

Observations of Cannibalism by Polar Bears (*Ursus maritimus*) on Summer and Autumn Sea Ice at Svalbard, Norway

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ABSTRACT. We report three instances of intraspecific killing and cannibalism of young polar bears by adult males on the sea ice in Svalbard in summer and autumn. During breakup and melting in summer, the area of sea ice around the Svalbard Archipelago declines to a fraction of the winter total, and in many areas it disappears completely. As the area of sea ice that polar bears can use for hunting declines, progressively fewer seals are accessible to the bears, and therefore the bears' hunting success likely declines as well. Thus, at this time of year, young polar bears may represent a possible food source for adult males. As the climate continues to warm in the Arctic and the sea ice melts earlier in the summer, the frequency of such intraspecific predation may increase.

Key words: polar bear, *Ursus maritimus*, intraspecific predation, cannibalism, Svalbard

RÉSUMÉ. Nous signalons trois cas d'ours polaires adultes qui ont tué de jeunes ours polaires et fait du cannibalisme intraspécifique sur la glace de mer de Svalbard à l'été et à l'automne. Pendant la débâcle et les fontes de l'été, la zone de glace de mer aux environs de l'archipel de Svalbard n'occupe qu'une fraction de la superficie totale atteinte en hiver et dans bien des endroits, elle disparaît complètement. Puisque la zone de glace de mer dont les ours polaires se servent pour leur activité de chasse devient plus petite, il y a de moins en moins de phoques à la disposition des ours, ce qui fait que la récolte de chasse des ours est susceptible de chuter par le fait même. Par conséquent, à ce moment-là de l'année, les jeunes ours polaires peuvent représenter une source de nourriture possible pour les adultes mâles. Au fur et à mesure que le climat de l'Arctique continuera de se réchauffer et que la glace fondra plus tôt en été, la fréquence de cette prédation intraspécifique sera susceptible d'augmenter.

Mots clés : ours polaire, *Ursus maritimus*, prédation intraspécifique, cannibalisme, Svalbard

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INTRODUCTION

Intraspecific killing of one polar bear (*Ursus maritimus*) by another, including both infanticide and predation on older bears, as well as cannibalism, has long been known to Inuit hunters in Canada and Greenland, and several observations have been reported in the scientific literature (Lunn and Stenhouse, 1985; Taylor et al., 1985; Derocher and Wiig, 1999; Dyck and Daley, 2002; Amstrup et al., 2006; Stone and Derocher, 2007; Stirling et al., 2008). Both male and female adult polar bears are also known to scavenge on the carcasses of polar bears killed and skinned by humans (e.g., Larsen and Kjos-Hanssen, 1983). Most intraspecific killing is focused on cubs and subadults, though some adult females are known to have been specifically preyed upon as well (Taylor et al., 1985; Amstrup et al., 2006; Stirling et al., 2008). In all observations of such killings recorded to date, the predators have been adult males. When fully mature, adult male polar bears are roughly twice the size of adult females (Kingsley, 1979; Derocher et al., 2005).

In this note, we report three instances of probable intraspecific killing by adult male polar bears, followed by cannibalism, observed on the sea ice in Svalbard, Norway, in midsummer and early autumn. Excellent full-frame photographs of all the males and their apparent victims, taken at the time each incident was observed, were available from each event. The size and age of both the adult males and their victims were estimated by the first author on the basis of his 40-year experience of observing and handling several thousand polar bears in long-term studies of their behaviour and population ecology.

OBSERVATIONS

On 24 August 2008, southwest of Moffen Island, near the north coast of Spitsbergen Island (79°55' N, 14°10' E), a medium-sized adult male polar bear was observed on the sea ice, at a distance of a few hundred metres from the deck

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of an ecotourism ship, as it fed on a two- to three-year-old subadult of undetermined sex about half or a bit less than half the size of the adult male (M. Curiel, pers. comm. 2008). The sex of the adult male bear was confirmed from his size and morphology, as well as from the presence, in a few of the photographs, of the long diagnostic hairs that hang down from the penis. Although the killing of the smaller bear was not witnessed, it had been bitten extensively on the head and was still bleeding from the bites, suggesting that the kill was fresh and that the smaller bear had been preyed upon by the adult male. No other bears were seen in the area. The adult male, which appeared to be in average condition (or possibly a bit less than average) for that time of year, was bleeding from a puncture wound on its left shoulder and limped slightly when it walked. The wounds appeared to have come from a fight with another bear and were possibly inflicted by the dead bear attempting to defend itself or by a third bear. The body of the dead subadult lay on its back throughout the hour-long observation while the adult ate most of the fat from the lower abdomen and upper thighs.

On 3 September 2009, east of Rossøya (80°30' N; 23°20' E), a very large and very fat polar bear, assumed from its size alone to be an adult male, was observed from the deck of a small ship as it fed on a smaller bear on the sea ice (N. Rosing, pers. comm. 2009). The sex of the dead bear was undetermined. Its size, as shown photographically, suggests that the dead bear was approximately three to four years of age. No other bears were present. When first seen, the adult male had already eaten most of the fat from the subadult's belly, chest, and upper thighs as the dead bear lay on its back. The actual killing of the smaller bear was not observed. However, it was heavily bitten around the head; there was fresh blood on the ice; and at one point, the male lifted up the limp left front arm of the subadult, which indicated that rigor mortis had not yet set in. All these factors suggest that the death of the smaller bear was recent and most likely caused by the large male.

On 21 July 2010, in Olgastretet (78°54' N; 23°21' E), J. Ross observed a medium-sized adult male polar bear from the deck of a small ship for about an hour as it fed on and transported the carcass of a yearling on the sea ice (Fig. 1). The sex of the adult male bear was confirmed by its size and morphology, as well as by the presence, in a few of the photographs, of the long diagnostic hairs that hang down from the penis. Although the actual killing was not witnessed, the limp appearance of the yearling's carcass when the male lifted it, active bleeding from its head, and fresh blood on the ice indicated that the male had killed the young bear very recently. Much of the fur around the yearling's neck was saturated with fresh blood when it was first observed, and there was blood in several places on the head where it had been bitten, probably multiple times. The skin had been peeled back from the yearling's lower abdomen to its left side and part of its back and rump, where the adult male had been feeding on the fat and exposed flesh. Both bears appeared to be in good physical condition. A second bear of



FIG. 1. Medium-sized adult male on sea ice, transporting the fresh carcass of a yearling polar bear it has probably just killed. Note the blood stains from multiple bites to the head. (Photo © Jenny E. Ross)

unknown age and sex watched from an ice floe 50–100 m away but did not try to interact in any way. This bear had no scars, and no blood was visible on either the animal or the nearby sea ice, suggesting it had not been in an altercation. It was unknown whether this second bear was the mother of the dead yearling or an unrelated bear, possibly waiting for an opportunity to scavenge. When the ship approached, the adult male stopped feeding and straddled the carcass as if to defend its possession. Eventually, the adult picked up the carcass, carried it across numerous ice floes, and swam with it across several open leads before stopping to feed on it again. As the ship initially approached and the male began carrying the carcass away, the second bear stood up and moved a short distance away at a tangent to the male, and then lay down again to watch passively from a low ice ridge on a nearby floe. Throughout the period of observation, the second bear made no effort either to approach the feeding bear or to leave the area. No other bears were observed.

All three dead bears appeared to have been killed by more than one bite to the head shortly before they were first observed. The instantly lethal effect of this pattern of biting was confirmed from examination of the skull of a yearling polar bear preyed upon by an adult male in the southern Beaufort Sea (Fig. 2). The similar pattern of wounding on the heads of all three dead bears, as well as fresh blood on and exuding from their carcasses, suggests they were recent victims of direct predation by the males feeding on them and that they were not simply being scavenged after having died from natural causes.

DISCUSSION

Most observations of intraspecific predation and cannibalism by polar bears outside the breeding season have been made on land in late summer or autumn. To a large



FIG. 2. Crushed skull of a yearling male polar bear killed by an adult male in the southern Beaufort Sea, April 2004. (Photo © Ian Stirling)

degree, the prevalence of terrestrial sightings is probably due to the fact that this habitat is easily and regularly accessed by humans, which increases the probability that such events will be observed and reported. The instances of intraspecific predation and cannibalism reported on land have been undertaken by adult male bears that were mainly large and often visibly thin (e.g., Lunn and Stenhouse, 1985; Stone and Derocher, 2007), and which had been forced to fast on land for an extended period during the open water season. While waiting for the sea ice to refreeze so they can return to hunting ringed seals (*Phoca hispida*, their normal prey), polar bears have little to eat and thus fast on their stored fat reserves. Plainly, these thin males were hungry, and having few available food sources, they killed smaller bears for food.

The three observations we describe are different from most other reports of infanticide and cannibalism in polar bears because they took place between midsummer and early autumn, while some bears of all age and sex classes were still actively using the remaining sea ice as a platform from which to hunt. All three adult males appeared to be in good physical condition (i.e., not obviously thin), and one was both very large and very fat.

Relatively little sea ice remains around the Svalbard Archipelago in mid to late summer, compared to ice extent in winter and spring. Most floes are less than a kilometre across and some are only tens of metres or smaller in diameter. In many areas the ice disappears completely, though the amounts remaining vary geographically and between years in the same areas. Ringed and bearded seals (*Erignathus barbatus*) complete their moult by the end of June, at which time large numbers haul out on the abundant coastal sea ice. Later in summer, they are present in the water, but relatively few are hauled out on the sea ice. From studies of a sample of ringed seals fitted with satellite radios, it is clear that some, though an unknown proportion, move north of Svalbard to feed where they are not accessible to bears that remain around the archipelago (Freitas et al., 2008). Similarly, when open water predominates, most bearded seals

are pelagic and largely unavailable for capture by polar bears. Small numbers of bearded seals still haul out on the ice, mainly as single animals on small floes, where they are difficult for bears to capture, although some are caught by polar bears using “aquatic stalks” (Stirling, 1974). Because bearded seals are large, most are taken by large adult male bears (Stirling and Derocher, 1990; Thiemann et al., 2008). Even so, the number of bearded seals caught in summer and fall is probably too small to meet the energetic demands of the adult males at that time of year.

We suggest that, taken together, these behavioral and ecological factors indicate that by late summer, when the available ice and the number of seals accessible to hunt are both greatly reduced, young polar bears may offer one of the few prey choices still available for adult males to hunt from the surface of the residual sea ice. Thus, to some degree, intraspecific predation for food on the remaining sea ice at this time of year may be relatively normal and possibly occurs more frequently than has previously been thought. However, as the climate continues to warm and sea ice continues to break up and melt at earlier dates, thus making seals less available earlier in the summer, the frequency of intraspecific predation and cannibalism may increase. Similarly, as more ships go farther into the disintegrating ice to view and photograph polar bears, it is likely that similar instances of intraspecific predation and cannibalism on the sea ice will be reported more frequently.

Taylor et al. (1985), who reviewed reports in the literature of intraspecific aggression, infanticide, and cannibalism by polar bears in all seasons between 1896 and 1984, suggested that during the breeding season in spring, a male might try to kill a cub in order to gain a reproductive advantage with the cub’s mother, as has similarly been reported for other carnivores (Hrady, 1979). In a detailed study of this sexually selected infanticide (SSI) hypothesis in brown bears (*Ursus arctos*) in Sweden, Bellemain et al. (2006) listed three requirements for infanticide to qualify as SSI: (1) the infanticide shortens the time to the mother’s next estrus, (2) the perpetrator is not the father of the killed infant(s), and (3) the putative perpetrator sires the next litter. It is difficult to determine whether or not these requirements have been met in any given instance; however, the available data on occurrences of intraspecific predation in polar bears during the breeding season appear to indicate that these criteria indeed were not met in the reported incidents.

Several incidents of intraspecific predation in polar bears during the breeding season in spring were documented in the southern Beaufort Sea region between 2004 and 2006 (Amstrup et al., 2006; Stirling et al., 2008). In one instance involving the infanticide of a yearling polar bear, the dead animal was eaten by the predaceous adult male while the young bear’s mother apparently fled. It cannot be determined whether the adult male later relocated and mated successfully with the dead cub’s mother; however, from a statistical perspective, it is highly unlikely. In addition, three adult females were also determined to have been

preyed upon and eaten by adult males during the breeding season in the southern Beaufort Sea region between 2004 and 2006 (Amstrup et al., 2006; Stirling et al., 2008). One of the females was still in her maternity den when she was killed and cannibalized. Tracks of a four-month-old cub near the carcass of another dead adult female indicated that her cub had fled and was not killed by the predaceous male (Amstrup et al., 2006). It is noteworthy that these four predation events in the southern Beaufort Sea region occurred during a period when polar bears in that particular population were confirmed to have been in significantly poorer physical condition than those in the adjacent population because of food stress related to declining sea-ice conditions (Amstrup et al., 2006; Stirling et al., 2008). Furthermore, before these predation events in 2004–06, no instances of infanticide or cannibalism had been observed for 24 years in the Alaskan Beaufort Sea and 34 years in the Canadian Beaufort Sea during extensive survey and tagging studies. In addition, in an earlier study, Taylor et al. (1985) also reported that adult females were killed and eaten by adult males in spring while their cubs or yearlings were not. Thus, the available data do not support the theory that attaining a reproductive advantage is the motivating factor for infanticide by adult male polar bears. In fact, on the contrary, the data support the conclusion that, even during the breeding season, feeding rather than reproduction is the motivation for intraspecific killing by predaceous adult males.

Finally, it is of behavioral interest to note that all the bears we observed in this study, as well as the yearling and the three adult females killed in the southern Beaufort Sea, appeared to have been killed by multiple bites to the head or base of the skull (Amstrup et al., 2006; Stirling et al., 2008). Polar bears also kill seals in this manner (Stirling, 1974 and unpubl. observations), and in most cases, the bear also drags the dead seal well away from the kill site before beginning to feed. Even in the prime feeding period of late spring and early summer, when fat, recently weaned ringed seal young are most available, a polar bear spends an average of about five days hunting unproductively before it succeeds in capturing a seal (Stirling and Øritsland, 1995). Consequently, in an evolutionary sense, it is probably very important for a bear to use multiple bites to the head of a seal to ensure it is dead and unable to escape before pausing to begin feeding on it. Thus, it is interesting to see that the same manner of killing appears to be applied during intraspecific predation, probably for similar reasons. An additional motivation for a polar bear to kill another bear quickly using multiple bites to the head might be to reduce the possibility of being wounded itself in the process, as it appears may have happened to the male described in the first Svalbard incident.

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