

Variability in herbivore feeding ecology and the decline of roan antelope *Hippotragus equinus* in Kruger National Park, South Africa

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Stable

C

Isotopes



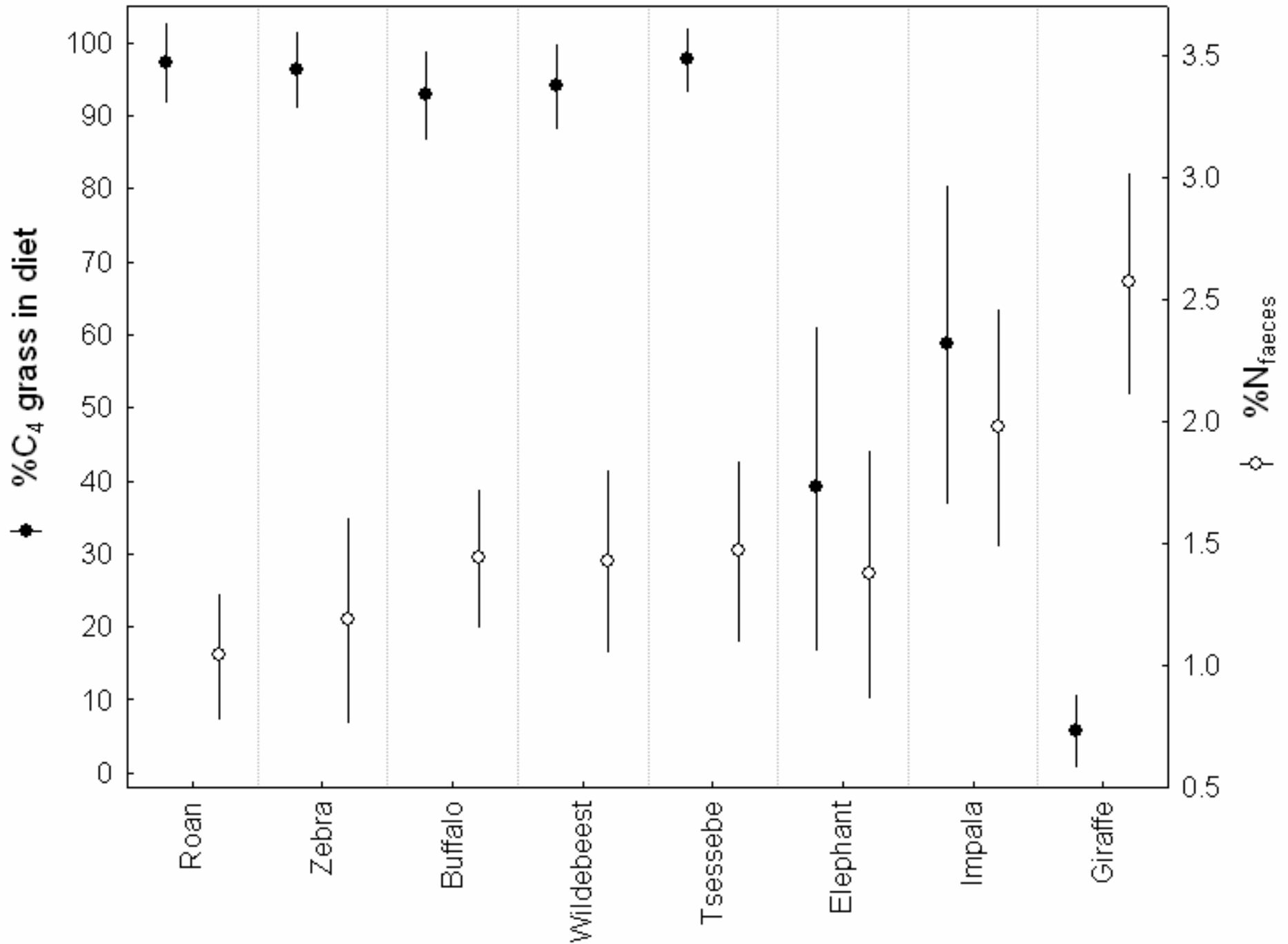
Roan Declines

- Waterholes: reduce habitat heterogeneity on NBP
 - More grazers (Harrington et al. 1999; Grant et al. 2002)
 - ↑ competition
 - ↓ condition of grass layer
 - ↑ predation
 - Roan habitats (Kröger & Rogers 2006)
 - ↓ edaphic grasslands
 - ↓ riparian/grassland ecotone
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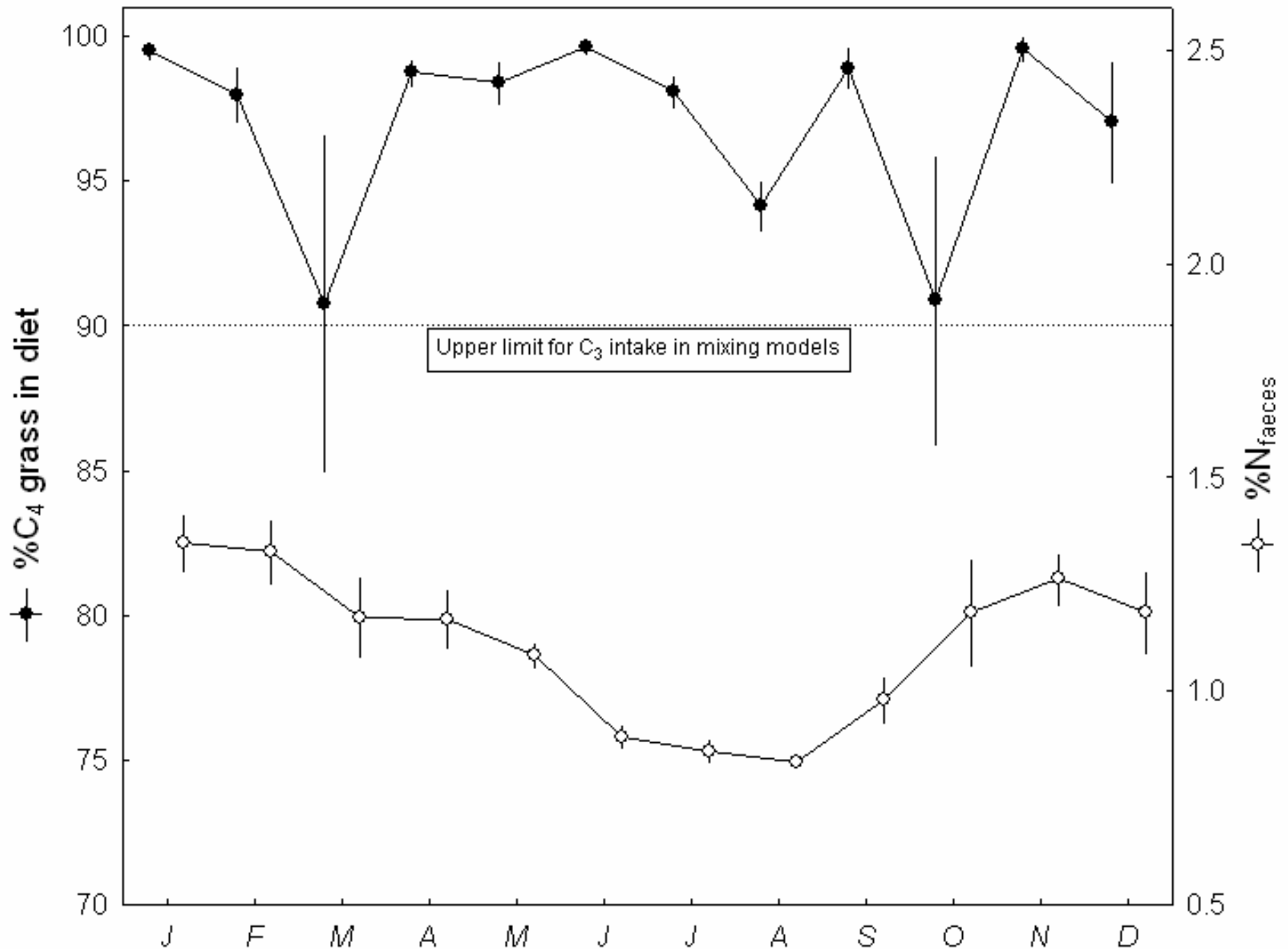
Objectives

- Do roan diets on NBP indicate nutritional stress?
 - Have diets of sympatric herbivores been affected by homogenization of NBP habitats?
 - Are waterholes responsible for these changes?
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Nutritional Stress?



Nutritional Stress?



Nutritional Stress?

Taxon	Species	KNP faeces			%C ₄ in Diet				
		<i>n</i>	d ¹³ C (‰) Mean	SD	KNP	SD	S.Afr.	E.Afr.	Field studies
Perissodactyla									
Equidae	<i>Equus burchellii</i>	166	-14.1	1.0	92	6			90
Rhinocerotidae	<i>Diceros bicornis</i>	9	-26.1	0.4	9	2			5
	<i>Ceratotherium simum</i>	28	-13.9	1.3	90	8			98
Artiodactyla									
Suiformes	<i>Hippopotamus amphibius</i>	26	-13.8	1.6	91	8			95
	<i>Phacochoerus africanus</i>	62	-14.2	1.2	91	7			95
Ruminantia									
Giraffidae	<i>Giraffa camelopardalis</i>	177	-26.4						
Bovidae	<i>Syncerus caffer</i>	319	-14.7						
	Tragelaphini	<i>Taurotragus oryx</i>	5	-26.6					
	<i>Tragelaphus strepsiceros</i>	145	-26.4	0.8	7	6	4	4	15
	<i>T. angasii</i>	102	-24.2	3.7	23	26	33		20
	<i>T. scriptus</i>			1.6	9	12	0	0	10
Alcelaphini	<i>Connochaetes taurinus</i>	1		1.1	90	7	90	100	88
	<i>Damaliscus lunatus</i>	3		1.0	94	6	100	100	95
Reduncini	<i>Kobus ellipsiprymnus</i>	3		1.2	90	7	100	92	84
Hippotragini	<i>Hippotragus equinus</i>	86	-13.5	1.1	96	7	91	100	85
	<i>H. niger</i>	122	-13.0	0.8	98	4	100	94	85
Aepycerotini	<i>Aepyceros melampus</i>	606	-18.8	2.9	60	21	51	52	45
Neotragini	<i>Raphicerus campestris</i>	26	-26.4	2.1	7	14	10	18	34
Cephalophini	<i>Sylvicapra grimmia</i>	14	-25.1	2.9	15	21	2	0	12

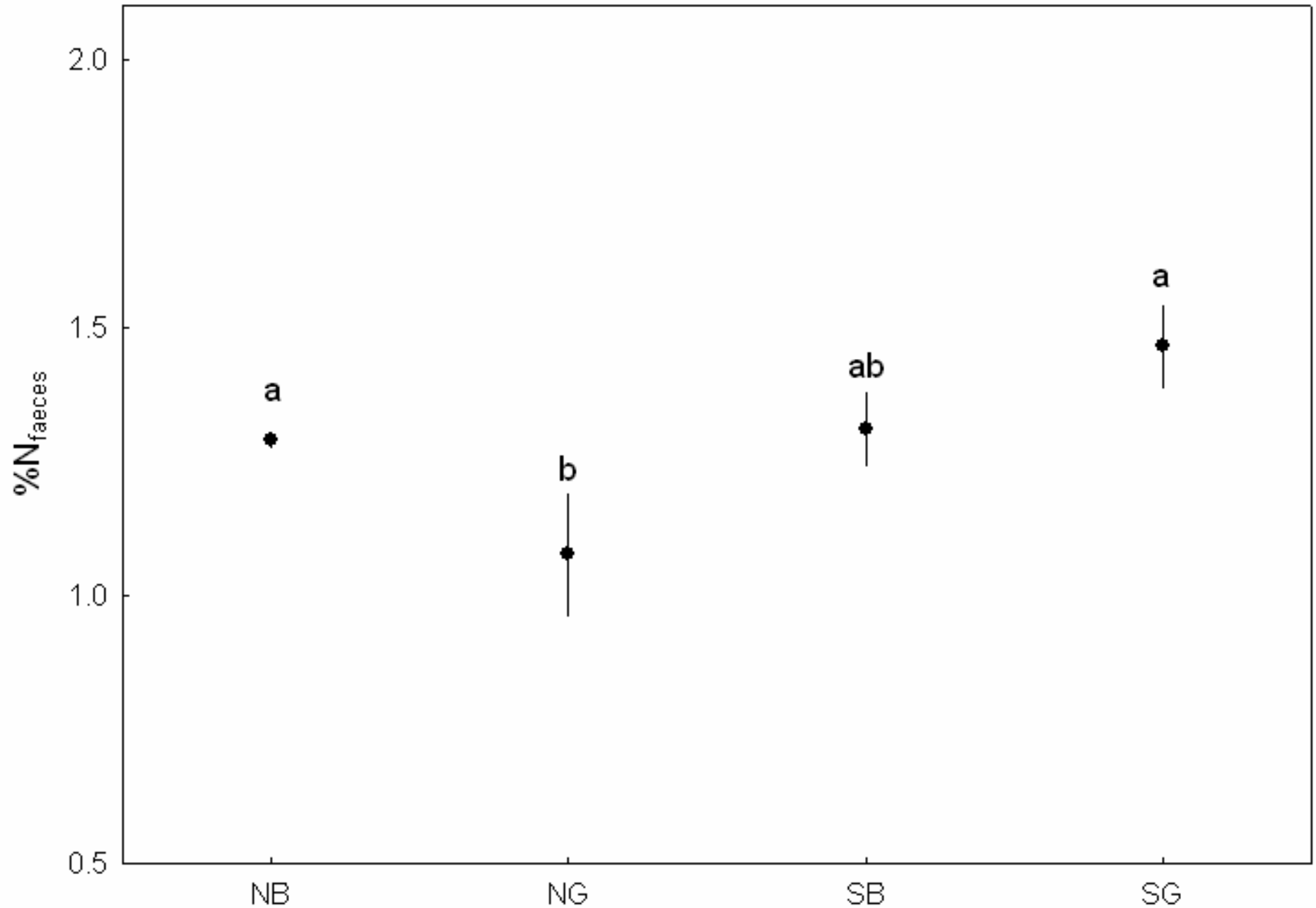
Southern Africa: 91%

East Africa: 100%

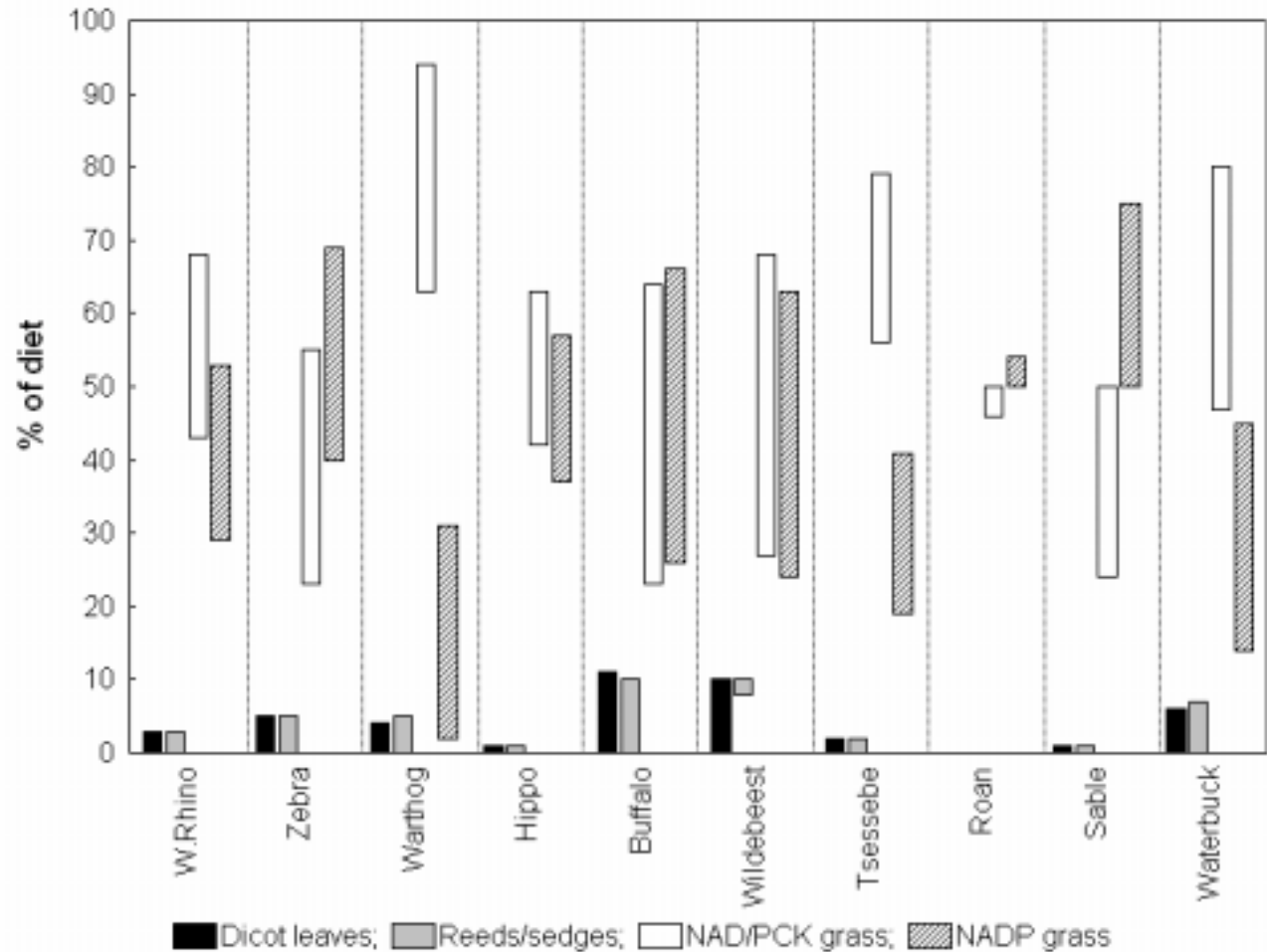
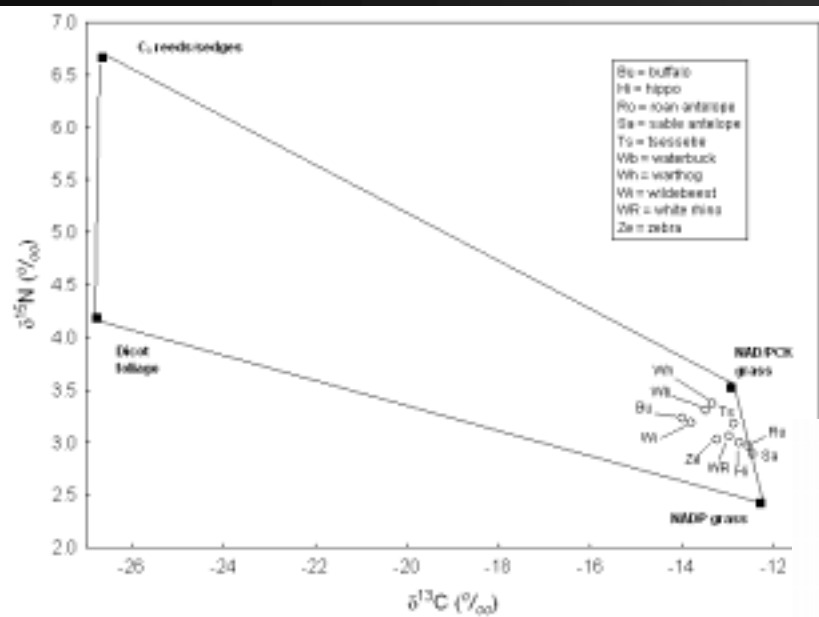
KNP: 96%

Nutritional Stress?

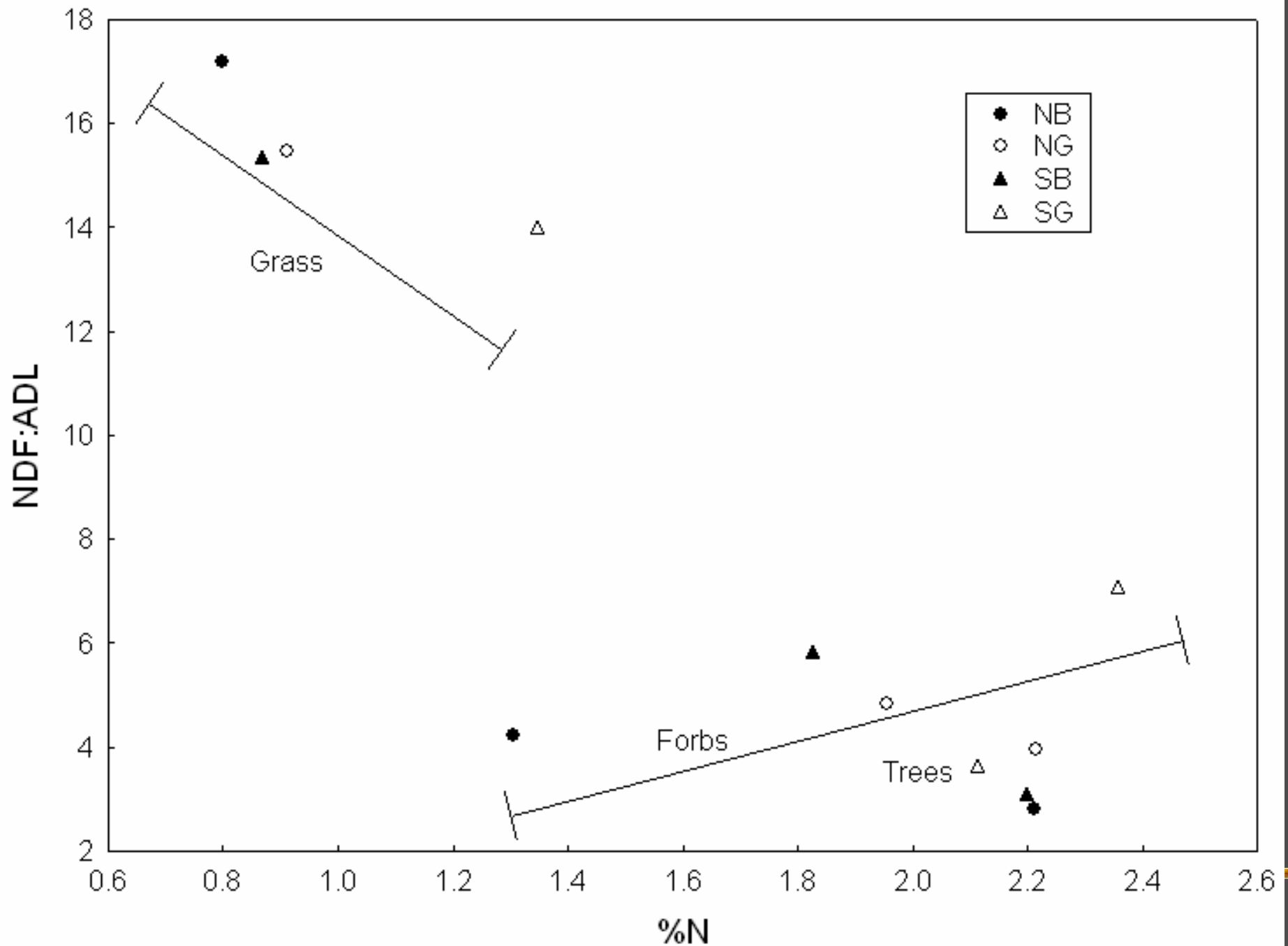
GR: Zebra, Buffalo, Wildebeest



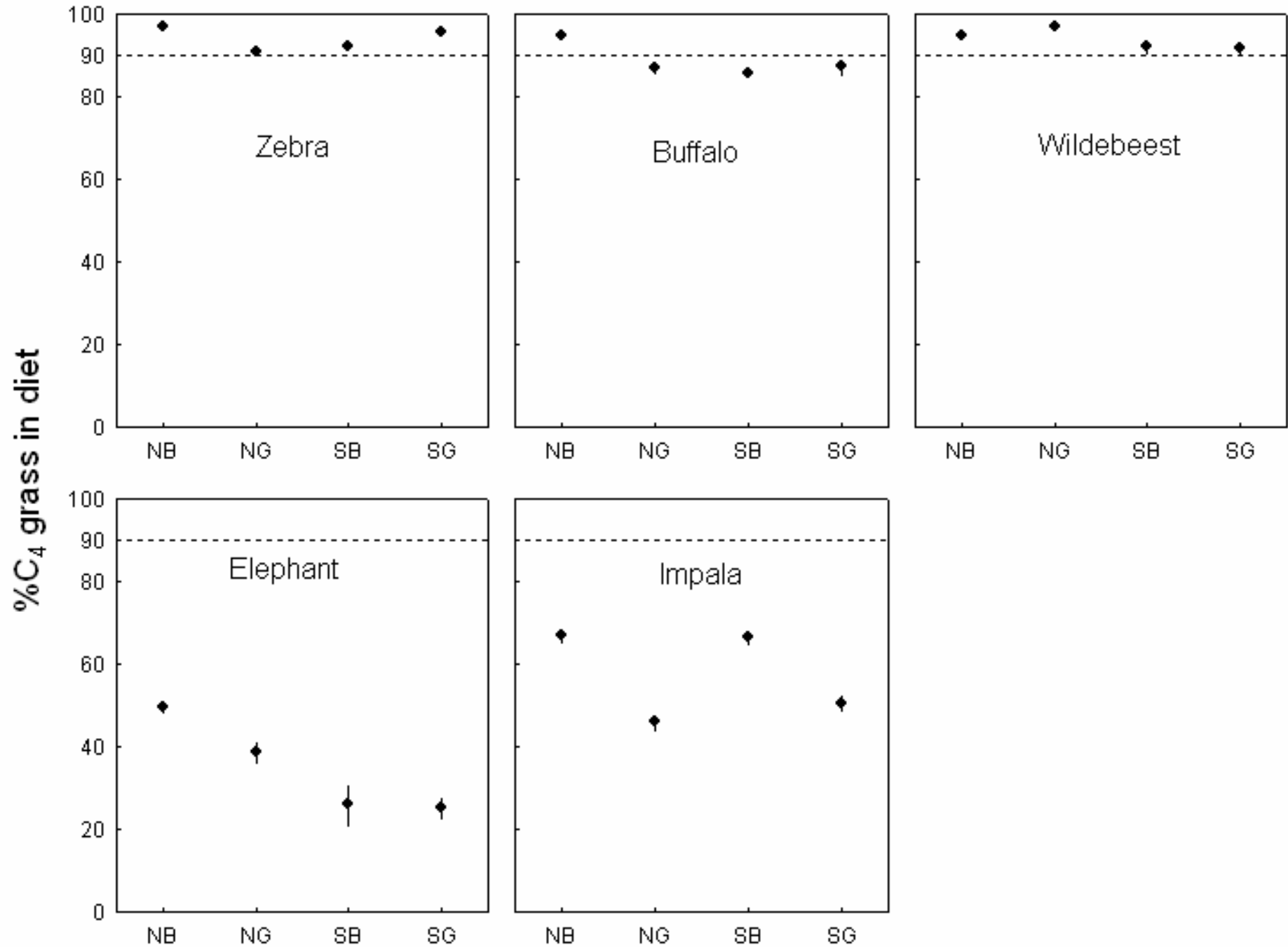
Nutritional Stress?



Sympatric Herbivores?



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Sympatric Herbivores?

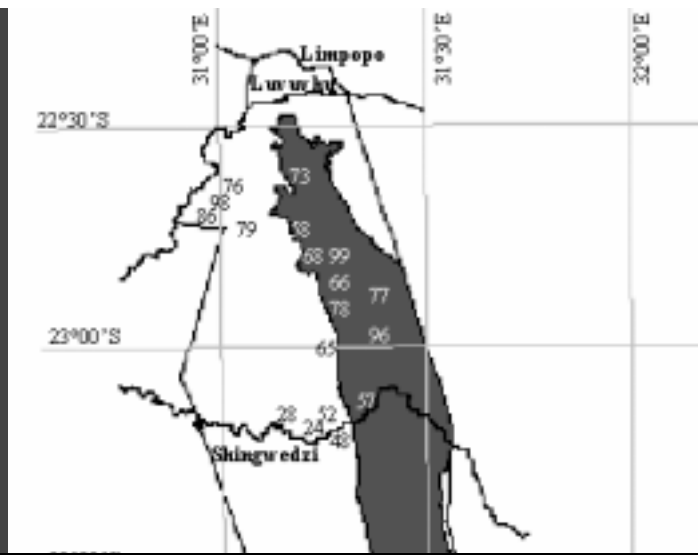
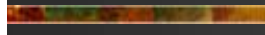
Group	Season	%C4 grass in diet				%N of faeces			
		NB	NG	SB	SG	NB	NG	SB	SG
Grazers	Dry	97	88	90	91	1.3	1.4	1.2	1.4
	Wet	95	90	87	96	1.4	0.9	1.8	1.7
Elephants	Dry	48	33	11	10	1.5	1.2	1.3	1.2
	Wet	52	44	56	50	1.7	1.3	2.0	2.0
Impala	Dry	57	38	62	42	1.9	2.1	1.8	2.0
	Wet	78	53	73	62	1.9	2.0	2.0	2.3



$P < 0.05$

Waterholes?

Habitat type	$\delta^{13}\text{C}$ (‰)			%C4 in diet
	<i>n</i>	Mean	S.E.	
Grassland-dependant (Gr)				
Grassland	260	-18.1	0.2	69
Closed / wooded	465	-19.2	0.1	63
Geology-dependant (Ge)				
Basalt	265	-18.0	0.2	69
Granite / sandveld	460	-19.2	0.1	63
Mopane-dependant (M)				
Mopane present	502	-18.6	0.1	67
Mopane absent	223	-19.2	0.2	61
River-dependant (R)				
Riparian vegetation	126	-21.3	0.2	47
Non-riparian vegetation	599	-18.3	0.1	69
Waterhole-dependant (W)				
Waterhole at sample site	226	-17.6	0.1	74
No waterhole at site	499	-19.3	0.1	61



Model ID	<i>K</i>	ΔAIC	w_i	Weighted averages					
				Parameter	$\sum w_i$	S.E.	-95% conf.	+95% conf.	
Gr Ge M R W - dependant	6	3.37	0.04	Gr	0.33	0.0215	-0.0481	0.0364	
Gr Ge R W - dependant	5	2.45	0.06	Ge	0.37	0.0219	-0.0511	0.0347	
Gr R W - dependant	4	1.00	0.13	M	0.42	0.0137	-0.0411	0.0127	
Gr M R W - dependant	5	1.48	0.10	R	1.00	0.0205	0.1350	0.2153	
Ge M R W - dependant	5	1.42	0.10	W	1.00	0.0137	-0.0735	-0.0200	
Ge R W - dependant	4	0.45	0.17						
M R W - dependant	4	0.35	0.18						
R W - dependant	3	0.00	0.21						
Dry season only									
Gr Ge M R W - dependant	6	2.00	0.08	Gr	0.40	0.0338	-0.0065	0.1260	
Gr Ge R W - dependant	5	1.27	0.11	Ge	0.35	0.0340	-0.1147	0.0186	
Gr R W - dependant	4	1.51	0.10	M	0.49	0.0202	-0.0622	0.0171	
Gr M R W - dependant	5	1.27	0.11	R	1.00	0.0303	0.1146	0.2334	
Ge M R W - dependant	5	1.95	0.08	W	1.00	0.0203	-0.1297	-0.0500	
Ge R W - dependant	4	2.02	0.08						
M R W - dependant	4	0.00	0.22						
R W - dependant	3	0.02	0.21						

Conclusions

- No browsing; Low N_{faeces}
 - Roan likely well-adapted to low quality diets
 - Grazing favoured more on NB than other regions – also in IM
 - Persists across seasons – limited variability
 - Increased grazing mainly due to waterholes
 - Poor and homogenous browse
 - These changes could well lead to more competition, and helped marginalize roan
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