Laforge, M.P., M. Bonar & E. Vander Wal. Tracking snowmelt to jump the green wave: Phenological drivers of migration in a northern ungulate. Ecology.

**Appendix S2: Additional results**

Table S1: Summary of sample size and timing of migration, calving, snowmelt and green-up for caribou (*n* = 94) in Newfoundland, Canada from 2007–2013.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | All Herds | Buchans | Grey River | Lapoile | Middle Ridge | Topsails |
| Number of individuals | 94 | 14 | 13 | 18 | 34 | 15 |
| Number of ID years | 216 | 44 | 40 | 50 | 59 | 23 |
| Median + [range], start date of migration | Mar 25 [Feb 09, May 19] | Mar 31 [Feb 09, Apr 22] | Mar 29 [Feb 14, May 19] | Mar 22 [Mar 01, Apr 19] | Mar 17 [Feb 23, Apr 25] | Apr 07 [Mar 11, May 10] |
| Median + [range], end date of migration | May 10 [Mar 20, Jul 13] | May 08 [Apr 14, Jun 22] | May 07 [Mar 29, Jun 22] | May 17 [Apr 13, Jun 17] | May 03 [Mar 20, Jul 13] | May 10 [Apr 08, Jun 07] |
| Median + [range], duration of migration (days) | 43 [3, 128] | 40.5 [13, 84] | 39.5 [7, 123] | 50.5 [18, 94] | 43 [3, 128] | 19 [4, 74] |
| Median + [range], distance of migration (km) | 61.8 [30.5, 174.9] | 105.3 [42, 143] | 58 [36.4, 174.9] | 99.8 [32.1, 173.5] | 48.3 [30.5, 82.3] | 48 [32.1, 139.1] |
| Median + [sd], date of snowmelt over migratory route | Apr 25 [17.6 days] | May 02 [13.3 days] | Apr 26 [13.1 days] | May 08 [19.3 days] | Apr 14 [9.7 days] | May 03 [10.9 days] |
| Median + [range], date of calving | May 24 [May 22, Jul 13] | May 22 [May 22, Jun 23] | May 24 [May 22, Jul 04] | May 28 [May 22, Jun 17] | May 24 [May 22, Jul 13] | May 24 [May 22, Jun 15] |
| Median + [sd], date of peak IRG during calving | Jun 06 [13.5 days] | Jun 08 [13.4 days] | May 30 [12.9 days] | Jun 12 [9.5 days] | Jun 02 [14.2 days] | Jun 07 [10.5 days] |

Table S2: Estimated date of the optimal lag (number of days before/after peak instantaneous rate of green-up (IRG) or snowmelt) for caribou (*Rangifer tarandus*, *n* = 94) selection of areas with high IRG or near the date where snow melts, along with log-likelihood values of the top model. We generated models using the absolute value of days to snowmelt/peak IRG across several lags. Lagged datasets were constructed by adding or subtracting the value of the lag to the number of days until snowmelt/peak IRG. This was done to allow us to test for model fit at the focal day of the lag (see main text, Methods). Estimates represent the lag/day (number of days added or subtracted) that resulted in the best fitting model fit using days from peak as a squared term based on log-likelihood of models. The estimated range represents the day at which interpolated log-likelihood values have a difference of 1 (ΔAIC = 2). The difference is the number of days between the minimum and maximum estimate. LL is the log-likelihood of the top model.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Snowmelt—Migration | | | IRG—Calving | | | IRG—Migration | | |
| Herd | Estimate (range) | Differ-ence | LL | Estimate (range) | Differ-ence | LL | Estimate (range) | Differ-ence | LL |
| All | -7 (-7.1, -7) | 0.1 | -1203170.6 | 4 (3, 4.3) | 1.3 | -636481.44 | -60 (-60.2, -59) | 1.2 | -1210719.7 |
| Buchans | -6 (-6.1, -5.6) | 0.5 | -224873.13 | 8 (6.9, 9.3) | 2.4 | -118198.26 | -64 (-65.5, -63.4) | 2.1 | -226292.2 |
| Grey River | -3 (-3.2, -2.8) | 0.4 | -202849.83 | 4 (3.3, 6.8) | 3.5 | -107657.91 | -15 (-30.5, NA) | NA | -203687.85 |
| Lapoile | -13 (-13.1, -13) | 0.1 | -312009.16 | 6 (5.5, 6.2) | 0.7 | -133579.25 | -45 (-45.1, -44.5) | 0.6 | -315670.7 |
| Middle Ridge | 2 (1.6, 2.2) | 0.6 | -372759.19 | -11 (-12.6, -10) | 2.6 | -214962.7 | -31 (-31.3, -29.5) | 1.8 | -373436.7 |
| Topsails | 3 (2.6, 3.4) | 0.8 | -89117.399 | 0 (-1.4, 0.9) | 2.3 | -61826.128 | -69 (NA, -67) | NA | -89659.702 |

\*Not computed due to insufficient data on adjacent lags. This occurred when 1 log-likelihood away from the best model was outside the range with which the data could be interpolated. See Fig. S2 panels C and F.



Figure S1: Correlations between surfing indices (mean days from snowmelt or peak IRG) for caribou (*Rangifer tarandus*, *n* = 94) in Newfoundland, Canada. Panel A is the correlation between snowmelt surfing index and peak IRG (“green wave”) surfing index (both during migration), B) is the correlation between snowmelt index during migration and peak IRG during calving, and C) is the correlation between peak IRG indices across the two seasons. Different herds are represented by different symbol types.



Figure S2: Delta log-likelihood of models predicting caribou (*Rangifer tarandus*, *n* = 94) selection behaviour for days from peak instantaneous rate of green-up during migration (*n* = 216). We generated models using the absolute value of days to peak IRG across several lags. Lagged datasets were constructed by adding or subtracting the value of the lag to the number of days to peak IRG. This was done to allow us to test for model fit at the focal day of the lag. Panel A) is data for individuals from all herds, B­–F represent data from individual herds: B) Buchans; C) Grey River; D) Lapoile; E) Middle Ridge; and F) Topsails. These results are shown to contrast with models for snowmelt, and outline that model fit for tracking green-up during migration in this population results in poor fitting models.



Figure S3: Model-predicted selection of caribou (*Rangifer tarandus*, *n* = 94) as a function of the number of days from peak IRG during migration from conditional logistic regression models. Dashed lines represent 95% confidence intervals. Panel A) is data for individuals from all herds, B­–F represent data from individual herds: B) Buchans; C) Grey River; D) Lapoile; E) Middle Ridge; and F) Topsails. These results contrast with models for snowmelt, and outline that model fit for tracking green-up during migration in this population result in poor fitting models.