

Comparative Water Dependency of Sable Antelope and Zebra in Kruger National Park

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Water Provisioning

- **Surface water availability has a major influence on the seasonal distribution of water-dependent herbivores**
 - **E.g., >80% of the biomass of water-dependent species within 4 km of perennial water sources (Western 1975)**
- **Not all herbivores are equally influenced by the distribution of perennial water sources**
 - **Grazers more water-dependent than browsers**
 - Browse moisture content >40-50%
 - Grass moisture content commonly <10% in dry season

Water Policy in KNP

- **Construction of boreholes and dams began in 1930s and continued into 1990s**
 - **By 1995, 365 boreholes, 50 dams had been constructed**
- **Expand distribution of herbivores/use of forage resources into areas devoid of natural sources of water**
- **Mitigate for the loss of dry season range due to construction of western boundary fence**
- **Stabilize populations during droughts**

Unintended Consequences of KNP Water Policy

- Rare antelope (i.e., sable, roan, tsessebe, and eland) concentrated in largely waterless, northern region of park
- Severe droughts in 1982/83
- Influx of zebra and other water-dependent species (i.e., wildebeest and buffalo) into northern region
 - Increased competition for forage
- Increase in lion abundance
 - Increased predation pressure during a period of below average rainfall
- Decline in rare antelope species
- Managers began closing boreholes and removing dams

Previous Research in KNP

- **Previous research in KNP on the influence of water sources on herbivore distribution**
 - **Analyzed herbivore distributions relative to water sources based on aerial survey data from early dry season (May – Aug)**
 - Water was not yet limited in availability due to numerous ephemeral sources
 - Did not distinguish between natural or man-made sources or between ephemeral and perennial sources in analyses
 - During this period only 8% of the park >5 km from water
- **Commonly assumed that water-dependent species need to drink daily but there is little documentation of frequency of drinking or distances traveled to access water**

Objectives

Our objective was to assess water use by sable antelope and zebra during the late dry season

- **Determine the frequency and timing of movements to water.**
- **Estimate distance traveled during movements to water.**
- **Estimate the difference in total daily movement distances between water movement days and non water movement days.**
- **Assess the time lost to feeding and other activities as a result of travel to water.**

- **Sable antelope** (*Hippotragus niger*)
 - **Selective grazer**
 - **Ruminant**
 - **Classified as highly water dependent**
 - 2 – 4 km from water (Wilson and Hirst 1977)
 - Infrequently >1 km from water (Grobler 1981, Ben Shahr 1990, Magome 1991)

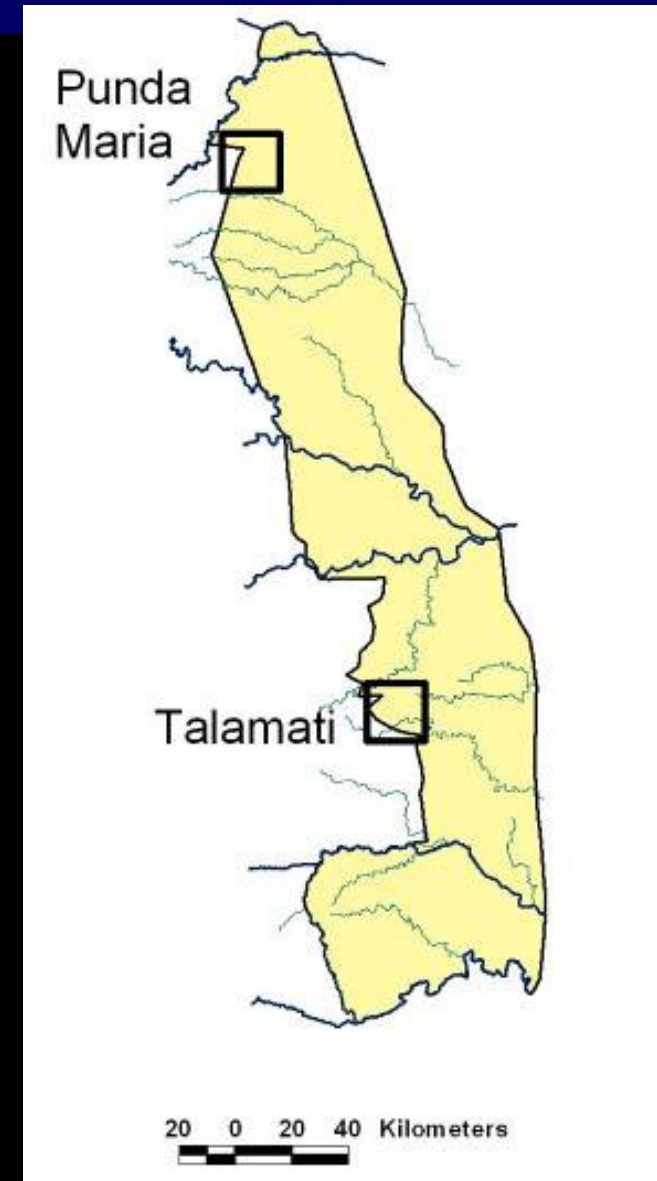


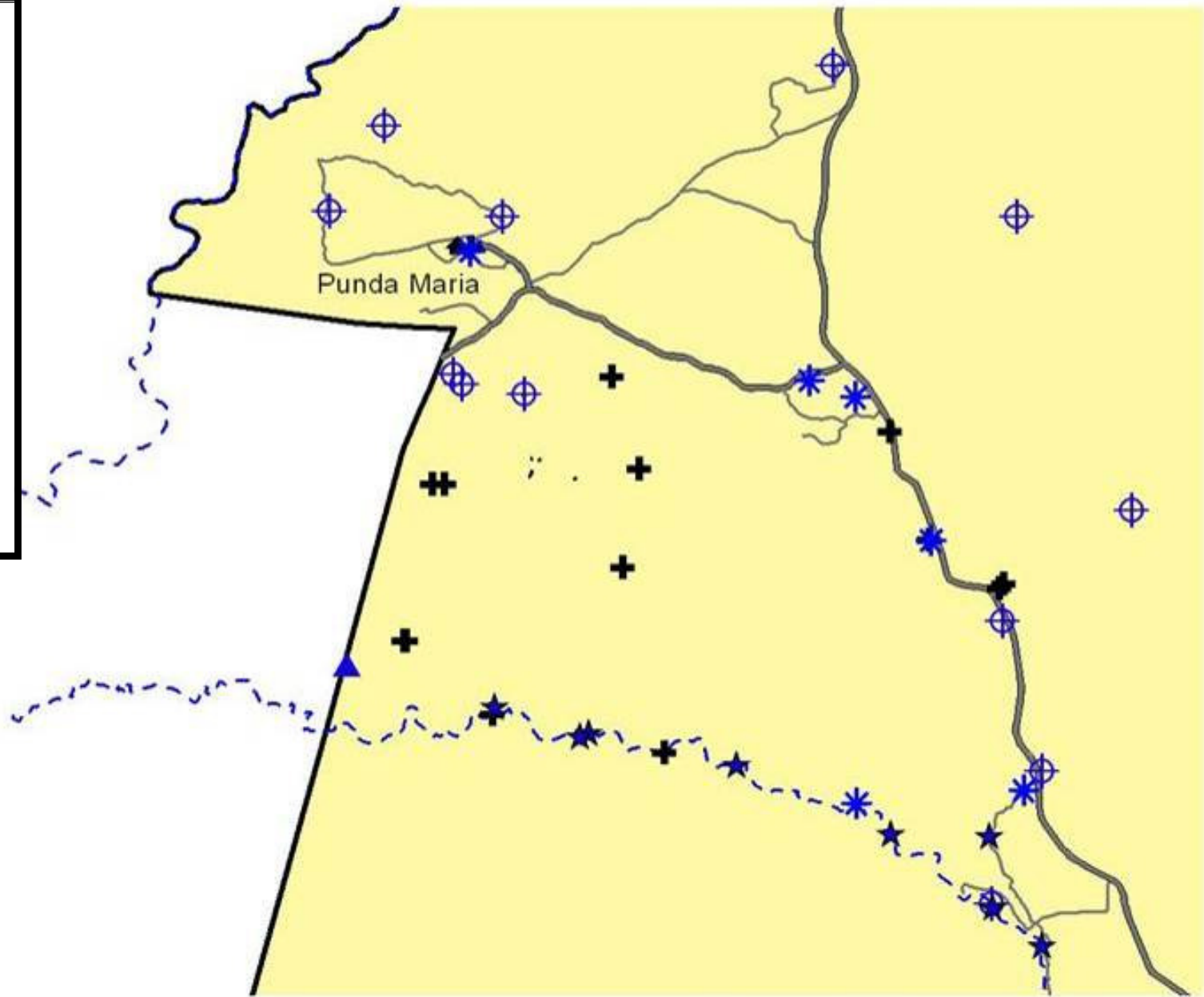
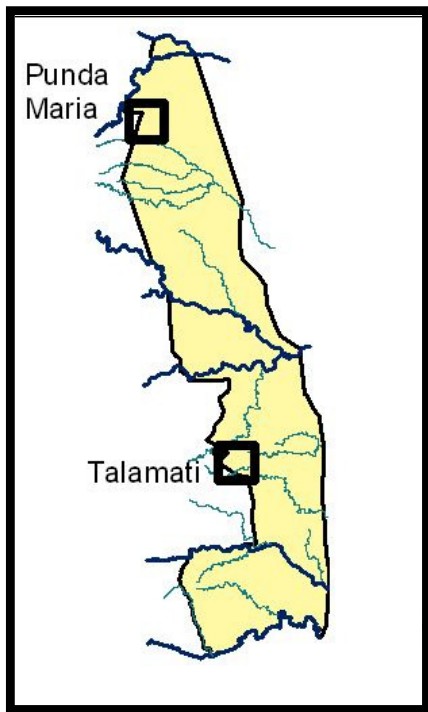
- **Plains zebra** (*Equus quagga*)
 - **Non-selective, bulk grazer**
 - **Hindgut fermenter**
 - **Classified as highly water dependent**
 - 85% of zebra within 2 - 4 km of water during dry season (Western 1975)



Study Areas

- **Punda Maria (532 mm rain)**
 - **Sable and Zebra**
 - **2006 and 2007 dry seasons**
 - 2006 42% above average rainfall
 - 2007 25% below average rainfall
- **Talamati (550 mm rain)**
 - **Sable only**
 - **2004 dry season**
 - 25% below average





Water

▲ Gravel Pit

★ Pool

Boreholes

✚ Closed

✳ Open

⊕ Dams

■ Pans

--- Rivers

▲ Camps

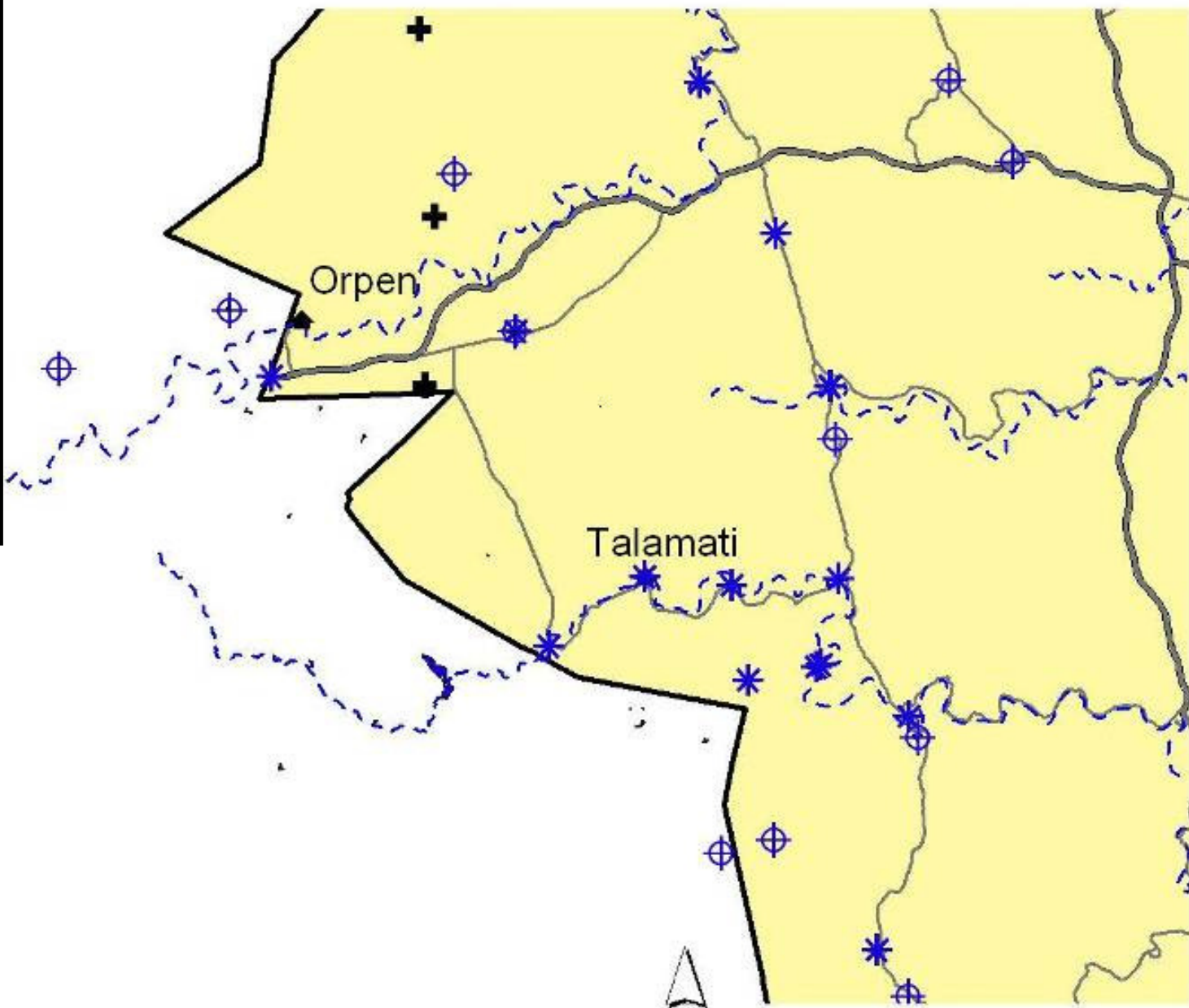
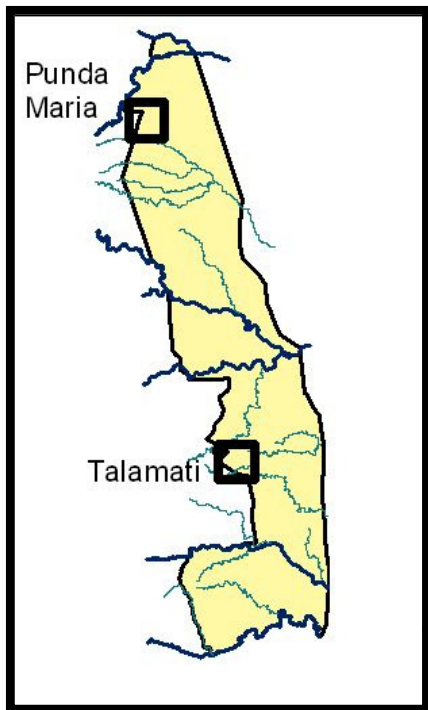
Roads

⚡ Gravel

⚡ Tar

■ Park boundary





- Water
- Boreholes**
- + Closed
- * Open
- ⊕ Dams
- ▲ Camps
- Rivers
- Roads**
- Gravel
- Tar
- Park boundary



Methods

- **GPS collars on adult females**

- **Punda Maria**

- Sole sable herd in the region collared in 2006
 - 4 zebra herds collared in 2006 and 2 additional herds in 2007
 - GPS fixes at 6-hourly intervals interspersed with periods of 2-8 days at 1-hr intervals
 - Aug 2007 all set to 1-hr intervals

- **Talamati**

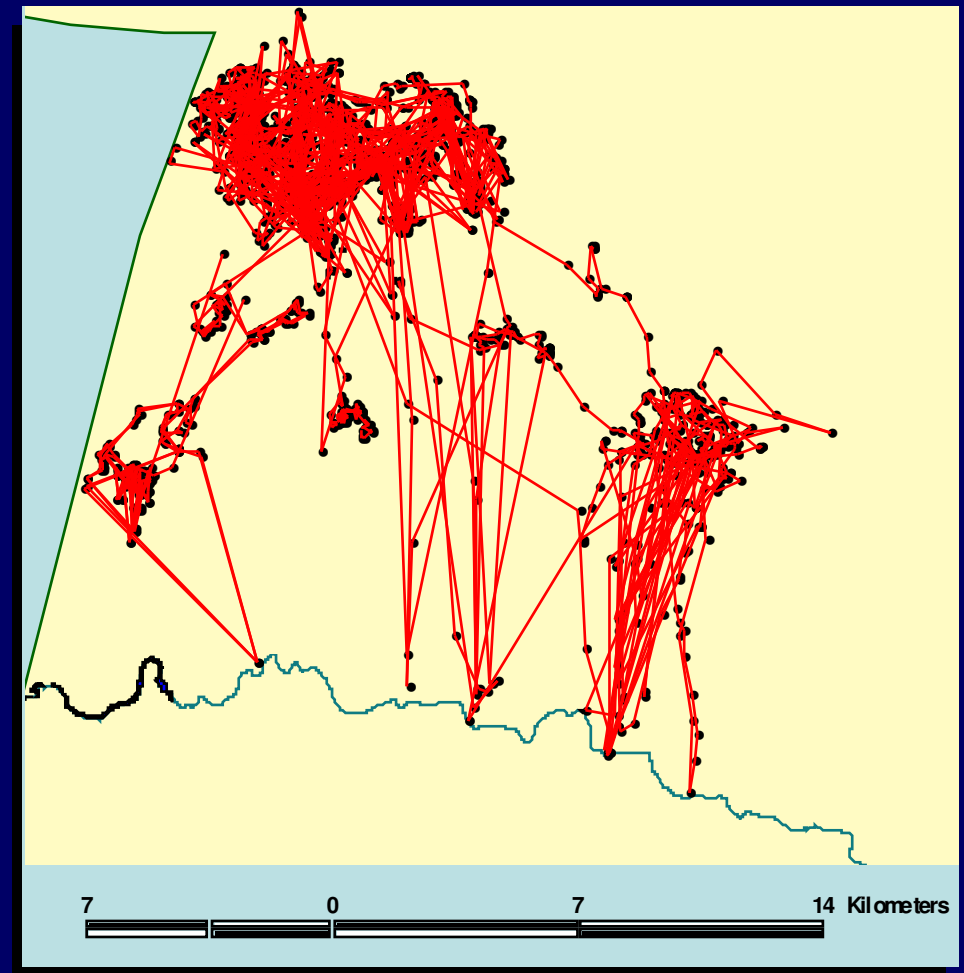
- Two sable herds collared in 2004
 - GPS fixes at 6-hourly intervals

- **6 hr GPS data - water use frequency only**

- **1 hr GPS data - frequency and distance and time costs**

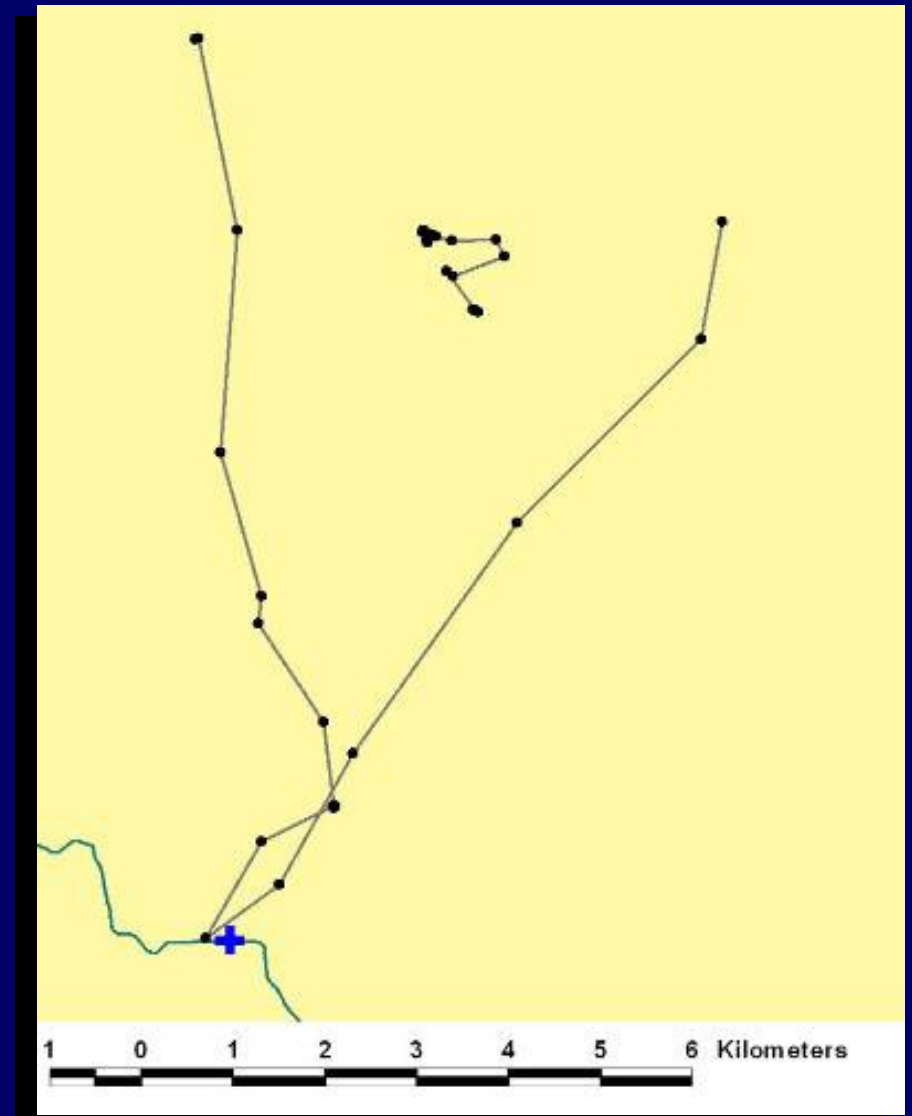
Methods

- **Frequency of movements**
 - **GPS positions converted to movement paths in to identify movements to water sources**
 - Characterized by back and forth movement to a known water source during the same day



Methods

- **Movement distances**
 - **Sum of the straight-line distances between 1 hr GPS locations**
 - Water movement days and non water movement days



Results

- Frequency of water movements

Animal	Dry season	<i>n</i>	Range	Water use interval (days)				
				1 Day	2 Days	3 Days	4 Days	5 Days
Sable-TAL	Jul - Nov 2005	42	2-5		2	29	10	1
Sable-PM	Oct - Nov 2006	23	1-4	1	10	10	2	
Sable-PM	Aug - Nov 2007	27	1-5	5	10	10	1	1
Zebra 141	Aug - Oct 2006	83	1-2	73	10			
Zebra 141	Aug - Sep 2007	31	1-4	9	18	3	1	
Zebra 142	Aug - Oct 2006	58	1-3	33	19	6		
Zebra 142	Oct - Nov 2007	37	1-3	21	15	1		
Zebra 147	Aug - Nov 2006	41	1-4	6	27	5	3	
Zebra 277	Aug - Nov 2007	29	1-3	8	19	2		
Zebra 280	Aug - Nov 2007	33	1-2	4	29			

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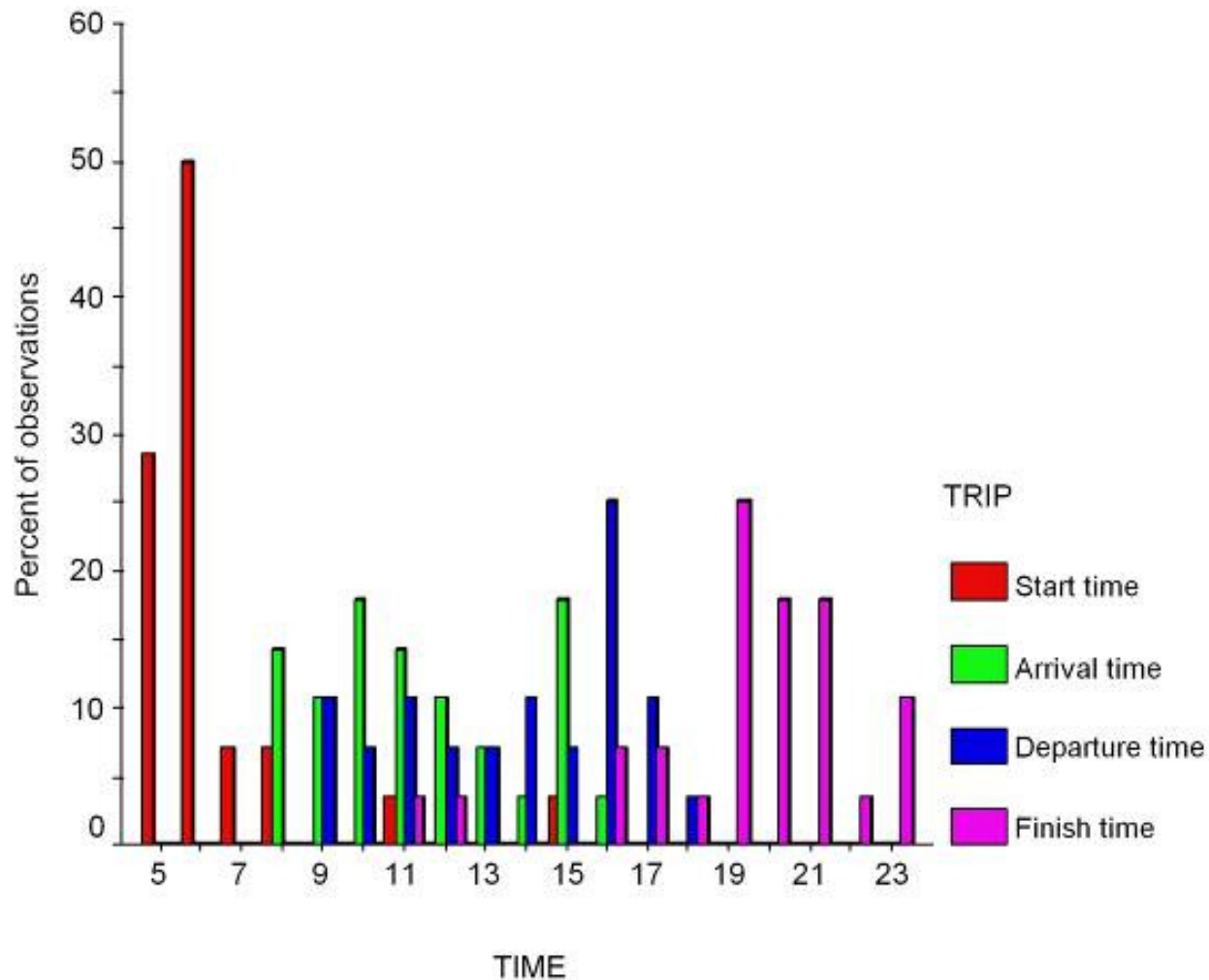
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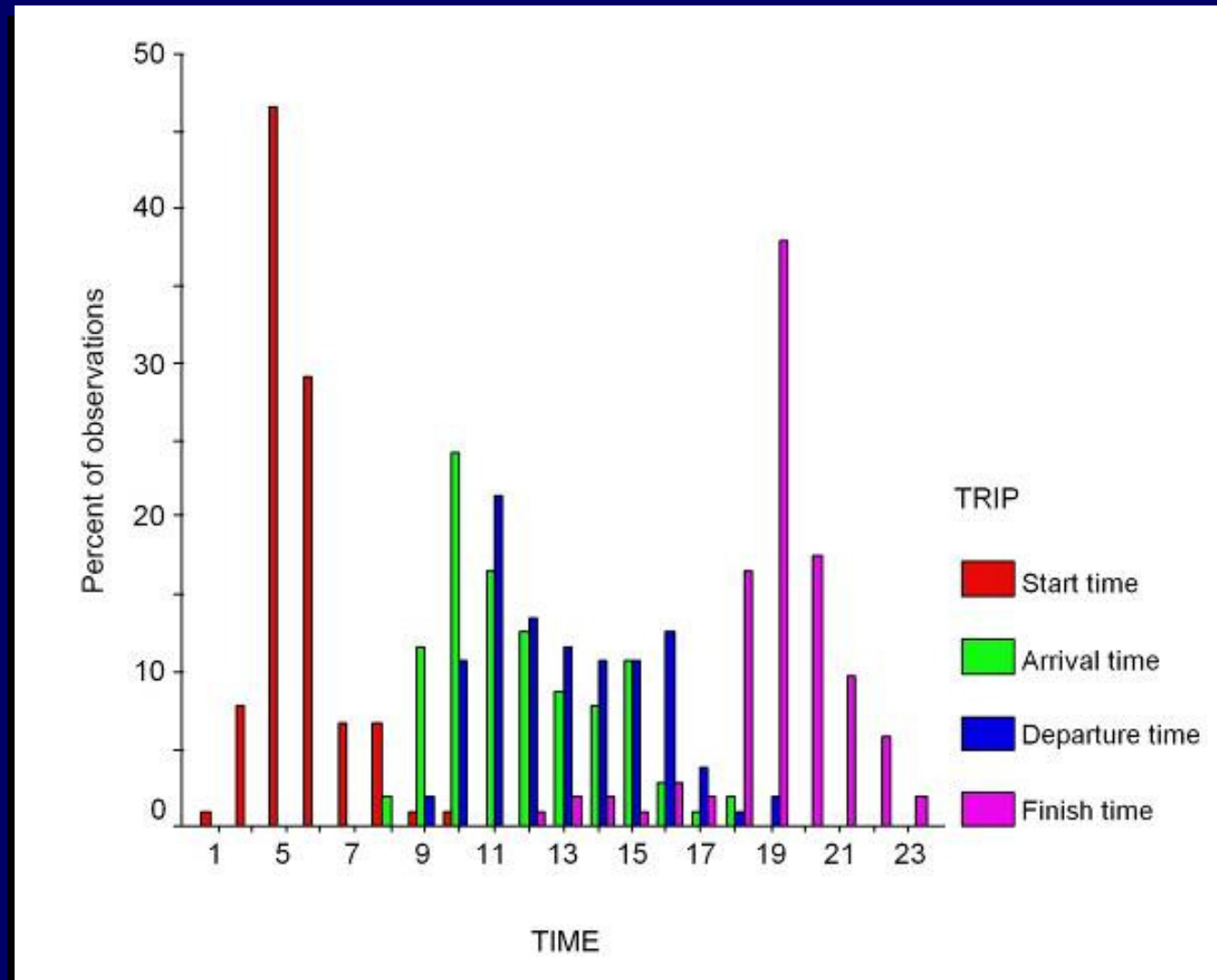
Results

- Sable



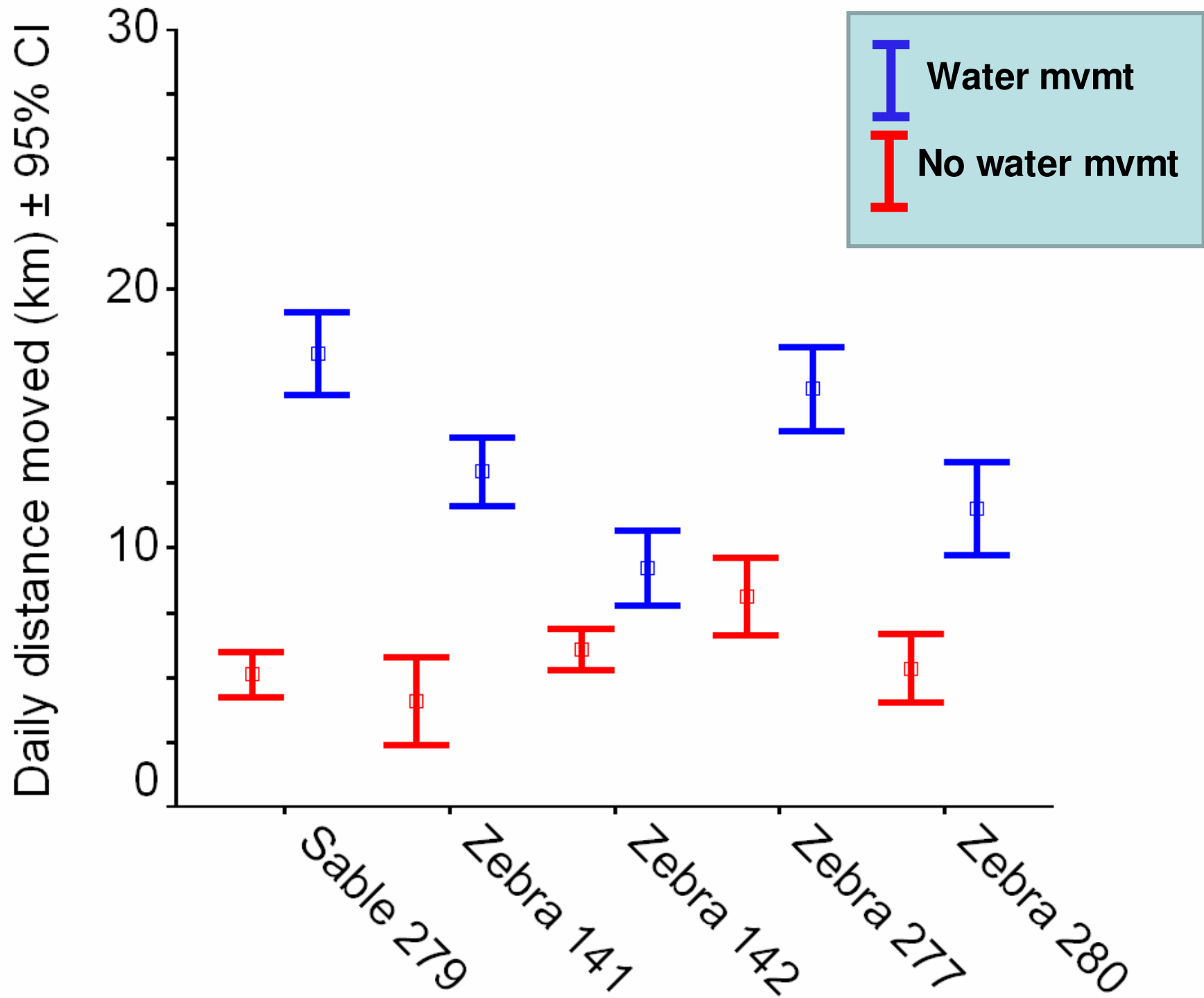
Results

- Zebra

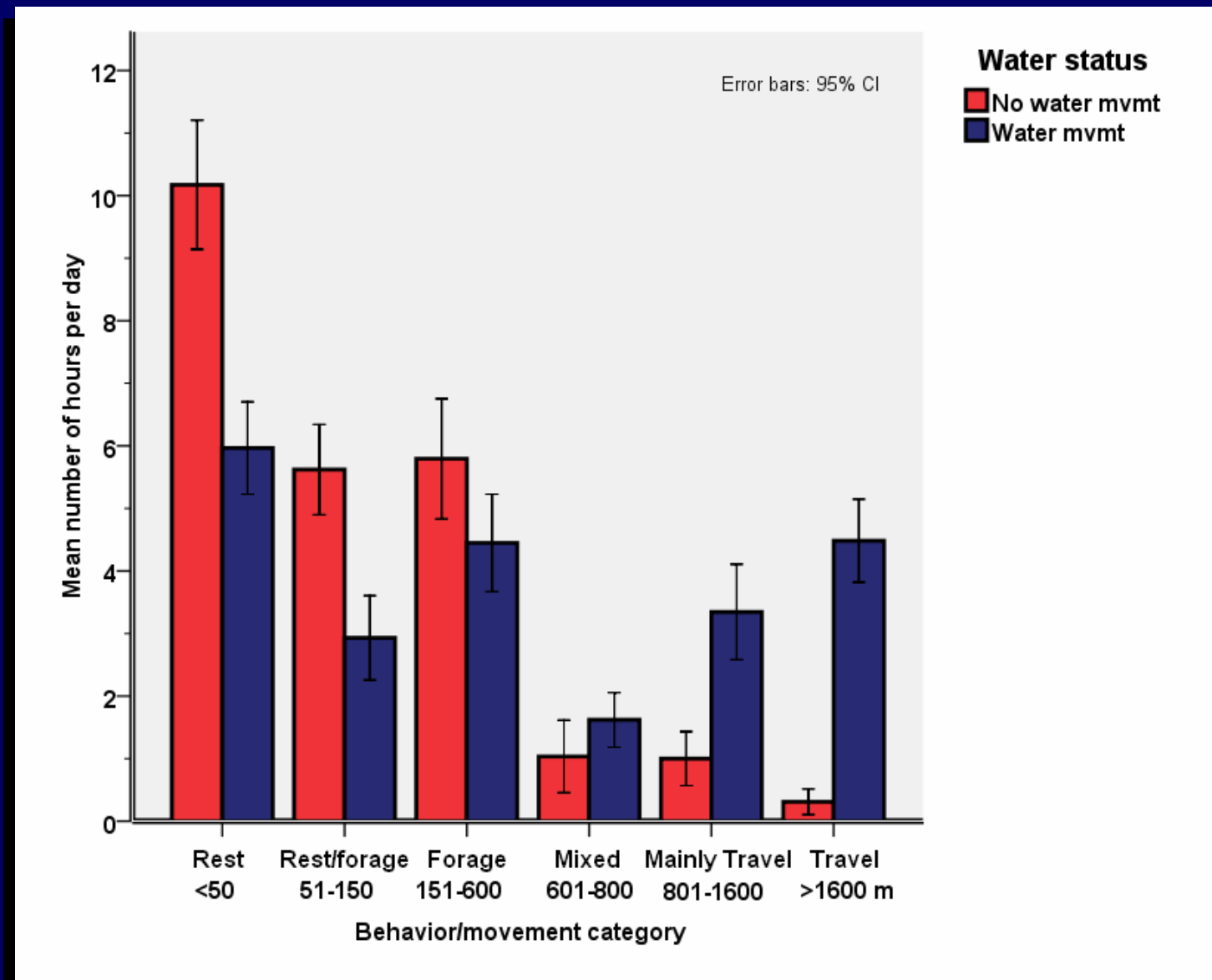


Distance to and from water sources

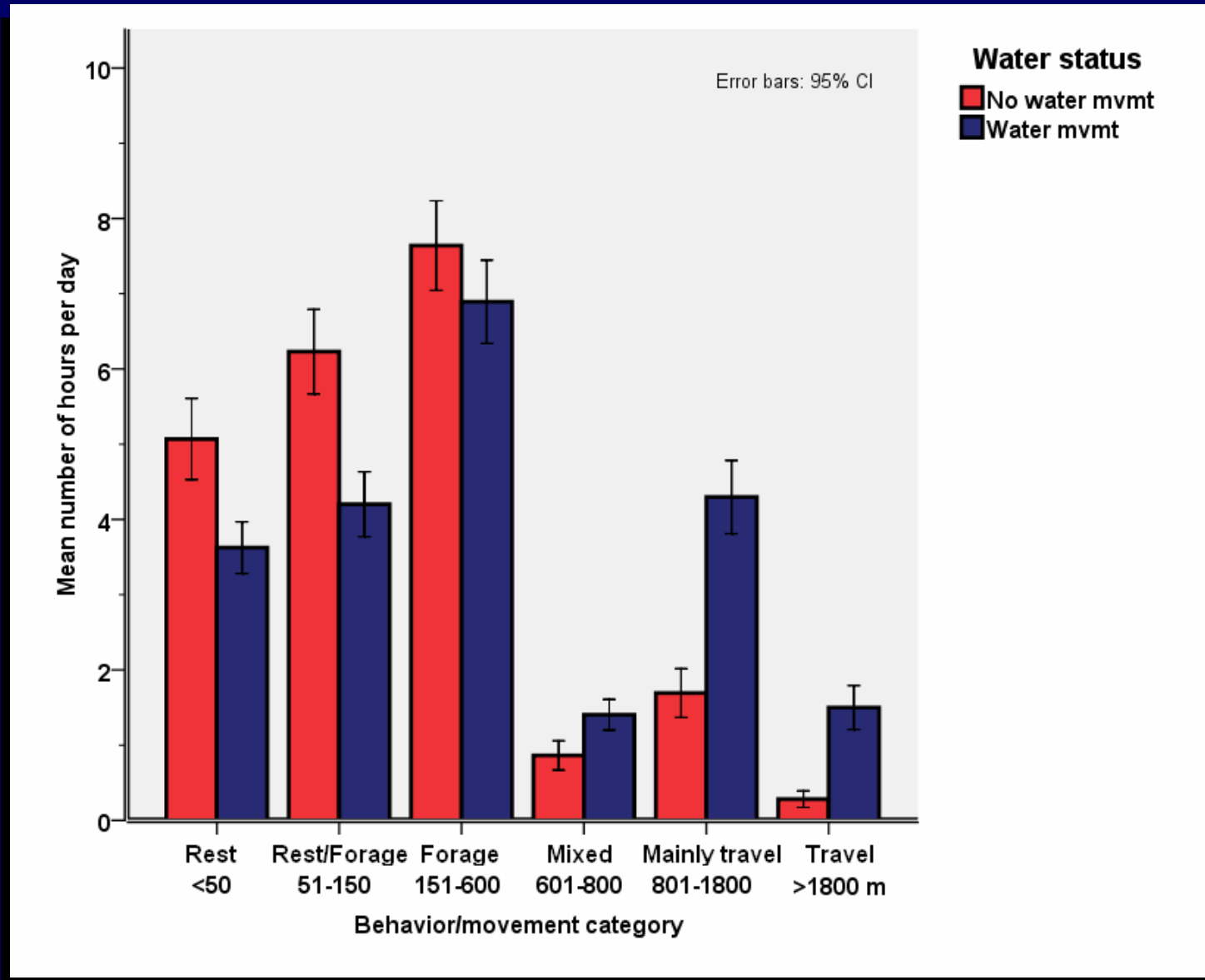
Animal	Dry season	Mean total round trip distance (km) moved to water sources (\pmSD)
Sable-PM	2006	14.8 (3.4)
Sable-PM	2007	15.6 (4.3)
Zebra 141	2006	11.6 (3.1)
Zebra 141	2007	12.8 (1.4)
Zebra 142	2006	5.4 (1.8)
Zebra 142	2007	8.5 (3.5)
Zebra 277	2007	12.2 (3.3)
Zebra 280	2007	15.2 (3.9)



Time cost of water movement sable antelope



Time cost of water movement zebra



Discussion

- **Zebra are more water dependent than sable antelope**
 - **Differences in digestive physiology and diet**
 - Nonselective, bulk grazer (zebra) vs. selective grazer (sable)
 - **Differences in physiological mechanisms for water conservation**
 - Hindgut fermenters generally have higher fecal moisture loss than many ruminants

Discussion

- **Movement distance and time costs**
 - **Use of limited naturally occurring water sources by sable and zebra increases daily movements at the expense of time resting and foraging**
- **Management implications**
 - **Removal of man-made water sources may ultimately benefit rare antelope**
 - If return to “natural” levels of water availability results in lower abundance of more water dependent species, reducing competition and predation risk

Acknowledgments

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