Disentangling the roles of bottom-up and top-down drivers in the trade-off between food acquisition and safety in prey with multiple predators

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Appendix 1

We tested for differences of biomass and proportions of green tissues and bare soil between enriched and control plots, cut and uncut strips controlling for season and year.

In the uncut strips, biomass was on average higher in enriched plots compared to control plots in 2009: February ($\beta_{enriched} \pm SE = 0.070 \pm 0.030$, P = 0.019), March ($\beta_{enriched} \pm SE = 0.059 \pm 0.039$, P = 0.127) and May ($\beta_{enriched} \pm SE = 0.079 \pm 0.042$, P = 0.060) 2009; March ($\beta_{enriched} \pm SE = 0.140 \pm 0.033$, P < 0.001) and July ($\beta_{enriched} \pm SE = 0.098 \pm 0.057$, P = 0.048) 2010 (Fig 3). In the cut strips, biomass did not differ between enriched and control plots in February (P = 0.156), March (P = 0.674), May (P = 0.940) 2009 and in March (P = 0.237) and July (P = 0.280) 2010 (Fig S1).

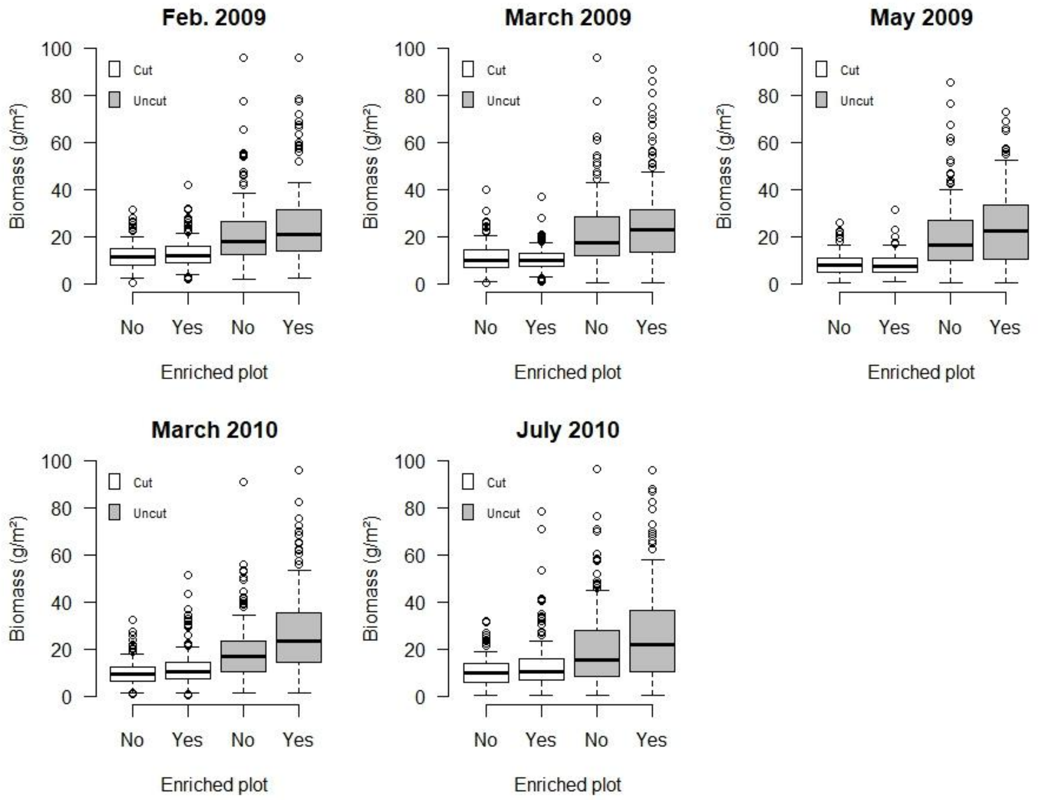

Fig. S1. Variation of grass biomass between enriched and control plots, cut and uncut strips over the 2 years of the experiment.

In the cut and uncut strips in 2009, the proportion of green tissues was higher in enriched plots compared to control plots in April ($\beta_{enriched\ in\ cut} \pm SE = 0.078 \pm 0.036$, P = 0.032, $\beta_{enriched\ in\ uncut} \pm SE = 0.131 \pm 0.041$; P = 0.002) as well as in July 2010 ($\beta_{enriched\ in\ cut} \pm SE = 0.032 \pm 0.014$, P = 0.019) while we did not detect any difference in green tissues among the uncut strips ($P = 0.456$) (Fig S2). The proportion of green tissues was higher in April 2009 compared to July 2010 ($\beta_{April} \pm SE = 0.188 \pm 0.011$, $P < 0.001$) and in cut compared to uncut strips ($\beta_{Cut} \pm SE = 0.025 \pm 0.009$, $P = 0.009$) (Fig S2).

In cut and uncut strips, the proportion of bare soil was less in enriched plots compared to control plots in April 2009 ($\beta_{enriched\ in\ cut} \pm SE = -0.116 \pm 0.039$, $P = 0.003$, $\beta_{enriched\ in\ uncut} \pm SE = -0.123 \pm 0.048$, $P = 0.012$) as well as in July 2010 ($\beta_{enriched\ in\ cut} \pm SE = -0.178 \pm 0.028$, $P < 0.001$; $\beta_{enriched\ in\ uncut} \pm SE = -0.187 \pm 0.028$, $P < 0.001$) (Fig S2). We did not detect any difference in the proportion of bare soil between April 2009 and July 2010 ($P = 0.793$) while the proportion of bare soil was higher in the cut compared to uncut strips ($\beta \pm SE = 0.069 \pm 0.018$, $P < 0.001$) (Fig S2).

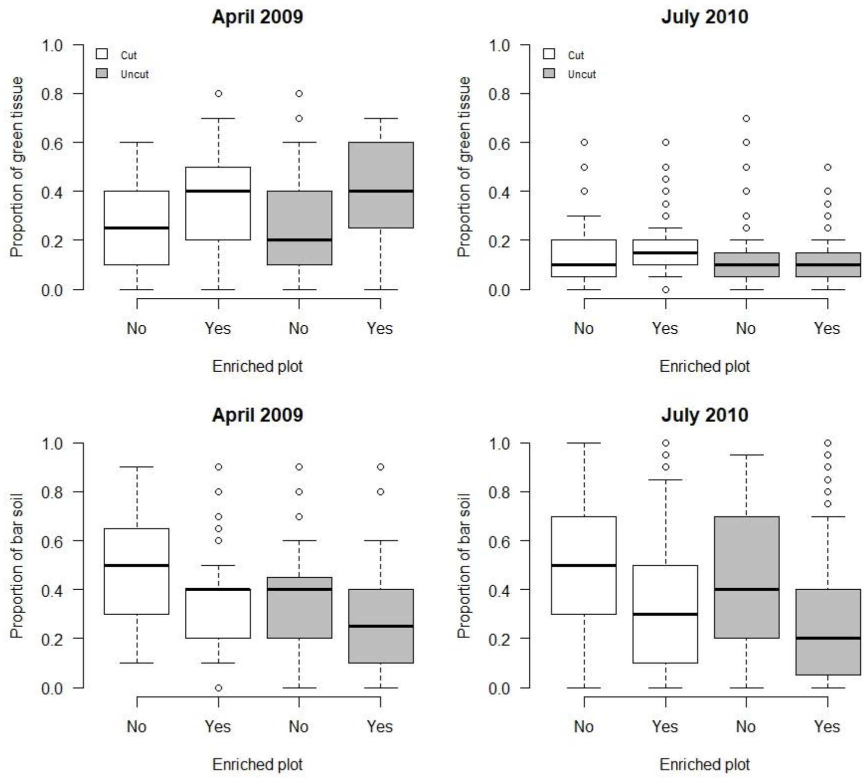

Fig. S2. Variation of the proportion of green tissues and bare soil between enriched and control plots, cut and uncut strips over the 2 years of the experiment.

Appendix 2

Lions are known to live in a fusion-fission society but the frequency of pride fission increases with increase in pride size (Mbizah et al. 2019. Applying the resource dispersion hypothesis to a fission-fusion society: a case study of the African lion (Panthera leo) Ecology and Evolution 9: 9111-9119). In the Main Camp area, where the study site is located, prides are rather small and composed of up to 4 female adults and previous work has revealed that lionesses from the same pride stay together most of the time, with females from a pride sighted together in 89.2% of sightings (Valeix et al. 2009. article in Ecology cited in the manuscript). Therefore, for lions, we can be rather confident that the movements of the collared individuals are quite representative of the movements of almost all lions around the study site (only dispersing individuals were missed).

Regarding wild dogs, members from a pack always stay together except during the denning period when some individuals become helpers at the den. So overall, the individuals that have been GPS collared per pack were representative of the movements of all individuals in their pack around the study site.

Regarding spotted hyaenas, because clans are characterized by a very high level of fission-fusion, we have to acknowledge that the movements of the collared individuals cannot be considered representative of the members of the monitored clans. Hence, the results about hyaenas must be interpreted with caution, as it is very likely that the movements of uncollared individuals were missed. However, we believe that the effect of undetected hyaenas should mainly reduce our capacity to detect differences.

Appendix 3

Post-hoc Tukey tests on the effect of grass height on bite rate (bites per minute), step rate (steps per minute) and number of bites per step (Log-transformed) over the 2-year period [(a)] and when comparing focals when equipped predators were present with the days before their arrival [(b)].

Contrast	Bite rate [a]			Bite rate [b]			Log(Step rate) [a]			Log(Bite per step) [a]		
	β	SE	P	β	SE	P	β	SE	P	B	SE	P
High - Medium	1.461	0.789	0.065	1.389	1.340	0.301	0.104	0.032	**0.001**	-0.117	0.037	**0.002**
High - Short uncut	4.060	1.409	**0.005**	5.507	2.469	**0.026**	0.195	0.054	**<0.001**	-0.116	0.062	0.060
High - Short cut	3.073	1.327	**0.021**	9.471	2.278	**<0.001**	0.186	0.053	**<0.001**	-0.147	0.058	**0.013**
Medium - Short uncut	2.606	1.363	0.056	4.117	2.318	0.077	0.091	0.053	0.085	0.001	0.060	0.992
Medium - Short cut	4.642	1.037	**<0.001**	8.082	2.113	**<0.001**	0.082	0.054	0.126	-0.029	0.060	0.615
Short uncut- Short cut	2.036	1.555	0.191	3.964	2.961	0.182	-0.009	0.071	0.899	-0.030	0.079	0.703

Appendix 4

Fig. S3. Diagnostic plots on the structure of residuals from the linear mixed-effects model investigating the plot enrichment, predator within 2 km, grass height and their two-was interactions and including year, season and plot ID (a-c) or predator event ID (d-f) as three nested random factors on bite rate in the impalas over the 2-year experiment (a-c) and contrasting focals sampled during days with predators and focals on the days before predators' arrivals (d-f). An autocorrelation function of order 1 ("corAR1") was also considered in models to control for the sequential structure of the data set (see Methods). The residuals against fitted values in (a) and (d) show that the variance remains approximately constant as the fitted values increased. (b) and (e) show that the distribution of residuals was consistent with normality. (c) and (f) show the autocorrelation function (ACF) estimated on residuals. The horizontal dotted lines provide an approximate 95% confidence interval for the autocorrelation estimate at each lag and reveal that sequential correlation was controlled.