

The 12<sup>th</sup> North American Caribou Workshop,  
Happy Valley/Goose Bay, Labrador, Canada,  
4–6 November, 2008.

## Frame size and caribou population cycles: a modeling approach

Don Russell<sup>1</sup>, Craig Nicholson<sup>2</sup>, Robert G. White<sup>3</sup>, & Anne Gunn<sup>4</sup>

<sup>1</sup> Northern Research Institute, Yukon College, Box 10038, Whitehorse, YT, Y1A 7A1, USA (don.russell@ec.gc.ca).

<sup>2</sup> Natural Resources Conservation, U. Mass. Amherst, MA.

<sup>3</sup> Institute of Arctic Biology, University of Alaska Fairbanks, Fairbanks, Alaska, 99775.

<sup>4</sup> 368 Roland Road, Salt Spring Island, BC, V8K 1V1, Canada.

In North America, and likely in Eurasia, large migratory *Rangifer* populations experience distinct phases in abundance (increase, stable or decrease). As caribou populations in northern North America have experienced at least three complete variations in the last century they can be classed as cyclical. Currently, populations appear to be either at a low or are declining across Arctic North America. There is concern that under increased industrial development, climate change and greater hunter access, populations currently at a low in their cycle may take longer to recover and that the population trough may be lower. However, the exact timing of the cycles and their amplitudes can vary among populations. Various theories have been presented to explain why a *Rangifer* population cycles, and why some populations appear relatively synchronized in their phases of abundance. It is generally conceded that both phenomena relate to continental-scale climatic phenomenon which influences the caribou's environment. We are investigating whether the environmental driver(s) influence the population through nutritional stress in the individual. We assume that for migratory *Rangifer* the mechanism will result in distinct patterns in body size throughout the cycles, and that this outcome should be observable in extant data sets such as jaw and leg bone measurements, and body mass. In times of limited resource availability, smaller frame size individuals would be at an advantage because of lower energetic demands for non-productive energy requirements (maintenance, and possibly activity), leaving more net energy available for productive requirements (gestation and lactation in the female). Conversely, during periods of high resource availability, larger frame individuals would be at an advantage through greater calf survival. In this paper we use a modeling approach to explore the theoretical characteristics of frame size in *Rangifer* throughout a population cycle. Using a North American data base for body condition of caribou, we examine frame size across herds throughout various stages of a population cycle with the objective to speculate on management implications of our findings.