

THE GROWTH RESPONSES OF TWO POLAR BEAR (*URSUS MARITIMUS*) CUBS TO REGIMENTED DIETARY ENERGY.

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Introduction

The growth of polar bear (*Ursus maritimus*) cubs depends to a large extent on litter size and the provision of maternal care, specifically, milk production and the sharing of prey (Derocher and Stirling, 1996, Robbins et al., 2012). Cubs in most subpopulations stay with their mothers for up to 2 ½ years and rely solely on maternal milk during the first 3 months of life. Subsequently, they consume milk and prey, however, the amounts and proportions vary, particularly since 20% of females with cubs and 60% of females with yearlings will stop lactating at some point during the ice-free summer season (Derocher et al., 1993).

Structural body size in polar bears is variable across subpopulations and is dependent upon nutritional and genetic factors, including gender (Derocher and Stirling, 1996, Derocher and Wiig, 2002). Even within structural body size, the mass of polar bears can vary considerably across years and season due to patterns of hyperphagia and fasting, dictated by environmental conditions and opportunistic feeding behaviors (Knudson, 1978, Atkinson and Ramsay, 1995, Stirling, 2011, Derocher and Lynch, 2012). Adult female polar bear mass may change up to four-fold within a year (Stirling, 2011, Derocher and Lynch, 2013). Variation in body mass relative to nutrition of growing polar bear cubs is not well understood.

Materials & Methods

In 2011 and 2013, polar bear cubs were born at The Toronto Zoo and in each year only one male cub survived. Both cubs were removed from their mothers and hand reared within the zoo's Wildlife Health Centre (Mihailovic et al., 2012). After 16 and 14 weeks, respectively, the cubs were transferred to the polar bear house maternal unit, which included indoor and outdoor holding areas, a small pool, and weighing scales. Cubs were kept on a regimented diet of known composition until almost one year of age. The controlled feeding regime provided a unique opportunity to document the growth of polar bear cubs as a function of dietary energy.

This diet was composed of increasing amounts of Toronto Zoo Feline Diet, dog chow, fish oil and smelt, with a consistent amount of milk replacer. It was decided to let the cubs develop gradually and to adjust their daily feed supply (aiming at maximum 5 % increase per week) according to their weekly gains in weight. The cubs were fed several times per day and the majority (estimated over 99%) of the diet was consumed, and so an assumption was made of 100% intake. The cubs were weighed once a week.

The metabolizable energy (ME) content of the diet was estimated by using equations derived for dogs (National Research Council, 2006), or was obtained from product diet labels. Preliminary calculations are presented in Table 1, and Figures 1 and 2.

This work was done to support conservation of polar bears in the wild.

Table 1: Total and daily growth and metabolizable energy (ME) intake and daily energy supply related to maintenance and growth of two polar bear cubs on a regimented diet.

Polar Bear	Total ME (MJ)*	Total Growth (kg)	Daily ME Intake (MJ/day)*	Daily Growth (kg/day)	ME /kg Growth (MJ)*
Cub 1	6122	100.2	25.8	0.42	61
Cub 2	5863	79.3	24.3	0.33	74

*Please note: These amounts of ME are for maintenance, growth and movement for a polar bear cub reared in human care only.

**Please note: During the summer of 2012, for a period of 20 days, ethograms were made during mornings and afternoons of the 2011 cub. This was performed in anticipation of behavioral changes due to potential heat stress. No clear signs of behavior adaptations to excessive heat (like decreased activity, staying in the shade, panting, etc.) were observed.

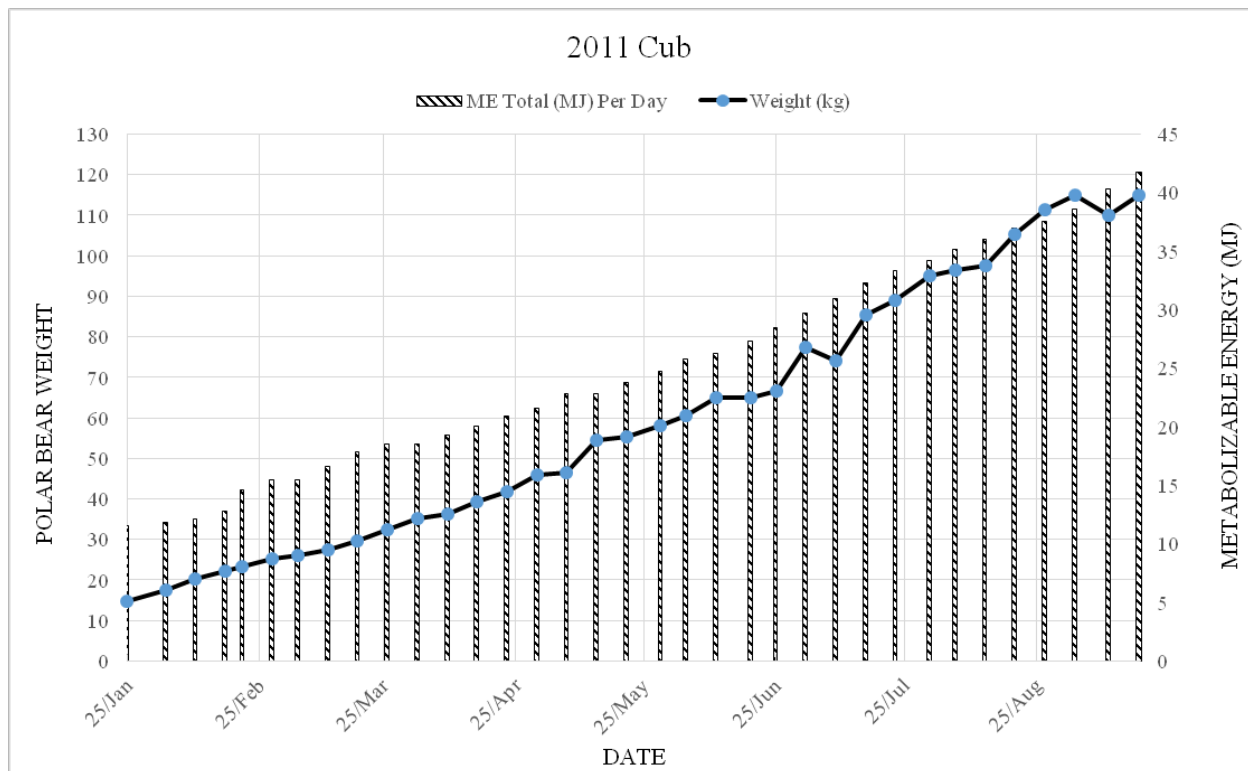


Figure 1. Cub weight and daily ME intake at week intervals, January to September 2012

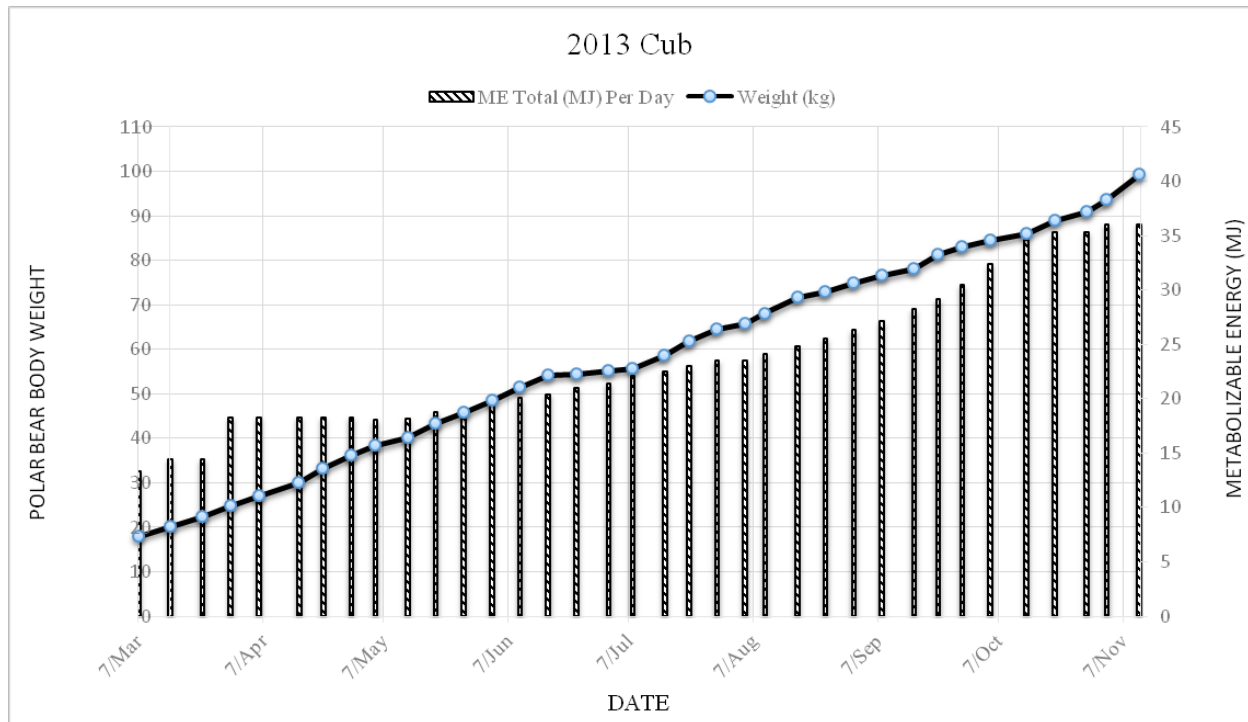


Figure 2. Cub weight and daily ME intake at week intervals, March to November 2014

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