Muskox Collar Data Exploration

Sample Size

Movement data for this project come from 10 female muskoxen in the Sahtu region of the Northwest Territories (NWT) that were collared between December 2007 and February 2012.

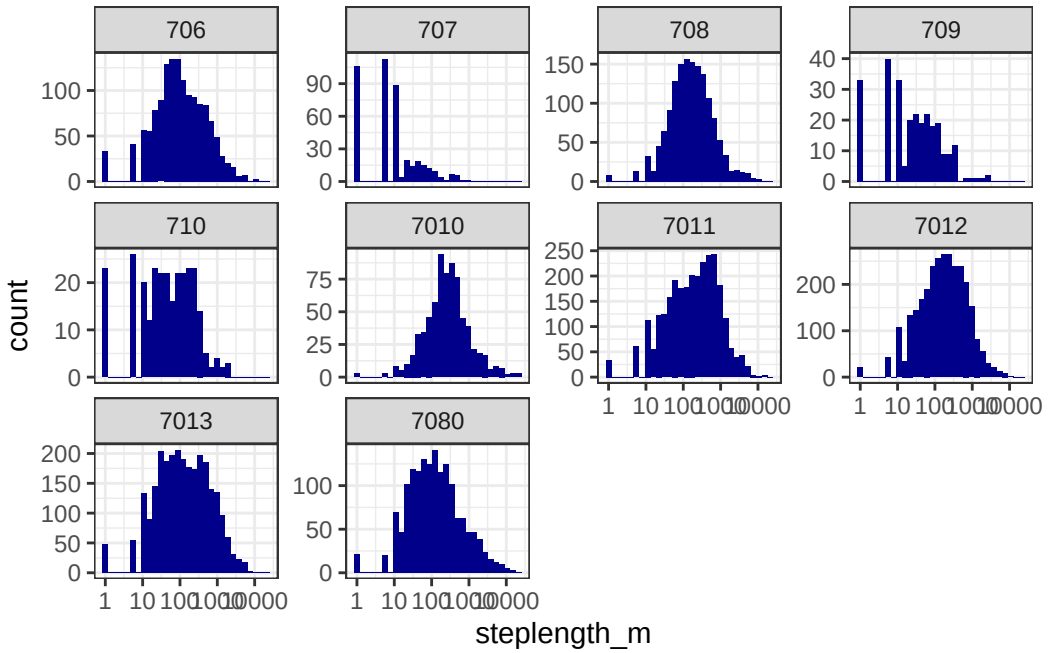
We can plot the date ranges of individual collared muskoxen below:

Id_Number	DateRange	NumDays
706	Dec 2007 to May 2009	515
707	Dec 2007 to Apr 2008	145
708	Feb 2009 to Dec 2010	669
709	Jan 2008 to Apr 2008	98
710	Jan 2008 to Apr 2008	100
7010	Feb 2009 to Jan 2010	345
7011	Jan 2009 to Dec 2011	1055
7012	Feb 2009 to Feb 2012	1106
7013	Feb 2009 to Aug 2011	926
7080	Dec 2007 to Aug 2009	607

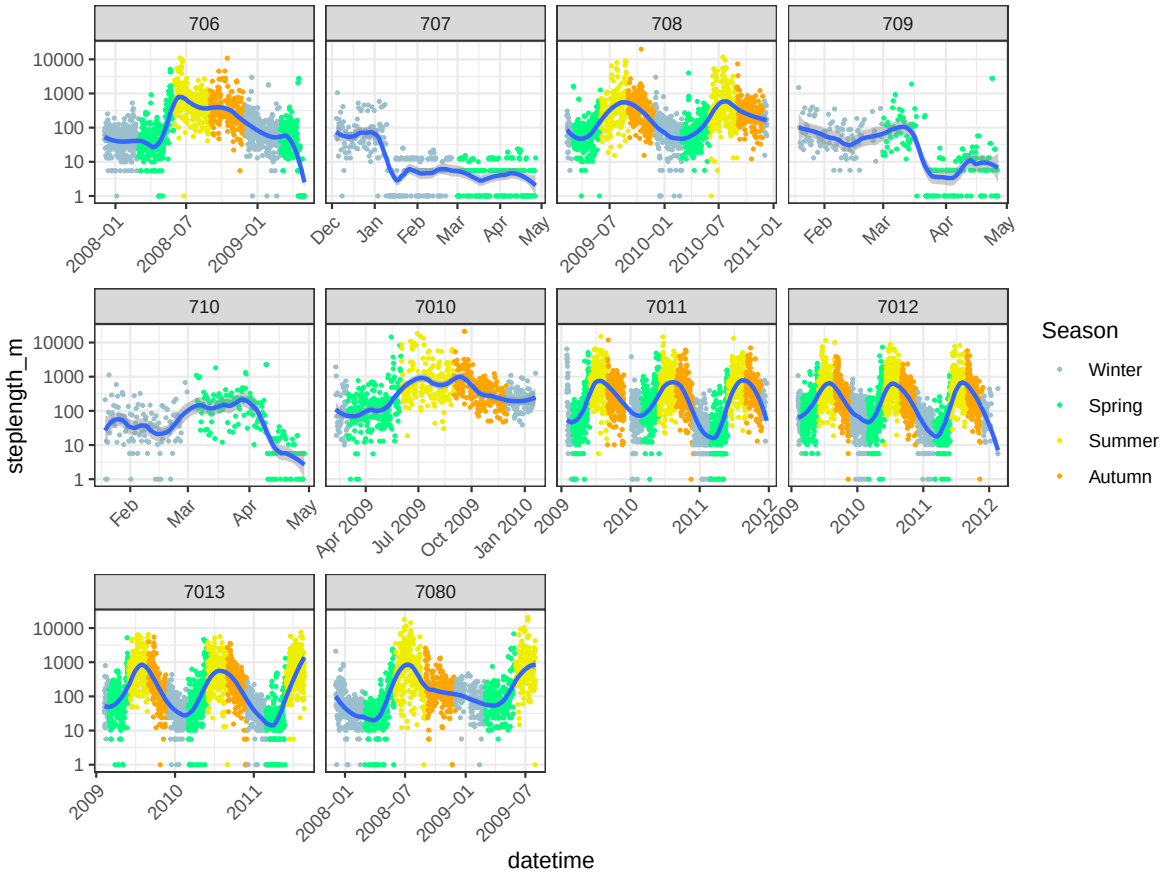
Muskoxen 707, 709, 710, and 7010 have less than a year of movement data and only 7011, 7012, and 7013 have more than 2 years of data.

Muskox Step Lengths

We can plot histograms of movement distances for each muskox:



The stepped nature of the distances traveled on the left side of the graph are a result of the resolution of the GPS device. For some muskoxen, there appear to be a greater-than-expected number of instances where the muskoxen move negligible distances. Possible reasons include GPS malfunction, mortality, or dropped collars. We can explore this further by plotting the distances travelled with time:

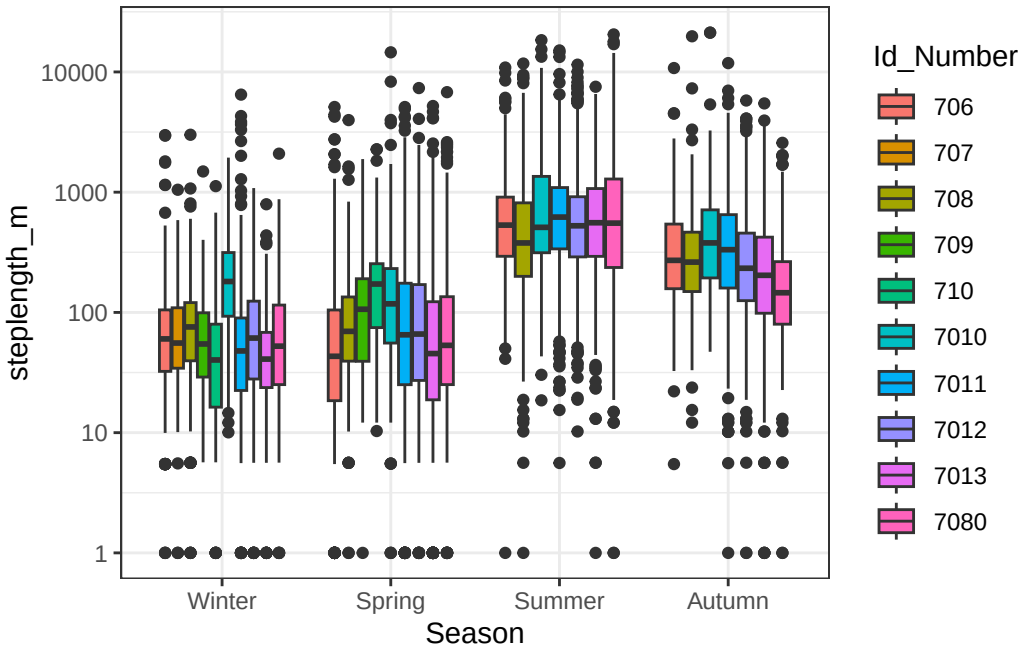


Movement distances tend to be highest in the summer (June, July, August), gradually decrease during autumn (September, October, November) and winter (December, January, February) and experience a sharp increase in the late spring (May). Perhaps this increase is timed with parturition, which has been found to start in April/May (Adamczewski 1997). Alternatively, this could be tied to the timing of snowmelt.

Muskoxen 707, 709, and 710 have extended periods of time at the end of their time series where the collar data suggest negligible movements. We can examine the time series to pinpoint the approximate timing of these events. For simplicity, let's remove all points following the first two consecutive short step lengths (i.e. 0 or 4.4747041) at the end of the time series.

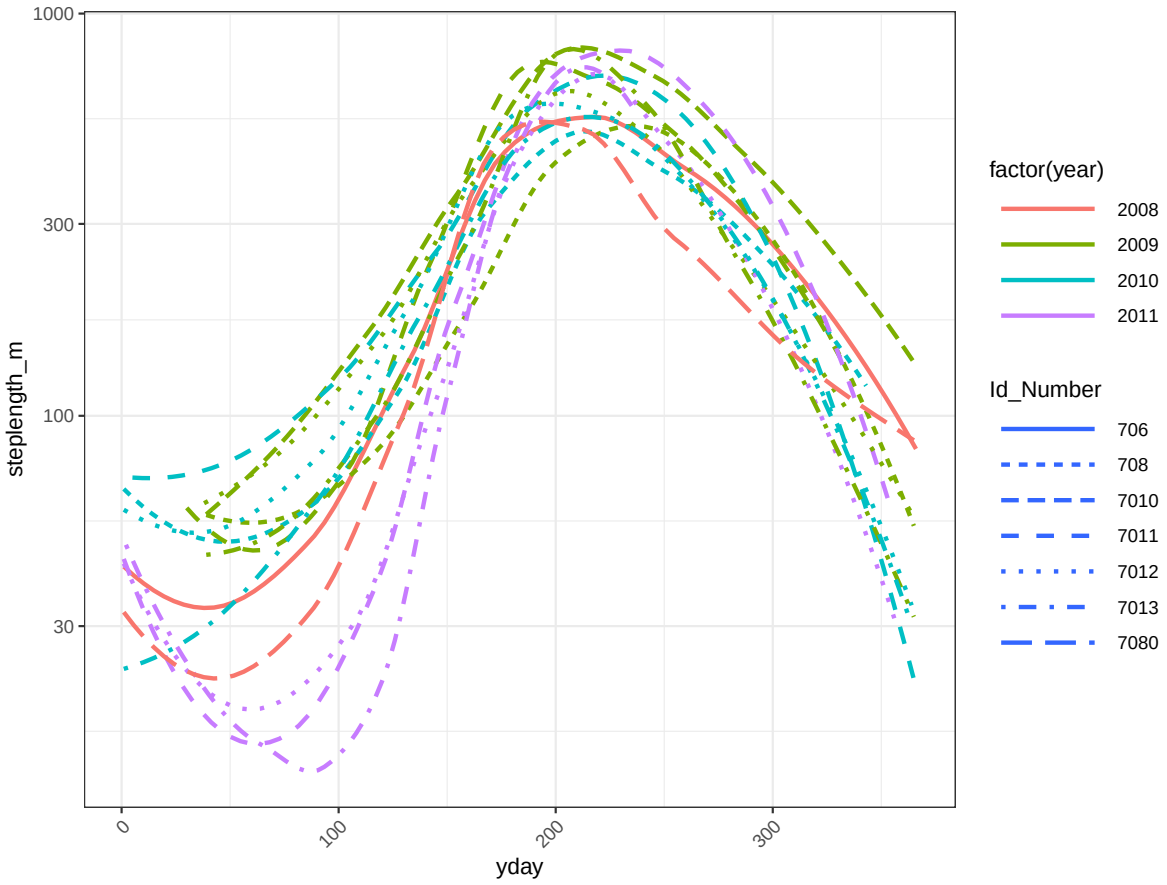
Id_Number	DaysRemoved
707	108
709	36
710	19

Let's look at average seasonal step lengths for muskoxen that have data from all four seasons:



Step lengths in the winter and spring are similar, whereas autumn step lengths are intermediate between winter and summer. This again highlights the discrepancy between the gradual decrease in step lengths from summer to winter compared with the sharper increase from winter to summer.

For the most part, average seasonal step lengths are consistent between muskoxen, though there appear to be greater variation in the spring and autumn. To examine this further, let's plot smoothed curves of step lengths against day of year for different years. We'll restrict this plot to muskoxen-year combinations with more than half a year's worth of data:



The greatest variation in step lengths appears to occur in the early spring. The curves of step lengths follow similar trajectories within the same year and variation in step lengths across years appears to be greater than variation in step lengths across muskoxen. In particular, step lengths from the late winter and early spring of 2011 are considerably shorter than those from the same time during other years.

Spatial Patterns