Water availability drives human-baboon encounters:
Identifying the patterns, drivers, and consequences of human encounters for savannah baboons

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As human-nonhuman primate interactions increase globally, we use 27 years of data on human-baboon encounters in the Amboseli ecosystem from 1993-2020:

OBJECTIVE 1
(i) to identify spatial, environmental, and group-level predictors of human-baboon encounters

Baboons encounter humans more often during times of low rainfall and when in close proximity to waterholes.

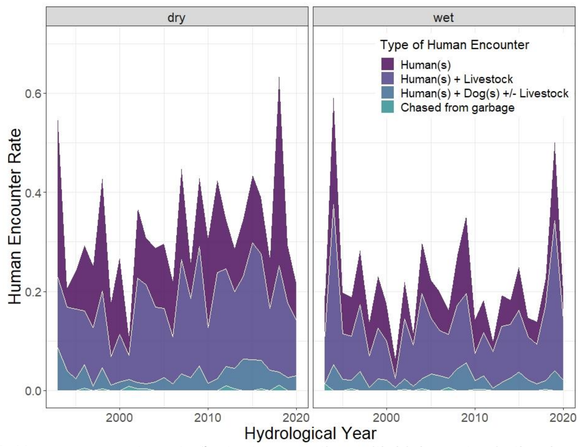

Figure 1. Human encounter rate fluctuates over time with higher rates in the dry season. This plot shows the daily rate of human-baboon encounters across all groups in each hydrological year, colored by the type of human encounter. Daily rates were calculated as the number of observed human encounters in a given hydrological year divided by the number of group-days in that year; group-days are all the unique dates each study group was censused.

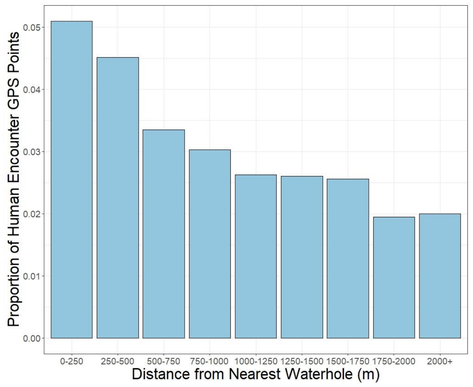

Figure 2. Baboon social groups experience more human encounters when they are in close proximity to waterholes (b=-0.266, p=1.64x10^{-32}).This plot shows the relationship between the proportion of GPS points that are associated in time with a human encounter and the GPS point's distance (m) in 250 m intervals from the nearest waterhole.

OBJECTIVE 2
(ii) to test whether human-provided sources of water affect baboon ranging patterns

Baboons alter their ranging patterns based on the activity of human-constructed waterholes.

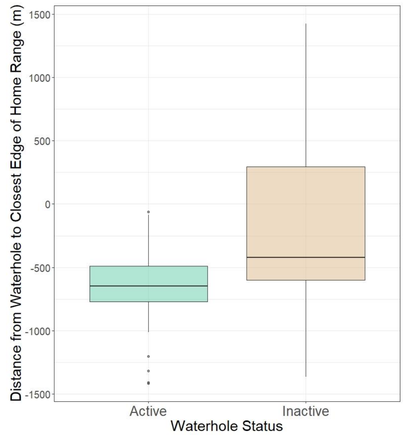

Figure 3. This plot shows the difference in the distance from the human-constructed waterhole to the closest edge of a baboon group's 95% kernel density home range for active and inactive waterholes. The distance from the waterhole to the closest edge of the home range is greater for inactive waterholes (b=448.29, p=1.11x10^{-5}).

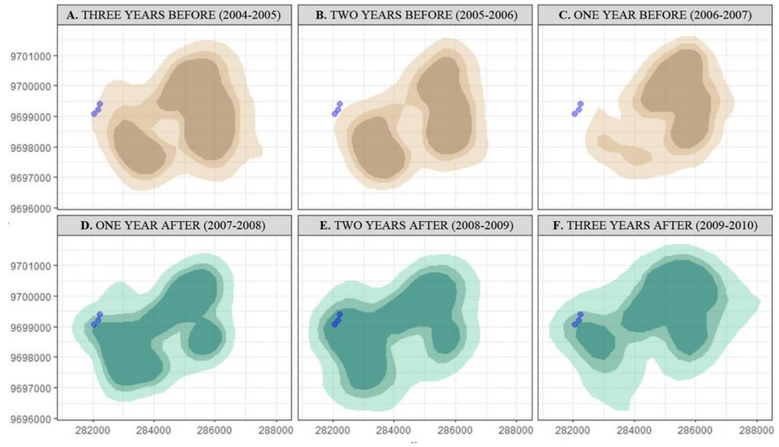

Figure 4. This plot shows an example for Nyayo's group, which shifted their home range to include a cluster of three human-constructed waterholes built in 2007. This plot shows the 95%, 80%, and 65% kernel density home ranges of Nyayo's group in the three years before (top row; brown ranges) and three years after (bottom row, green ranges) the waterhole cluster became active.

OBJECTIVE 3
(iii) to test the reproductive and health consequences for baboons experiencing human encounters

Human encounters are linked to increased parasite richness in females and decreased offspring survival.

PARASITE RICHNESS IN FEMALE BABOONS							
	Complete model (n=908)			Best model by AIC (n=908)			
Random	Variance	SD	N	Variance	SD	N	
Individual ID	0.105	0.325	147	0.102	0.319	147	
Who Counted	0.207	0.455	30	0.193	0.440	30	
Group	0.050	0.224	13	0.027	0.163	13	
Variable	Estimate	SE	P	Estimate	SE	P	Interpretation
SCI-F	-0.079	0.037	**0.035**				
SCI-M	-0.015	0.038	0.689				
Age	0.112	0.044	**0.012**				
Rank	-0.005	0.008	0.584				
Top ranking female	-0.243	0.171	0.157				
Season	0.262	0.120	**0.029**				
Rainfall	0.274	0.254	0.293				
Temperature	-0.169	0.254	0.516	-0.113	0.037	**0.002**	↓ Temperature, ↑ Richness
Group size	0.079	0.082	0.338				
Group size squared	0.182	0.088	**0.039**				
State (L)	-0.197	0.062	**0.002**				
State (P)	-0.108	0.042	**0.011**				
Human encounter frequency	0.040	0.040	0.313	0.110	0.037	**0.004**	↑ Human encounter frequency, ↑ Richness

Table 1. The best model for parasite richness in female baboons included human encounter frequency and temperature as significant predictors.

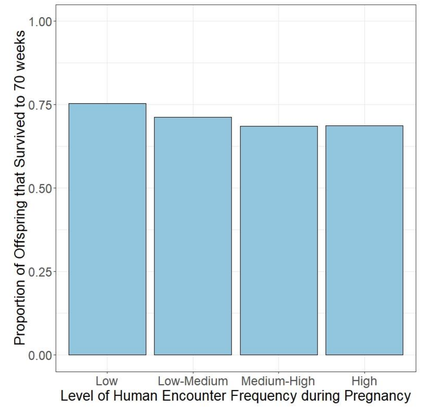

Figure 5. Increased human encounter frequency is linked to lower offspring survival (b=-0.181, p=0.018). This figure shows the relationship between proportion of offspring surviving to 70 weeks and the level of human encounter frequency experienced by the mother during her gestation. Human encounter frequency was divided into four levels, represented by the four quartiles of the human encounter frequency distribution.

CONCLUSIONS

- The primary driver of human-baboon encounters was water availability.
  - During the dry season, pastoralists migrate into baboon habitats, leading to increased encounter rates, especially near human-constructed waterholes.
  - The construction and abandonment of these waterholes significantly altered the baboons' ranging patterns as social groups were more likely to shift their range to encompass an active waterhole.
- Human-baboon encounters were linked to increased parasite richness in female baboons and decreased offspring survival.
- Overall, our results highlight the complexity of human-nonhuman primate relationships, especially for primates that appear to be successful in human-altered environments.

Acknowledgments

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