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TITLE: The seasonal energetic landscape of an apex marine carnivore, the polar bear

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ABSTRACT:

Abstract Divergent movement strategies have enabled wildlife populations to adapt to environmental change. In recent decades, the Southern Beaufort Sea subpopulation of polar bears (Ursus maritimus) has developed a divergent movement strategy in response to diminishing sea ice where the majority of the subpopulation (73?85%) stays on the sea ice in summer and the remaining bears move to land. Although declines in sea ice are generally considered a challenge to energy balance in polar bears residing in some regions of the Arctic, little quantitative data exists concerning the seasonal energy expenditures of this apex marine carnivore. We used GPS satellite collars with tri?axial accelerometers and conductivity sensors to measure the location, behavior, and energy expenditure of five adult female polar bears in the southern Beaufort Sea across seasons of sea ice breakup and minimum extent. Using a Bayesian mixed?effects model, we found that energy expenditure was influenced by month, ocean depth, and habitat type (sea ice or land). Total energy expenditure from May through September ranged from 37.7 to 47.2 mJ/kg for individual bears. Bears that moved to land expended 7% more energy on average from May through September than bears that remained on the receding sea ice. In August, when bears were moving from the sea ice to land or moving north with the receding pack ice, bears that moved to land spent 7% more time swimming and expended 22% more energy. This means the immediate cost of moving to land exceeded the cost of remaining on the receding summer pack ice. These findings suggest a physiological reason why the majority of the Southern Beaufort Sea subpopulation continues to inhabit a diminishing summer ice platform. However, bears that moved to land spent 29% more time in preferred hunting habitats over the continental shelf than bears that remained on the sea ice. Bears on land also had access to subsistence?harvested bowhead whale carcasses. Hence, our findings indicate there may be a greater overall energetic benefit to move to land in this region, which suggests that the use of the diminishing summer sea ice may be functioning as an ecological trap.

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