

The April 2009 to April 2010 study of polar bear movements and habitat use in Northwest Greenland

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A study initiated in April 2009 using satellite transmitters was intended to provide updated and supplementary information on distribution, movement and habitat use of polar bears in the Baffin Bay and Disko West area.

During the 2009 field operation, 16 polar bears were tagged in April 2009 on the fast ice and the pack ice in the north of the Disko West assessment area between 70° 14' N and 71° 04' N (Figure 1, Table 1). Fifteen of these bears were fitted with a satellite radio transmitter. Ten of these transmitters were small ear-tags (Born et al. 2010) which were applied to sub-adult polar bears of both sexes and adult males. Ear-tag transmitters had an expected life time of 3-6 months. Five adult female bears were fitted with satellite radio-collars with an expected life time of 2+ years.

Movements, home ranges and focal areas

One of the bears with satellite radio-collars (D7273, 6 years old) dropped her transmitter shortly after deployment and another adult female (D7276, 17 years old) was shot in NW Greenland 13 February 2010. Adult males and sub-adult bears of both sexes experienced shorter tracking durations due to ear tag attachments (mean duration of transmission: 75.7 d, SD = 45.0, range: 28-196 d, n = 10). Hence, the annual cycle of movement can be described for four adult females only and three females after February 2010.

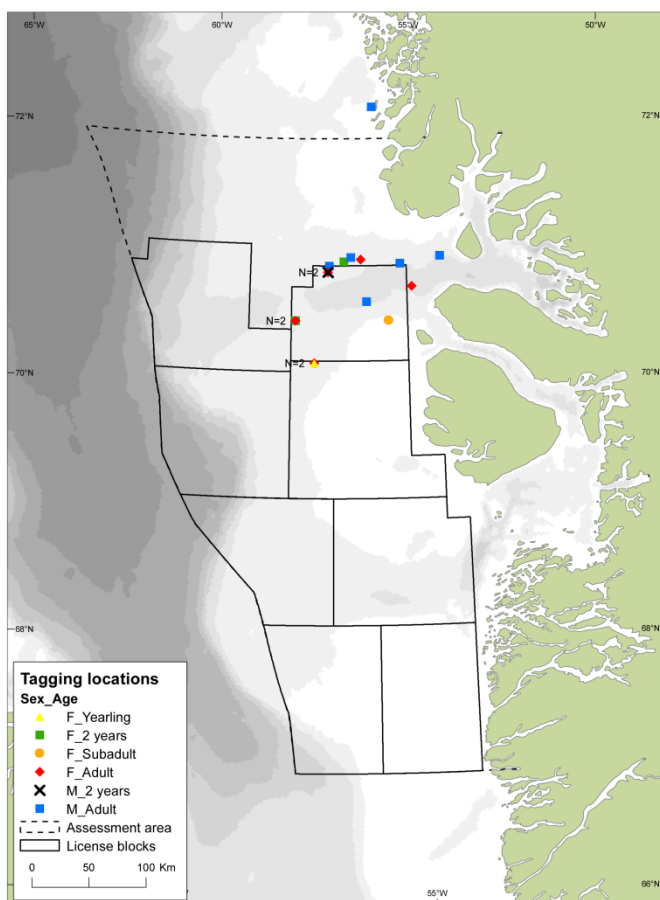


Figure 1. Disko West assessment area with borders of license blocks and locations where 16 polar bears were tagged during April 2009. Fifteen of these bears were fitted with satellite transmitters. F = females, M = males.

Tracking of four adult female polar bears for a single year between April 2009 and April 2010 (as stated one stopped in February 2010) confirmed previous information obtained from a telemetry study in the 1990s (Taylor et al. 2001), that polar bears are widely distributed over Baffin Bay sea-ice in spring and summer with a more contracted land-based distribution in fall on Baffin Island, and dispersal from Baffin Island in winter once the sea-ice forms again (Figure 2).

In *spring* 2009 (April-May), the polar bears ($n = 15$) used a large area over the annual sea-ice in Baffin Bay and were concentrated in the Baffin Bay assessment area and to the south hereof (Figure 2) from ca. $67^{\circ} 30' N$ to offshore at ca. $75^{\circ} N$. The area of the 95 % kernel home range was approximately $198,400 \text{ km}^2$. As sea-ice receded during early summer the range of the polar bears shifted west towards Baffin Island (Figure 2).

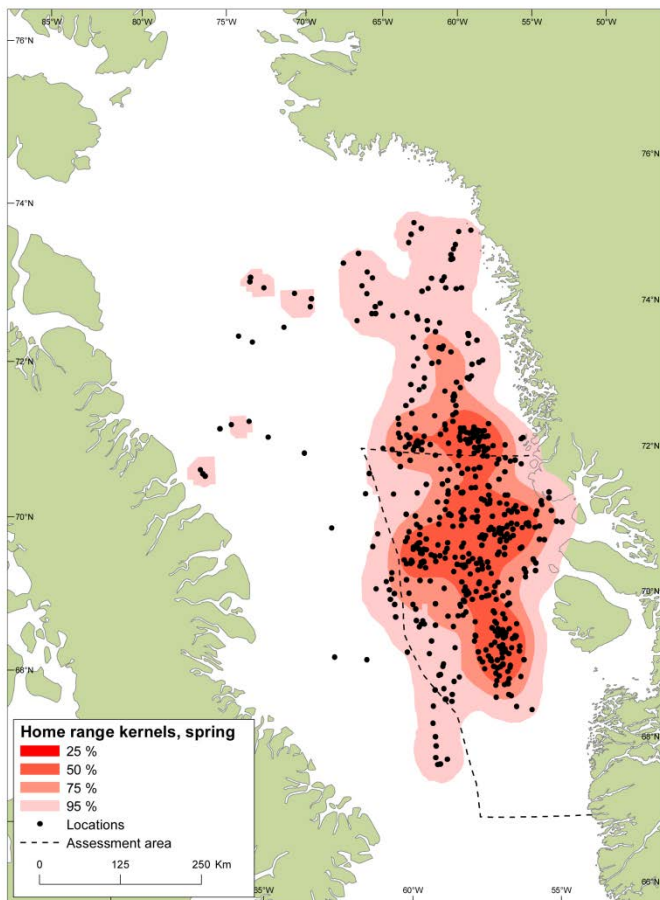


Figure 2. Home range of 16 tracked polar bears in spring (April-May) 2009. Home range calculated as kernel polygons, which show the fraction in % of the locations they include.

In *summer* 2009 (June-August) the polar bear home range ($n = 13$ bears) for the most part remained on the remaining sea-ice, and shifted to the western side of Baffin Bay. Polar bears were found on the eastern edge of the Baffin Bay pack ice (i.e. in the western sector of the Baffin Bay assessment area). There was also some area use on the fast ice of Melville Bay (Figure 3). The summer 95 % home range was larger than during spring and the other two seasons, totalling approximately $349,000 \text{ km}^2$ (Figure 3).

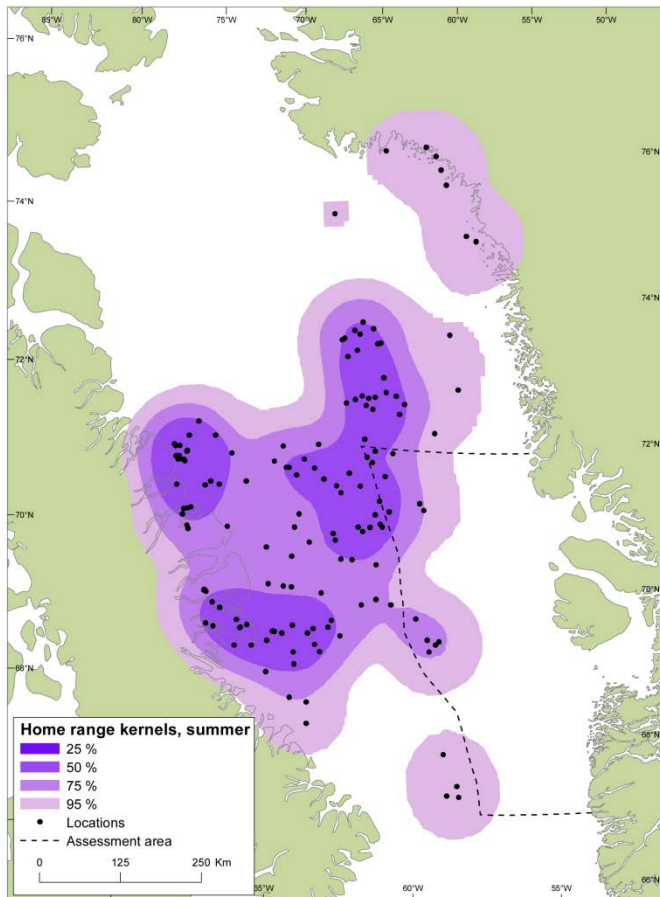


Figure 3. Home range of 13 tracked polar bears in summer (Jun.-Aug.) 2009. Home range calculated as kernel polygons, which show the fraction in % of the locations they include.

In *autumn* 2009 (September-December), polar bears ($n = 5$ bears) were located on the coast of Baffin Island (Figure 4). The total autumn range was approximately $66,300 \text{ km}^2$ and thus the smallest of all the seasons. Adult female D7276 (Transmitter ID 68004) left Baffin Island around 3 November and moved towards Melville Bay in NW Greenland (Figure 4).

In *winter* 2010 (January-March), when the annual sea-ice had formed, three adult polar bears (D7283, D7285, D7287) departed from the land on eastern Baffin Island where they had spent the open water season and moved offshore. Two of these bears moved from Baffin Island during late January 2010, whereas D7283 which had been in a maternity den on Baffin Island moved onto the sea-ice sometime around 31 March 2010. Polar bears typically show fidelity to den and spring feeding areas (Wiig 1995). This tendency was confirmed by bear D7283 and bear D7285 which moved towards the West Greenland coast where they occurred in the shear zone between land fast ice and the offshore Baffin Bay pack ice between ca. 72° and ca. 76° N. D7283 was shot in Upernavik on 13 February 2010. Bear D7287 used the northern Baffin Bay in late winter (Figure 5). However, the two other adult female polar bears (D7283; D7287) were on the ice in the west side of Baffin Bay as of April 2010 (Figure 5).

Due to low sample sizes and the influence of denning locations on the probability distribution of the home range, the winter home range was divided in a western and eastern portion (Figure 5). The total combined winter home range was approximately $310,400 \text{ km}^2$.

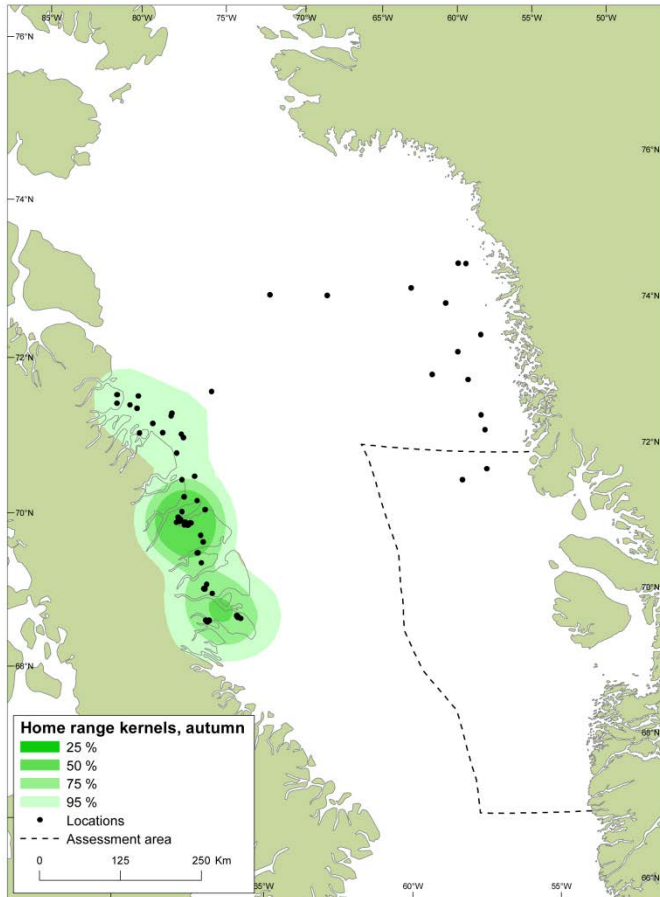


Figure 4. Home range of 5 tracked polar bears (1 male, 4 females) in autumn (Sept.-Dec.) 2009. Home range calculated as kernel polygons, which show the fraction in % of the locations they include.

Adult males and sub-adults of both sexes had shorter tracking durations due to ear tag attachments and all except bear D7286 remained on the Baffin Bay sea-ice during the period they were tracked. Similar to adult females, there was a consistent movements westward by adult males and sub-adults as the Baffin Bay sea-ice receded in late spring. Overall, the range of adult males was similar to that of adult females. Specific movement patterns were contrasted between adult male and adult female polar bears during the on-ice period in spring and early summer (Figure 6).

The 2009-2010 study confirmed that polar bears in Baffin Bay move considerable distances during the year (Figure 6). Satellite telemetry studies in the 1990s showed that the home range size of individual polar bears exploiting Baffin Bay averaged 192,000 km² being considerably larger than the home ranges of bears inhabiting areas with more consolidated ice (Ferguson et al. 1999). It was suggested that the explanation for the large home ranges of bears in Baffin Bay was that these bears explore a habitat with large seasonal flux of annual ice in which the distribution of various prey in particular ringed seals is variable and patchy.

All polar bears that were instrumented in April 2009 chose to follow the receding ice and spend the summer at the east coast of Baffin Island. Hence, their general movement was similar to that of 10 adult female polar bears that were instrumented with satellite collars on the sea-ice in the Melville Bay area (74°-76° N, 58°-68° W) in the spring of 1992 and 1993 (Taylor et al. 2001, DEGN and GINR, unpublished data).

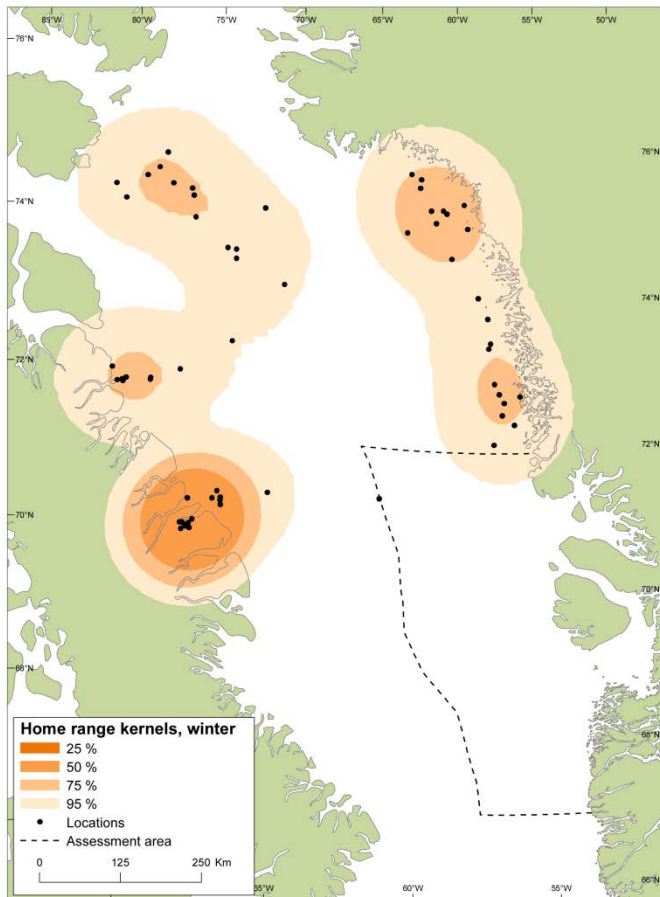


Figure 5. Home range of 4 tracked polar bears in winter (Jan.-Mar.) 2010. Home range calculated as kernel polygons, which show the fraction in % of the locations they include.

Time spend on the West Greenland side

None of the 15 bears that were instrumented during April 2009 chose to spend the summer in West Greenland. Dates on which bears moved west of 60° W longitude varied within the months of May and June (Table 2). The earliest departure date was May 6 and the latest was June 8. For the most part, dates of crossing 60° W were concentrated at the last 10 days of May. It should be noted that bears crossed this longitude threshold however many remained in the vicinity (between 60° and 63° W) for several more weeks until the sea-ice had disappeared in central and western Baffin Bay.

Maternity denning sites

During the one year study period two maternal denning sites used by two different female bears were identified along the Baffin Island coast (Figure 6). Both dens were on land and located in Eglinton Fjord north of Clyde Inlet. Female bear D7283 occupied her den in this fjord between approximately 14 October and 23 March (dates based only on geographic locations). She was 13 years old and accompanied with a 2-year old cub when marked in West Greenland on 15 April 2009. Apparently this female came into oestrus after having been instrumented, as at the time of capture she was apparently not in oestrus. Bear D7285 (6 years old at capture) entered her den around 8 September. However, she emerged on 2 January 2010. She was in oestrus at the time of capture in 2009 therefore it is assumed this bear entered a maternal den. However the denning duration likely was too short to have resulted in a successful cub rearing. This bear may have left the maternal den prematurely due to some failure in pregnancy (intrauterine mortality or stillborn cubs).

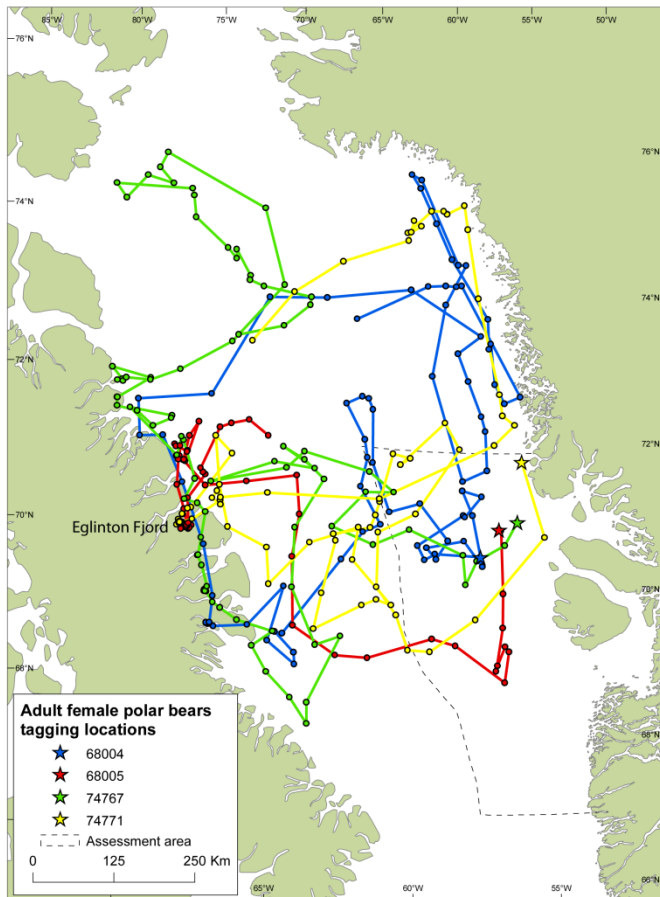


Figure 6. Tagging locations and movements of four female polar bears in 2009 and 2010.

Summary and conclusions

The study was limited to only one field season and only one year of satellite tracking. Owing to these *a priori* constraints in effort only 15 polar bears were instrumented with satellite tags in 2009 of which only 3 bears *de facto* could be used for describing habitat and area use for a full annual cycle. Due to low sample size refined analyses and comparisons of habitat use and movement were not attempted. Furthermore, these constraints do not allow any final conclusions concerning the importance of the Disko West assessment area for polar bears.

Nevertheless, based on the current knowledge regarding the distribution and movements of polar bears within the Baffin Bay (Taylor et al. 2001 and this study) it may tentatively be concluded that polar bears from the Baffin Bay subpopulation range the Disko West assessment area during winter, spring and summer. Polar bears in this area follow the receding sea-ice westward towards Baffin Island during early summer. This movement commences early May. Polar bears range widely over the Baffin Bay pack ice during winter, spring, and summer. The majority of Baffin Bay polar bears spend the summer on the east coast of Baffin Island and the bears have a tendency to show fidelity to the eastern edge of the Baffin Bay pack ice including that part of the ice edge that is located in the Disko West assessment area. The Baffin Bay polar bears prefer to den on the east coast of Baffin Island. Overall, females and males seem to have the same range. Judging from recoveries in harvest in West Greenland of marked bears from the Davis Strait subpopulation, the occurrence in the assessment area of polar bears from this subpopulation seems to be low.

Table 1. Polar bears tagged during the 2009 tagging operations in the Disko West region. Type of transmitter and duration of tag attachment is shown for those tags which stopped as of April 2010. Individual age was obtained from reading of tooth cementum growth layers.

ID	Sex	Category	Date tagged	Deg. N	Min	Deg. W	Min	Age	Transmitter ID	Type	Transmitter stop	Duration (days)
D7272	M	Adult	08.04.2009	71	1	55	24	4	68011	SPOT5	6/22/2009	76
D7273	F	Adult	08.04.2009	70	14	57	27	5	68006	TAW-4610H	05/03/2009	26
D7274	F	Yearling	08.04.2009	70	14	57	27	1	-	-		
D7275	M	Adult	09.04.2009	71	4	56	35	10	68012	SPOT5	06/04/2009	57
D7276	F	Adult	10.04.2009	70	34	57	54	17	68004	TAW-4610H	2/13/2010	SHOT
D7278	F	2 years	10.04.2009	70	34	57	54	2	68013	SPOT5	05/08/2009	29
D7277	F	Subadult	10.04.2009	70	34	55	42	4	68014	SPOT5	6/24/2009	76
D7280	M	Adult	11.04.2009	71	4	54	26	7	74777	SPOT5	07/06/2009	88
D7281	M	Adult	15.04.2009	70	43	56	13	7-8	74778	SPOT5	6/16/2009	63
D7282	M	Adult	15.04.2009	71	0	57	6	15	74779	SPOT5	06/12/2009	59
D7283	F	Adult	15.04.2009	70	57	57	8	13	68005	TAW-4610H	12/29/2009	transmitting
D7284	M	2 years	15.04.2009	70	57	57	8	2	74780	SPOT5	06/12/2009	59
D7285	F	Adult	16.04.2009	70	50	55	8	5	74771	TAW-4610H	1/14/2010	transmitting
D7286	M	Adult	18.04.2009	72	15	56	2	25	74781	SPOT5	10/30/2009	196
D7287	F	Adult	19.04.2009	71	3	56	21	7	74767	TAW-4610H	1/14/2010	transmitting
D7288	F	2 years	23.04.2009	71	2	56	45	2	74782	SPOT5	6/20/2009	59

Table 2. Date when polar bears crossed 60° W longitude for at least one week in spring with the recession of spring Baffin Bay sea-ice.

Transmitter ID	Date crossed 60° W	Season	Deg. N	Deg. W
68004	08.06.2009	summer	71.13	-61.83
68005	27.05.2009	spring	69.10	-62.23
68011	24.05.2009	spring	72.13	-60.22
68012	24.05.2009	spring	70.51	-61.05
68013	Did not cross			
68014	22.05.2009	spring	70.70	-60.71
74767	11.05.2009	spring	70.66	-62.38
74771	27.05.2009	spring	71.80	-61.5
74777	26.05.2009	spring	70.49	-60.7
74778	Did not cross			
74779	16.05.2009	spring	72.54	-61.16
74780	23.05.2009	spring	72.24	-60.52
74781	04.06.2009	summer	73.45	-62.88
74782	06.05.2009	spring	72.05	-60.6