Space Use and Movement Patterns of North Baffin Caribou

NWMB Project No. 03-09-01

Field Summary and Progress Report
December 2011
Ver.2

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ACKNOWLEDGEMENTS

This project was funded by the Department of Environment, Government of Nunavut, Baffinland Iron Mines Inc., the Nunavut Wildlife Management Board, and Polar Continental Shelf Project. It was further supported by the Hunters and Trappers Organizations (HTO) from five local communities, Pond Inlet, Arctic Bay, Clyde River, Igloolik and Hall Beach and by Parks Canada. Special thanks to our pilots Louis Drapeau (2008), Matt O'Brian (2009), Elou (2010) and Maltee Dahler (2011) and engineer Jason Simms. The wildlife capture and collaring team of Heli-Horizons, Paul Dubois, Laurier Breton, and Rolland Lemieux were outstanding. Thanks to a team of observers Grigor Hope, Sheatie Tagak, Mitch Campbell, Jaypiti Inutiq, Andrew Maher, Gerry Courtemanche, Susan Breckon, Alex Millar, Jaylene Goorts, and Ben Widdowson. Personnel at the Mary River exploration camp were extremely helpful, particularly, Trevor Myers, Jim Millard, Cheryl Wray, Cliff Pilgrim, Brian Larson, Dalton Head, David McCann, Jeff Bush, Kirk Keller, Roland Landry, Wendy Wiseman, and John McLean. Thanks to the kitchen crew that feed us so well. Finally, a special thanks to Mike Kristjanson and Tim McCagherty at PCSP for their logistical support, Mitch Campbell for lending his collaring expertise, Grigor Hope for technical support, and to Jane Chisholm for her assistance with permits.

Photos by G. Hope

SUMMARY

As part of a multi-year caribou collaring program to evaluate the distribution, movement, and space use of Barren-ground caribou (*Rangifer tarandus groenlandicus*) on northern Baffin Island, GPS collars were deployed on a total of 32 adult female caribou in April 2008 (n= 4) and April 2009 (n=28). Each collar collected 2 locations per day for a maximum of 27-28 months when the collars were programmed to automatically release. Monitoring efforts throughout the program included the investigation and collection of inactive collars and moralities, the assessment of summer condition and calf production, and the recovery of released collars. Collars deployed in April 2008 automatically released on August 31, 2010, while collars deployed in April 2009, released July 31, 2011. All but 4 collars were located and retrieved. This report provides a brief overview of the project, a summary of the summer field investigations (2010 and 2011), and a preliminary evaluation of the collaring data.

INTRODUCTION

Barren-ground caribou are the only ungulates, which inhabit Baffin Island, Nunavut, Canada. North Baffin caribou are one of three populations (North Baffin, Northeast Baffin, and South Baffin) currently recognized on the island and there is limited knowledge regarding their distribution, abundance, movement and use of space. Based on expert opinion, the number of caribou was estimated at greater than 30,000 in 1985 (Williams and Heard, 1986) and at 50,000-150,000 in 1991 (Ferguson and Gauthier,1992).

Local communities and hunters have reported a decline in North Baffin caribou since the mid 1990s. Notably, harvest data (limited to the NWMB Harvest Study Data 1997-2001) shows an annual decrease in harvest from approximately 4700 in 1997 to ca. 3400 in 2000 (spatial extent, between 73.5N and 69.7 N, and -87.3 W and –73.5 W).

Recent exploration efforts in North Baffin, particularly the Mary River area, has heightened concerns and raised questions about the potential impact of development on caribou fitness and survival. The ecosystem is fragile and changes in habitat quality, access and availability can impact wildlife. Human activity and development may act as barriers or diversions to movement, displace wildlife, and directly effect caribou demographics through increases in mortality (Vistnes and Nellemann 2007, Hansen *et al*. 2001, Dyer 1999, Horejsi 1981). As well, disturbance can have energetic consequence, impacting body condition, calf survival, and reproductive success (Frid 2002, Bradshaw *et al*. 1998, Harrington and Veitch 1992). Notably, both Inuit Qaujimajatuqangit (IQ) and a preliminary calving survey in 1997 (Jenkins 2007) previously identified the Mary River area as important to caribou (Figure 1).

Because detailed information on space use and movement is critical to understanding habitat use and the spatial/temporal dimensions of caribou range,

the principle aim of this program was to deploy GPS collars on adult female caribou across northern Baffin Island and collect daily location data. These data are being used to:

i. evaluate space use and movement of caribou from 2008-2011,
ii. evaluate and characterise caribou range use (including seasonal and annual ranges),
iii. assess fidelity to calving sites
iv. analyse distribution and habitat use, and
v. recommend appropriate conservation and management initiatives.

Supplemental information from sample collections and site investigations will provide valuable data on mortality, cow/calf ratios, body condition, diet, population structure and genetic diversity. A summary of the field results and preliminary analysis of the caribou location data is presented in this report.

1.0 STUDY AREA

In 2008 the study area, ca. 40,000 km^2, was located in northern Baffin Island and extended south from Milne Inlet to Steensby Inlet (from 71.91° to 70.291° N and – 83.0° to –77.0° W). The topography varied from rugged mountainous terrain in the north and east (0 - 960 m ASL), to low lying areas of limited relief in the west and southwest (0-320 m ASL). Based on recommendations from the Arctic Bay HTO, the study area was expanded in 2009 to include the Borden Peninsula (from Admiralty Inlet ca. 85°44' W to approximately 77° W) and portions of Sirmilik National Park (Figure 2).

The study area lies within three ecoregions: the Borden Peninsula, Lancaster Plateau, and the Boothia-Fox Shield, under the broader Northern Arctic ecozone (Environment Canada 1993). The regions are underlain with continuous permafrost and support vegetated areas with moss, low-growing herbs and prostrate shrubs such as purple saxifrage, *Dryas spp,* arctic willow, and sedge. However, large areas of permanent ice and exposed bedrock are also present

within the landscape (Walker *et al*. 2005).

The area is generally characterized by low species diversity, extreme temperature gradients, a short growing season length, low resource availability, low annual productivity and other oscillating environmental conditions (Billings 1987; Forbes *et al*. 2001). Typically, temperatures reach below –30° C in the winter months, with only July, August, and most years June, having average monthly temperatures above 0° C. Snow is usually present between September and June (Environment Canada 2011). In November, the sun sets permanently until late January, leaving the region in darkness for nearly three months. Conversely, between May and August, the sun never sets, contributing to the pronounced, but short, growing season (June-August; Billings 1987).

Within the study area, Baffinland Iron Mines operates field camps at Milne Inlet, Mary River, and Steensby Inlet and a tote road from Milne Inlet to Mary River. The closest communities are Pond Inlet, Arctic Bay and Igloolik (Figure 2).

2.0 PROJECT DESIGN

This multi-year research program utilized standard scientific methods, Inuit Qaujimajatuqangit (IQ), and local knowledge. Through a series of community and HTO meetings both historical and current information on caribou ecology and their seasonal distribution was collected. In conjunction with existing data, this information was used to develop the survey and collar deployment schedule and define the spatial extent of the study area.

2.1. Reconnaissance Survey

In order to locate caribou for collar deployment, reconnaissance surveys were flown between March 29th and April 5th 2008 (AS 350B2 A-Star rotary wing aircraft), and between March 27th and April 13th 2009 (Bell LR rotary wing aircraft). Field crew included three observers in addition to the pilot. We used a systematic line transect design with a random starting location and followed

standard aerial survey techniques and distance sampling methodology (Buckland *et al*. 2001). Lines were positioned 10 km apart and ran east-west across the study area. Survey routes were developed in Map Source© and uploaded to Garmin© GPSmap 276C units to facilitate navigation. Transects covered the entire land base; we did not survey sea ice or large ice fields and glaciers. The survey was flown approximately 120 m (400ft) above ground level at an average air speed of 130 km/hr. Upon detection, the helicopter rose in elevation before approaching the caribou to record group size and the location where they were first observed. To minimize disturbance and reduce the potential for movement, animals were not sexed or aged. All data were recorded in field books and flight tracks were logged and downloaded daily from the GPS units. All data were integrated in a Geographical Information System where the perpendicular distance from each animal group to the transect line was determined.

When caribou tracks were encountered, they were flown (for up to 5 km) in an effort to locate caribou for collaring. If caribou were encountered, GPS locations were recorded and provided to the collaring crew. Track investigation was limited to areas outside Sirmilik National Park.

2.2. GPS Collars and Data

Telonics GPS generation III TGW-3580 collars, with an automatic release (CR-2) mechanism, a partial cast, and a VHF beacon, were purchased for deployment on caribou in North Baffin, Nunavut. The GPS collars were programmed to acquire two locations per day (+/- 15m), which are stored in the on-board memory and transmitted every 3 days to the ARGOS DCLS (data collection system) on board the NOAA polar orbiting satellite(s). The location data were recovered by CLS America Inc. and provided to the user on CDs.

2.3. Collaring

Collar deployment was scheduled to occur in parallel with survey efforts using a second helicopter and professional capture team (Pathfinder Helicopter Wildlife Management, 2008; Heli-horizons, 2009). The collaring team included a pilot, net gunner and handler.

Using the survey data, the collaring team returned to the location of each caribou group and an outward spiraling search pattern was initiated if caribou were not present. Once located, the aircraft was used to move the animals to a suitable capture area, specifically an area with deep snow (Valkenburg *et al*. 1983) or flat, soft, and level terrain. Capture involved shooting a net over the caribou. Only female caribou in good condition were considered for capture. Once the net was deployed, the aircraft landed and personnel tended to the animal. The caribou was untangled from the net, and a blindfold and hobbles applied. The body condition was assessed (including photo documentation), a neck measurement and hair sample collected, and the GPS collar fitted. The collared animal was released and a fecal sample was collected from the capture site (if available). A data sheet was completed for each capture event.

To ensure that collars would be broadly distributed throughout the study area, collar deployment was limited to one adult female per caribou group; each animal representing an independent sample unit. Animal capture and handling followed detailed Animal Care Protocols reviewed and accepted by the Department of Environment, GN, and Parks Canada, after significant consultation and input from participating HTOs.

2.4. Status of Caribou and Collar Retrieval

The status and condition of collared caribou was monitored post collar-deployment in 2008. This included retrieving collars and information from hunters that harvested collared animals, investigating inactive collars, retrieving collars at mortality sites, and assessing the status and condition of animals with active collars. Field activities generally corresponded with collar drop-off and

retrieval efforts due to the remote location, large study area, and resource limitations.

Using a rotary wing aircraft, a VHF receiver, and the most recent GPS locations for each collar (referred to as the PPT site) all active and inactive collars were investigated prior to collar release. At the PPT sites, circular patterns were flown to locate the collars and in the event that collars could not be located, data on the site, occurrence of tracks, faeces, and other sign were gathered.

3.0 RESULTS

3.1. Reconnaissance Survey 2008 and 2009

In 2008, a total of 4,587 kilometers of primary transect were flown across the study area. Total flight time for the survey (including ferries to and from location) was 50.52 hours. Nine (9) groups of caribou, from 2 to 15, were observed, for a total of 47 individuals (Figure 3). This included caribou seen while flying transects (identified as on-transect), but also opportunistic observations collected while traveling to and from base camp, traveling between transect lines or by following caribou tracks traveling (identified as off-transect). The number of on-transect encounters was too low to generate a robust density estimate using Distance Sampling (Buckland et al. 2001). For survey details see Jenkins (2008).

In 2009, a total of 7,186 kilometres of transect were flown across the study area. Excluding duplicates, 23 groups (ranging in size from 1-19) of caribou were observed, for a total of 119 individuals. This included caribou seen while on-transect, but also opportunistic observations collected off-transect (Figure 4). The number of on-transect encounters was too low to generate a robust density estimate using Distance Sampling. For survey details see Jenkins (2009).

Data are being analysed to determine if sufficient encounters are available to generate abundance estimates using Strip Transect (Jolly 1969). A limitation of

this method includes using a narrow strip width that supports the assumption that all caribou have been observed.

3.2. Collar Deployment 2008 and 2009

In April 2008 and 2009, caribou location data from reconnaissance surveys were used to deploy a total of 32 Telonics© GPS Generation III collars on adult female caribou (Figure 3 and 4). Caribou were captured using a net gun (n = 4, 2008; n=28, 2009) from a McDonald Douglas 500D (2008) and A-Star (2009) helicopter, operated by a pilot, net gunner and handler. Only one animal per group was collared; each animal representing an independent sample unit. There were no moralities or serious injuries to caribou during deployment.

3.3. Status of Caribou and Collar Retrieval

Field investigations and collar retrieval, based from Mary River, took place on August 30-31, 2010 and from July 28-31, 2011, with final collection of released collars on September 9, 2011.

2010 Field Program - In August 2010, we flew to 19 PPT sites. A total of 36 caribou (including 8 with collars) were observed directly and the tracks of an additional six caribou (3 cow/calf pairs) were observed. Among the eight females observed directly, six were accompanied by calves (Figure 5; Table 1). Collars were retrieved at six mortality sites and information was collected to determine the cause of death.

2011 Field Program - In July 2011, we flew to 11 PPT sites. A total of 14 caribou were observed, including three with collars. The tracks of an additional four caribou (2 cow/calf pairs) were observed at two of the PPT sites. Each of the collared females was accompanied by a calf (Figure 6; Table 2). The number of sightings was low and could be attributed to poor visibility and low light conditions during two of the three nights flown, particularly July 28th and July 31st when flights were cut short due to heavy winds and rain. Three of the 11 PPT sites

were moralities. We collected collars and investigated the cause of death at two sites. A collar/caribou could not be located at the third site where the best last location corresponded to a river.

A summary of the collared animals, tracking period, and status is provided on Table 3. Of the 32 animals collared, 10 caribou remained active throughout the study period, 13 were harvested, 5 died of natural causes and 4 of unknown causes (Figure 7).

3.4. Preliminary Analysis of Location Data

Caribou Range - The range of collared caribou in northern Baffin was defined as the 100% minimum convex polygons (MCP; Jennrich and Turner, 1969) of all caribou locations following Ferguson and Elkie (2004) and was calculated using Hawths Tools extension for Arc Map (Figure 8). The area covers 50,138 km^2 and extends approximately 250 km north to south, and 300 km east to west.

From the survey and local information, we know that caribou occur beyond this area, but in 2008 and 2009 they occurred in very low numbers. For example, collars were not deployed on the Borden Peninsula where only 3 small groups of caribou, representing 5 individuals, were located (Jenkins 2009).

Caribou Calving – The area used during calving was delineated as a 100% MCP surrounding all caribou locations collected between May 26 and July 15th, 2008 through 2011. Following Russell *et al*. (2002), this period was chosen with consideration for pre-calving cows, initiation of calving, natural variation in the time of year when calves are dropped, and calf reliance on milk intake for maintenance and growth. The area, 32,670 km^2, extends 200 km north-south and 220 km east-west (Figure 10).

Movement – The movement paths of all collared caribou were mapped using Hawth's Tools extension for Arc Map©. Figure 9 illustrates the regional scale of

caribou movement and fidelity to northern Baffin Island. Regionally, adult female caribou generally maintained a dispersed distribution throughout the year although the movement of some individuals to an area north of Mary River during the calving period is apparent (e.g. PPT 37492, PPT36835). Analysis of movement direction, rates and seasonal patterns is on-going.

Individual Home Range – The annual home range of individual caribou was defined by a 100% MCP; only caribou tracked for at least 12 months were included in this analysis. In total, data from 19 female caribou were analyzed and mapped (Figures 11-29). Home ranges varied in size from 462 km^2 to 5456 km^2. Seasonal range use and movement are being analyzed and preliminary mapping of locations data suggests that for some caribou there may be separation between seasonal use areas e.g. calving.

4.0 DISCUSSION

Data analysis is on-going and updates to this report will be provided when available.

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TABLES AND FIGURES

Table 1: Summary of field observations for August 30th and 31st, 2010.

Obs. #	Date	Location		PPT (Collar)	Group Size	Composition						Notes	Cause of Mortality	Samples Collected
		Lat.	Long.			Collared Cow	Bull	Cow	Yearling	Calf	Unk			
1	30-Aug-10	70.0849	-76.2256	37493	DIED							Caribou skeleton found. Likely starved.	Natural	leg, jaw
2	30-Aug-10	70.5515	-76.0310	36841	Unknown (Tracks)	Not Seen		1		1		Feces and cow/calf prints. Samples.		feces, cow and calf tracks
3	30-Aug-10			Not Collared	1		1							
4	30-Aug-10	70.3270	-78.4320	37490	Not Seen							no sign		
5	30-Aug-10	70.4376	-77.7829	36847	DIED							Wolf Scat,	Wolf	wolf scat
6	30-Aug-10	70.5056	-77.6261	37052	2	1				1		Good Condition,		
7	30-Aug-10	70.5704	-77.681	36842	5	1		1	1	2		Good Condition,		
8	30-Aug-10	70.5636	-77.2606	37054	Not Seen							One large male in area (see below).		
9	30-Aug-10	70.5839	-77.1639	Not Collared	1		1					In area of 37054		
10	30-Aug-10	70.7334	-78.7948	36848	DIED							Located beside river, collar on rock. Head in water.	UK	
11	30-Aug-10	70.7161	-78.7360	37055	Not Seen							no sign		
12	30-Aug-10	70.9798	-76.6182	37407	DIED							Collar not located, wash out, boldery area, hair but no other evidence.	UK	
13	30-Aug-10	71.0571	-76.9456	37123	DIED							Natural Mortality - scaveged on.	Natural	teeth, 2 legs
14	31-Aug-10	71.2013	-80.2139	37492	2 (Tracks)	Not Seen		1		1		prints on sand, cow and calf, scat sample.		cow and calf tracks, feces
15	31-Aug-10	71.8538	-79.7129	37048	2	1			1			WP near location.		
16	31-Aug-10	71.5405	-78.9136	36840	Unknown (Tracks)							lots of tracks, including calves. See other F (without collar) and calf .		tracks
17	31-Aug-10			Not Collared	2			1		1		Not collared (see above). Photos.		
18	31-Aug-10	71.7494	-77.4049	37033	2 (Tracks)	Not Seen		1		1		Not seen. Tracks seen and fecal samples taken.		tracks and feces
19	31-Aug-10	71.3921	-76.9881	36846	5	1	1			1	2	Very good condition.		
20	31-Aug-10	71.3894	-77.6627	37025	9	2	2	1		3	1	2 Collared animals together.		
		71.3889	-77.6695	36851	Not Seen									
21	31-Aug-10	71.2617	-77.9602	36843	Not Seen							On side of hill, rocky, beautiful valley, no sign, travelling?		
22	31-Aug-10	70.7161	-78.7360	37055	2	1		1				Near location		
23	31-Aug-10	70.3270	-78.4320	37490	8	1	2	1		2	2	Near location, very good condition,		
24	31-Aug-10	70.5636	-77.2606	37054	DIED							Wolf scat, jaw teeth, collar on rocks near lake.	UK	

Table 2: Summary of field observations for July 28th to 31st, 2011.

Obs. #	Date	Location		PPT (Collar)	Group Size	Composition						Notes	Cause of Mortality	Samples Collected
		Lat.	Long.			Collared Cow	Bull	Cow	Yearling	Calf	Unk			
1	July 28 2011	71.3683	-78.0600	36851	Not Seen							Rocky highland		no samples collected
2	July 28 2011	71.3134	-77.9955	36843	1	Not Seen		1				Good condition, large antlers, no calf.		no samples collected
3	July 28 2011	71.4181	-77.7534	37025	4	1			1	1	1	Adult female in good condition. In river basin at junction of two streams		no samples collected
4	July 28 2011	71.3914	-76.9338	36846	Not Seen	Not Seen								2 fecal samples
5	July 28 2011	71.5125	-78.7096	36840	Unknown (Tracks)	Not Seen		1		1		Tracks with calf.		6 fecal samples,
6	July 28 2011	70.7268	-78.7348	37055	Unknown (Tracks)	Not Seen		1		1		Tracks with Calf		3 fecal samples and 1 old jaw
7	July 28 2011	70.3801	-78.4221	37490	Not Seen									6 fecal samples
8	July 29 2011	70.7949	-76.7621	Not Collared	2		2					seen while ferrying to 36841 ppt site		
9	July 29 2011	70.6146	-75.9546	36841	5	1				1	3			2 fecal samples
10	July 29 2011	70.4406	-77.6896	37052	Not Seen									3 fecal samples and 3 sets of tracks
11	July 29 2011	70.4371	-77.6245	36842	DIED							Collar Pick-up, mortality, preyed on	Wolf?	1 fecal sample, 1 hair/skin sample, 1 jaw
12	July 29 2011	69.9916	-76.9818	36838b	DIED							Collar Pick-up, couldn't locate collar. Possibly in river. BLD Jan.6, 2011	Unknown	no samples collected
13	July 29 2011	70.3835	-78.4274	37490	2	Not Seen		1		1				
14	July 29 2011	71.7826	-77.6296	37033	DIED							Collar Pick-up, natural morality, scavenged on.	Natural	1 wolf fecal sample, 1 leg, 1 lower jaw
15	July 31 2011	70.3636	-78.5763	37490	Not Seen							Poor Lighting Conditions. Hunting camp.		no samples collected
16	July 31 2011	70.4249	-77.6296	37052	2	1				1		Collars detached that morning, but given location of the female in relation to the last gps point downloaded, the cow seen was likely the collared cow.		no samples collected
17	July 31 2011	70.7301	-78.6960	37055	Not Seen							Poor Lighting Conditions.		no samples collected
18	July 31 2011	71.3459	-78.0443	36851	Not Seen							Raining, dark, very bad lighting conditions		no samples collected
19	July 31 2011	71.3645	-78.2594	36843	Not Seen							Raining, dark, very bad lighting conditions		no samples collected

Table 3: Summary of collar deployment and end status, 2008-2011.

CTN #	Decimal #	Collar #	Date Collared	Date collared month	Date collared day	Date collared year	Best Last Date	Best Last Date month	Best Last Date day	Best Last Date year	Suspected Cause of Mortality
608608	36835	1	4/6/2008	April	6	2008	2/21/2010	February	21	2010	Harvested
608609	36836a	2	4/12/2008	April	12	2008	5/17/2008	May	17	2008	Harvested
608609	36836b	2	4/13/2009	April	13	2009	3/18/2010	March	18	2010	Harvested
608616	36844	9	4/9/2009	April	9	2009	9/1/2009	September	1	2009	Harvested
608620	36849	13	4/10/2009	April	10	2009	5/16/2009	May	16	2009	Harvested
608624	37030	17	4/10/2009	April	10	2009	3/3/2010	March	3	2010	Harvested
608626	37035	19	4/8/2009	April	8	2009	3/24/2010	March	24	2010	Harvested
608628	37050	21	4/9/2009	April	9	2009	8/29/2009	August	29	2009	Harvested
608611	36838a	4	4/13/2008	April	13	2008	4/14/2008	April	14	2008	Unknown
608610	36837	3	4/12/2008	April	12	2008	8/31/2010	August	31	2010	Alive as of August 2010
608618	36847	11	4/12/2009	April	12	2009	11/21/2009	November	21	2009	Natural Mortality
608633	37407	26	4/8/2009	April	8	2009	7/23/2009	July	23	2009	Unknown
608613	36841	6	4/10/2009	April	10	2009	7/31/2011	July	31	2011	Alive as of July 2011
608619	36848	12	4/12/2009	April	12	2009	5/28/2009	May	28	2009	Unknown
608632	37123	25	4/8/2009	April	8	2009	4/25/2010	April	25	2010	Harvested
608634	37408	27	4/12/2009	April	12	2009	8/14/2010	August	14	2010	Harvested
608637	37493	30	4/13/2009	April	13	2009	11/3/2009	November	3	2009	Natural Mortality
608611	36838b	4	4/13/2009	April	13	2009	1/6/2011	January	6	2011	Unknown
608612	36840	5	4/9/2009	April	9	2009	7/31/2011	July	31	2011	Alive as of July 2011
608614	36842	7	4/12/2009	April	12	2009	11/5/2010	November	5	2010	Natural Mortality
608615	36843	8	4/8/2009	April	8	2009	7/31/2011	July	31	2011	Alive as of July 2011
608617	36846	10	4/8/2009	April	8	2009	7/31/2011	July	31	2011	Alive as of July 2011
608621	36851	14	4/8/2009	April	8	2009	7/31/2011	July	31	2011	Alive as of July 2011
608622	36852	15	4/10/2009	April	10	2009	6/1/2010	June	1	2010	Harvested
608623	37025	16	4/8/2009	April	8	2009	7/31/2011	July	31	2011	Alive as of July 2011
608625	37033	18	4/9/2009	April	9	2009	5/7/2011	May	7	2011	Natural Mortality
608627	37048	20	4/8/2009	April	8	2009	6/1/2011	June	1	2011	Harvested
608629	37052	22	4/10/2009	April	10	2009	7/31/2011	July	31	2011	Alive as of July 2011
608630	37054	23	4/9/2009	April	9	2009	3/4/2010	March	4	2010	Natural Mortality
608631	37055	24	4/9/2009	April	9	2009	7/31/2011	July	31	2011	Alive as of July 2011
608634	37490	28	4/12/2009	April	12	2009	7/31/2011	July	31	2011	Alive as of July 2011
608636	37492	29	4/12/2009	April	12	2009	Unknown	May?	20?	2011	Harvested

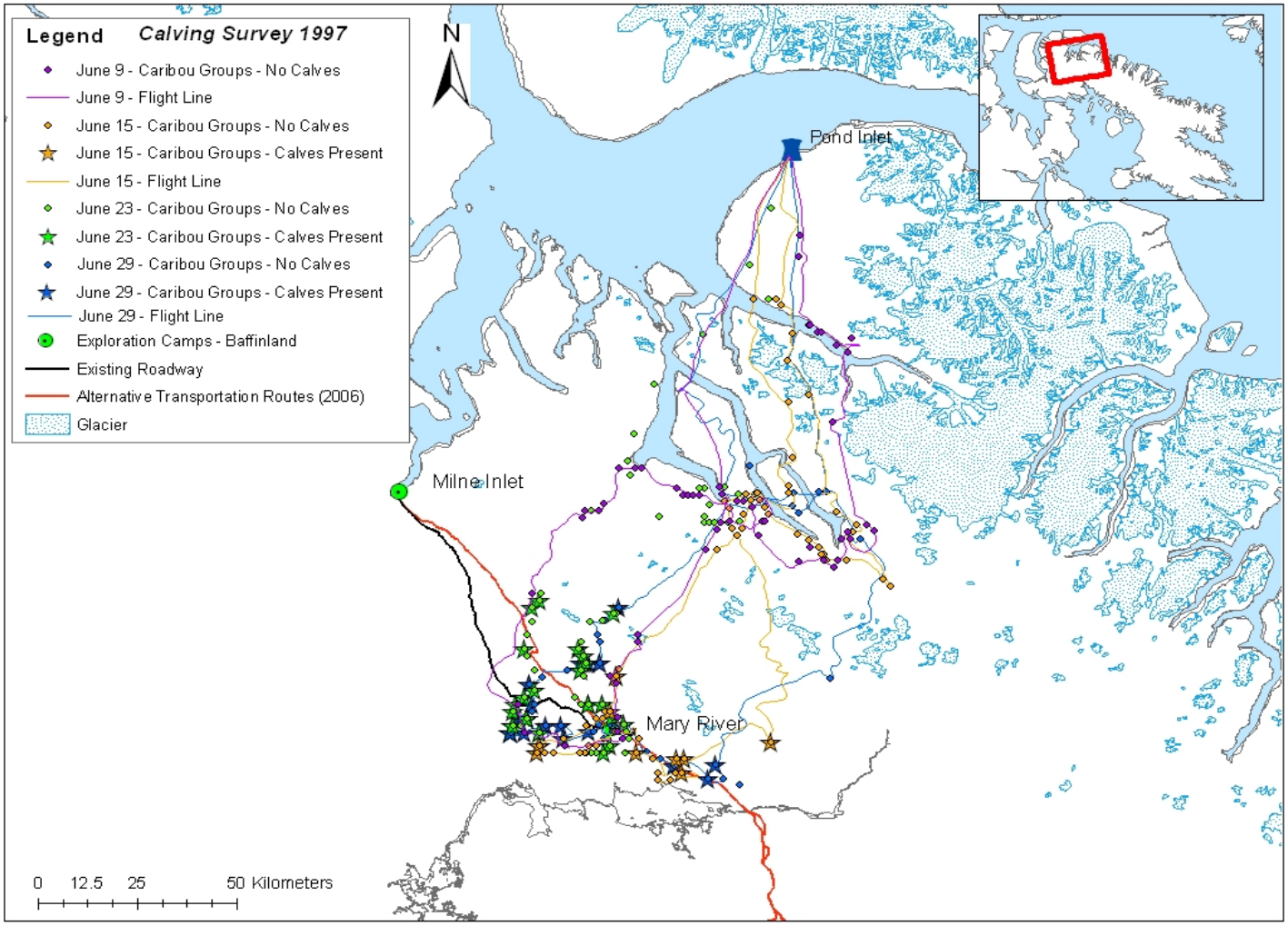

Figure 1: A preliminary calving survey, completed in June 1997, used non-random flight lines from Pond Inlet to the Mary River area to record the occurrence of caribou groups with and without calves. June 15, 1997 – 12 groups with 13 calves; June 23, 1997 – 38 groups with 59 calves; June 29, 1997 – 28 groups with 52 calves.

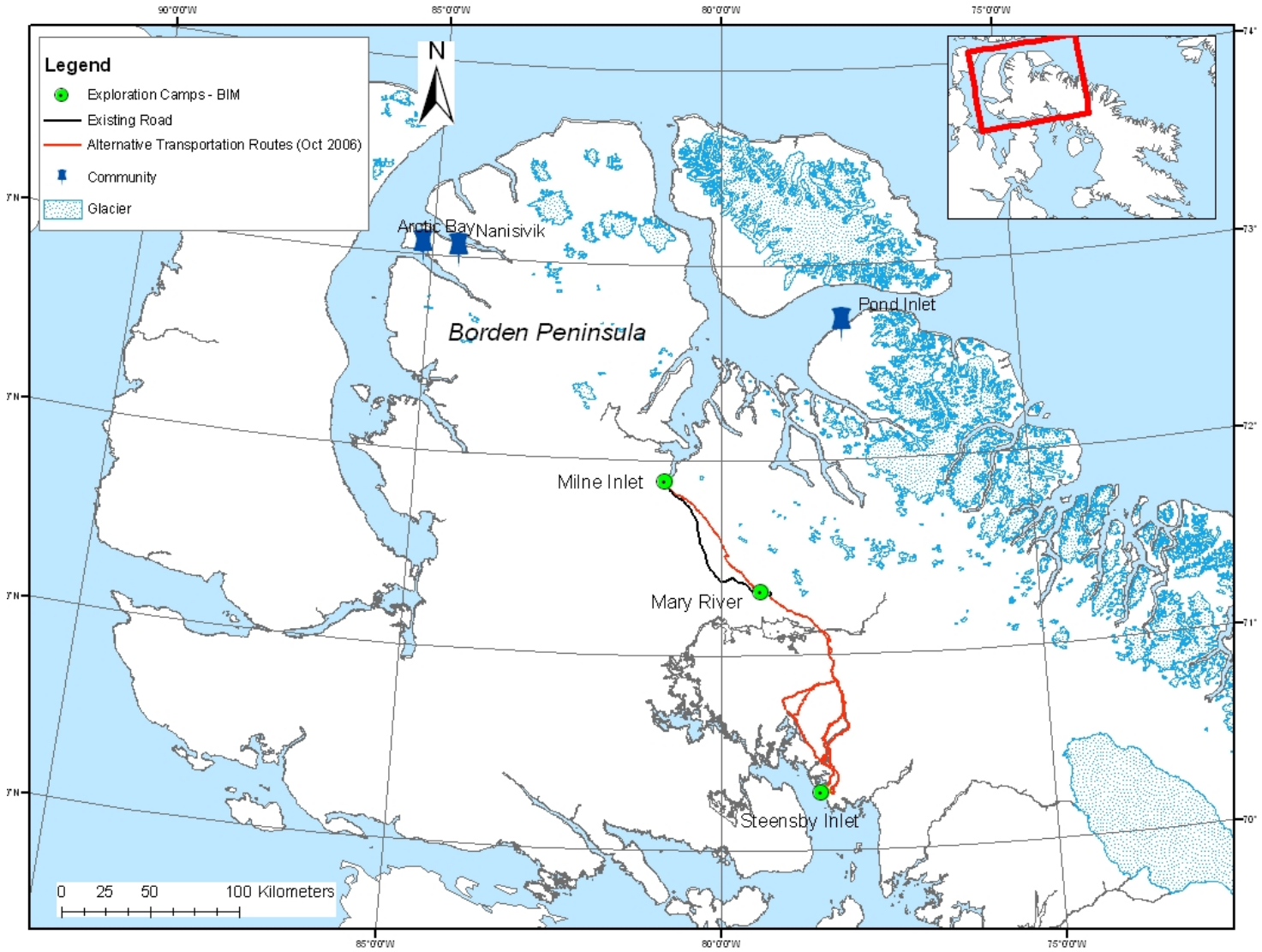

Figure 2: The study area on northern Baffin Island extended across the Borden Peninsula and south to Steensby Inlet.

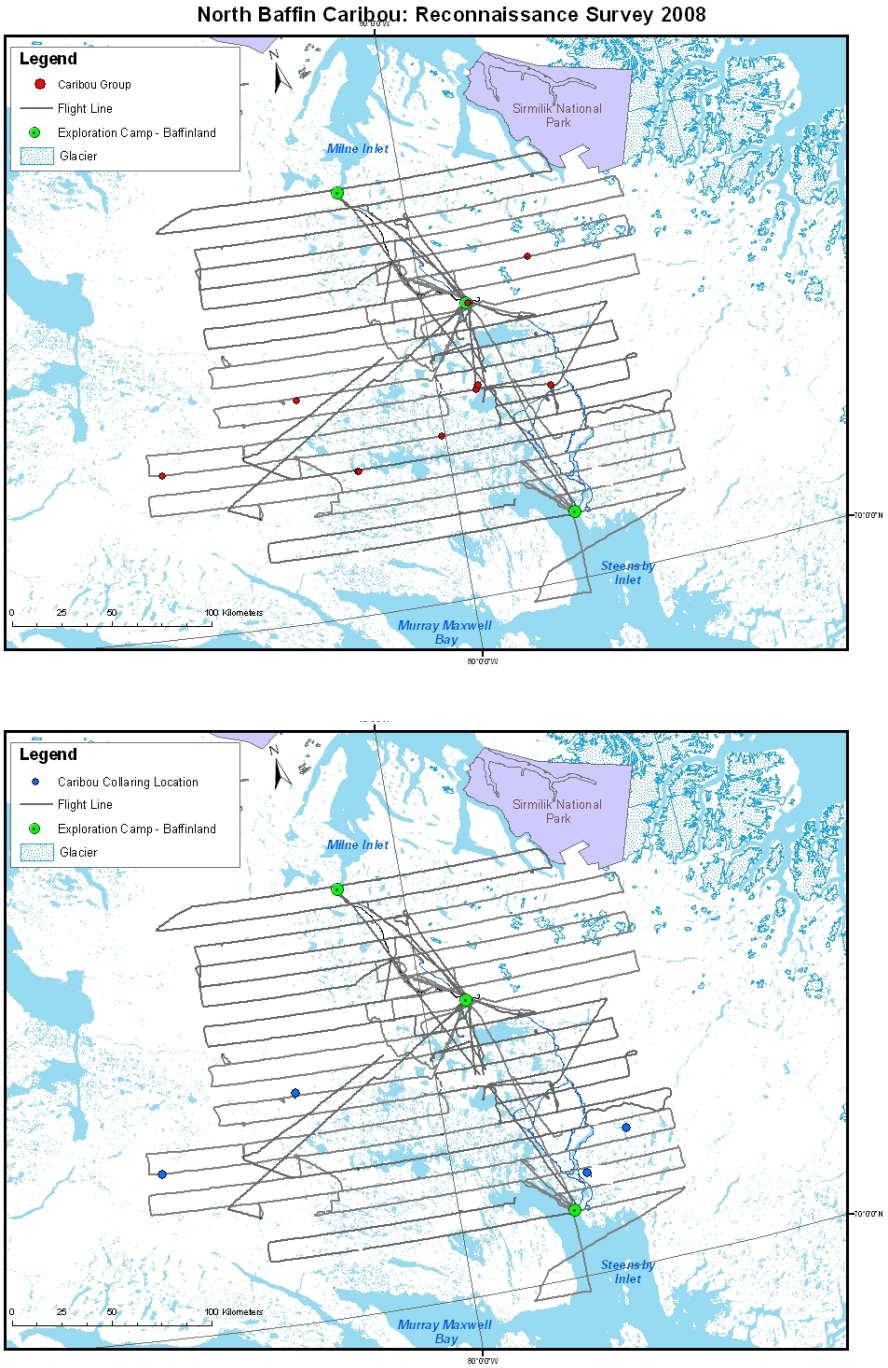

Figure 3: In March-April 2008, the reconnaissance survey centred on Mary River. The majority of caribou observations and all collaring locations occurred south of Mary River.

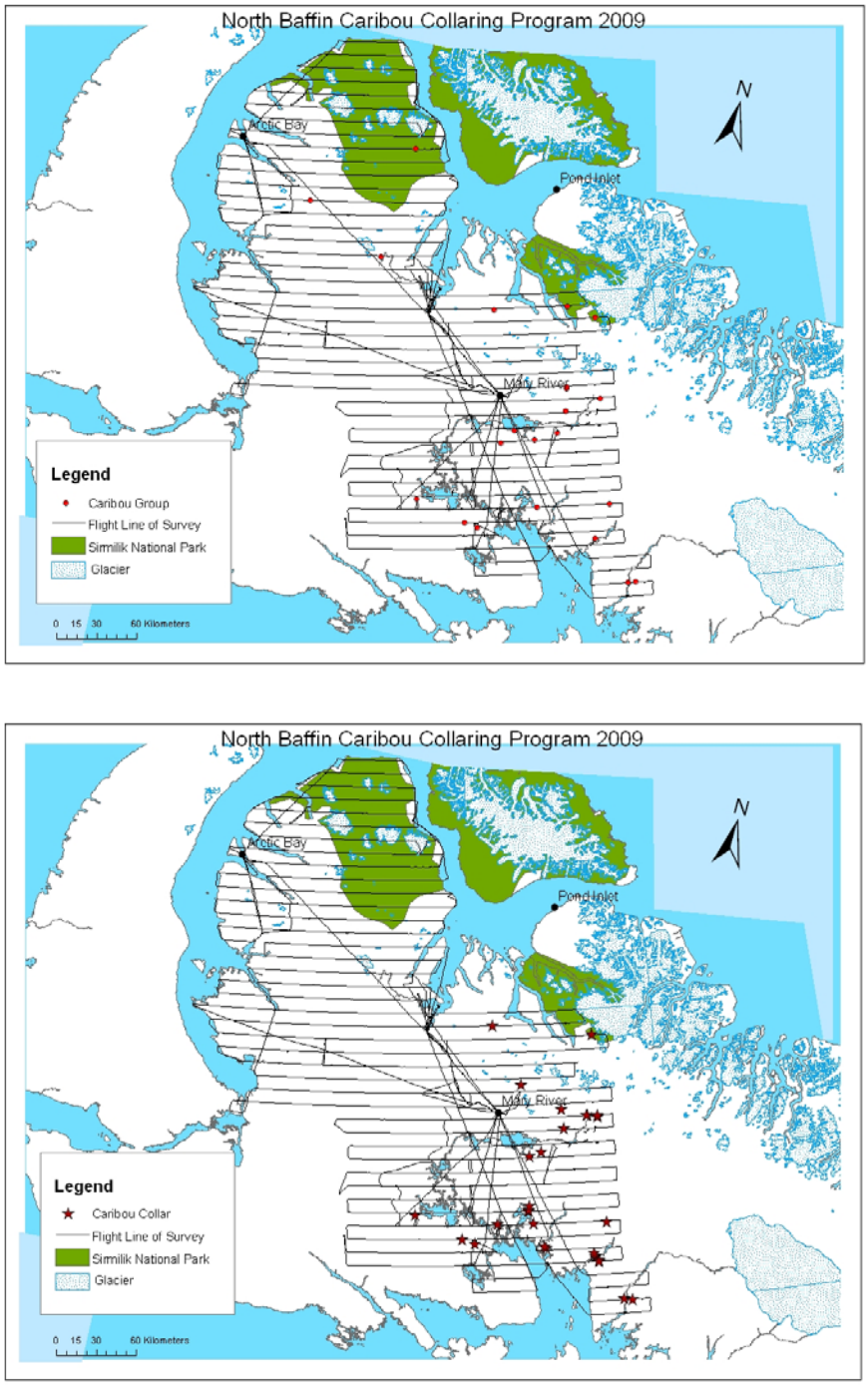

Figure 4: In March-April 2009, the spatial extent of the reconnaissance survey extended to include the Borden Peninsula. The majority of caribou observations and most collaring locations occurred south of Mary River.

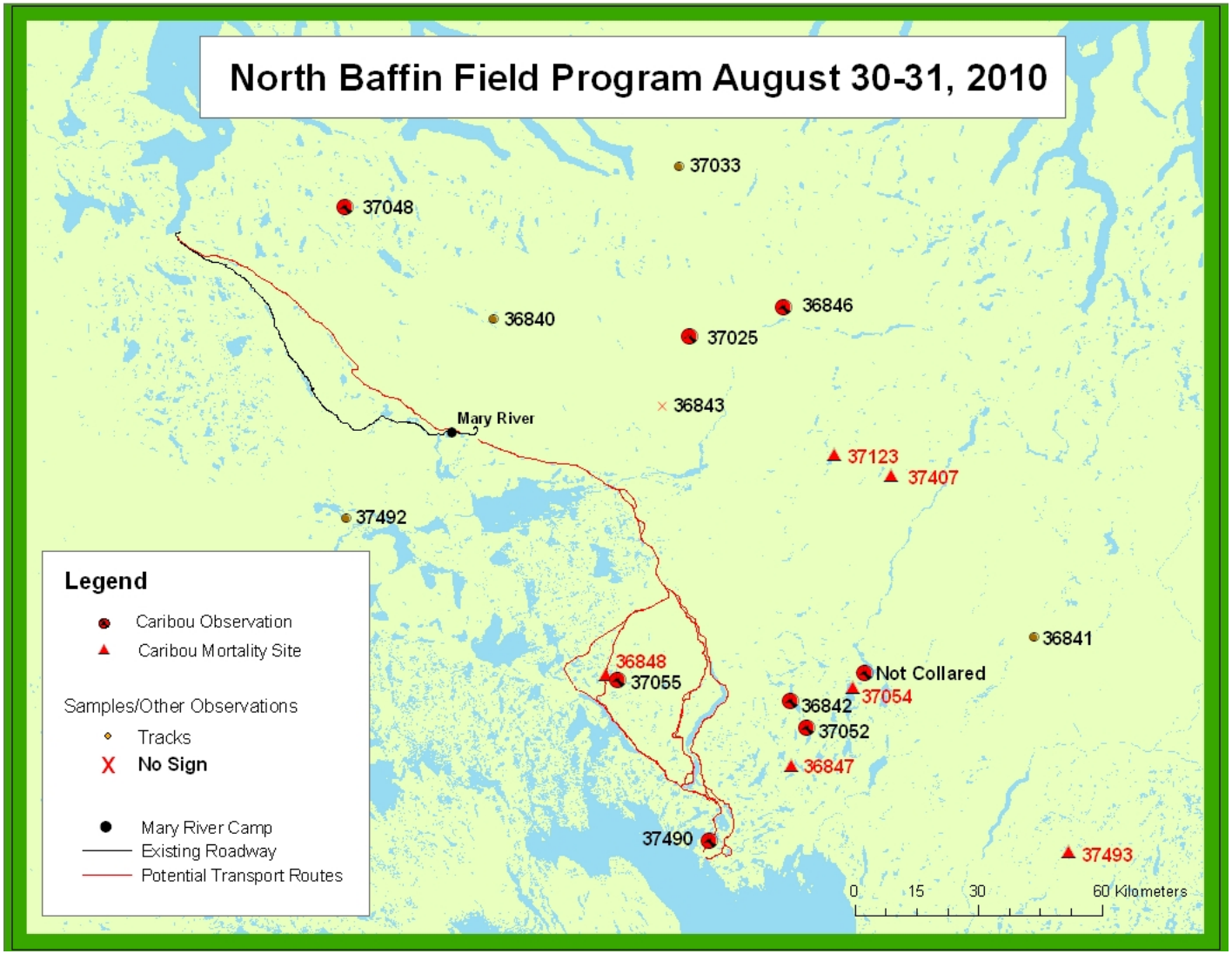

Figure 5: Summary of field observations for August 30th and 31st, 2010.

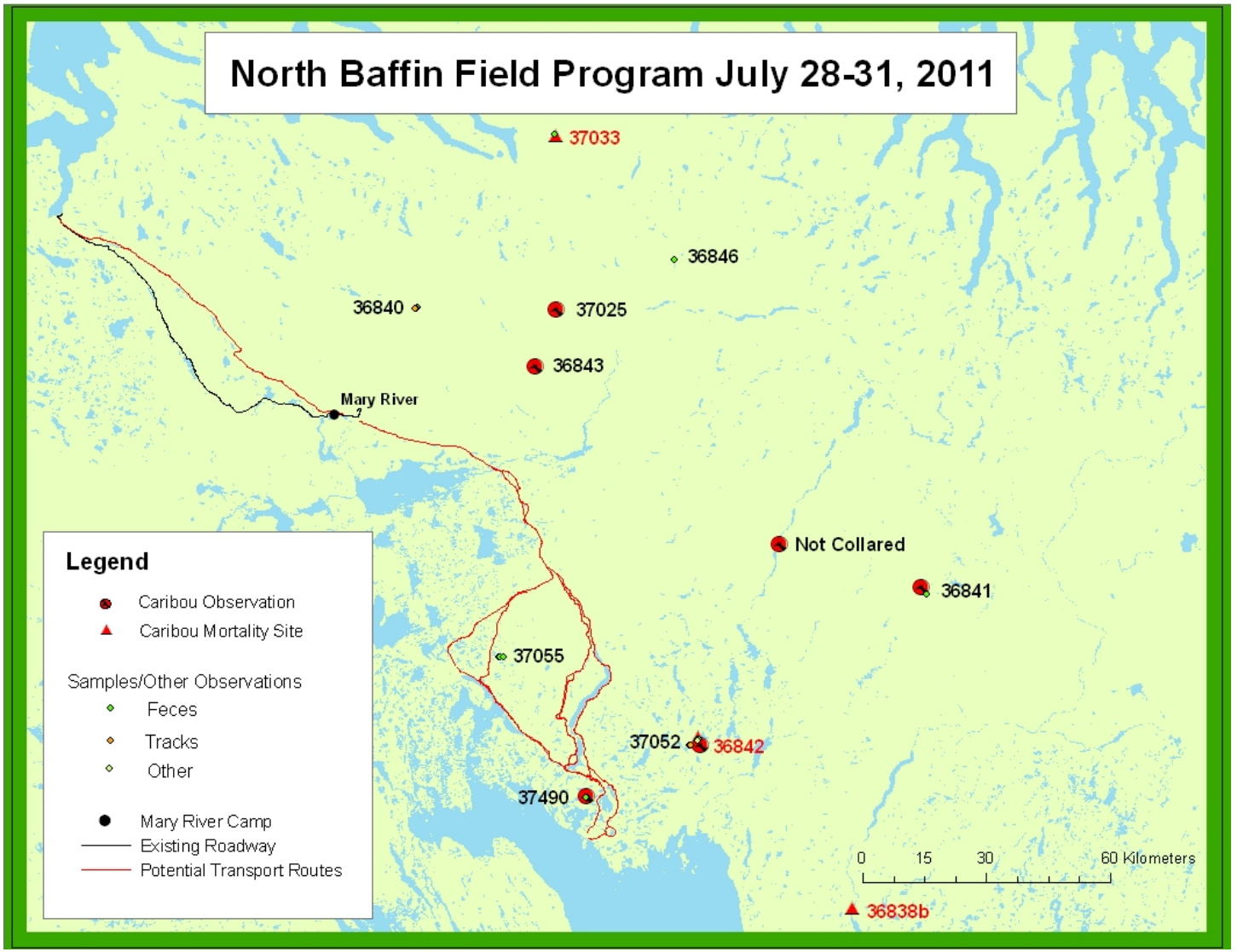

Figure 6: Summary of field observations for July 28th to 31st, 2011

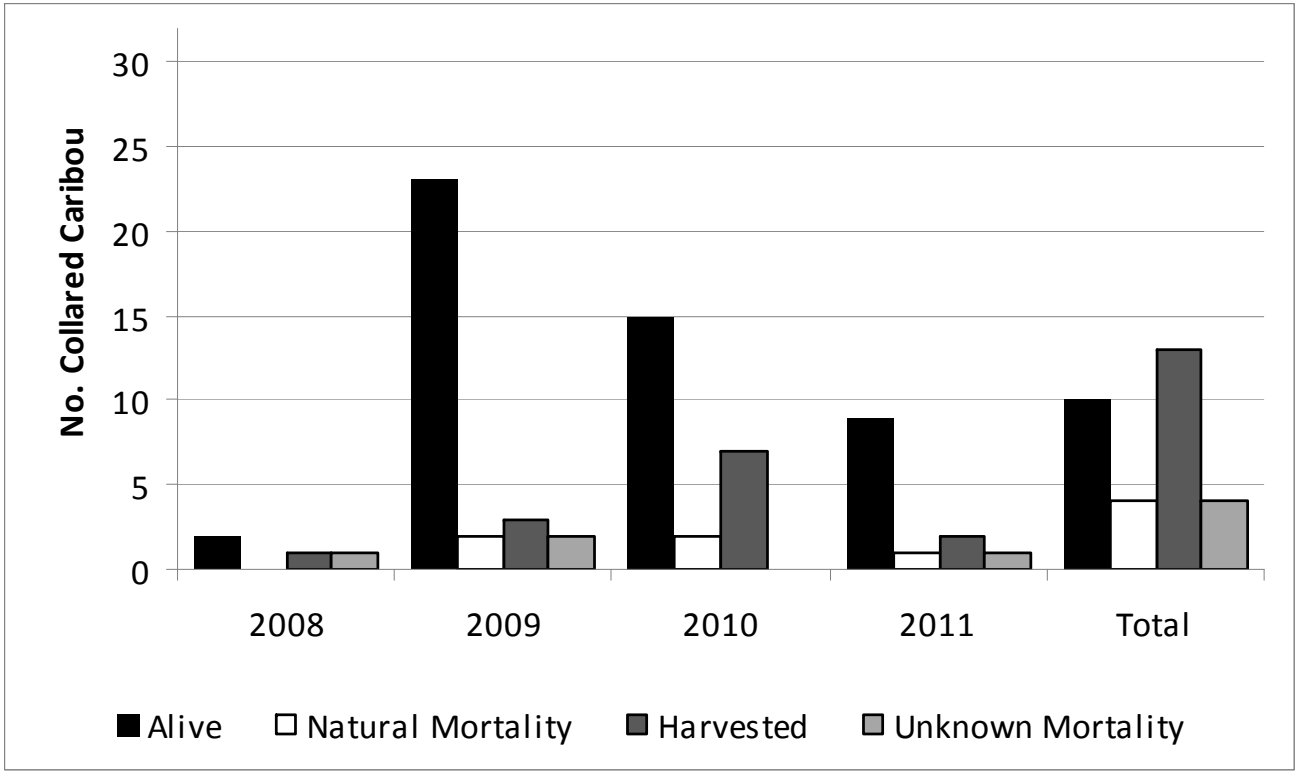

Figure 7: Status of caribou by year, 2008-2011.

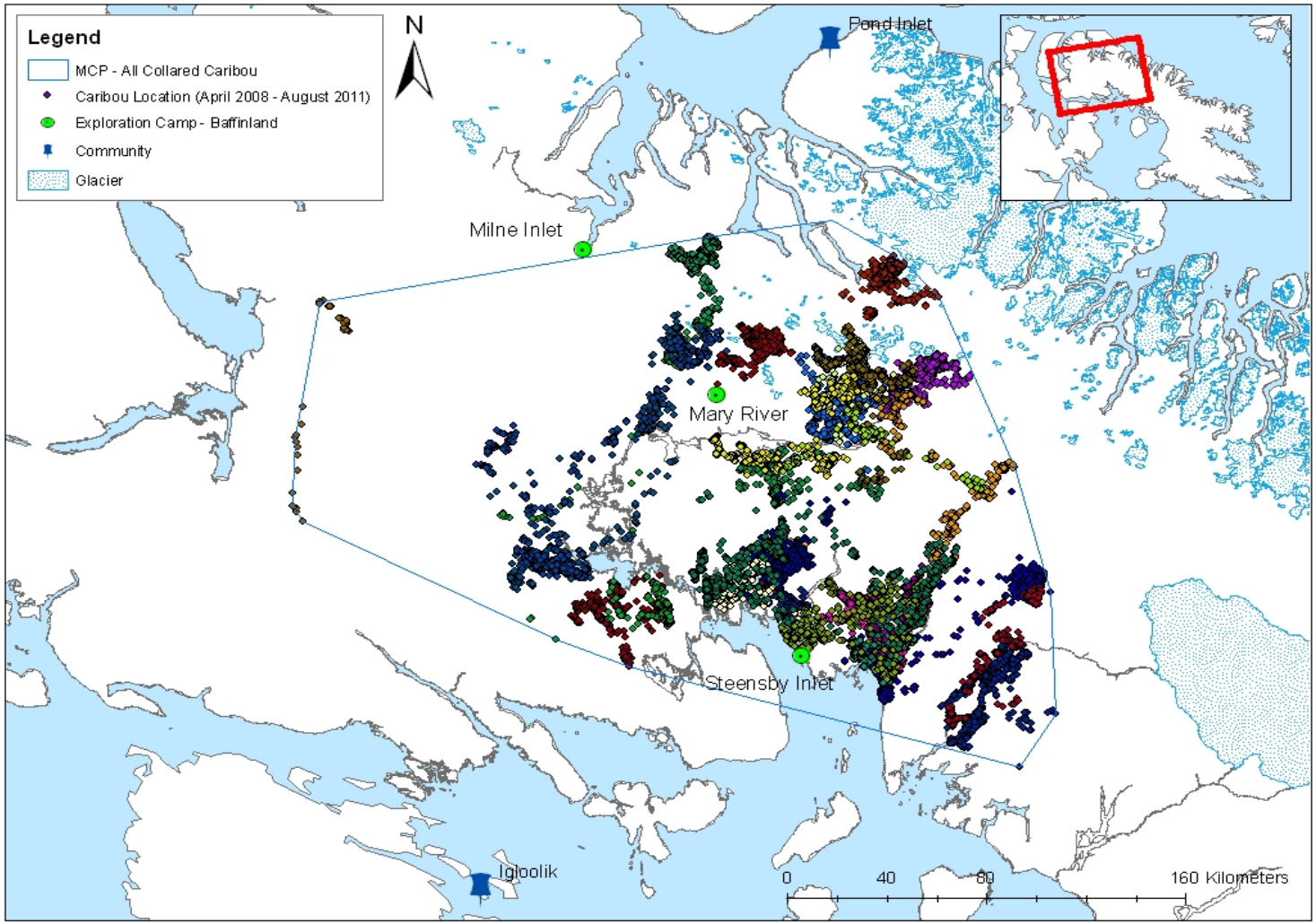

Figure 8: Minimum Convex Polygon (MCP) delineates area used by all collared adult female caribou (collared in April 2008 and April 2009) and their combined locations (individuals represented by different colours). The last collars dropped off on July 31, 2011 and have been collected from the field.

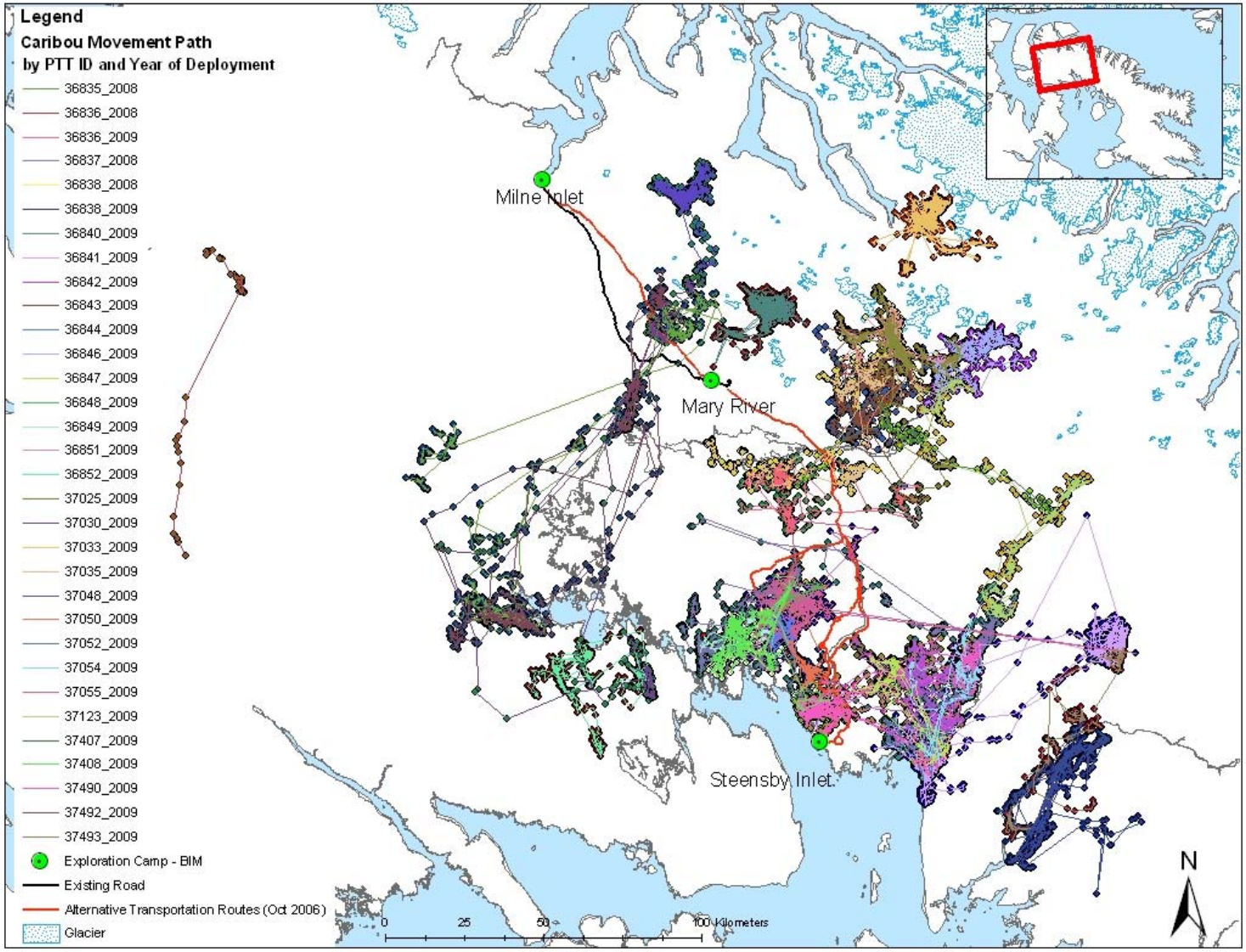

Figure 9: The movement path of all collared adult female caribou from the date of deployment (April 2008 or April 2009) until the date when collars became inactive (varies between individuals)

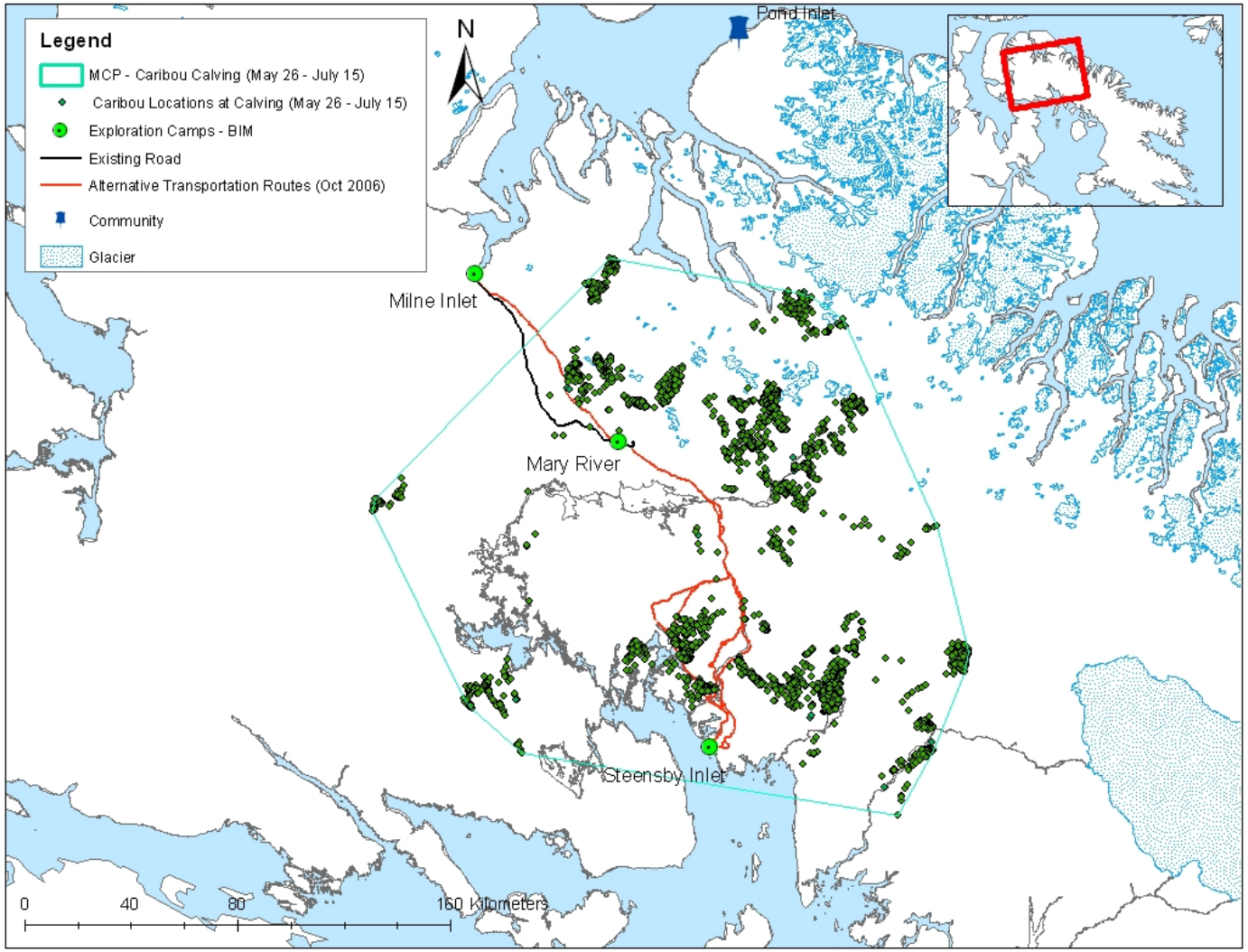

Figure 10: Minimum Convex Polygon delineates the area used by all collared adult female caribou during the calving period (May 26 to July 15) on northern Baffin Island.

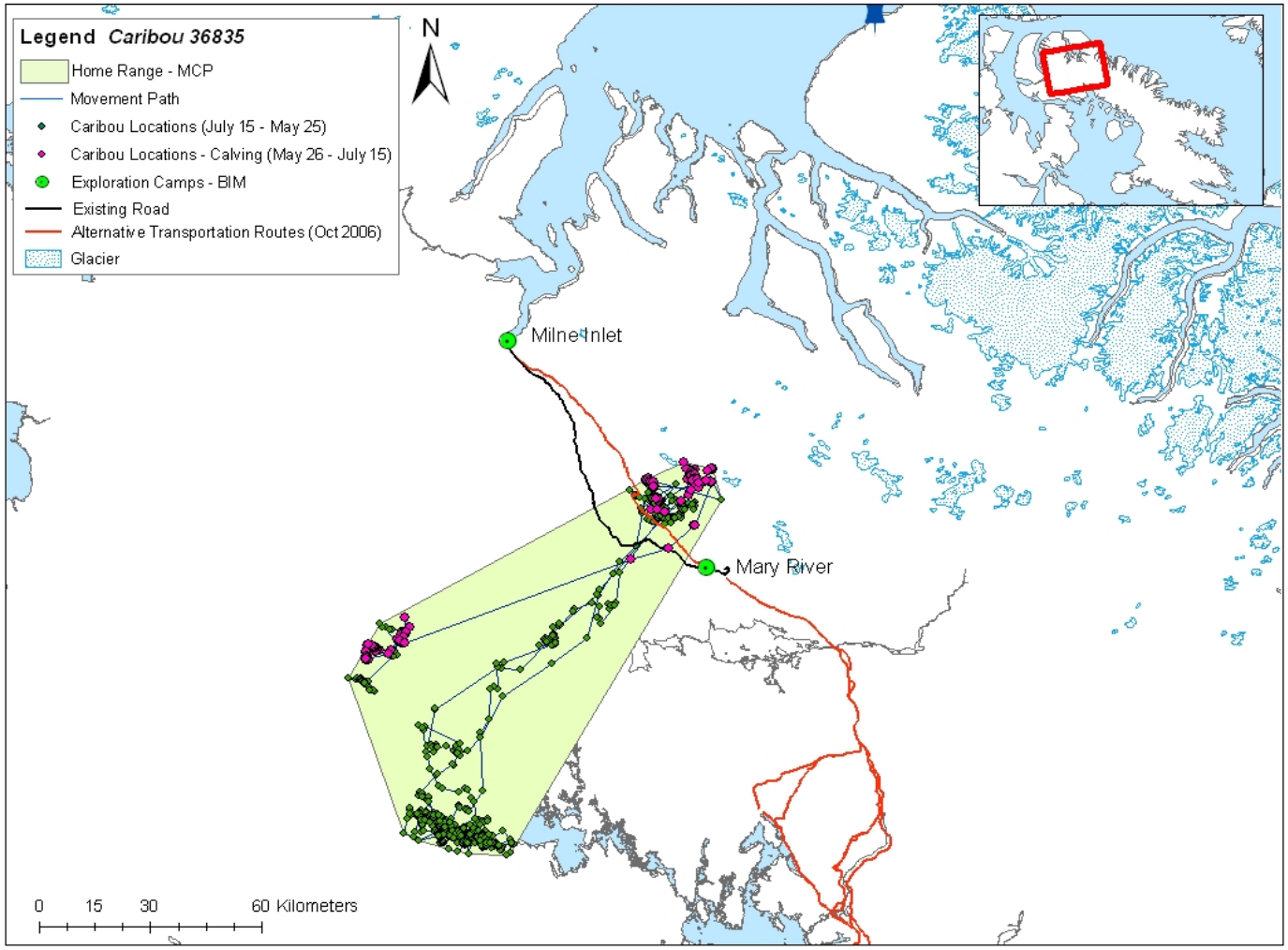

Figure 11: Minimum Convex Polygon delineates the annual range of an adult female caribou (PPT number 36835), collared from April 2008 –February 2010. Locations and movement path are presented. Locations during the calving period are highlighted in pink.

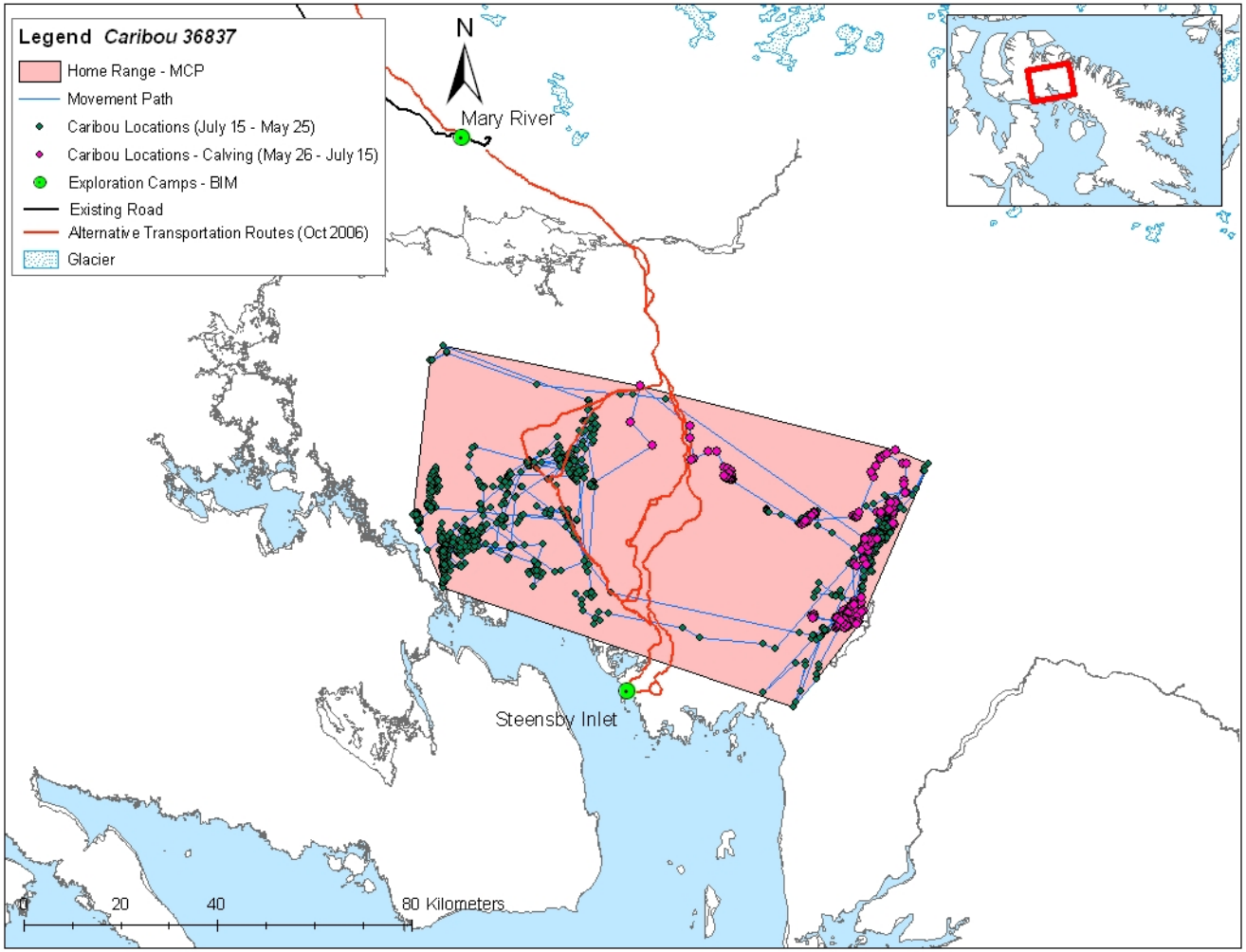

Figure 12: Minimum Convex Polygon delineates the annual range of an adult female caribou (PPT number 36837), collared from April 2008-December 2010. Locations and movement path are presented. Locations during the calving period are highlighted in pink.

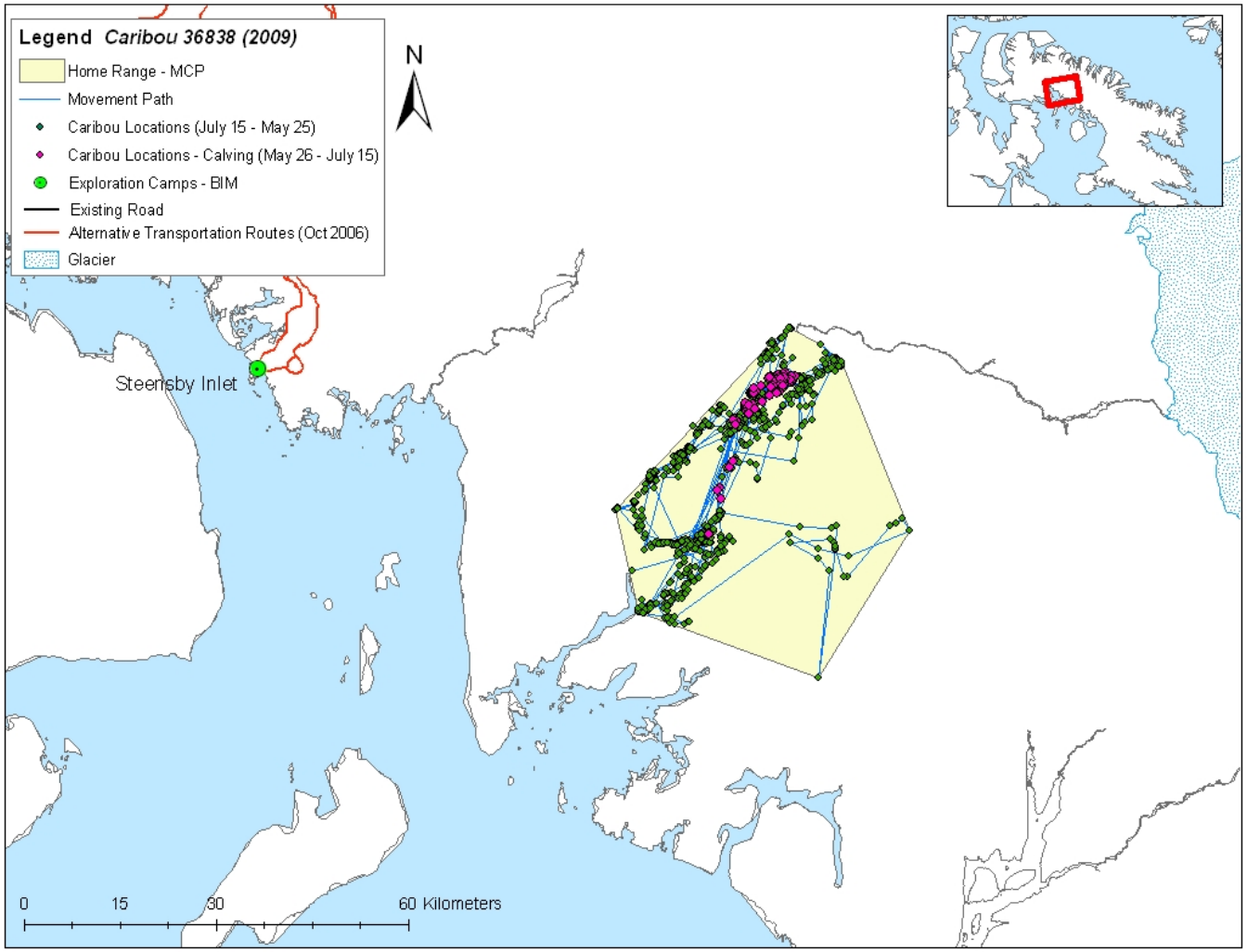

Figure 13: Minimum Convex Polygon delineates the annual range of an adult female caribou (PPT number 36838), collared from April 2009-January 2011. Locations and movement path are presented. Locations during the calving period are highlighted in pink.

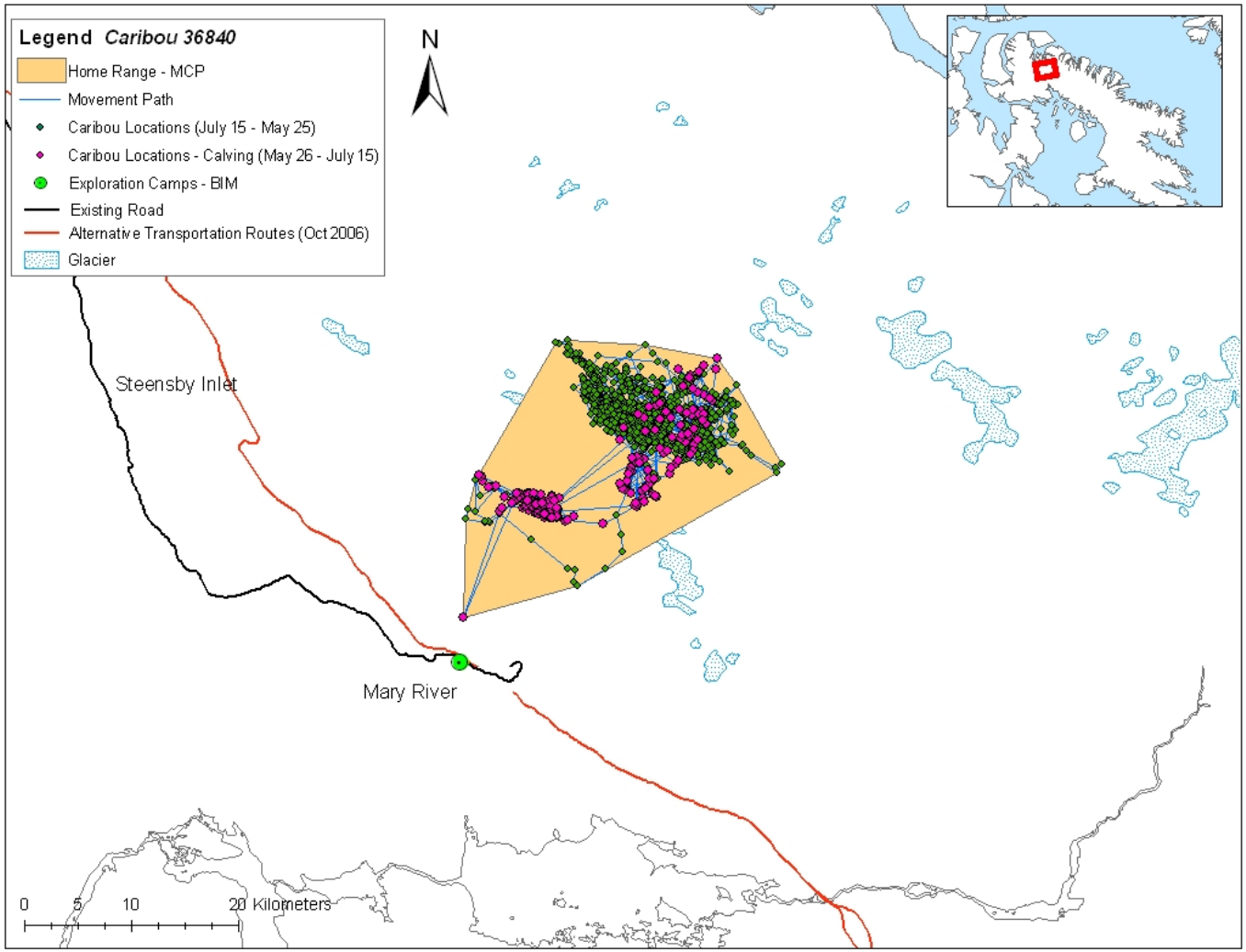

Figure 14: Minimum Convex Polygon delineates the annual range of an adult female caribou (PPT number 36840), collared from April 2009-July 2011. Locations and movement path are presented. Locations during the calving period are highlighted in pink.

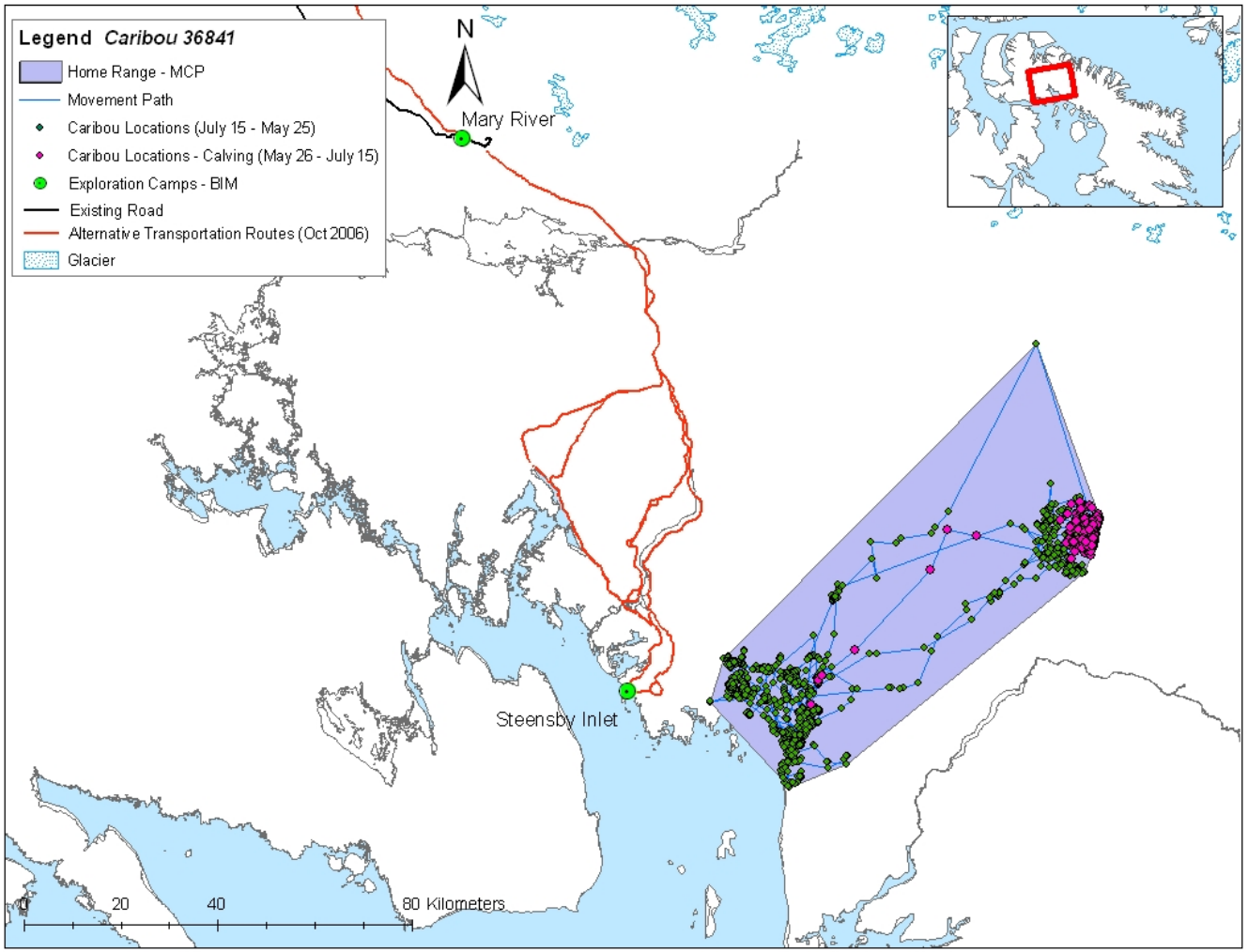

Figure 15: Minimum Convex Polygon delineates the annual range of an adult female caribou (PPT number 36841), collared from April 2009-July 2011. Locations and movement path are presented. Locations during the calving period are highlighted in pink.

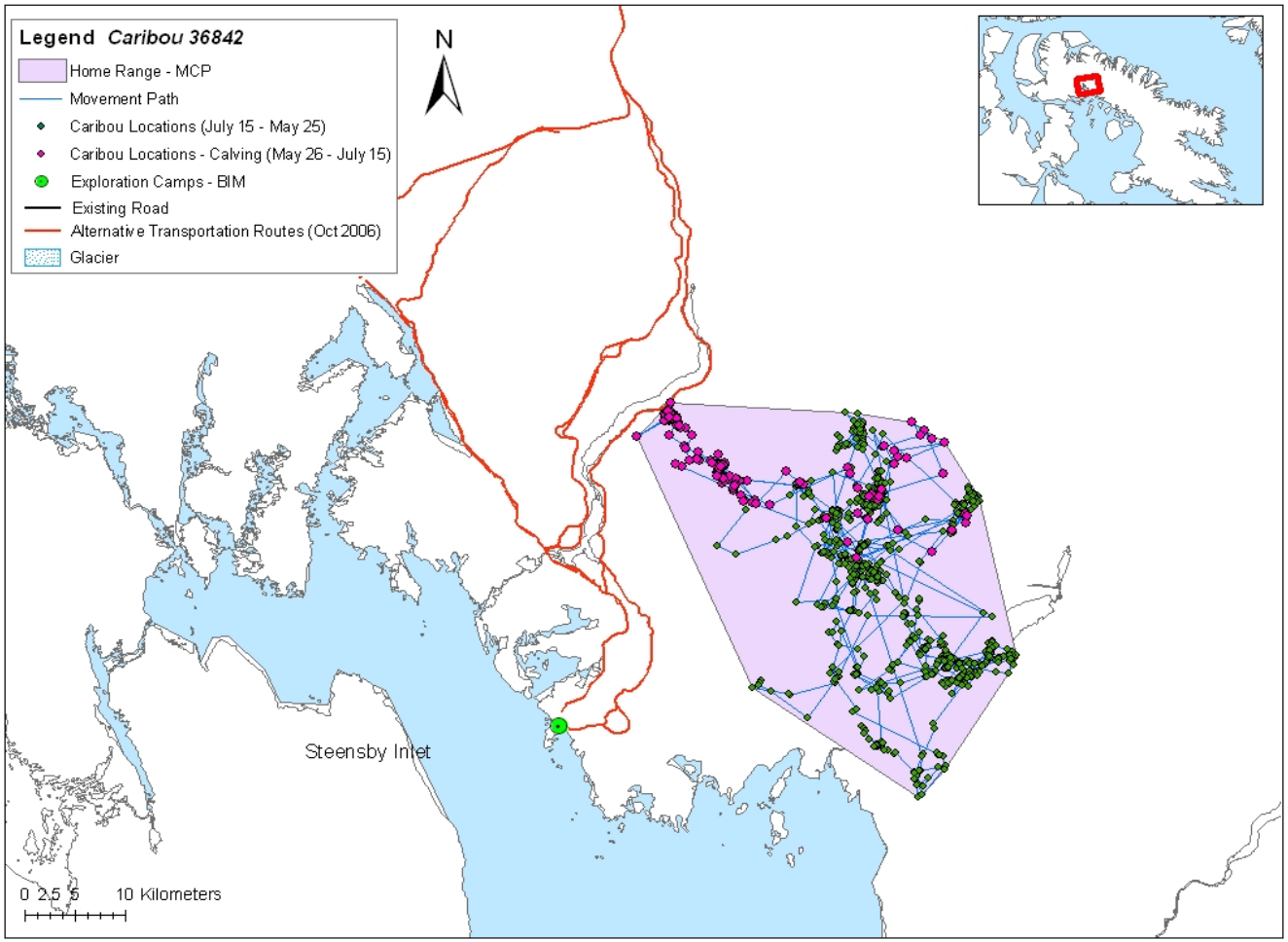

Figure 16: Minimum Convex Polygon delineates the annual range of an adult female caribou (PPT number 36842), collared from April 2009-November 2010. Locations and movement path are presented. Locations during the calving period are highlighted in pink.

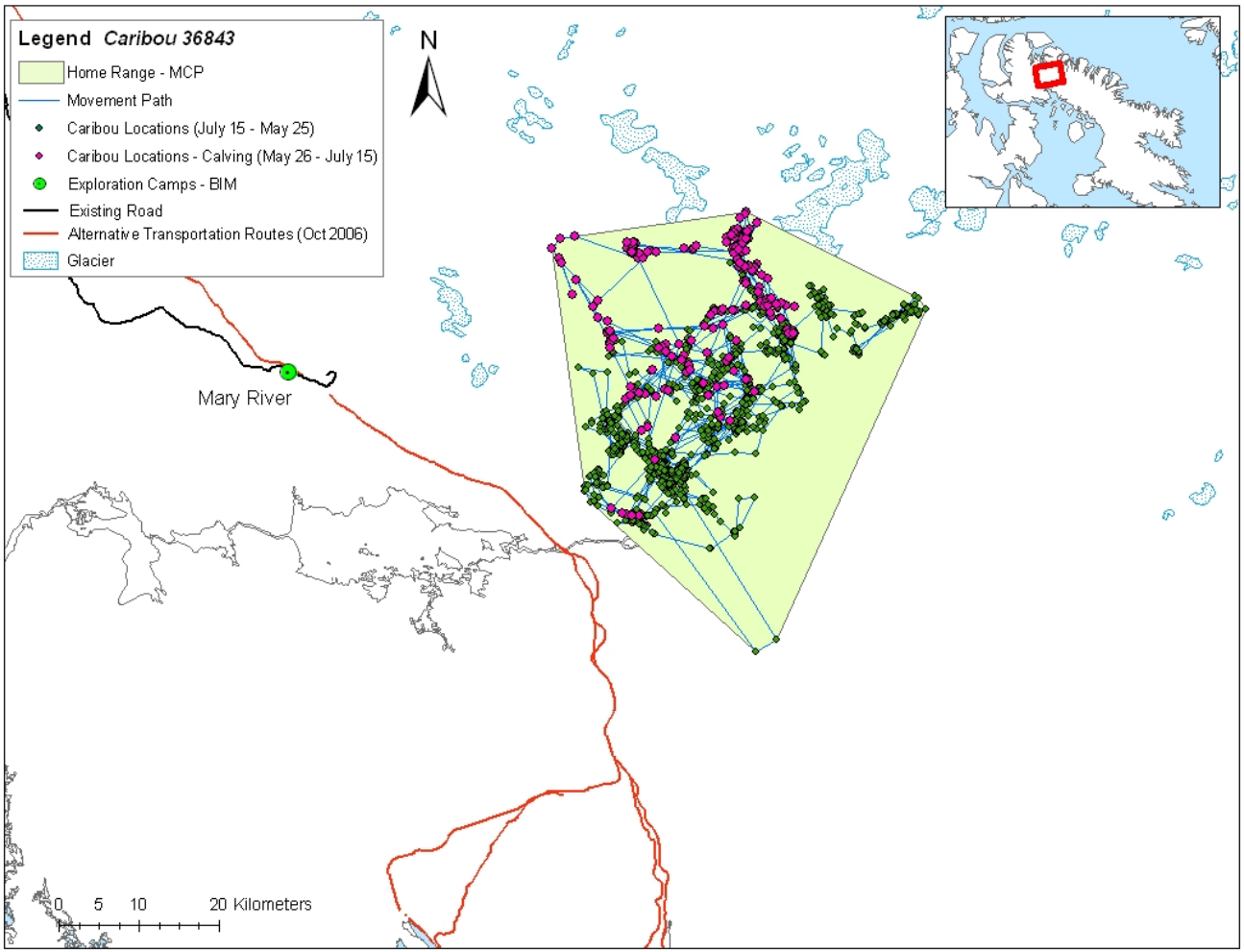

Figure 17: Minimum Convex Polygon delineates the annual range of an adult female caribou (PPT number 36843), collared from April 2009-July 2011. Locations and movement path are presented. Locations during the calving period are highlighted in pink.

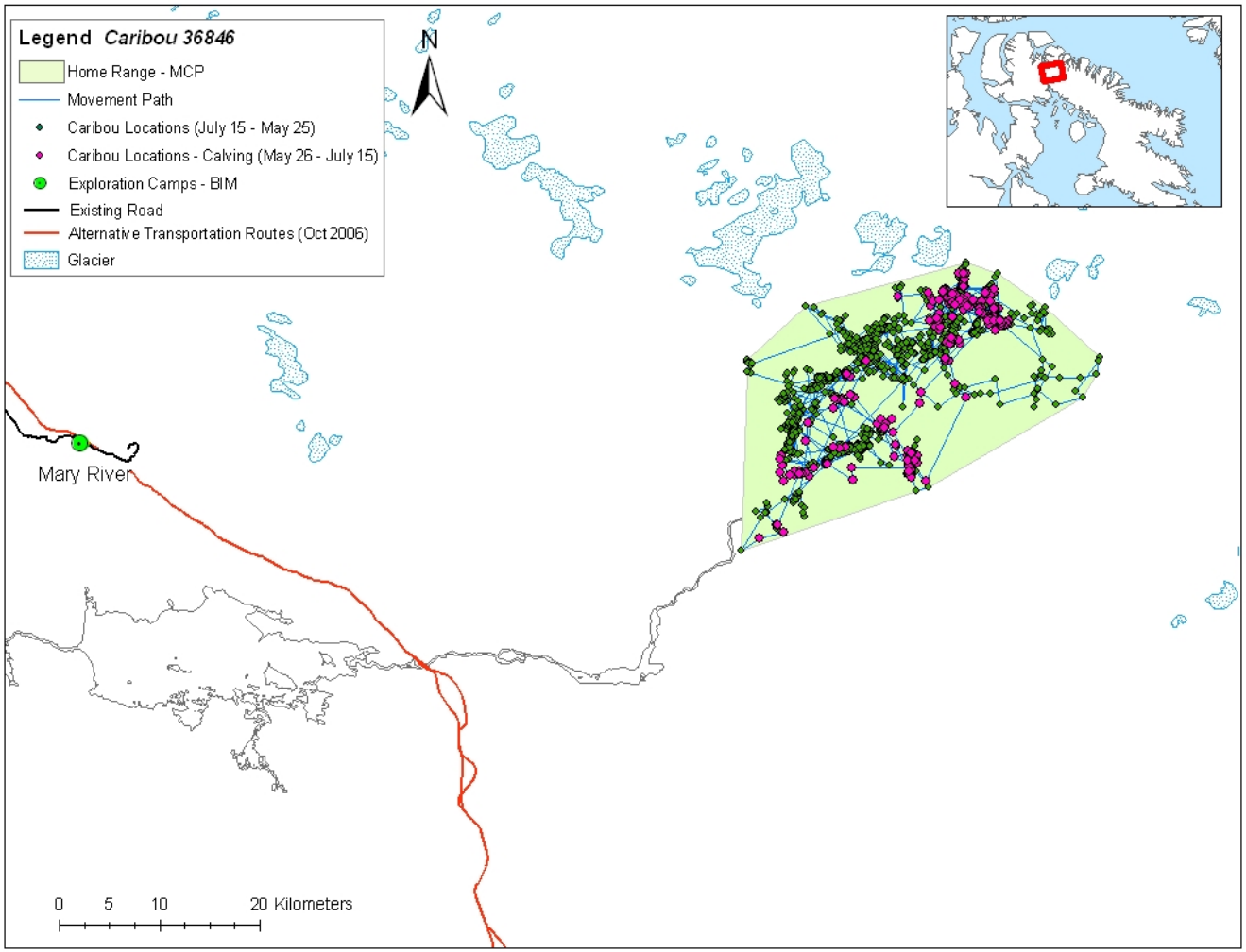

Figure 18: Minimum Convex Polygon delineates the annual range of an adult female caribou (PPT number 36846), collared from April 2009-July 2011. Locations and movement path are presented. Locations during the calving period are highlighted in pink.

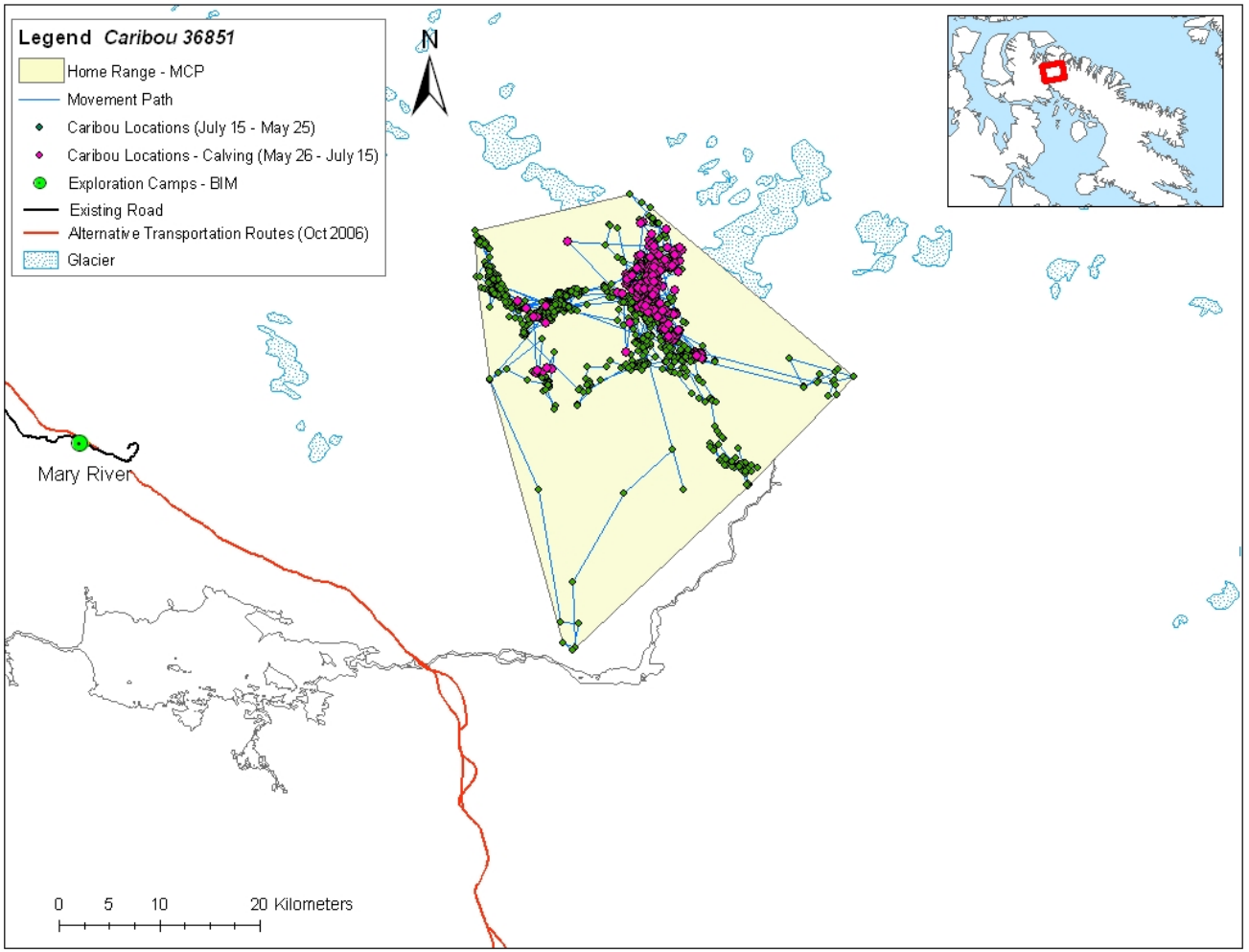

Figure 19: Minimum Convex Polygon delineates the annual range of an adult female caribou (PPT number 36851), collared from April 2009-July 2011. Locations and movement path are presented. Locations during the calving period are highlighted in pink.

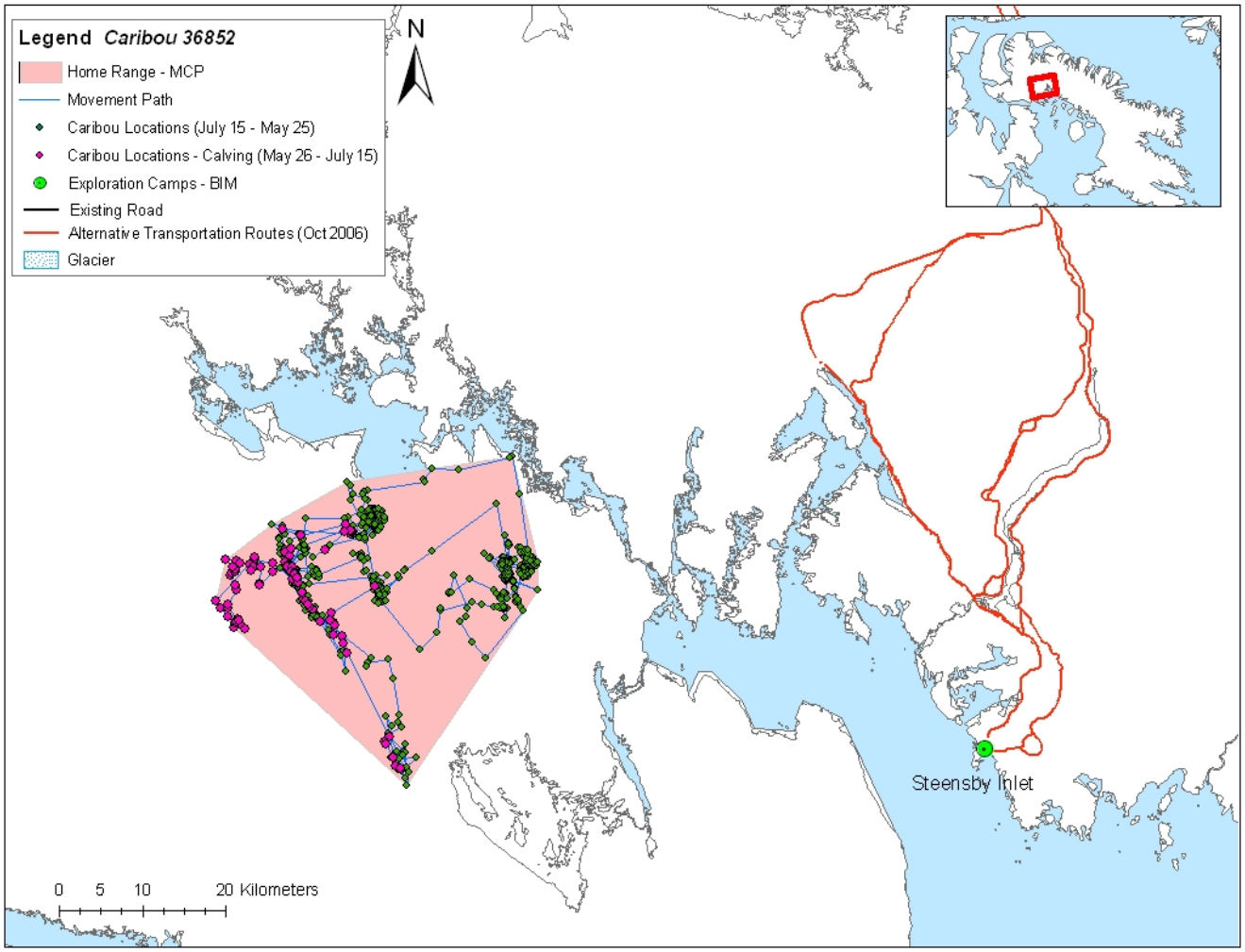

Figure 20: Minimum Convex Polygon delineates the annual range of an adult female caribou (PPT number 36852), collared from April 2009-June 2010. Locations and movement path are presented. Locations during the calving period are highlighted in pink.

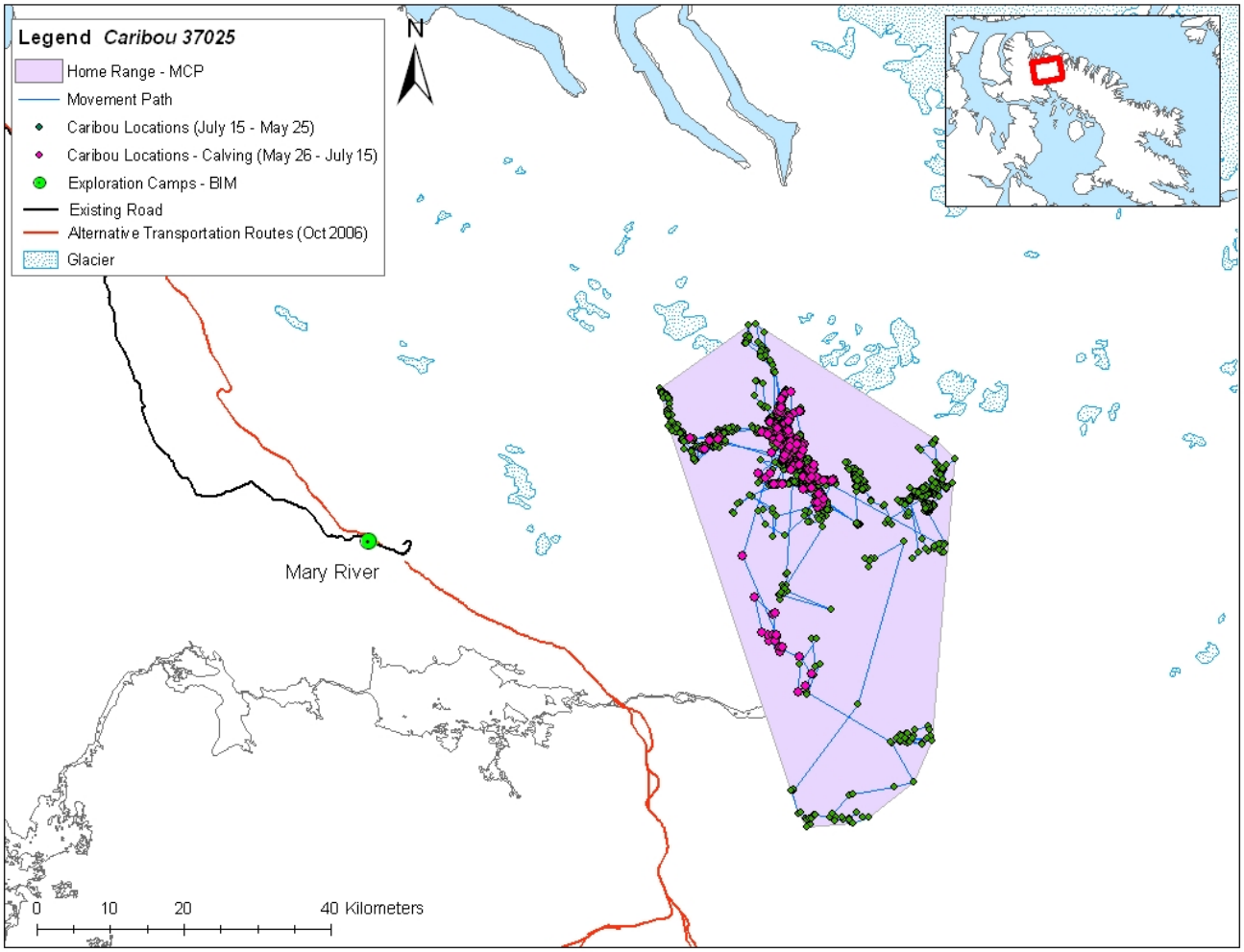

Figure 21: Minimum Convex Polygon delineates the annual range of an adult female caribou (PPT number 37025), collared from April 2009-July 2011. Locations and movement path are presented. Locations during the calving period are highlighted in pink.

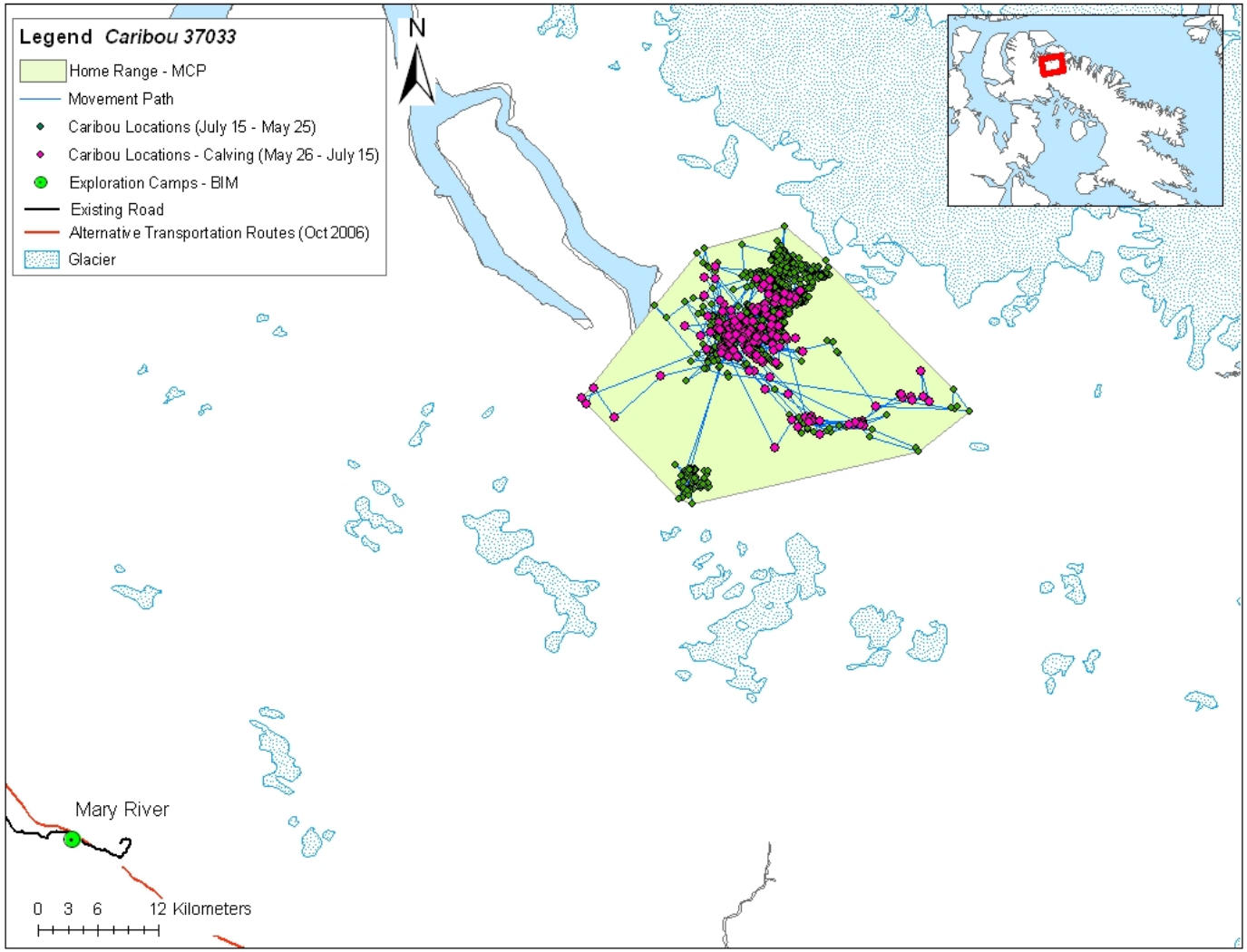

Figure 22: Minimum Convex Polygon delineates the annual range of an adult female caribou (PPT number 37033), collared from April 2009-May 2011. Locations and movement path are presented. Locations during the calving period are highlighted in pink.

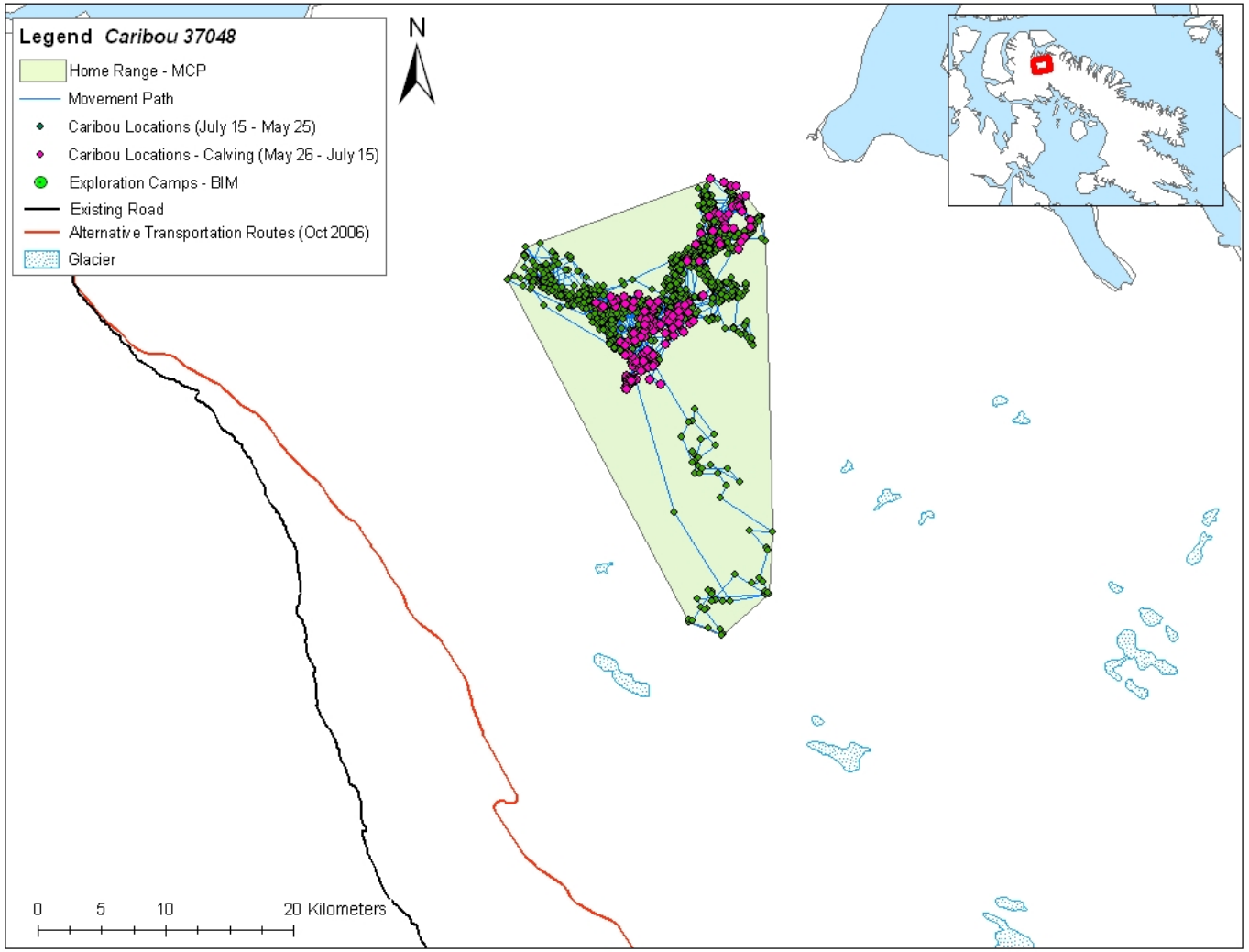

Figure 23: Minimum Convex Polygon delineates the annual range of an adult female caribou (PPT number 37048), collared from April 2009-June 2011. Locations and movement path are presented. Locations during the calving period are highlighted in pink.

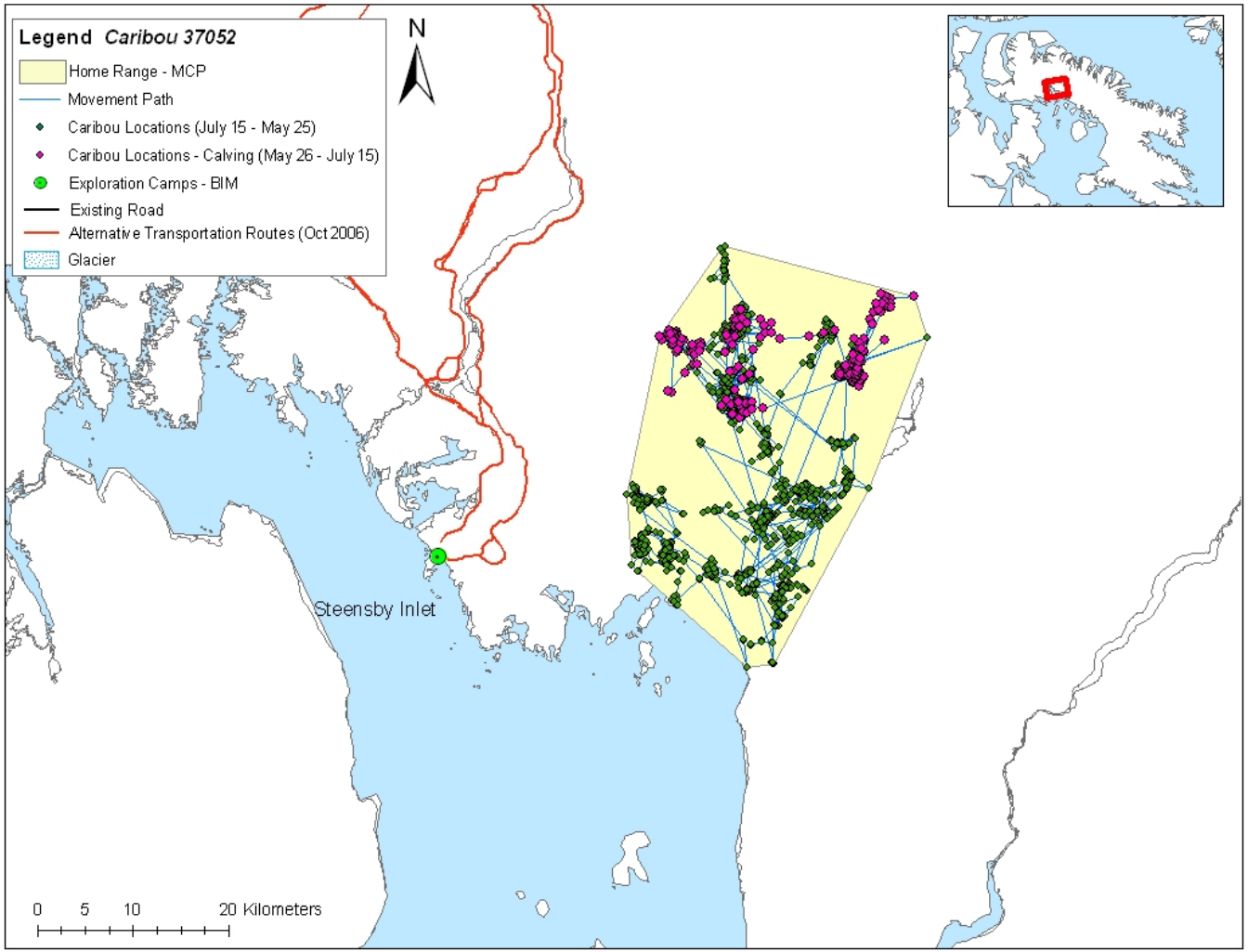

Figure 24: Minimum Convex Polygon delineates the annual range of an adult female caribou (PPT number 37052), collared from April 2009-July 2011. Locations and movement path are presented. Locations during the calving period are highlighted in pink.

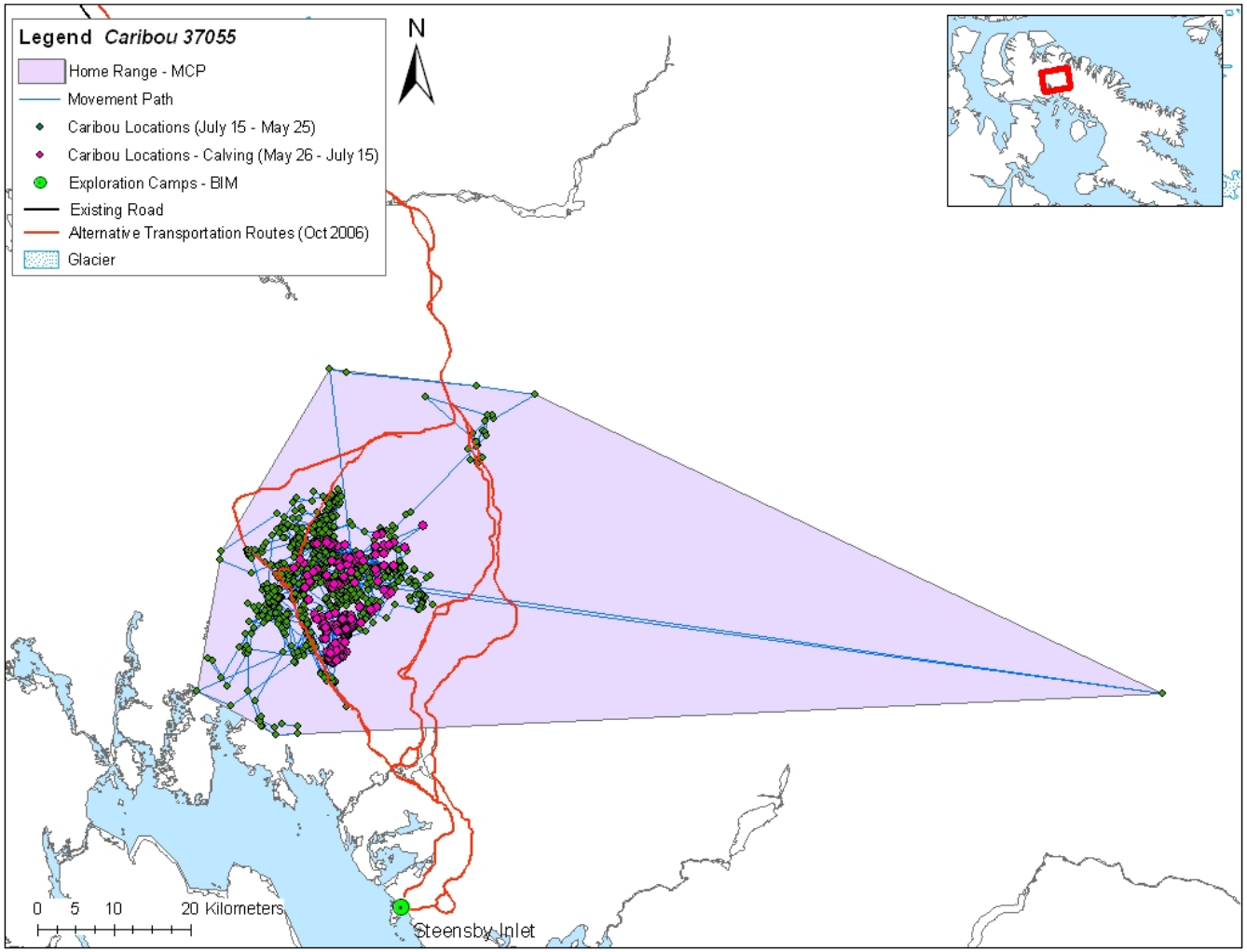

Figure 25: Minimum Convex Polygon delineates the annual range of an adult female caribou (PPT number 37055), collared from April 2009-July 2011. Locations and movement path are presented. Locations during the calving period are highlighted in pink.

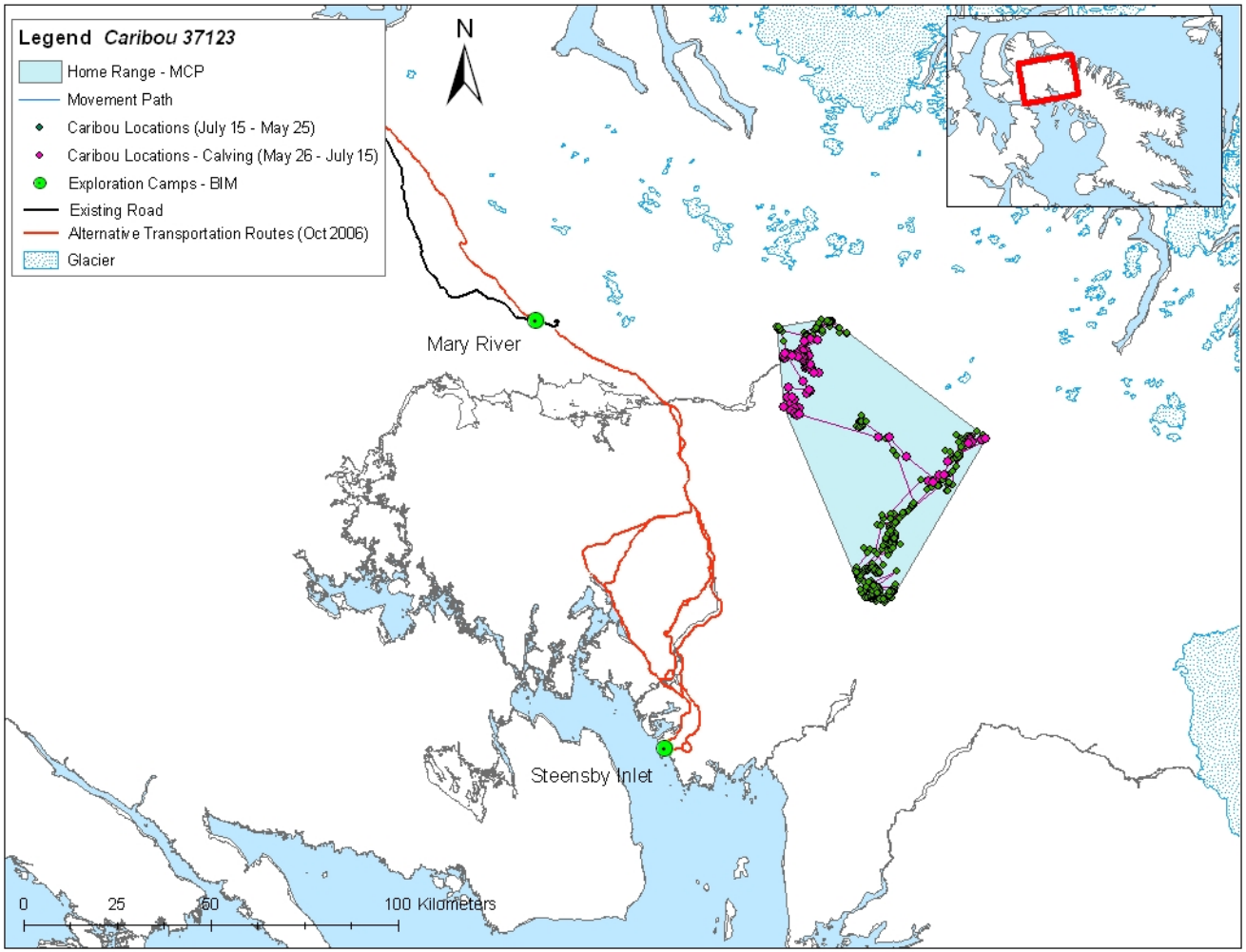

Figure 26: Minimum Convex Polygon delineates the annual range of an adult female caribou (PPT number 37123), collared from April 2009-April 2010. Locations and movement path are presented. Locations during the calving period are highlighted in pink.

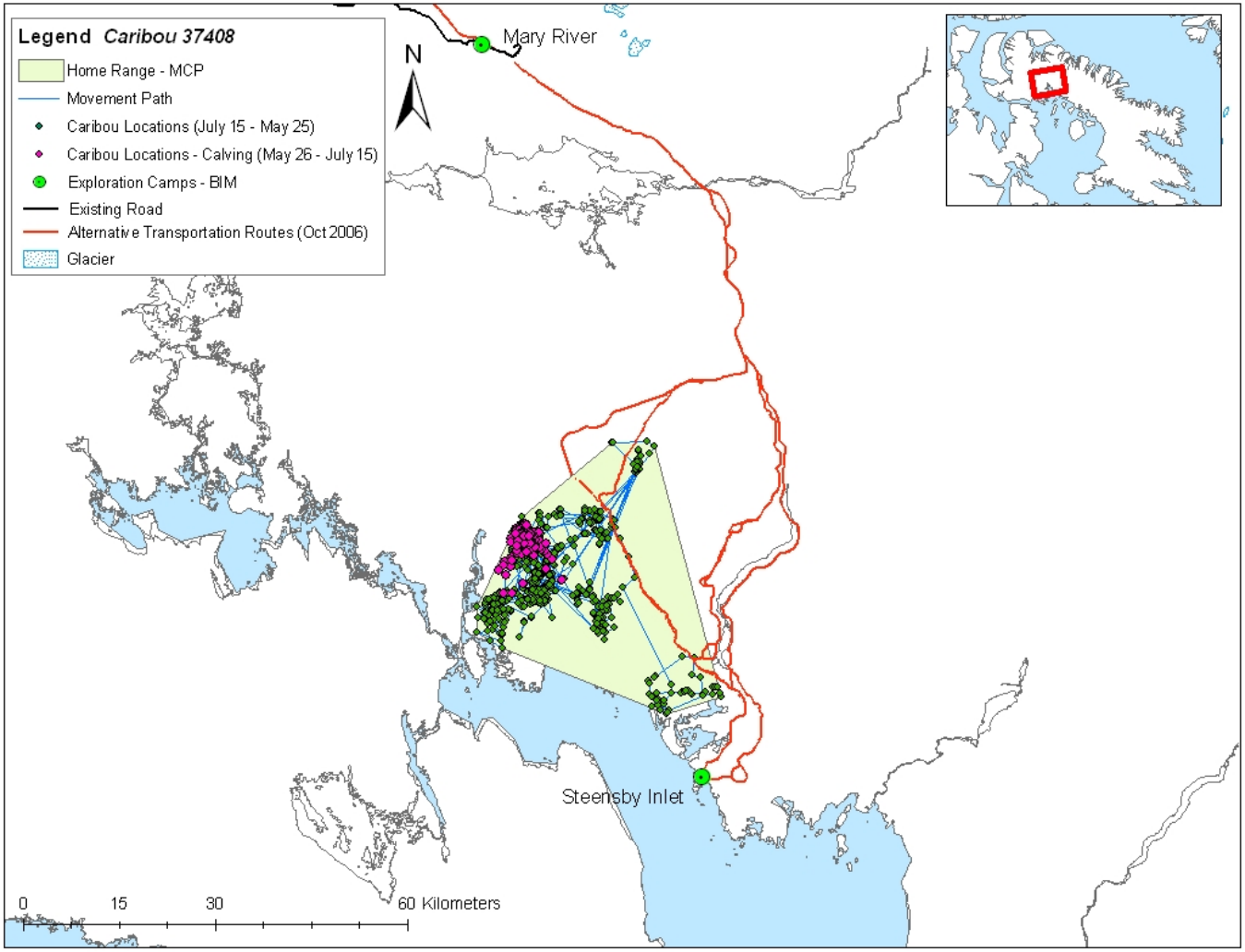

Figure 27: Minimum Convex Polygon delineates the annual range of an adult female caribou (PPT number 37408), collared from April 2009-August 2010. Locations and movement path are presented. Locations during the calving period are highlighted in pink.

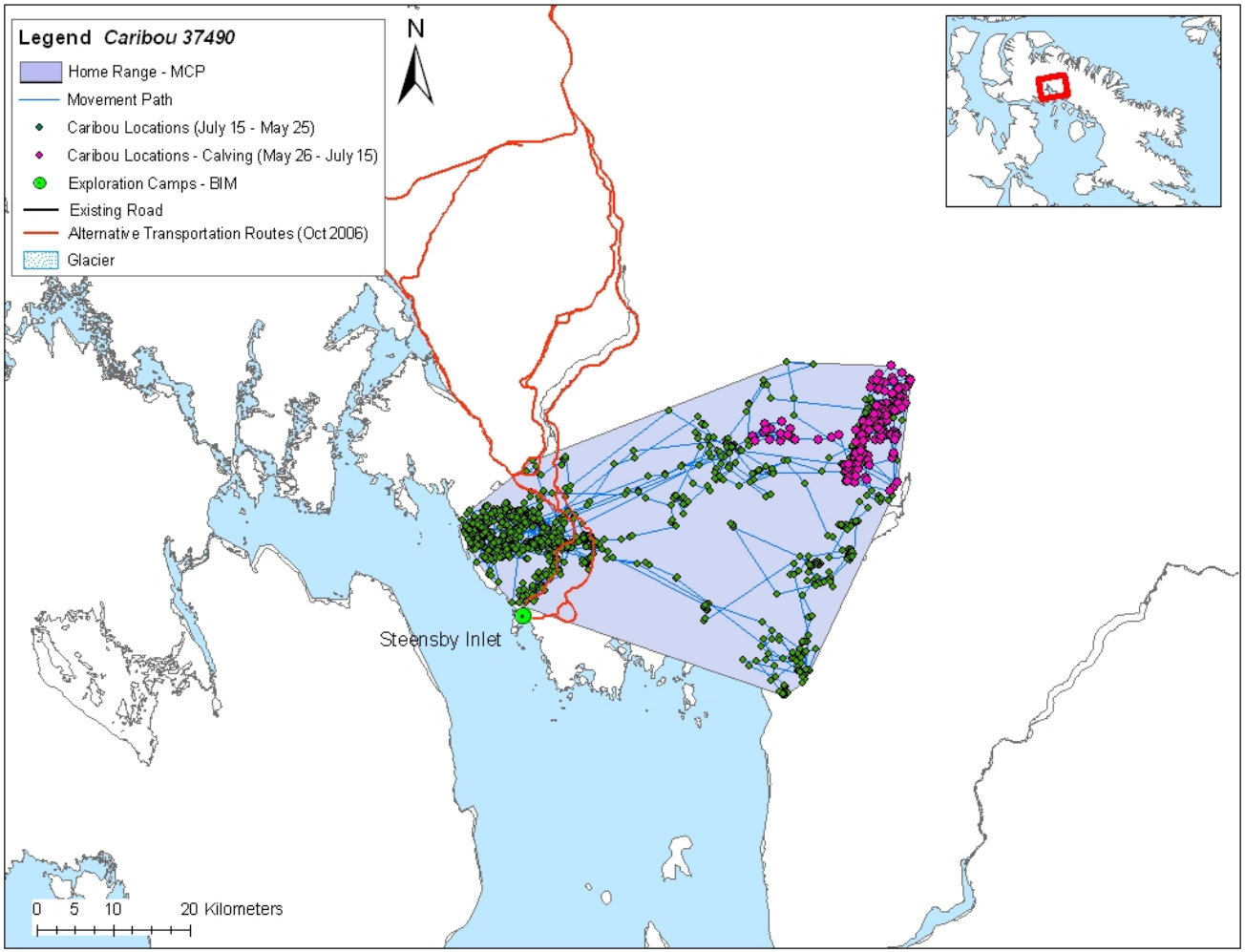

Figure 28: Minimum Convex Polygon delineates the annual range of an adult female caribou (PPT number 37490), collared from April 2009-July 2011. Locations and movement path are presented. Locations during the calving period are highlighted in pink.

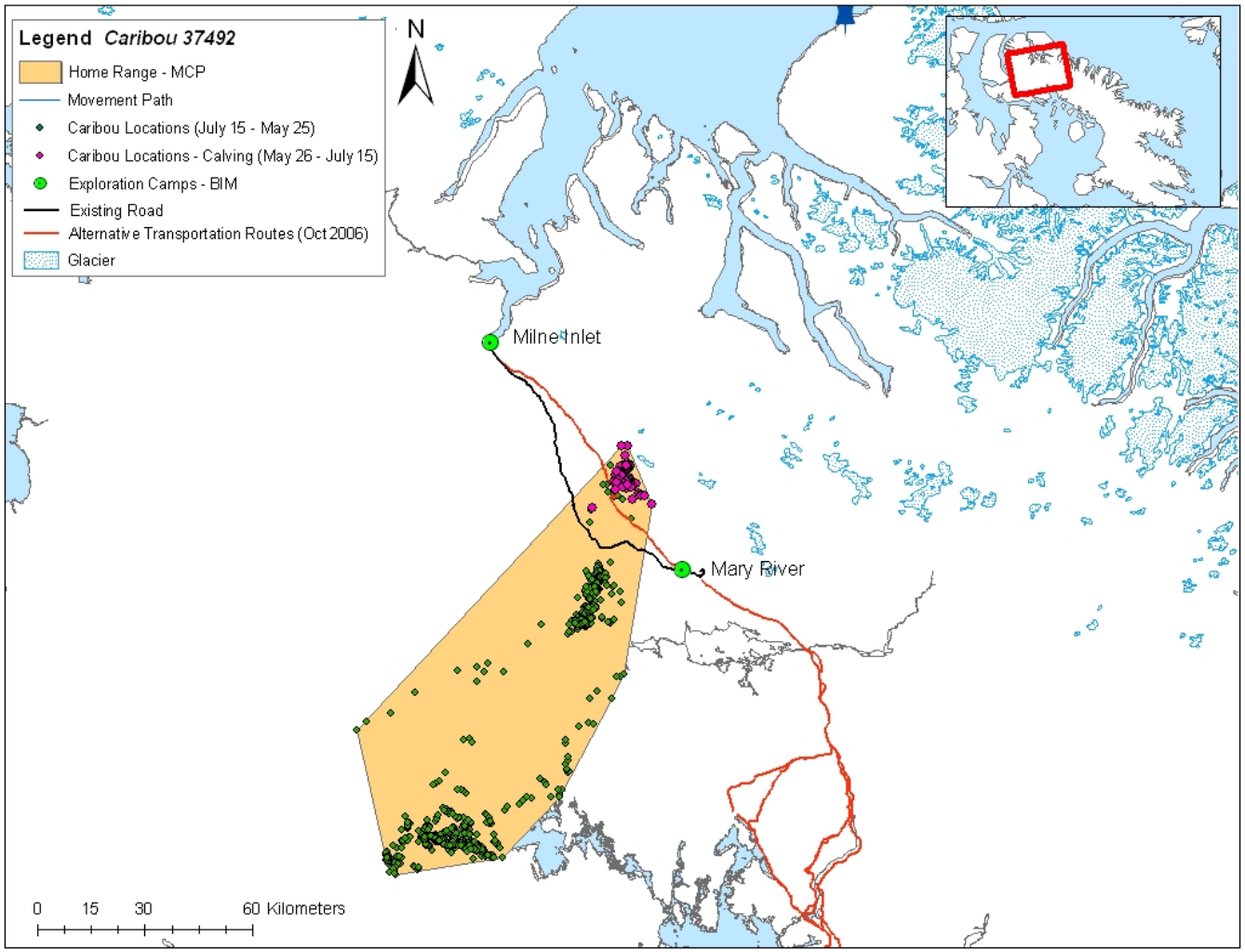

Figure 29: Minimum Convex Polygon delineates the annual range of an adult female caribou (PPT number 37492), collared from April 2009-May 2011. Locations and movement path are presented. Locations during the calving period are highlighted in pink.