**Electronic Supplementary Material 5: Age structuring of the parasite community composition**

*Age structure of parasite community: methods*

We used PERMANOVA in the R package “vegan” [Oksanen *et al.* 2019] to evaluate if parasite communities (Euclidean distance matrix) differed between age categories, including condition and season as model covariates. To account for repeated measures, we constrained permutations within individuals. We used the R package “pairwiseAdonis” [Arbizu 2017] to partition the variation in parasite communities attributed to age across pairwise differences in age categories.

Samples were included in this analysis if animals were < 3 years of age (pre-reproductive age: [Sinclair 1977]) and data on each parasite had been collected. Owing to the challenges associated with collecting fecal and blood samples from young animals, calves <5 months of age had incomplete datasets (i.e., macro- and / or micro- diagnostics were not able to be run for the sample) and were excluded from the community-level analysis. We included 35 animals and 140 samples. Animals were binned into 6-month age categories, with the exception of the first age category, which contained one sample where the animal was 5 months of age (age categories: 5 – 12 months, 13– 18 months, 19 – 24 months, 25 – 30 months & 31 – 36 months).

*Age structure of parasite community: results*

Age explained a significant proportion of the variation in parasite community (R2 = 0.195, p-value = 0.001, table 1). Of the ‘total variation in parasite community explained by age category’ (19.5%), 67.5% was explained by differences between the first age category (5-12 months) and the remaining age categories (> 13 months) (table 2, figure 1). Differences between the second category (13-18 months) and fourth (26-30 months) and fifth (31-36 months) age categories (table 2, figure 1) explained 22.3% of this variation.

*References*

Arbizu PM. 2017 pairwiseAdonis: Pairwise Multilevel Comparison using Adonis. R package version 0.0.1.

Oksanen J, Guillaume Blanchet F, Friendly M, Kindt R, Legendre P, McGlinn D, Minchin PR, O'Hara RB, Simpson GL, Solymos P, Stevens MHM, Szoecs E, Wagner H. 2019 vegan: Community Ecology Package. R package version 2.5-4. [https://CRAN.R-project.org/package=vegan](https://CRAN.R-project.org/package%3Dvegan)

Sinclair ARE. 1977 *The African buffalo; a study of resource limitation of populations*. Chicago, Ill.: University of Chicago Press.

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|  |  |  |  |  |  |  |  |
|   | Df | SumsOfSqs | MeanSqs | F.Model | R2 | Pr(>F) |   |
| Age category | 4 | 40.04 | 10.01 | 5.93 | 0.19 | < 0.01 | \*\*\* |
| Season | 1 | 2.33 | 2.33 | 1.38 | 0.01 | 0.24 |   |
| BCS | 1 | 4.36 | 4.36 | 2.58 | 0.021 | 0.41 |   |
| Animal ID | 23 | 82.82 | 3.60 | 2.13 | 0.40 | 0.17 |   |
| Residuals | 45 | 75.90 | 1.69 |   | 0.37 |   |   |
| Total | 74 | 205.44 |   |   | 1 |   |   |
| PERMANOVA from a species matrix estimated with Euclidean distance measures, N = 140 |  |  |  |
| strata = Numeric Animal ID to account for repeated measures (permute within animals) |

Electronic Supplementary Material 5, table 1. Results from PERMANOVA of buffalo parasite community composition with age

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| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |
| pairs | Df | SumsOfSqs | F.Model | R2 | p.value | p.adjusted |
| 1 vs 2 | 1 | 10.994444 | 4.097006 | 0.12764448 | 0.001 | 0.01 |
| 1 vs 3 | 1 | 19.713632 | 7.325958 | 0.18166854 | 0.001 | 0.01 |
| 1 vs 4 | 1 | 17.811111 | 6.357042 | 0.17016985 | 0.001 | 0.01 |
| 1 vs 5 | 1 | 18.452302 | 7.156502 | 0.19793127 | 0.001 | 0.01 |
| 2 vs 3 | 1 | 3.803753 | 1.796679 | 0.06239187 | 0.041 | 0.41 |
| 2 vs 4 | 1 | 6.338889 | 2.870007 | 0.10297834 | 0.002 | 0.02 |
| 2 vs 5 | 1 | 5.905385 | 3.148836 | 0.12041975 | 0.002 | 0.02 |
| 3 vs 4 | 1 | 3.496569 | 1.52293 | 0.04831183 | 0.124 | 1 |
| 3 vs 5 | 1 | 4.670287 | 2.302401 | 0.0759808 | 0.019 | 0.19 |
| 4 vs 5 | 1 | 5.077289 | 2.406681 | 0.08472235 | 0.021 | 0.21 |

Electronic Supplementary Material 5, table 2. Results from a pairwise PERMANOVA with age categories.



Electronic Supplementary Material 5, figure 1. Comparisons of parasite/pathogen community composition across age categories (note sample sizes), with communities in age class 1 being significantly different to the remaining classes.