

Elephant and Rhino Watering Hole Preferences in South Africa

Giulietta Schutte

Original Study

Study:

Insights into artificial waterhole utilization patterns by elephants and rhinos: Lessons from a South African Nature Reserve

Study Size:

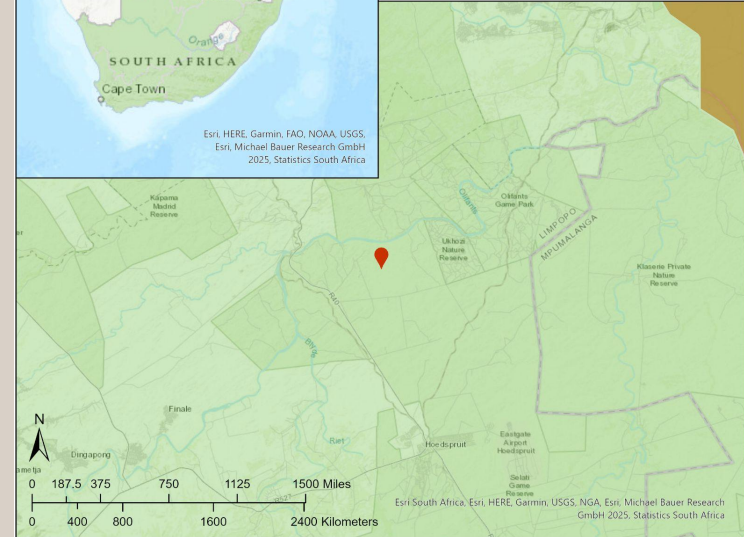
Elephants $n = 770$

Black rhinos $n = 107$

White rhinos $n = 30$



Location of Study Site
Olifants West Nature Reserve (OWNR)



[1],[2],[5]

Variables Tracked

African savanna elephant (*Loxodonta africana*) – Black rhinoceros (*Diceros bicornis*) –
White rhinoceros (*Ceratotherium simum*)

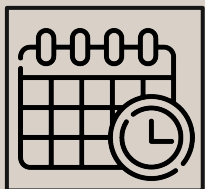
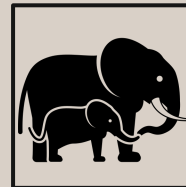


Watering Hole

Type, size, ground access,
surrounding vegetation

Social Type

Group type, presence of
other animals

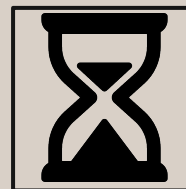


Date, Period, Season

Season –warm/wet or cold/dry
Daily Period – night, morning,
midday, afternoon

Duration of Visit

Hours:Minutes:Seconds



Key Findings

Preferences:

Elephants = reservoirs

Black rhinos = earth dams

White rhinos = troughs*

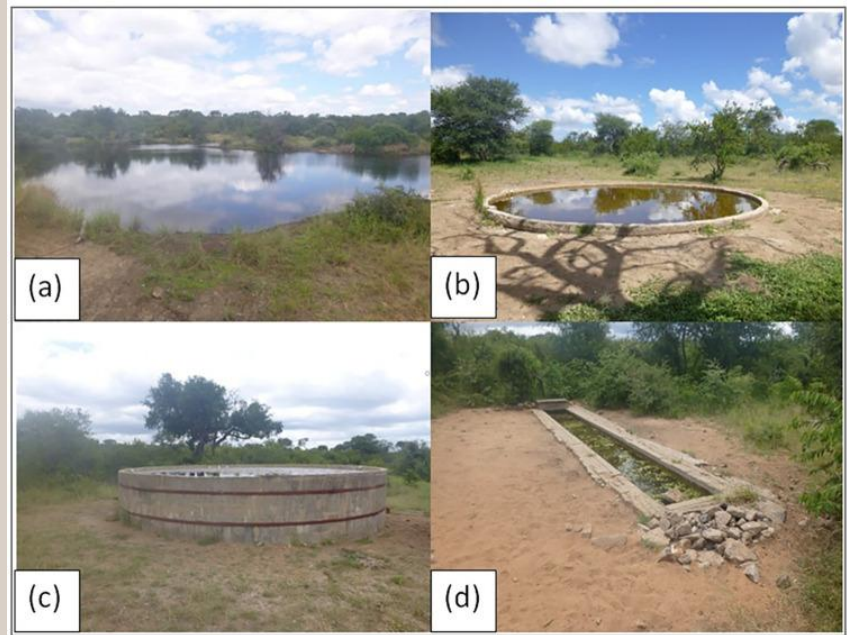
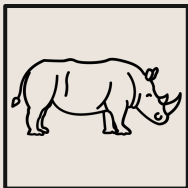


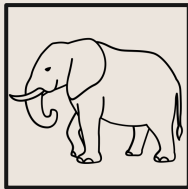
Figure 1: (a) – earth dam, (b) – pan, (c) – reservoir, (d) – trough [5]

Questions



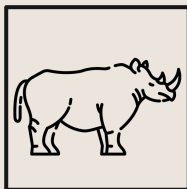
Question 1

Is there a relationship between duration of visit and number of animals at a species' preferred watering hole type?



Question 2

Is there a relationship between duration of visit and season at a species' preferred watering hole type?



Question 3

How do these relationships compare between the three tracked species?

Methodology

1.

Read Study

Familiarize with background information and figure out what questions have already been answered

2.

Data Cleanup/Setup

Clean data in Google sheets, import to RStudio. Reclassify, study variables. Separate by species.

3.

Questions & Models

Set up research question. Find best model for each question

4.

Analyze Results

Run models, visualize results

Models

Variables:

Duration of visit: numeric, continuous

Number of animals: numeric, discrete

Season: character, discrete –

warm season [1], cool season [2]

Model Chosen:

GLM – Gamma (continuous, 0–infinity)

LM returned negative lower bounds, not realistic

Results – Elephants

Statistical Test – African savanna elephant

Model 2 – Duration vs. Number of Animals

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	0.92660	0.23684	3.912	0.000181 ***
NoAnimals	0.20607	0.04653	4.429	2.74e-05 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for Gamma family taken to be 2.080183)

Null deviance: 210.77 on 88 degrees of freedom

Residual deviance: 172.04 on 87 degrees of freedom

AIC: 479.23

Number of Fisher Scoring iterations: 10

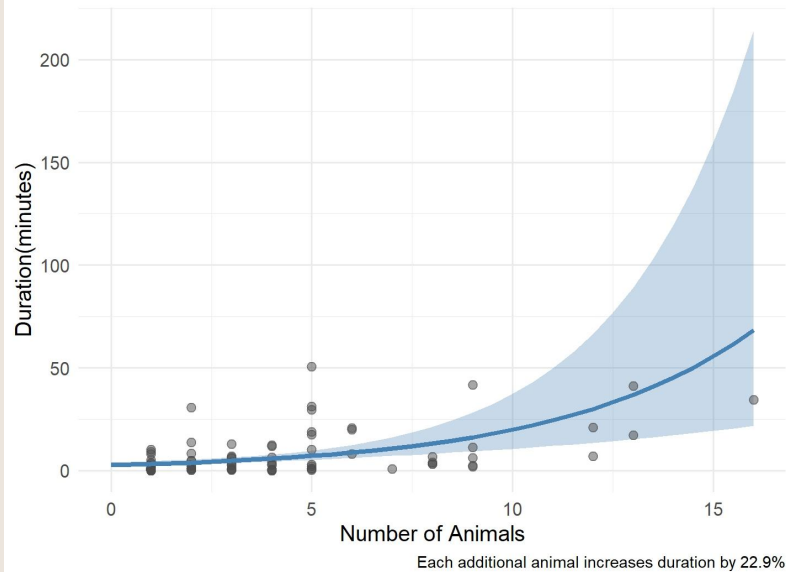
P value = <0.05, 0.01
0.0000274

$e^{(0.20607)} = 1.2288$
 $1 - 1.2288 = 0.2288$
 $0.2288 * 100 = 22.9\%$

Results – Elephants

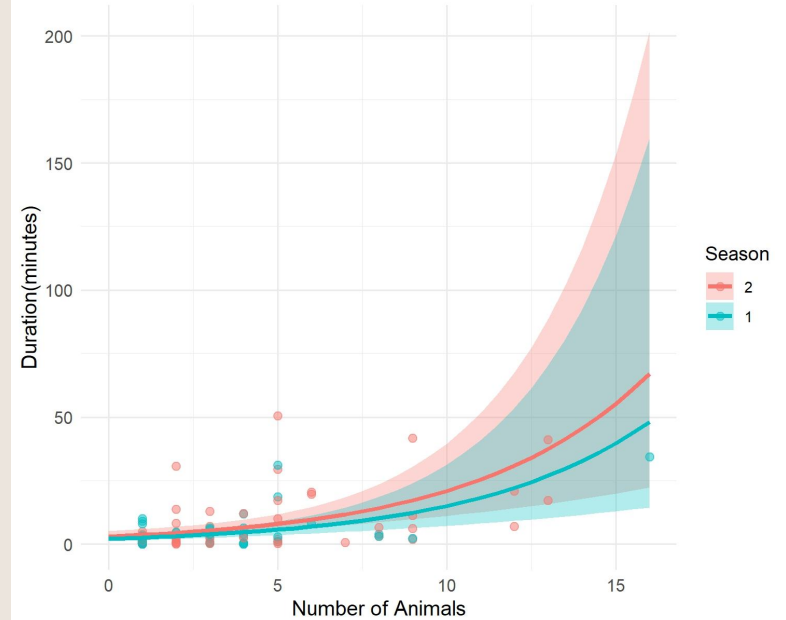
Effects of Number of Animals on Duration of Visit

Gamma GLM with 95% confidence intervals



Effects of Number of Animals on Duration of Visit by Season

Gamma GLM with 95% confidence intervals



References:

- [1] Chenay Simms. Kruger National Park – Basic Locational data. Updated 25.06.2025. Online GIS data. Accessed 08.12.2025. Online linkage: <https://usflibrary.maps.arcgis.com/home/item.html?id=fd56576c675e4e4883805e1fela2dc54>
- [2] Esri. South African Province Boundaries. Updated 31.10.2025. Online GIS data. Accessed 08.12.2025. Online linkage: <https://usflibrary.maps.arcgis.com/home/item.html?id=5b8071a043814d9783b0bb4819462991>
- [3] Garrett Grolemund, Hadley Wickham (2011). Dates and Times Made Easy with lubridate. Journal of Statistical Software, 40(3), 1–25. URL <https://www.jstatsoft.org/v40/i03/>.
- [4] H. Wickham. ggplot2: Elegant Graphics for Data Analysis. Springer-Verlag New York, 2016.
- [5] Smith, E., Brown, L. R., & Barrett, A. S. (2024). Insights into artificial waterhole utilization patterns by elephants and rhinos: Lessons from a South African Nature Reserve. PloS one, 19(10), e0312158. <https://doi.org/10.1371/journal.pone.0312158>
- [6] Wickham H, Bryan J (2025). _readxl: Read Excel Files_. doi:10.32614/CRAN.package.readxl
<<https://doi.org/10.32614/CRAN.package.readxl>>, R package version 1.4.5, <<https://CRAN.R-project.org/package=readxl>>.
- [7] Wickham H, François R, Henry L, Müller K, Vaughan D (2023). _dplyr: A Grammar of Data Manipulation_. doi:10.32614/CRAN.package.dplyr <<https://doi.org/10.32614/CRAN.package.dplyr>>, R package version 1.1.4, <<https://CRAN.R-project.org/package=dplyr>>.

Thank You

Any questions?

Credits: This presentation template was created by [Slidesgo](#), including icons by [Flaticon](#) and infographics & images by [Freepik](#)

Please keep this slide for attribution
