ARCTIC
VOL. 52, NO. 4 (DECEMBER 1999) P. 413–415

Observation of Adoption in Polar Bears (*Ursus maritimus*)

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(*Received 16 February 1999; accepted in revised form 9 June 1999*)

ABSTRACT. We observed a case of adoption of a single four-month-old polar bear cub (*Ursus maritimus*) into an existing litter of two cubs on Hopen Island, Svalbard. We believe the high density of maternity dens in the study area may increase the likelihood of natural adoption. Speculation about theoretical implications of adoption is of scientific interest. However, we believe that the probability of adoption may increase when family groups are captured, and the scientific interpretation of such events is of questionable value. We urge researchers to exercise caution in handling family groups in high-density den areas.

Key words: adoption, Barents Sea, capture, handling, polar bear, *Ursus maritimus*, Svalbard

RÉSUMÉ. Dans l'île Hopen au Svalbard, on a observé le cas d'adoption d'un ourson polaire (*Ursus maritimus*) unique âgé de quatre mois au sein d'une portée de deux oursons. On pense que la forte densité de tanières de mise bas dans la zone d'étude pourrait accroître la probabilité de l'adoption naturelle. Les hypothèses concernant les implications théoriques de l'adoption relèvent d'un intérêt scientifique. Nous croyons cependant que la probabilité de l'adoption peut augmenter quand les groupes familiaux sont capturés, et on peut se poser des questions quant à l'interprétation scientifique de telles manifestations. Nous recommandons fortement aux chercheurs de prendre des précautions lors de la manipulation de groupes familiaux dans des aires de mise bas à forte densité.

Mots clés: adoption, mer de Barents, capture, manipulation, ours polaire, *Ursus maritimus*, Svalbard

Traduit pour la revue *Arctic* par Nésida Loyer.

The reproductive ecology of female polar bears is characterized by a low rate of reproduction due to late maturation, small litter sizes, and an extended mother-offspring bond that results in a long reproductive interval (Taylor et al., 1987; Ramsay and Stirling, 1988). Polar bears are typically distributed at low densities on the sea ice, and interactions between family groups are uncommon. Despite the rarity of interaction between families, adoption has occasionally been observed in polar bears (Lønø, 1970; Vibe, 1976; Atkinson et al., 1996; Lunn et al., in press).

Polar bears were sampled as part of a long-term ecological study on Hopen Island (76˚30′N, 25˚E), Svalbard, in the western Barents Sea. Bears were located from a helicopter and captured by injection of tiletamine hydrochloride and zolazepam hydrochloride (1:1 mix), using a dart fired from the helicopter (Stirling et al., 1989). A temporary dye mark was painted onto adult bears. All adults and cubs were individually marked with plastic ear tags and a transponder chip (Texas Instruments). Satellite radio transmitters (Telonics, Mesa, Arizona) were attached to some adult females to monitor movements and reproductive history. A premolar tooth was extracted from adults for age determination (Calvert and Ramsay, 1998).

On 13 April 1998, an adult female (7 years old) was captured with two female cubs (ca. 4 months old) on Hopen Island, a few hundred metres from the maternity den. The capture and handling of the family group followed the typical procedure, and nothing unusual was noted. The mother was not resighted after capture, but it is known from satellite telemetry data that she survived. Further, we know that this mother, who lost one of her two cubs to the adoptive mother, did not den in 1998; this suggests that she still had a cub.

On 16 April 1998, an adult female (7 years old) with three cubs was captured within 100 m of the capture site of the first family. These cubs were two males and one female, but the female cub was from the litter captured three days earlier. Snow obscured the tracks, so we could not determine how the cub had been adopted. The cub had not lost weight between captures; it appeared to be in good health and integrated into its new family. On 21 April, a dye-marked female with three cubs was observed near the capture location; presumably, this was the foster family with the adopted cub.

The two mothers involved in the adoption on Hopen Island were young and relatively inexperienced at rearing offspring. Females in the Barents Sea are sexually mature at 5 or 6 years of age (Wiig, 1998), and the mothers may have been primiparous. Perhaps among polar bears, as among brown bears *U. arctos* (Craighead et al., 1995a), females that adopt may be younger than reproductive females in general.

The events that resulted in the Hopen Island adoption are unknown. The mothers involved had dens within

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200 m of each other. Adoptions can be associated with the death of the mother in brown bears (Craighead et al., 1995a), but the mother we observed is known to have survived. The effects of handling on polar bears have been only partially assessed, and little clear impact has been demonstrated (Ramsay and Stirling, 1986; Derocher and Stirling, 1995b). However, the capture and marking of brown bears is thought to increase their rate of offspring abandonment (Craighead et al., 1995a). Given that abandonment of offspring is a precursor of adoption, it is possible that handling was a factor influencing adoption in our example. Female polar bears with cubs in high-density den areas typically avoid conspecifics and retreat into the den when conspecifics are seen (Hansson and Thomassen, 1983). If females recovering from drugging are less vigilant in avoiding conspecifics (making interaction between families more likely), the drugging and marking of polar bears may increase abandonment and adoption.

There are several theoretical implications of adoption in mammals (Reidman, 1982). In brown bears, abandonment followed by adoption has been speculated to increase a female's reproductive fitness (Tait, 1980). Regarding one case of adoption in polar bears, Atkinson et al. (1996) speculated that in their study population, proximity of kin would increase the likelihood of altruistic behaviour. Alternatively, female polar bears that have recently lost their young may be hormonally primed to adopt young (Atkinson et al., 1996). However, unless the adoptive mother we observed had also adopted the two male cubs, it appears that loss of offspring was not a factor.

Female polar bears can reproduce up to 27 years of age and produce 12 to 18 cubs over their life span (Derocher and Stirling, 1994). Therefore, a single cub represents 5–8% of a female's lifetime reproductive output. Fostering out a cub to another female that has two cubs of her own is unlikely to benefit the birth mother, because in 83% of triplet litters, at least one cub dies between spring and autumn (Derocher and Stirling, 1996). Further, adopting a cub would have little evolutionary value in the present case, because the additional nutritional burden placed on the adoptive mother would reduce investment in her own offspring. However, the mother fostering out one of her cubs could increase investment into the single remaining cub and thereby partly compensate for the loss of one cub.

The highest den density (up to 12.1 dens/km^2) reported for polar bears is on Kongsøya, Svalbard (Larsen, 1985). By comparison, in a 6000 km^2 den area of western Hudson Bay, where adoption has also been reported, approximately 191 females produce cubs each year (Derocher and Stirling, 1995a), giving a density of only 0.03 dens/km^2. The number of maternity dens on Hopen Island varies from year to year; density was about 0.46 dens/km^2 in 1998 (Derocher and Wiig, unpubl. data). However, the area where the adoption occurred had the highest density of dens on the island, with eight dens over an area of 6.3 km^2, or 1.3 dens/km^2 (Derocher and Wiig, unpubl. data). It is possible that in the high-density den areas of Svalbard, adoption may be more common because the probability that families interact is higher.

Cub survival rates for polar bears are variable but generally do not exceed 60% in the first year (Amstrup and Durner, 1995; Derocher and Stirling, 1996; Wiig, 1998). The causes of cub mortality are poorly known. Estimates of cub mortality are based on changes over time in the number of cubs with a mother (Amstrup and Durner, 1996; Derocher and Stirling, 1996) or on den entry behaviour, determined from satellite telemetry (Wiig, 1998). When a cub is not present with the mother, it is assumed to have died. However, offspring adoption in polar bears raises some doubts about the accuracy of this approach.

We agree with Atkinson et al. (1996) that mother-offspring relationships should be tested using genetic markers (Craighead et al., 1995b; Paetkau et al., 1995; Lunn et al., in press) to assess the frequency of adoptions under natural conditions. However, we also believe that scientists should exercise caution in the capture and handling of polar bear families in areas of high density.

ACKNOWLEDGEMENTS

The research program on polar bear ecology is funded by the Norwegian Polar Institute. All research methodology was approved by the Norwegian Experimental Animal Committee.

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