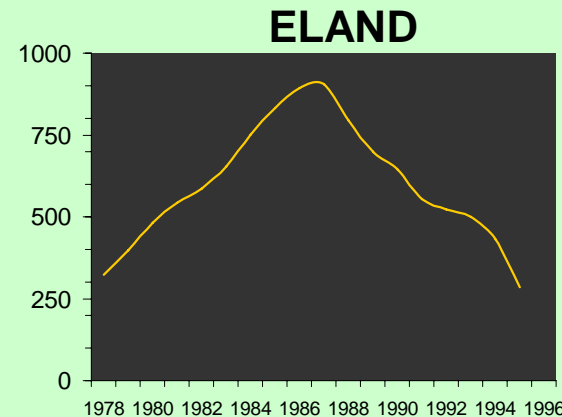
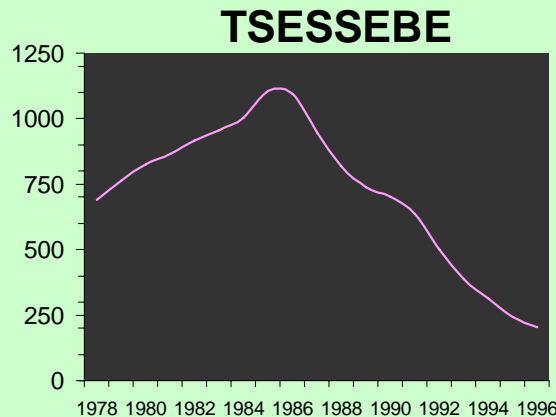
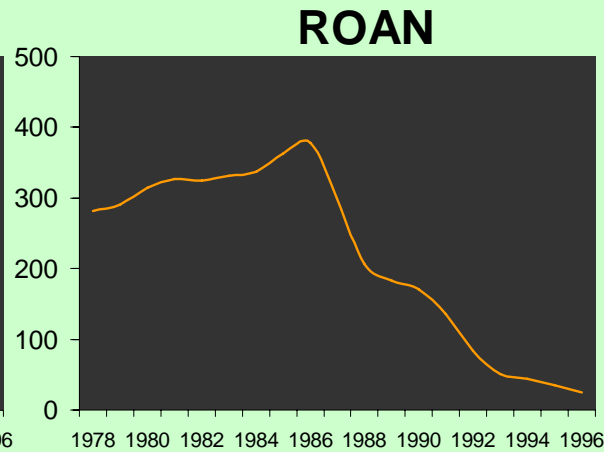
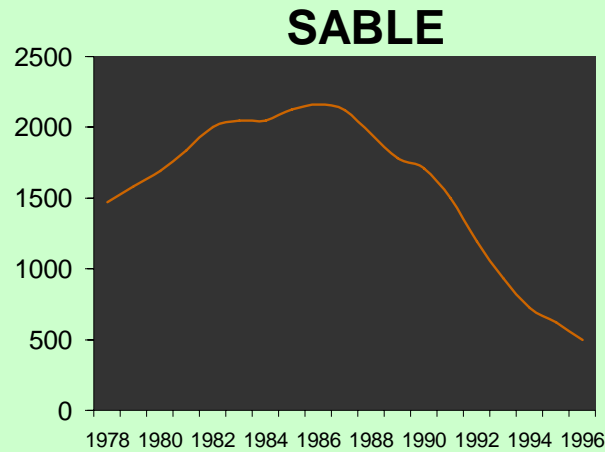


A herd of topi, a type of antelope, is shown in a savanna landscape. The animals are dark brown with white underparts and have long, spiraling horns. They are standing on a dry, dusty ground with sparse vegetation. In the background, there are trees and a hazy horizon. The image is framed by a light green border at the top and bottom.

INDICATORS OF NUTRITIONAL STRESS FROM GPS TRACKING OF ANIMAL MOVEMENTS

Norman Owen-Smith
Centre for African Ecology
University of the Witwatersrand

Rare antelope declines in Kruger Park



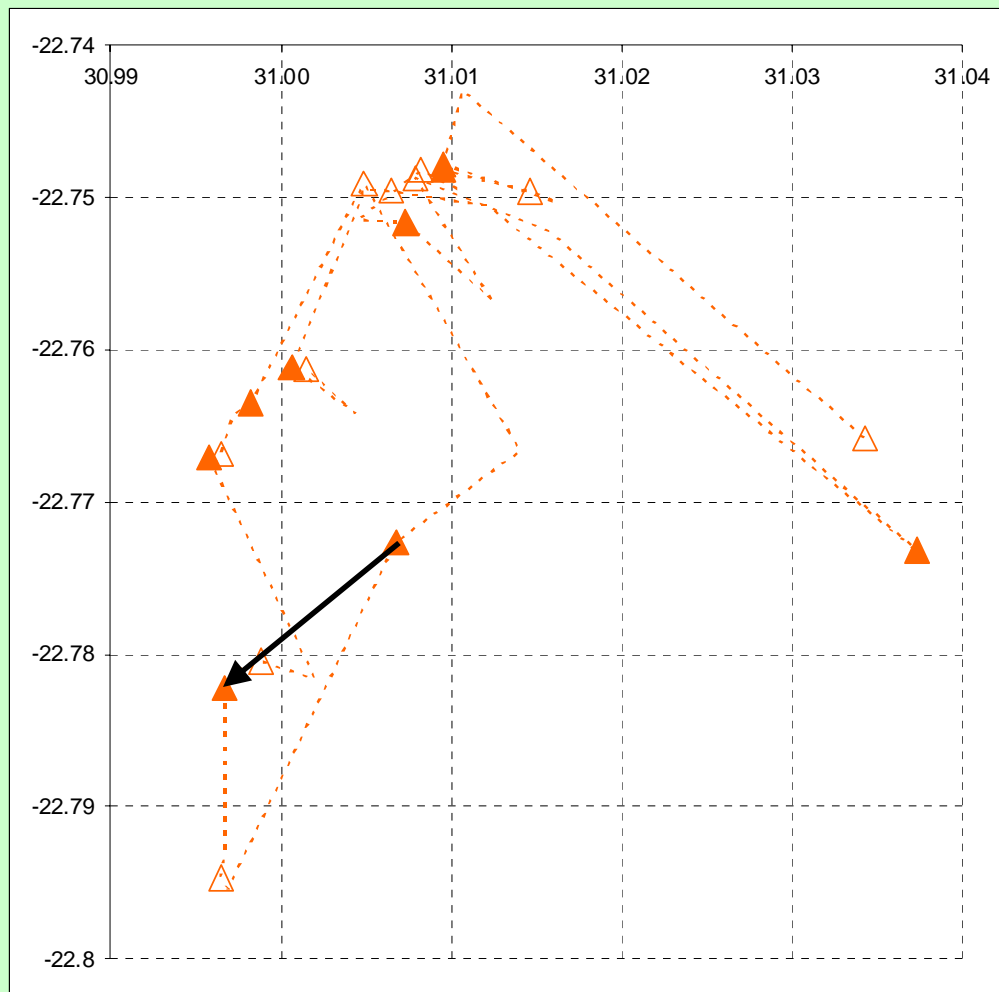
GPS-GSM COLLARS



- GPS location from satellites
- SMS sent to GSM network
- Locations stored at website
- Fixes routinely at 6-hour intervals
 - 8:00, 14:00, 20:00, 02:00
 - Intermittently at 1-hour intervals

BEHAVIOURAL INDICATOR

Diel (24h) displacement between foraging areas on successive days



HYPOTHESES

Stressful conditions → more frequent long moves between foraging areas:

1. *Move more during **dry season** than in wet season*
2. *Move more during **dry years** than in wet years*
3. *Move more than **zebra or buffalo** during adverse periods*

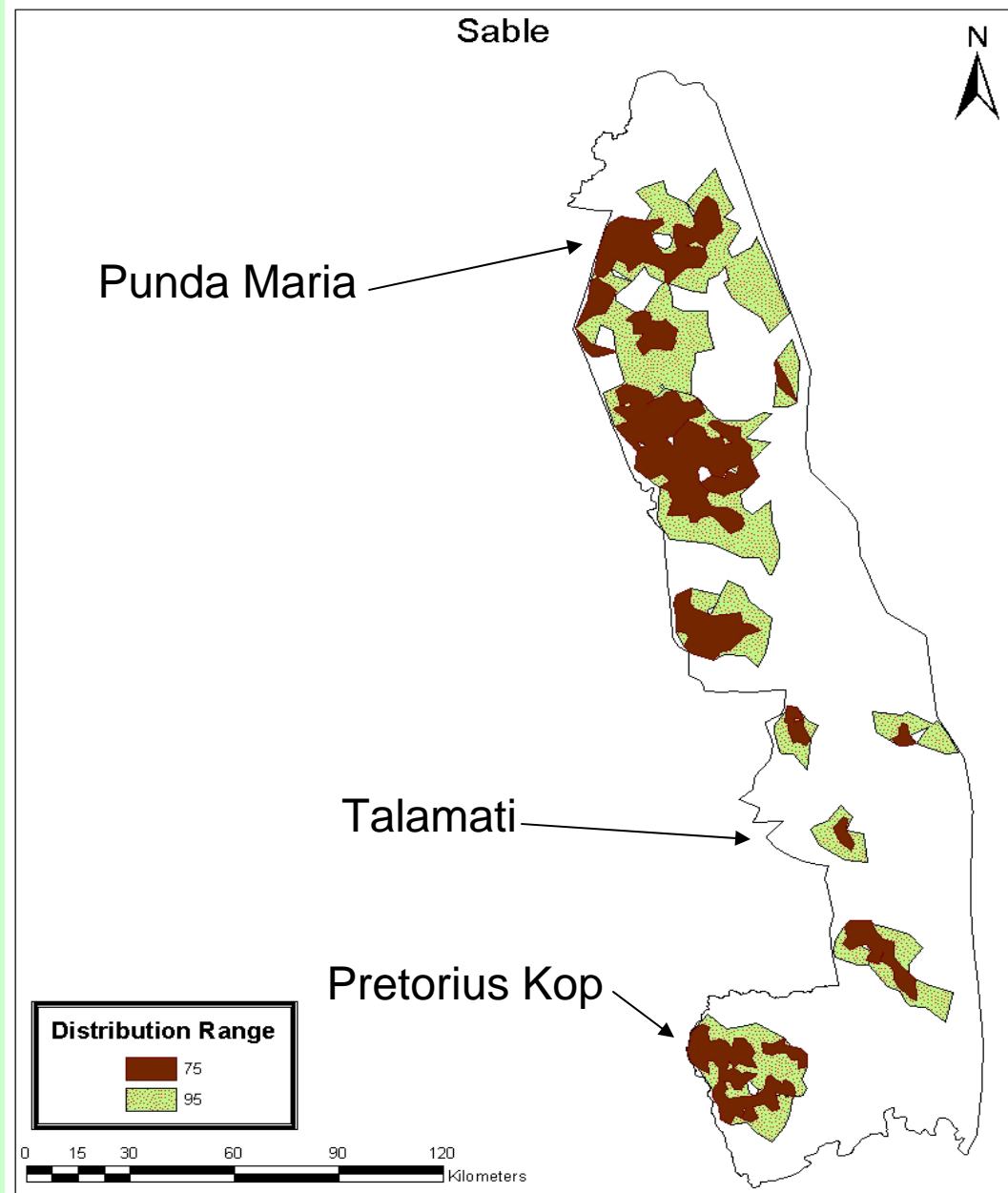
Sampling structure for GPS tracking

comparing species, regions and years

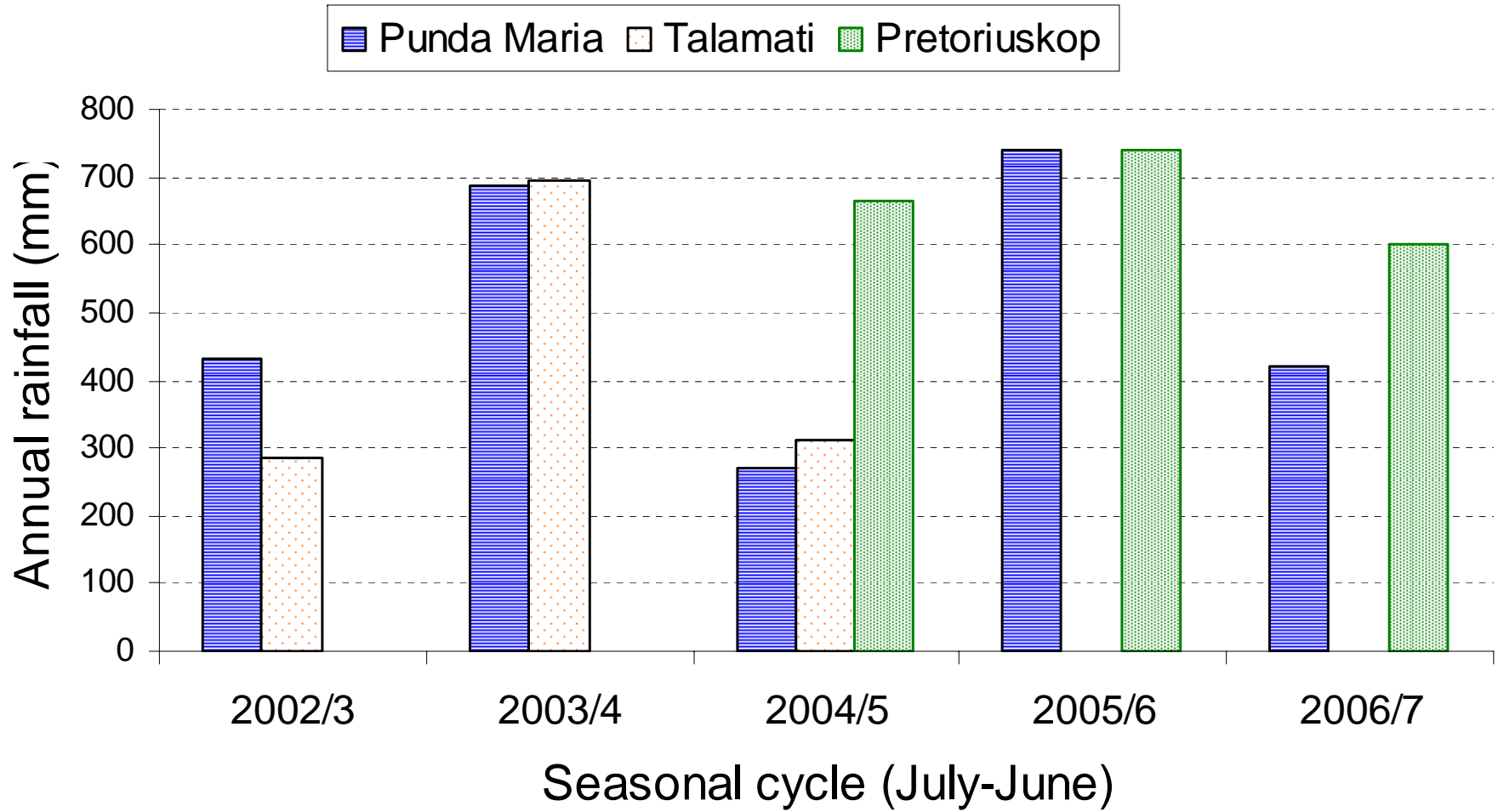


Species	Region	Year		Herds
		Wet season	Dry season	
Sable	Punda (north)	2003/4	2004	1-2
			2006	1
		2006/7	2007	1
	Talamati (central) Pretoriuskop (south)	2007		1
		2004/5	2005	2
		2005/6	2006	4
Buffalo	Punda	2006/7	2007	3-4
		2007/8	2008	2-3
			2006	2
		2006/7	2007	2
		2007/8	2008	1
Zebra	Punda		2006	4
		2006/7	2007	3-5
		2007/8	2008	3

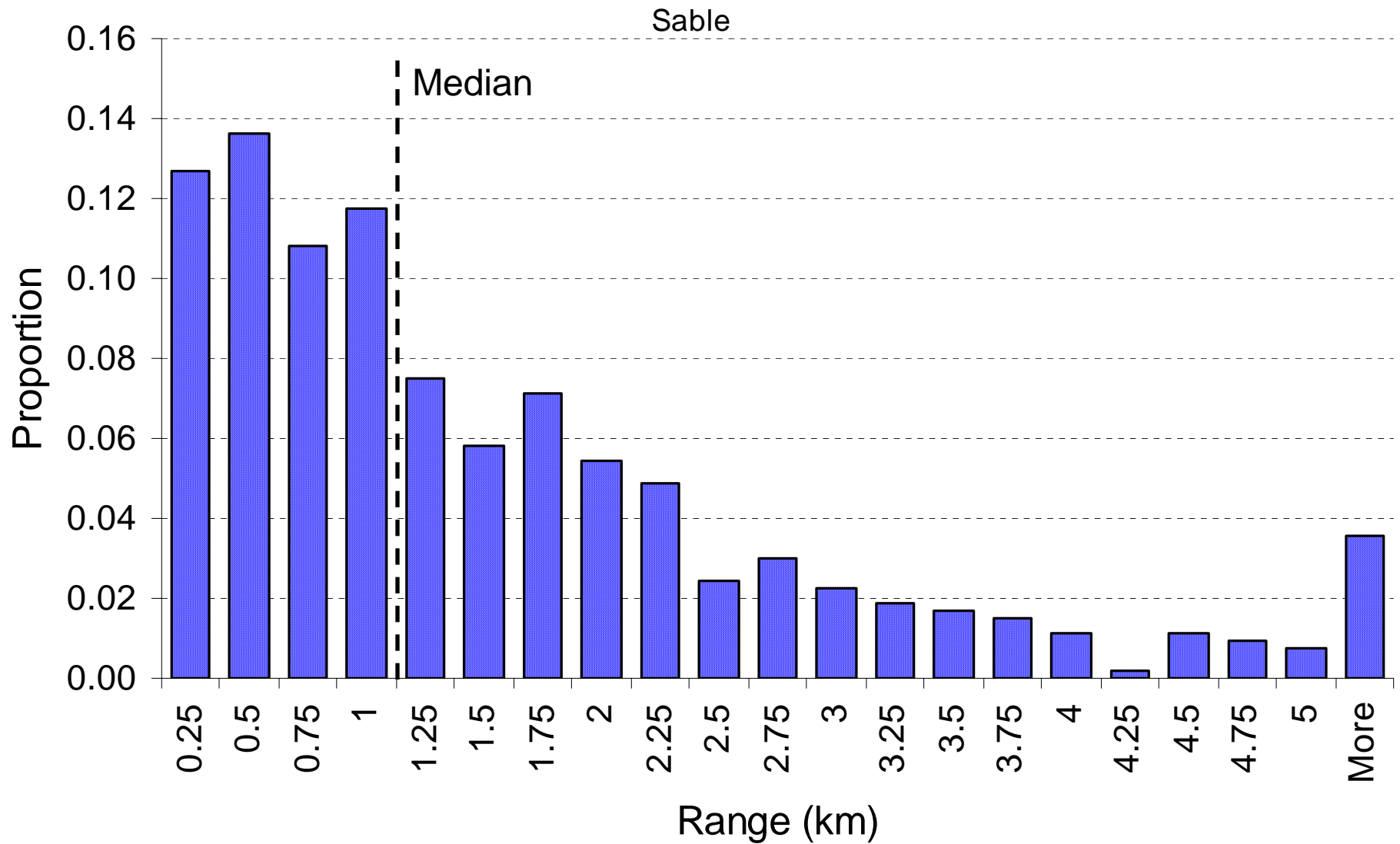
STUDY AREA LOCATIONS



Rainfall conditions

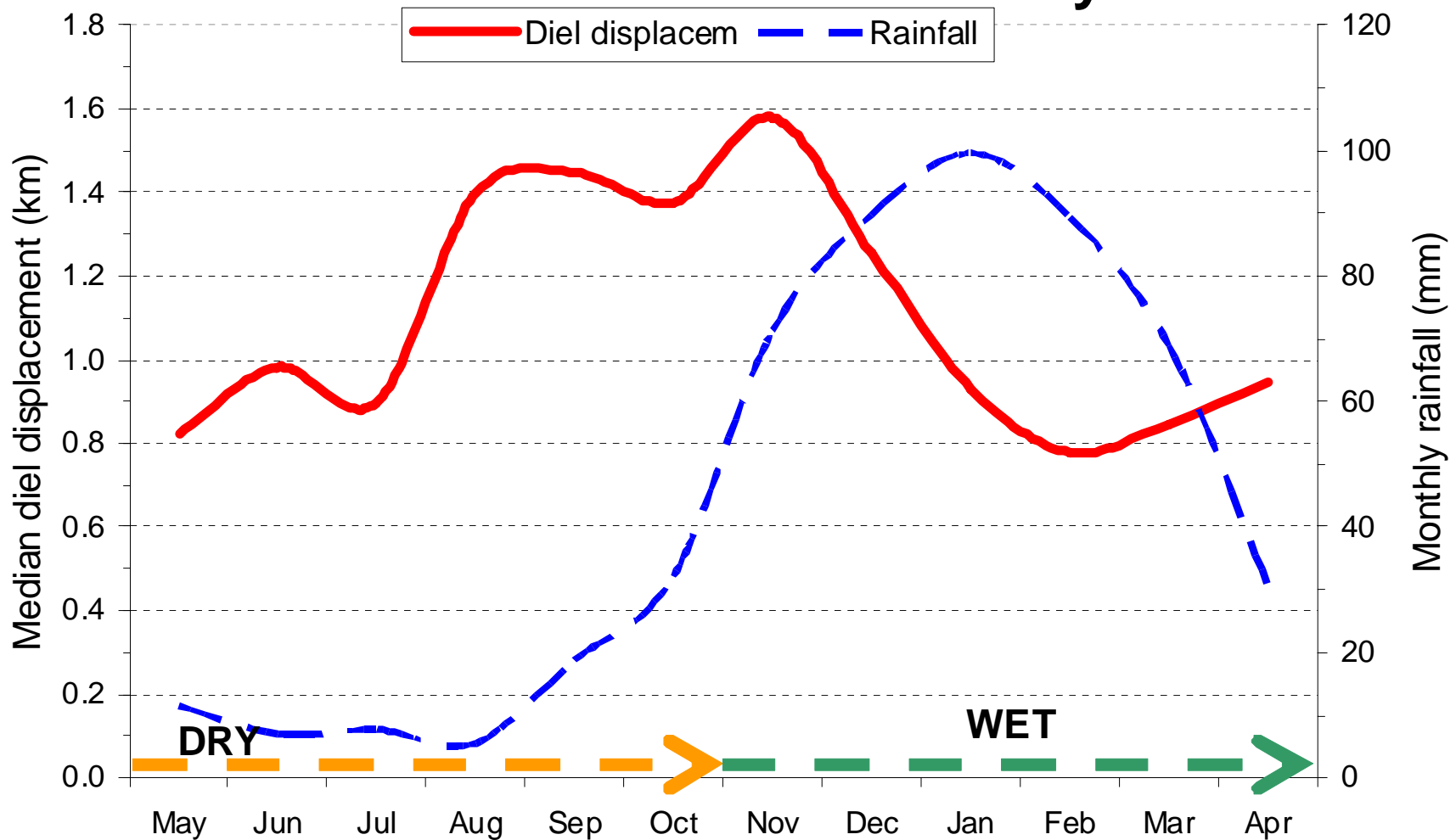


DISPLACEMENT DISTRIBUTION

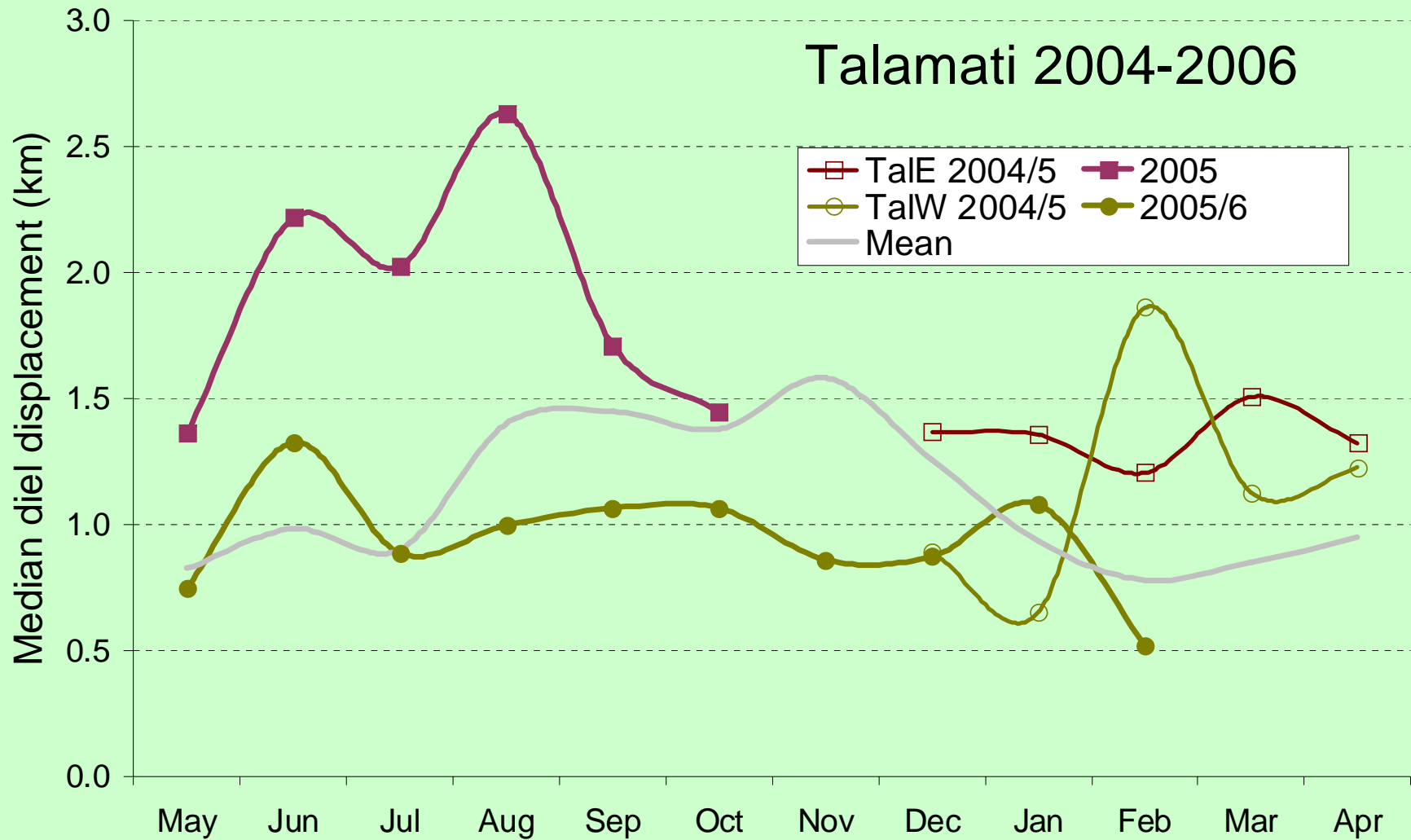


SEASONAL PATTERN

All Sable Herds: Seasonal cycle

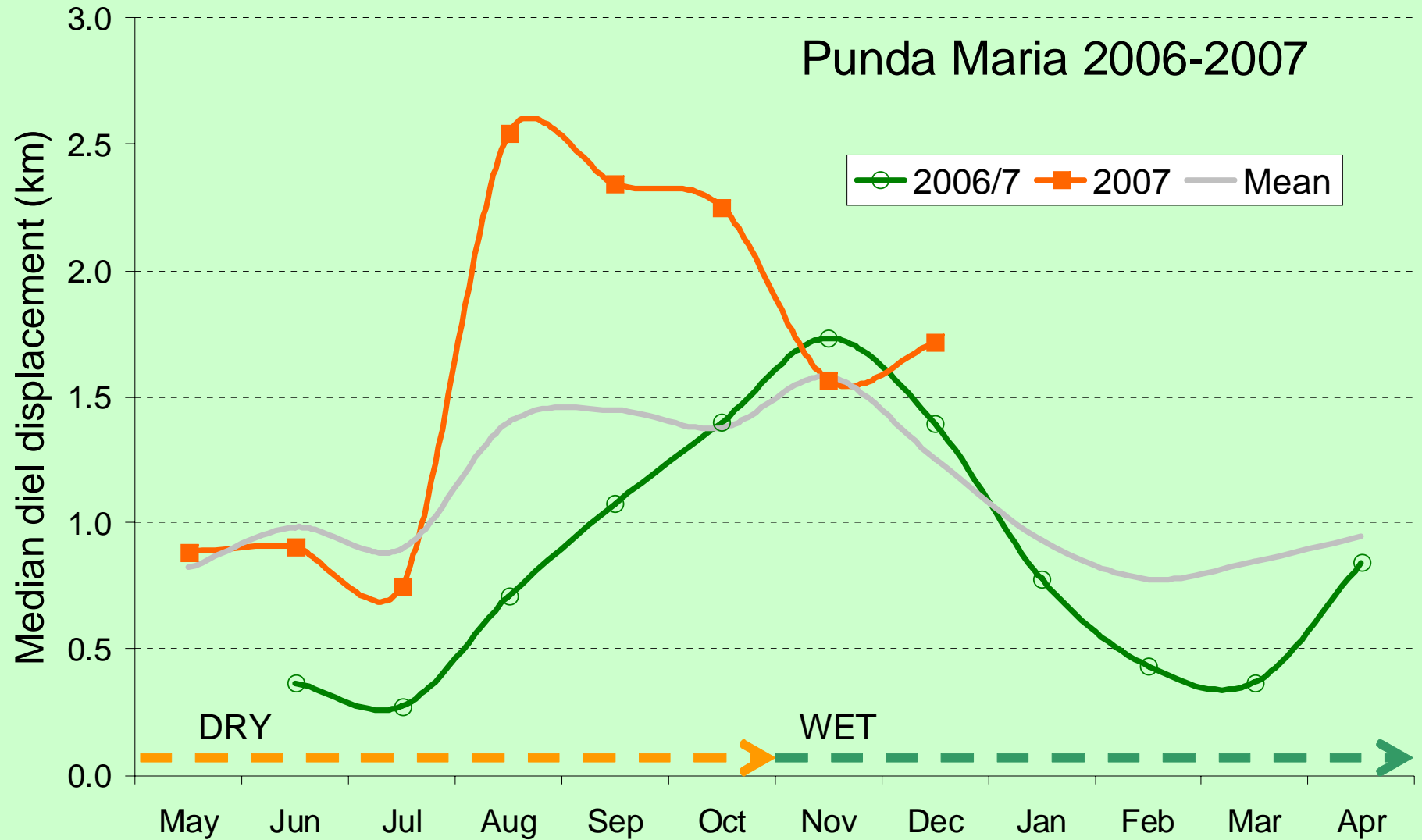


YEAR AND HERD CONTRAST

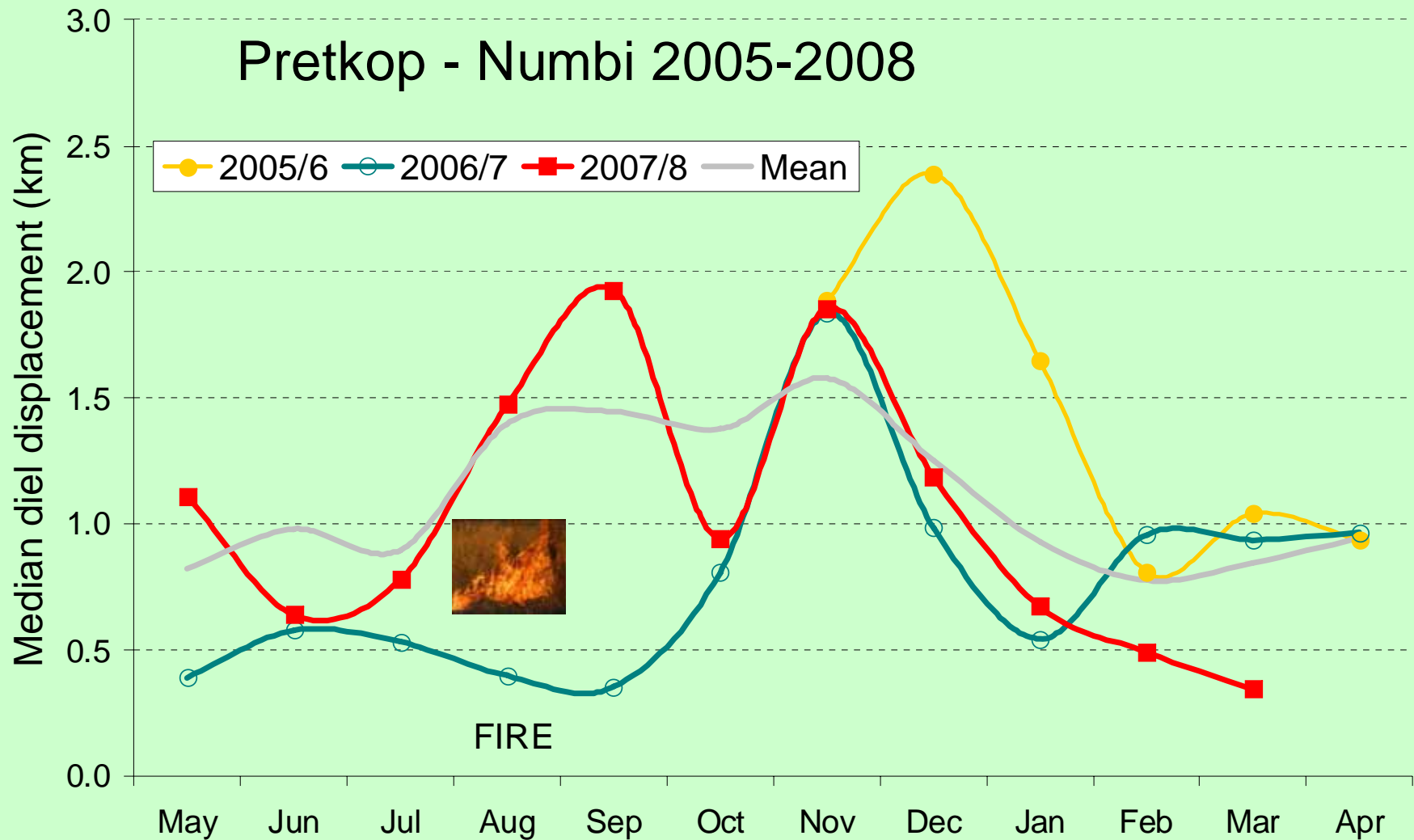


YEAR CONTRAST

Punda Maria 2006-2007

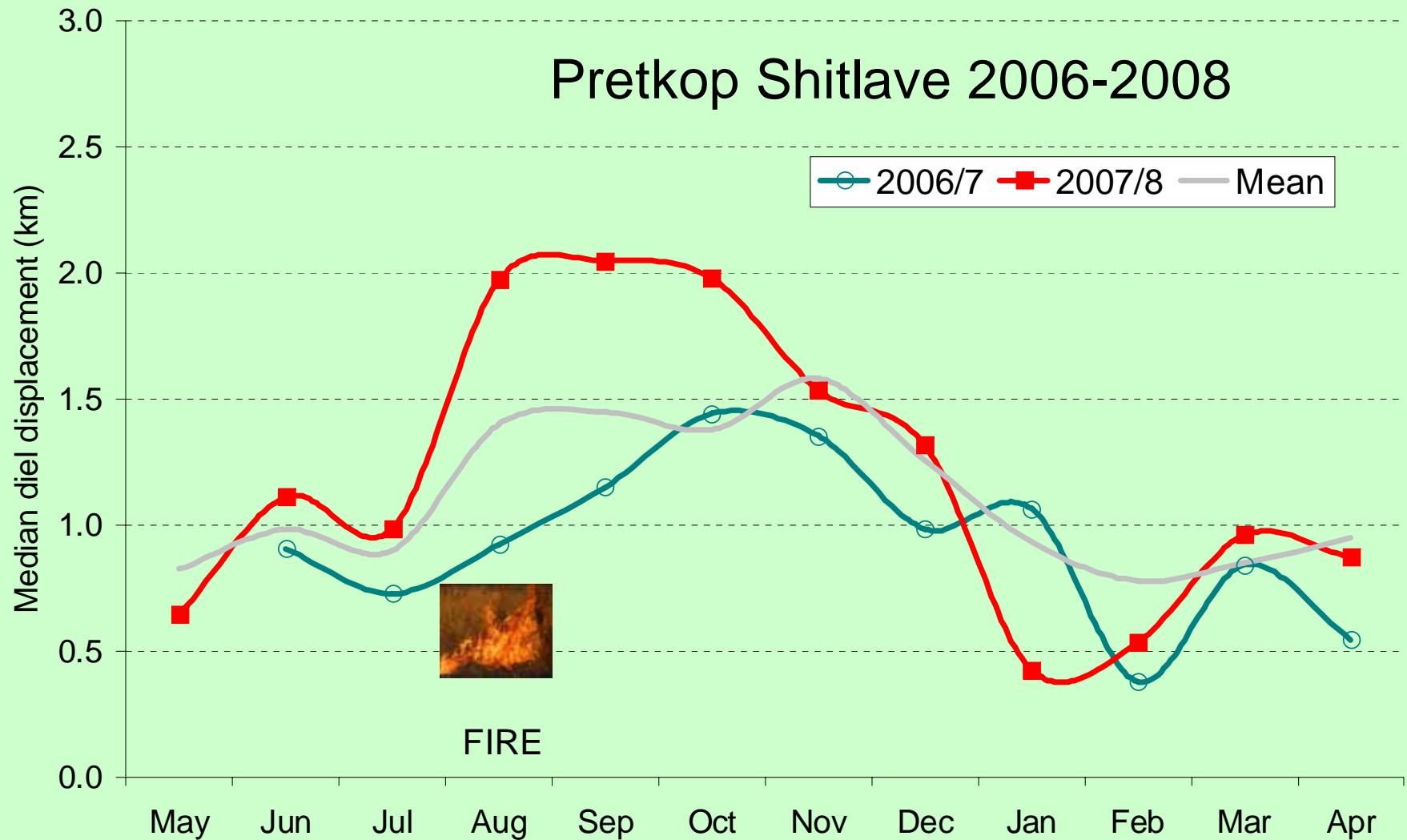


DEVASTATING FIRE



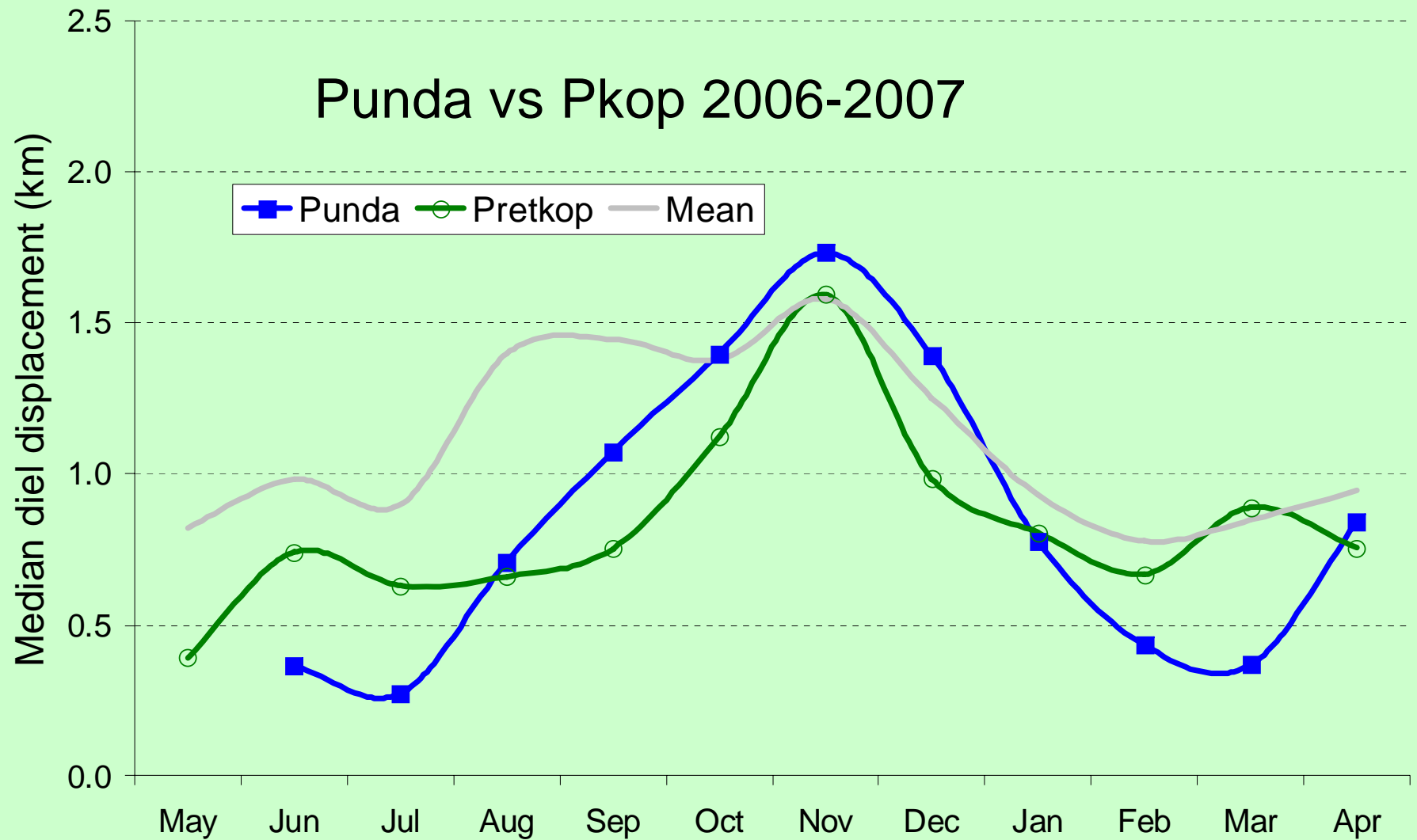
DEVASTATING FIRE

Pretkop Shitlave 2006-2008

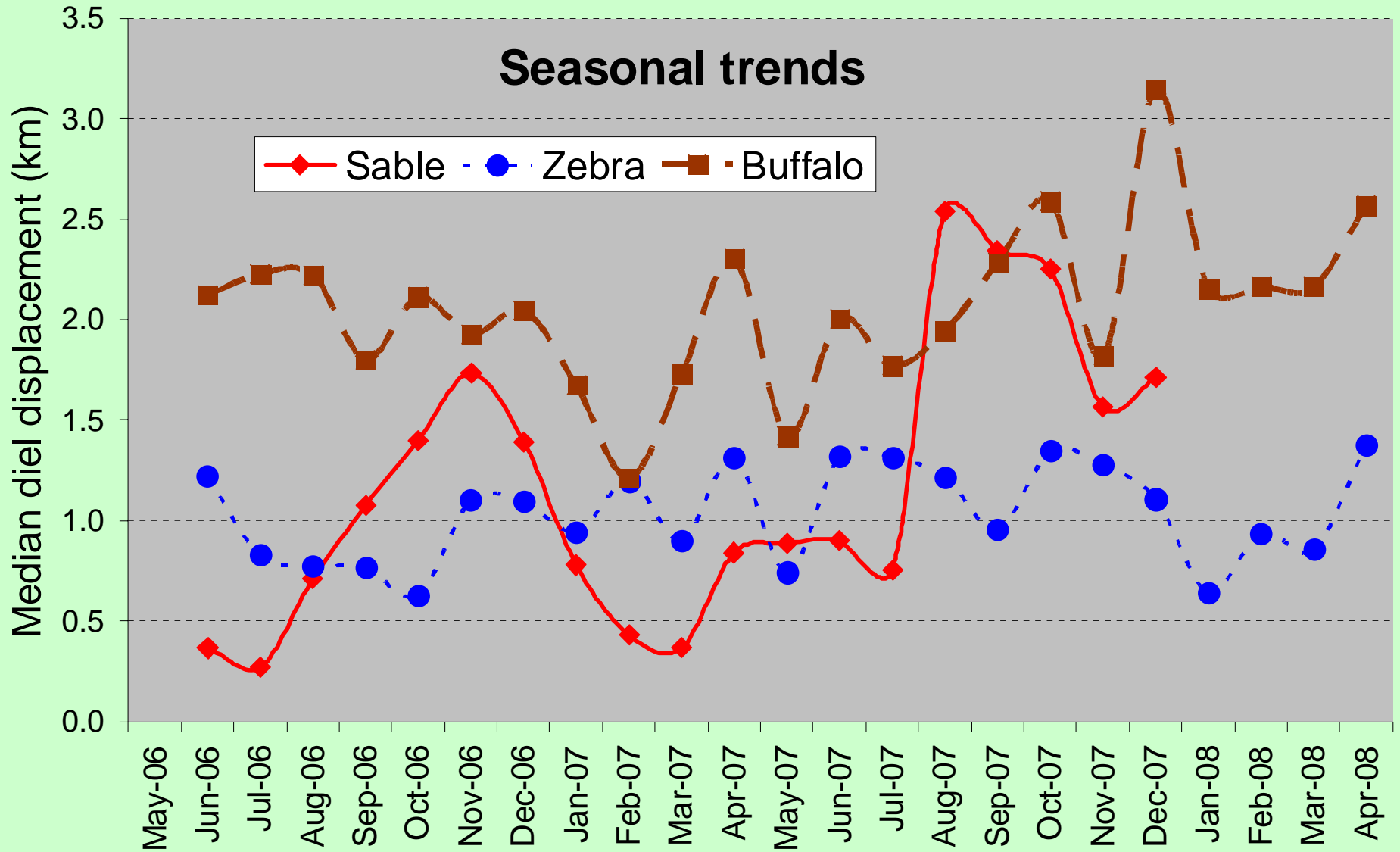


COMPARISON BETWEEN AREAS

(Benign year)



SPECIES CONTRAST



SUMMARY OF FINDINGS

- Sable moved more in the late dry and transitional seasons than in wet or early dry seasons
- Sable moved more during the dry seasons of adverse years than in benign years
- Sable moved more in late dry season after a devastating fire
- Sable moved further in the drier study area than in the wetter study area
- Buffalo and zebra did not obviously show greater movement under adverse conditions

SUMMARY OF FINDINGS

- Sable moved more in the late dry and transitional seasons than in wet season or early dry seasons
- Sable moved more during dry seasons of adverse years than in benign years
- Sable moved more in late dry season after a devastating fire
- Sable moved further in the drier study area than in the wetter study area
- Buffalo and zebra did not obviously show greater movement under adverse conditions

SUMMARY OF FINDINGS

- Sable moved more in the late dry and transitional seasons than in wet season or early dry seasons
- Sable moved more during dry seasons of adverse years than in benign years
- Sable moved more in late dry season after a devastating fire
- Sable moved further in the drier study area than in the wetter study area
- Buffalo and zebra did not obviously show greater movement under adverse conditions

SUMMARY OF FINDINGS

- Sable moved more in the late dry and transitional seasons than in wet season or early dry seasons
- Sable moved more during dry seasons of adverse years than in benign years
- Sable moved more in late dry season after a devastating fire
- Sable moved further in the drier study area than in the wetter study area
- Buffalo and zebra did not obviously show greater movement under adverse conditions

SUMMARY OF FINDINGS

- Sable moved more in the late dry and transitional seasons than in wet season or early dry seasons
- Sable moved more during dry seasons of adverse years than in benign years
- Sable moved more in late dry season after a devastating fire
- Sable moved further in the drier study area than in the wetter study area
- Buffalo and zebra did not obviously show greater movement under adverse conditions

COSTS OF MOVEMENT

- Energy expenditure greater
- Feeding time reduced
- Fat reserves depleted earlier
- Juvenile mortality increased
- Risk of predation elevated

→ *Poor population performance*

WHY ARE SABLE NOT RECOVERING?

*Repeatedly stressed
by
adverse years?*

Grassland deterioration??