Foxe Basin Polar Bear Project
2010 Interim Report – Part 1 (Part 2 - Population Survey Report)
Movements, Habitat, Population Delineation & Inuit Qaujimajatugangnit

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EXECUTIVE SUMMARY (available in Inuktitut translation)

This report summarizes progress on the Foxe Basin Polar Bear Project from November 2009 – November 2010. 2010 field work consisted of searching for active and failed satellite collars using VHF telemetry while conducting the fall aerial population survey. Two female polar bears were captured and collars removed. Two other female polar bears with collars were observed but not captured, their collars continue to transmit.

The trends in available habitat analysis is complete and publication nearing completion. Significant losses of preferred polar bear habitat were found in Foxe Basin, Hudson Strait and Hudson, particularly during freezeup, spring and breakup. The habitat selection model analyses (coarse and fine scale) are in progress and will be reported on in 2011. A summary of the 2009-2010 polar bear movement data is presented in this report. As in previous years, the collared polar bears moved throughout Foxe Basin, Hudson Strait and northern Hudson Bay. Early breakup forced some bears ashore earlier than in previous years. A consolidation and analysis of all movement data from 2007-2010 will be completed in 2011.

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) 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

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.

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. 2010). 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 2010 in prep.). 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 30 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). *See Report Part 2 (Stapleton etal 2010….)*

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 movements and habitat selection of Foxe Basin polar bears as related to ice conditions (2007 – 2013).

IV. **Inuit Qaujimajaiugangit.** To collect for the purpose of including IQ in the development of the habitat and aerial survey studies, and, interpretation of the results (2007 – 2012).

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, 13 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 (Peacock et al 2009). Gen IV collars were programmed to drop off on 31 October 2011 and the Gen III collar to drop off on 31 October 2010. The 2009 collars preformed better but 3 dropped off and 13 failed. The Gen III collar and one Gen IV collar were retrieved in September 2010, leaving only 7 collars to continue collecting data until October 2011 (Table 1).

The population delineation analysis will commence after all satellite collar data are collected (October 2011). 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 plotting of the home-ranges and movement paths of the 2009-2010 adult female collared polar bears shows that the generally the FB bears travel within the current boundaries of FB, although some do move into adjacent management units during the fall, winter and spring.

II. POPULATION INVENTORY

To be reported on by Stapleton et al 2010 – see Report Part 2

III. HABITAT ECOLOGY

This section describes progress on analysis of sea ice habitat in FB and a summary of the movements of bears collared in 2009. Throughout, we 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.

Polar bear sea ice habitat trends in Foxe Basin, Hudson Strait and Hudson Bay

Status: We completed the imagery update (1979 – 2008) and re-analyzed trends in available sea ice habitat. We are currently completing revisions to the publication manuscript (Sahanatien and Derocher 2010, in prep.). The accepted manuscript will be provided to GN-DOE and included in V. Sahanatien's Ph.D. thesis.

Recap Peacock et al 2009

The monthly (January – December) mean sea ice concentration (percent areal coverage of sea ice) data for 1979 – 2008 were obtained from the National Snow and Ice Data Center website (http://nsidc.org/). The data was collected by the Nimbus-7 Scanning Multichannel Microwave Radiometer (SMMR) and Defense Meteorological Satellite Program (DMSP) -F8, -F11 and -F13 Special Sensor Microwave/Imager (SSM/I) and the raw data were processed at a grid cell of 25 x 25 kilometres.

Ice concentration data were imported into ArcMap 9.3 as raster layers maintaining the original grid cell size. Each grid cell had attributed percent ice concentration between 0-100%. Each monthly ice concentration layer was classified to four classes, each reflecting a habitat type and relative quality.

We used fragmentation analysis to examine polar bear habitat over the past 30 years (1979-2008). FRAGSTATS v3.3 was used to compute patch based fragmentation metrics for each monthly sea ice habitat map. Significant losses of preferred polar bear habitat were found in Foxe Basin, Hudson Strait and Hudson, particularly during freezeup, spring and breakup.

Habitat Selection

Status: We are currently working on the analyses and plan to complete reports and manuscripts in 2011. All results will be included in V. Sahanatien's Ph.D. thesis.

Recap Peacock et al 2009.

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).

Landscape or Coarse Scale Habitat Selection

Second-order RSM development will use discrete choice analysis (Arthur et al. 1996, Durner et al 2009). 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 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://iceglaces.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. 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 information 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.

Feature or Fine 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 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 km², 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). 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).

A detailed analysis will be completed in 2011 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, ice floes, and land. We will then develop a RSM using distance metrics, feature shape metrics, and habitat complexity indices. This work will result in a new analytical technique for investigating polar bear sea ice habitat selection.

Foxe Basin Polar Bear Seasonal and Annual Movements (2009 – 2010)

Status: Here we report on polar bear movements for the time period August 2009 to September 2010. The 2009 satellite collar and ear tag deployment effort was reported on in the 2009 Foxe Basin Polar Bear Study Report (Peacock et al. 2009). Further analyses of all movement data collected from 2007-2010 will be completed in 2011. These analyses will be included in V. Sahanatien's Ph.D. dissertation and a publication will be prepared.

Recap Peacock et al 2009

During August - September 2009, 1 Gen III and 23 Telonics Gen IV satellite collars were deployed on adult female polar bears. One Spot 5 eartag was deployed on a adult male polar bear. The male bear movements were reported in Peacock et al. (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 collar 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.

Satellite Collars

As of November 2010 seven satellite collars continued to transmit. The status of remaining collars: two collars were removed, three collars slipped off (one was retrieved in March 2010 by GN DOE Igloolik field staff), and thirteen collars failed (Table 1). Two collars were removed using standard helicopter field capture protocols in September 2010 during the FB aerial population survey. One Gen IV satellite collar (CTN 618542A) that was deployed in 2008 continued to transmit into its 2nd year as programmed and failed in March 2010. Despite the collar failures, almost a full year of data was obtained for twelve bears.

It is not known if there technical problems with the automatic release (CR2-A) mechanism in 2010. It is possible that the collar failures were caused by the collars pre-maturely releasing into the ocean. It is also possible that the failures resulted from damaged antennae or GPS failure. The one collar (CTN 618540B) retrieved by snowmobile had been removed by the bear (slipped over her head), as the attachment was intact. Two collared polar bears with collars were observed during the aerial survey and their collars continue to transmit. The failed collars were searched for using VHF telemetry from a helicopter during the 2010 fall aerial population survey but no failed collars were found.

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 (2009 – 2010) for collared FB adult female polar bears with at least four seasons (open-water, freeze-up, winter, spring) of data (*n* = 16) ranged from 22,529 – 255,684 km² (Figure 1, Table 2). The mean annual home range size was 101,660 km² (Table 3) and similar to 2008_09 but less than 2007_08 (Figure 2). The open-water home range size was smallest (6,781 km²) and freeze-up largest (28,363 km²). The seasonal home range size patterns were similar to those observed in 2007-08 and 2008-09 (Peacock et al 2008, 2009). Differences and similarities between years will be explored in the final FB polar bear movements report.

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 monthly rates of travel were highest in December, June and July and lowest in August, September and October (Table 4). 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 mean seasonal movement rates were highest during breakup and lowest during the open water season (Table 5).

The monthly distances travelled were individual and variable (Table 6). The greatest mean monthly distances travelled were in April, May and June, and least in August, September and October (Table 7). Long distance overland movements occurred during the open water seasons of 2009-2010 as the previous year. Bears 631694A and 631716A crossed the Melville Peninsula to Committee Bay, Bear 618540B moved up to the head of Steensby Inlet from Grant Suttie Bay, and Bears 631687A and 634586A moved from the Airforce Island area of central Baffin Island to Hudson Strait (Figures 4, 5 and 6). Long distance swimming events occurred in the open water and break-up seasons. Five bears swam between islands during the open water season. In early July, Bears 600661B and 631681A swam from the retreating ice edge of Hudson Bay to Southampton Island

(~ 68 km) and to Coates Island (~125 km) respectively. We observed fidelity to summer home range in 8 bears. These bears returned to the island or mainland coast where they were captured then spent the remainder of the season nearby. Another 6 bears returned to the general region of capture.

As in 2007 – 2009, we observed movements from the Foxe Basin study area into adjacent polar bear subpopulations (management zones): 5 bears moved into WH (Figures 3 and 6); 2 bears moved into GB for a period of time (Figures 3, 4 and 5); and 2 bears moved into DS (Figures 3 and 6).

IV. Inuit Quajimajatuqangit

Habitat ecology

Status: A Nunavut Wildlife Management Board Wildlife Research Grant was awarded to this research component in May 2010. Follow-up meetings and interviews are scheduled for February-March 2011. Reports will follow closely.

The following recaps Peacock et al. 2009.

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 completed.

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.

V. 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 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.

VI. 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. In 2010, the field crew met with some HTOs during the aerial survey. Maps of polar bear movements, the 2007, 2008, 2009, and current interim reports and posters (FB Aerial survey, FB polar bear project, FB Inuit Knowledge Study) have been sent to all FB HTOs and Wildlife Secretariats. The most recent map report was completed in July 2010.

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)
- 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, August 2010)
- Kimmirut
    - Hunters and Trappers Organizations (May 2007, January 2009, May 2009, August 2009, August 2010)
    - Public meeting (January 2009)
- Baker Lake
    - Hunters and Trappers Organization (emailed and mailed information only in 2006, 2007 and 2008)
- Sila Lodge Co-Owners (July 2007)
- Ukkusiksalik Park Management Committee (December 2006, February 2007, January 2008); emailed reports 2009, 2010
- Qikiqtalluq Wildlife Board (November 2007, November 2008, November 2009)
- Kivalliq Inuit Association – Lands (February 2007, February 2008, February 2009)
- Nunavut Tunngavik Incorporated, Wildlife (February 2007, February 2008)
- Nunavut Wildlife Symposium (all HTOs, RWOs, NWMB and NTI attended), March 2009

Table 1. Status of Foxe Basin satellite collars deployed in 2009, November 2010.

CTN	*Status*	*Date Deployed*	*Date Last Transmission*
618532B	OK	08 September 2009	
618535B	OK	27 September 2009	
618537B	OK	02 October2009	
631681A	OK	24 September 2009	
631684A	OK	13 September 2009	
631692A	OK	14 September 2009	
631694A	OK	13 September 2009	
600661B[1]	Removed - helicopter	27 August 2009	14 September 2010
631682A	Removed - helicopter	18 September 2009	21 September 2010
618540B	Dropped & Retrieved - snowmobile	07 September 2009	21 February 2010
618539B	Dropped	03 September 2009	03 April 2010
634586A	Dropped	28 August 2009	11 January 2010
618529B	Fail	03 September 2009	21 June 2010
618531B	Fail	02 September 2009	03 August 2010
618542A[2]	Fail	15 August 2008	31 March 2010
631643A	Fail	08 September 2009	05 September 2010
631687A	Fail	27 August 2009	25 August 2010
631688A	Fail	23 September 2009	26 September 2010
631691A	Fail	23 September 2009	20 March 2010
631693A	Fail	07 September 2009	05 November 2009
631695A	Fail	23 August 2009	01 July 2010
631696A	Fail	24 September 2009	09 November 2009
631716A	Fail	18 September 2009	15 March 2010
631718A	Fail	26 September 2009	16 June 2010
631720A	Fail	19 September 2009	06 October 2010

[1] Gen III satellite collar. [2] Gen IV satellite collar deployed in September 2008.

Table 2. Area (km²) of individual seasonal home ranges (MCP) of satellite collared female polar bears, Foxe Basin (2009-2010).

CTN	Open-water	Freeze-up	Winter	Spring	Break-up	Annual
600661B	647	55834	46224	16333	20995	91600
618532B	144	26794	16062	7290	11685	56014
618535B	227	25241	24866	56101	30717	127229
618537B	1685	7228	3052	20855	15254	50030
631643A	1443	8035	4124	10881	4470	22529
631682A	383	67284	45660	30632	42545	255684
631684A	1563	27895	16001	35178	24012	91571
631687A	40317	3697	19157	3947	15668	107505
631692A	464	13639	12741	12602	12929	42163
631694A	11674	38802	5341	20219	14827	86341
631688A	267	1615	5771	7992	46405	160894
618529B	1101	24762	18107	17940		49694
631681A	2548	26138	11488	25159		105501
631695A	1141	39773	75599	24202		135081
631718A	8284	66260	71161	37099		196446
631720A	3995	20253	7138	12672		48279
618539B	3221	1353	811			
618540B	3494	5872	441			
618542A	4699	12183	6370			
618531B	3473	124150	4942			
631691A	809	5552	22527			
631716A	35045	48140	7186			
631693A	4158	1853				
631696A	1238					
634586A	37514					

Table 3. Mean area (km²) of seasonal home range (MPC) of satellite collared female polar bears, Foxe Basin 2009-2010.

	Open-water	Freeze-up	Winter	Spring	Break-up	Annual
Mean	6781	28363	19308	21194	21773	101660
SE	2389	6084	4579	3375	3967	15622
N	25	23	22	16	11	16
Minimum	144	1353	441	3947	4470	22529
Maximum	40317	124150	75599	56101	46405	255684

Table 4. Mean monthly movement rate (km/hr) of satellite collared female polar bears, Foxe Basin 2009-2010.

	September	October	November	December	January	February	March	April	May	June	July	August	September
Mean	0.27	0.45	1.05	1.21	1.12	1.10	1.13	1.19	1.43	1.51	1.91	0.69	0.12
SE	0.04	0.06	0.12	0.12	0.11	0.10	0.09	0.10	0.13	0.20	0.21	0.19	0.04
N	14	24	23	21	20	18	17	15	12	10	7	6	5
Minimum	0.02	0.16	0.13	0.31	0.09	0.37	0.57	0.69	0.83	0.84	1.49	0.09	0.03
Maximum	0.61	1.34	2.57	2.47	2.05	2.21	1.87	2.10	2.18	3.08	3.01	1.16	0.22

Table 5. Mean seasonal movement rate (km/hr) of satellite collared female polar bears, Foxe Basin 2009-2010.

	Open-water	Freeze-up	Winter	Spring	Break-up
Mean	0.38	1.13	1.11	1.30	1.67
SE	0.04	0.09	0.06	0.08	0.15
N	38	44	56	27	17
Minimum	0.02	0.13	0.09	0.69	0.84
Maximum	1.34	2.57	2.21	2.18	3.08

Table 6. Monthly distances (km) moved by satellite collared female polar bears, Foxe Basin 2009-2010.

CTN	September	October	November	December	January	February	March	April	May	June	July	August
618532B	302	947	748	901	805	993	1180	1223	955	1005	375	17
631643A	103	588	669	540	550	709	554	628	803	507	224	344
631687A	249	418	409	573	779	612	548	407	419	550	134	117
618529B	28	369	1171	1072	1369	1069	825	970	1189	902		
631681A		152	760	442			517	259	454	310	198	66
631682A		172	566	927	701	529	572	635	604	576	623	448
631684A		208	781	561	629	565	564	663	1247	1051	991	568
600661B		173	751	773	828	391	710	587	389	415	144	22
618535B		112	452	542	808	494	715	1107	1175	957	736	42
618537B		280	495	395	207	442	789	920	1143	1641	1106	64
631692A		70	446	599	683	534	502	536	558	558	442	138
631694A		471	856	635	538	503	389	699	780	793	859	528
618542A		88	248	821	1167	982	802	1283				
631695A	67	122	109	965	920	709	780	832	509			
631718A		174	867	926	855	678	590	738	640			
631720A		344	563	314	633	365	451	595	334			
631688A		131	158	345	144	126	354	703				
618540B	183	401	384	218	324	144						
631691A		279	255	528	661	482	649					
631716A		241	885	1178	888	504						
618539B	157	242	186	212	64							
618531B	88	519	1388	1150								
634586A		274	468									
631693A	195	515										
631696A		222										

Table 7. Mean monthly distances (km) moved by satellite collared female polar bears, Foxe Basin 2009-2010.

	September	October	November	December	January	February	March	April	May	June	July	August
Mean	153	301	592	664	678	570	638	752	747	772	530	214
SE	30	40	67	63	72	58	46	67	83	106	106	65
N	9	25	23	22	20	19	18	17	15	12	11	11
Minimum	28	70	109	212	64	126	354	259	334	310	134	17
Maximum	302	947	1388	1178	1369	1069	1180	1283	1247	1641	1106	568

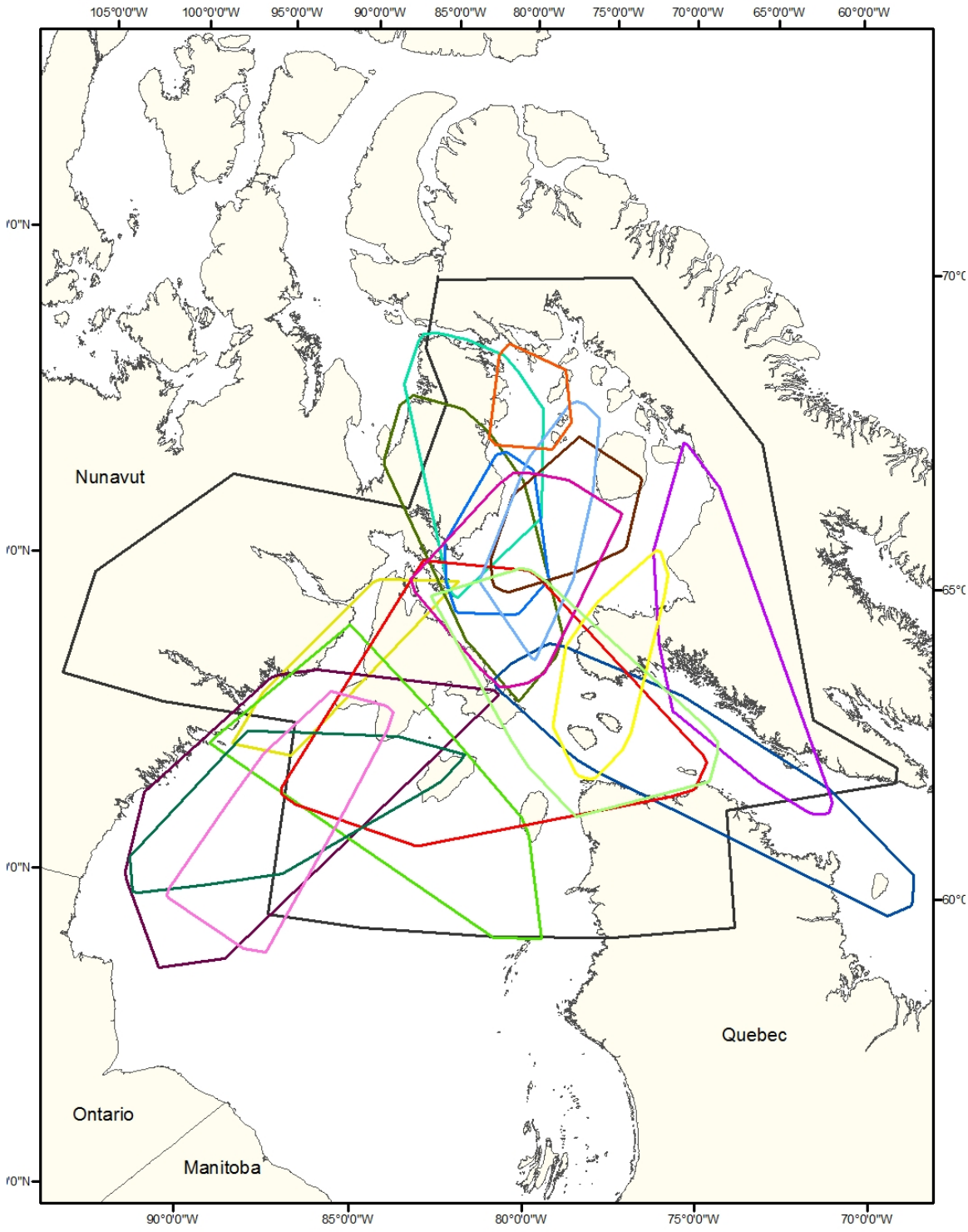

Figure 1. Annual home ranges (minimum convex polygon) of satellite collared female polar bears, Foxe Basin 2009-2010. Heavy black line shows the Foxe Basin management zone (subpopulation).

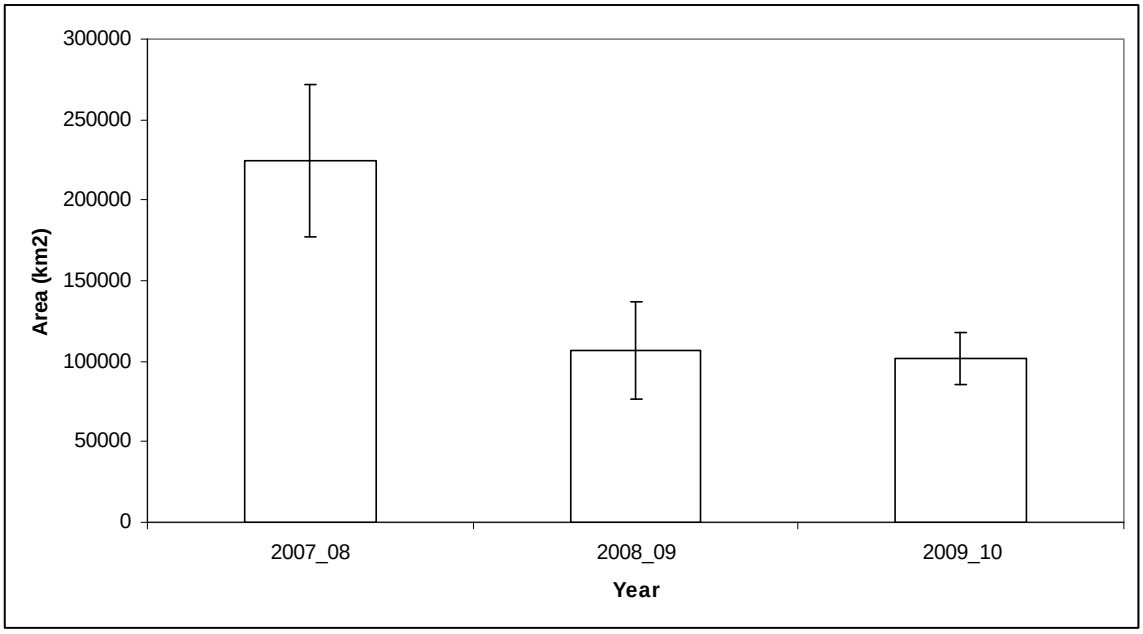

Figure 2. Minimum convex polygon annual home range size (km²) of satellite collared female polar bears, Foxe Basin (2007-2010).

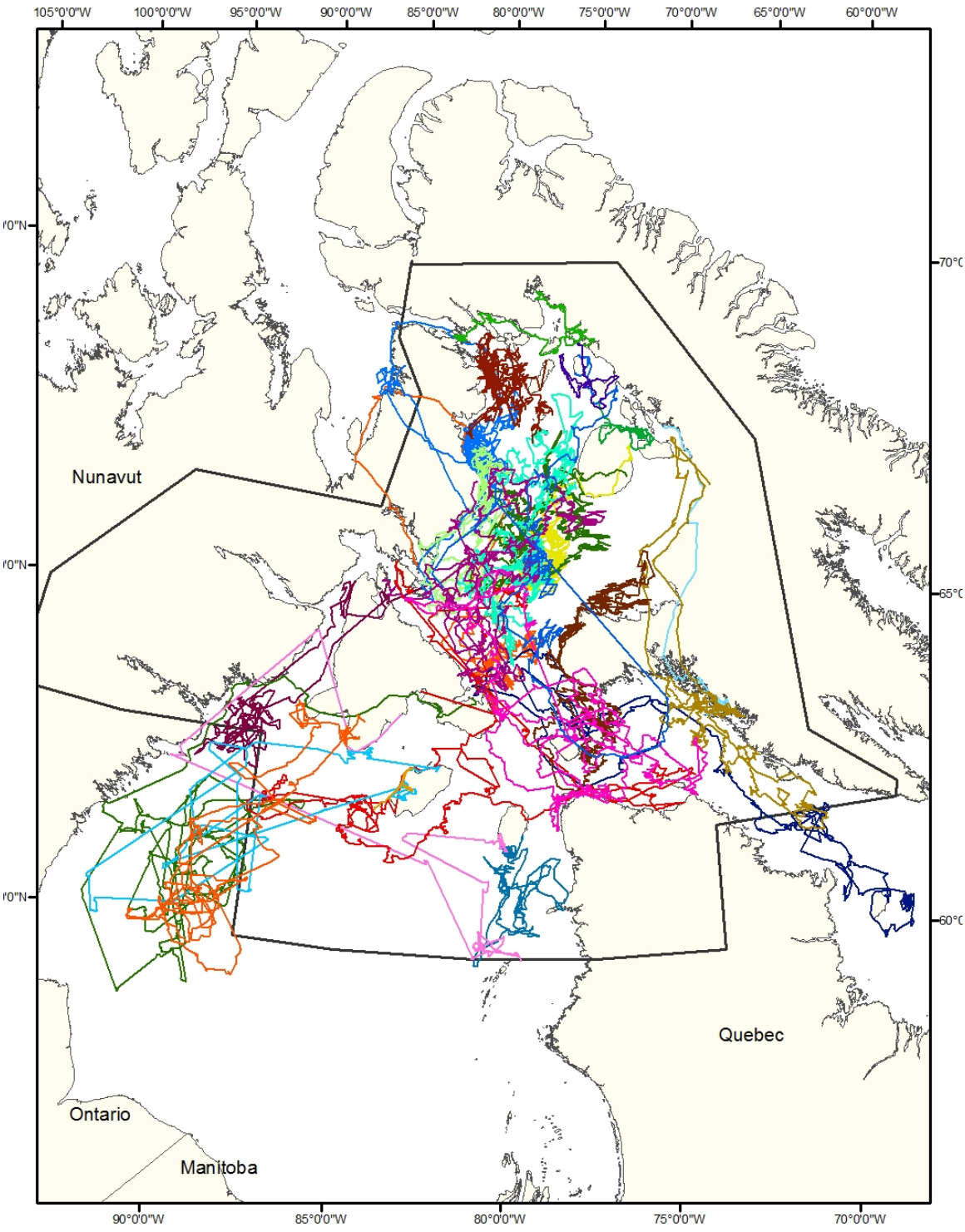

Figure 3. Annual movements of satellite collared female polar bears, Foxe Basin 2009-2010. Heavy black line shows the Foxe Basin management zone (subpopulation).

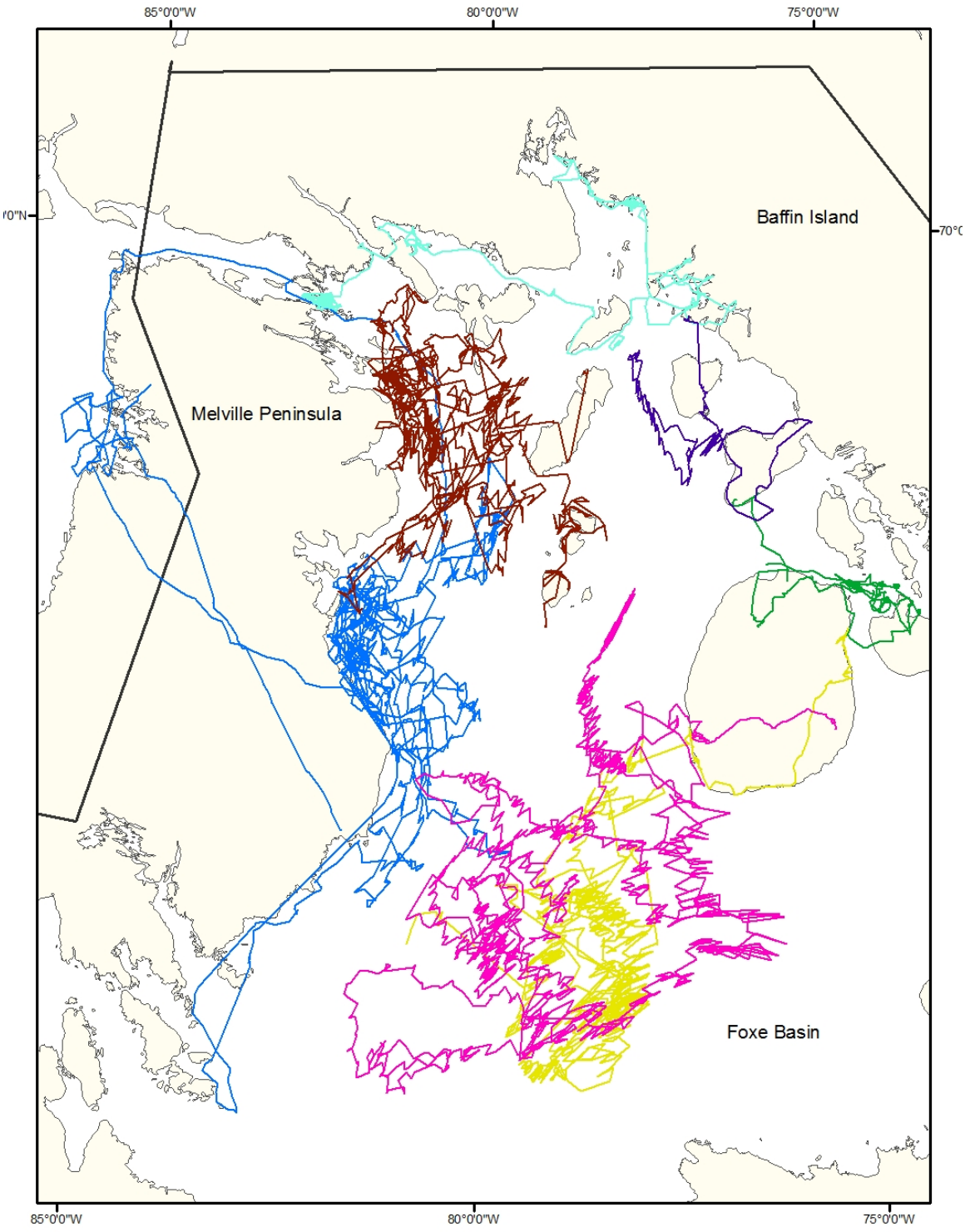

Figure 4. Annual movements of seven satellite collared female polar bears in northern Foxe Basin 2009-2010. Heavy black line shows the Foxe Basin management zone (subpopulation).

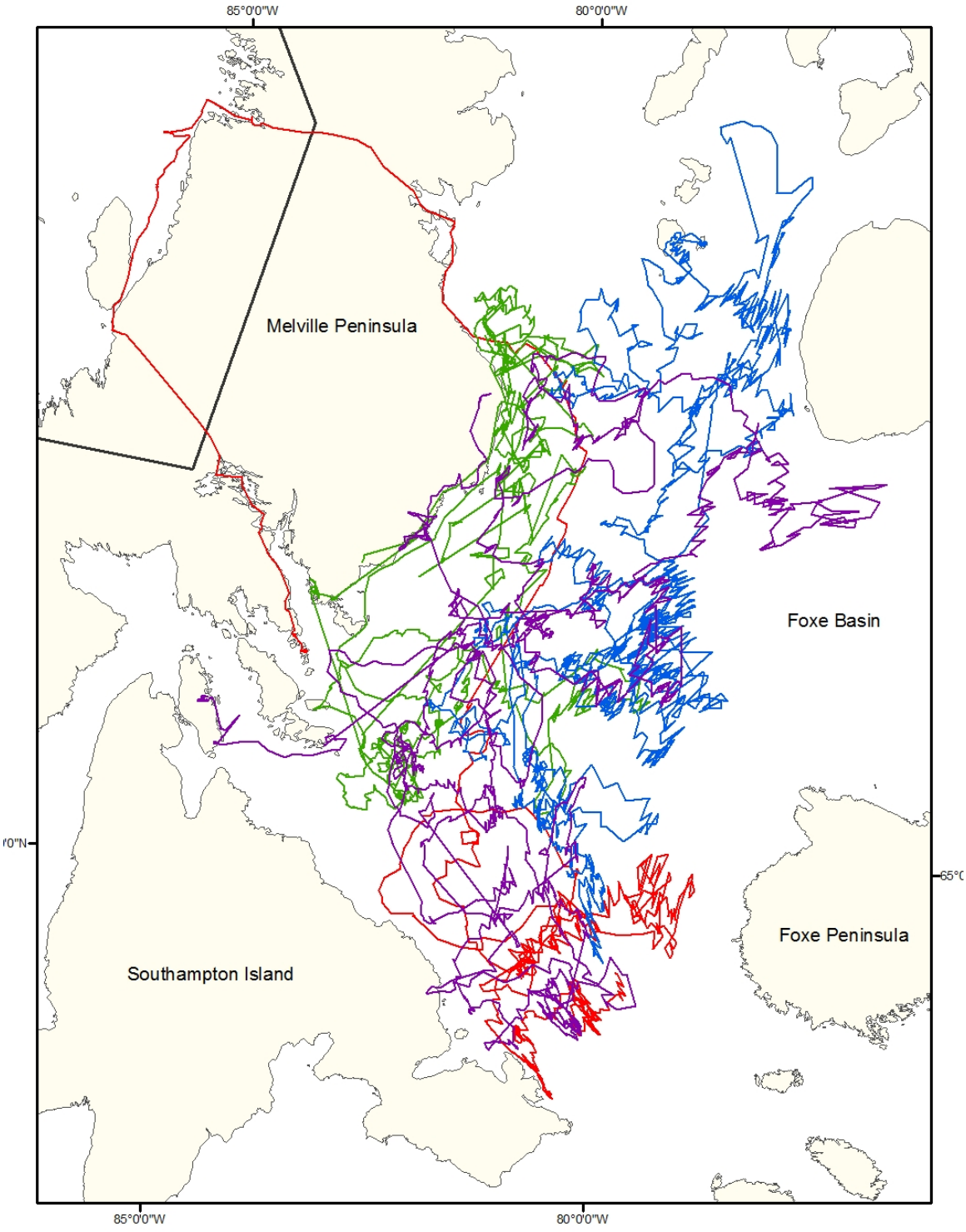

Figure 5. Annual movements of four satellite collared female polar bears in Foxe Basin 2009-2010. Heavy black line shows the Foxe Basin management zone (subpopulation).

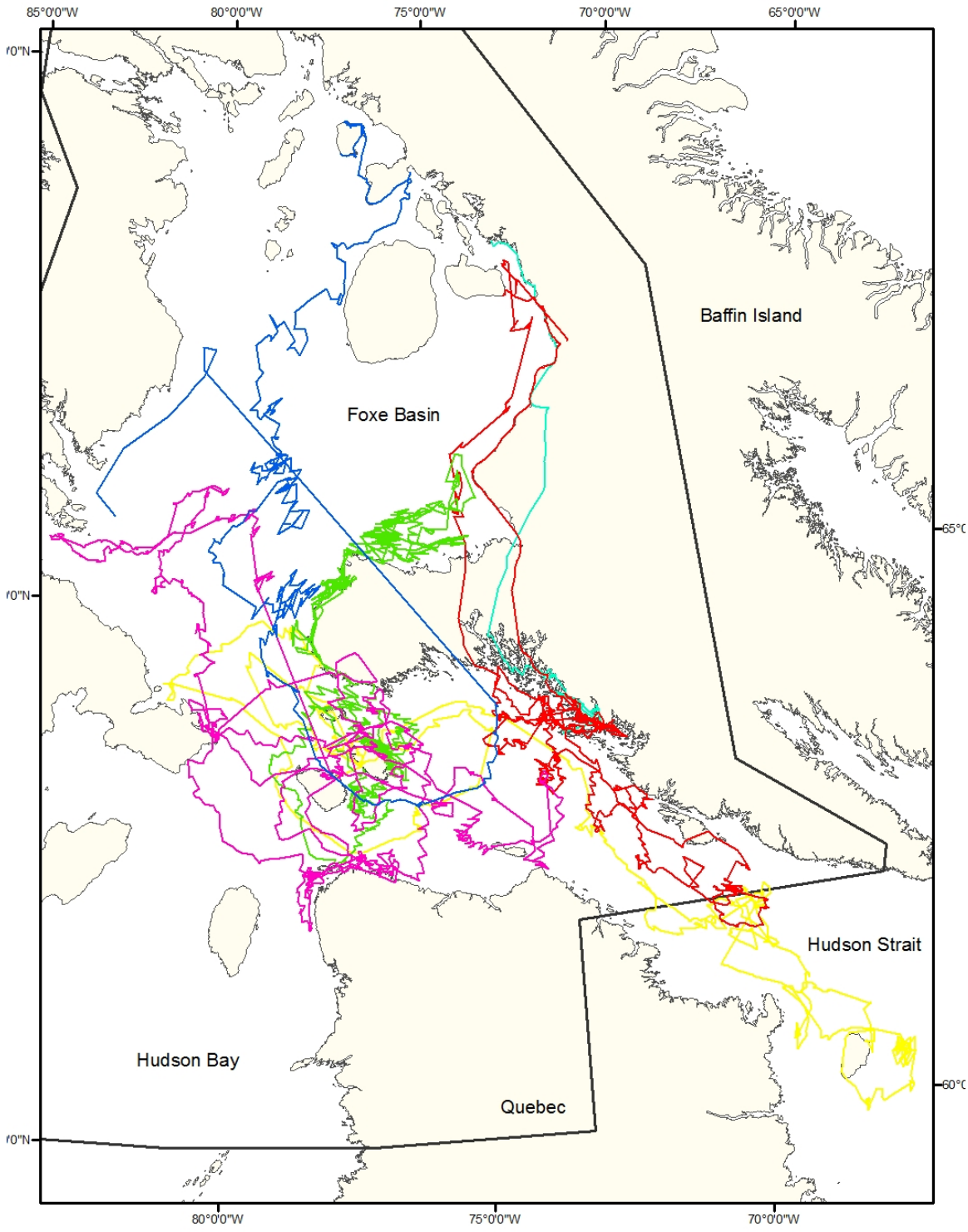

Figure 6. Annual movements of six satellite collared female polar bears in Foxe Basin and Hudson Strait, 2009-2010. Heavy black line shows the Foxe Basin management zone (subpopulation).

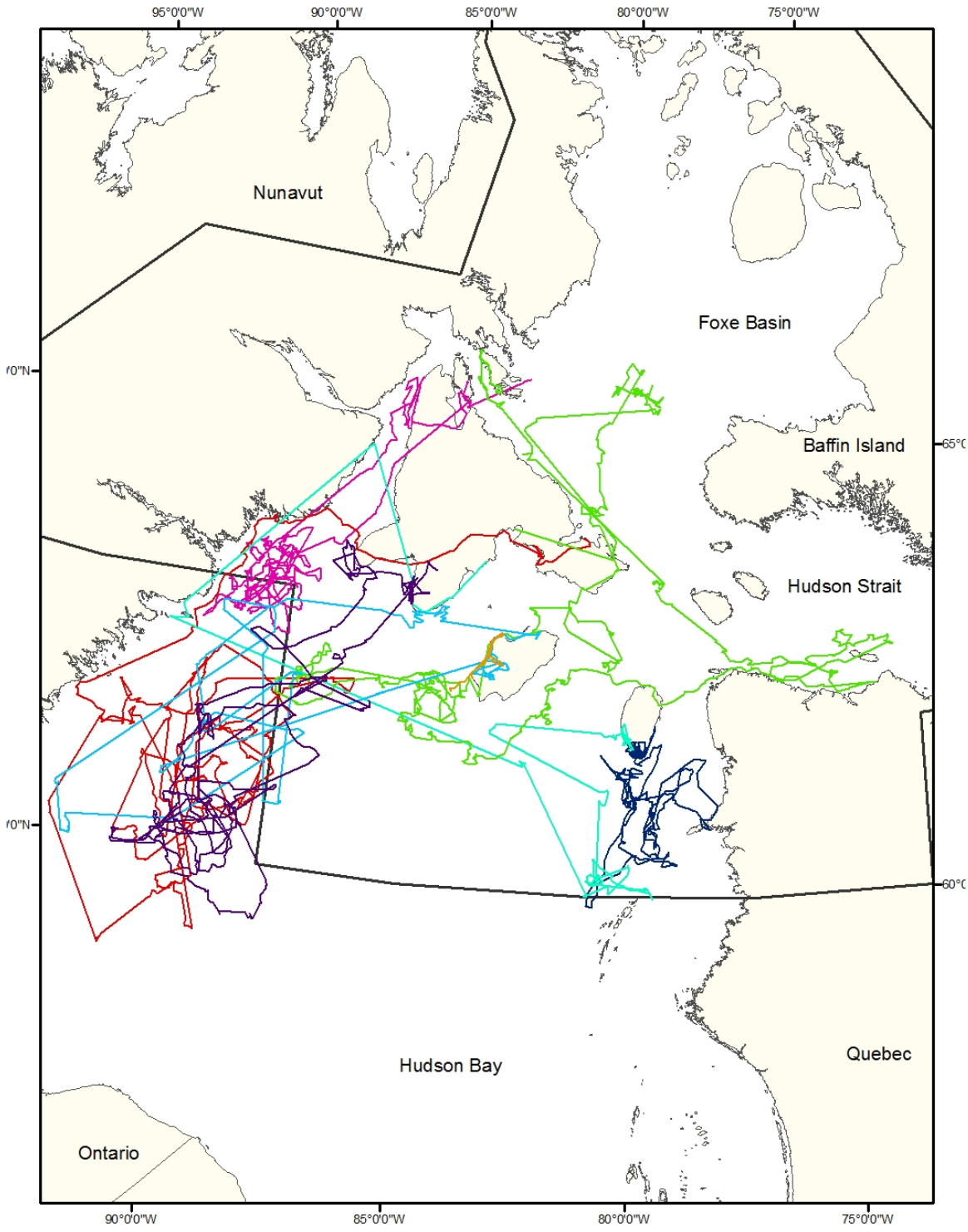

Figure 7. Annual movements of four satellite collared female polar bears in Foxe Basin, Hudson Strait and Hudson Bay, 2009-2010. Heavy black line shows the Foxe Basin management zone (subpopulation).

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