



Biotic vs. abiotic determinants
of the local distribution of a low-
density large herbivore in
the Kruger National Park

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AIM: To determine which factors restricted a wider distribution of sable antelope in Kruger



Resource Selection (Johnson 1980)

- 1st order – geographic range
- 2nd order- HOME RANGE distribution



2nd order

- Abiotic factors – indicate environmental conditions that allow a population to persist (spatial extent of fundamental niche)
- Biotic factors – constrain occupation to a proportion of those conditions (subset of fundamental niche)

Abiotic factors

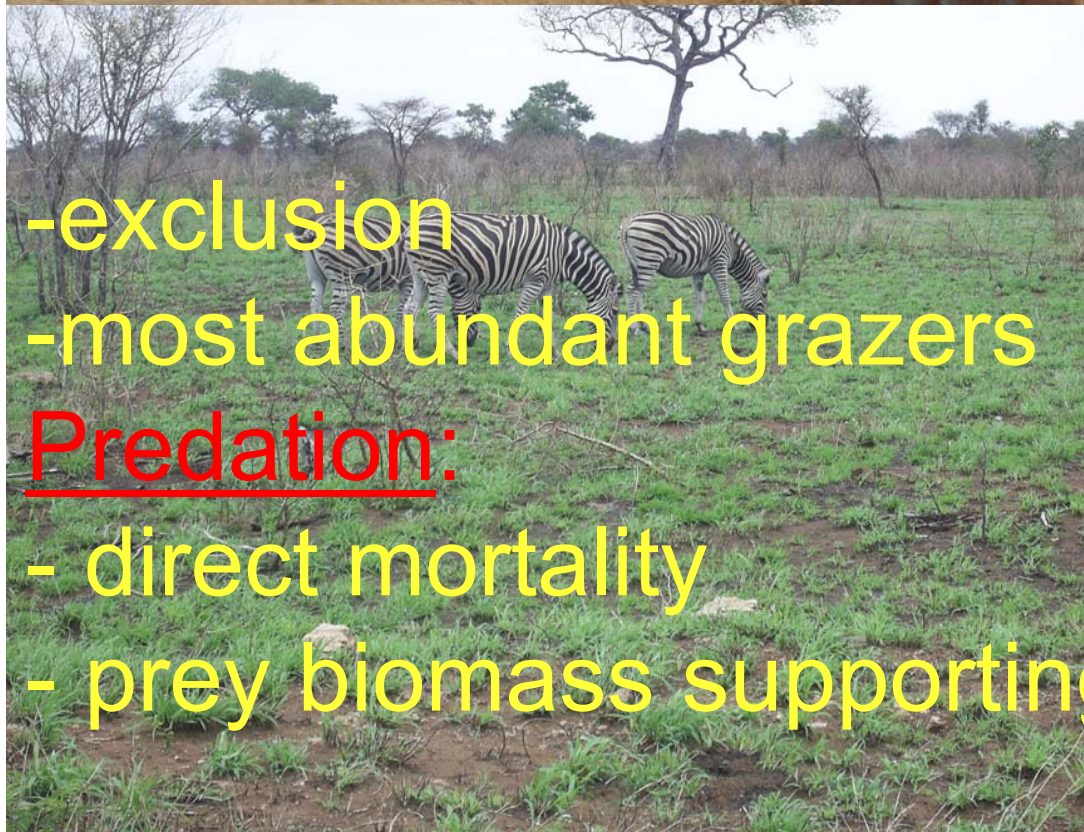
- Geology :- distribution of nutrients (soils)
- Rainfall/NDVI:- vegetation production (growing season) + retention of green foliage (dry season)
- Distance from perennial water sources
- Landscapes:- specific vegetation features

Biotic factors



Competition:

-resource depletion



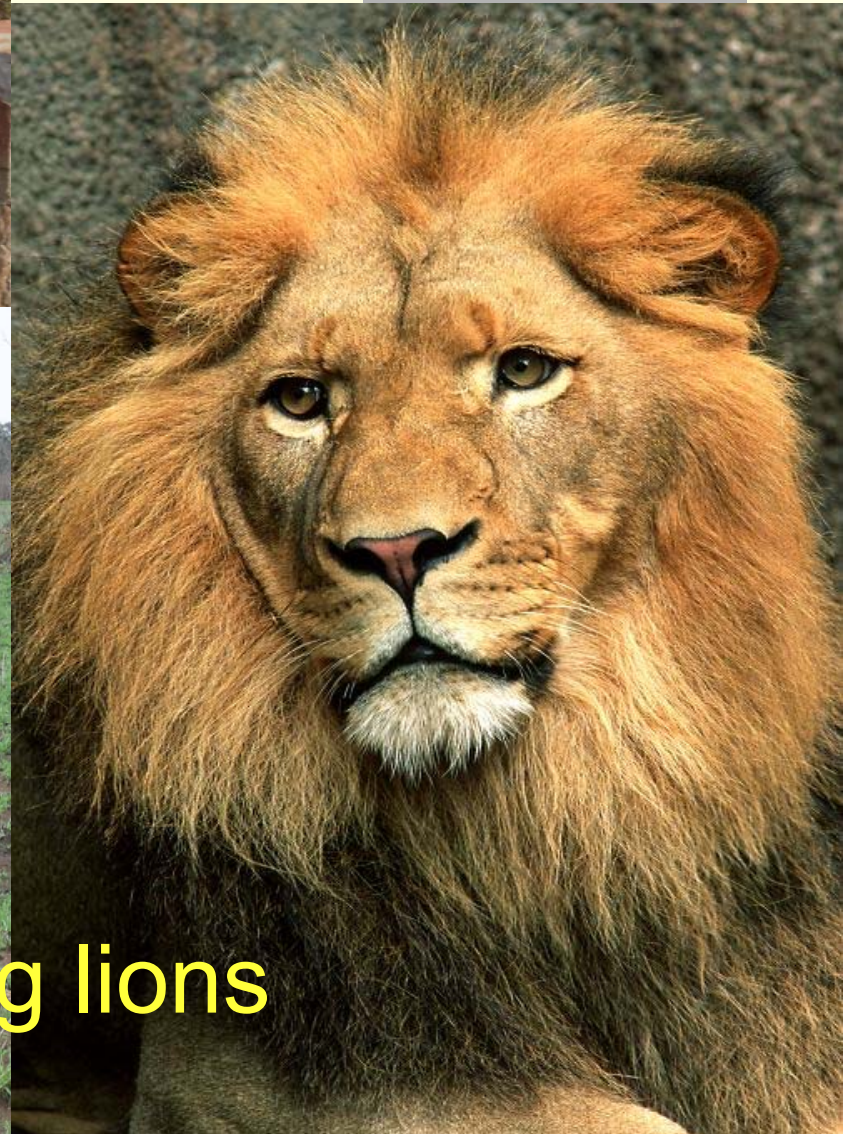
-exclusion

-most abundant grazers

Predation:

- direct mortality

- prey biomass supporting lions



Data characteristics

- Herd records from EAS 1978-1993
- Reliable absences
- Sedentary species → used 5x5 km tiles as (estimate of sable home range)



Methods (abiotic factors)

- Geology: -(Venter 1990)
- Distance from water sources : 0-1, 1-2, 2-3 3-5 km (categories)
- Rainfall: Long term (mean: annual and dry season) (range 18-85 years)---(Kriging in GIS)
- NDVI (wet & Dry season)
- Landscapes: - Gertenbach (1983), Venter 1990)

Methods (Biotic factors)

Competition proxy:

- biomass (buffalo, zebra, wildebeest, impala)
 - 1- separately
 - 2 - combined
- down weighted impala (50%) (contribution of grass to diet)

Methods (Biotic factors)

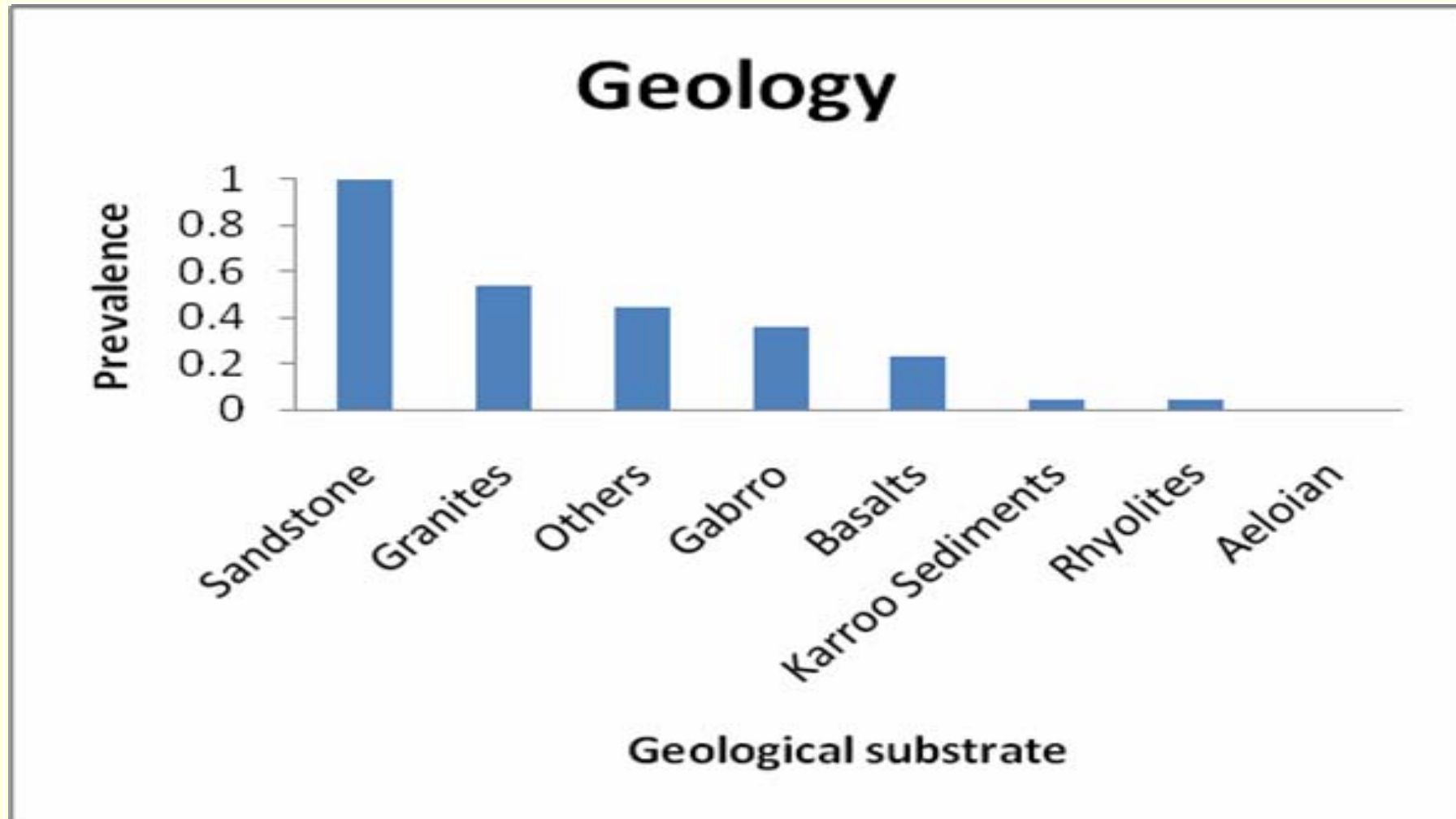
Spatial predation risk:

- product of each species number, carcass mass and relative kill likelihood for lions, summed over all prey species.
- Lion counts (EAS)

Model fitting

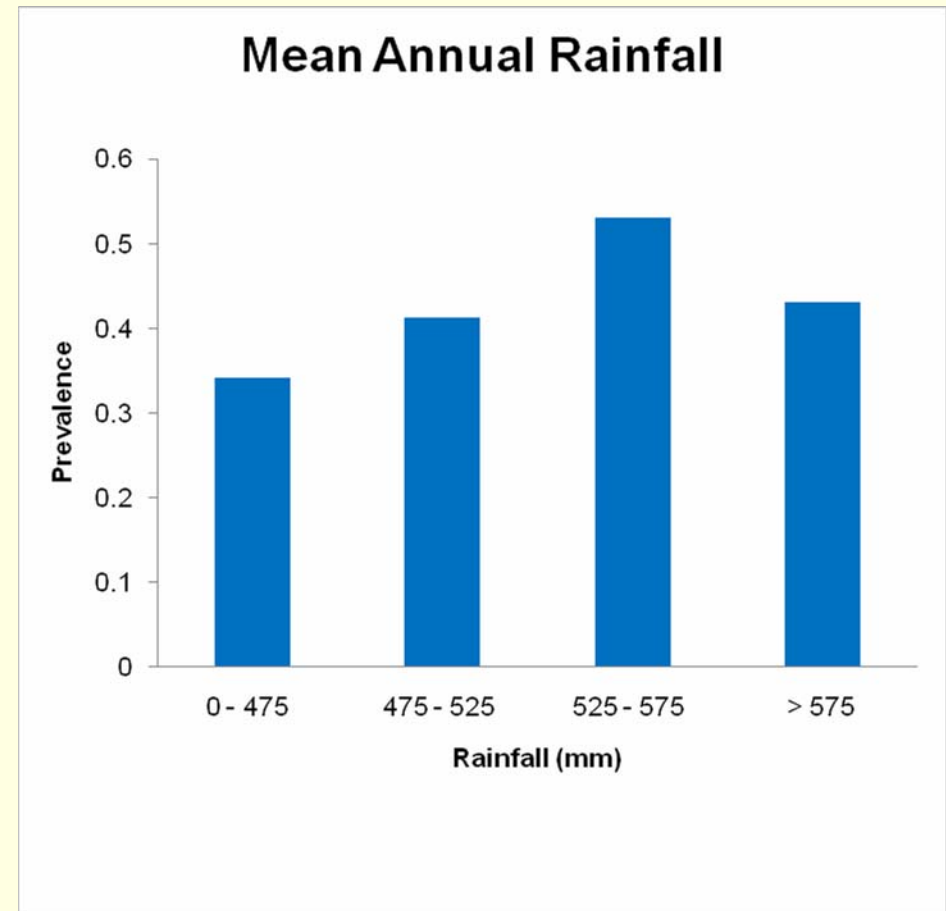
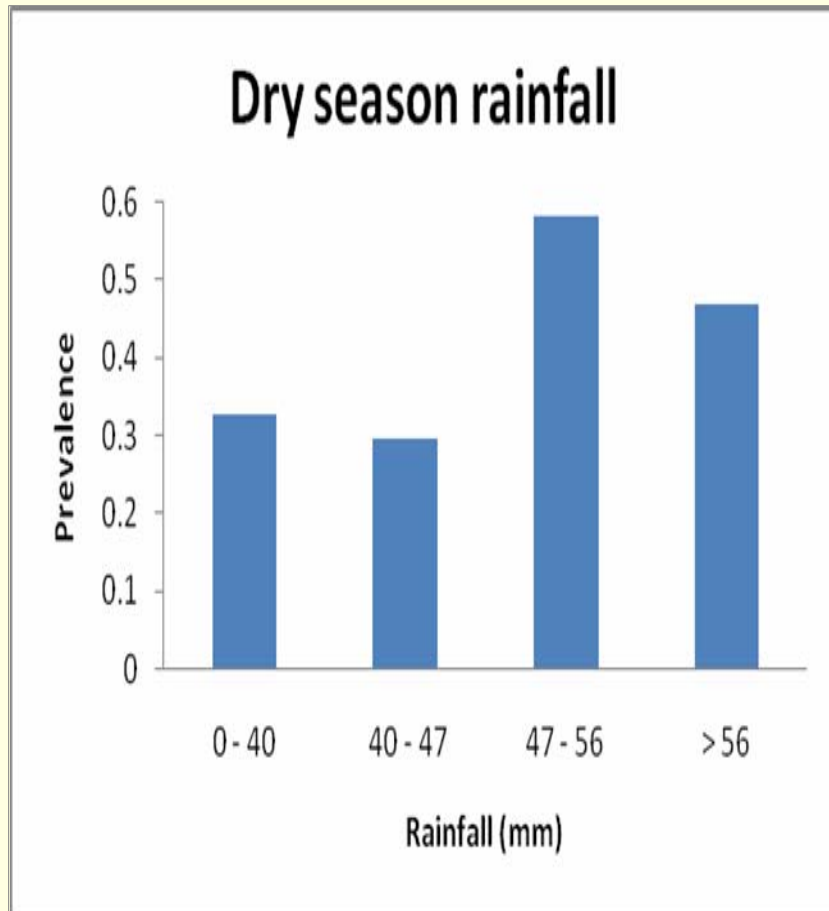
- Logistic regression models
(Presence/absence of resident sable herd)
- Exclude tiles less than 0.5 home range size
- Models fitted in a hierarchical fashion
- AIC – model selection procedures

Geology-best supported among broad abiotic factors



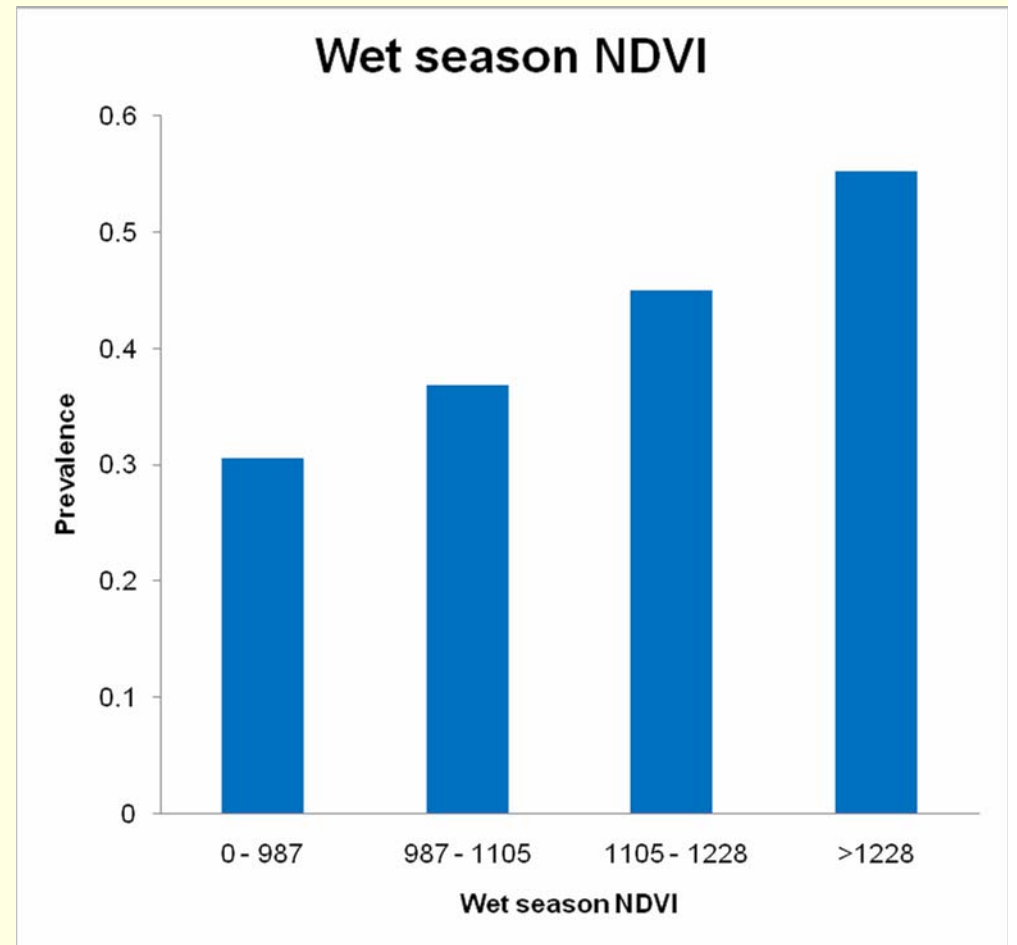
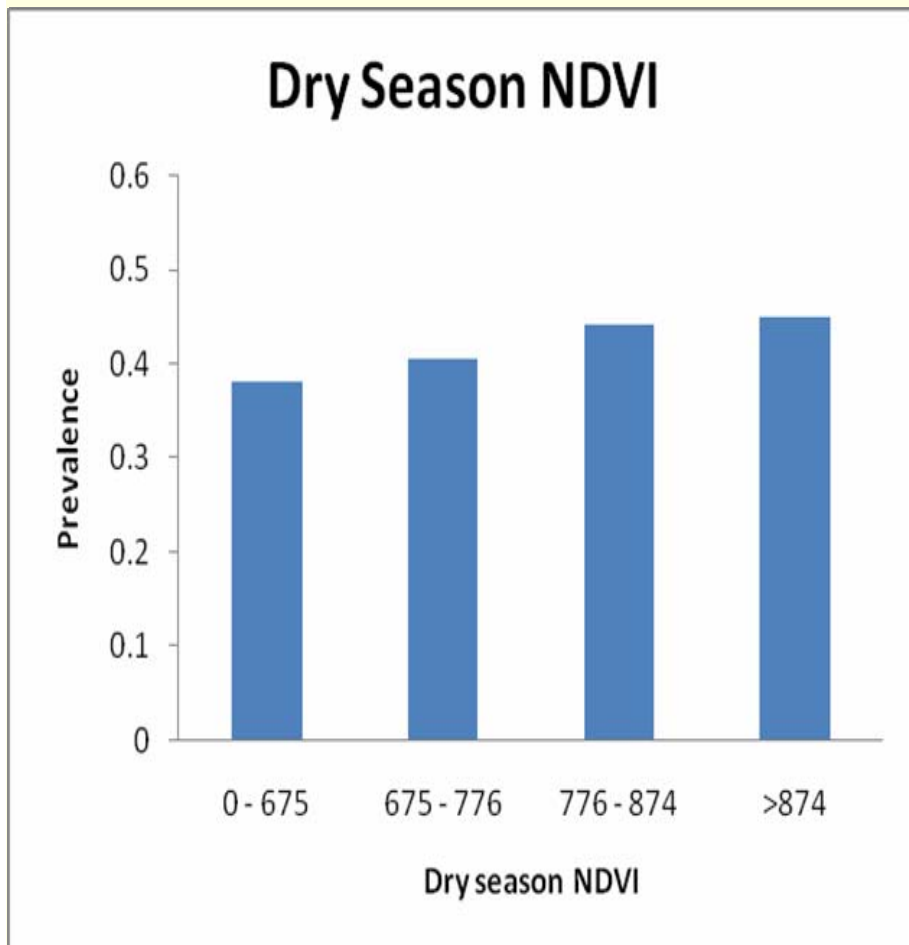
*Prevalence differed from expectation, was highest for poor nutrient granite and sandstone instead of nutrient rich basalt and gabbro

Rainfall



Both rainfall components positive correlation with sable prevalence

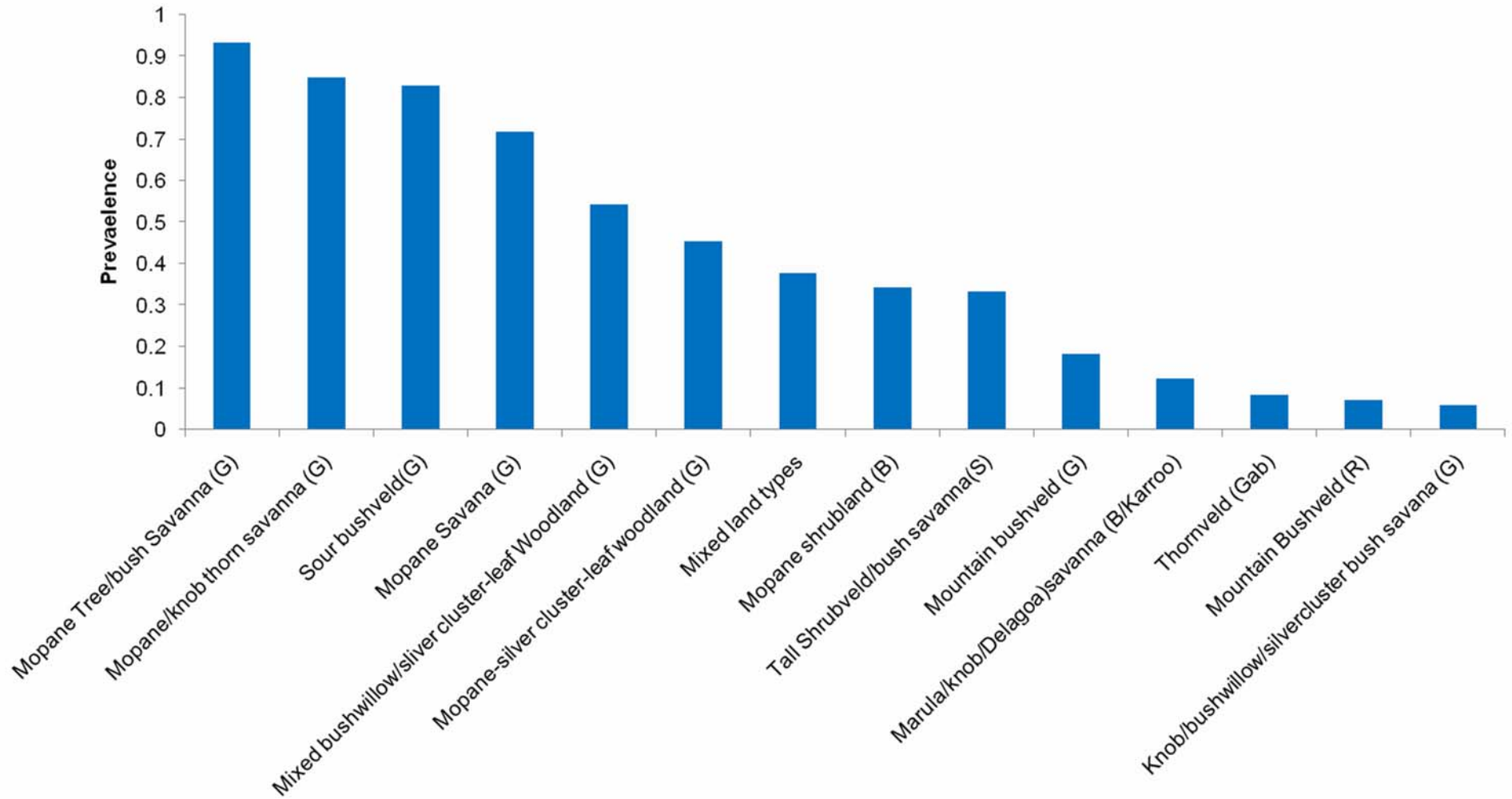
NDVI



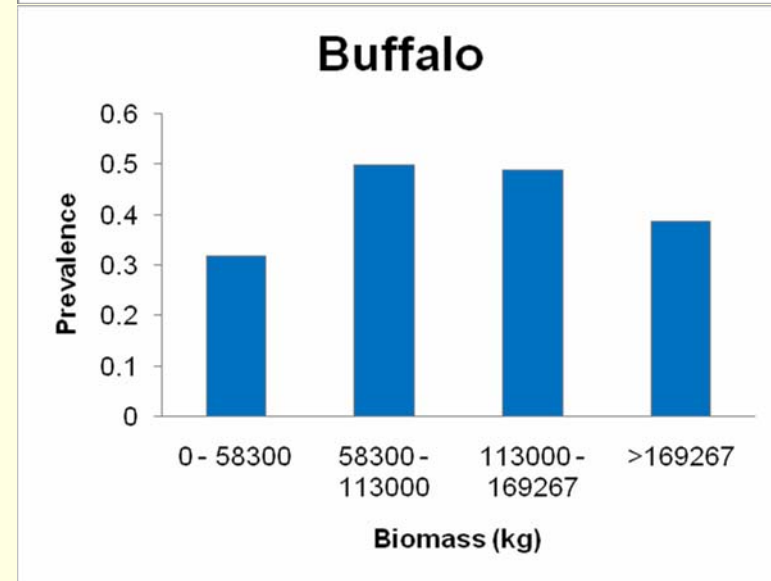
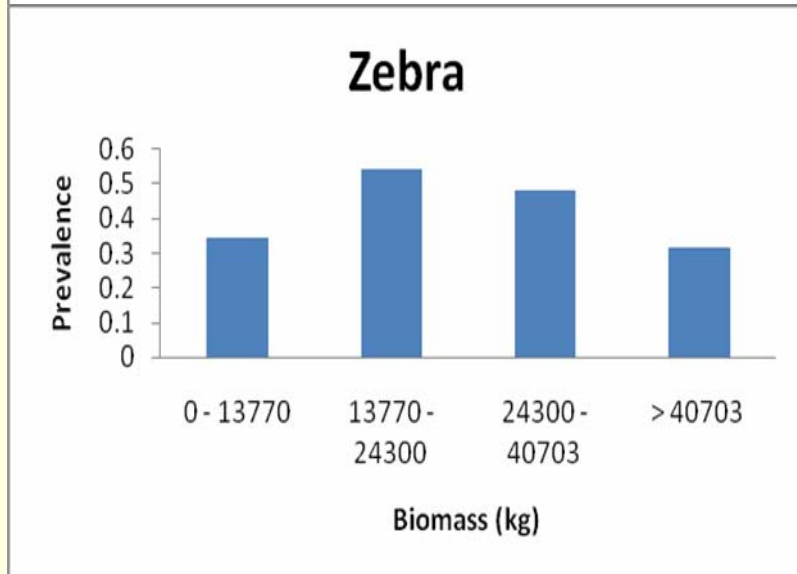
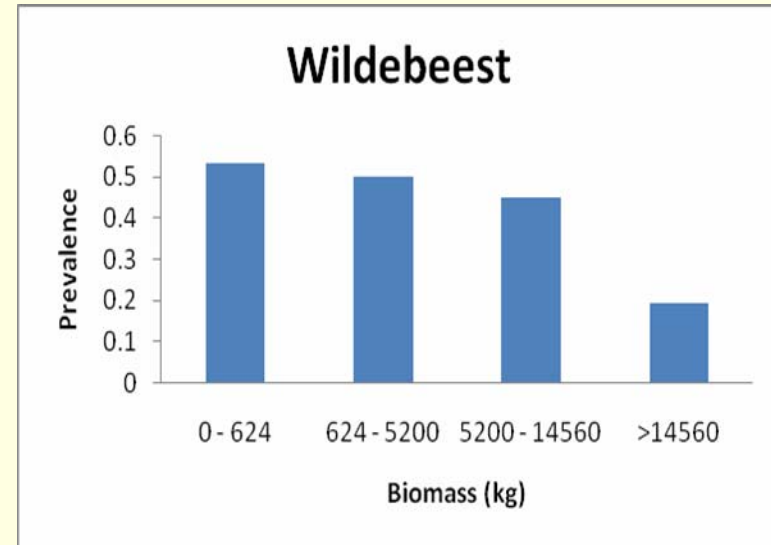
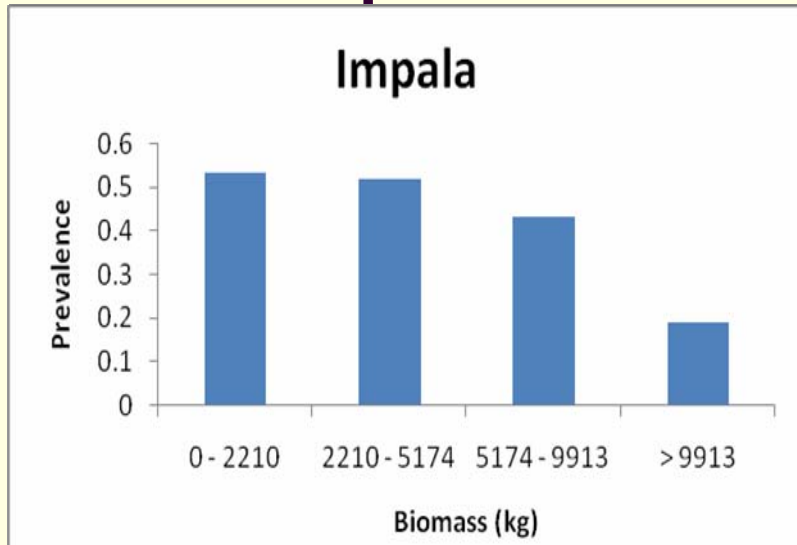
Positive correlation for both components

Land type

Land types



Competition



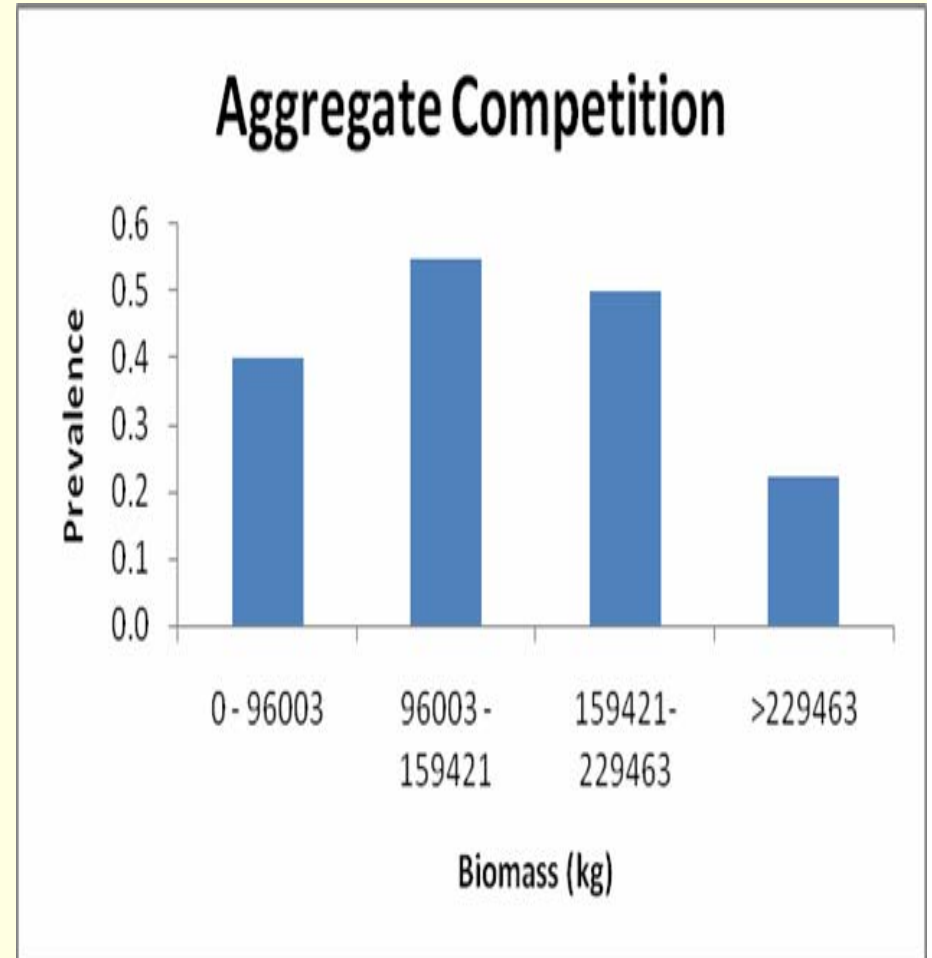
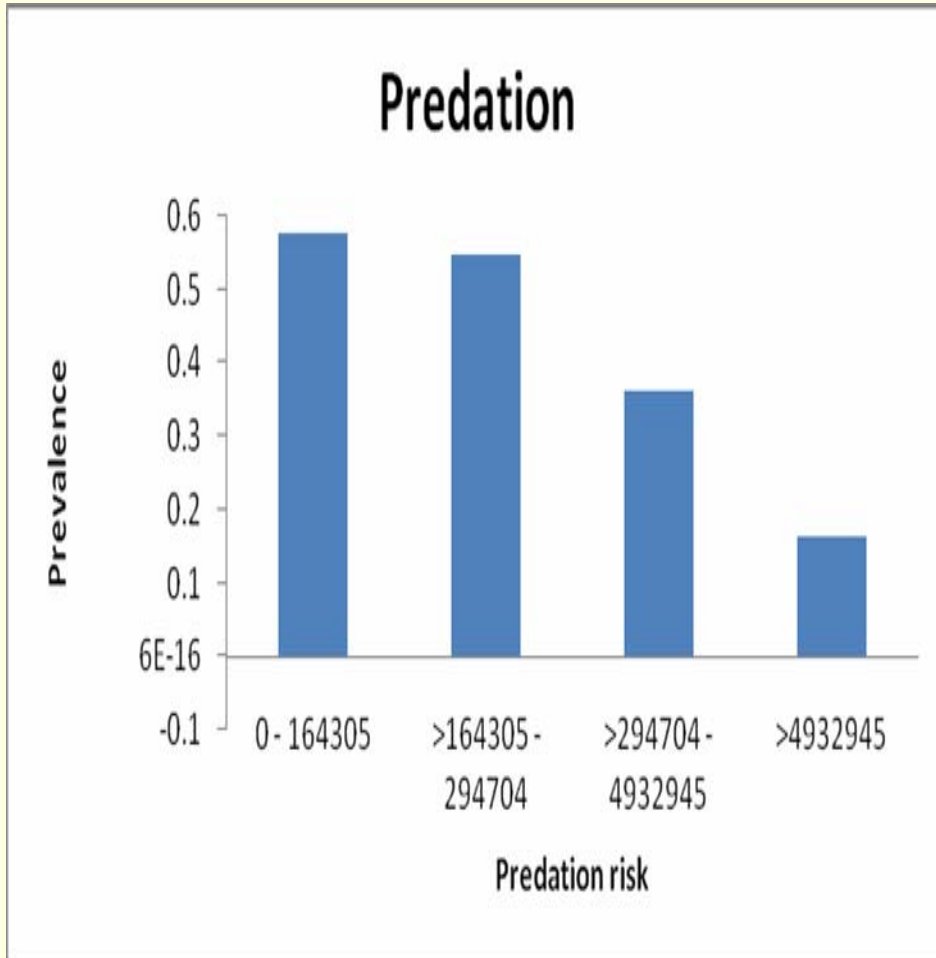
Impala & wildebeest - negative correlation

Buffalo & zebra- overlap

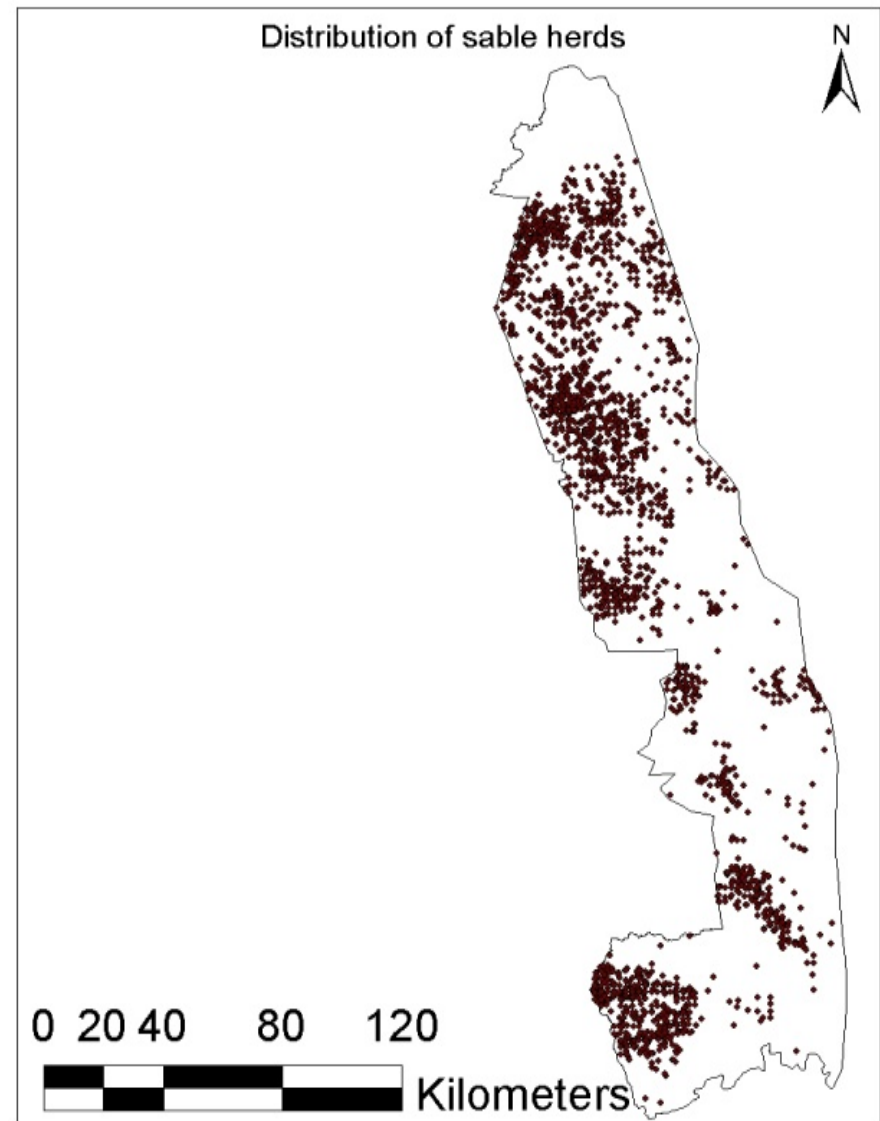
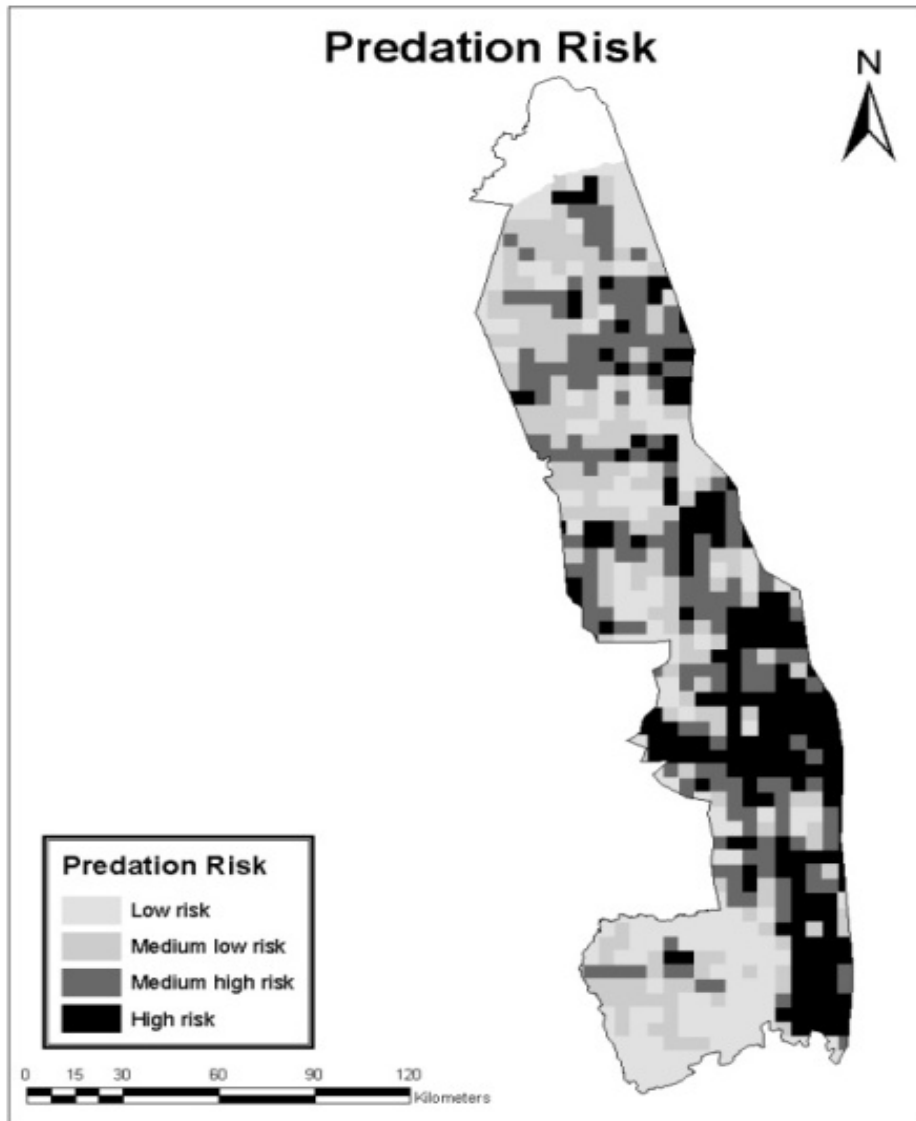
Sable distribution as a function of competition vs. predation risk

- Effects of predation were better supported than effects of aggregate competition or any individual competitor alone
- Sable prevalence dropped 0.58 in areas of lowest predation risks to 0.16 in areas of highest predation risk

Aggregate competition & Predation



Distribution of sable and distribution of predation risk



Summary

- Abiotics factors (most influential)

1. Land type :

- Biotic factors

1. Competition: -impala

2. -wildebeest

More overlap between sable, buffalo & zebra – likely more competition here but no avoidance because buffalo and zebra are every where

Summary

1. Prevalence was highest on less nutritious geology (granite and sandstone)
2. No strong support for rainfall support
3. NDVI confounded by woody component
4. Impala and wildebeest- selection for different habitat type

Conclusions

1. Risk of predation by lions has overriding influences on effects of competition and effects of abiotic factors.
2. Evidence implicates predation as having key influence on where sable herds occur

Acknowledgements
CAE, Wits University
Sable Team



Thank you