Table S1: Model selection table for the spatio-temporal patterns of brucellosis infection in southern and central KNP from 2000-2005. Model selection included age (categorical variable including calf, juvenile, subadult, adult and mature adult buffalo), sex, season (seas, wet vs. dry season), the section of Kruger where buffalo were captured (section, southern vs. central), soil type (basalt vs. granite), capture year (yr, categorical 2001-2005), and buffalo density (dens). Models represent density as the number of buffalo in a 245 $km^2$ area around each capture location, but similar results were found when density was calculated at larger scales. Displayed are the top seven models predicting brucellosis infection based on their AIC value and number of parameters (n). For comparison, the additive model is also displayed. We present the bolded model with the lowest number of parameters within 2 values of the model with the lowest AIC value.

| Model | n | AIC | ΔAIC |
|---|---|---|---|
| **Brucellosis prevalence (N= 669, prevalence= 23.8%)~** | | | |
| age+ sex+ seas+ section+ soil+ yr+ (section×soil)+ (section×seas) | 15 | 669.77 | - |
| age+ sex+ seas+ section+ soil+ yr+ (section×soil) | 14 | 671.14 | 1.37 |
| **age+ sex+ section+ soil+ yr+ (section×soil)** | **13** | **671.34** | **1.57** |
| age+ sex+ seas+ section+ soil+ dens+ yr+ (section×soil)+ (section×seas) | 16 | 671.66 | 1.89 |
| age+ sex+ section+ soil+ yr+ (section×soil)+ (sex×soil) | 14 | 671.88 | 2.11 |
| age+ sex+ seas+ section+ soil+ dens+ yr+ (section×soil)+ (section×seas)+ (soil×seas) + (sect×dens) | 18 | 672.14 | 2.37 |
| age+ sex+ seas+ section+ soil+ dens+ yr+ (section×soil)+ (section×seas)+ (sect×dens) | 17 | 672.39 | 2.62 |
| age+ sex+ seas+ section+ soil+ yr | 13 | 679.92 | 10.15 |

Table S2: Model selection table of host body condition and survival. The top eight models based on the lowest AIC value and number of parameters (n) are displayed below. For comparison, the additive model is also displayed. We present the bolded model because it is the most parsimonious model within 2 values of the model with the lowest AIC value. Independent variables include age (continuous, in years), site (Lower Sabie vs. Crocodile Bridge), season (seas, wet vs. dry season), brucellosis status (br), host body condition at the current time period (cond, continuous 0-5), and animal density (dens).

| Model | n | AIC | ΔAIC |
|---|---|---|---|
| **Body condition (N=229)~** | | | |
| age+ site+ br+ seas + calf+ br×seas+ seas×age + br×age+ br×calf | 9 | 327.2 | - |
| age+ site+ br+ seas + calf+ br×seas+ seas×age + br×age | 8 | 328.0 | 0.8 |
| age+ site+ br+ seas + calf+ br×seas+ br×age+ br×calf+ seas×calf | 9 | 328.4 | 1.2 |
| **age+ site+ br+ seas + calf+ br×seas+ seas×age** | **7** | **328.7** | **1.5** |
| age+ site+ br+ seas + calf+ br×seas+ br×age+ seas×calf | 8 | 328.8 | 1.6 |
| age+ site+ br+ seas + calf+ br×seas+ br×age+ br×calf | 8 | 328.8 | 1.6 |
| age+ site+ br+ seas + calf+ br×seas+ br×age | 7 | 329.2 | 2.0 |
| age+ site+ br+ seas + calf+ br×seas+ seas×calf | 7 | 329.2 | 2.0 |
| age+ site+ br+ seas + calf+ dens | 6 | 349.2 | 22.0 |
| | | | |
| **Mortality (N= 43)~** | | | |
| **age$^2$+ cond$^2$+ site+ br** | **6** | **352.7** | **-** |
| age$^2$+ cond$^2$+ site+ br+ site×cond | 7 | 353.1 | 0.4 |
| age$^2$+ cond$^2$+ site+ br+ br×site | 7 | 353.2 | 0.5 |
| age$^2$+ cond$^2$+ site+ seas+ br+ br×site+ site×cond | 8 | 353.6 | 0.9 |
| age$^2$+ cond$^2$+ site+ br+ br×cond | 7 | 353.9 | 1.2 |
| age$^2$+ cond$^2$+ site+ br+ site×age | 7 | 354.0 | 1.3 |
| age$^2$+ cond$^2$+ site+ br+ seas | 7 | 354.6 | 1.9 |
| age$^2$+ cond$^2$+ site+ seas+ br+ seas×age | 8 | 354.9 | 2.2 |
| age$^2$+ cond$^2$+ site+ br+ seas+ br×site | 8 | 355.1 | 2.4 |

Table S3: Model selection tables of host fecundity. The top eight models based on the lowest AIC value and number of parameters (n) are displayed below. We present the bolded model because it is the most parsimonious model within 2 values of the model with the lowest AIC value. Independent variables for host pregnancy include age (continuous, in years), site (Lower Sabie vs. Crocodile Bridge), season (seas, wet vs. dry season), brucellosis status (br), host body condition ($cond_t$ or $cond_{t-1}$, continuous 0-5), and buffalo density (dens). Independent variables for the odds of observing a calf include age, condition, and animal density. We were not able to test for region or season dependent effects on calving because calf observations were most accurate and representative of fecundity immediately following the birthing season. Thus, this data only includes observations of the region captured at that time (Crocodile Bridge). We abbreviate the covariates, age+ $age^2$, and condition+ $condition^2$, as $age^2$ and $cond^2$, respectively. We performed model selection for the odds of observing a calf in two steps: (Step 1) we conducted model selection using condition at the previous capture and (Step 2) model selection using condition at the current time point. We use lagged condition because the high energetic costs of lactation likely drive current condition (the median body condition score during this period for buffalo with calves was 2.75 compared to 3.25 in buffalo without calves). This is supported by the negative association between current body condition and having a calf in models of host body condition (Figure 3a) and in step 2 below (condition, $\beta$= -1.42, p=0.0004). Therefore, we assume body condition at the current time period is driven by the energetic costs of raising a calf and use the model selection in Step 1 to test if host body condition before the birthing season is associated with the presence of a calf at the subsequent capture.

| Model | n | AIC | ΔAIC |
|---|---|---|---|
| **Step 1: Host body condition at previous time period** | | | |
| **Fecundity (calf observation, N= 115)~** | | | |
| **$age^2$+ cond** | **3** | **100.4** | **-** |
| $age^2$+ cond+ dens | 4 | 102.7 | 2.3 |
| age+ cond | 2 | 102.9 | 2.5 |
| cond | 1 | 103.3 | 2.9 |
| age+ cond+ dens | 5 | 104.3 | 3.9 |
| $age^2$ | 2 | 107.3 | 6.9 |
| $age^2$+ dens | 3 | 108.4 | 8.0 |
| age | 1 | 110.4 | 10.0 |
| | | | |
| **Step 2: Host body condition at current time period** | | | |
| **Fecundity (calf observation, N= 172)** | | | |
| **$age^2$+ cond** | **3** | **133.7** | - |
| $age^2$ | 2 | 134.4 | 0.7 |
| $age^2$+ cond+ dens | 4 | 135.0 | 1.3 |
| $age^2$+ dens | 3 | 135.8 | 2.1 |
| cond | 1 | 140.3 | 6.6 |
| age+ cond | 2 | 140.7 | 7.0 |
| age+ cond+ dens | 3 | 141.5 | 7.8 |
| age | 1 | 141.7 | 8.0 |
| | | | |
| **Fecundity (pregnancy, N= 677)~** | | | |
| **$age^2$+ site+ seas+ $cond_t^2$+ seas×$cond_t$** | **7** | **846.9** | **-** |
| $age^2$+ site+ seas+ $cond_t^2$+ dens+ seas×$cond_t$ | 8 | 847.8 | 0.9 |
| $age^2$+ site+ seas+ $cond_t^2$+ dens+ seas×$cond_t$+ site×dens | 8 | 848.7 | 1.8 |
| $age^2$+ site+ seas+ $cond_t^2$+ dens+ seas×$cond_t$+ $cond_t$×dens | 8 | 848.7 | 1.8 |
| $age^2$+ site+ seas+ br+ $cond_t^2$+ seas×$cond_t$ | 8 | 848.9 | 2.0 |
| $age^2$+ site+ seas+ $cond_t^2$ | 6 | 849.3 | 2.4 |
| $age^2$+ site+ seas+ br+ $cond_t^2$+ dens+ seas×$cond_t$ | 9 | 849.5 | 2.6 |
| $age^2$+ site+ seas+ br+ $cond_t^2$+ dens | 7 | 849.8 | 2.9 |

Table S4: Results of best fitting models of host fecundity. Parameter values (**β),** standard errors (SE), and significance tests are shown for each independent variable. A positive parameter value for season indicates hosts had a higher odds of being pregnant in the wet season and a positive association with capture site indicates hosts had a higher odds of being pregnant in the Lower Sabie region.

| **Parameter** | **β** | **SE** | **Z-value** | **p-value** |
|---|---|---|---|---|
| **Fecundity (calf at heel) ~** | | | | |
| age | 1.486 | 0.699 | 2.124 | 0.034 |
| $age^2$ | -0.075 | 0.041 | -1.856 | 0.063 |
| $condition_{t-1}$ | 1.518 | 0.566 | 2.683 | 0.007 |
| | | | | |
| **Fecundity (pregnancy) ~** | | | | |
| age | 1.055 | 0.182 | 5.806 | <0.0001 |
| $age^2$ | -0.054 | 0.012 | -4.590 | <0.0001 |
| site-LS | 0.504 | 0.172 | 2.929 | 0.003 |
| season-wet | 2.317 | 1.009 | 2.298 | 0.022 |
| $condition_t$ | 3.755 | 1.170 | 3.208 | 0.001 |
| $condition_t^2$ | -0.517 | 0.180 | -2.873 | 0.004 |
| season×$condition_t$ | -0.676 | 0.330 | -2.048 | 0.041 |