

## Polar bear cubs may reduce chilling from icy water by sitting on mother's back

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**Abstract** The principal habitat of polar bears *Ursus maritimus* is sea ice where they hunt seals. Much of the sea ice habitat is scattered or with leads of open water. Adults are good swimmers. They are well adapted to cold water, while small cubs do not yet have fat layer sufficient to avoid chilling if swimming in icy water for any prolonged period of time. An important question is thus how female mothers and their cubs may behave to avoid that cubs get chilled, but at the same time making it possible for the families to hunt in those areas. We describe an observation of a polar bear cub on its mother's back while the mother was swimming among ice floes in Svalbard, Norwegian Arctic. Similar observations are to our knowledge not earlier described in the scientific literature. We point out that this behaviour minimize exposure to cold water and hence significantly may reduce chilling of the cub. It may also be a way for the mother to transfer cubs not yet able or willing to swim. The behaviour may be necessary to allow the families to get around in areas of sea ice with many open leads.

**Keywords** Polar bears · Swimming · Body temperature

During the evening of 21 July 2006, a group of tourists onboard the ship Professor Molchanov reached the mouth of Duvefjorden, Nordaustlandet, in the Svalbard archipelago, at approximately 80° 20'N, 24°E. Here they encountered scattered sea ice with high polar bear activity. Among the ice floes, they spotted a female bear swimming with a

cub on her back. The higher part of the cub was out of the water. It is not known when the cub got onto the mother's back, nor for how long it was in this position. Neither do we know the length of time the bears were in the water. The mother swam to an ice flow and climbed onto it. She then walked for several meters with the cub sitting on her back until she shook it off. Figure 1 shows the mother and the cub, with the position of the cub being the same as when they were in the water. This mother had a collar with a GPS satellite tag, deployed by the Norwegian Polar Institute. She was marked on 12 April 2006 in Zorgdragrfjorden (80° 26'N, 22° 50'E), when she was with two cubs. The mother's age was determined to be 19 years (based on cementum layers in a premolar tooth, Hensel and Sørensen 1980), an old age for a reproducing female (Amstrup 2003). She was thin in April (138 kg), and given her age and condition, the loss of one of the cubs before late July was not surprising. The tag revealed that from April to July, she largely restricted her movement to an area north of Nordaustlandet, latitude 80° 00'N–80° 30'N, and longitude 21° E–25°E.

We questioned polar bear researchers and northern resident people with many hours of polar bear observations whether they had seen cubs sitting on their mothers' back either when swimming or walking. Jason Roberts (pers. comm.) has seen several cases where cubs rode on their mother's backs while swimming. In one case he observed two cubs that went onto the mother's back before she crossed a lead in the sea ice 30–40 m wide, and cubs were not swimming at all. That observation was in late April in Svalbard, the family on the way from the den area out to the hunting ground on the sea ice. Nikita Ovsianikov (pers. comm.) has also seen cubs in different positions on the back of their swimming mother. He suggested that in some cases cubs are so far toward the front of their mother's

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**Fig. 1** Adult female with cub on the back, still in the same position as when the mother was observed swimming before she climbed onto the ice floe (photo: Angela Plumb). The mother is equipped with a GPS satellite collar (around the neck)



**Fig. 2** Adult female polar bear swimming in Svalbard. She lies rather high in the water, illustrating that a cub on her back would potentially be partly out of the water (photo: Kit Kovacs, Norwegian Polar Institute)

body it is unlikely they contribute any swimming effort. He tells that usually only the head or a very minor part of the cub's back is clear of the water. The observations are from late summer–autumn, in eastern Russian Arctic.

That polar bear cubs can ride on their mother's back either on land or in water is also mentioned by Brown (1993), but without further details. He points out that several bear species, including brown bears *Ursus arctos*, the closest relative of the polar bear, can be seen carrying cubs on the back. It is unclear how common the behaviour is among polar bears, but scant observations could be due to the remoteness of the Arctic areas. The observation described here together with several other similar observations document that cubs of the year in some cases sit on the back of their mother when she crosses areas of open water. Although stress due to the presence of humans could have been inducing the behaviour in some cases, these observations still show a behaviour that can potentially reduce heat loss in the cubs, and possibly be vital for their ability to survive in habitats with scattered sea ice, which is prime habitat for polar bears when hunting seals.

Sitting on the back of a mother, much of the cub's lower body will be in direct contact to her fur, and thus heat loss through this part will likely be considerably reduced compared to if the cub was swimming. The sides of the body will be exposed to the water, and the back could be either under water or partly above. In the observation described here, part of the back was above water. The picture of the cub (Fig. 1) clearly shows that the upper part is relatively dry, compared to the lower part of the cub's body and the pelt of the mother. Figure 2 shows a swimming female and her position in the water. From the picture

one can imagine that a cub on the back of a swimming mother may have a considerable part of the body out of the water, reducing heat loss.

The conduction of heat through water is about 25 times higher than in air (Schmidt-Nielsen 1997). The water in the Arctic, if air temperature is low, is typically about  $-1.8^{\circ}\text{C}$ , the freezing point at salt water salinity of 3.3% (Gill 1982). The thick subcutaneous fat layer in adult polar bears provides effective insulation and buoyancy that make it possible to swim for long periods even at such temperatures. The cubs however, have very little subcutaneous fat, and no brown fat (Blix and Steen 1979). Their pelt, if immersed in ice water, loses most of its insulating value (Scholander et al. 1950). The vulnerability of young cubs to cold water was demonstrated when a three month old cub immersed in ice water had a drop in rectal temperature of  $11^{\circ}\text{C}$  in 30 min (Blix and Lentfer 1979), and it is thus unlikely that cubs can cope with the chill of ice water for any prolonged period of time. Thus females with young cubs will likely avoid exposure to cold water except for very short periods of time. Nikita Ovsianikov (pers comm.) has frequently observed cubs of the year swimming, but only once in spring when water and air temperature were very cold (early April). That time the mother had tried to hinder the cubs from swimming, and finally she actively led them away from the water. If however, polar bear cubs are forced to cross open water, it may be vital to behave in a way that minimizes heat loss. This observation could indicate a behaviour that accomplishes that goal. In addition to maintain the cub's body temperature, this behaviour may be necessary to allow mother bears to cross open water leads when that is necessary.

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