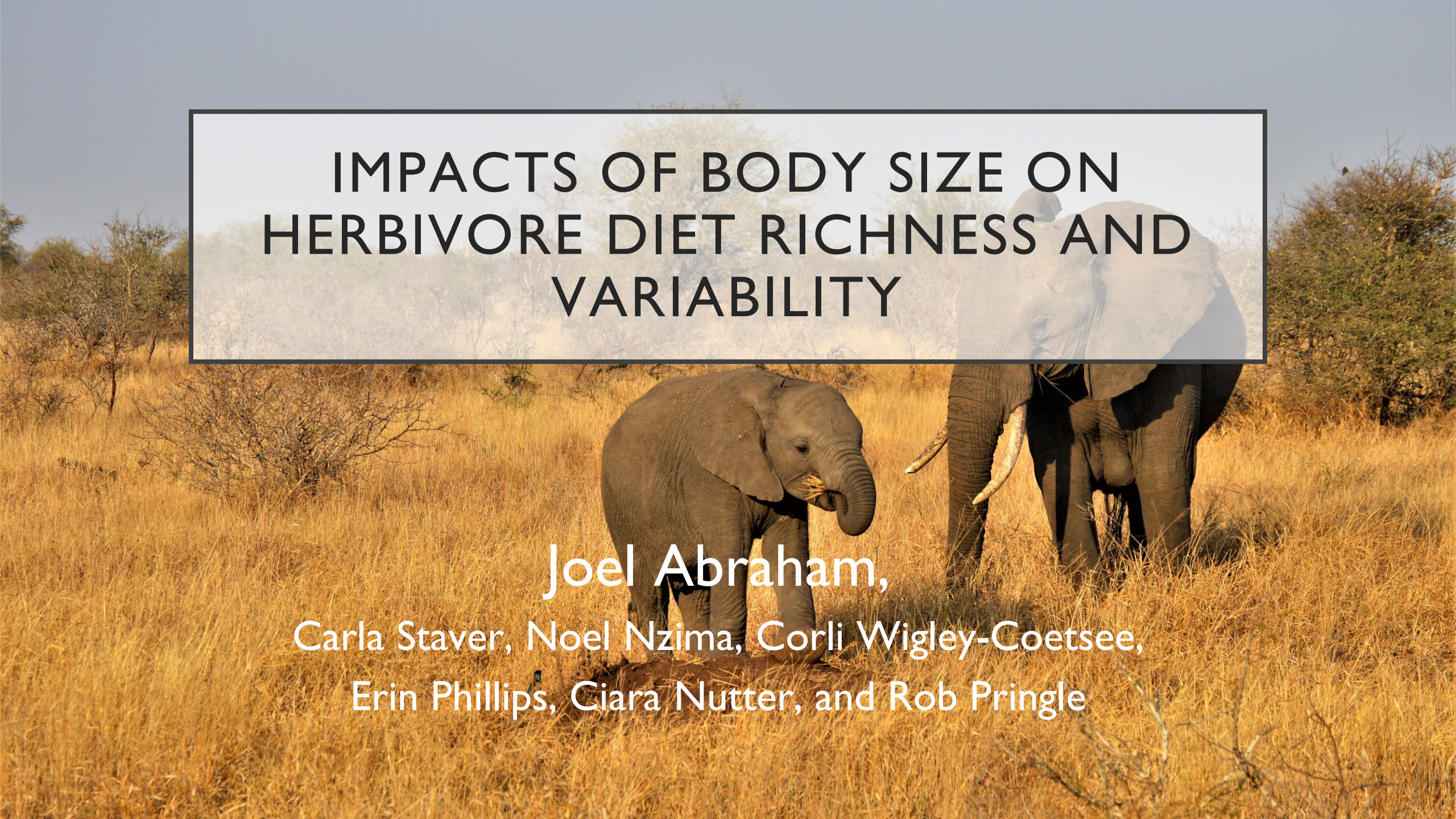
IMPACTS OF BODY SIZE ON HERBIVORE DIET RICHNESS AND VARIABILITY



Joel Abraham,

Carla Staver, Noel Nzima, Corli Wigley-Coetsee,

Erin Phillips, Ciara Nutter, and Rob Pringle

BODY SIZE IS FUNDAMENTAL TO SPECIES INTERACTIONS

THE ROLE OF BODY SIZE IN HERBIVORE FORAGING ECOLOGY?

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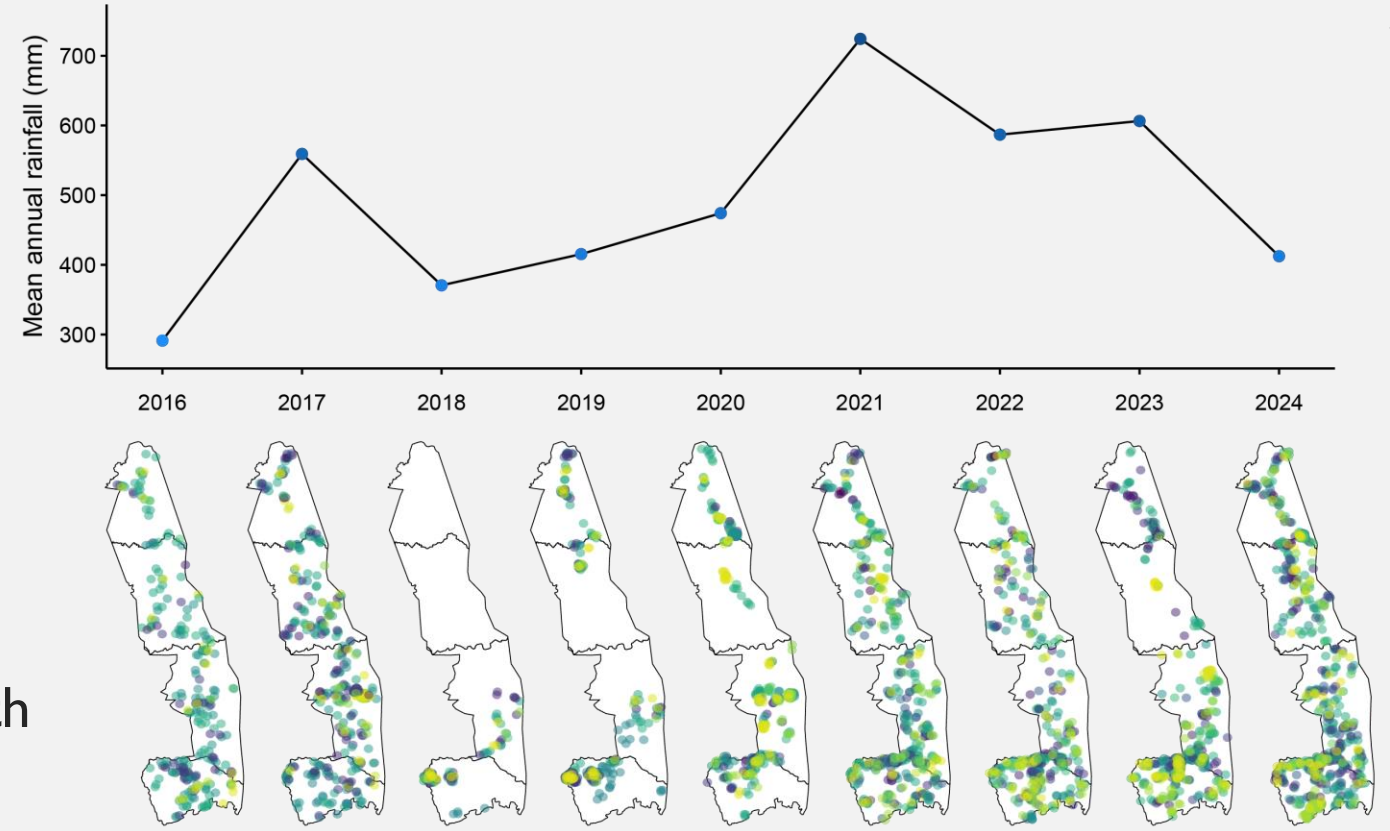
- Small body size might be good
  - Lower forage and water requirements mean persistence through periods of scarcity?

THE ROLE OF BODY SIZE IN HERBIVORE FORAGING ECOLOGY?

- Small body size might be good
  - Lower forage and water requirements mean persistence through periods of scarcity?
- Small body size might be bad
  - Greater dietary constraint – can only subsist on high quality foods (Jarman-Bell Principle)

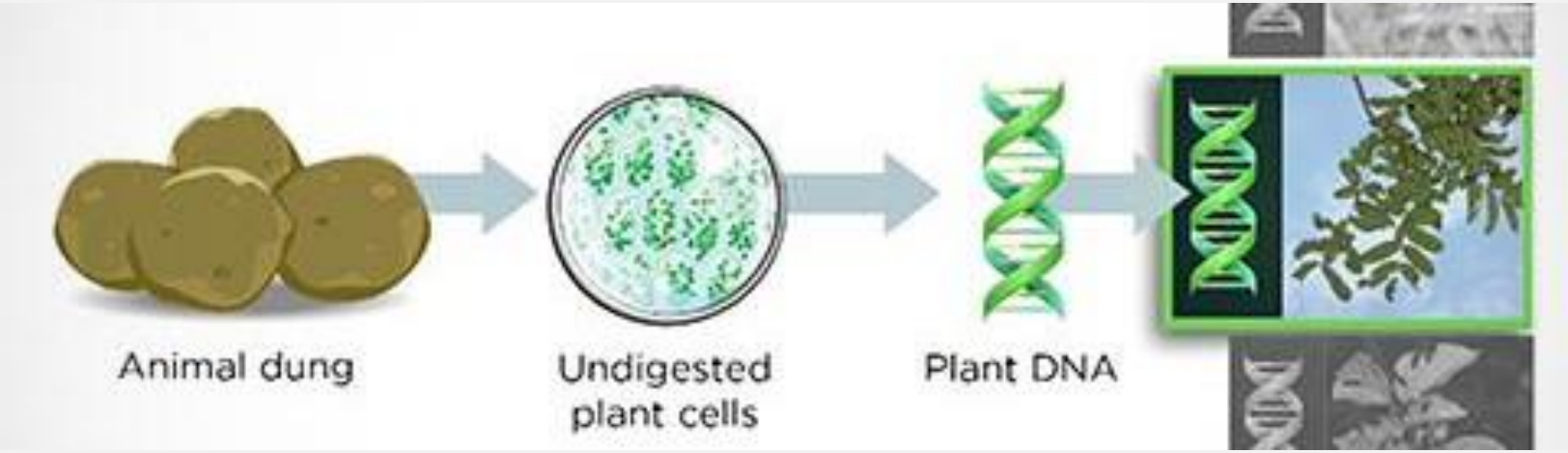
CHARACTERIZING THE DIETS OF KRUGER'S HERBIVORES

- Fecal sample collections spanning 2016-present
  - >3,500 samples
  - 23 herbivore species
  - Collections span an exceptionally dry year (2016) and a relatively wet year (2021) and both wet and dry seasons



USING FECAL DNA METABARCODING TO DETERMINE DIET

- What goes in = what comes out
- Extract the DNA from feces, amplify the plant component, sequence the DNA, and compare the sequences ('mOTUs') to reference sequences ('DNA barcodes')
- Provides comparatively complete, quantitative data on what animals are eating



SAMPLE-LEVEL DIET RICHNESS

of unique sequences per sample

SAMPLE-LEVEL DIET RICHNESS

of unique sequences per sample

~

Body mass

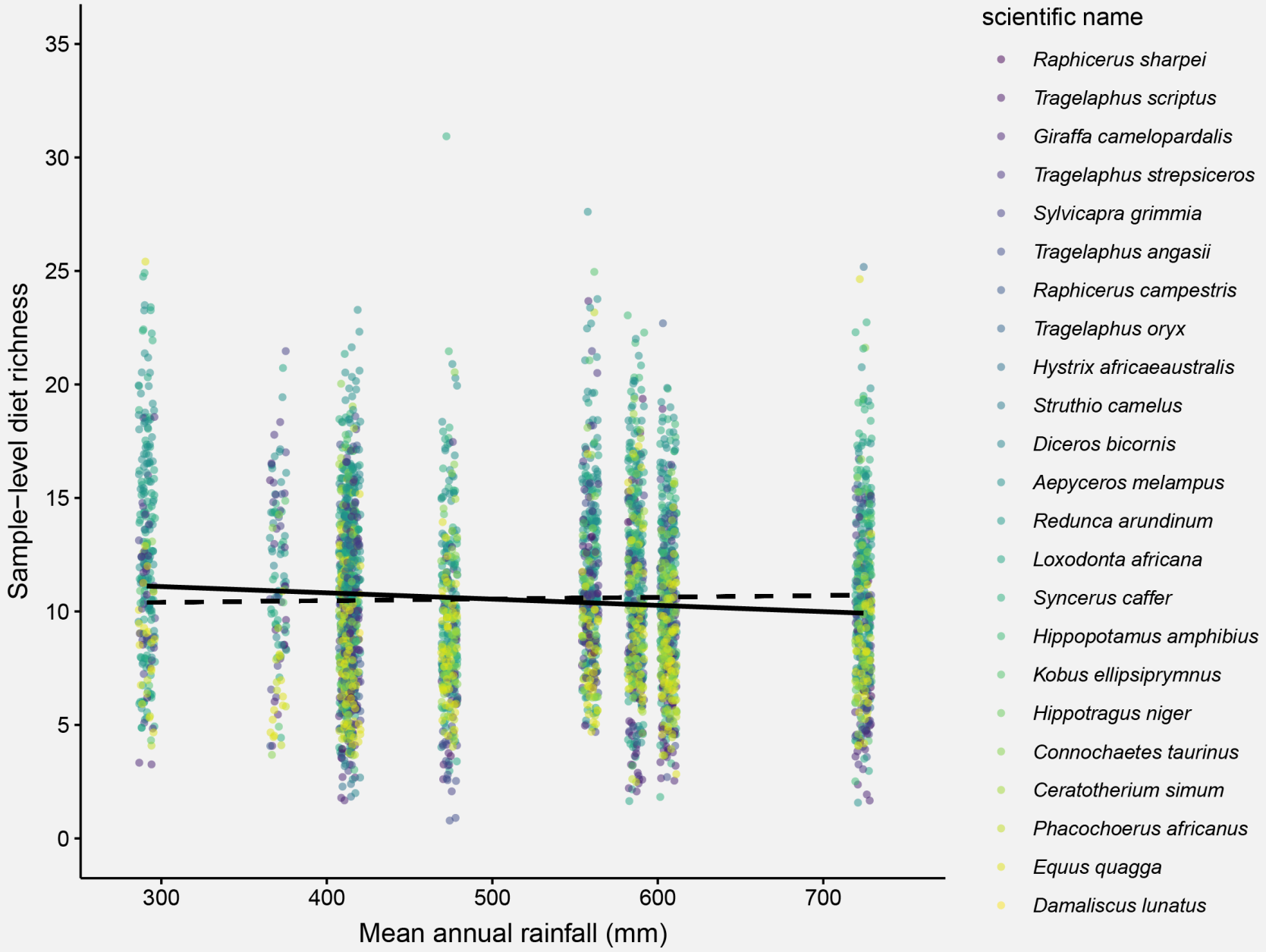
Gut type (ruminant vs. non-rumiant)

Grass consumption

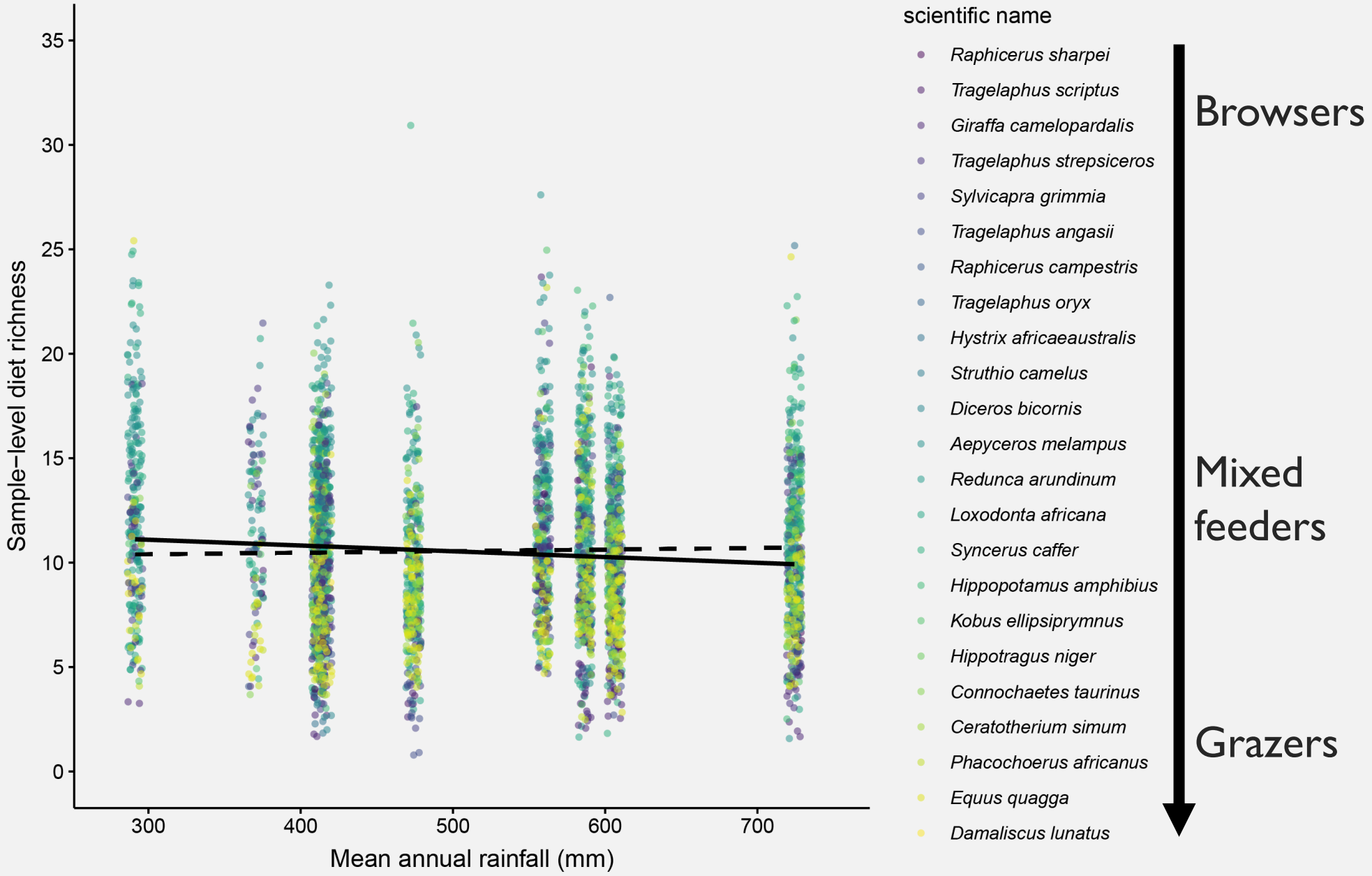
Annual rainfall

Season (wet vs. dry)

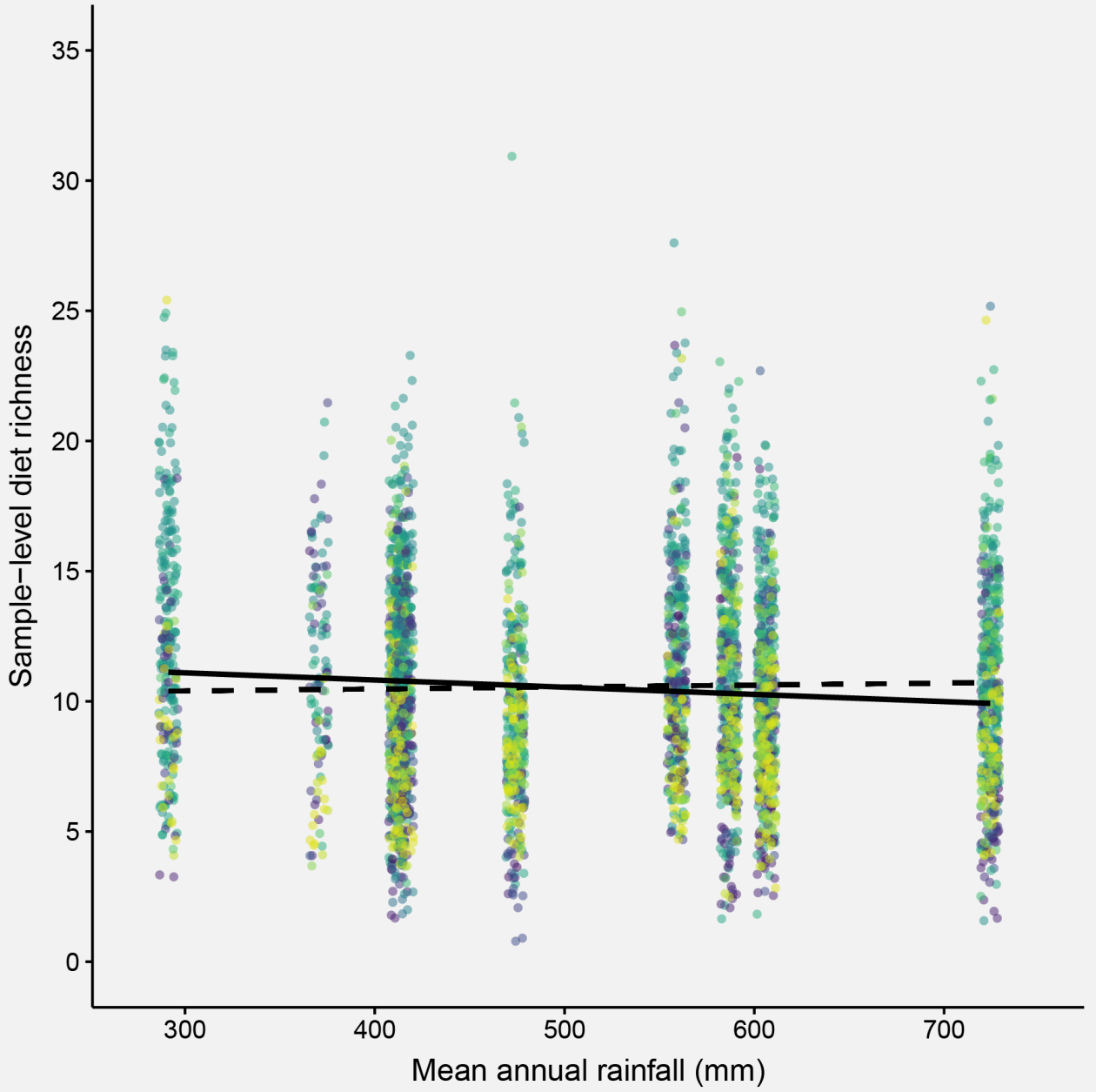
SAMPLE-LEVEL DIET RICHNESS



SAMPLE-LEVEL DIET RICHNESS



SAMPLE-LEVEL DIET RICHNESS

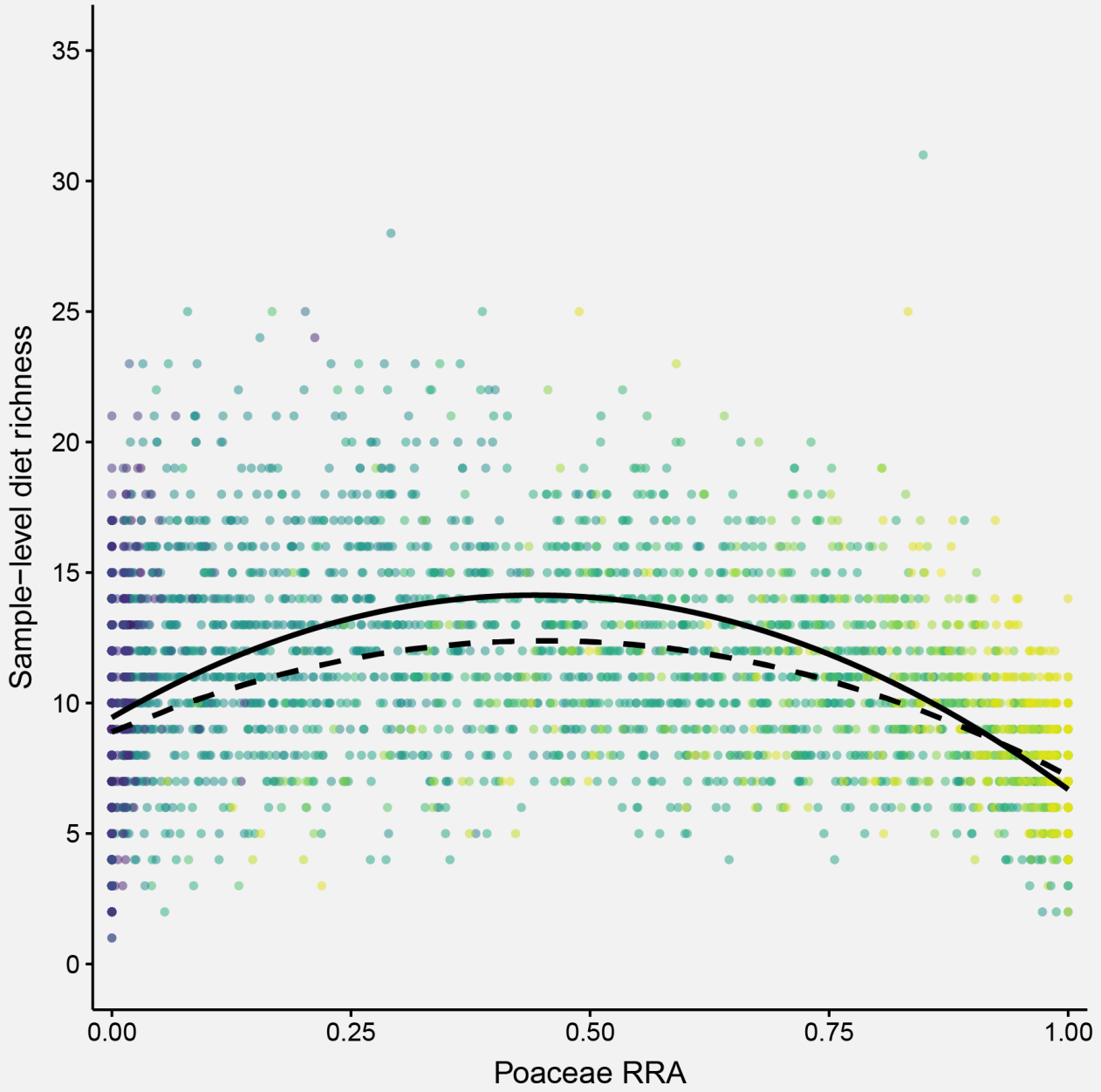


scientific name

- *Raphicerus sharpei*
- *Tragelaphus scriptus*
- *Giraffa camelopardalis*
- *Tragelaphus strepsiceros*
- *Sylvicapra grimmia*
- *Tragelaphus angasii*
- *Raphicerus campestris*
- *Tragelaphus oryx*
- *Hystrix africaeaustralis*
- *Struthio camelus*
- *Diceros bicornis*
- *Aepyceros melampus*
- *Redunca arundinum*
- *Loxodonta africana*
- *Syncerus caffer*
- *Hippopotamus amphibius*
- *Kobus ellipsiprymnus*
- *Hippotragus niger*
- *Connochaetes taurinus*
- *Ceratotherium simum*
- *Phacochoerus africanus*
- *Equus quagga*
- *Damaliscus lunatus*

- Does NOT vary across rainfall contexts

SAMPLE-LEVEL DIET RICHNESS



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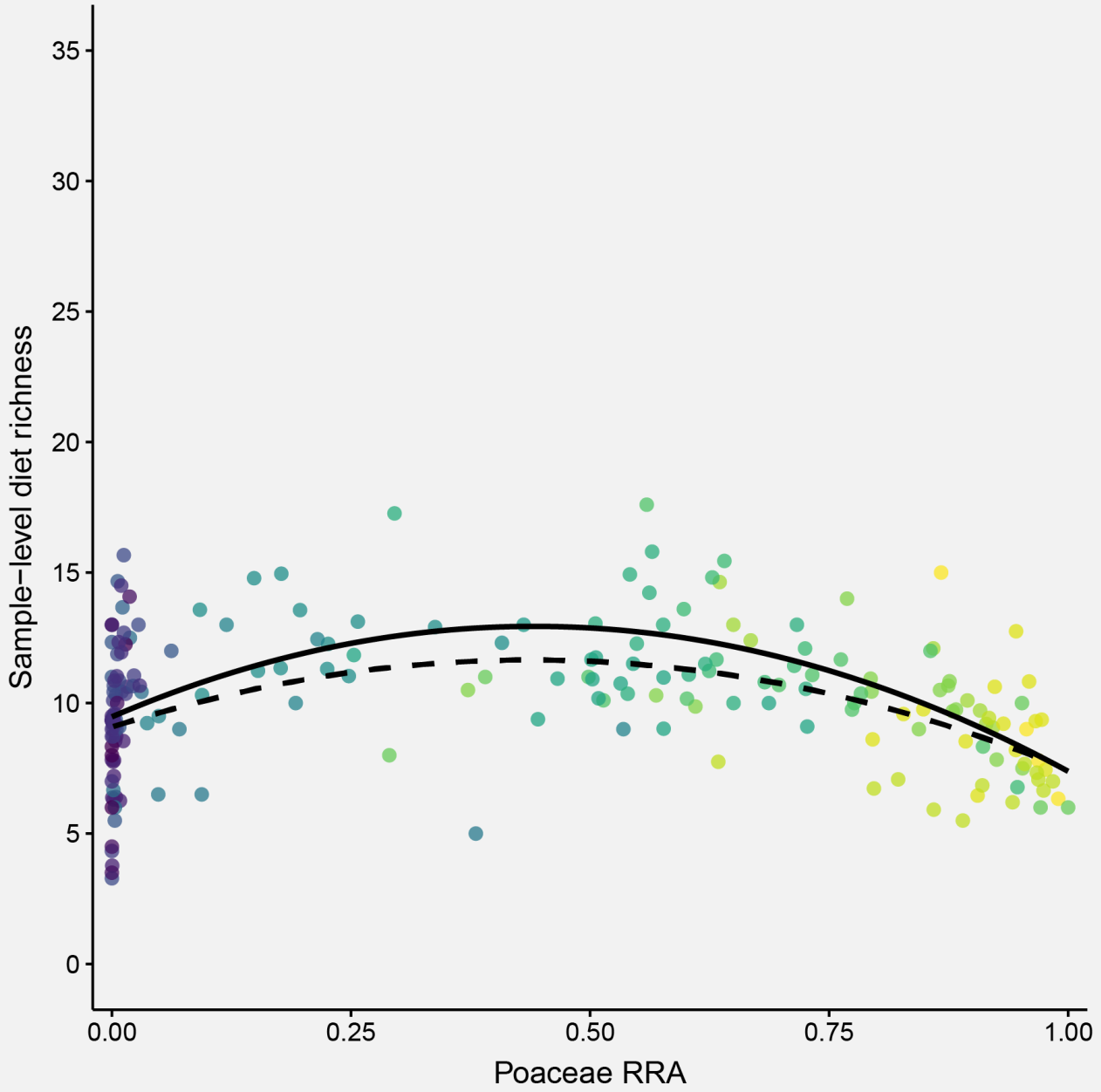
- Varies with grass RRA and gut type
  - Richness peaks at intermediate dietary grass fractions
  - Richness is higher for ruminants

SAMPLE-LEVEL DIET RICHNESS



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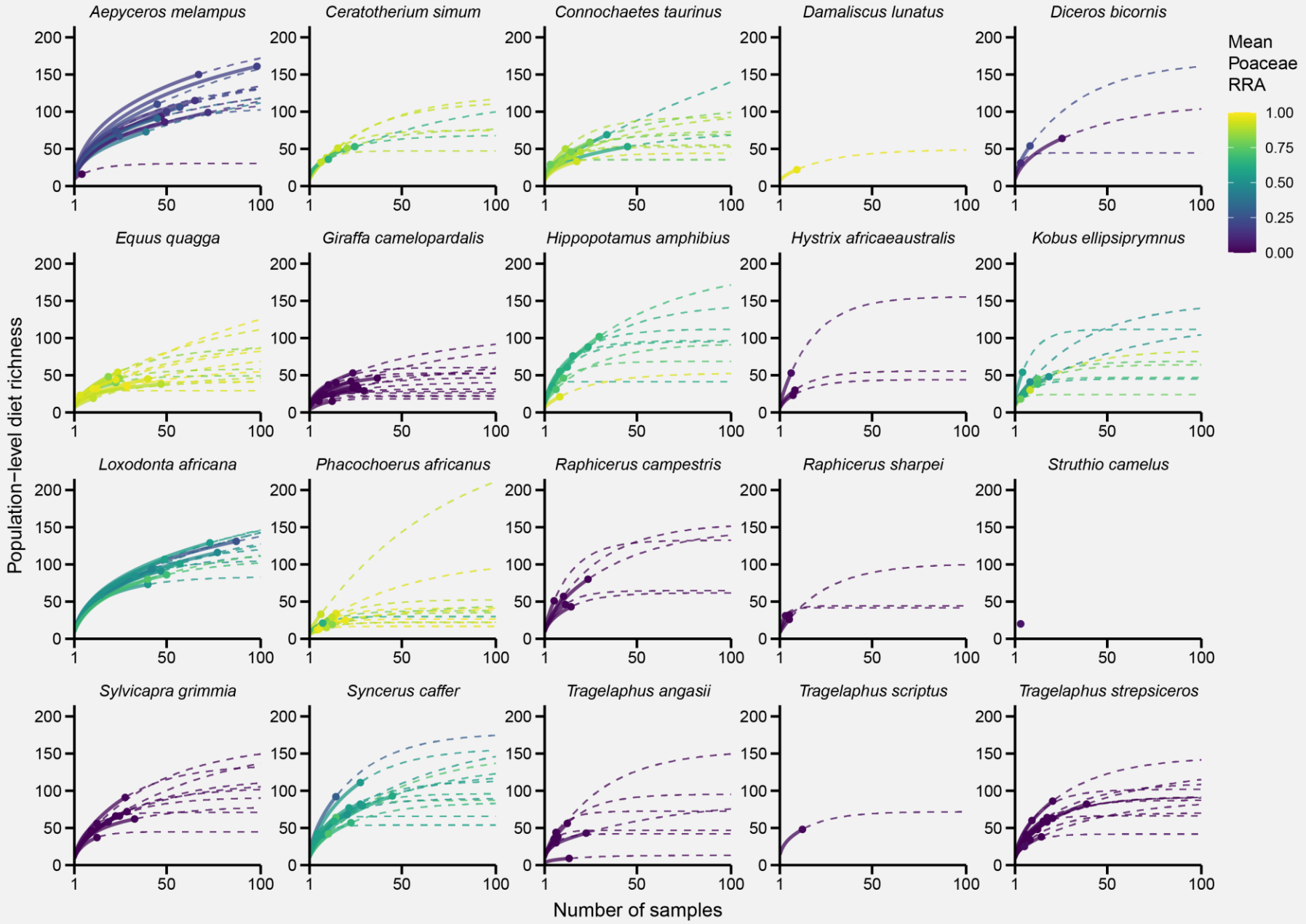
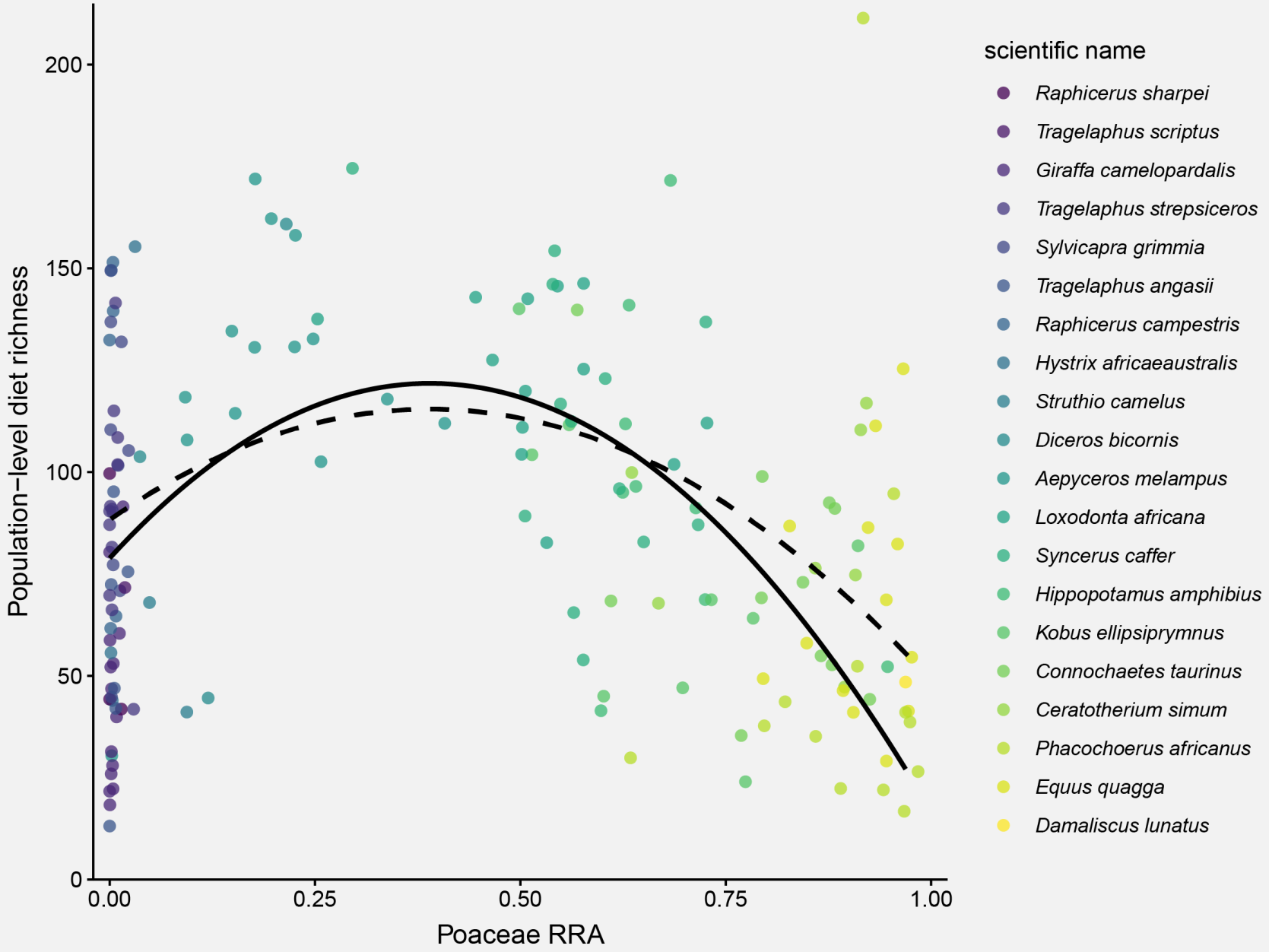
- These relationships hold true when averaged by species and sampling bout

POPULATION-LEVEL DIET RICHNESS



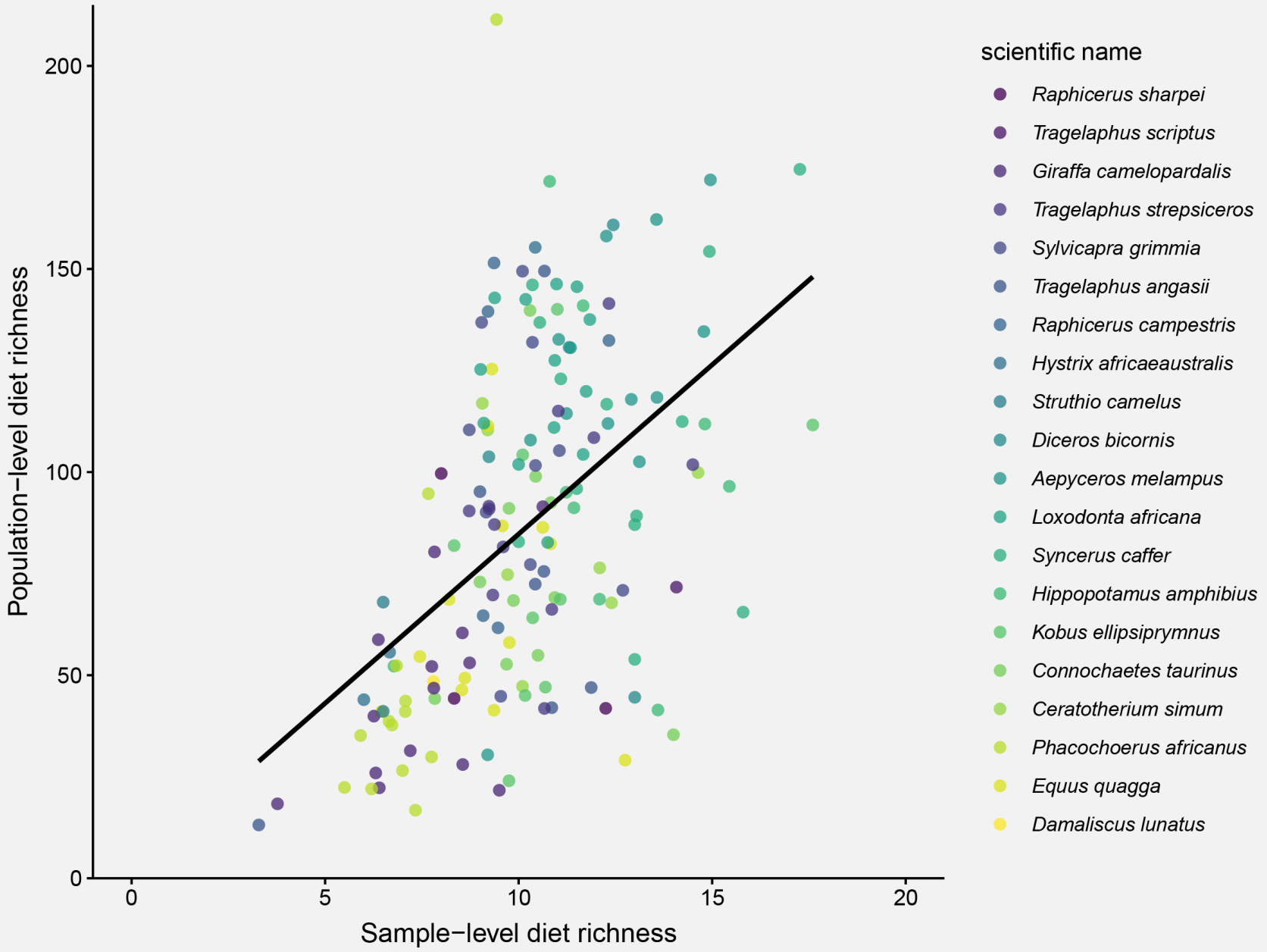
- Estimated diet richness at 100 samples per species (the maximum number of samples for a species within a sampling bout)

POPULATION-LEVEL DIET RICHNESS

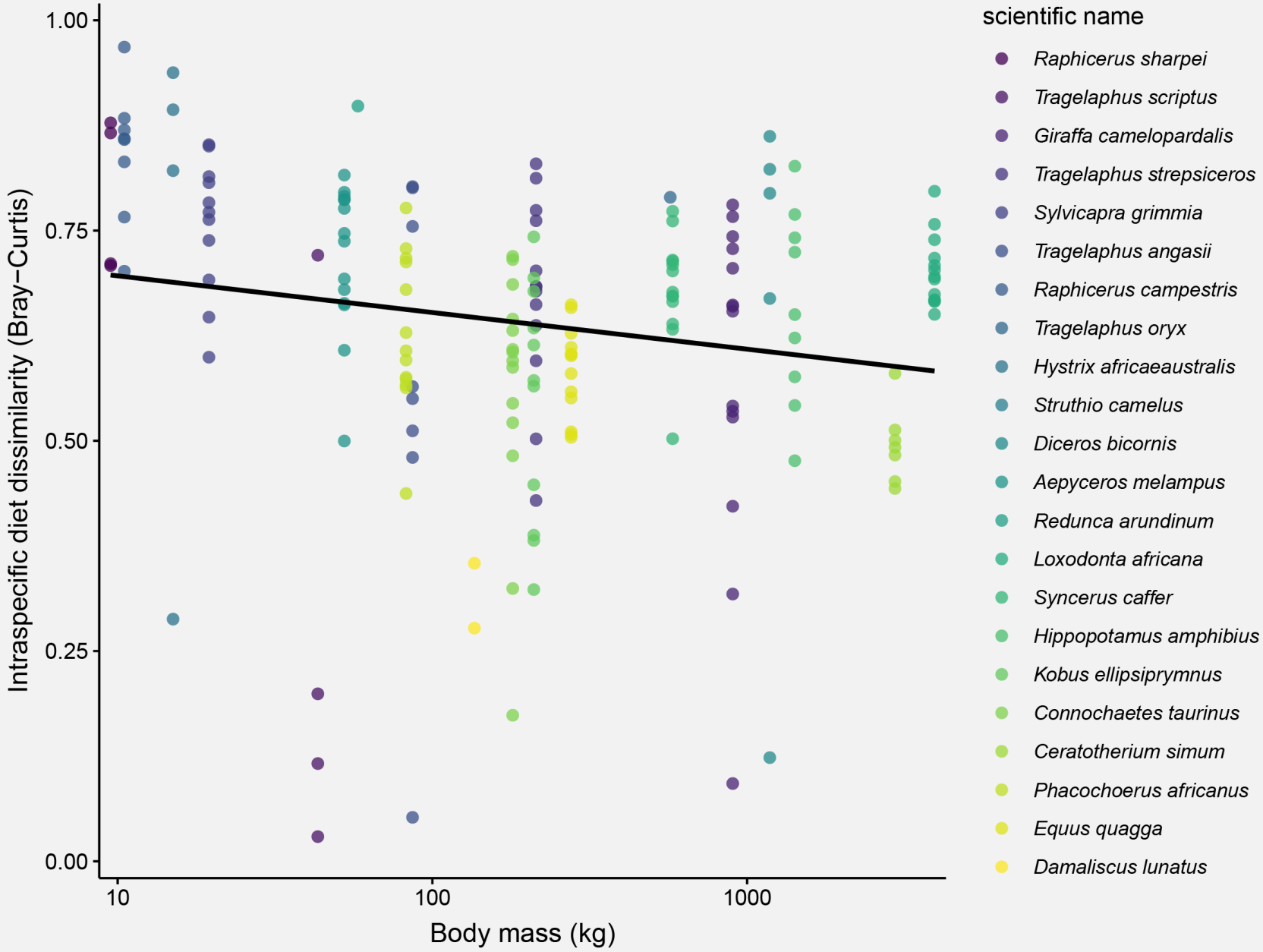


- As with sample-level diet richness, it varies with grass RRA and gut type

SAMPLE- VS. POPULATION-LEVEL DIET RICHNESS

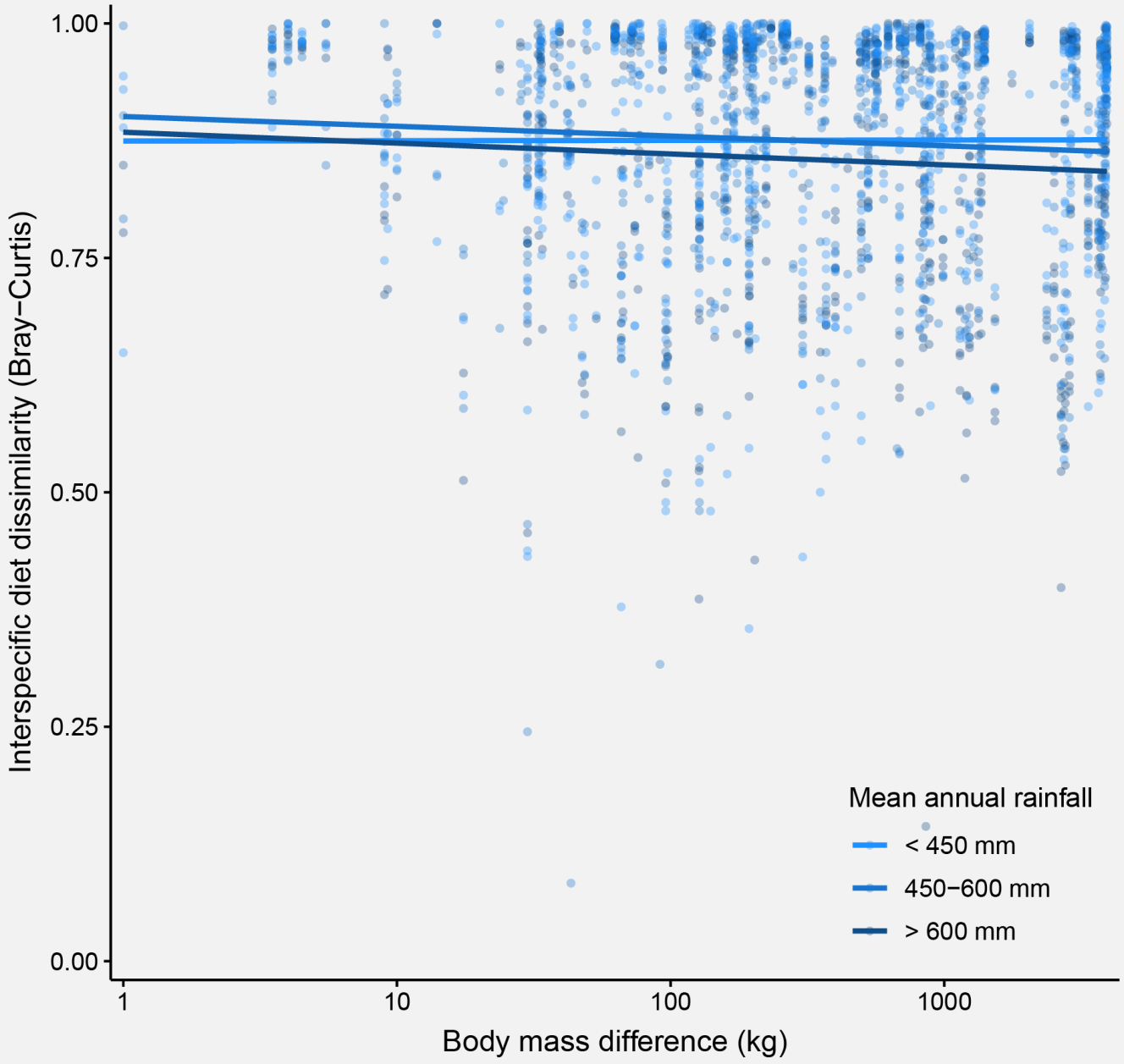


WITHIN-SPECIES DIET VARIABILITY



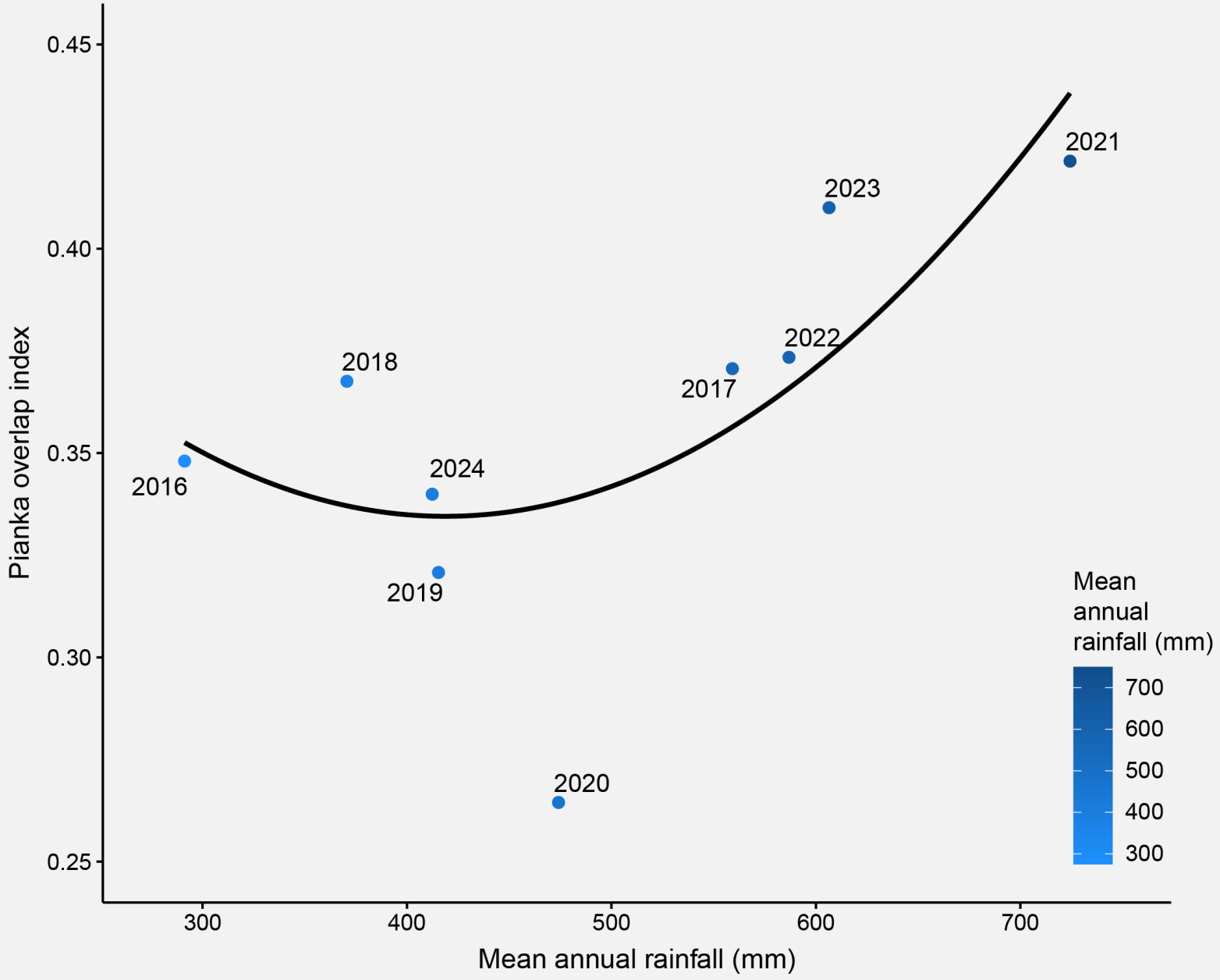
- Diet variability declines with body size
  - Larger species have less variable diets

BETWEEN-SPECIES DIET DIFFERENTIATION



- Species that differ in body size have more similar diets (lower dissimilarity), especially in wetter years
  - Small- and large-bodied herbivore diets converge more at high rainfall

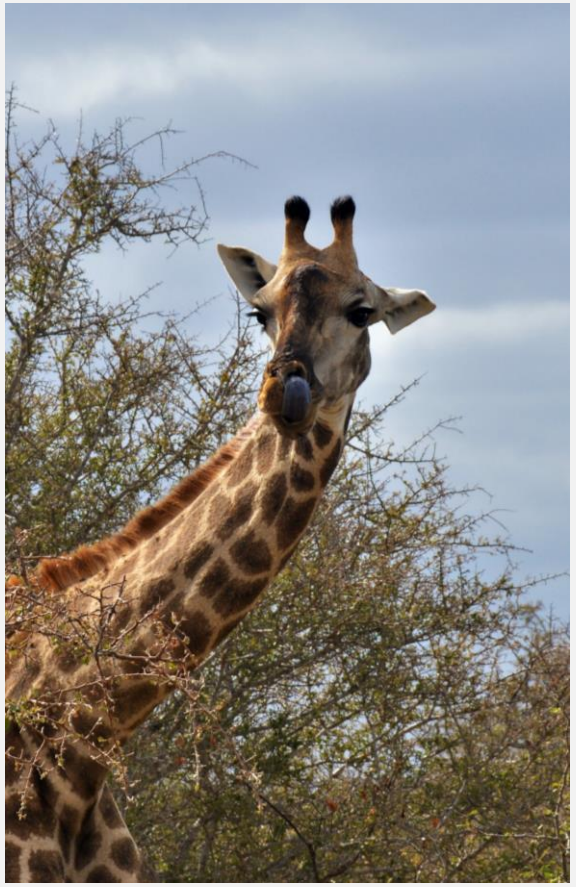
STRENGTH OF DIETARY NICHE PARTITIONING



- Herbivore diets overlap least in years with intermediate rainfall
  - Lots of rain and very little rain erode dietary niche partitioning

TAKEAWAYS

- Sample- and population-level diet richness peak at intermediate grass dependence and are higher for ruminants than non-ruminants
- Within-species diet variability declines with body size
- Between-species diet differentiation declines with body size difference and rainfall
- Niche partitioning is greatest at intermediate rainfall



TAKEAWAYS

- Body size does not appear to structure diet richness, but it does structure intra- and interspecific diet variation
  - Large-bodied species had less variable diets, possibly suggestive of greater constraint?
- Interspecific diet differentiation is climate-dependent, as is the overall strength of dietary niche partitioning

ACKNOWLEDGEMENTS

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