COUNTER-STRATEGIES TO INFANTICIDE: THE IMPORTANCE OF CUBS IN DETERMINING LION HABITAT SELECTION AND SOCIAL INTERACTIONS

Appendix 1. Results with six-month-old cubs

Table S1.1. Coefficients (β) and standard errors (SE) for selection ratio model of lioness habitat selection for distance to water (WATER), open habitats (OPEN), and distance to the home range centroid (HR) accounting for the presence/absence of cubs within the pride (CUB ; without cub = 0, with cub = 1). Main effects estimate selection strength by females without cubs, and interaction terms estimate the additional effect on selection strength from having cubs in a pride. All continuous variables were scaled to compare their strength of selection.

Model – cubs < 6 months	β	SE	z-value	p-value
Intercept	-2,40	0,08	-29,33	<0.001
WATER	-0,21	0,01	-31,06	<0.001
OPEN	0,41	0,01	70,01	<0.001
HR	-0,29	0,01	-43,95	<0.001
CUB	-0,08	0,01	-7,97	<0.001
WATER x CUB	0,07	0,01	7,04	<0.001
OPEN x CUB	-0,01	0,01	-1,41	0.16
HR x CUB	-0,31	0,01	-31,19	<0.001

Table S1.2 Coefficients (β) and standard errors (SE) for selection ratio models of pride male habitat selection for distance to water (WATER), open habitats (OPEN), and distance to the home range centroid (HR) accounting for the presence/absence of cubs within the pride (CUB ; without cub = 0, with cub = 1) and for the presence/absence of females in proximity (FEM ; without female = 0, with female = 1). Main effects estimate selection strength by pride males without cubs but with females in proximity, and interaction terms estimate the additional effect on selection strength from having cubs in a pride. All continuous variables were scaled to compare their strength of selection.

Model – cubs < 6 months	β	SE	z-value	p-value
(Intercept)	-2,73	0,17	-15,58	<0.001
WATER	-0,51	0,04	-13,17	<0.001
OPEN	0,52	0,03	18,26	<0.001
HR	-0,69	0,04	-16,87	<0.001
(FEM & CUB)	-0,58	0,06	-9,30	<0.001
(no FEM & no CUB)	0,11	0,04	2,85	<0.01
(no FEM & CUB)	0,10	0,04	2,42	<0.05
WATER x (FEM & CUB)	-0,27	0,06	-4,43	<0.001
WATER x (no FEM & no CUB)	0,28	0,04	6,51	<0.001
WATER x (no FEM & CUB)	-0,05	0,04	-1,01	0.31
OPEN x (FEM & CUB)	-0,12	0,04	-2,86	<0.01
OPEN x (no FEM & no CUB)	0,16	0,03	4,78	<0.001
OPEN x (no FEM & CUB)	0,00	0,03	0,12	0.90
HR x (FEM & CUB)	-0,62	0,07	-9,33	<0.001
HR x (no FEM & no CUB)	0,24	0,05	5,33	<0.001
HR x (no FEM & CUB)	0,34	0,05	7,45	<0.001

Table S1.3. Coefficients (β) and standard errors (SE) for the GLMMs testing the influence of the mean habitat openness (OPEN) and the presence of cubs (CUB) on (a) the percentage of time pride males spent in proximity with pride females, (b) the frequencies and (c) the duration of male-female proximity events.

Model – cubs < 6 months	**β**	**SE**	**z-value**	**p-value**
(a) Percentage of time spent in proximity – logistic regression				
(Intercept)	-0,71	0,16	-4,48	<0.001
CUB	-0,06	0,02	-3,07	<0.01
OPEN	0,57	0,15	3,86	<0.001
CUB x OPEN	-0,03	0,02	-1,51	0.13
(b) Frequency of proximity events – Poisson regression				
(Intercept)	2,51	0,10	25,46	<0.001
CUB	0,19	0,10	1,91	0.056
OPEN	0,21	0,10	2,18	<0.05
CUB x OPEN	-0,05	0,10	-0,52	0.60
(c) Duration of proximity events – negative binomial regression				
(Intercept)	2,94	0,06	50,07	<0.001
CUB	-0,12	0,05	-2,32	<0.05
OPEN	0,10	0,05	1,91	0,056
CUB x OPEN	-0,03	0,05	-0,62	0.54

Table S1.4. Frequency of pride male-competitor male proximity events according to the presence of cubs within the pride (CUB) and the overlap of the utilization distributions of pride and competitor males (UD overlap). We run a log-linear regression adding a random intercept with dyad identity.

Model – cubs < 6 months	**β**	**SE**	**z-value**	**p-value**
Intercept	-3,65	0,56	-6,56	<0.001
CUB	0,11	0,70	0,15	0.88
UD overlap	8,89	1,83	4,86	<0.001
CUB x UD overlap	0,19	2,45	0,08	0.94

Table S1.5. Spatial characteristics of proximity events between pride males and competitor males. Likelihood for pride males to use locations (a) outside of their core home range, (b) close to waterholes (<1km), and (c) within open areas, estimated using three logistic regressions adding a random intercept with dyad identity, according to the presence of cubs within the pride (CUB) and the presence of competitor males close (i.e. <1km) to the pride males (COMPETITOR).

Model – cubs < 6 months	**β**	**SE**	**z-value**	**p-value**
a) Likelihood for pride males to use locations outside of their core home range				
Intercept	0,05	0,06	0,73	0.47
CUB	-0,54	0,01	-41,10	<0.001
COMPETITOR	0,17	0,14	1,24	0.22
CUB x COMPETITOR	1,30	0,20	6,35	<0.001
b) Likelihood for pride males to use locations close to waterholes (<1km)				
Intercept	-1,50	0,10	-14,59	<0.001
CUB	0,45	0,02	30.0	<0.001
COMPETITOR	0.68	0,16	4.26	<0.001
CUB x COMPETITOR	-1.11	0,22	-5.0	<0.001
c) Likelihood for pride males to use open habitats				
Intercept	-0,51	0,28	-1,86	0.06
CUB	0,35	0,02	23,05	<0.001
COMPETITOR	0,03	0,18	0,14	0.89

CUB x COMPETITOR	-0,41	0,23	-1,74	0.08

Table S1.6. Outcome characteristics of proximity events between pride males and competitor males. (a) Likelihood for pride males to initiate the proximity events with competitor males, estimated using a logistic regression to the binary response variable ("initiated" or " did not initiate"), (b) Logarithm of the competitor displacement to the proximity-event site with pride males, estimated using a log-linear regression model, according to the presence of cubs in the pride (CUB), the difference of age between the pride males and their competitors (AGE) and the time following the proximity event (HOUR).

Model – cubs < 6 months	**β**	**SE**	**z-value**	**p-value**
a) Likelihood for pride males to initiate the proximity event with competitor males				
Intercept	0,36	0,28	1,29	0.20
CUB	0,50	0,31	1,59	0.11
AGE	0,01	0,21	0,03	0.98
b) Logarithm of the competitor displacement to the proximity event site with pride males				
Intercept	6,92	0,15	45,43	<0.001
Log(HOUR)	0,19	0,03	6,49	<0.001
CUB	0,26	0,09	2,84	<0.01
AGE	-0,39	0,15	-2,64	<0.01