

101

PODDED RHINO

**insights into drivers of
home range size
in white and black
rhinoceros**

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& BEYOND

INTRODUCTION



Home Ranges

Cryptic

“That area traversed by the individual in its normal activities of food gathering, mating, and caring for young” Burt (1943)



Population management

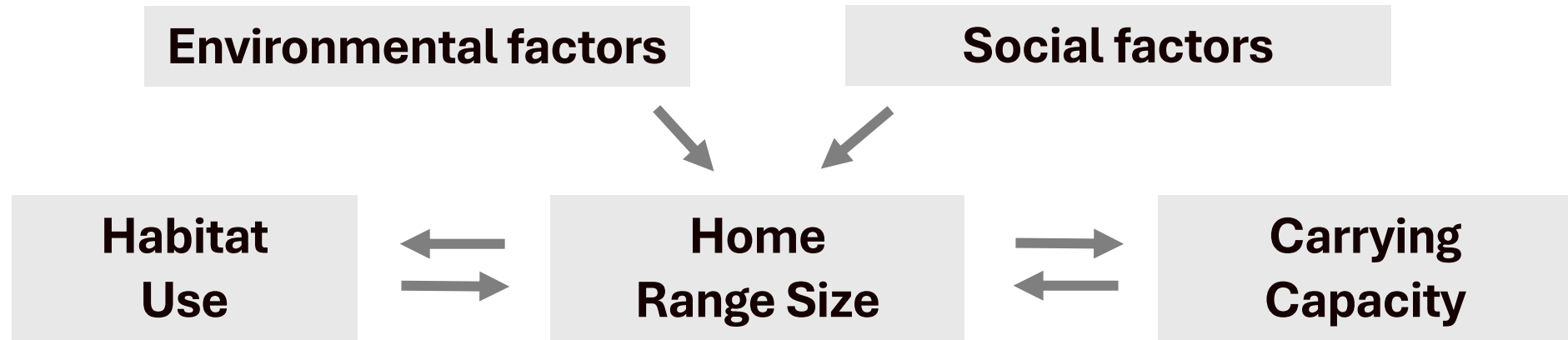


Ecosystem processes

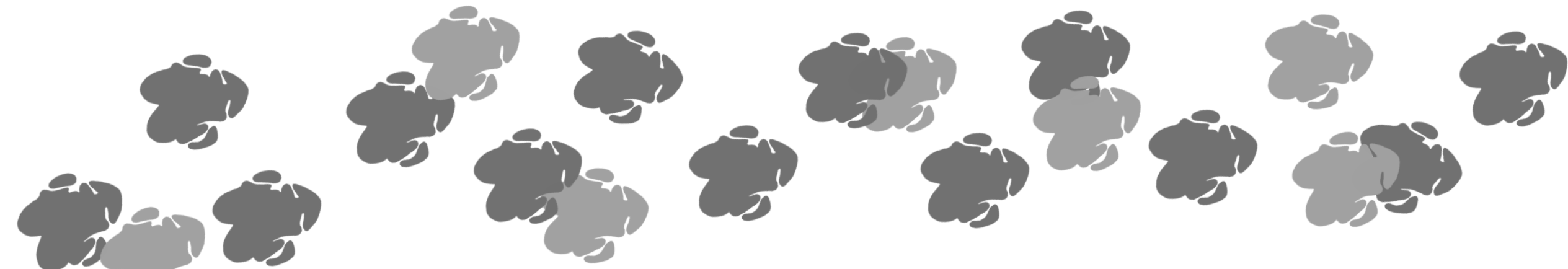


Conservation strategies





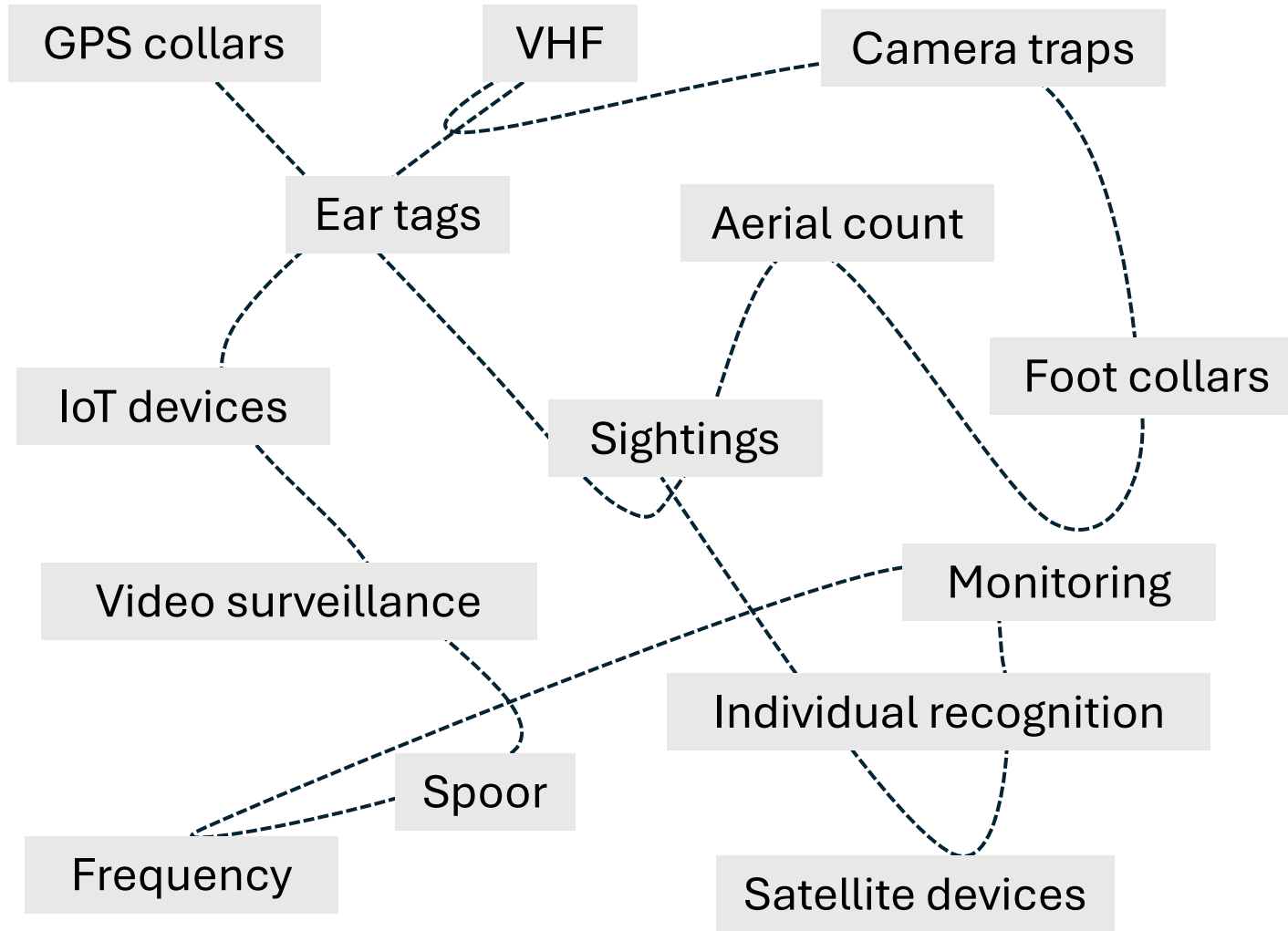
What drives rhino home range size?



HOME RANGE VARIABILITY

WHITE RHINO			BLACK RHINO		
Home Range (km ²)	Density (rhinos/km ²)	Study site / Reference	Home Range (km ²)	Density (rhinos/km ²)	Study site/ Reference
185–492	0.03	<i>Garamba NP, Zaire/DRC</i> <i>Hillman Smith (2014)</i>	12–234	0.02	<i>Etosha NP, Namibia</i> <i>Götttert et al. (2010)</i>
58.6–60.8	0.12–0.18	<i>Timbavati PNR, South Africa</i> <i>Roche (2000)</i>	37–64	0.009	<i>Okavango Delta, Botswana</i> <i>Pfannerstill et al. (2022)</i>
17–49	0.14	<i>Ithala GR, South Africa</i> <i>Hebbelmann (2013)</i>	43.6	0.058	<i>Gonarezhou NP, Zimbabwe</i> <i>Wielgus et al. (2023)</i>
7.2–45.2	0.5–1.4	<i>Kruger NP, South Africa</i> <i>Pienaar et al., (1993)</i>	45	0.02	<i>Kruger NP, South Africa</i> <i>le Roex et al. (2019)</i>
4.7–22.9	0.6–1.8	<i>Ndumu GR, South Africa</i> <i>Conway & Goodman (1989)</i>	8.9–13.6	0.14	<i>Ithala GR, South Africa</i> <i>Duthé et al. (2023)</i>
6.1–20.5	3–5.7	<i>iMfolozi GR, South Africa</i> <i>Owen-Smith (1973)</i>	7.4–8.2	0.12	<i>Sweetwaters RS, Kenya</i> <i>Tatman et al. (2001)</i>
3–20	0.7	<i>Kyle NP, Zimbabwe</i> <i>Condy (1973)</i>	8.7–10.4	0.23	<i>HiP, South Africa</i> <i>Plotz et al. (2016)</i>

TRACKING RHINOS: VARIABLE METHODS



HOME RANGE & METHOD VARIABILITY

WHITE RHINO			BLACK RHINO		
Home Range (km ²)	Method	Study site / Reference	Home Range (km ²)	Method	Study site/ Reference
185–492	?	<i>Garamba NP, Zaire/DRC Hillman Smith (2014)</i>	12–234	Telemetry	<i>Etosha NP, Namibia Götttert et al. (2010)</i>
58.6–60.8	Sightings	<i>Timbavati PNR, South Africa Roche (2000)</i>	37–64	GPS collar	<i>Okavango Delta, Botswana Pfannerstill et al. (2022)</i>
17–49	Sightings	<i>Ithala GR, South Africa Hebbelmann (2013)</i>	43.6	Sightings	<i>Gonarezhou NP, Zimbabwe Wielgus et al. (2023)</i>
7.2–45.2	Aerial count	<i>Kruger NP, South Africa Pienaar et al., (1993)</i>	45	Telemetry	<i>Kruger NP, South Africa le Roex et al. (2019)</i>
4.7–22.9	Sightings	<i>Ndumu GR, South Africa Conway & Goodman (1989)</i>	8.9–13.6	Sightings	<i>Ithala GR, South Africa Duthé et al. (2023)</i>
6.1–20.5	Sightings + Telemetry	<i>iMfolozi GR, South Africa Owen-Smith (1973)</i>	7.4–8.2	Sightings	<i>Sweetwaters RS, Kenya Tatman et al. (2001)</i>
3–20	?	<i>Kyle NP, Zimbabwe Condy (1973)</i>	8.7–10.4	Telemetry	<i>HiP, South Africa Plotz et al. (2016)</i>

POD CONCEPT

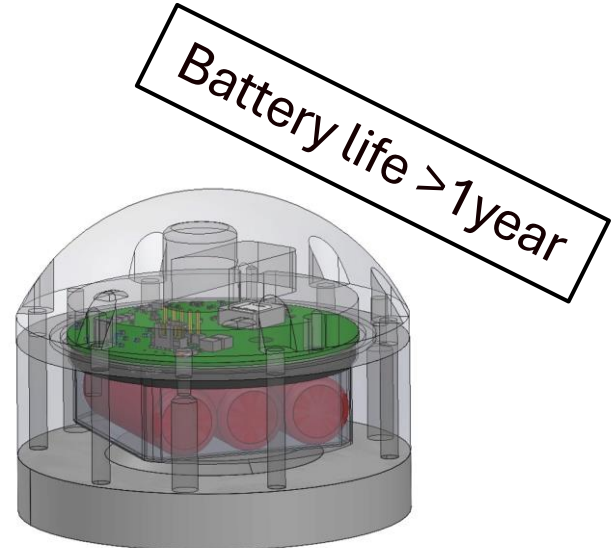
IoT
(LoRa, Sigfox)

Satellite
(Astrocast)

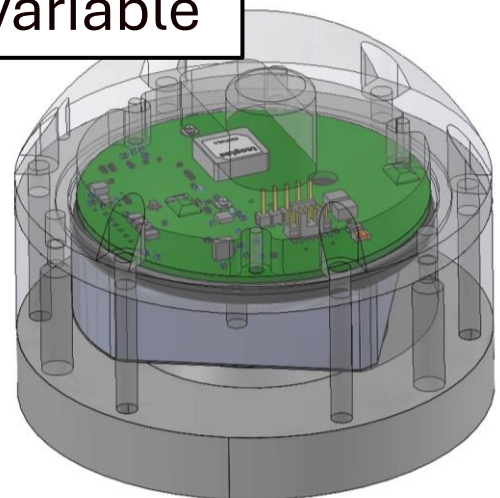
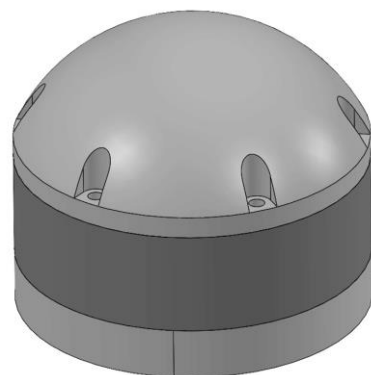
Telemetry
VHF



Horn pod



Fix rate variable



NUMEROUS DEPLOYMENTS

Improving
Monitoring

Research
Questions

Trialling
Effectiveness



Horn pod



Dehorning Operations

Dehorning



Roughening



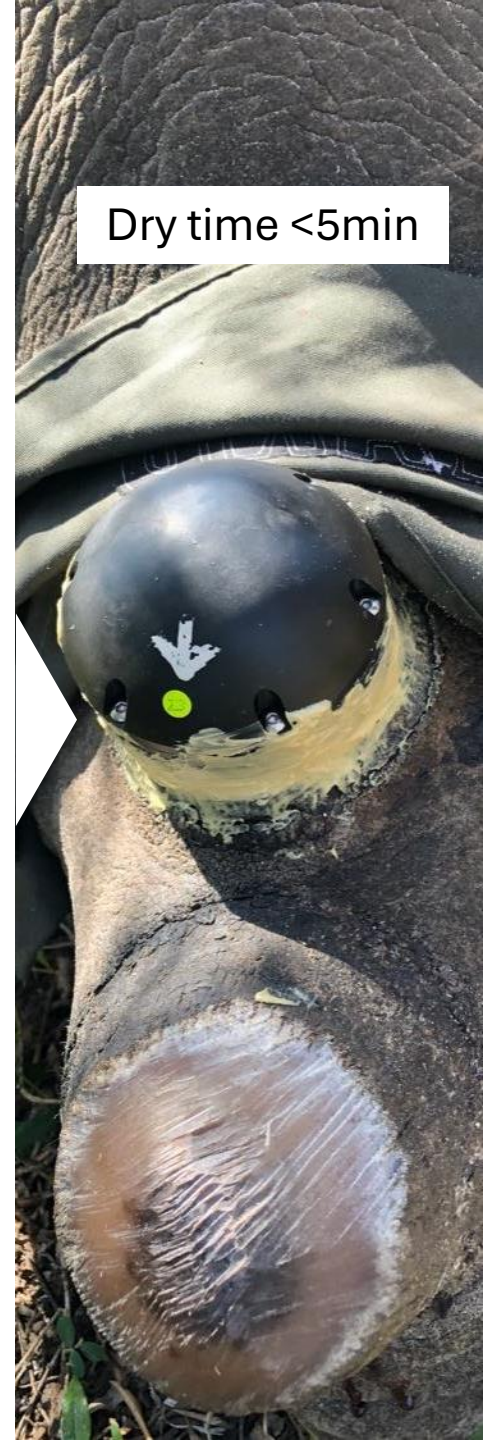
Gluing



Icing



Dry time <5min







STUDY POPULATIONS

Size & Rainfall

Hluhluwe-iMfolozi Park (HiP)	Munywana Conservancy (Phinda)	Ithala Game Reserve	Kruger NP IPZ	Kruger NP JPZ
927 km2	303 km2	291 km2	4126 km2	5095 km2
780 mm	746 mm	738 mm	650 mm	550 mm
WR BR	WR BR	WR BR	WR	WR



DATASET



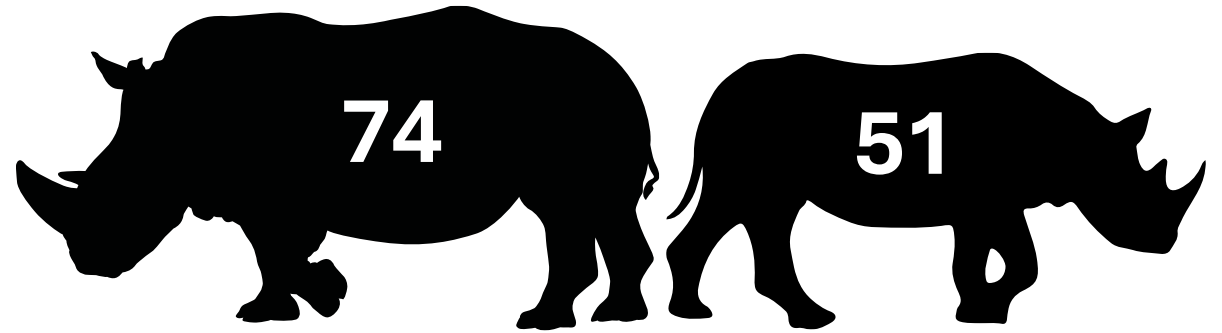
278'884

clean GPS points

Time Frame

Oct 2023 – Feb 2025

Fix rate: 30min/1h



38♂ 36♀ + 26♂ 25♀

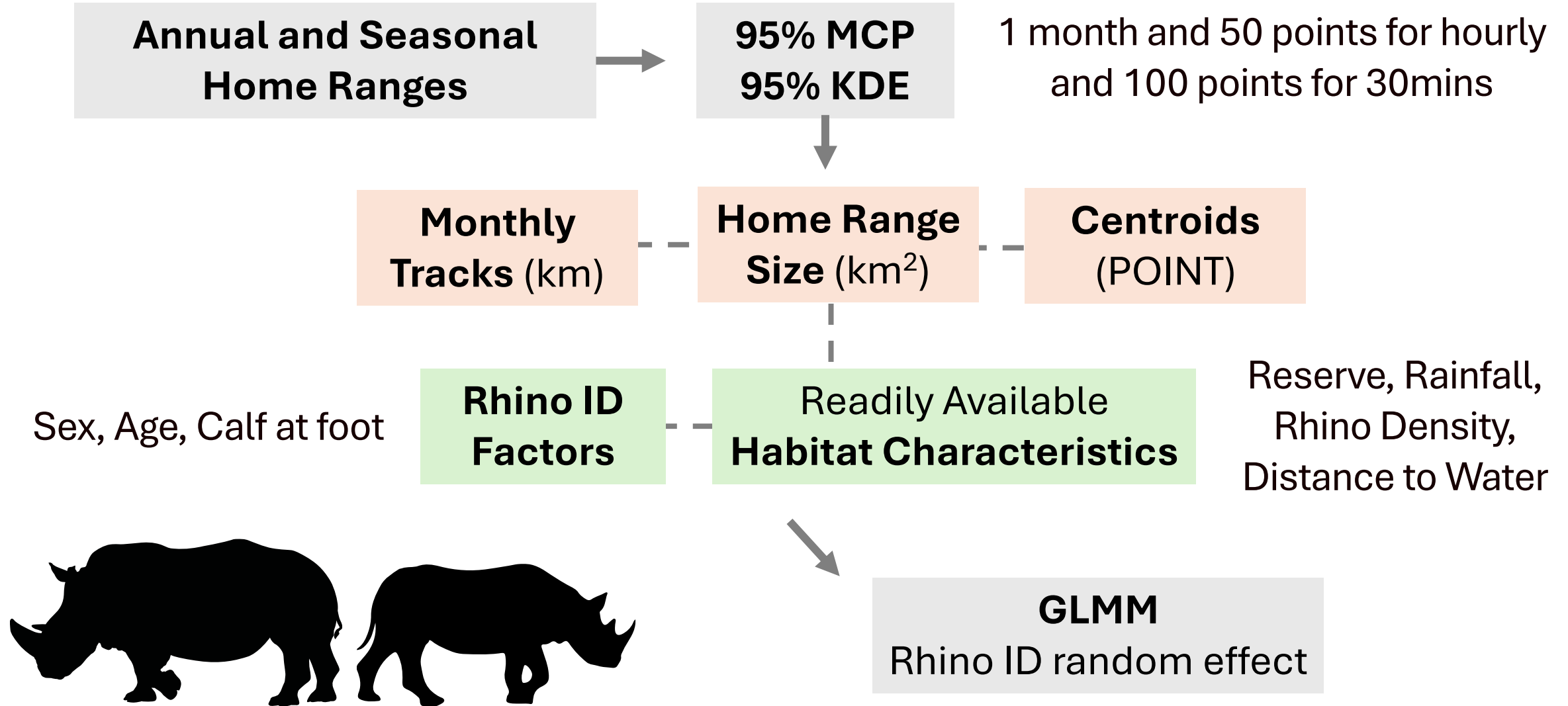
Mean number of Points/Animal

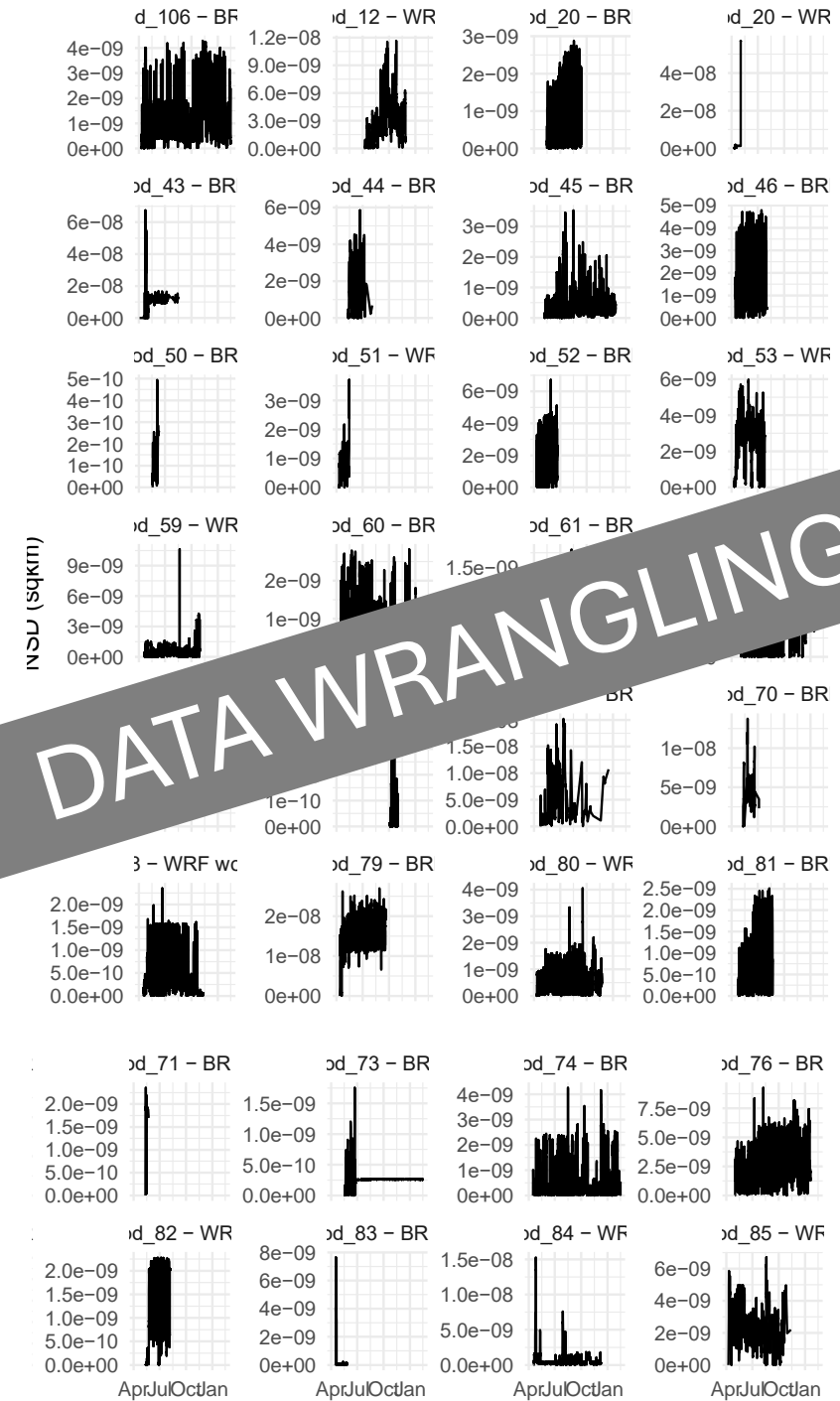
2228

Average duration: **5 months**

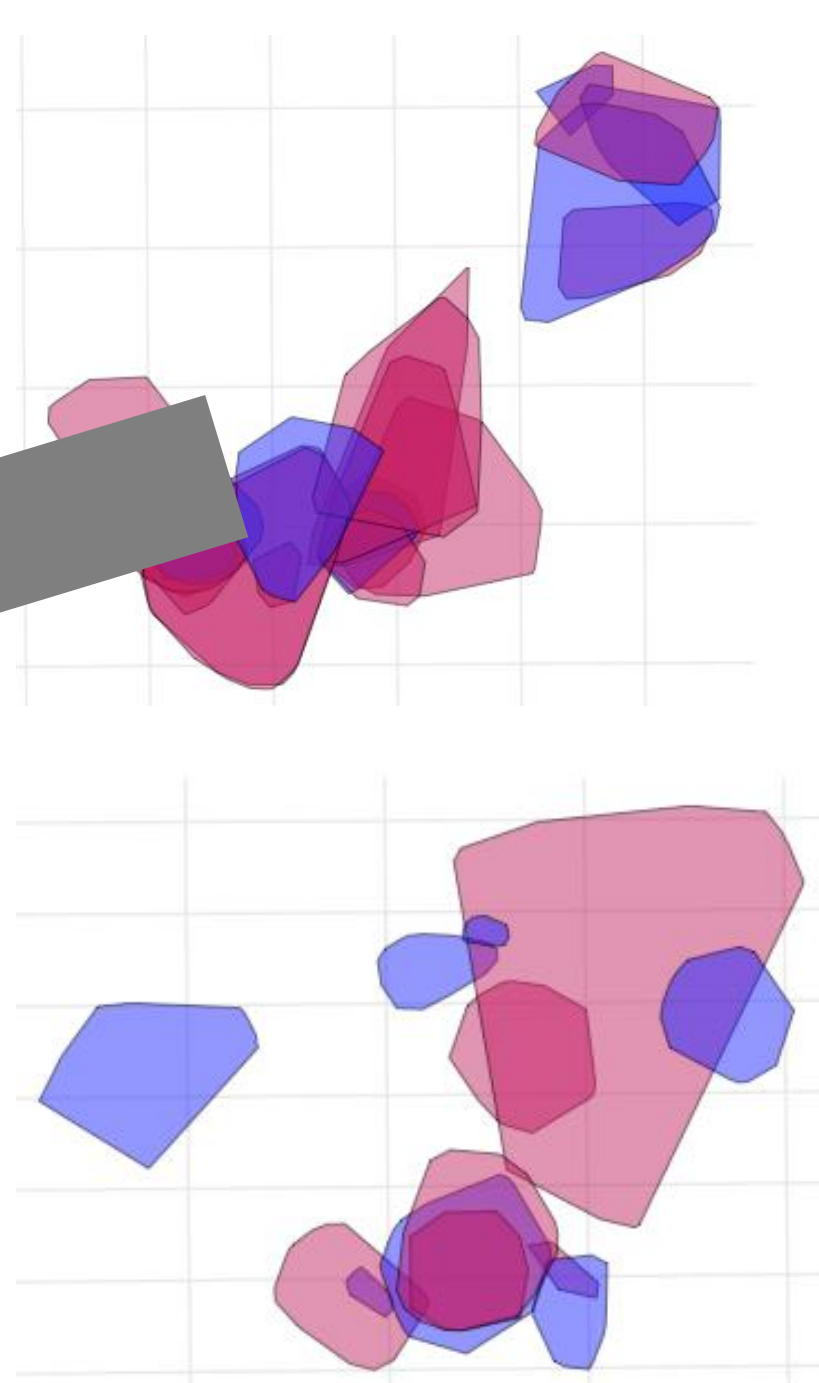
but up to 16 months

METHODS – HOME RANGE SIZE ESTIMATION





DATA WRANGLING



RESULTS



White Rhino



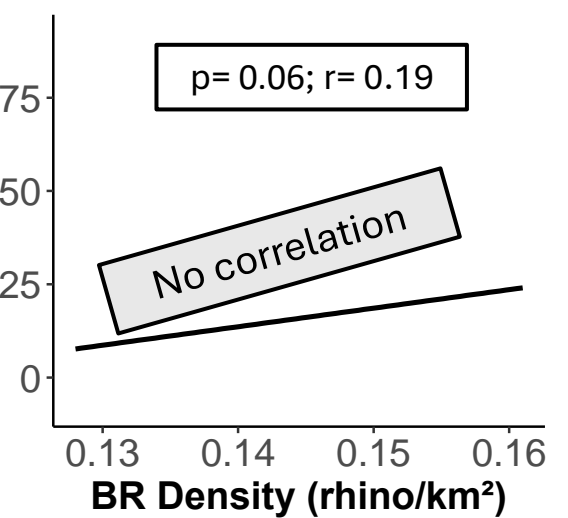
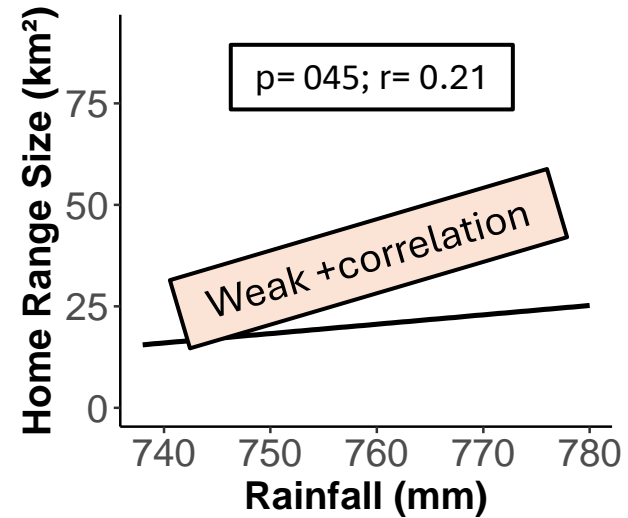
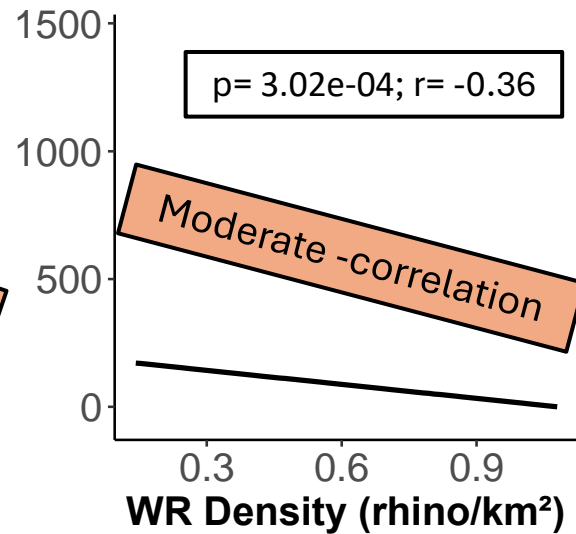
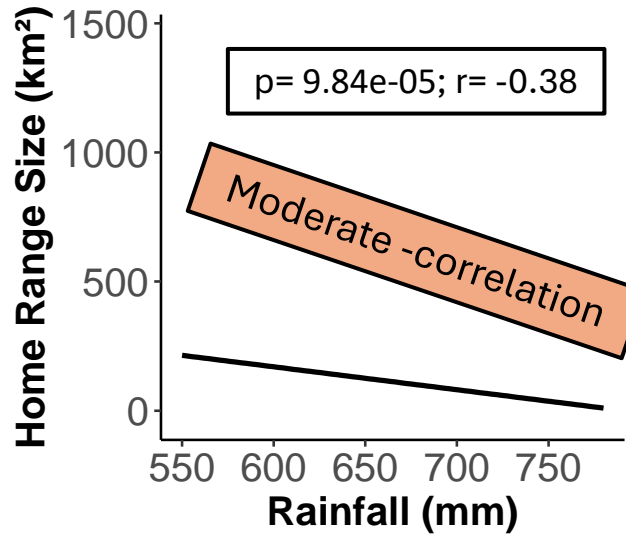
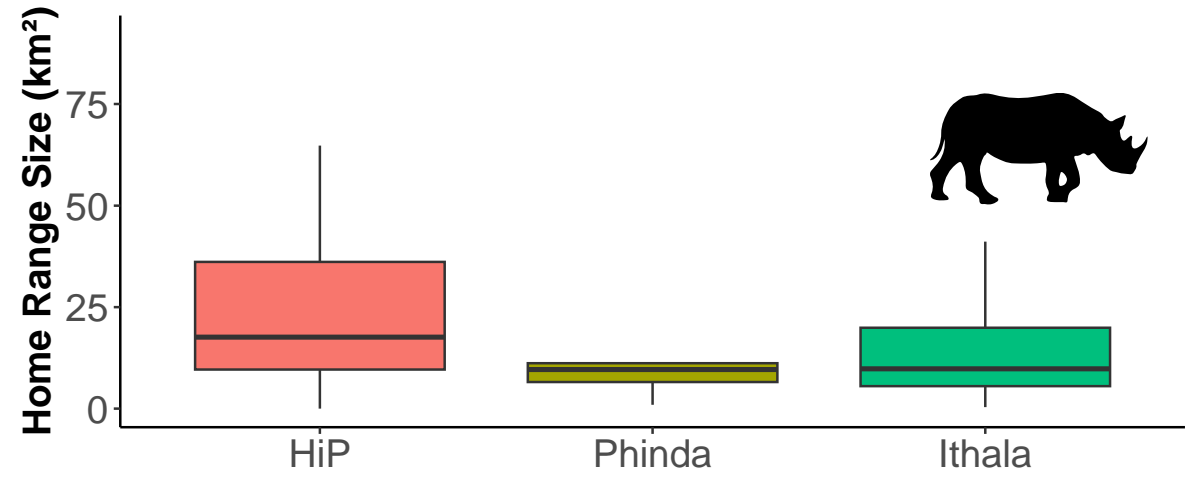
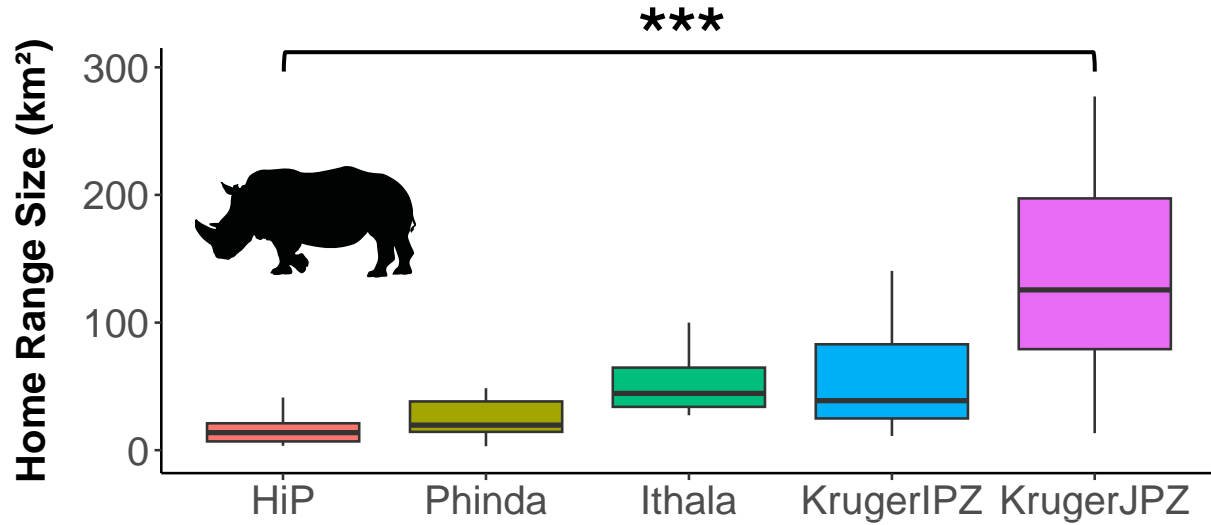
Black Rhino

**Annual
Home Range
size (km²)**

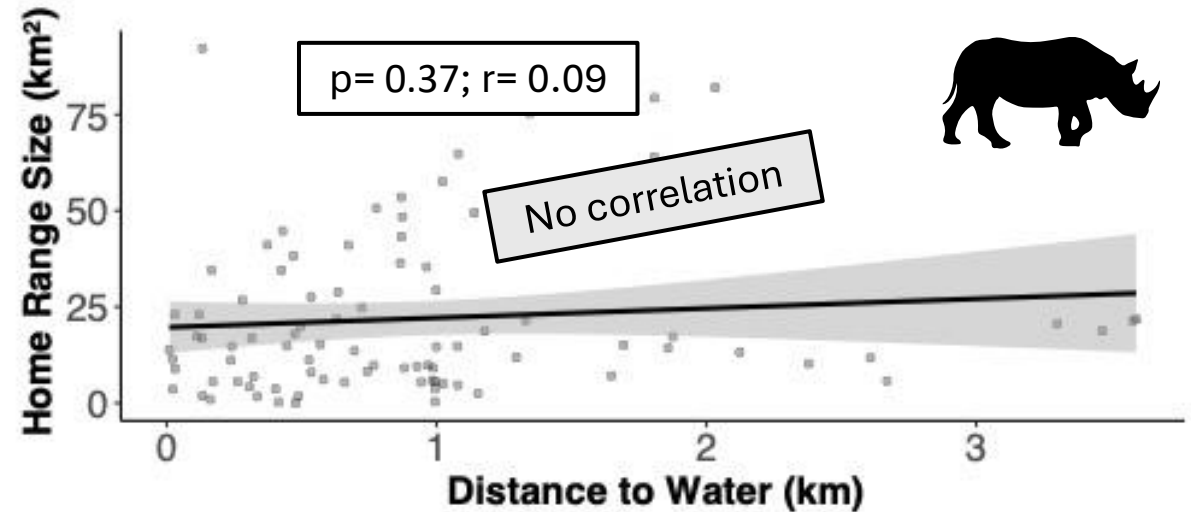
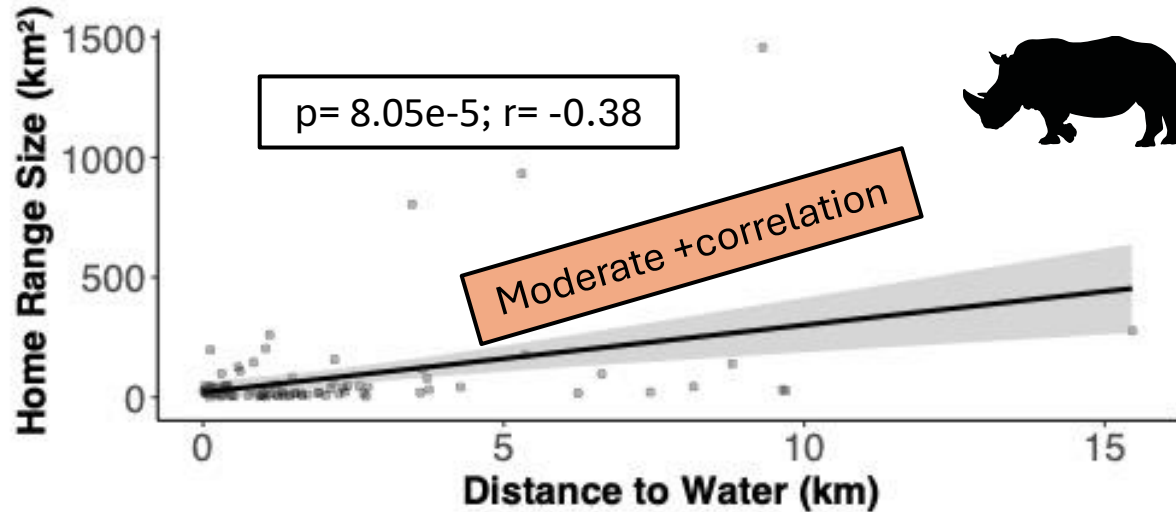
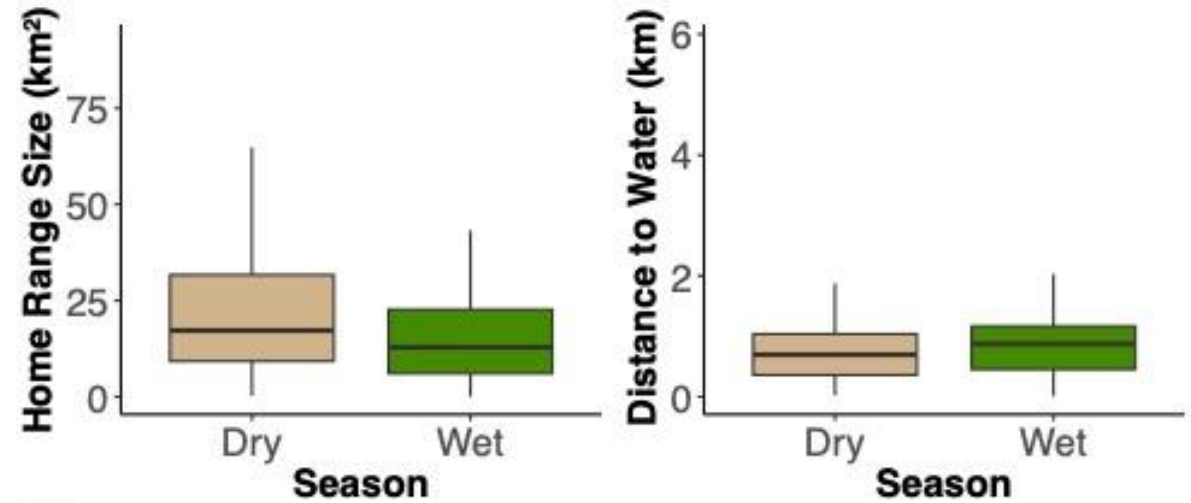
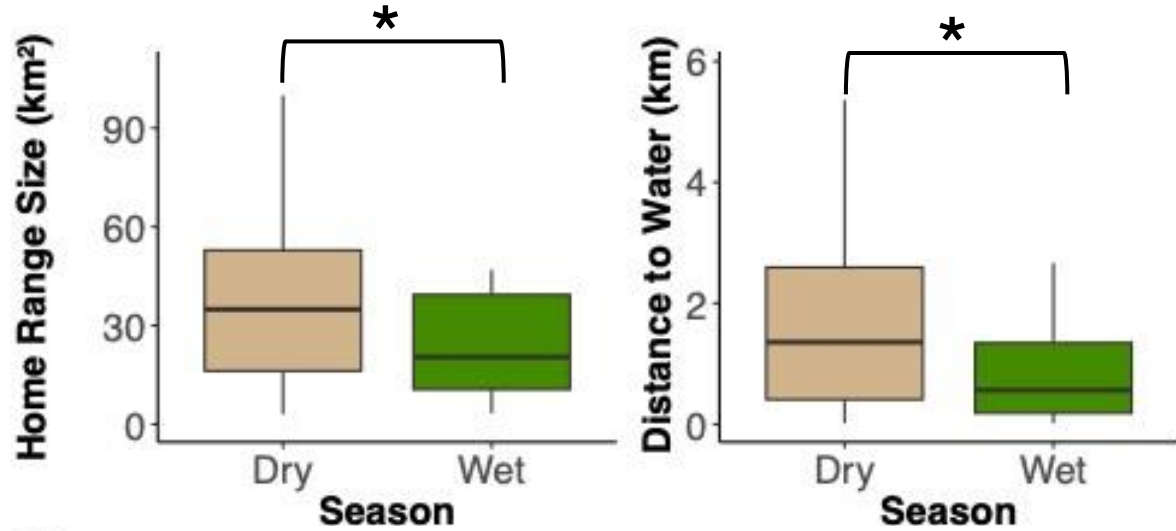
95 % MCP

<i>Average (SE)</i>	75.9 (17.3) km ²	22 (2.14) km ²
<i>Median (IQR)</i>	25.1 (33.7) km ²	14.7 (21.9) km ²
<i>Range</i>	3 – 1458.7 km ²	1 – 92.2 km ²
<i>N</i>	62	49

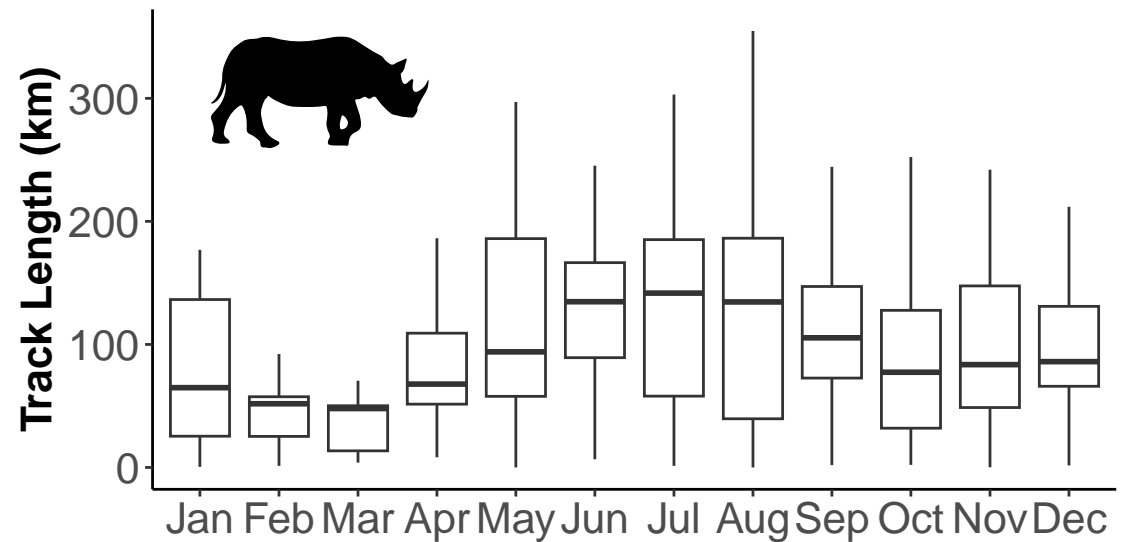
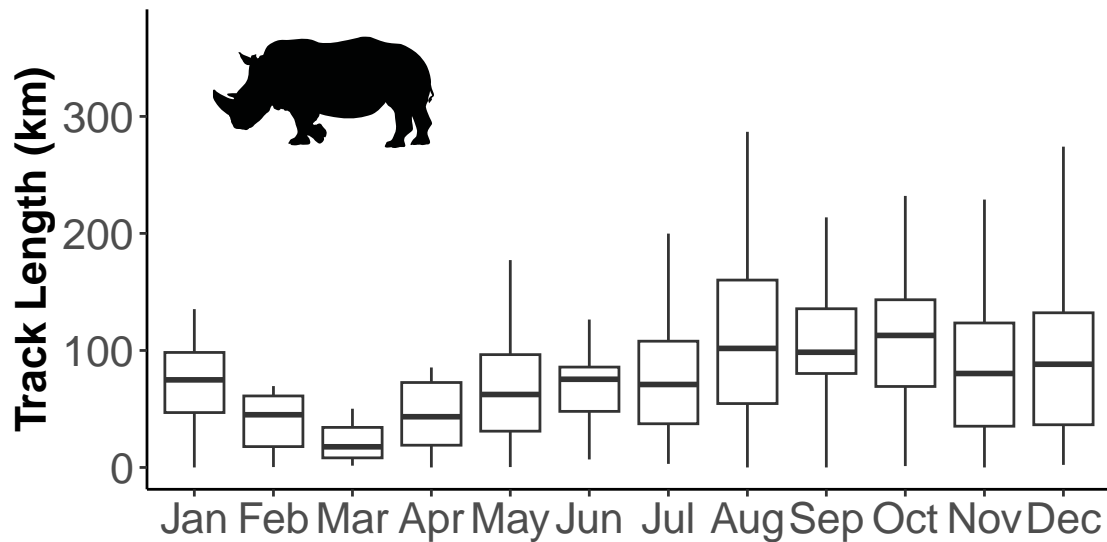
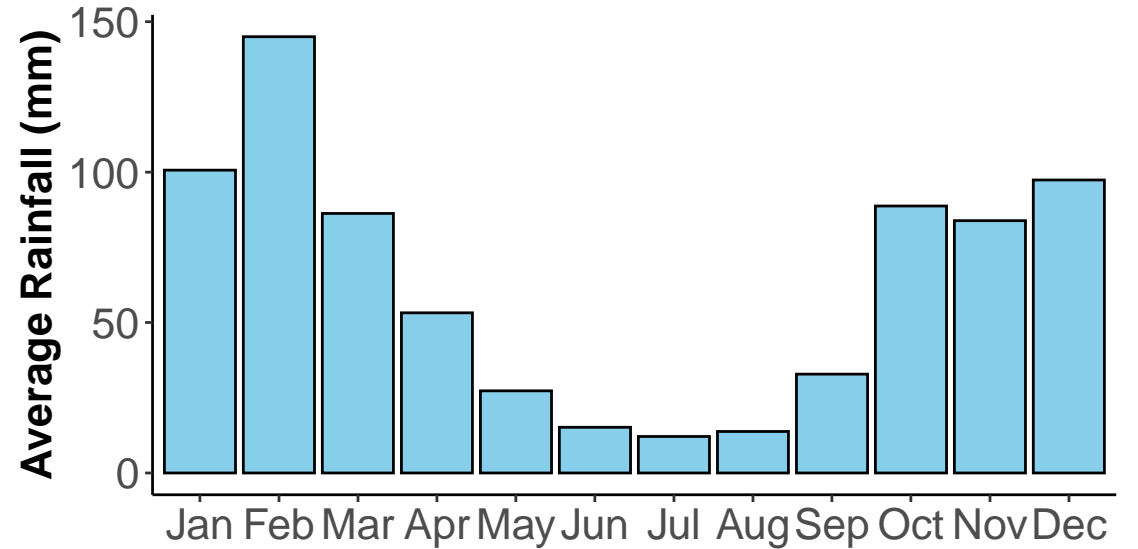
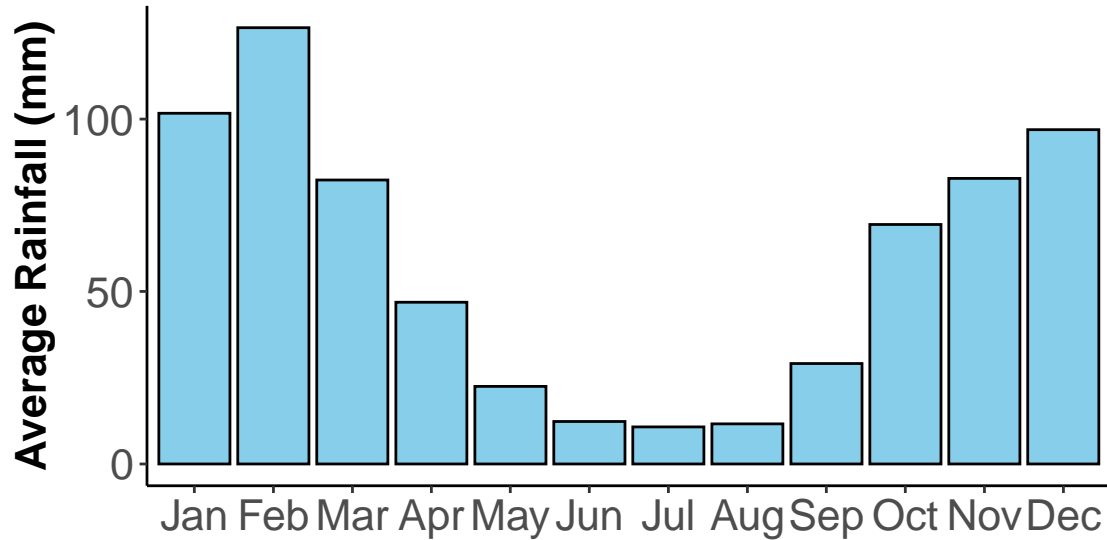
Factors driving Home Range Size – Reserve, Rainfall, Rhino Density



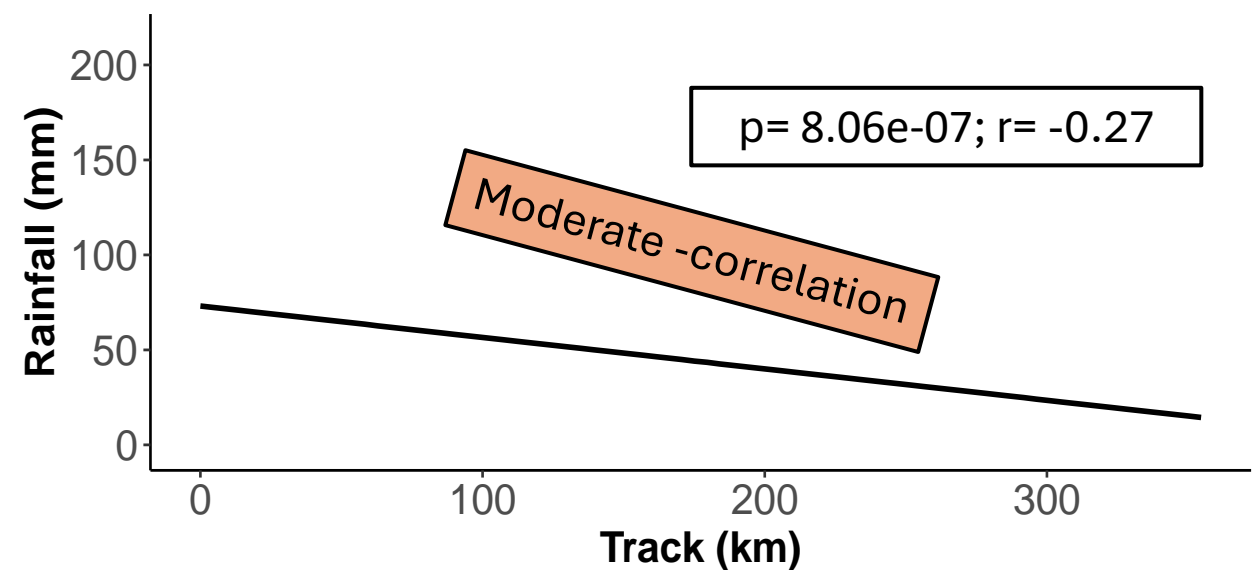
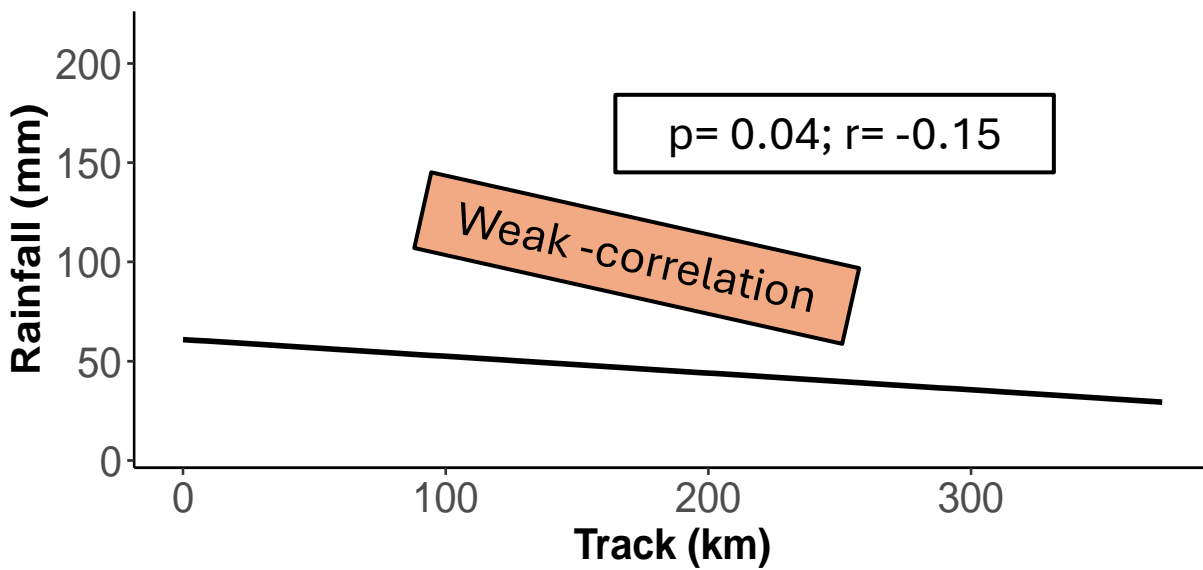
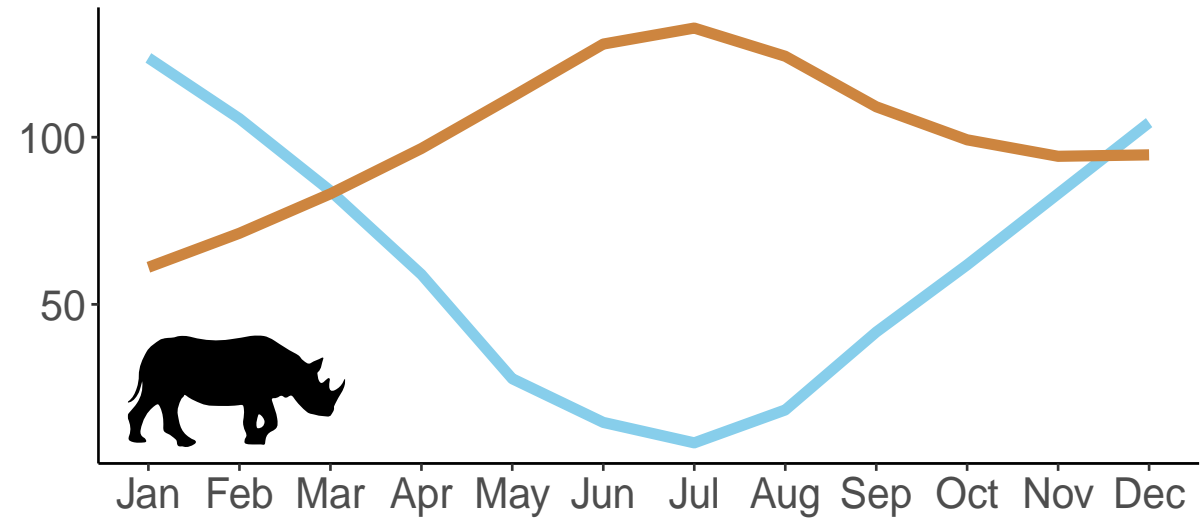
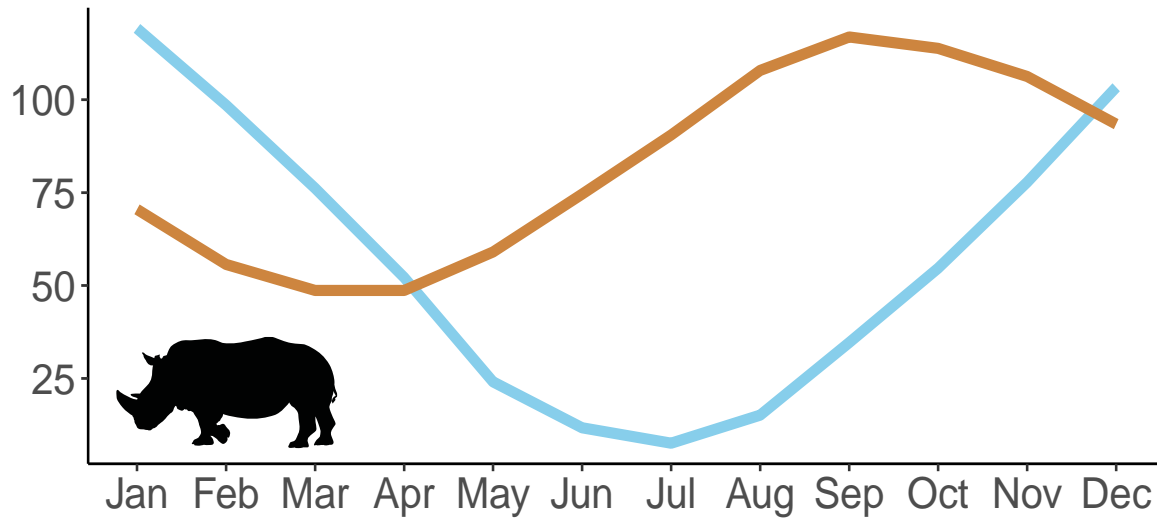
Factors driving Home Range Size – Season and Distance to Water



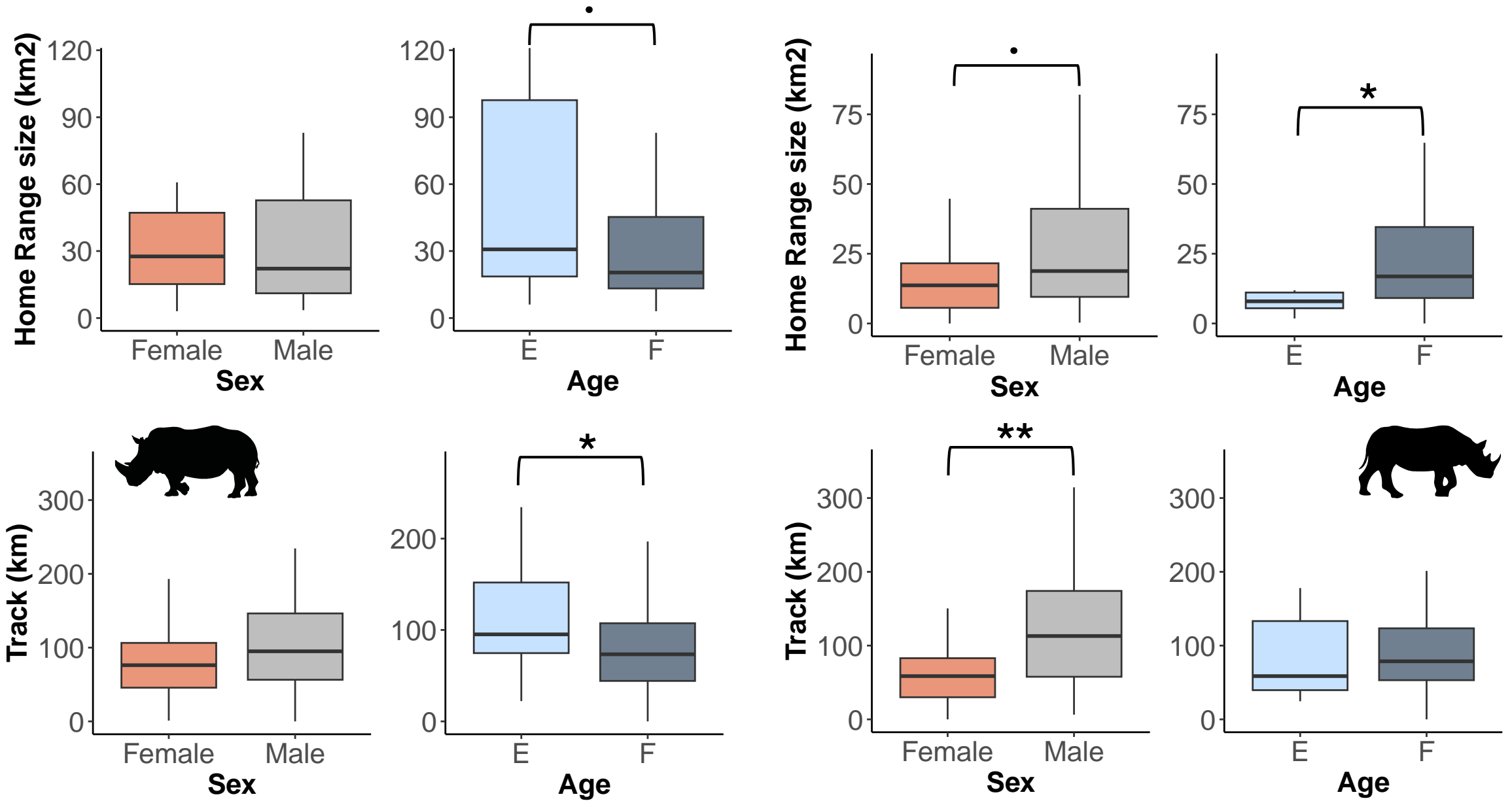
Average monthly rainfall and track length



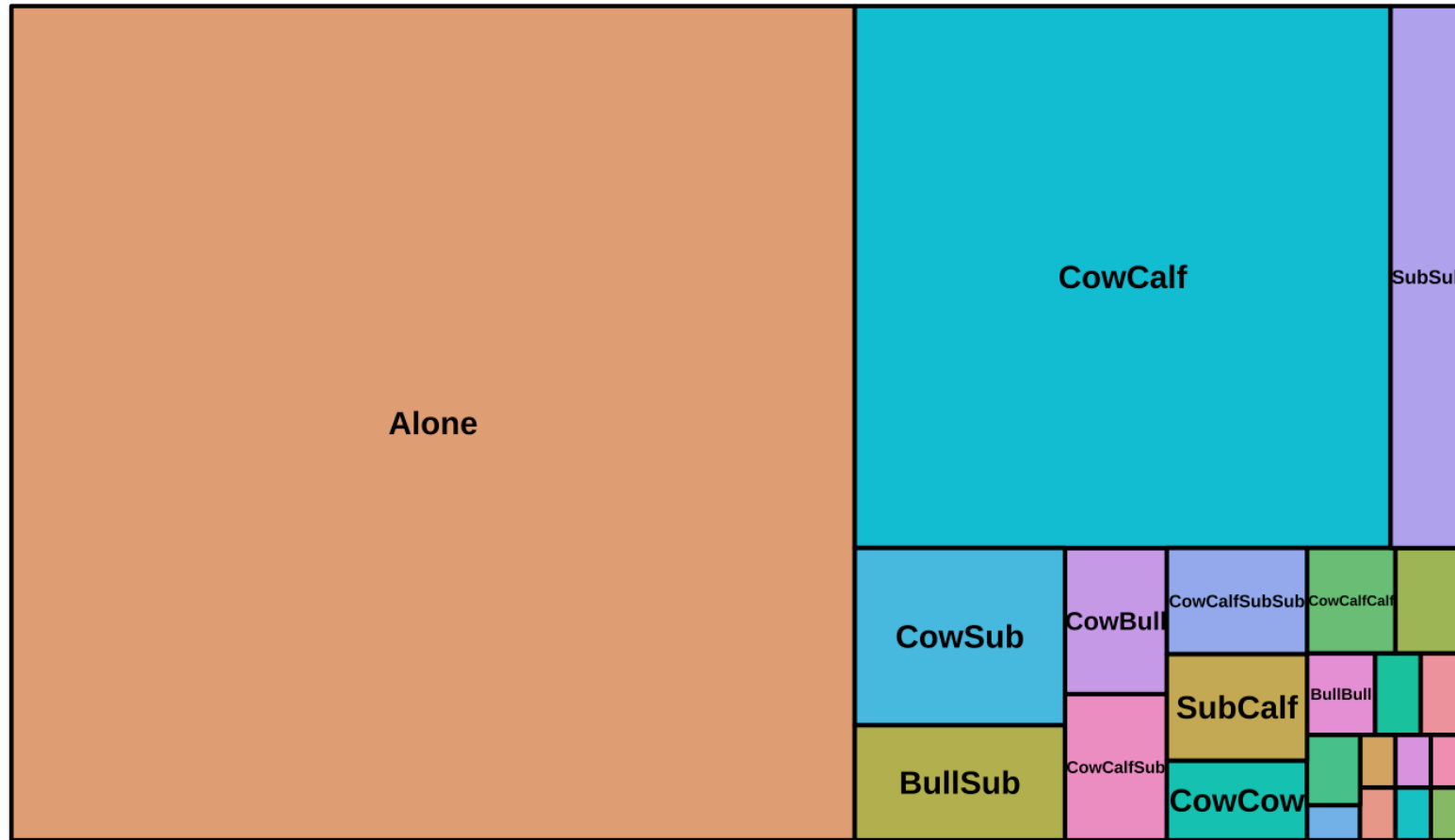
Average monthly rainfall and track length



Factors driving home range size – Sex and Age



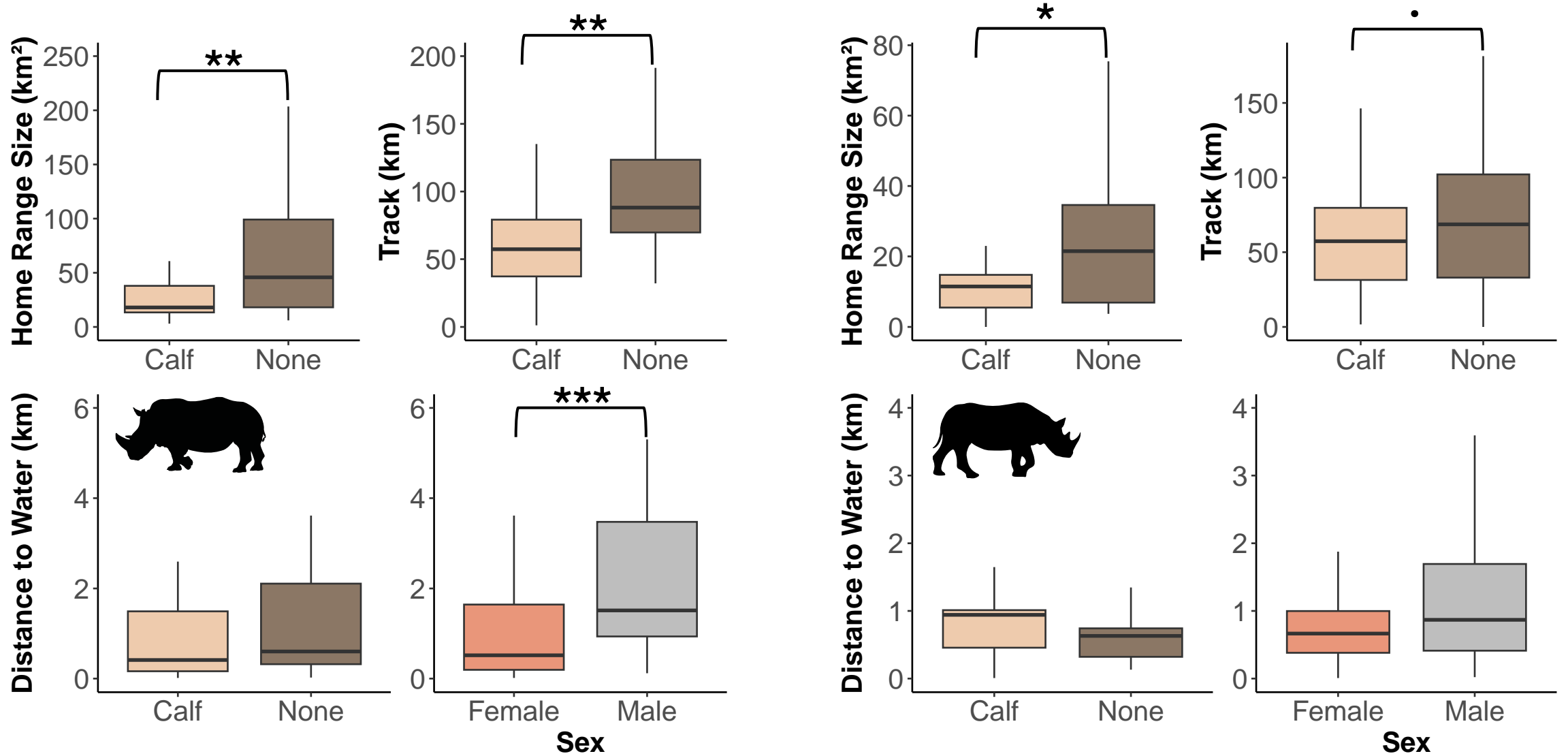
WHITE RHINO TYPES OF ASSOCIATIONS



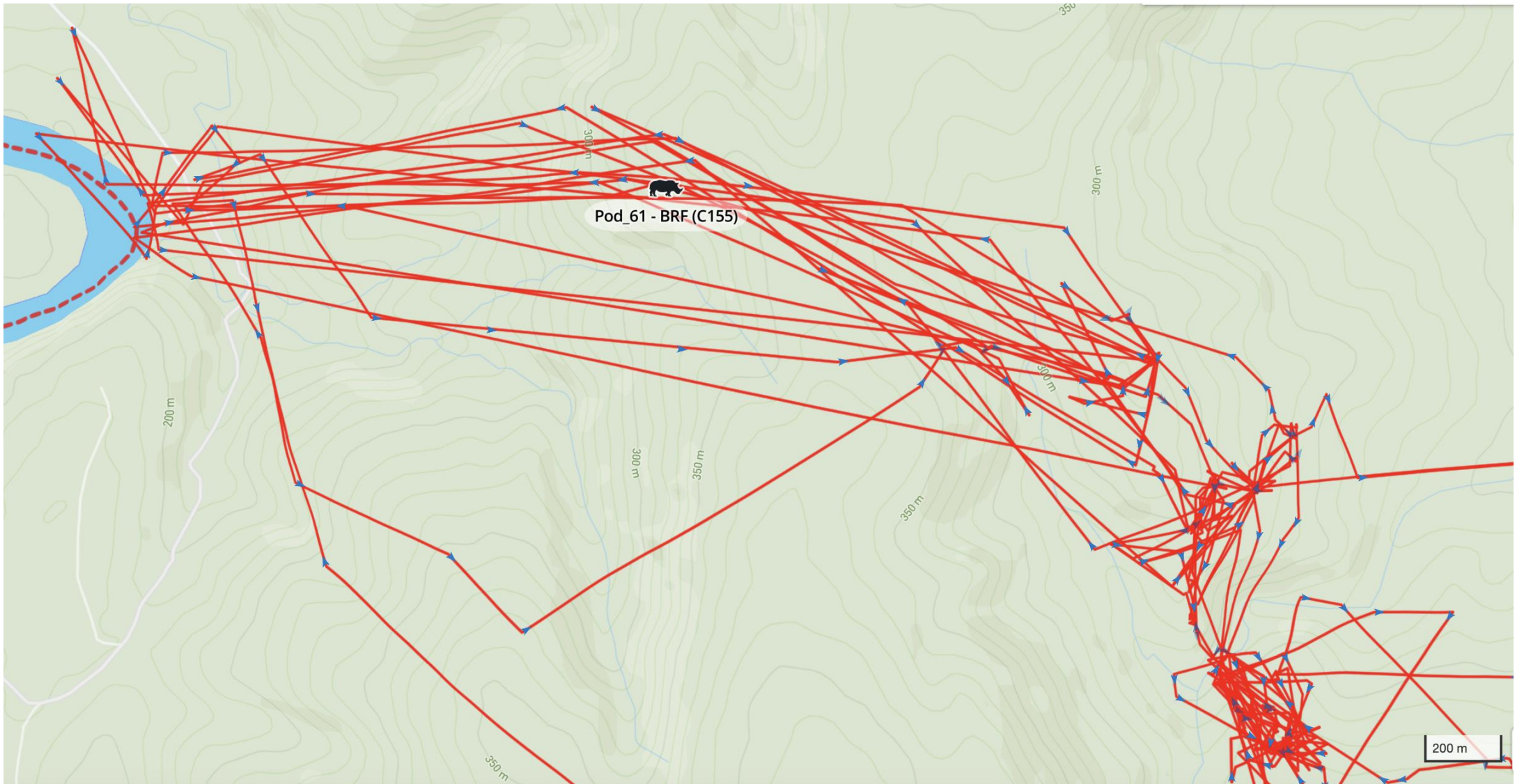
BullBull	0.46%
BullBullSub	0.15%
BullCalf	0.31%
BullSub	1.99%
BullSubSub	0.31%
CowBull	1.23%
CowCalf	23.93%
CowCalfCalf	0.77%
CowCalfCalfSub	0.15%
CowCalfSub	1.23%
CowCalfSubSub	1.23%
CowCow	0.92%
CowCowCalf	0.61%
CowCowCalfCalfSub	0.15%
CowCowSub	0.15%
CowSub	3.07%
CowSubSub	0.31%
SubCalf	1.23%
SubCalfCalf	0.15%
SubSub	3.37%
SubSubCalf	0.15%
SubSubSubSub	0.15%
Adult Alone	57.98%

5.05% of associations “unsupervised subs”

Factors driving home range size – Calves



BIRTH: SMALL RANGE & WATER PROXIMITY



SUMMARY



Home Range Size \neq Reserves

↗ ↗ Home Range

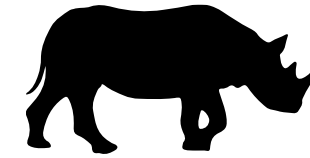
↘ **Rainfall** ↘ **Density** ↗ **Distance to Water**

Home Range **Dry** > **Wet** Season

Distance to Water **Dry** > **Wet** Season

↗ **Tracks** ↘ **Monthly Rainfall**

Delay → resource depletion by water first



Home Range Size = Reserves

↗ Home Range

↗ **Rainfall** = **Density** = **Distance to Water**

Home Range **Dry** \geq **Wet** Season

Distance to Water **Dry** = **Wet** Season

↗ **Tracks** ↘ **Monthly Rainfall**

Increase early dry season → selective browsing

SUMMARY

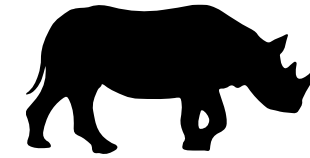


Home Range
Male = Female
Age $F < E$

Social structure, buddy system

Home Range
Females/Calves < Females/None

Distance to Water
Male > Female



Home Range
Male > Female
Age $F > E$

Bulls Tracks ↗ patrol more

Home Range
Females/Calves < Females/None

Distance to Water
Male = Female

FURTHER STEPS



Fill in the gaps

Include black rhino outside of Zululand



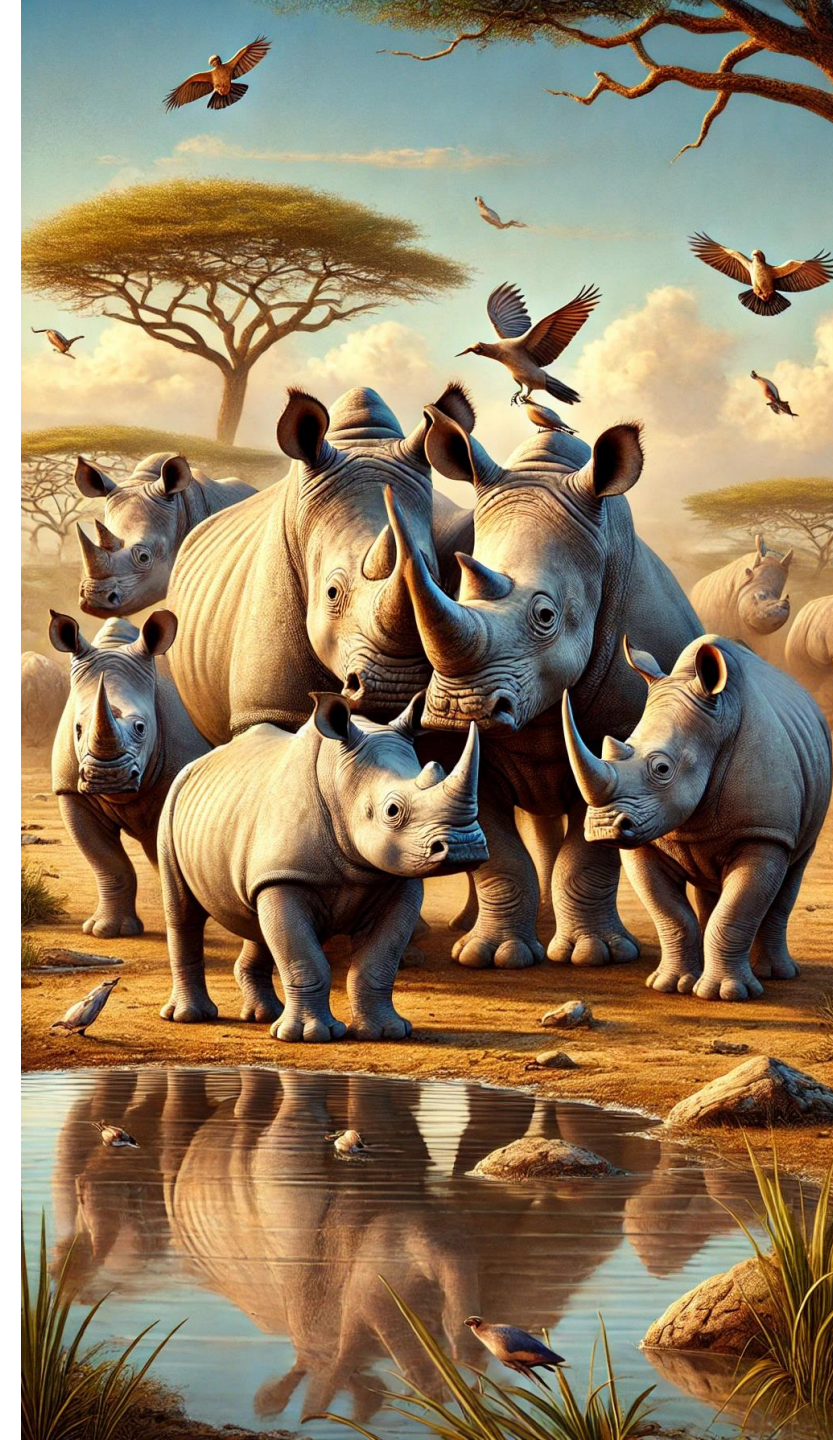
Precise habitat characterization

Remote sensing and microclimatic data

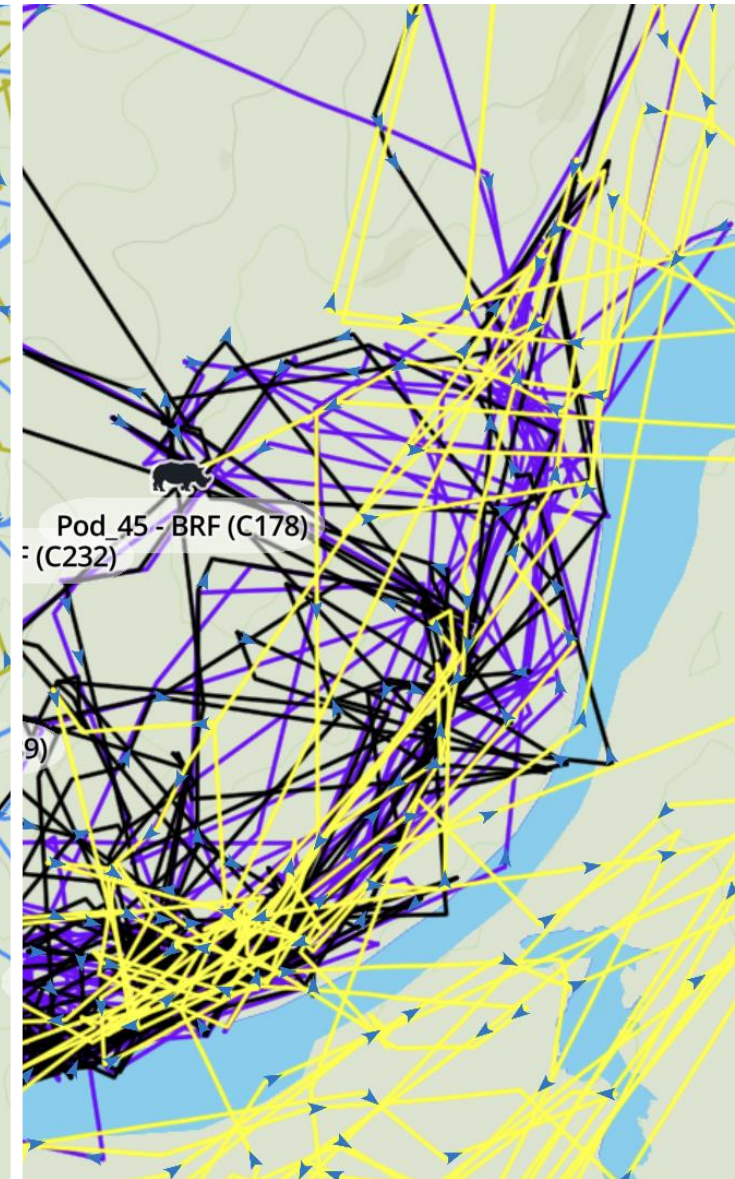
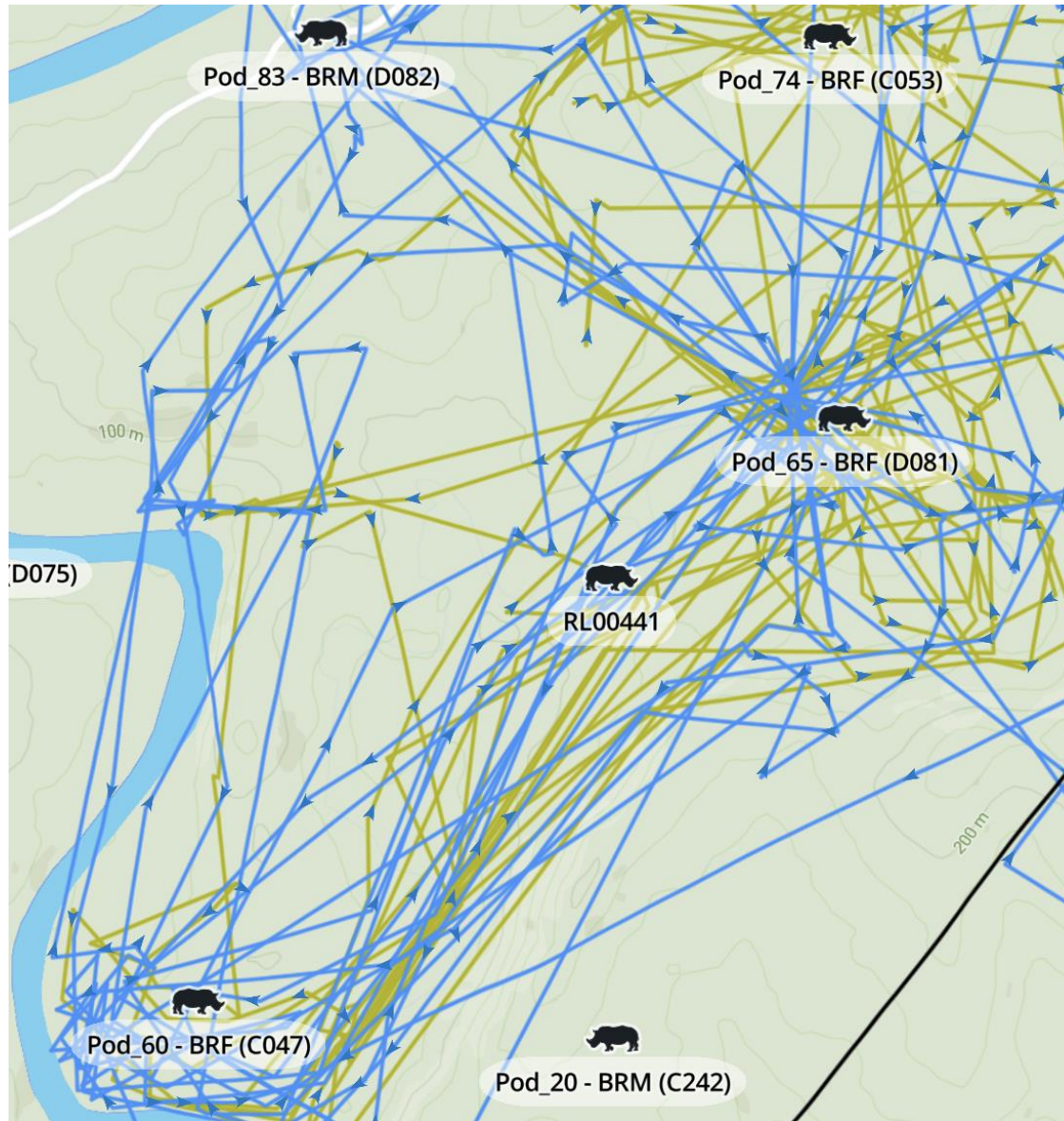
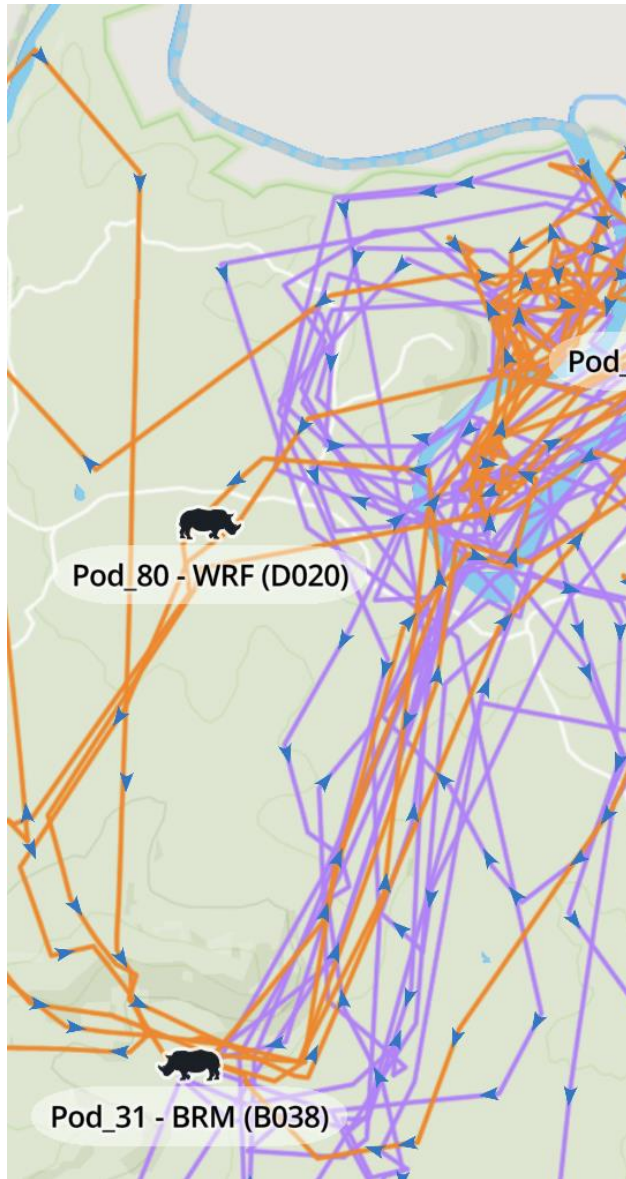


Social aspects

Overlapping home ranges and interactions



SOCIAL BLACK RHINOS



THANKS

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HARVARD
UNIVERSITY



South African
NATIONAL PARKS



E & BEYOND



EZEMVELO
KZN WILDLIFE
Conservation, Partnerships & Ecotourism



Rhino
Recovery
Fund



AFRICAN
WILDLIFE
VETS



INTERNATIONAL
RHINO
FOUNDATION



WILDLIFE ACT



BLACK
RHINO
RANGE
EXPANSION
PROJECT



WWF

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