult) bears, and documented a mean litter size of 1.57 (0.06, SE) for COY (Table 3). As anticipated, encounter rates were greatest along the coast, on islands, and in the high density stratum, although a substantial number of bears were also detected in the low and very low density inland strata (Tables 5 and 6; Figures 7 – 9). We expect that the 'inland' bear sightings will make a significant contribution to the overall population estimate given the expansive interior of FB (Aars et al. 2009). We additionally recorded 100 bears on the very small, offshore islands and 4 individuals on ice floes. The distribution of polar bear sighting distances from the transect line suggest that we will be able to obtain a robust detection function for the distance sampling analyses (Figure 10).

Population analyses will include comparison among multiple analytical techniques such as Multiple Covariate Distance Sampling (Aars et al. 2009) and integrative procedures such as Mark-Recapture Distance Sampling (Laake et al. 2008). These methods, respectively, facilitate the inclusion of variables that may affect detection probabilities and account for situations in which the detection probability of animals located on the transect line is < 1. We will also evaluate the utility and precision of estimates derived solely from perpendicular, inland transects versus estimates derived from a combination of coastal contour transects and inland transects. We will obtain a population estimate for FB in the spring of 2010 will recommend technique modifications for the 2010 aerial survey in FB. The final FB estimate will be comprised of separate estimates of bears residing along the coast, further inland, on large islands, on small offshore islands, and on ice floes.

As our previous pilot research on Southampton Island suggested (S. Stapleton, unpublished data; Peacock et al. 2008), the late summer distribution of bears was highly clumped and concentrated along the coast in 2009 (Figures 7 – 9). We note that FB polar bears show some evidence of sex- and age-class segregation, and we hypothesize that this behavior, combined with the late summer movement of ice around FB, are significant determinants of polar bear distribution on land. We will use polar bear locations in a GIS-based analysis to further evaluate parameters potentially impacting bear distribution and segregation, including sea ice (using remote sensing data obtained from the Canadian Ice Service), proximity to the coastline, proximity to communities, and topography. These data will help to spatially structure future aerial survey research and also may help identify potential hotspots for human-polar bear conflict.

Additional research in FB during 2010 will be critical to the continued development and refinement of the aerial survey technique, to examine the consistency of population estimates derived from this method, and to further evaluate the factors affecting the distribution of polar bears during the ice-free season. All data and results from the FB aerial survey will be incorporated in S. Stapleton's Ph.D. dissertation.

II. Habitat Ecology

This section describes progress on analysis of ice habitat change in Foxe Basin and northern Hudson Bay, and polar bear habitat ecology and movement studies from the 2007 and 2008 collaring efforts. We also provide some preliminary information on initial movements of bears collared in the autumn of 2009.

Throughout, we have defined the seasons as follows: open-water (August – October), freeze-up (November – December), winter (January – March), spring (April-May) and break-up (June-July). All seasons but spring reflect sea ice phenology; spring is the main ringed seal pupping season.

Change in polar bear habitat in Foxe Basin

We completed analyses of sea ice concentration and available polar bear habitat in the Foxe Basin polar bear population area for the time period 1979 – 2004 (Sahanatien and Derocher 2007). Monthly (October – June) sea ice concentration maps, derived from satellite images, were reclassified to four polar bear habitat classes using ArcGIS: sea ice class 1 (0 – 30% or open water), sea ice class 2 (30 – 60% or very open ice), sea ice class 3 (60 – 85% or open ice) and sea ice class 4 (85 – 100% or closed ice). The area of each sea ice habitat class was calculated by month and year. Over time, least squares regression analysis showed significant declines over the 26 years in the total area of available habitat of sea ice classes 3 and 4 in November, December, May and June. Further, mean monthly air temperature was significantly correlated with amount of available sea ice habitat in October, November and December.

Landscape metrics were calculated using FRAGSTATS (McGarigal et al. 2002) to assess fragmentation of polar bear sea ice habitat. During the study period, the number of patches of all sea ice habitat classes increased and the mean patch size of sea ice classes 3 and 4 decreased in November, December, January, May and June. Overall, available polar bear habitat (sea ice classes 3 and 4) in Foxe Basin during fall and spring decreased and became increasingly fragmented.

This habitat fragmentation analysis will be updated to include 2005 – 2009 sea ice data and prepared for publication in 2010. These results will be included in V. Sahanatien's Ph.D. thesis.

Habitat Selection

We are investigating seasonal habitat selection of polar bears in FB using a combination of satellite imagery, sea ice maps and polar bear location information to develop spatial, predictive Resource Selection Models (RSM). The analyses will build on previous understanding and approaches to modeling polar bear habitat selection (Arthur et al. 1996b, Ferguson et al. 2000, Mauritzen et al. 2003, Wiig et al. 2003, Durner et al. 2009).

Polar bear habitat selection will be studied using a hierarchical approach; landscape scale (coarse) or 2nd-order and at the feature scale (fine) or 3rd-order (Johnson 1980, Durner et al. 2009). Habitat selection will be studied using the use-availability approach and RSMs of individual bears will be estimated (Manley et al. 2000). Habitat selection of family group status, sex, and age-class will be compared by year, month and season. Seasonal definitions are to be determined and will be based on the timing of the sea ice cycle and ringed seal (*Phoca hispida*) life history in FB.

Landscape Scale Habitat Selection

Second-order habitat selection model development will use discrete choice analysis, the approach used for species that experience changing habitat availability (Arthur et al. 1996). Discrete choice analysis is appropriate because polar bear sea ice habitat is dynamic, undergoing the annual cycle of freeze-up and break-up, as well as, being influenced by currents and tides. FB is a particularly dynamic system, with continuously moving ice occupying central Foxe Basin and Hudson Strait. It is not reasonable to use single or even seasonal sea ice habitat maps, as the available habitat changes on a faster temporal scale.

We are using weekly sea ice charts produced by the Canada Ice Service (http://ice-glaces.ec.gc.ca/app/WsvPageDsp.cfm). The resolution of the charts is approximately 35 x 35 km.

Polar bear locations for each time period will be intersected with sea ice charts and associated sea ice attribute information. Attribute data include information on ice conditions: total ice concentration; partial ice concentration; stage of development (proxy for ice thickness); and ice floe size. We will also include sea ice habitat types as variables: open water; ice free; bergy water (ice bergs (in Hudson Strait only) and small low-density ice floes); and fast ice. Additional attribute variables included in models are: distance to land; distance to landfast ice; and ocean depth. These attributes will be used as the choice set of habitat variables available to the polar bears. We will then compare the used habitat choice sets with available habitat choice sets to determine habitat selection. The available habitat choice sets will be generated by intersecting random points on the sea ice charts within a selected radius around the actual bear location.

Here we present an exploratory analysis of the habitat use by female polar bears collared in 2007. No statistics are presented, as these analyses are merely exploratory to first understand basic aspects of habitat use of polar bears in FB; final analyses will be presented within the statistical framework of RSM. The information presented here is pooled data from 13 female polar bears with cubs.

We defined available habitat as the sea ice habitat types and their relative proportion at 10 random locations within a 25-km buffer of each bear location. We defined used habitat as the sea ice type at each bear location. In general, we found some evidence of habitat selection, as used-habitat in some cases exceeds available-habitat. With subsequent more detailed analysis described above, we will determine is habitat selection occurs or if the bears simply use sea ice habitat according to its availability. In October, collared female polar bears moved onto the sea ice as soon as it was available and made use of lower concentrations of sea ice (50 – 70%) as well as higher concentrations (90 – 100%). As time progressed the bears shifted their use to higher concentrations of sea ice until winter when all used locations were in 100% ice concentration. In spring, 100% ice concentration was used most often (Figure 11). There appears to be preference for different ice thickness depending on month (Figure 12). In November, sea ice of 10 – 15 cm thickness is used in greater proportion that available, in December and January 30 – 70 cm is used similarly. In February and March, the female polar bears began to use thicker ice (>120 cm). In spring, habitat use focused almost exclusively to sea ice of 10-15 cm in thickness. Early in the fall polar bears used small floes (20 – 500 m in diameter), then shifted to medium (0.5 – 2.0 km) and vast (> 2 km) floes as these floe sizes became available (Figure 13). In winter when the seascape was dominated by vast floes there was some use of medium floes, indicating some habitat selection. This patterned continued in April and May; in June and July there was use of landfast ice and small floes, as well as vast floes.

Feature Fine Scale Habitat Selection

To develop better understanding of climate change effects on polar bear populations it is important to quantify fine scale habitat selection and the relationship of polar bears movements to sea ice structure. Greater knowledge of fine scale sea ice habitat will guide development of regional scale habitat models.

It has been hypothesized (Stirling et al. 1993, Stirling 1997) and generally accepted that linear and open water sea ice features (polynyas, leads, ridges and landfast ice edge) are important habitat for polar bears. The actual use of and significance of these habitat features has not been well studied because of logistical and technological challenges. For example, polynyas, unless > 650 km^2, and leads are not detectable on sea ice charts and concentration maps. To date two types of base maps have been used to study polar bear habitat and movements: the Canadian Ice Service (CIS) and National Ice Service (NIC) charts (Ferguson et al. 2000, Barber and Iacozza 2004, Durner et al. 2004) and SSM/I imagery (Mauritzen et al. 2003, Wiig et al. 2003, Durner et al. 2009). Distance metrics to ice floe edge (landfast or floating) have been used in some of these studies but more detailed investigation of ice structure has not been possible due to the resolution of the base maps.

Synthetic aperture radar (SAR) satellite imagery is an appropriate alternate base map for polar bear habitat and movement research because it is available year round (including during dark seasons and in cloudy conditions). It is of particular utility in polar bear movement and habitat research because it is of high resolution (8 – 150 m), permitting detection of fine scale features such as polynyas, leads, floe size, and sea ice texture (ridging, floes) (Figures 14 – 15). To date there has been little use of SAR in habitat studies of ice dependent species, with the exception of ringed seals (Nichols 1999) but there been studies using SAR for wildlife habitat assessment of other animals (Taft et al. 2003, Bergen et al. 2007, Van der Wal et al. 2005)

We completed a preliminary analysis assessing the complexity of sea ice habitat used by three adult female polar bears collared in the autumn of 2008 in FB to assess the appropriateness and applicability of our proposed method (Sahanatien et al. 2009). We used EnviSat ASAR imagery of Hudson Strait for December 25, 28, and 31 2008; January 01, 13, 16, 22, 19; February 06, 13, 17, 20, 23, and 26; and March 02, and 08, 2009. We used ENVI image analysis software to prepare the images that were exported to ArcGIS. In ArcGIS the images were reclassified to reflect habitat complexity using a moving window analyses. The neighbourhood was 7x7 pixels, which was equivalent to an area of 525 x 525 m. Each pixel was assigned a complexity value. Habitat complexity is an index of ice surface texture or roughness, which in turn is a product of ice floe size, the amount and size of ice ridges and the relative proportion of open water, fast ice, new ice and first year ice. The moving window resulted in each pixel being reclassified and being assigned a complexity value. Complexity values ranged from 0 to 3,500 with, 3,500 being the most complex. Polar bear locations were then intersected with the appropriate image and habitat complexity information recorded at that location.

The test analysis completed showed that these female polar bears used lower complexity values (300 – 600) of sea ice habitat (Figures 16 – 18). This use pattern was consistent over time and between bears. First, this exploratory analysis indicates that our method involving SAR imagery can be successfully used to detect year-round fine scale habitat use and selection. Secondly, it appears that the three test collared bears did show some level of fine scale habitat selection, as they used sea ice habitat with lower complexity than the majority of habitat (complexity value of approximately 600).

A detailed analysis will be completed in 2010 using time coincident EnviSat ASAR and RADARSAT WideSwath SAR imagery and all FB polar bear location data to quantify fine scale habitat selection. Each image will be reclassified to delineate open water sea ice features, a sea ice habitat complexity index and land. We will then develop a RSM using distance metrics, feature shape metrics, and habitat complexity index. This work will result in a new analytical technique for investigating polar bear sea ice habitat selection.

The habitat selection analyses using the 2007 – 2010 movement data will be completed early in 2010 and a progress report prepared. The 3rd-order and 2nd-order habitat selection methods and results will be prepared for publication in 2010. All results will be included in V. Sahanatien's Ph.D. thesis.

Foxe Basin Polar Bear Seasonal and Annual Movements (2008 – 2009)

Here we report on polar bear movements for the time period August 2008 to October 2009, based on polar bears collared during 2008. The 2008 collar and ear tag deployment effort was reported on in the 2008 Foxe Basin Polar Bear Study Report (Peacock et al. 2008). During August - September 2008, 23 Telonics Gen IV satellite collars were deployed on adult female polar bears and four Spot 5 eartags were deployed on adult male polar bears.

There were technical problems with the automatic release (CR2-A) mechanism used on the Telonics 4 satellite collars (for more details see above, METHODS AND RESUTS: POPULATION DELINEATION). Of 23 collars deployed in 2008, only one collar continues to operate at this time (CTN 618542A). In January 2009 only 7 of 23 collars were active, by April only 4 collars and by July, one. This level of collar failure significantly affected the volume of information that could be collected in 2008 – 2009, resulting in the additional collar deployment in 2009.

The Gen III and most Gen IV satellite collar collect a GPS location every four hours, collecting up to six locations/day. Four of the refurbished Gen IV satellite collars collect a GPS location every three hours; collecting up to eight locations/day. The GPS location data are transmitted from the collars to the Argos satellite once/day. The satellite collar location information is coded as good or bad quality. All bad locations are removed from the dataset for each collared bear. The resultant movement data had from zero to eight locations/day. The satellite ear tag collected 3 locations/day. Each location is given an accuracy class (3, 2, 1, 0, A, B), 3 being most accurate and B least. We used the best location class and not less than 1 that was available for each day. One location/day was used in the male movement metric calculations. The ear tag transmitted locations daily. Location quality depends on the collar or ear tag and polar bear's position relative to the GPS satellites. The collar and ear tag data is received by CLS America (http://www.clsamerica.com) and emailed to the University of Alberta every three days. Data are also sent to the GN, Wildlife Research Section, periodically.

Further analyses of all movement data collected from 2007-2010 will be completed in 2010. These analyses will be included in V. Sahanatien's Ph.D. dissertation and a publication will be prepared.

Adult female Polar Bear Home Range

Annual and seasonal home ranges were calculated using the Hawth's Tool minimum convex polygon method in ArcMap 9.3©. Annual home ranges (2008 – 2009) for collared FB adult female polar bears with at least four seasons (open-water, freeze-up, winter, spring) of data (n = 4) ranged from 19,634 – 160,126 km² (Table 7). The two bears (CTN 618542, 618536) that remained in Foxe Basin (the water body) had smaller home ranges than bears that used Hudson Bay (CTN 618527, 617098). In 2008, bears were collared throughout the northern region of FB (see map in Peacock et al. 2008). The 2008 – 2009 home ranges were smaller than that observed in 2007 – 2008 (108,348 – 339,681 km²; Peacock et al. 2008). In 2007 – 2008, all collared bears but one used Hudson Bay during the sea ice period; in 2007 polar bears were collared in Wager Bay, Roes Welcome Sound and Southampton Island. While both Hudson Bay and Foxe Basin bears use large central zones of moving ice, it is possible that bears using Hudson Bay experience a stronger environmental (wind, currents, and sea ice phenology) forcing affects than those in Foxe Basin, and, this is reflected in that the bears collared in southern FB (2007) had larger annual home range sizes. Prey (seal) densities of Hudson Bay and Foxe Basin have not been quantified but both regions are considered to be very productive; it may be possible that polar bear movements reflect relative prey density, and it is know that ringed seal density and availability fluctuates among years (Stirling and Oritsland 1995, Rosing-Asvid 2006).

During 2008 – 2009, mean home range sizes of adult females were largest during freeze-up and break-up and smallest during the open-water season (Tables 7 and 8, Figure 19; note Figures 3 – 5 are home ranges of bears collared in 2007 and 2008). This same pattern was observed in 2007 – 2008. The mean open-water home range size of the 2009 collared bears was less than that of 2008 – 2009, although the range of values was similar. Collaring location is probably an important factor influencing home range size, as in 2009 we collared more individuals on smaller islands (Coates, Mansel, Nottingham and the Spicers) that are a great distance from other islands or the mainland, possibly restricting the bears movements.

Male Polar Bear Home Range

We calculated seasonal home ranges of adult male polar bears, tagged in 2008 (n = 4) and 2009 (n = 1) using the Hawth's Tool minimum convex polygon method in ArcMap 9.3©. Three of 4 male polar bear seasonal home ranges were smaller during the open-water season than during freeze-up (Table 9). This follows the same pattern as adult female polar bear home range size, but both the range of sizes and mean size of female home ranges during each season from 2008 – 2009, are much greater than for males (Figure 19, Tables 7, 8 and 13, 14). Despite the generally accepted notion that male Ursids range further than females, the difference we found here may by reflective of adult females with cubs using larger areas to find appropriate habitat patches (for foraging needs or avoidance), which may be spread over a larger area. The purpose of the tagging adult males with satellite ear tags was primarily to test the effectiveness of the ear tag, not to gather extensive data on male polar bears. However, these interesting preliminary results suggest the need for further research, and demonstrate the effectiveness of this tag design.

Female Polar Bear Movements

We calculated movement distances using the Hawth's Tool movement parameters method in ArcMap 9.3©. Movement rates were calculated by dividing the distance (km) moved by the intervening time (hr) between locations. The movements of the polar bears in 2008 – 2009 and 2009 bears were distinctly different than the 2007 – 2008. Long distance overland movements were made by four bears in 2008 – 2009 and five bears in 2009 (Figure 20) during the open-water season. In 2009, five bears swam long distances, up to 35 km, between islands (Figure 20). One bear (CTN 618536) in 2008 – 2009 appeared to be in a temporary den in December and January (Table 12). The 2008 – 2009 monthly distances moved were extremely variable (Table 12). The greatest mean monthly distances travelled were in May, June, July (breaku-up) and November (freeze-up), and, the least in August and September (open-water) (Table 12, Figures 3 – 5). In contrast, the greatest monthly rates of travel were in July, November, February and March (Tables 9 and 10). Generally rate of travel and distance travelled are positively correlated, the contrary values are likely a reflection of the large variation of individual movement rates and distances. The open-water distances and movement rates of the bears collared in 2009 were similar to those in 2008 – 2009.

On the seasonal basis, the mean movement rate was lowest during open-water, with a sharp increase at freeze-up (Tables 9 and 10). The rate increased slightly in winter, decreased in spring and then rose to the maximum during break-up. In 2007 – 2008, we observed a similar pattern except that the winter movement rate was less than during freeze-up.

As in 2007 – 2008, we observed movements from the Foxe Basin study area into adjacent polar bear subpopulations (management zones): 2 bears moved into WH; 2 bears moved into GB for a period of time; and 1 bear moved into DS. Unfortunately, it is not possible to know if two of the bears (CTN 617098, 618538) returned to Foxe Basin as the collars failed.

As an example, CTN 617087 was captured on the Foxe Basin side of Melville Peninsula, and was re-collared (CTN 631694A) in a similar area 2009. In both years, she followed a very similar path between FB and GB.

Male Polar Bear Movements

We calculated distances moved using the Hawth's Tool movement parameters method in ArcMap 9.3©. Movement rates were calculated by dividing the distance (km) moved by the intervening time (hr) between locations. Male mean distances moved for September, October and November were less than female rates (Tables 14 – 16). Male seasonal movement rate for open-water was less than freeze-up, following the same pattern as that of female rates. Only one male bear swam; he moved from the Foxe Peninsula to Mill Island and then to Salisbury Island, distances of approximately 40 km each (Figure 20).

IV. Inuit Quajimajatuqangit

Habitat ecology

We completed 33 individual interviews and 5 focus groups (2 groups of 5, 3 groups of 2) were completed in five FB communities (Kimmirut, Cape Dorset, Igloolik, Hall Beach, Repulse Bay, and

Coral Harbour). It was not possible to conduct interviews in Chesterfield Inlet due to a blizzard on the first attempt and on the second trip to the Kivalliq the HTO was not available.

We followed the semi-directed interview method in which a set of questions guided but did not limit the discussions (Grenier 1998, Huntington 2000). We used Inuktitut-English translators in all but five interviews. Interviews were digitally recorded in audio and video formats. English transcriptions of all interviews have been completed. Inuktitut transcriptions are in progress. Copies of all audio and video recordings have been made and are currently held by V. Sahanatien, University of Alberta. Inuit knowledge was also recorded spatially; important seasonal habitat for polar bears was marked on regional maps. The maps will be digitized and habitat attribute information attached to each point and polygon.

Copies of all materials will be deposited for archiving at the Igloolik Research Centre. Copies of each person's interview will be provided to that person. Summaries of each community's transcripts, maps and a selection of videotaped interviews will be created and distributed to the HTO. A summary report will be created and distributed to all Foxe Basin communities, Inuit wildlife management organizations, NWMB, Parks Canada and Nunavut DOE. The summary report will include all historical information obtained from reviewing existing Inuit oral history reports, other reports and databases and published information on Inuit knowledge of polar bear habitat and distribution.

We are using Invivo software to complete content analysis of the interviews. Content analysis is expected to be finished early in 2010. At this time it appears that there will be sufficient polar bear sea ice habitat information to create a spring habitat model. The framework for using IQ in habitat modeling is that based on the premise that Inuit knowledge (traditional ecological knowledge) is expert knowledge (Berkes 1999) thus can be used in models. Expert knowledge and opinion have been used to create models in medicine, transportation, economics and recently in ecology (e.g. image analyses, population status, species distribution). Specific to this research it has been demonstrated that Inuit have significant sea ice knowledge and expertise (e.g. Oozeva et al. 2004, Laidler and Elee 2008, Laidler et al. 2009). The habitat modeling approach has not been selected at this time but there are several approaches to choose from: fuzzy logic (Mackinson 2001, Patterson et al 2007, Peloquin and Berkes 2009), delphi (Grech and March 2008, O'Neill et al. 2009), habitat suitability index/resource selection (Johnson and Gillingham 2004), Bayesian inference (Martin et al. 2007, Wilson et al. 2009) and frequentist inference (Lele and Allen 2006, Hurley et al 2009). These results will be prepared for publication and included in V. Sahanatien's Ph.D. thesis.

Aerial survey

We also attempted to gather information from the HTO's and community members to assist in the design of the Foxe Basin aerial survey and to evaluate the agreement between local knowledge and science regarding summertime polar bear distribution. In mid-summer 2009, we sent regional maps to HTO's and CO's, requesting that hunters and elders identify areas of high polar bear concentrations during the late summer, as well as a brief questionnaire assessing an individual's seasonal activities. We received completed distribution maps from 2 of 7 communities (Kimmirut HTO and the Igloolik CO). An additional community (Coral Harbour) indicated that the entire region should be surveyed, and an impromptu discussion with an individual in Chesterfield Inlet helped to identify regional polar bear concentrations. We initially planned to use distribution data to stratify the aerial survey sampling effort; however, because an individual's interpretation of high and low density area is relative to their particular community and because of low participation of the HTO's, we were unable to stratify the aerial survey in 2009 with Inuit Knowledge. As such, this application of Inuit Knowledge across the Foxe Basin subpopulation will be challenging. We will assess new ways to integrate local knowledge and science in the aerial survey and continue to promote local participation in the aerial survey field work. The completed distribution maps will be digitized and submitted to the Igloolik Oral History Project at the Igloolik Research Centre (Nunavut Research Institute) for archiving. Data will be incorporated into the summary reports for communities, management authorities, and agencies as appropriate.

Application of Results

The primary results will include, for the first time, the geographic delineation of the FB polar bear subpopulation boundaries; the first subpopulation estimate since 1994; development of a new non-invasive method of population estimation of polar bears in a seasonal-ice population; for the first time explicitly incorporating IQ into habitat selection models (and predictive models) for polar bears; comprehensively collecting IQ on polar bear habitat use; developing a new method of fine scale habitat selection for polar bears, which includes finer scale year-round resolution of satellite imagery; and development of a polar bear RSM for FB.

Scientific results will be published in peer-reviewed literature, at scientific conferences and in interim reports.

Data can be used to inform management decisions on amount and distribution of harvest and to predict changes in habitat use, and the consequences of, as climate warms.

Poster Presentations

Sahanatien, V., Derocher, A.E., and Peacock, E. 2008. Polar bear movements in relation to sea ice structure, Foxe Basin, NU. ArcticNet – Arctic Change Conference, Quebec City.

Sahanatien, V. 2006. Incorporating Inuit knowledge in polar bear research. ArcticNet Annual Science Meeting. Victoria.

Oral Presentations

Sahanatien, V. 2007. Sea icescapes and polar bear habitat, Foxe Basin, Nunavut (1979-2004). October 2007: Association of Colleges and Universities Northern Studies (ACUNS), Saskatoon, SK

Sahanatien, V., Derocher A.E. 2007. Sea icescapes and polar bear habitat, Foxe Basin Nunavut (1979-2004). Sixteenth International Bear Research and Management Conference, Monterrey, Mexico

Sahanatien, V. 2008. Polar bear habitat fragmentation, sea icescapes and climate change. ACUNS – Annual General Meeting, Ottawa.

Sahanatien, V., Derocher, A.E., Peacock, E and Haas, C. 2009. SAR and Polar Bear Sea Ice Habitat. Marine Mammal Society 18th Biennial Conference, Quebec City.

Sahanatien, V., Peacock, E., and Derocher, A.E. 2009. Polar bear habitat in a seasonal sea ice ecozone. ACUNS – Communities of Change Conference, Whitehorse.

Sahanatien, V., Derocher, A.E. and Peacock, E. 2009. Beyond Maps and Stories: Wildlife habitat modeling using traditional ecological knowledge. 9th World Wilderness Congress, Merida, Mexico.

Future Professional Presentations

As analyses are finalized, E. Peacock, S. Stapleton and V. Sahanatien will present these results at scientific conferences including International Conference on Bear Research and Management, Biennial Conference of the Society of Marine Mammals, Wildlife Society, Arctic Net, ACUNS and Ecological Society of America.

Data will also be presented at the Polar Bear Technical Committee Meetings and at the working meetings of the Polar Bear Specialist Group.

REPORTING TO COMMUNITIES/RESOURCE USERS

Community consultation efforts were shared between the University of Alberta and the GN in 2007. In 2008 and 2009, the GN conducted consultations.

Maps of polar bear movements, the 2007, 2008 and current interim reports and posters (FB Aerial survey, FB polar bear project, FB Inuit Knowledge Study) have been sent to all HTOs.

Completed Consultations

- Repulse Bay
  - Hunters and Trappers Organization (February 2007, February 2008, February 2009, April 2009)
  - Grades 9-12
- Chesterfield Inlet
  - Hunters and Trappers Organization (February 2007, February 2008, April 2009)
- Coral Harbour

  - Hunters and Trappers Organization (April 2007, July 2007, February 2007, February 2008, April 2009)
  - Radio call-in show (February 2008)
  - Public Meeting (April 2009)
- Rankin Inlet
  - Hunter and Trappers Organization (February 2007, February 2008)
  - Kivalliq Inuit Association – Lands (February 2007, February 2008, February 2009)
  - Nunavut Tunngavik Incorporated, Wildlife (February 2007, February 2008)
  - Sila Lodge Co-Owners (July 2007)
  - Nunavut Wildlife Symposium (all HTOs, RWOs, NWMB and NTI attended), March 2009
- Igloolik
  - Hunters and Trappers Organizations (May 2007, May 2008, November 2008, January 2009)
- Hall Beach
  - Hunters and Trappers Organizations (May 2007, May 2009)
- Cape Dorset
  - Hunters and Trappers Organizations (May 2007, March 2009, April 2009)
- Kimmirut
  - Hunters and Trappers Organizations (May 2007, January 2009, May 2009, August 2009)
  - Public meeting (January 2009)
- Baker Lake
  - Hunters and Trappers Organization (emailed and mailed information only in 2006, 2007 and 2008)
- Ukkusiksalik Park Management Committee (December 2006, February 2007, January 2008)
- Qikiqtalluq Wildlife Board (November 2007, November 2008)

Table 1. Polar bears immobilized and handled in Foxe Basin, August – October 2009.

Sex	Adult	Subadult	2-YR*	Yearling*	COY	Total
Female	25	1	3	5	9	43
Male	2		4	9	9	24
Total	27	1	7	14	18	67

*Accompanied by mother. Note no teeth were taken from bears accompanied by mothers, thus 2YR and Yearling represent field ages.

Table 2. Average and standard errors of body metrics (cm) of polar bears captured during the Foxe Basin Polar Bear Project 2007 – 2009. Sample sizes are in parentheses.

	Adult	Subadult	2YR*	Yearling*	COY
Straight-line body length					
Female	193.54 ±1.35 (66)	170.00 ± 4.00 (2)	160.17 ± 7.13(3)	158.26 ± 5.50 (10)	120.53 ± 1.19 (26)
Male	230.18 ± 2.65 (11)	None captured	163.40 ± 9.70 (6)	159.86 ± 3.67 (17)	119.90 ± 2.24 (27)
Zygomatic breadth					
Female	20.80 ± 0.18	17.35 ± 0.65	15.9 ± 0.45	16.29 ± 0.33	13.65 ± 0.12
Male	26.15 ± 0.69	None captured	18 ± 0.38	17.26 ± 0.26	13.89 ± 0.10
Axillary girth					
Female	126.10 ± 2.38	115.80 ± 4.30	107.87 ± 16.75	94.22 ± 4.41	77.42 ± 1.60
Male	179.55 ± 9.05		116.95 ± 3.58	106.16 ± 2.56	82.55 ± 2.07

Table 3. Litter sizes (SE) of observed family groups during aerial surveys or caught to deploy collars in 2007 – 2009.

Year and method	COY	Yearling*	2YR*	Number of litters
2007 captured	1.13 (0.13)	1.60 (0.40)**		13
2008 captured	1.63 (0.13)	1.56 (0.18)**		25
2009 captured	1.64 (0.15)	2.00 (0.22)	1.40 (0.25)	23
2009 observed	1.57 (0.06)	1.66 (0.09)	1.44 (0.13)	127

*field ages; no teeth pulled.

** pooled 2YR and Yearling litters because of small sample size

Table 4. Mean and standard errors of axillary girth in centimeters (sample size) of captured COY and encumbered adult female polar bears in FB, 2007 – 2009.

Year	COY	Adult females with COY	Adult females with YRL	Adult females with 2YR
2007	81.56 ± 6.03 (9)	121.25 ± 3.09 (8)	122.33 ± 1.45 (3)	128.50 ± 9.5 (2)
2008	81.17 ± 1.44 (26)	133.04 ± 3.01 (16)	124.86 ± 5.16 (7)	117.75 ± 5.25 (2)
2009	77.06 ± 1.71 (18)	114.17 ± 11.39 (11)	126.66 ± 2.68 (7)	126.44 ± 5.14 (5)

Table 5. Polar bear observations, categorized by sex, age, and sighting location, documented during the Foxe Basin aerial survey, August and September 2009. Individuals which were seen from multiple transects (*n* =44) are included in all relevant sighting location categories. Bears observed on inland transects between paired 5 km (*n* =17) and paired 15 km (*n* =4) inland transects are presented in the *Inland 5-15 km* category. Note: do not change figures to proportions of bears seen in different habitats, as habitats were sampled in a stratified manner.

	Coast	Inland < 5 km	Inland 5-15 km	Inland 15-50 km	Large Islands	Small Islands and Water	Ice Floes	Ferry and Off Transect	Total
Males	123	48	5	3	33	45	2	20	279
Females	56	17	7	9	8	13	2	18	130
Family Groups*	127 (49)	60 (23)	50 (20)	0	50 (20)	34 (14)	0	26 (9)	347 (135)
Subadults	42	19	2	0	13	14	0	10	100
Other**	0	0	0	0	4	0	0	0	4
Total	348	144	64	12	108	106	4	74	860

*Total bears (Number of family groups)
**Unidentified independent bears

Table 6. Polar bear encounter rates (encounters per 1,000 km), categorized by sex, age-class, and stratum, documented during the Foxe Basin aerial survey, August – September, 2009. Individuals which were seen from multiple transects (*n* = 44) are included in all relevant sighting location categories. Bears observed on inland transects between paired 5 km (*n* = 17) and paired 15 km (*n* = 4) inland transects, as well as the respective transect distances, are presented in the Inland 5 – 15 km category. See Figure 9 for graphical representation of these data.

	Km flown*	Males	Females	Family groups (individuals)	Family groups (groups)	Subadults	Other**	Total
Coast	7,168	17.2	7.8	17.7	6.8	5.9	0	48.6
Inland <5 km	4,936	9.7	3.4	12.1	4.7	3.8	0	29.2
Inland 5-15 km	5,748	0.9	1.2	8.7	3.5	0.3	0	11.1
Inland 15-50 km	2,415	1.2	3.7	0	0	0	0	5.0
Large islands	1,280	25.8	6.2	39.1	15.6	10.2	3.1	84.4
Total	21,547*	12.9	6.0	16.1	6.3	4.6	0.2	39.9***

*Excludes all ferries and small island survey flights
**Unidentified independent bears
***Total encounter rate for individuals

Table 7. Area (km^2) of individual seasonal home ranges (MCP) of satellite collared female polar bears, Foxe Basin 2008 – 2009.

CTN	Open-water	Freeze-up	Winter	Spring	Break-up	Annual
618542	1076	44320	37359	27129	21391	113483
618527	6251	44831	17101	11936	30452	133443
618536	7509	297	5695	2393		19634
617098	1157	50544	16388	8286		160126
618544	3388	21851	9971			
618538	4042	23763	28209			
618530	11117	1917	3747			
618534	41451	6210				
617090	13807	21070				
618543	9215	30518				
617097	574	9259				
617087	9422	980				
618882	2827	6137				
618541	13074					
618537	5375					
618532	876					
618526	2556					
618529	261					

Table 8. Mean area (km^2) of seasonal home ranges (MCP) of satellite collared female polar bears, Foxe Basin 2008 – 2009.

	Open-water	Freeze-up	Winter	Spring	Break-up	Annual
Mean	7443	20131	16926	12436	25922	106671
SE	2251	4964	4613	5277	4531	30545
N	18	13	7	4	2	4
Minimum	261	297	3747	2393	21391	19634
Maximum	41451	50544	37369	27129	30452	160126

Table 9. Mean monthly movement rate (km/hr) of satellite collared female polar bears, Foxe Basin 2008 – 2009.

	August	September	October	November	December	January	February	March	April	May	June	July
Mean	0.37	0.37	0.41	1.12	1.04	1.07	1.11	1.08	0.88	0.61	0.56	2.26
SE	0.11	0.07	0.05	0.21	0.20	0.23	0.24	0.17	0.20	0.37	0.32	
N	13	22	18	14	13	9	7	6	4	4	3	1
Minimum	0.01	0.02	0.11	0.02	0.00	0.01	0.34	0.50	0.48	0.44	1.17	
Maximum	1.34	1.34	0.84	2.74	2.64	2.01	1.95	1.59	1.38	1.93	2.27	

Table 10. Mean seasonal movement rate (km/hr) of satellite collared female polar bears, Foxe Basin 2008 – 2009.

	Open-water	Freeze-up	Winter	Spring	Break-up
Mean	0.38	1.10	1.13	1.03	1.69
SE	0.05	0.20	0.19	0.23	0.45
N	22	13	7	4	2
Minimum	0.11	0.07	0.45	0.45	1.24
Maximum	1.08	2.40	1.66	1.47	2.14

Table 11. Mean monthly distances (km) of satellite collared female polar bears, Foxe Basin 2008 – 2009.

	August	September	October	November	December	January	February	March	April	May	June	July
Mean	117	181	236	572	482	511	484	530	365	563	643	832
SE	31	32	28	103	95	107	91	71	74	137	158	
N	7	22	18	13	11	9	7	6	4	4	3	1
Minimum	26	11	64	18	0	4	208	320	185	312	452	
Maximum	268	558	429	1140	1302	1031	918	757	512	950	957	

Table 12. Monthly distances (km) moved by satellite collared female polar bears, Foxe Basin 2008 – 2009.

CTN	August	September	October	November	December	January	February	March	April	May	June	July
618542		52	351	848	1302	1031	918	585	512	950	957	832
618527		383	95	882	285	405	367	757	305	454	521	
618536		529	266	73	0	4	401	687	457	535	452	
617098		11	171	845	577	423	208	320	185	312		
618544		46	221	818	517	481	304	389				
618538	101	61	194	319	474	850	635	443				
618530	162	247	187	18	418	595	552					
618534	117	180	429	201	331	666						
617090		558	359	775	371	146						
618543	268	172	77	691	499							
617097	32	100	64	699	526							
617087		269	124	124								
618882		44	286	1140								
618541		53	344									
618537		120	335									
618532		103	370									
618526		187	299									

CTN	August	September	October	November	December	January	February	March	April	May	June	July
618529	26	59	71									
618535	113	219										
618540		92										
618531		223										
618533		279										

(Table 12 continued)

Table 13. Seasonal home range (Minimum Convex Polygon) size (km²) of satellite ear-tagged male polar bears, Foxe Basin 2008 – 2009.

ArgosID	Open-water	Freeze-up
84561	3752	13955
84562	1817	2749
84563	2443	1908
84564	1770	5658
84565	8028	
Mean	3562	6067
SE	1173	2749
N	5	4
Minimum	1770	1908
Maximum	8028	13955

Table 14. Monthly distances (km) moved by satellite ear-tagged male polar bears, Foxe Basin 2008 – 2009.

ArgosID	September	October	November	December
84561	340	55	554	
84562	170	142	244	
84563	99	159	52	238
84564	55	205		
84565	96	146		
Mean	152	141	284	
SE	50	24	146	
N	5	5	3	
Minimum	55	55	52	
Maximum	340	205	554	

Table 15. Monthly movement rate (km/hr) of satellite ear-tagged male polar bears, Foxe Basin 2008 – 2009.

ArgosID	September	October	November	December
84561	0.55	0.14	1.05	
84562	0.37	0.54	0.47	0.14
84563	0.14	0.20	0.10	0.48
84564	0.08	0.25		
84565	0.16	0.25		
Mean	0.26	0.28	0.54	0.31
SE	0.09	0.07	0.28	0.17
N	5	5	3	2
Minimum	0.08	0.14	0.10	0.14
Maximum	0.55	0.54	1.05	0.48

Table 16. Seasonal movement rate (km/hr) of satellite ear-tagged male polar bears, Foxe Basin 2008 – 2009.

ArgosID	Open-water	Freezeup
84561	0.36	0.85
84562	0.45	0.35
84563	0.17	0.30
84564	0.14	
84565	0.23	
Mean	0.27	0.50
SE	0.06	0.18
N	5	3
Minimum	0.14	0.30
Maximum	0.45	0.85

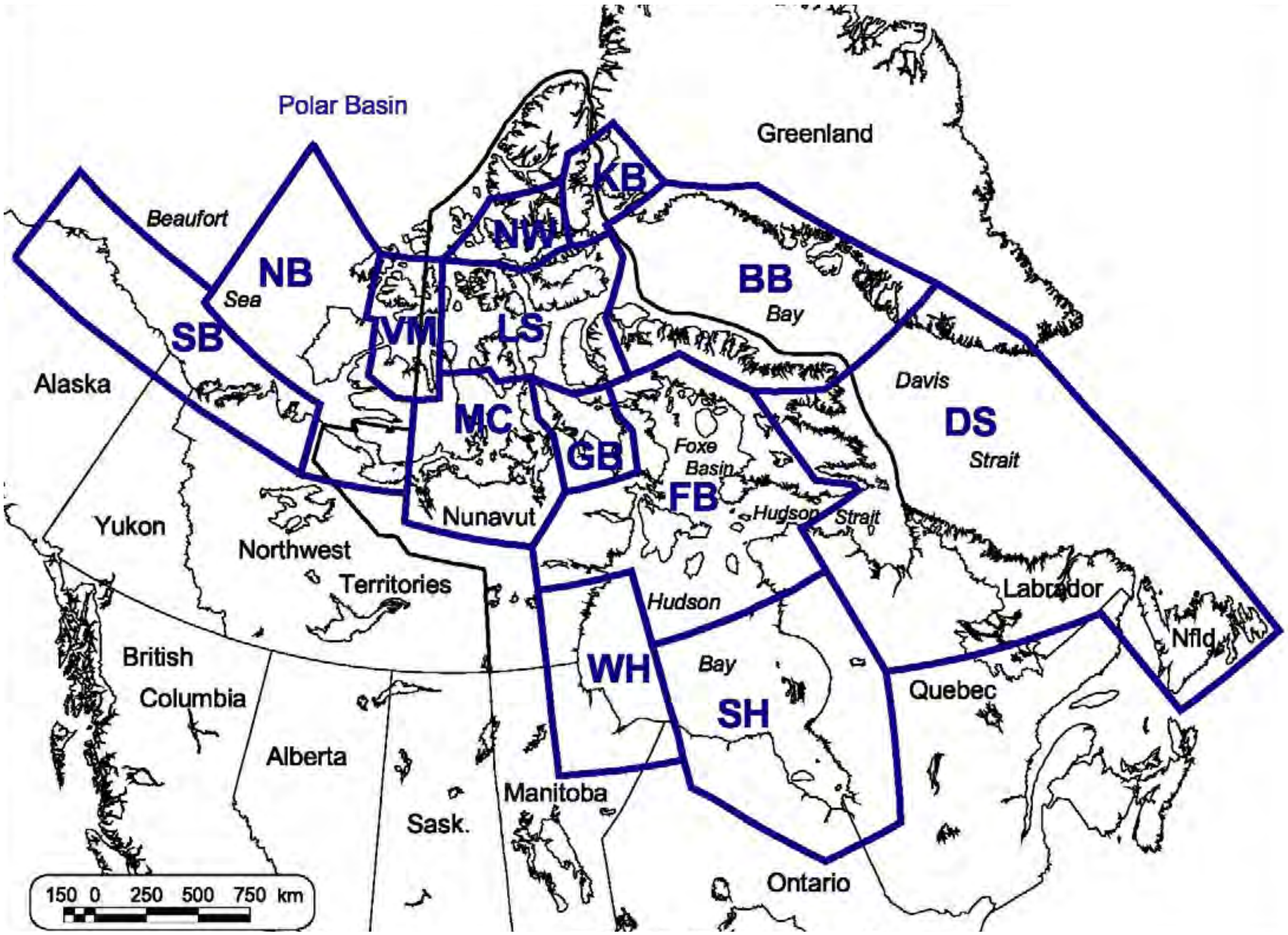


Figure 1. Boundaries of Canadian polar bear management zones or subpopulations, including Foxe Basin (FB).

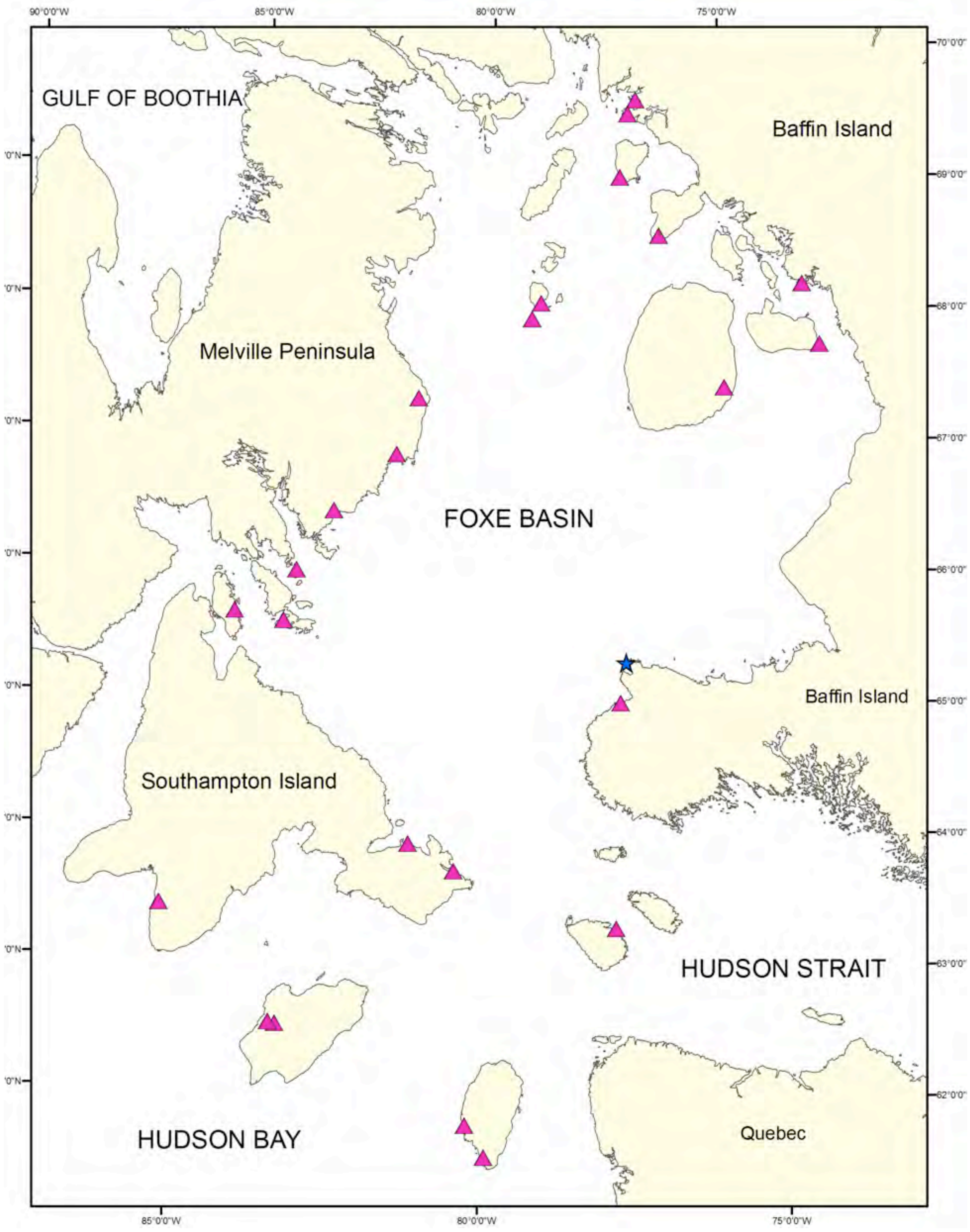


Figure 2. Satellite collars (pink triangles) and tag (blue star) deployed on polar bears in Foxe Basin, August – October 2009.

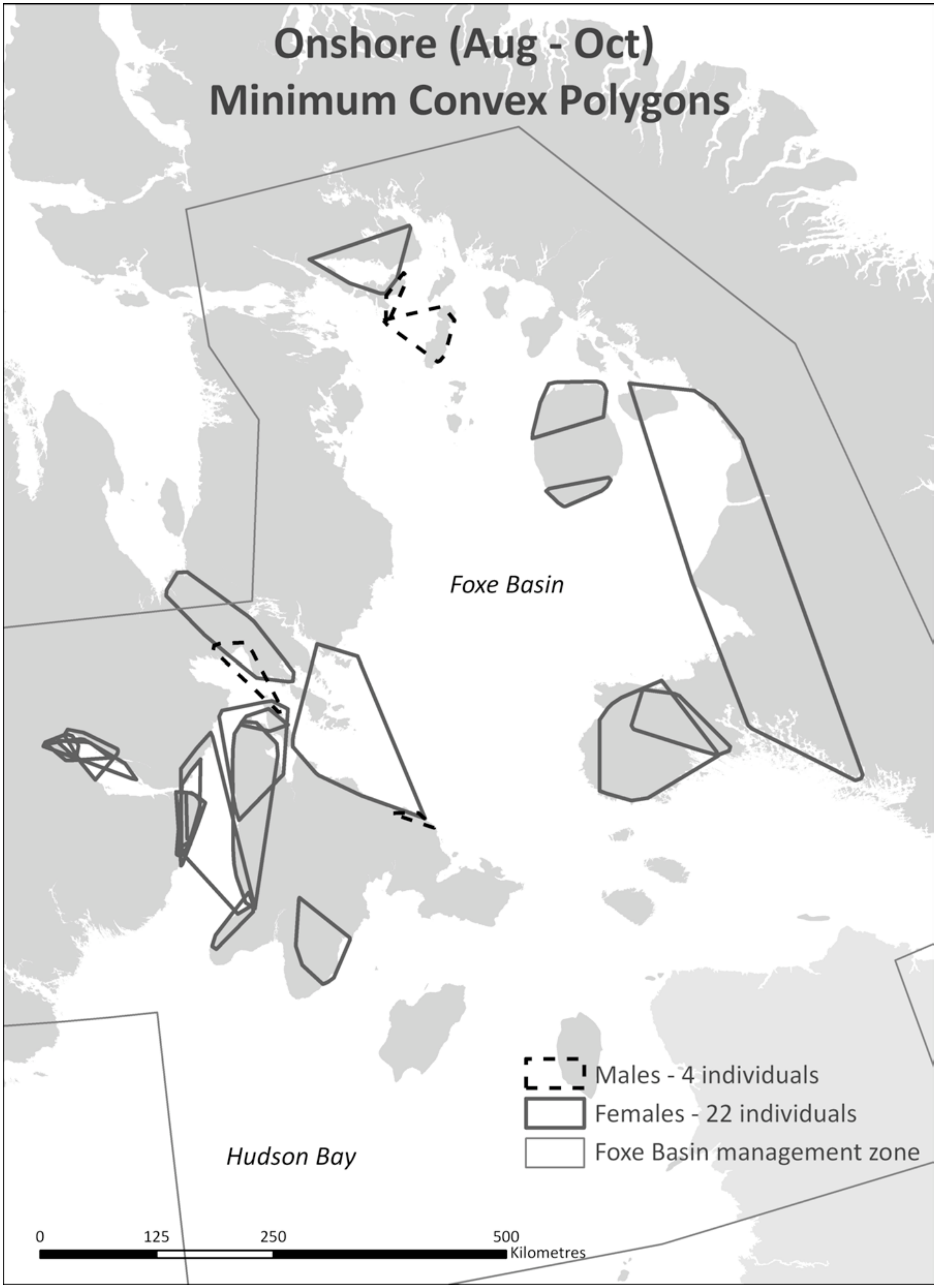


Figure 3. Home ranges (Minimum Convex Polygons) of polar bears collared in 2007 and 2008 during the open-water season in Foxe Basin.

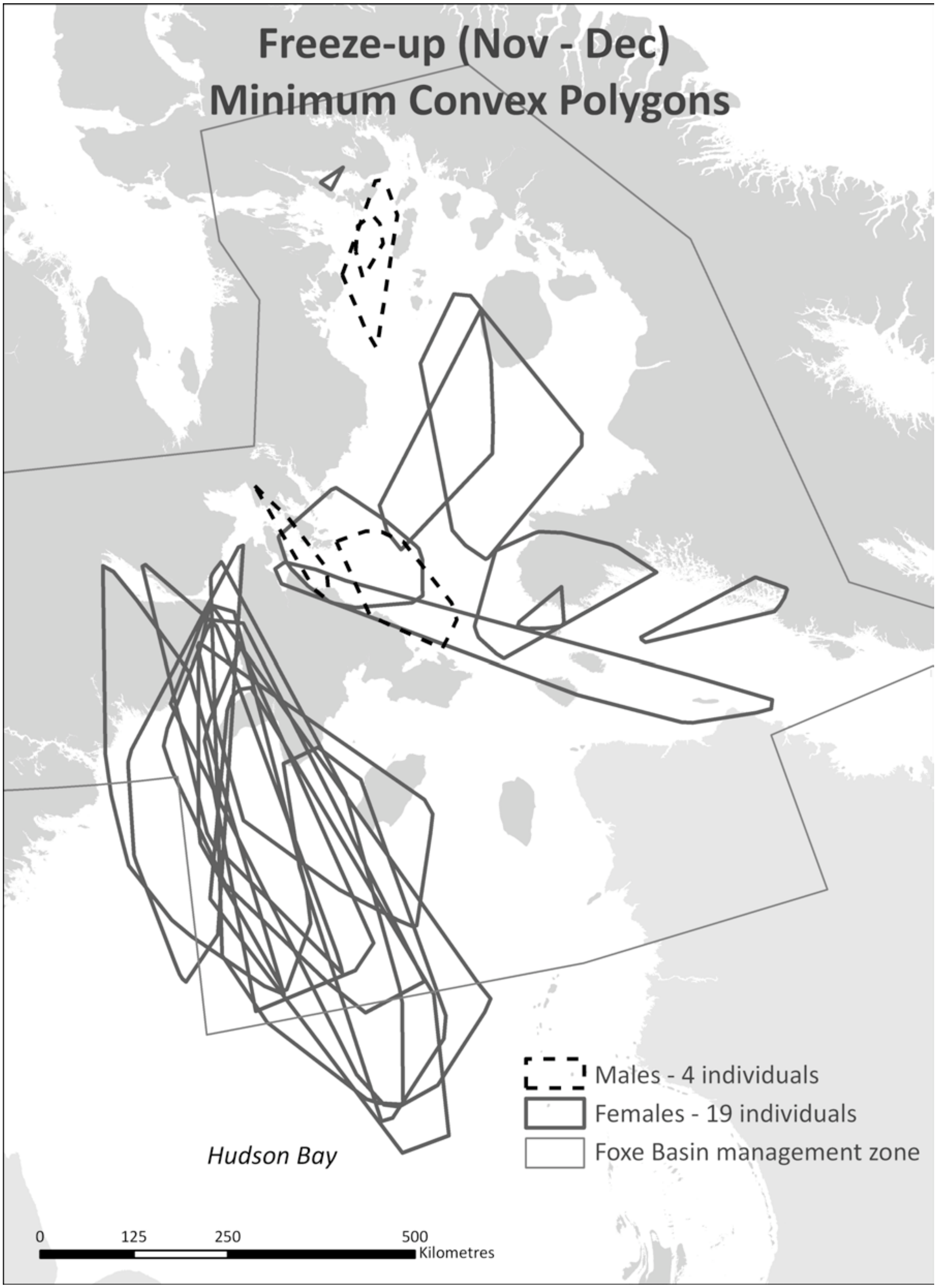


Figure 4. Home ranges (Minimum Convex Polygons) of polar bears collared in 2007 and 2008 during the freeze-up season in Foxe Basin.

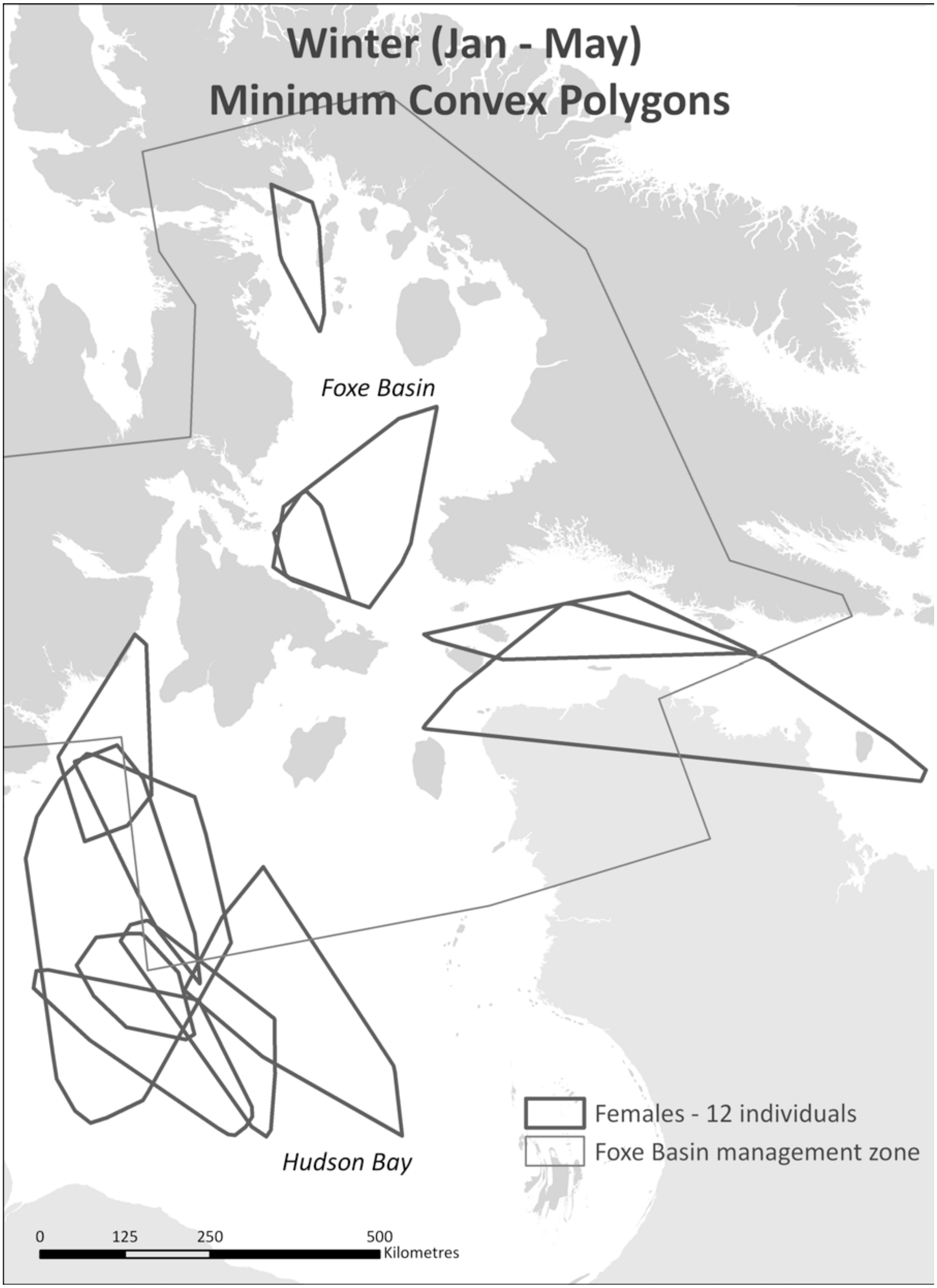


Figure 5. Home ranges (Minimum Convex Polygons) of polar bears collared in 2007 and 2008 during the winter season in Foxe Basin.

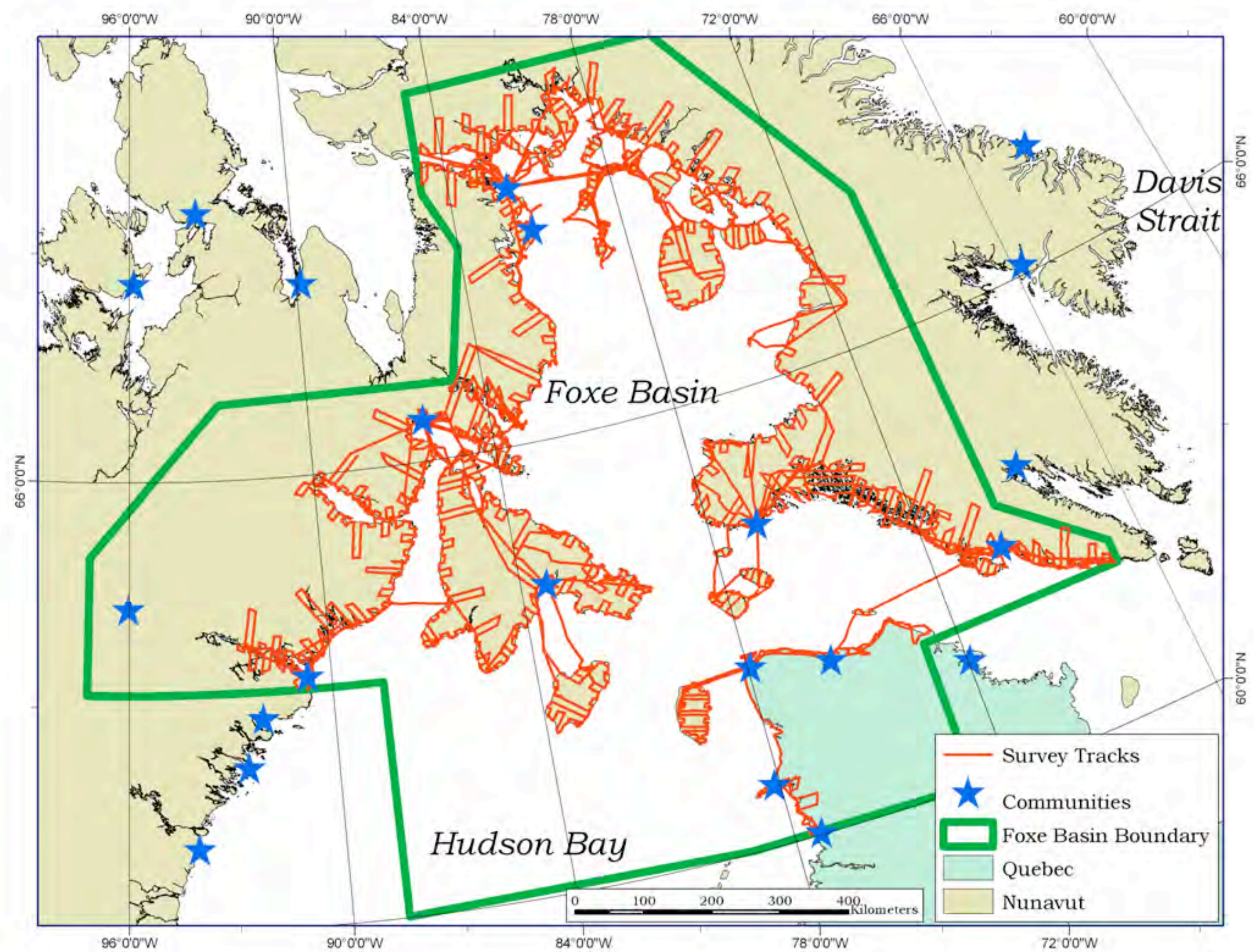


Figure 6. Transects flown during the aerial survey for polar bears in the Foxe Basin subpopulation, August – September 2009.

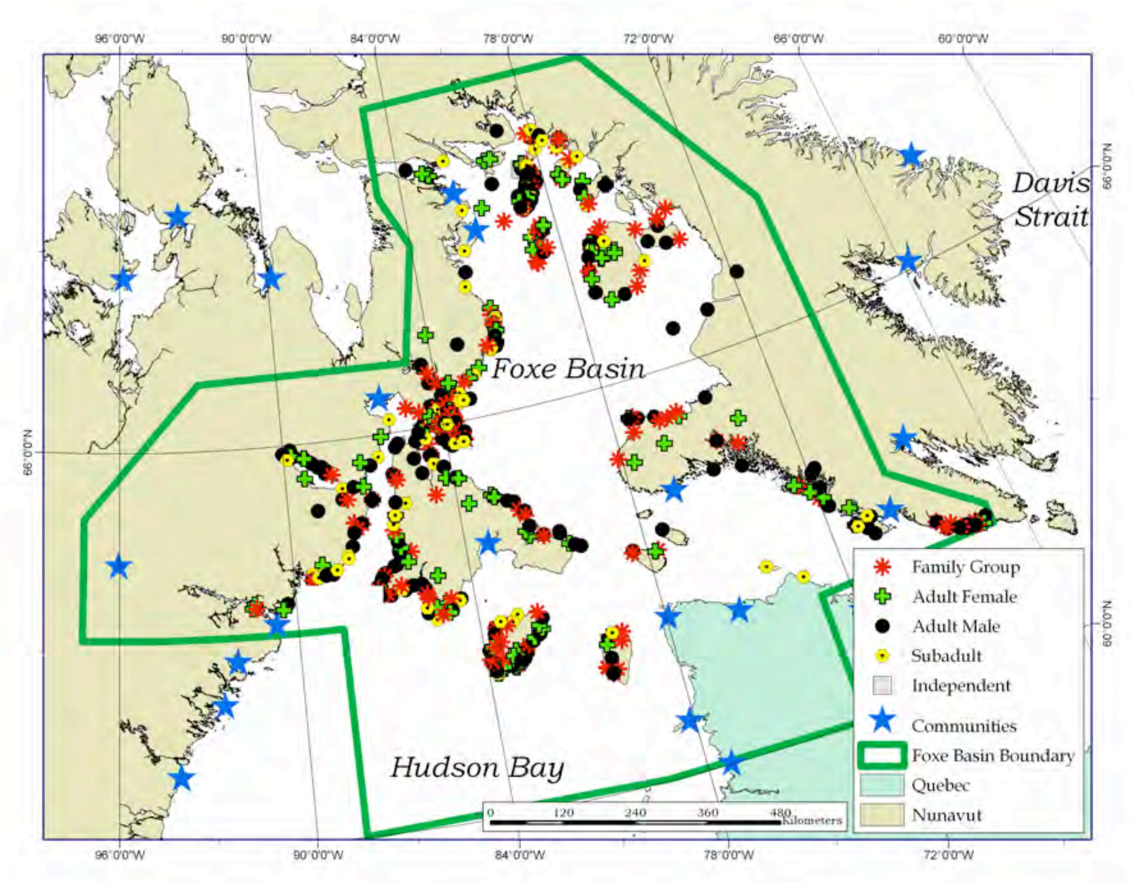


Figure 7. Distribution of 816 polar bears seen of various sex, age-classes and reproductive-status during the 2009 aerial survey in the Foxe Basin subpopulation.

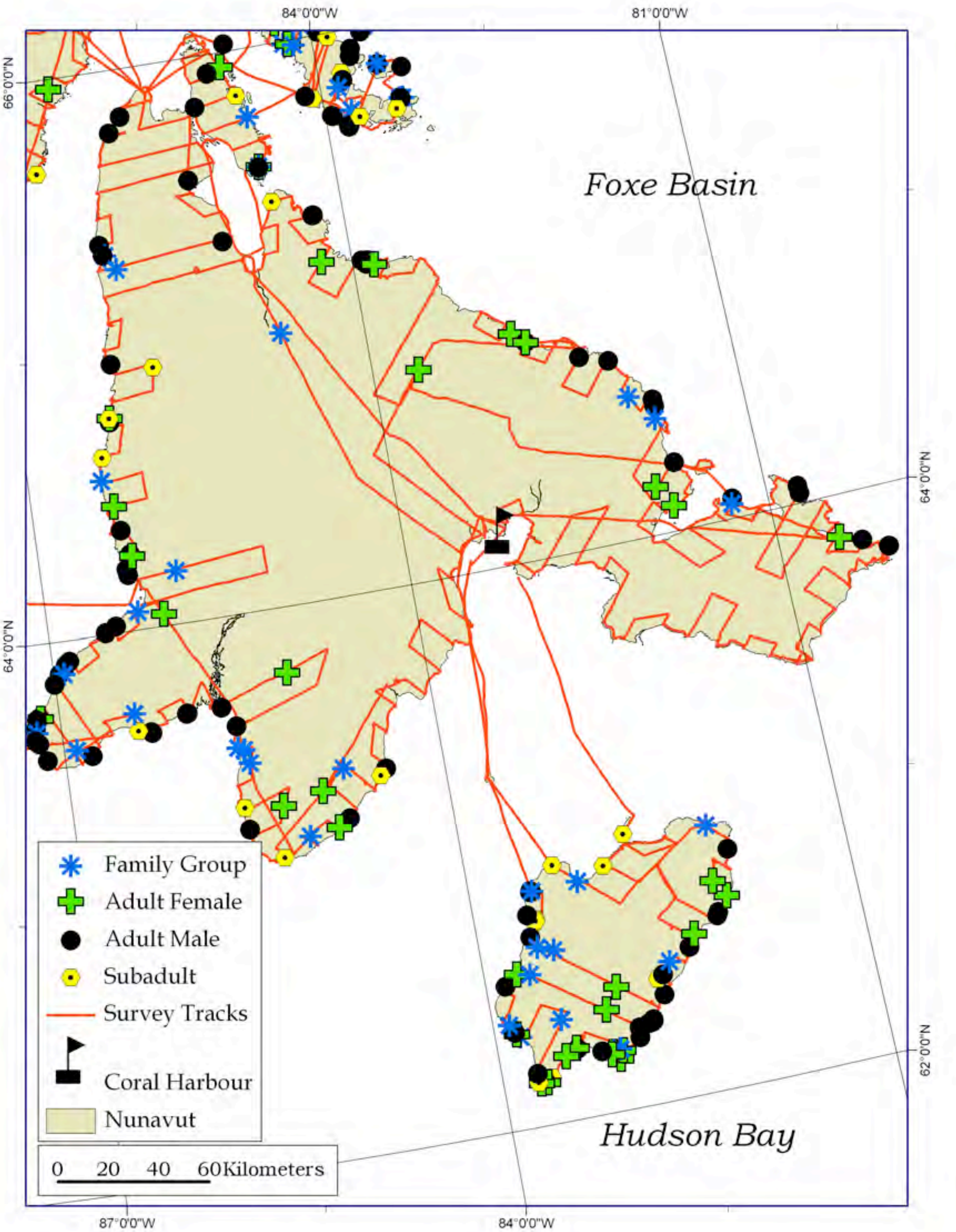


Figure 8. Distribution of polar bears seen of various sex, age and reproductive-status during the aerial survey on South Hampton and Coates islands in September 2009.

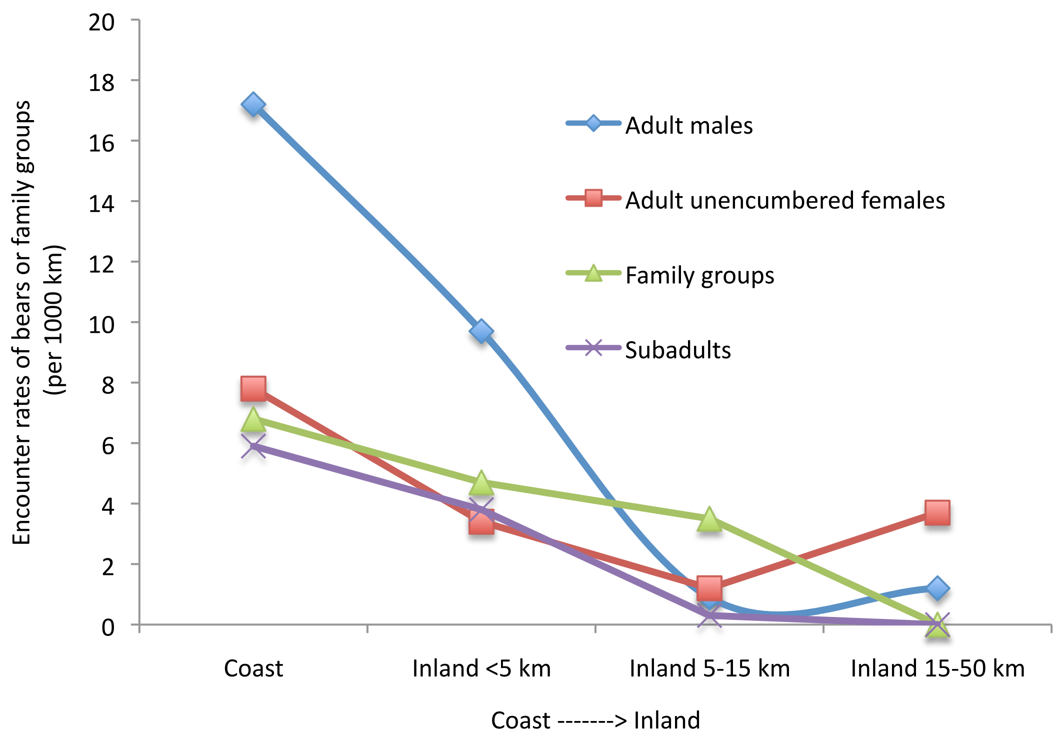
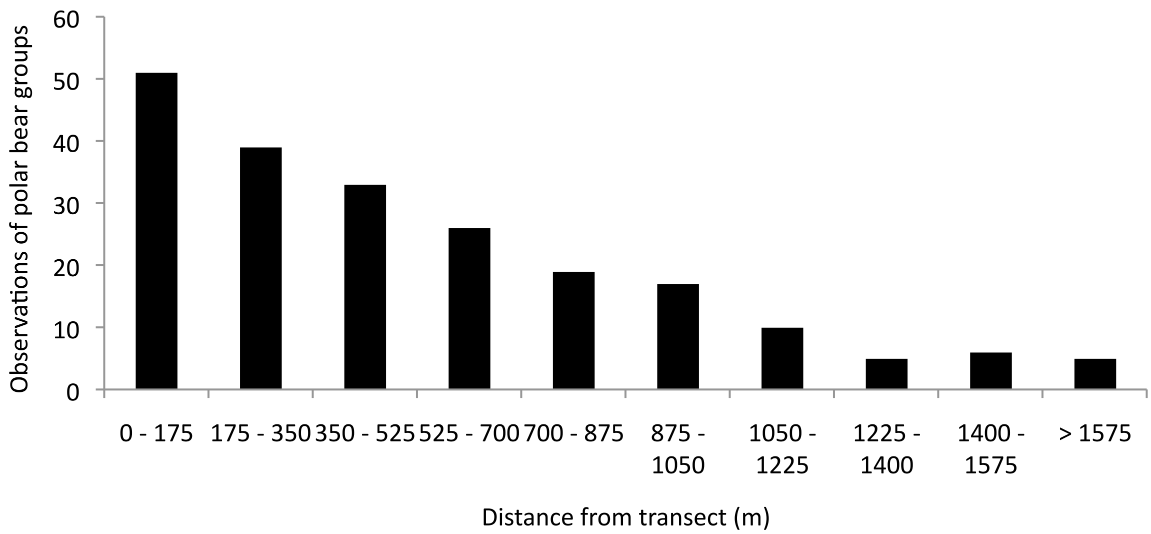
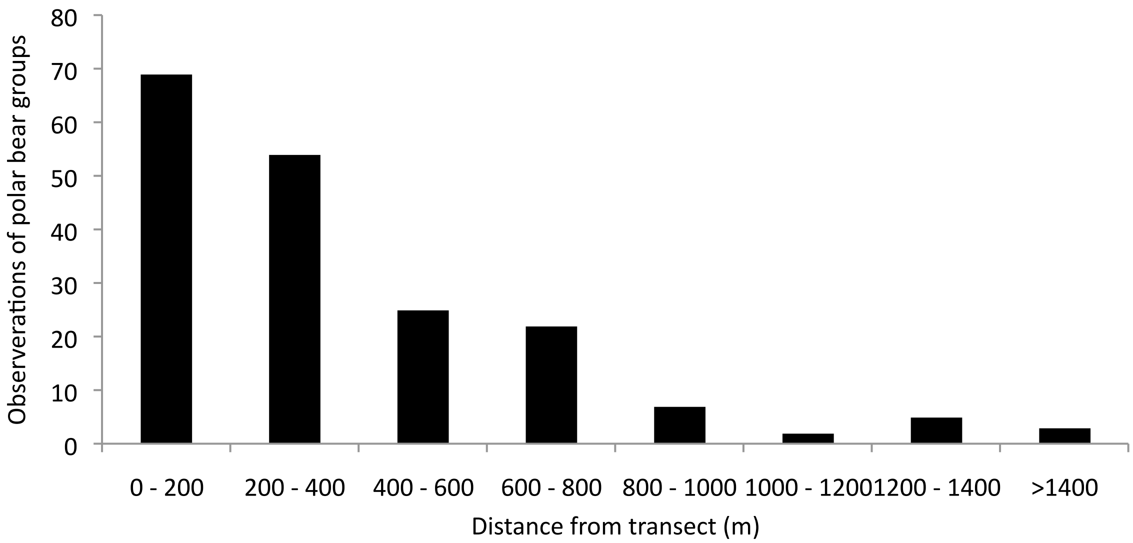


Figure 9. Data as in Table 6. The standardized encounter rates of polar bear groups in relation to the coast on the mainland and large islands (> 35 km in width) in Foxe Basin during the fall-time aerial survey in 2009.

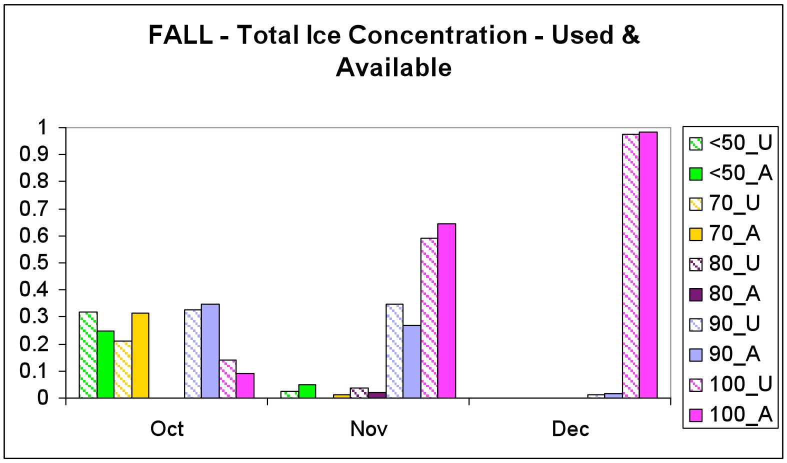


a.

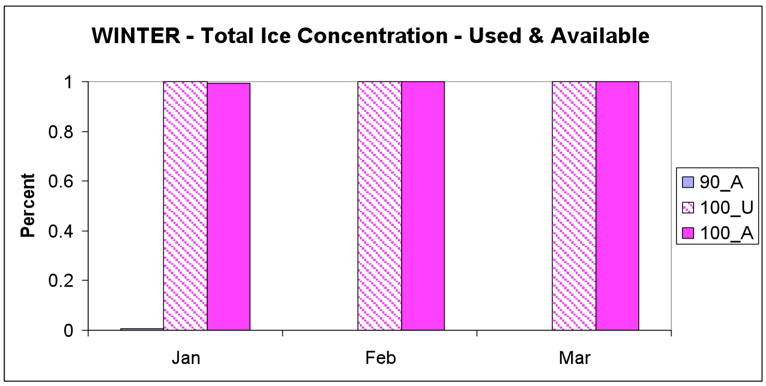


b.

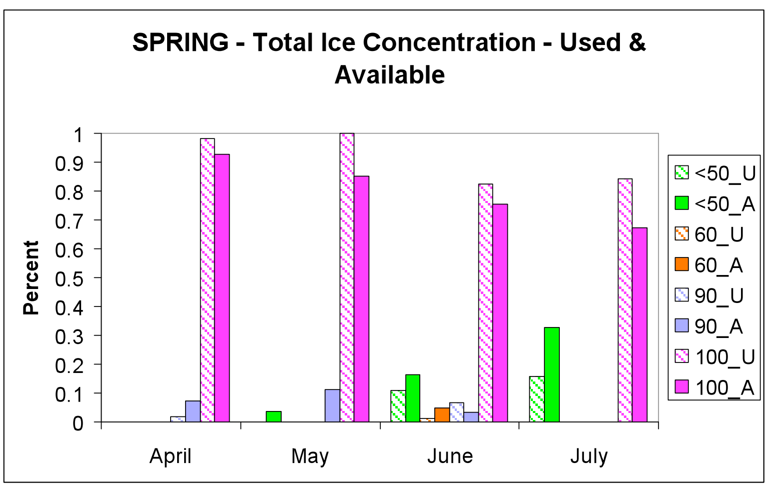
Figure 10. Distance detection function or distribution of perpendicular distances (i.e., from the transect line) of polar bears sighted during a. Foxe Basin aerial survey inland sampling, August and September 2009. Note that this figure does not include individuals sighted during overland ferries and b. for distance-sampling aerial survey study of polar bears in the Barents Sea for comparison (Aars et al. 2009); their coefficient of variation (CV) was 13%.



a.

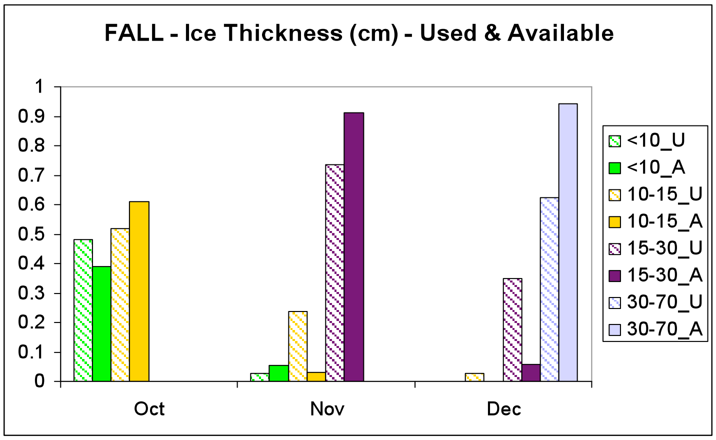


b.

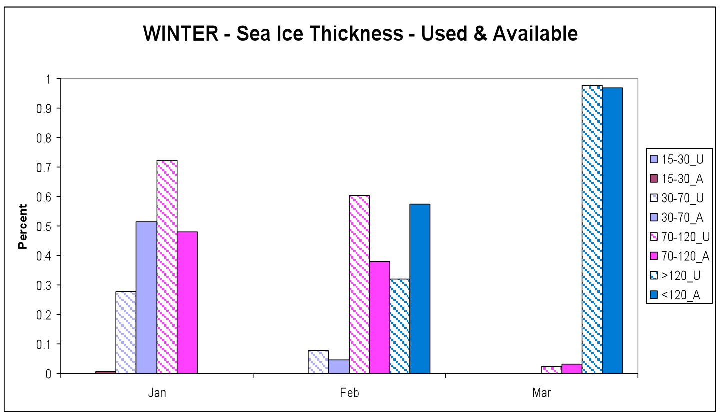


c.

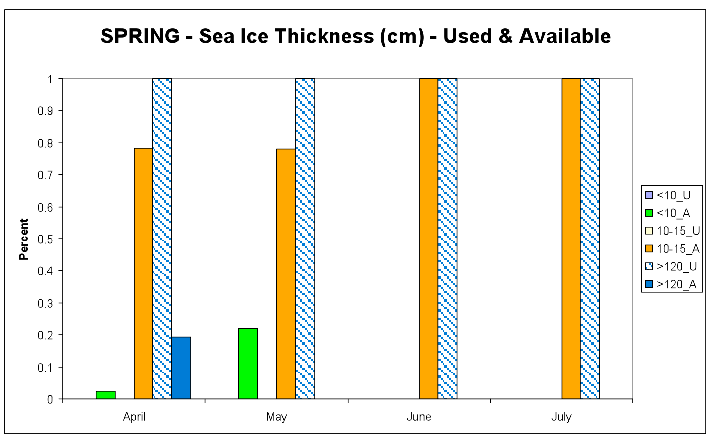
Figure 11. Total concentration of ice that was available (solid bars) and used (hashed bars) by thirteen adult female polar bears with collars from 2007 to 2008 in the a. fall; b. winter; and c. spring.



a.

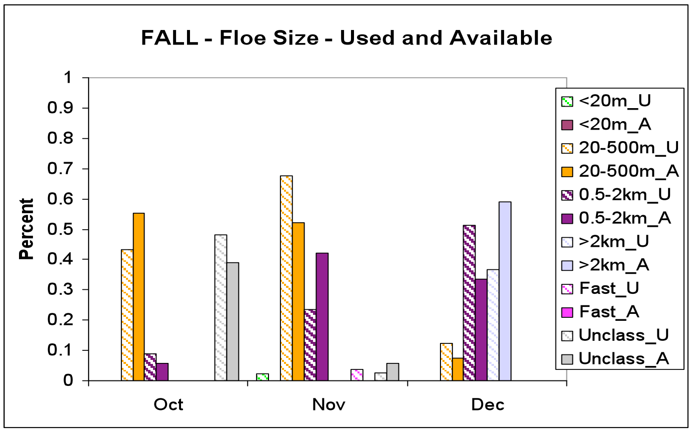


b.

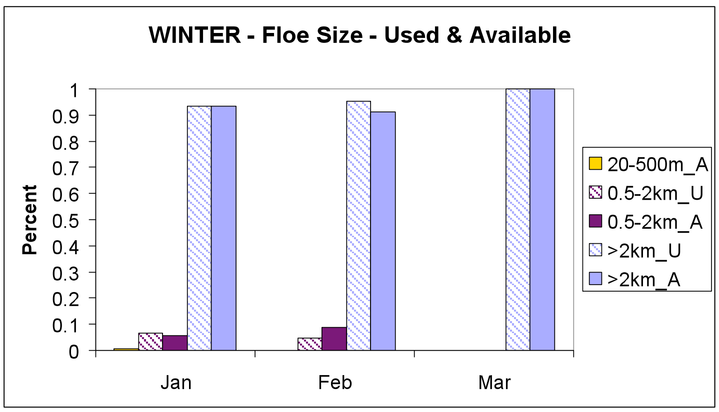


c.

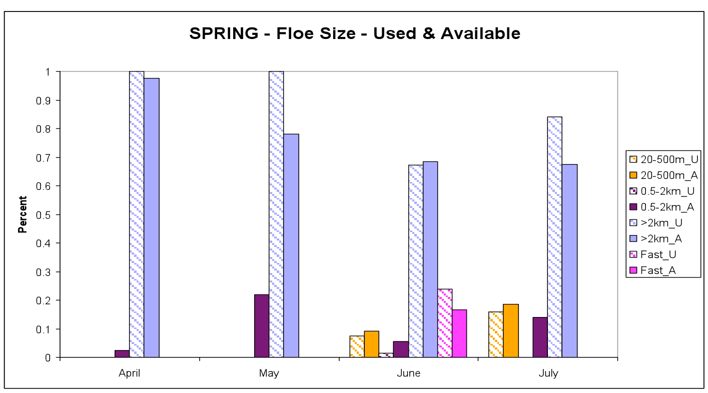
Figure 12. Ice thickness that was available (solid bars) and used (hashed bars) by thirteen adult female polar bears with collars from 2007 to 2008 in the a. fall; b. winter; and c. spring.



a.



b.



c.

Figure 13. Ice floe size that was available (solid bars) and used (hashed bars) by thirteen adult female polar bears with collars from 2007 to 2008 in the a. fall; b. winter; and c. spring.

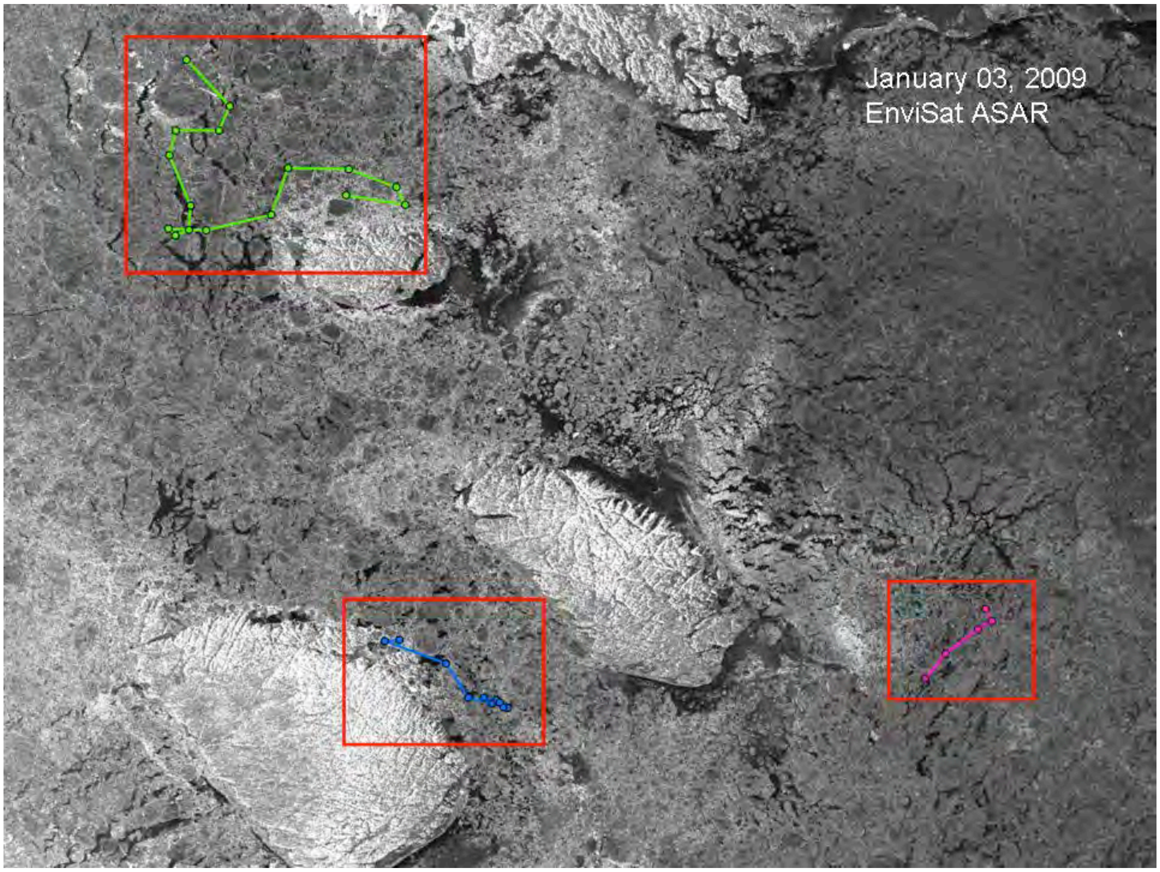


Figure 14. EnviSat ASAR image of western Hudson Strait and paths of 3 adult female polar bears on 3 January 2009. White areas of the image are land.

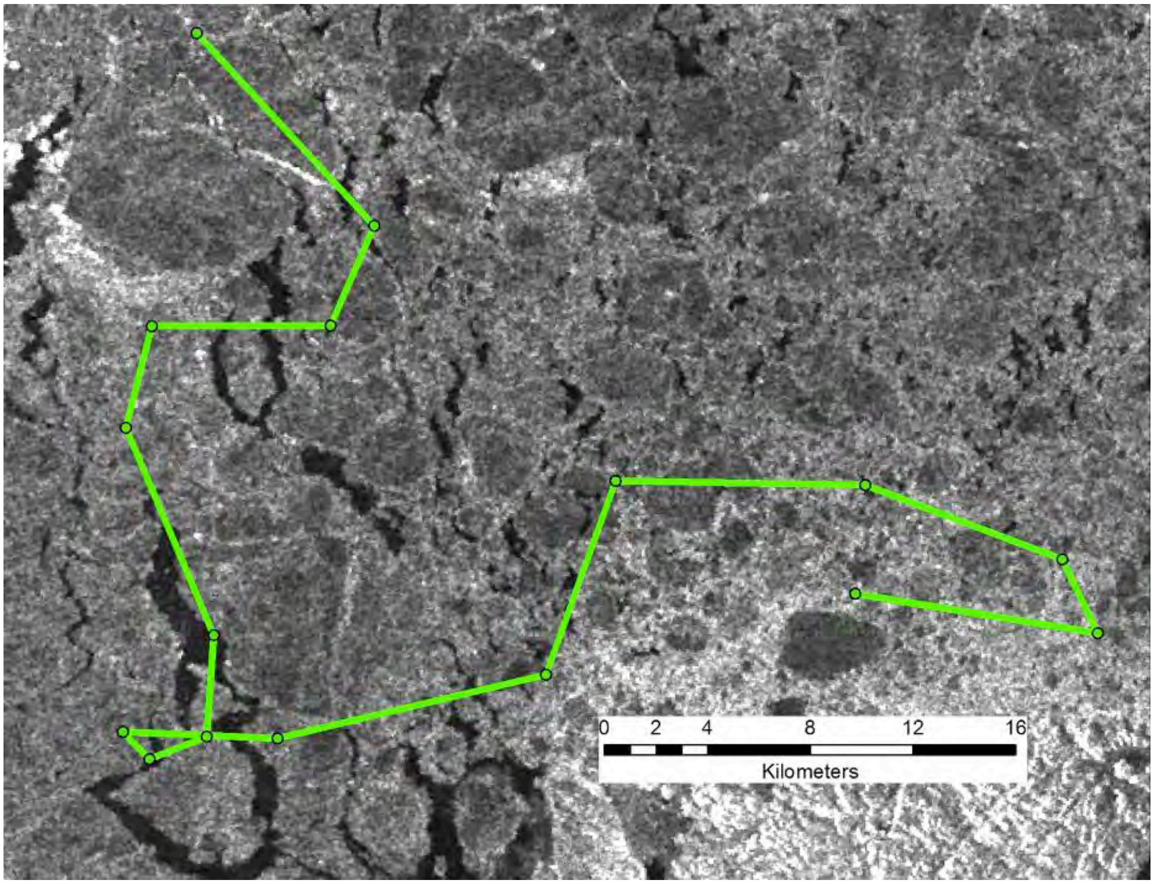


Figure 15. Path of a collared adult female polar bear (2 – 4 January 2009) mapped on EnviSat ASAR image (3 January 2009).

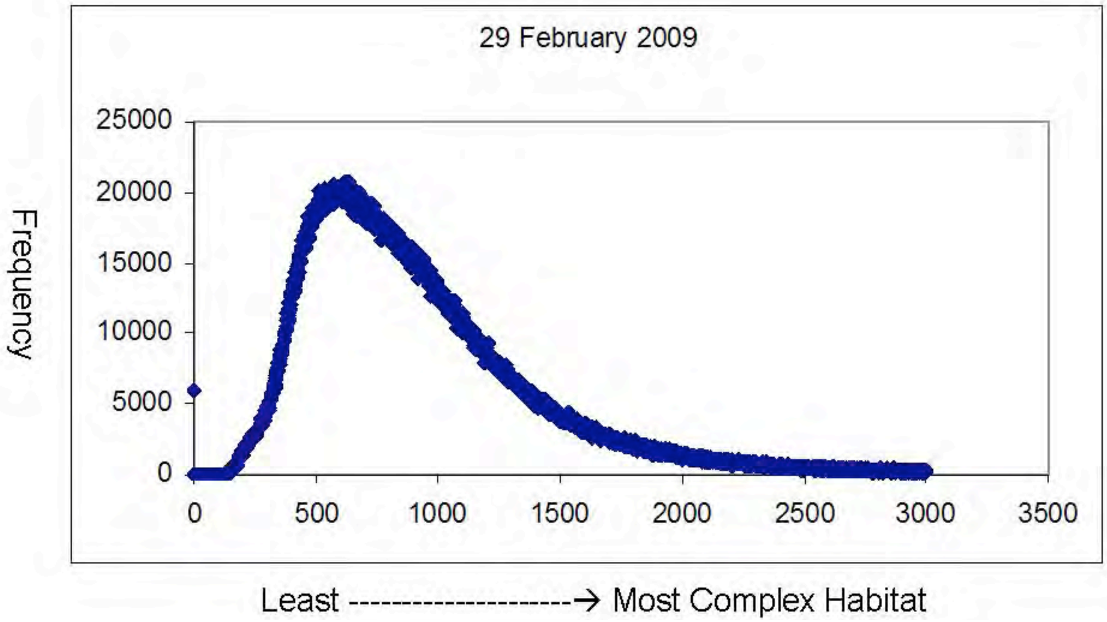


Figure 16. An example of sea ice habitat available to polar bears in Hudson Strait, 29 February 2009.

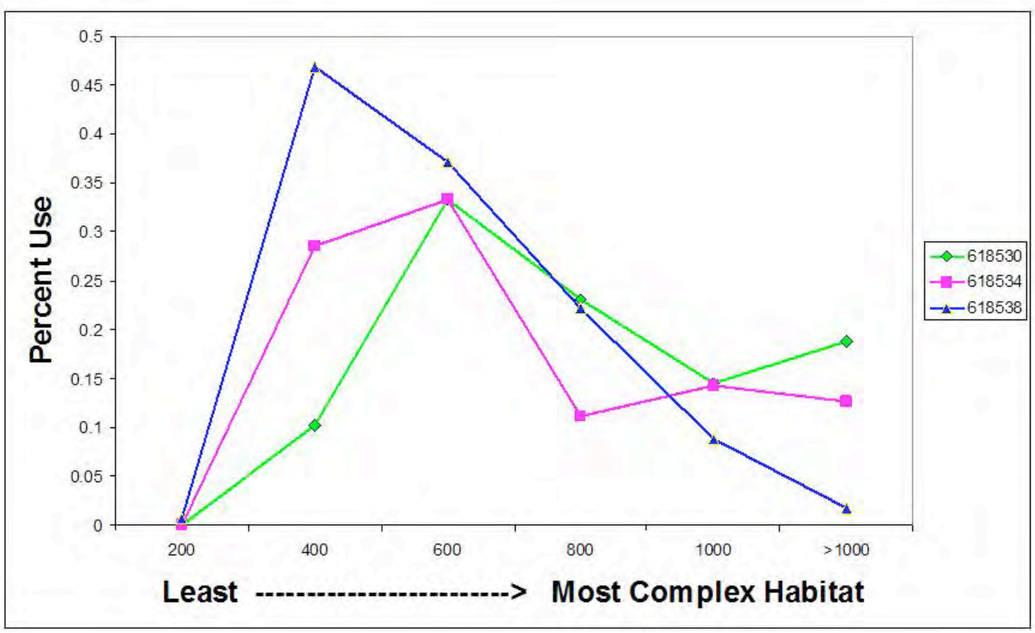


Figure 17. Sea ice habitat used by three collared female polar bears with cubs in Hudson Strait, December 2008 – March 2009.

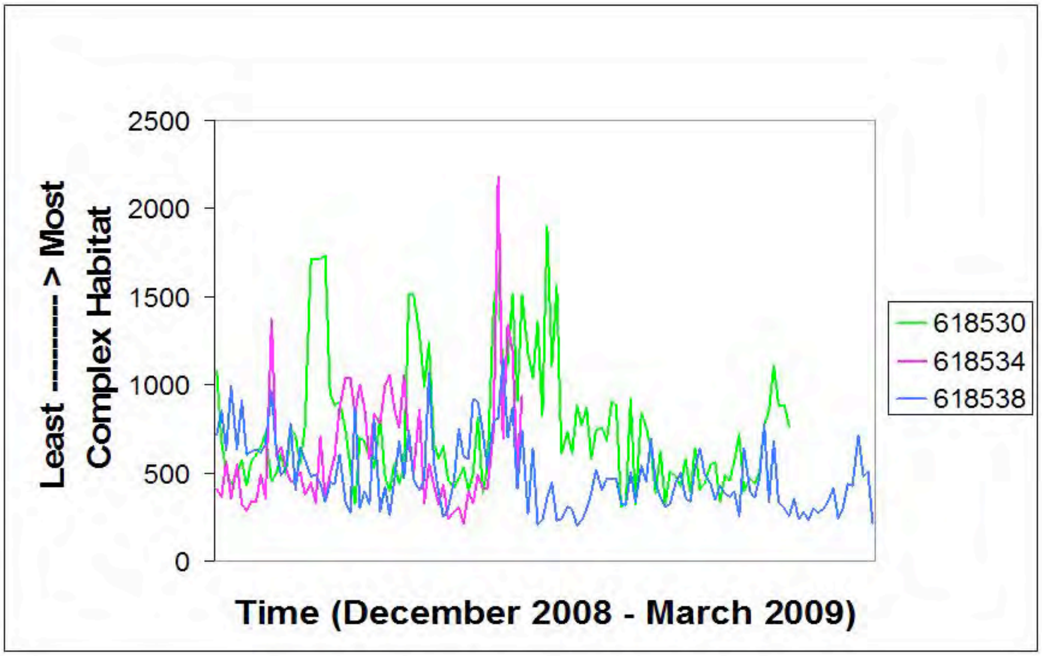


Figure 18. Daily sea ice habitat use, with respect to fine scale complexity, by three collared female polar bears with cubs, Hudson Strait, December 2008 – March 2009.

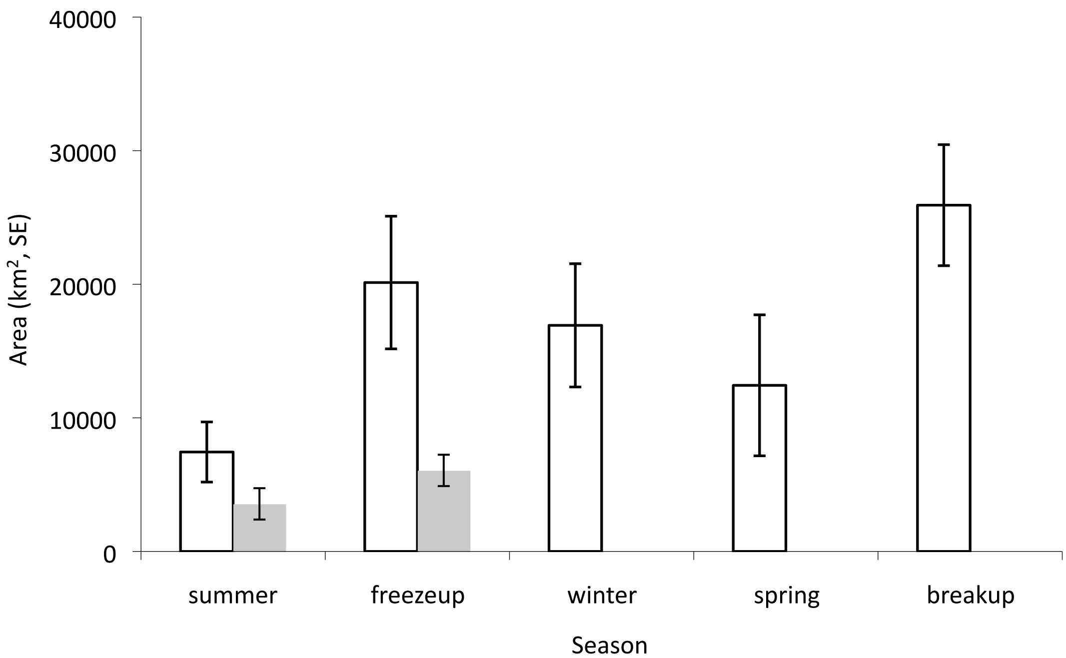


Figure 19. Area (km^2) of collared adult female (white bars) and male (gray bars) seasonal home ranges (Minimum Convex Polygons) between August 2008 and July 2009. Sample sizes are summer (18); freeze-up (13); winter (7); spring (4) and break-up (2) for females. Displayed are data for 4 males.

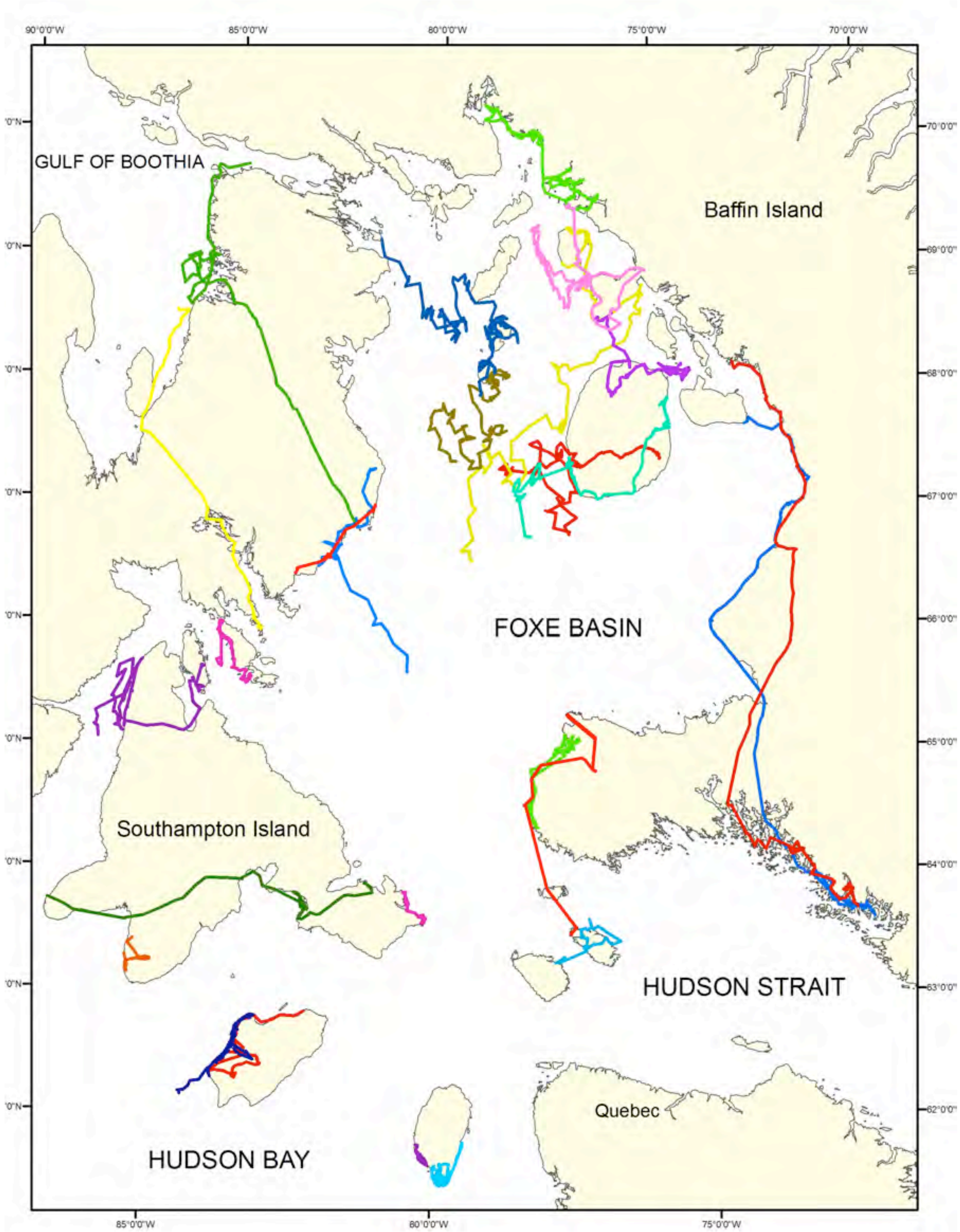


Figure 20. Paths of female (24) and male (1, red line on Foxe Peninsula) polar bears, collared during 2009, during the open-water season and the beginning of freeze-up, August – November 2009.

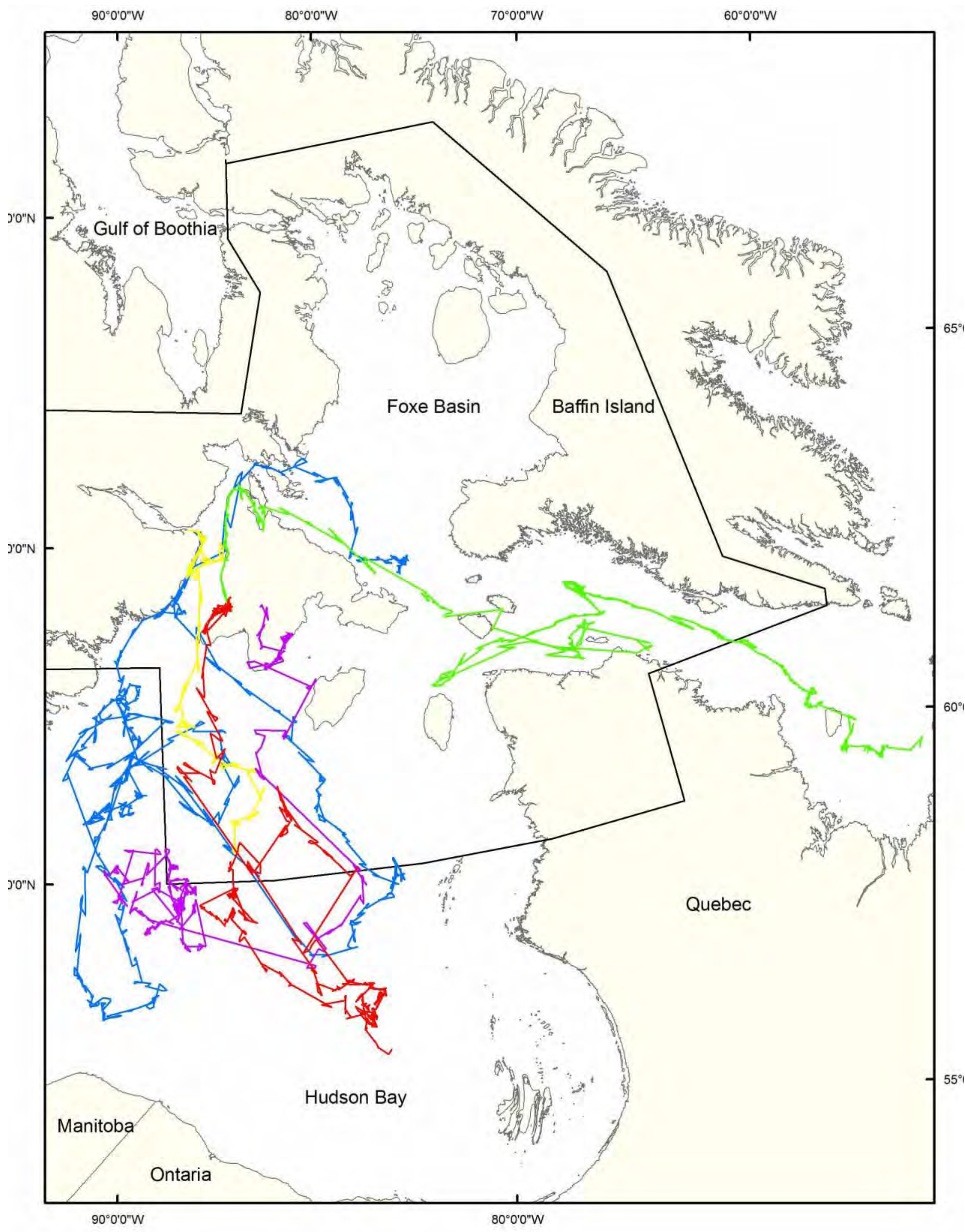


Figure 21. Annual movements of collared Foxe Basin adult female polar bears 2007 – 2008. The heavy black line shows the Foxe Basin management zone (subpopulation).

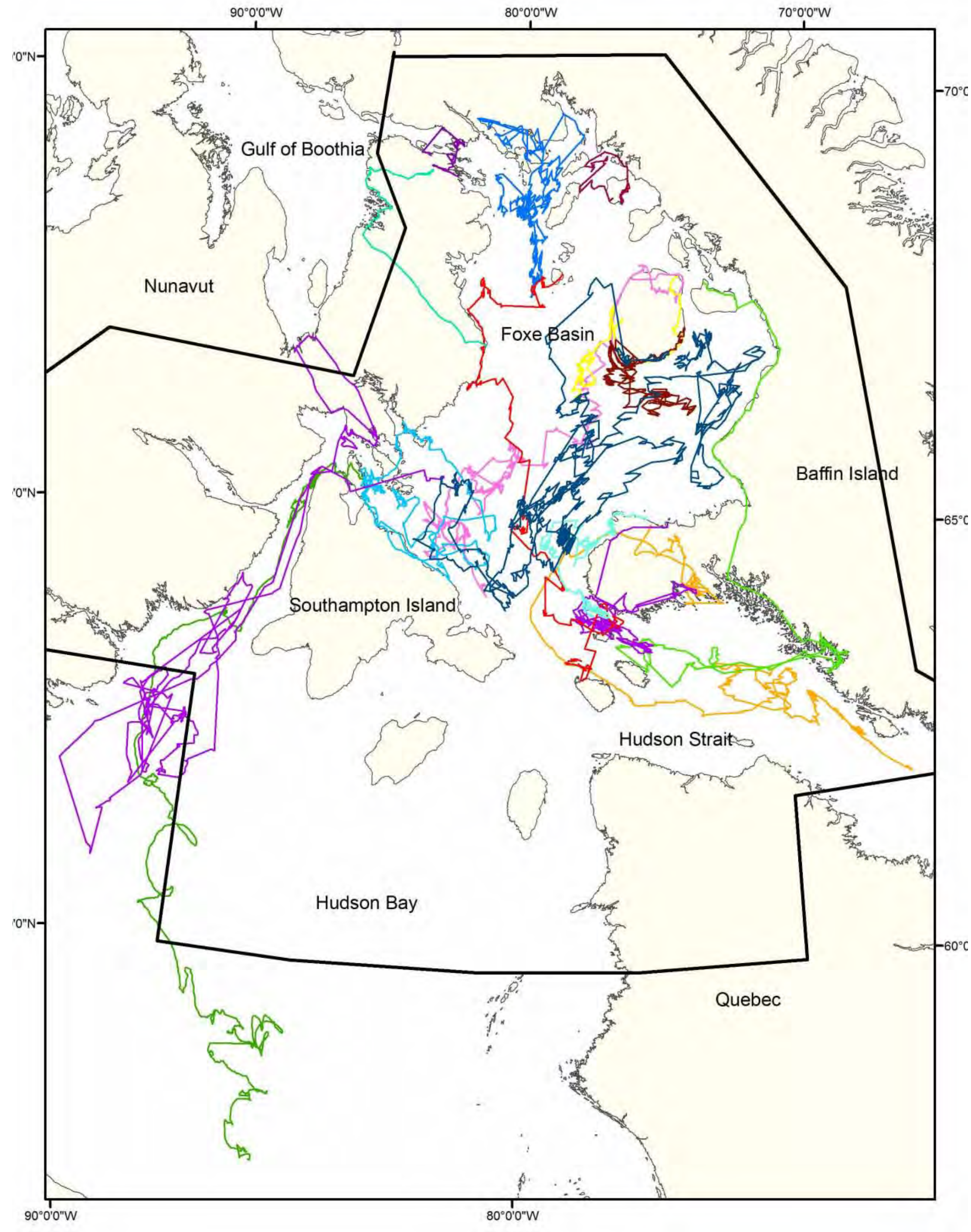


Figure 22. Annual movements of Foxe Basin collared adult female polar bears 2008 – 2009. The heavy black line shows the Foxe Basin management zone (subpopulation).

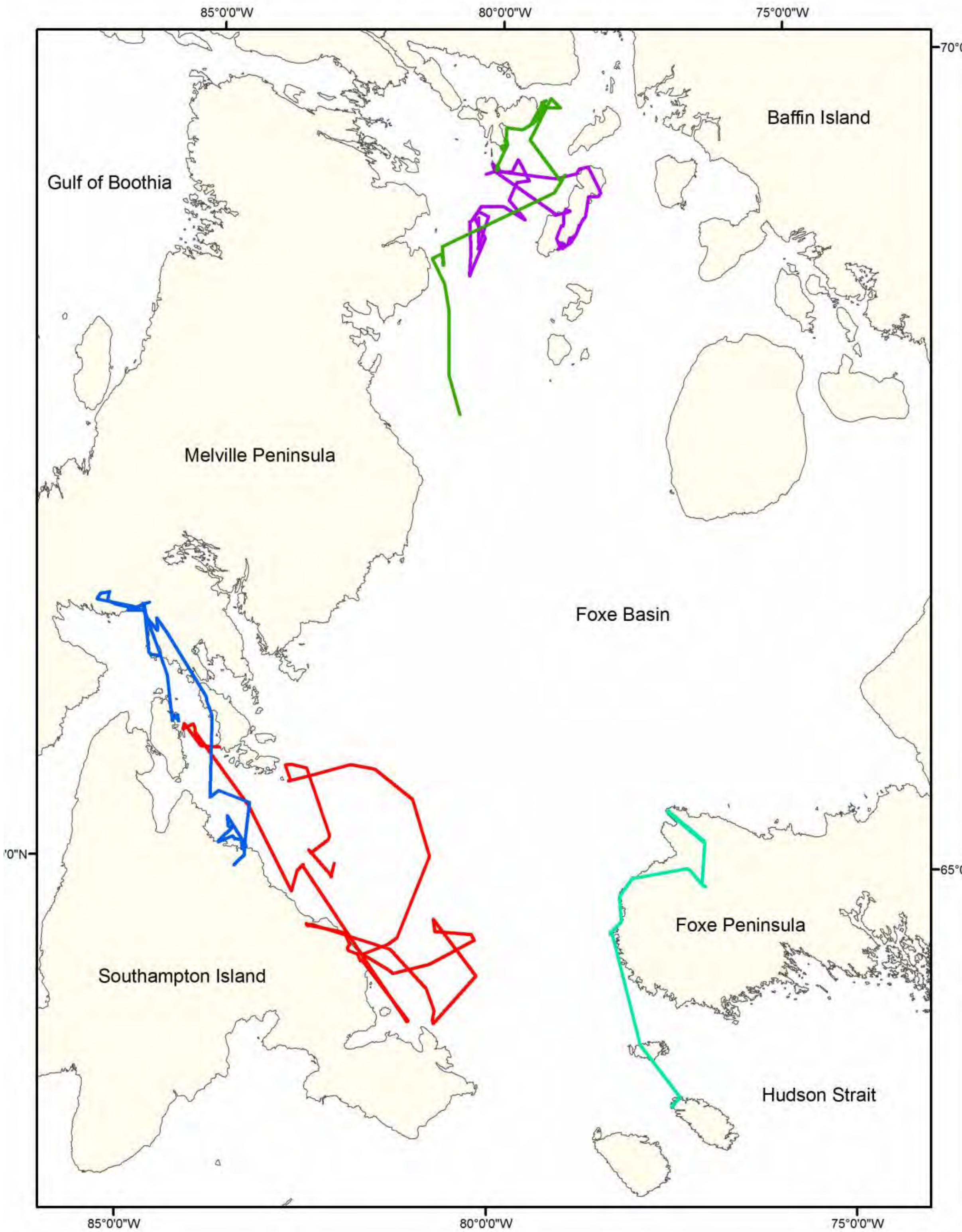


Figure 23. The movements for 5 satellite-tagged adult male polar bears in Foxe Basin 2008 (n = 4) and 2009 (n = 1; light green). The average number of days of ear tag transmitting was 98 ± 11 (SE).

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Appendix 1.

Polar bears affixed with RFID tags in right ears in 2008 and 2009, and the status of those tags. This table should be used as reference for searching for RFID tags during 2010 and if these bears are harvested, in order to understand retention rate of RFID tags.

Original number of bear	Year	Date of capture	Sex	Capture type	Field age-class	RFID number	Status
X35867	2008	August-7	F	M-CAP	ADULT	98370	Deployed in 2008; Searched in 2009 did not detect
X35900	2008	August-15	F	M-CAP	ADULT	98586	Deployed in 2008; Searched in 2009 did not detect
X35866	2008	August-7	F	M-CAP	ADULT	98763	Deployed in 2008; Detected in 2009; on bear; no infection
X35894	2008	August-15	F	M-CAP	ADULT	98986	Deployed in 2008; Searched in 2009; detected, but saw no bear; likely dropped
X35921	2008	August-27	F	M-CAP	ADULT	99242	Deployed in 2008; Detected in 2009; on bear; no infection
X35885	2008	August-14	F	M-CAP	ADULT	99274	Deployed in 2008; Searched in 2009 did not detect
X35870	2008	August-7	F	M-CAP	ADULT	99427	Deployed in 2008; Searched in 2009 did not detect
X35872	2008	August-7	F	M-CAP	ADULT	99618	Deployed in 2008; Searched in 2009 did not detect
X35924	2008	August-26	F	M-CAP	ADULT	99755	Deployed in 2008; Searched in 2009 did not detect
X35891	2008	August-14	M	M-CAP	ADULT	99811	Deployed in 2008; Searched in 2009 did not detect
X35876	2008	August-11	F	M-CAP	SUBAD	100435	Deployed in 2008; Searched in 2009 did not detect
X35906	2008	August-17	F	M-CAP	ADULT	100715	Deployed in 2008; Searched in 2009 did not detect
X35884	2008	August-14	F	M-CAP	ADULT	100883	Deployed in 2008; Searched in 2009; detected, but saw no bear; likely dropped
X35877	2008	August-11	F	M-CAP	ADULT	100954	Deployed in 2008; Searched in 2009 did not detect
X35875	2008	August-8	F	M-CAP	ADULT	101746	Deployed in 2008; Searched in 2009 did not detect
X35927	2008	August-26	F	M-CAP	ADULT	102098	Deployed in 2008; Searched in 2009 did not detect
X35903	2008	August-15	F	M-CAP	ADULT	102170	Deployed in 2008; Searched in 2009 did not detect
X35862	2008	August-7	F	M-CAP	ADULT	102210	Deployed in 2008; Searched in 2009 did not detect
X35917	2008	August-25	F	M-CAP	ADULT	102682	Deployed in 2008; Searched in 2009 did not detect
X35897	2008	August-15	F	M-CAP	ADULT	102706	Deployed in 2008; Searched in 2009 did not detect
X35892	2008	August-14	M	M-CAP	ADULT	102779	Deployed in 2008; Searched in 2009 did not detect
X35893	2008	August-14	M	M-CAP	ADULT	102874	Deployed in 2008; Searched in 2009 did not detect

X35881	2008	August-13	F	M-CAP	ADULT	102898	Deployed in 2008; Searched in 2009 did not detect
X35888	2008	August-14	F	M-CAP	ADULT	102935	Deployed in 2008; Searched in 2009 did not detect
X35930	2008	August-27	F	M-CAP	ADULT	102955	Deployed in 2008; Searched in 2009 did not detect
X35935	2008	September-5	F	M-CAP	ADULT	103098	Deployed in 2008; Searched in 2009 did not detect
X35879	2008	August-11	F	M-CAP	ADULT	103427	Deployed in 2008; Searched in 2009 did not detect
X35919	2008	August-25	F	M-CAP	ADULT	103587	Deployed in 2008; Searched in 2009 did not detect
X35911	2008	August-19	F	M-CAP	ADULT	103794	Deployed in 2008; Searched in 2009 did not detect
X35865	2008	August-7	M	M-CAP	ADULT	104162	Deployed in 2008; Harvested in February 2009; on bear; no infection
X35914	2008	August-19	F	M-CAP	ADULT	104282	Deployed in 2008; Searched in 2009 did not detect
X35933	2008	September-5	F	M-CAP	ADULT	104875	Deployed in 2008; Searched in 2009 did not detect
X35952	2009	September-3	F	M-CAP	ADULT	98571	Deployed in 2009; Have not searched for
X35866	2009	August-25	F	M-RECAP	ADULT	98763	note: recapture, not additional RFID tag
X35921	2009	September-13	F	M-RECAP	ADULT	99242	note: recapture, not additional RFID tag
X31673	2009	September-18	M	M-CAP	YRL	99290	Deployed in 2009; Have not searched for
X35399	2009	September-2	M	M-CAP	ADULT	99298	Deployed in 2009; Have not searched for
X31668	2009	September-18	F	M-CAP	ADULT	100002	Deployed in 2009; Have not searched for
X31655	2009	September-13	F	M-CAP	ADULT	100147	Deployed in 2009; Have not searched for
X35397	2009	September-2	F	M-CAP	ADULT	100891	Deployed in 2009; Have not searched for
X35945	2009	September-7	F	M-CAP	ADULT	100946	Deployed in 2009; Have not searched for
X35940	2009	September-3	F	M-CAP	ADULT	100995	Deployed in 2009; Have not searched for
X35398	2009	September-2	M	M-CAP	2YR	101034	Deployed in 2009; Have not searched for
X31674	2009	September-19	F	M-CAP	ADULT	102811	Deployed in 2009; Have not searched for
X31649	2009	September-8	F	M-CAP	ADULT	102827	Deployed in 2009; Have not searched for
X35404	2009	August-27	F	M-CAP	ADULT	102858	Deployed in 2009; Have not searched for
X31671	2009	September-	F	M-CAP	ADULT	102883	Deployed in 2009; Have not searched for

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X31653	2009	September-14	F	M-CAP	ADULT	102890	Deployed in 2009; Have not searched for
X35407	2009	August-28	F	M-CAP	ADULT	102914	Deployed in 2009; Have not searched for
X35408	2009	August-28	F	M-CAP	2YR	102923	Deployed in 2009; Have not searched for
X31675	2009	September-19	F	M-CAP	YRL	104275	Deployed in 2009; Have not searched for
X31672	2009	September-18	F	M-CAP	YRL	104763	Deployed in 2009; Have not searched for
X35406	2009	August-27	M	M-CAP	2YR	104843	Deployed in 2009; Have not searched for
X35949	2009	September-7	M	M-CAP	YRL	104914	Deployed in 2009; Have not searched for
X31650	2009	September-8	F	M-CAP	YRL	104923	Deployed in 2009; Have not searched for
X35948	2009	September-7	F	M-CAP	ADULT	126067	Deployed in 2009; Have not searched for
X31647	2009	September-8	F	M-CAP	ADULT	128395	Deployed in 2009; Have not searched for
Deployed in 2008 and 2009							55
Searched for as of 2009							33
Harvested as of 2009							1
Dropped as of 2009							2
Known-retained as of 2009							3