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Predation risk exerts primary control  
over the distribution of low density  
antelope species.

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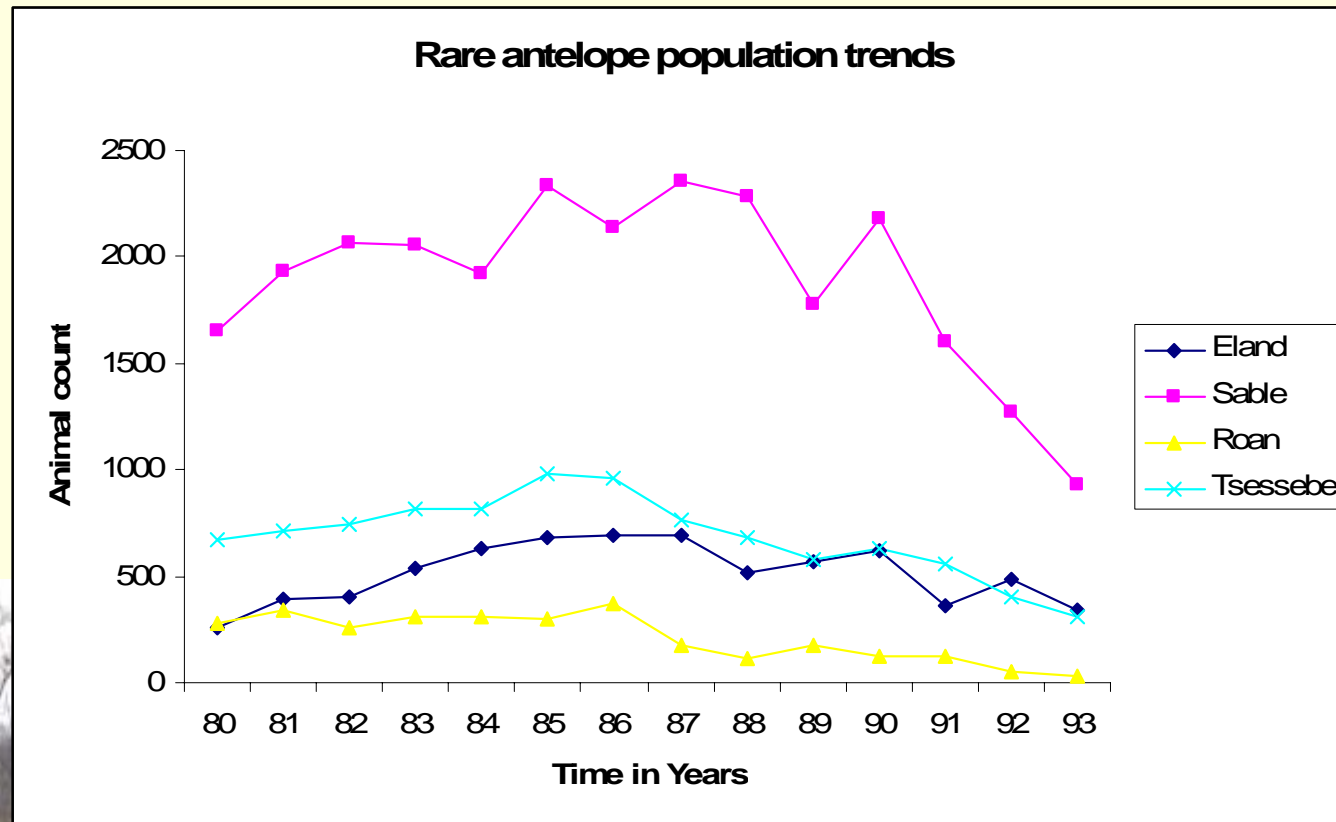
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# Introduction :Concerns

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- Efforts to protect since 1970s (eland, roan, sable and tsessebe)
- Despite these efforts (continue to decline)
- Sharp declines after 1987
- Knowledge of limiting factors mostly elusive

# Rare antelopes' Population trends after 1987



# Hypotheses

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Interplay between:

- competition
- resources
- predation
- Current focus : **competition and predation**





# Current focus

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1. Distinguishing associations between the aggregate abundance of prey for lions and distributions of rare antelope species
2. Distinguishing relationships between distributions of rare antelopes and distributions of leading competitors (zebra, buffalo and wildebeest)

# Methods

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- Data-aerial surveys - KNP
- LoCoH algorithms (Getz et al. 2004,2007) (k-NNCH)
  - Distribution ranges (1977-1993)
  - (pre-decline 1980-86 and post-decline 1987-1993)
  - Identify core and marginal areas
- Tiles – spatial associations (rare species with potential competitors) (10 x 10 km)

# Spatial Risk Index vs. Lion surveys

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- EAS lion data - **undercounts**.
- Lion distribution ranges pre-decline and post-decline --**visual checks** against our predation proxy index)
- Spatial distribution of predation hazard was estimated from the product of population density, carcass mass and relative kill likelihood for lions, summed over all prey species. (Owen-Smith, Mason and Ogutu 2005)

# Competitive effects from buffalo, wildebeest and zebra

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- Analyzed buffalo, wildebeest and zebra distribution during the same periods
- LoCoH: competitors' distribution ranges' identified core and marginal ranges
- Assessed rare species occurrences in these areas and overlaps with competitors

# Results: Buffalo



Buffalo are abundant and widely occur in rare species range

- Positive associations between the occurrence of rare antelopes with buffalo in marginal areas, but less rare species in areas of highest buffalo densities ( $>10/\text{km}^2$ )
- Sable, eland and roan (significant)
- Tsessebe showed same trend but not significant



# Zebra Distribution

Zebra occur widely in rare species range and showed positive associations on larger scales

- Positive associations with zebra were evident in general range, but rare species occurred less in areas of high zebra densities ( $> 7/\text{km}^2$ )
- Sable and eland significant
- Same trend was evident for tsessebe and roan though not significant

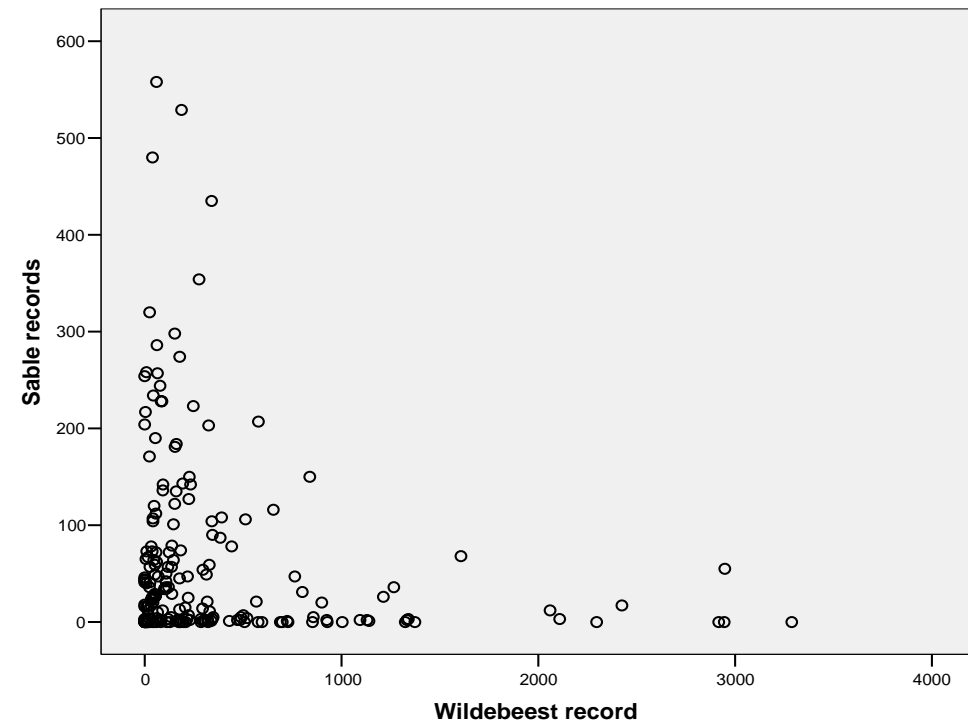
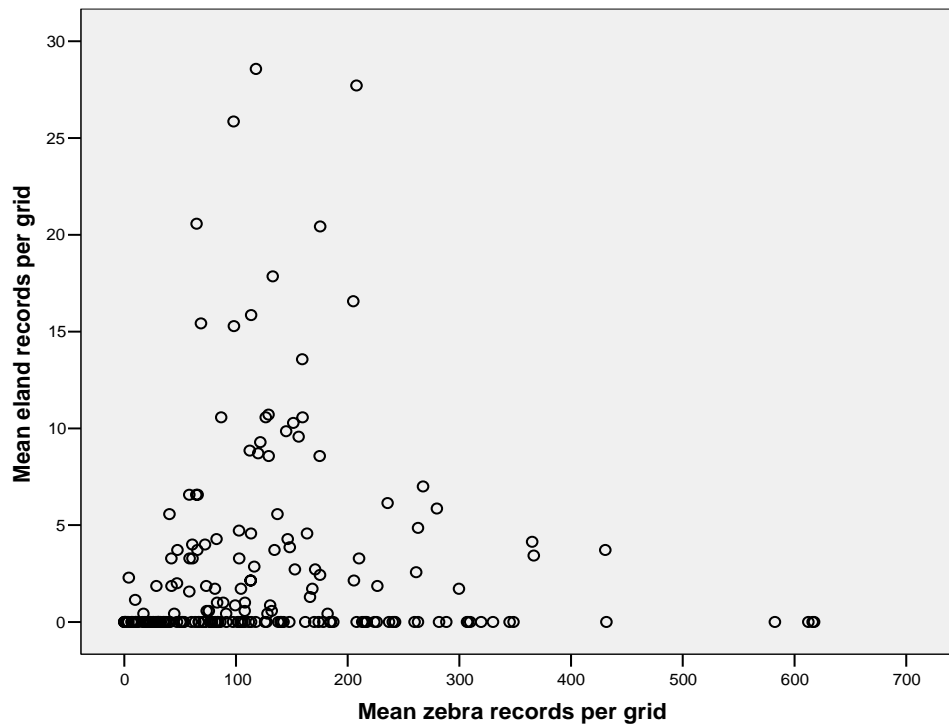
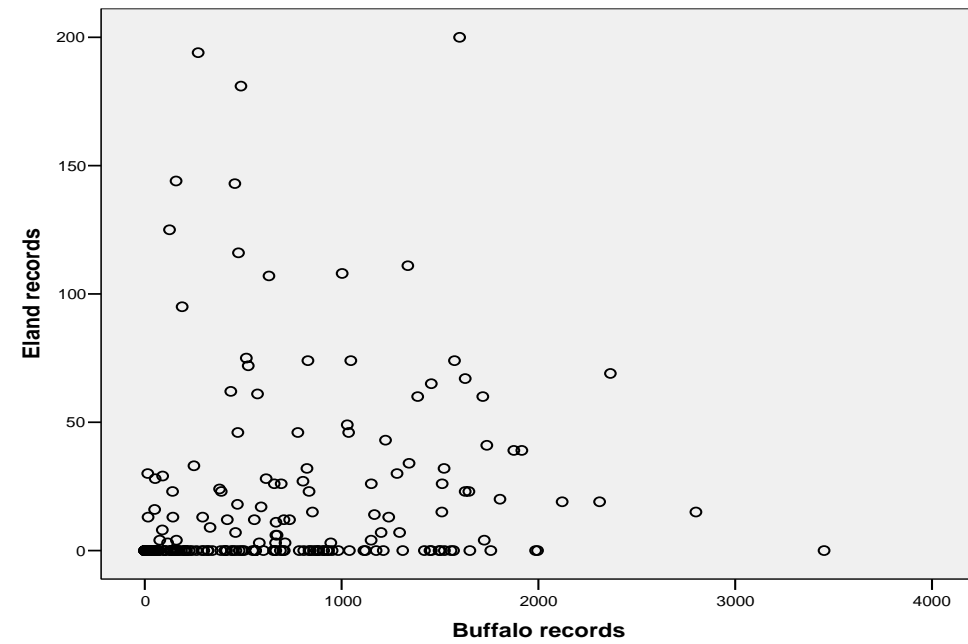
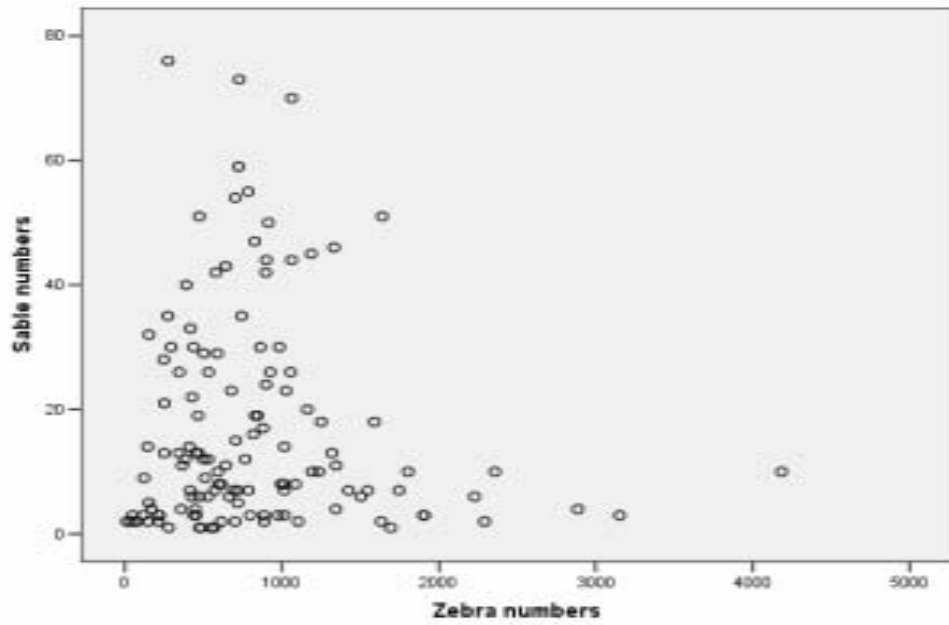
# Wildebeest Distribution



Wildebeest showed selection for different ranges to rare antelopes

- Rare antelopes showed negative associations with wildebeest (Pearson correlation):
- Sable, eland and roan (significant)
- Tsessebe showed same patterns but non significant

# Trends of occurrences in relation to competitors



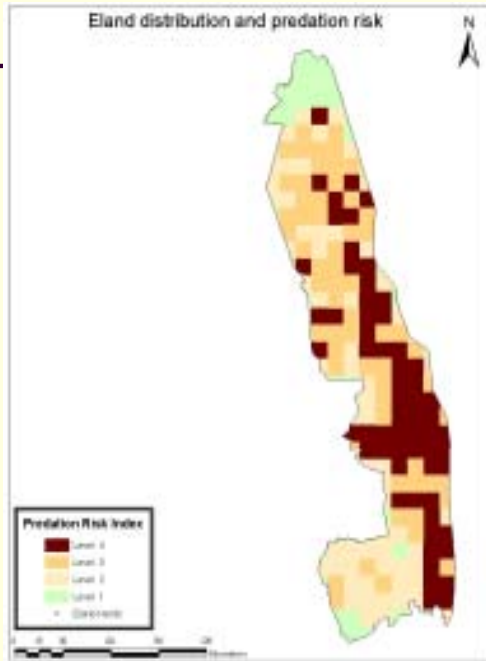
# Distribution ranges overlaps rare antelopes with competitors

**Table 1** Rare species (%) range overlaps with buffalo, wildebeest and zebra core areas

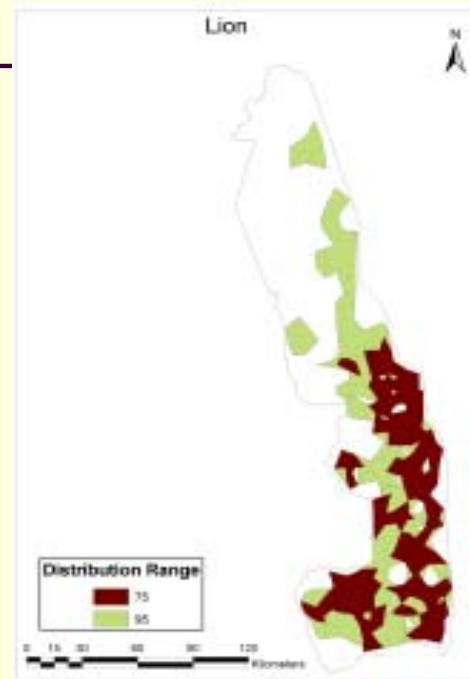
	Eland	Roan	Sable	Tsessebe
Buffalo	28	21	21	21
Wildebeest	3	5	2..3	8
Zebra	10..5	18	23	23

At large scales there is use of common ranges, BUT negative associations in core ranges

# Distribution of predation risk



1980-93



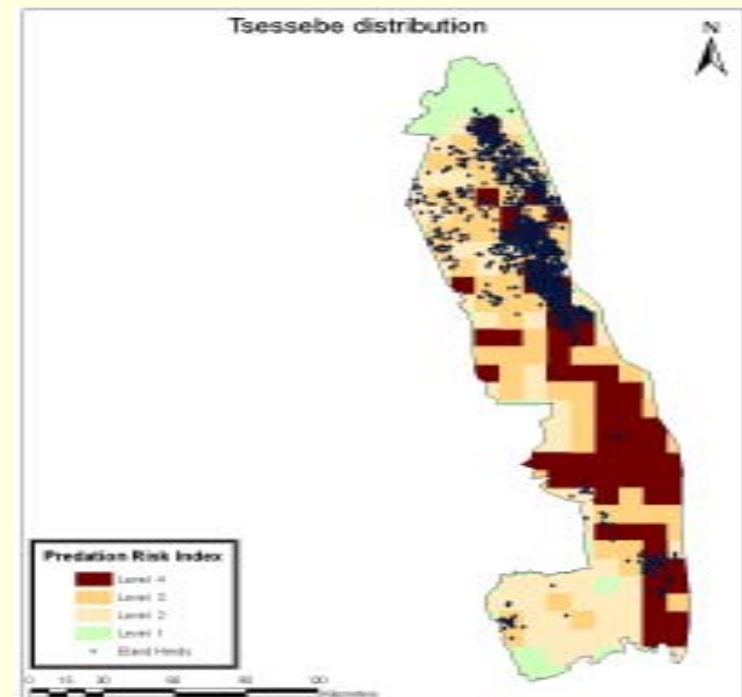
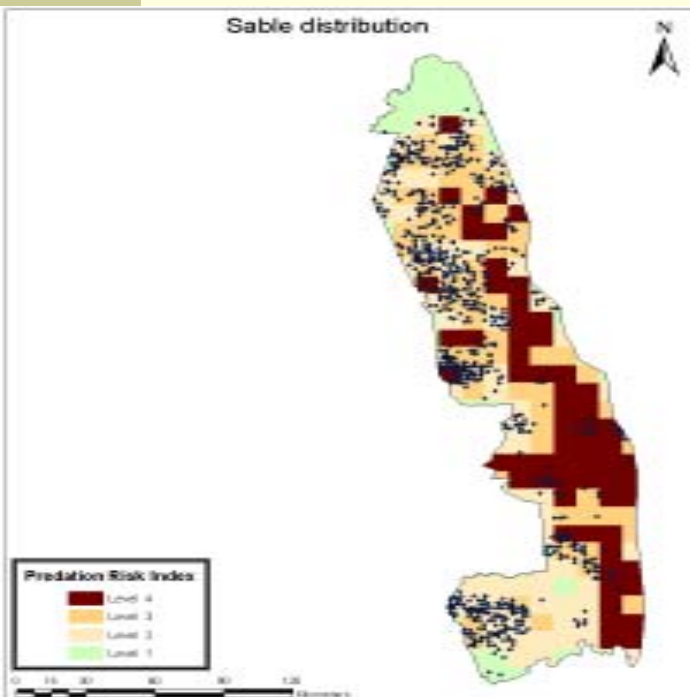
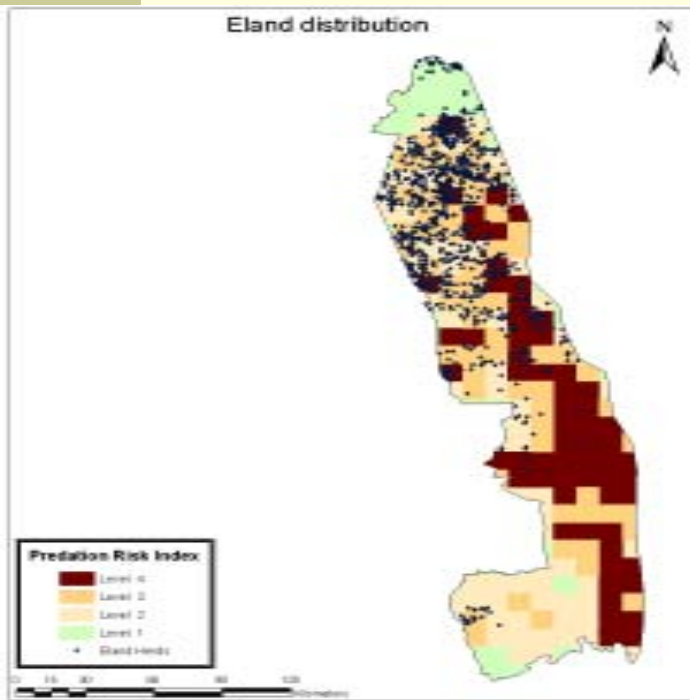
1980-86

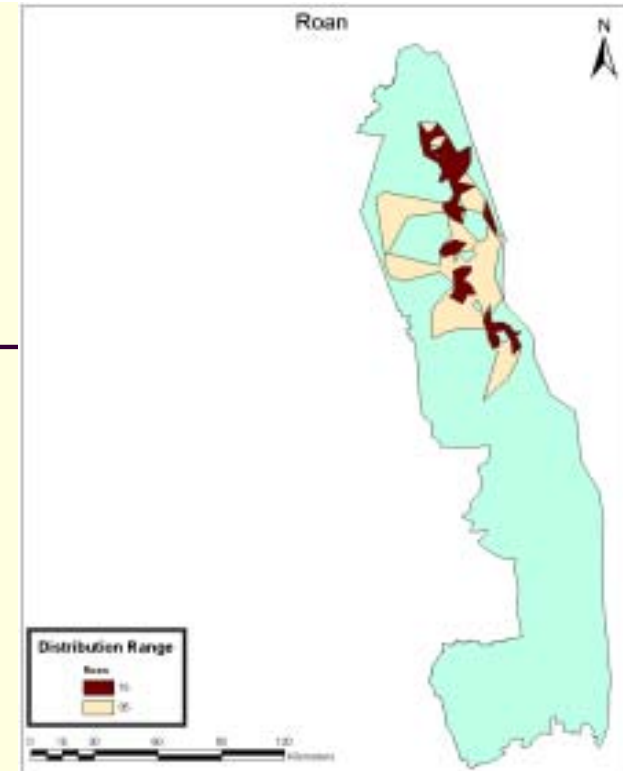
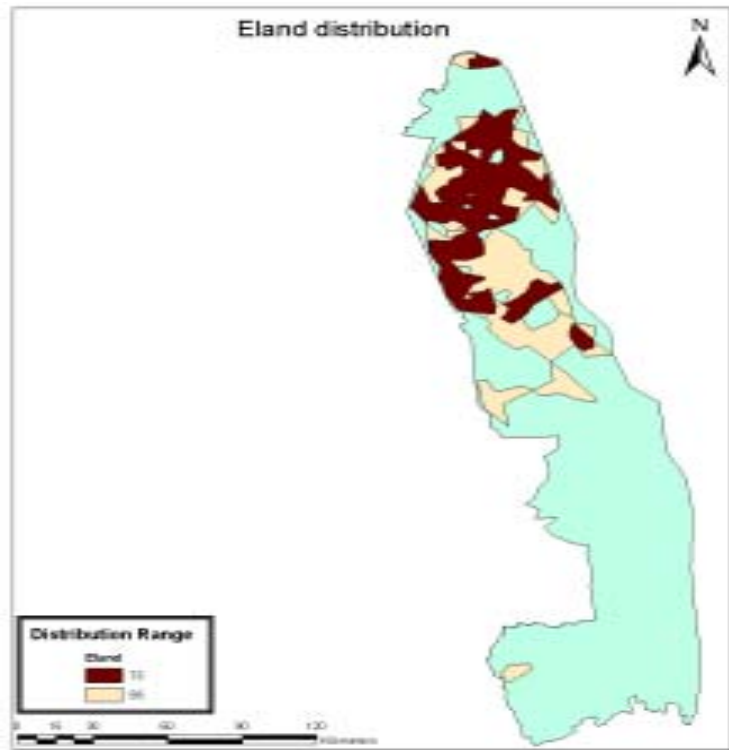


1987-93

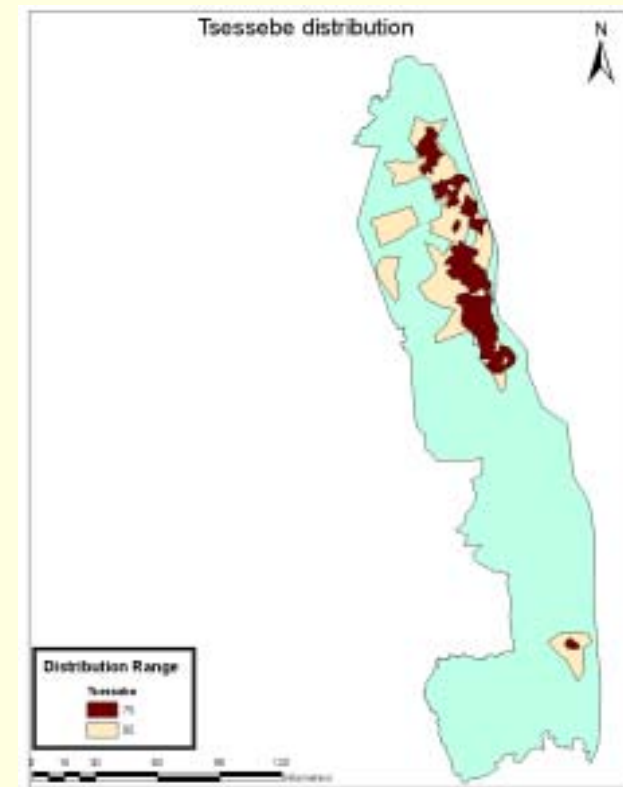
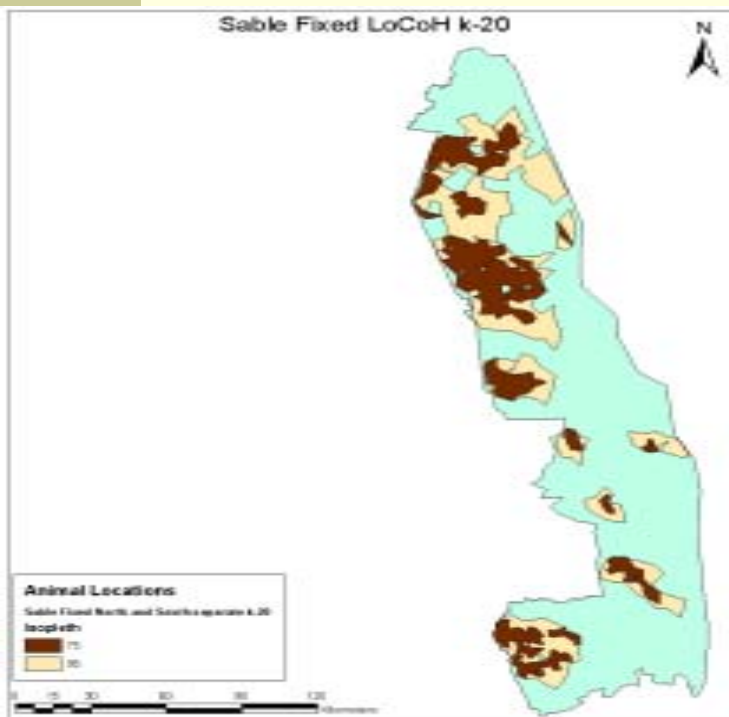
- Predation Index matched with lion distribution ranges
- Lion range expanding to north wards after 1987

# Distribution patterns in relation to predation



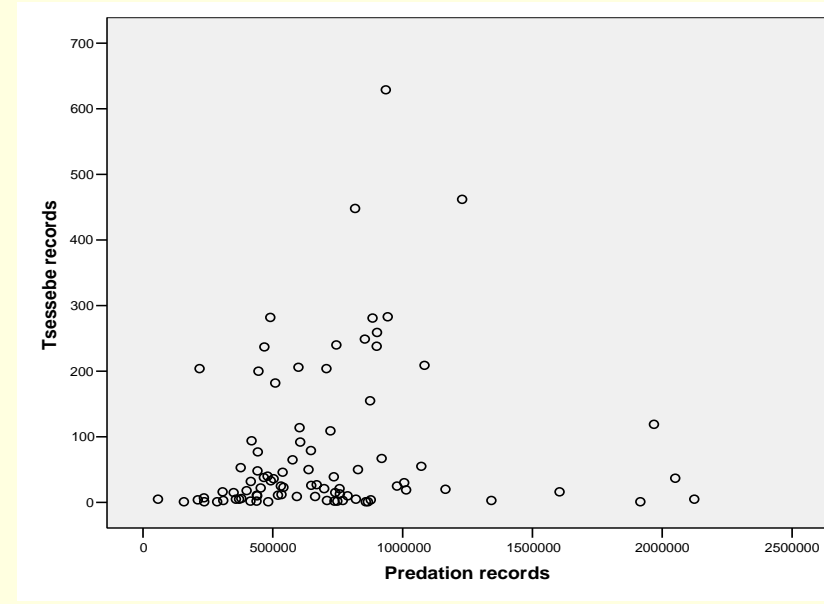
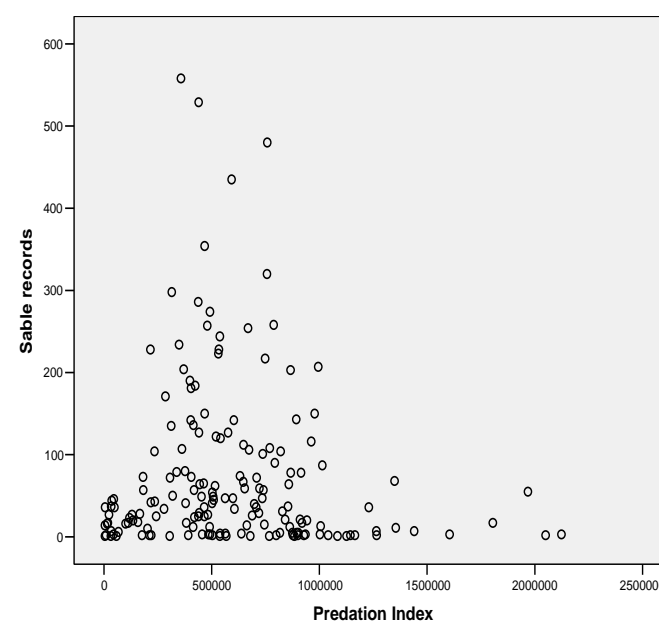
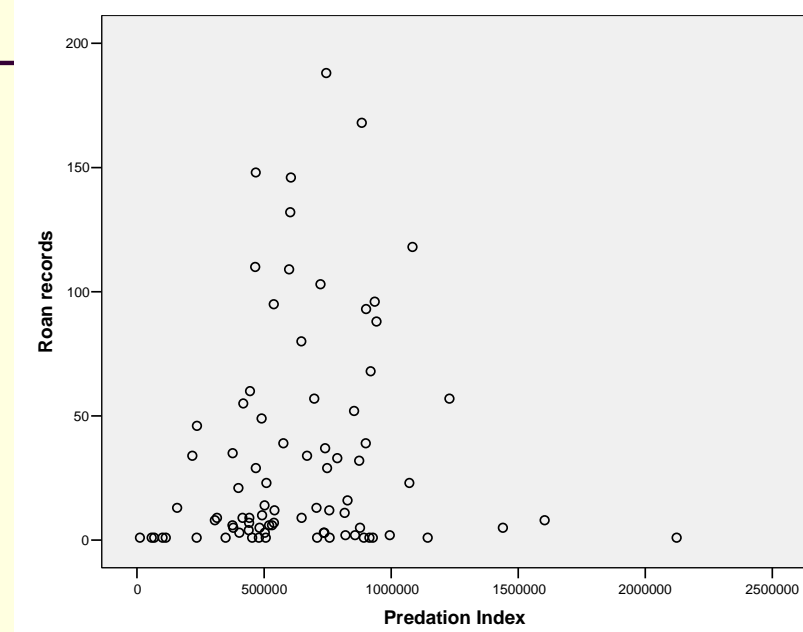
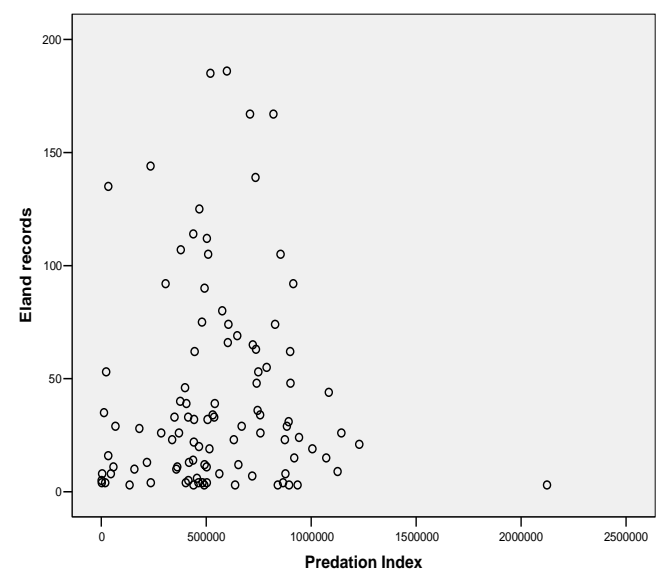


Zones where  
rare species  
persisted

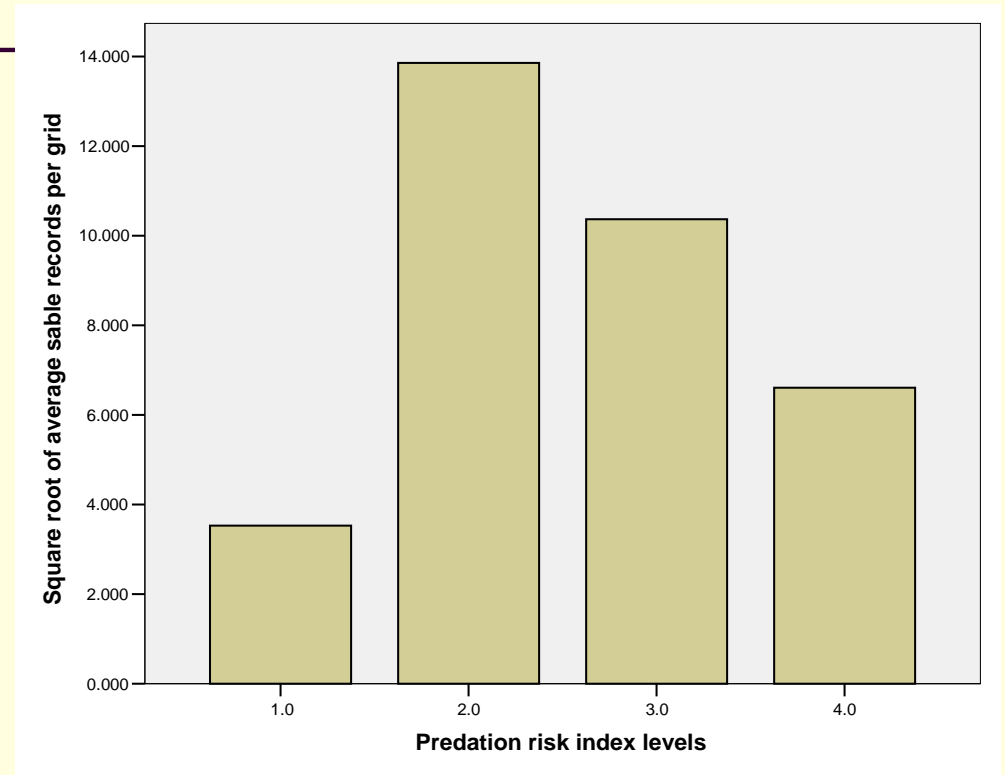


# Occurrence in relation to Predation Index

Rare antelopes occur with higher densities in zones where predation risk is lower



## General trends in different zone as shown by tiles



- Rare antelopes occurred in the low to medium risk predation zones.
- Evidence of unsuitable habitats Zone 1 zone

# Message Competition with Buffalo, wildebeest and Zebra

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- Limited spatial options to avoid competitive effects from zebra and buffalo because these two species are widely distributed KNP.
- Much more limited options during the dry season when these species widen their ranges to possibly include formerly less preferred habitats
- Wildebeest appeared to show selection for different resources to rare antelopes.

# Message Predation

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- The distribution of sable, roan, tsessebe and eland were concentrated in the far north and north of the park where predation risk appeared generally lower than elsewhere.
- Core areas were associated with regions of the park where this predation index was least.

# Current message

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- Appears :- predation has primary control at larger scales
- Appears: - zebra and buffalo competition might be important at smaller scales
- Future directions: Model development to:
  1. Best model to explain distribution patterns
  2. Effects of change scale on predation

**Findings suggest that risk of predation by lions is the primary factor governing the restricted distribution of the low density antelope species in the Kruger National Park.**

**Thank you**

**Acknowledgements  
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