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Would it be possible for every Canadian to own a polar bear?

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Abstract

This paper discusses the common stereotype/fantasy that every Canadian owns and rides a polar bear and whether this would be possible in real life. The paper begins with a background on polar bear range and eating habits, and then goes on to discuss sources of food in Canada. It was assumed only everyone of driving age would own a polar bear, allowing a population of 2.99×10^7 polar bears. It would take either 9.02×10^5 cows, 2.3×10^6 hogs, or 7.4×10^8 chickens per day to feed that amount of bears. Using cows and chickens as the model animals, the amount of pasture needed to support that much food for a year is calculated to be 4.5×10^7 km² for cows, which is larger than the total landmass of Canada, and 2.7×10^8 km² for chickens. While the landmass of Canada could support the chickens, due to their waste and pollution, it is concluded that it would not be possible for every Canadian to own a polar bear.

Introduction

Canadian stereotypes usually fall into three general themes: (1) Canada is a winter wonderland, (2) Canadians need Tim Hortons, and (3) Canadians are very polite and/or talk funny [1]. While this paper will not comment on the last two themes, it will discuss a stereotype that falls under the first theme. Since all of Canada is sometimes inaccurately thought of as winter wonderland, one common stereotype about Canadians is that they all own and ride polar bears [2]. While this is more of a fantasy than a stereotype, this paper will discuss whether this would be possible, and if so, how much food it would take to feed such a high number of polar bears.

Background

In Canada, polar bears are naturally found in an area covering James Bay to the northern Elsmere Islands (Figure 1). They can be found as far south as the northern border of Manitoba and Ontario where their range partially overlaps that of Grizzly Bears [3].

A fully-grown polar bear adult can weigh anywhere from 200 kg (female) to 600 kg (male). Polar bears are both scavengers and hunters, eating what they can find or catch in the harsh tundra environment [4]. Typically, polar bears use frozen sea ice to hunt seals and small whales, although they will eat other mammals, including humans, if the opportunities present themselves [4]. Polar bears depend on food

sources with high fat content and an average polar bear requires 2 kg of fat per day to obtain enough energy to survive [3].



Figure 1 – The year round polar bear range in Canada highlighted in blue [4].

In 2016, Canada's population was 36.71 million [5]. This paper will assume that owning a polar bear would be equivalent to owning a car as the stereotype suggests polar bears are a mode of travel. For this reason, only people over the age of 18 (the age which Canadians typically achieve their full licence) will be considered polar bear owners [5]. This is equivalent to 2.99×10^7 people according to Statistics Canada [5]. Therefore, if each person of driving age in Canada owned a polar bear, there would be 2.99×10^7 domesticated polar bears in the country. Multiplying this population by the average daily food intake requirements of 2 kg of fat, the daily

amount of fat required to feed the polar bear population would be 5.98×10^7 kg's of fat.

According to Statistics Canada, the three main agricultural meats in Canada are chicken, beef, and pork, with chicken accounting for just under 50% of the per capita meat consumption [5]. A single meat industry chicken typically contains 0.081 kg of fat, a single meat industry cow typically contains 66.22 kg of fat, and a single meat industry hog typically contains 26.13 kg of fat [6]. Dividing the total polar bear daily fat requirement by these values, it would take either 7.4×10^8 chickens, 9.02×10^5 cows, or 2.3×10^6 hogs to feed the polar bears each day. As cows and chickens offer the most and least fat per animal, they will be used to model whether Canada has enough land area to support the polar bear food demand.

Application

The amount of pasture needed to support a certain number of animals can be calculated using equation (1):

$$Acres = \frac{0.04 \times N_{animal} \times m \times N_{days}}{y}, \quad (1)$$

where 0.04 refers to the daily utilization constant for livestock which is always the same, N_{animal} refers to the number of animals per acre, m refers to the average mass of the animal being placed on the land, N_{days} refers to the number of grazing days of the land, and y refers to the yield per acre i.e. the amount of pasture food is available [7]. This paper will use the *Red Angus* breed of beef cow and the *Broiler chicken* for the calculations as they are the most common breeds of cow and chicken used for meat in Canada [6, 8]. The *Red Angus* has an average mass of 900 kg while the *Broiler chicken* tends to have a 2 kg mass at slaughter. The average Canadian pasture in the prairies has a yield of 1.1 tonnes per hectare which is equivalent to 404.7 kg per acre [6]. Therefore, the amount of acreage required to meet the food requirements of the polar bears for one day using cows and chickens would be:

$$\begin{aligned} Acres (cows) &= \frac{0.04 \times 9.02 \times 10^5 \times 900 \times 1}{404.7} \\ &= 80,237.2 \text{ acres} \end{aligned}$$

$$Acres(chickens) = \frac{0.04 \times 7.4 \times 10^8 \times 2 \times 1}{404.7}$$

$$= 146,281.2 \text{ acres}$$

For a full year, 3.3×10^8 cows and 2.7×10^{11} chickens would be required to feed the polar bears. Using these values along with the value of 365 days in equation (1), this would require 1.1×10^{10} acres or 4.5×10^7 km² of pasture land for the cows, and 1.95×10^{10} acres or 7.89×10^7 km² of pasture land for chickens. The total land area of Canada is only 9.99×10^6 km², and even if the entirety of Canada had a landmass suited toward pasture land (ignoring mountainous, arid, and tundra regions), it would not be large enough to support the number of cows required to feed the polar bears for a year [5].

While the use of equation 1 also suggests Canada would be unable to support the bears through chickens, the equation does not necessarily describe how meat chickens are raised in reality. Equation 1 calculates how much pasture is required to support free range animals, but chickens are not often raised in truly free range conditions [8, 9]. It takes less land to raise them in shelters, as approximately 1000 chickens can be raised per acre of land in shelters which protect the pasture from trampling [9]. Dividing the total number of chickens by 1000 chickens/acre, it would take 7.4×10^5 acres of land to rear enough chickens to feed the polar bears for a day, or 2.7×10^8 acres (1.1×10^6 km²) to feed the polar bears for a year.

Canada, when taken in a strictly land mass perspective, would be able to support this number of chickens. But *Broiler chickens* have huge waste outputs (523 million chickens a year produce an estimated 1.2 billion litres of waste) [10]. Attempting to feed 2.99×10^7 polar bears with chickens would destroy Canada's natural environment, so it will also be considered impossible [10].

Conclusion

It would not be possible for every Canadian of driving age to own a polar bear. Canada as a whole does not have enough land mass to support the number of cows required to feed 2.99×10^7 polar bears for a full year, assuming each day 9.02×10^5 cows or 7.4×10^8 chickens are slaughtered to meet their feeding requirements. While from a landmass perspective Canada could theoretically support the 7.4×10^8 chickens required, this would likely destroy Canada's natural environment and therefore is still considered impossible.

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