

The Importance of Polar Bear Provincial Park to the Southern Hudson Bay Polar Bear Population in the Context of Future Climate Change

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Abstract

Ontario's Polar Bear Provincial Park (PBPP) was established in 1970 as a 'primitive park'. The park protects two critical habitat elements for Southern Hudson Bay (SHB) polar bears (Ursus maritimus): coastal summer retreat habitat used by all classes of bears and inland maternity denning habitat used by pregnant females. Late-summer aerial surveys indicate that the park provides protection to 70% of the SHB population occupying summer retreat habitat; 23% of the population occupies the Ontario coast outside the park; and 7% occupies islands in James Bay. Winter aerial surveys indicate that 91% of dens were found in Ontario (36% within the park, and 55% outside), and 9% of dens were found on islands in James Bay. Preliminary data from satellite-collared bears and summer aerial surveys indicated bears selected treed areas, river banks, gravel ridges, and palsas to construct maternity dens. Gravel ridges were selected closer to James Bay where permafrost features were less common, whereas palsas were selected more often west of the Winisk River. If current trends continue, permafrost features such as palsas may disappear and polar bears will be forced to construct maternity dens in river banks and gravel ridges. These are more common inside the park suggesting that the park may be even more important to the SHB population as a maternity denning area in the future. Currently, PBPP provides protection for a high proportion of bears occupying summer retreat habitat, but for only about one-third of maternity dens. Nevertheless, PBPP performs a significant role in helping Canada to meet its obligations to protect polar bear habitat. If climate change models are correct, the importance of PBPP to the SHB polar bear population will increase in the future.

Introduction

Ontario's Polar Bear Provincial Park, which occupies 24 000 km² in the Hudson Bay Lowlands (Figure 1), is among the world's largest parks and is three times the size of Algonquin Provincial Park (OMNR, 1980). The park was established in 1970 and classified as a 'primitive park' at that time (Ontario Department of Lands and Forests, 1967). Primitive parks were intended to protect representative areas of natural landscapes for posterity in "natural, wild conditions" (OMNR, 1977). The initial goals for PBPP were identified in the park master plan as threefold: (i) to protect its environment for the benefit of present and future generations from significant alteration by humans; (ii) to provide quality, low-intensity wilderness recreational opportunities; and, (iii) to provide opportunities for scientific research complementary to Ministry of Natural Resources' programs (OMNR, 1980: 1).

Throughout the 1950s and 1960s there was a rapid increase in the recorded harvest of polar bears (*Ursus maritimus*) throughout the circumpolar Arctic (Prestrud and Stirling, 1994). In response to this significant threat to the survival of polar bear populations, the five nations with jurisdiction over areas where polar bears occur (Canada, Denmark, Norway, USA, and USSR) entered into lengthy negotiations that culminated in the signing of the *International Agreement on the Conservation of Polar Bears and their Habitat* in 1973 (Prestrud and Stirling, 1994).



Figure 1. Location of Polar Bear Provincial Park, Ontario.

Article II of the Agreement states:

“Each Contracting Party shall take appropriate action to protect the ecosystems of which polar bears are a part, with special attention to habitat components such as denning and feeding sites and migration pat-

terns, and shall manage polar bear populations in accordance with sound conservation practices based on the best available scientific data.” (IUCN/PBSG, 2002).

In the decades following the signing of the International Agreement, many polar bear populations recovered to former levels as harvests were controlled and closely monitored (Prestrud and Stirling, 1994). However, with the exception of some denning habitat, little progress has been made on the protection of habitat for polar bears (Prestrud and Stirling, 1994).

In Hudson Bay, where the sea ice melts annually, polar bears are forced ashore to fast and await the return of the ice (Stirling *et al.*, 1977). Hudson Bay is ice-free for approximately four months each year, roughly from mid-July to late November or early December (Kolenosky *et al.*, 1992; Stirling and Derocher, 1993; Stirling *et al.*, 1999). During this time, polar bears of the Southern Hudson Bay (SHB) population can be found on many of the islands in James Bay, and along most of the mainland shore of Ontario from the James Bay shore north of Attawapiskat to the Manitoba border (Prevett and Kolenosky, 1982). During the onshore season both males and females tend to show strong site fidelity to local areas of the coast (Prevett and Kolenosky, 1982; Stirling *et al.*, 1999; Stirling *et al.*, 2004). In contrast, pregnant females move inland up to 80 km or more to construct maternity dens in which they give birth to their cubs (Kolenosky and Prevett, 1983; Derocher and Stirling, 1990; Clark and Stirling, 1998).

Although Polar Bear Provincial Park was created by Order-in-Council in April 1970 (OMNR, 1977), more than three years prior to the signing of the International Agreement, the master plan recognized that the park was of scientific importance particularly with regard to permafrost, arctic tundra, waterfowl, shore birds, and polar bears (OMNR, 1980). The classification of PBPP as a ‘primitive park’ in 1970 recognized the importance of protecting the landscape. This value was re-emphasised when the classification name was changed to ‘wilderness park’ in 1978 (OMNR, 1978). The purpose of this paper is to document use of PBPP by polar bears, and to evaluate the degree to which the park helps Canada to meet its obligations to protect critical polar bear habitat under Article II of the international agreement.

Methods

To document the use of PBPP by polar bears we examined two sources of data: results of annual late-summer aerial surveys conducted by Ontario Ministry of Natural Resources (OMNR) staff from 1963-1996 (e.g., Prevett and Kolenosky, 1982), and results of winter aerial surveys conducted periodically in the 1970s, 1980s and 1990s (Kolenosky and Prevett, 1983). Late-summer aerial surveys were flown along the Ontario coast to count bears within 0.5 km of the high tide mark, and on offshore spits and islands. In 22 of 34 years an aerial survey of Akimiski Island in James Bay was also conducted. In the late 1980s and 1990s the use of twin-engine aircraft enabled observers to survey other smaller islands in James Bay. However, few bears were generally seen on these islands and as these data are available for only six of 34 years they are not considered here. The count of bears on Akimiski Island is considered to represent the count of SHB bears in James Bay, but not on the Ontario coast.

Although effort varied somewhat between years (aircraft type, number of observers), late-summer surveys were generally flown as single continuous tracks at about the same time of year (mid-August to mid-September). The Ontario coast was divided into three areas for data analysis: Area 1 (Hook Point on James Bay to the Winisk River), Area 2 (Winisk River to the Severn River) and Area 3 (Severn River to the Manitoba–Ontario border) (Figure 2). Although the western boundary of PBPP is about 30 km east of the mouth of the Severn River, very few polar bears are seen in any year between the western boundary of the park and the Severn River (Obbard, unpublished data), and data from early years often do not include exact location coordinates. Therefore, we assumed that the total count of bears for Areas 1 and 2 represented the bears found within the boundaries of PBPP. Winter aerial surveys were flown by OMNR staff along pre-determined transects in late February and early March and were designed to intersect tracks of family groups on their journey to the sea ice. At that time of year, adult females with approximately three-month-old cubs are returning from maternity dens to the ice to resume seal hunting (Kolenosky and Prevett, 1983). On sighting of tracks, it was assumed that adult females had denned inland of that location. If tracks were deemed to be fresh they were followed forward to encounter the family group and verify the litter size, or followed backwards to locate the maternity den. Due to fuel limitations, few tracks were followed to the maternity den location. Therefore observations indicate the minimum inland distance to maternity dens.

To supplement information derived from winter aerial surveys, preliminary data on maternity den locations of satellite-collared bears were obtained by averaging late fall locations of presumed pregnant females from 2000-2002. Presumed den locations were visited the following summer to document den type and habitat selection. Preliminary data from summer aerial surveys searching for dens are also included.

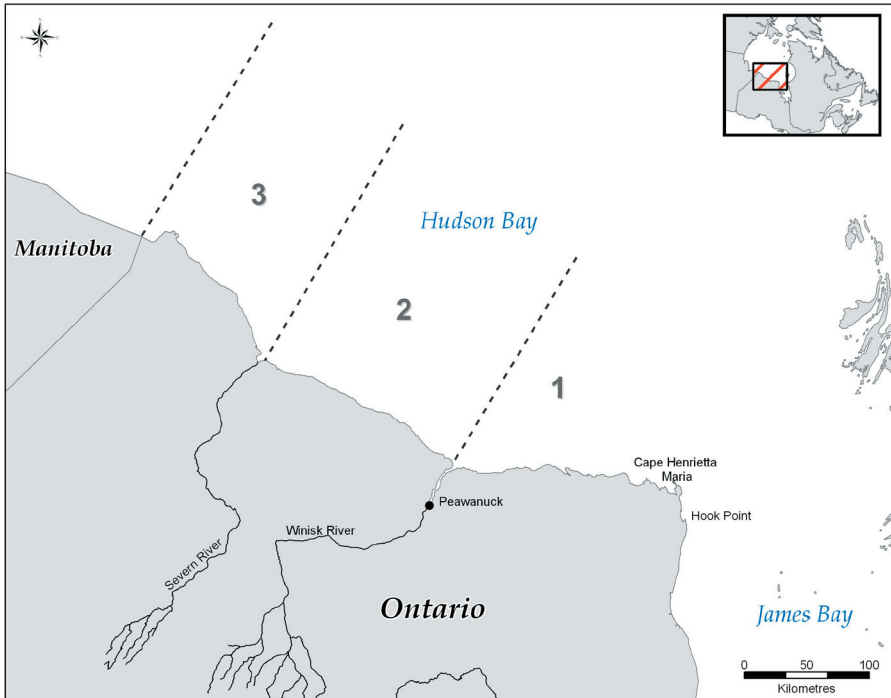


Figure 2. Sampling areas for polar bear counts used in data analysis.

Results

Late-summer Surveys

Though there was considerable variation in the number of bears observed over the years (Table 1), the largest proportion of bears was sighted in Areas 1 and 2 (i.e., within the boundaries of PBPP). On average, about 65-75% of bears seen along the Ontario coast in any one year were seen within PBPP. In recent

Table 1. Number of polar bears counted during annual aerial surveys of the Ontario coastline from Hook Point, James Bay to the Manitoba border, 1963-1996.

Year	Area 1	Area 2	Area 3	Total Area 1-3	Akimiski Island
1963	17	7	23	47	Not surveyed
1964	12	0	13	25	Not surveyed
1965	14	3	26	43	Not surveyed
1966	15	4	21	40	Not surveyed
1967	84	40	26	150	6
1968	35	22	34	91	15
1969	18	9	38	65	Not surveyed
1970	59	7	56	122	Not surveyed
1971	31	11	31	73	Not surveyed
1972	63	17	34	114	10
1973	29	16	26	71	12
1974	32	11	20	63	Not surveyed
1975	69	19	29	117	12
1976	35	7	24	66	13
1977	75	10	38	123	Not surveyed
1978	29	30	62	121	Not surveyed
1979	85	31	42	158	6
1980	93	21	59	173	17
1981	75	15	93	183	14
1982	78	11	47	136	9
1983	66	11	72	149	14
1984	89	25	20	134	5
1985	58	32	26	116	6
1986	57	11	33	101	15
1987	49	9	36	94	8
1988	45	23	75	143	Not surveyed
1989	59	36	66	161	6
1990	129	63	44	236	12
1991	87	27	45	159	6
1992	52	22	37	111	7
1993	103	54	Not surveyed	157	Not surveyed
1994	170	21	63	254	19
1995	171	22	47	240	28
1996	85	60	56	201	18

years (1990-1996), the survey was standardised using a de Havilland Twin Otter and three observers plus the pilot. For that period, the total number of bears observed averaged 216. The number of bears seen in Areas 1 and 2 averaged 152, the number seen in Area 3 averaged 49, and the number seen on Akimiski Island averaged 15. Therefore, on average, about 7% (15 of 216) of SHB bears were observed to summer on Akimiski Island, 23% (49 of 216) summered along the Ontario coast west of PBPP, and 70% (152 of 216) occupied summer retreat habitat within the boundaries of PBPP.

Winter Surveys

Systematic winter aerial surveys were conducted in February-March from 1974-1978 (Kolenosky and Prevett, 1983), 1984-86 (OMNR, unpublished reports), and 1994-95 (OMNR, unpublished reports). The number of family groups observed varied between years largely due to variation in dates females left maternity dens, but also due to variations in snow cover, weather, visibility, and possible synchrony of breeding females. The average number of family groups encountered was about 44 per year over all years (Table 2).

Results of a typical annual survey (1994) are shown in Figure 3. Tracks of some family groups were encountered more than 80 km inland from Hudson Bay, suggesting that females had denned inland of that point (Figure 3). On average, about 91% of family groups were observed on the mainland of Ontario, and 9% were observed on islands in James Bay. Of the 91% of family groups observed on the mainland in Ontario, 36% were observed within PBPP and 55% were observed outside the boundaries of PBPP to the south, west, or northwest. Within PBPP, a large number of family groups were generally observed in the western portion of the park between the Winisk River and the Shagamu River (Figure 3). This pattern was first noted by Kolenosky and Prevett (1983) for the surveys conducted from 1974-1978, and was evident during all subsequent surveys. From 40% to 55% of tracks recorded in any given year were found in the area between the Winisk River and the Shagamu River, though many originated south or west of the PBPP boundary (Figure 3).

Known Maternity Den Locations and Summer Surveys

Kolenosky and Prevett (1983) observed 19 maternity dens during aerial surveys from 1974-1978, and investigated seven of these on the ground. For 17 of

Table 2. Observations of polar bear family groups during late-winter aerial surveys in Ontario.

Year	Number of Family Groups ^a	Number of Litters ^b	Mean Litter Size ^b	Minimum Number of Cubs Produced ^c	Number of Family Groups Observed on Islands in James Bay
1974	20	12	2.1	41	4
1975	32	31	2.0	63	3
1976	40	36	1.9	80	1
1977	16	6	1.8	30	1
1978	53	43	1.9	102	1
1984	62	41	1.8	112	7
1985	23	16	1.6	37	-
1986	68	45	1.4	95	-
1987	65	56	1.8	117	-
1994	49	27	1.7	83	6
1995	53	42	1.6	86	10
Mean	43.7	32.3	1.8	76.9	4.1

^aIncludes visual observations and track counts.

^bDerived from visual observations of family groups and unambiguous counts of tracks.

^cTotal number of family groups observed \times mean litter size for visuals and unambiguous counts.

these dens located in mainland Ontario, distance inland averaged 61 km (range 29-118 km). Of the 17 dens located in Ontario, ten were located in treed areas including treed bogs, four were located at near the edge of small lakes, rivers, and creeks, and two were located at the base of an esker or rock outcrop.

Locations of maternity dens of satellite-collared bears were determined in fall from 2000-2002 for ten bears, and these sites were investigated during the following summer. Seven bears denned east of the Winisk River: of these, four denned in treed areas, one on an elevated gravel ridge, one in a river bank, and one on top of a palsa. Aerial surveys confirmed frequent use of elevated gravel ridges in the area east of the Brant River. Three satellite-collared bears denned west of the Winisk River: one in a treed area, one in a river bank, and one in a palsa. Aerial surveys confirmed frequent use of palsas for maternity dens west of the Winisk River (Obbard, unpublished data).

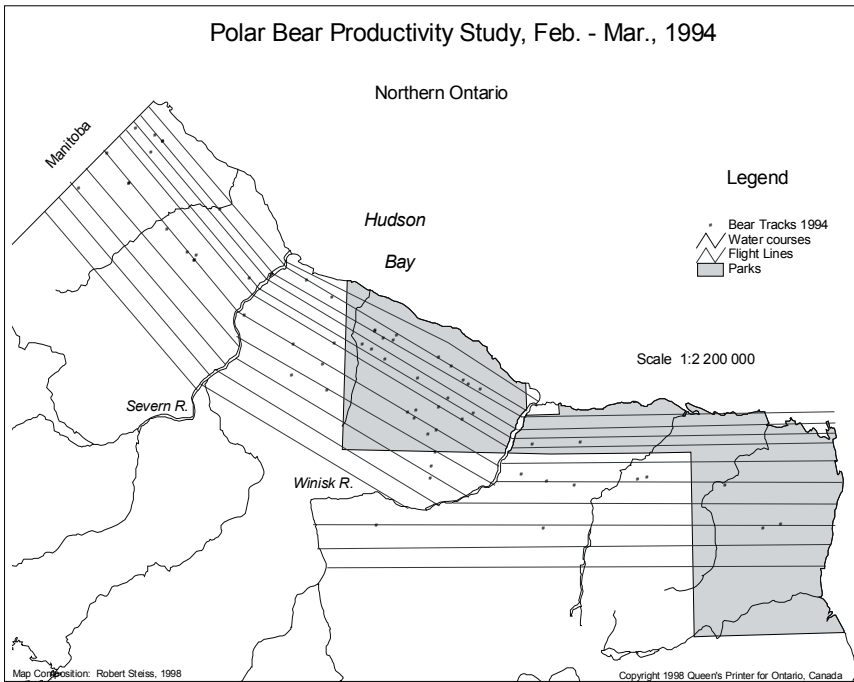


Figure 3. Locations of tracks of family groups of polar bears encountered during winter aerial surveys, February-March 1994 (• tracks of family groups; some are multiple observations of the same family group).

Discussion

A large proportion of the SHB population occupies summer retreat habitat within the boundaries of PBPP. Adult males often congregate on offshore islands and gravel bars and on spits and peninsulas, similar to the pattern documented in Manitoba (Stirling *et al.*, 1977; Stirling *et al.*, 2004). Areas of the coast with raised beaches where males can dig pits in which to rest during the off-ice period are also important concentration areas. Many family groups occupy the intervening coastal areas, but may be found near adult males, and some move inland — this is different from the general situation in Manitoba where most family groups tend to travel inland from the coast (Clark and Stirling, 1998). If current climate trends continue, the ice-free season in Hudson Bay will increase and polar bears will spend much longer periods on land occupying summer retreat habitat (Derocher *et al.*, 2004). The protection that PBPP provides to bears in summer retreat habitat will likely be even more im-

portant in the future, especially if declines in body condition continue (Stirling *et al.*, 1999; Obbard and Cattet, unpublished data).

In Manitoba, pregnant females of the Western Hudson Bay (WHB) population occupy earth dens dug into frozen peat banks along the edges of lakes, streams, and hummocks (Clark *et al.*, 1997; Lunn *et al.*, 2004). In Ontario, high frozen peat banks do not form along the edges of lakes, though stream and river banks and palsas are available to polar bears. West of the Winisk River pregnant bears dig earth dens into palsas similar to the bears in Manitoba. However, east of the Winisk River palsas are absent or are unsuitable because they are less than 1 m in height. Here, bears more often den in treed areas (presumably in snowdrifts formed in the lee of tree cover), or dig shallow dens in elevated gravel ridges. Longitudinal data are not available on adult females of the SHB population; however, females in the WHB population show strong fidelity to the denning area, though not to specific den sites (Ramsay and Stirling, 1990; Scott and Stirling, 2002). It is likely that SHB females show similar behaviour. Therefore, if the predictions of climate modelling are correct and the amount of permafrost in the Hudson Bay Lowlands is reduced in the future (Gough and Wolfe, 2000; Gough and Leung, 2002), then the protection provided by PBPP to denning females will increase in importance.

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