

# Mediterranean polar bears: an isolated case of adaptation or acclimation ?

## A pilot study



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### BACKGROUND

Polar Bears show excellent adaptation to the extreme Arctic environment (Miller *et al.*, 2012). These adaptations include a 10 cm thick layer of body fat, pigment-free fur providing camouflage for hunting on the ice, and black skin that can absorb heat from the sun (Øritsland, 1970; Harington, 2008). These adaptations can also mean that polar bears overheat above 10 °C (Stirling, 1988).

Breeding physiology shows climatic adaptations as well with induced ovulation and delayed blastocyst implantation. This allows a female bear to physiologically assess her condition prior to starting gestation and the process of birthing, nursing and carrying for her offspring for the next three years. In the Hudson Bay population, a polar bear female carrying a blastocyst must achieve a body weight of at least 220 kg to have the blastocyst implant and start gestation otherwise it is reabsorbed and the female will attempt to be fatter the following year to achieve a successful pregnancy (Stirling *et al.*, 2012).



### OBJECTIVES

Fasano zoo polar bears manage to thrive in a Mediterranean environment (January max/min temp.: 11,6-4,9 °C; August :29,8-21,4 °C) and to successfully reproduce on a regular basis (Noel, 3/12/2003; Dea, 2/12/2008; Gianna, 28/11/2006; Grace, 6/12/2012). The aim of this pilot study was to assess polar bear reaction to heat and crowd stress during summer (hottest and busiest season). In order to assess if these variables cause stress in resident polar bears, their behavior was monitored for four days recording daily temperatures and visitors numbers.

Our hypothesis was that with high temperatures and high visitors presence polar bears would spend more time indoors and off show where air conditioning is provided (22-23 °C indoor against 29-30 °C average outdoor).



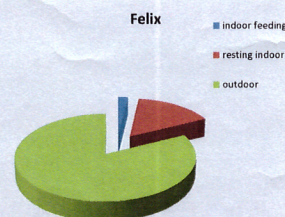
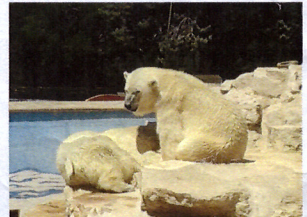
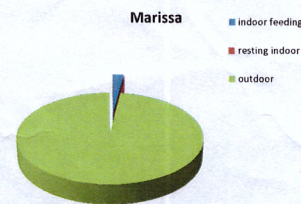
### MATERIALS AND METHODS

**Animals:** n. 3 individuals of *Ursus maritimus*, 1 male (Felix), 1 female (Marissa) and 1 female cub (Grace), aging 20, 19 and 2 years respectively. **Observational Methods:** six 50-minutes observations sessions were conducted daily between the 7th and the 10th August 2014. Each data collection day was divided into six time sessions: 0800-0850, 0850-0940, 1100-1150, 1300-1350, 1350-1440, 1600-1650 hours. In each time slot, all individuals were observed using focal sampling; observing one individual at a time for 16 minutes, recording state behaviours every minute (on the minute) and all occurrences of event behaviours were recorded during each minute of the 16 minute session. Relative humidity and wind speed was recorded daily, temperature every 16 minutes, decibel levels every 5 minutes and visitor crowd levels every minute. Every morning at the beginning of first session resting position of each bear and distance from each other was recorded to provide information on affiliative associations (Miller & Kuhar, 2008).



### RESULTS

In spite of our predictions the female (Marissa) and cub polar bear (Grace) avoided the indoor area except for indoor feeding times. Only the male (Felix) spent time indoors during the warmest hour of the day. Marissa and Grace spent 97% of the time outdoors. The only exception was during indoor feeding sessions when called by keepers (rangers). Only Felix spent a notable amount of the time indoors (19%) .



All the bears were seen sleeping outdoors at the beginning of the first morning session with Grace and Marissa in body contact with each other and Felix at body length from them indicating affiliative association ("morning social partners"; Miller & Kuhar, 2008).



As a further evidence of welfare despite local warm weather, mating was filmed previously during June and keepers report the female to always display hyperphagia and gain weight before giving birth (December-January) as would be expected in *in situ* populations.

### REFERENCES

- W. Miller, S. C. Schuster, A. J. Welch, A. Ratan, O. C. Bedoya-Reina, F. Zhao, H. Lim Kim, R. C. Burhans, D. I. Drautz, N. E. Wittekindt, L. P. Tomsho, E. Ibarra-Laclette, L. Herrera-Estrella, E. Peacock, S. Farley, G. K. Sage, K. Rode, M. Obbard, R. Montiel, L. Bachmann, Ö. Ingólfsson, J. Aars, T. Mailund, Ø. Wiig, S. L. Talbot, C. Lindqvist (2012): Polar and brown bear genomes reveal ancient admixture and demographic footprints of past climate change PNAS 2012 ; published ahead of print July 23, 2012, doi:10.1073/pnas.1210506109
- Øritsland NA (1970) Temperature regulation of the polar bear (*Thalarchos maritimus*). Comp Biochem Physiol 37:225.
- Harington C.R. (2008). The evolution of Arctic marine mammals. Ecological Applications 18, 523–540.
- Stirling, Ian (1988). Polar Bears. Ann Arbor: University of Michigan Press. ISBN 0-472-10100-5.
- Stirling, I. and Derocher, A.E. (2012). Effects of climate warming on polar bears: a review of the evidence. Global Change Biology 18:2694-2706.
- Miller A. and Kuhar C.W. (2008). Long-term monitoring of social behaviour in a grouping of six female tigers (*Panthera tigris*). Zoo Biology 27: 89-99.