

INTERIM REPORT

June 30th, 2007

The effects of translocation on the behavior and habitat use of African elephants

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Co-investigator: Dr. Lynette Hart

Actions taken:

This project monitors translocated elephants at their release site by using radio tracking and behavioral observations in the field, and through obtaining non-invasive hormone samples and analyzing the stress levels post-translocation. Through monitoring the movement patterns, physical state, and behavior of the translocated elephants in their new habitat, and comparing them to the local elephant population in Tsavo East, this study provides valuable conservation and management information regarding the factors contributing to successful translocations.

Translocation:

Stage 1: 150 elephants were translocated in September 2005 from Shimba Hills and Mwaluganje Elephant Sanctuary in Kenya to Tsavo East National Park (see map 1). 15 elephants: 12 females and 3 bulls were collared with GPS –VHF collars (see picture 1). All elephants were marked with white numbers and yellow zip ties (see pictures 1 and 5). The age and sex structure of the elephants translocated in this first stage can be seen in appendix I.

Stage 2: 78 more elephants were translocated in October 2006 from Shimba Hills and Mwaluganje Elephant Sanctuary to Tsavo East National Park. 2 GPS –VHF collars were deployed during this stage.

Monitoring:

Translocated elephants from the first stage were monitored for a year post translocation. An average of 82 locations for each collared individual was obtained through tracking from ground (picture 4) and air. Further monitoring from the ground provided information about the fate of 116 of the 150 elephants (see results below). Translocated elephants from the second stage are currently being monitored in Tsavo East by field researchers that were trained by the PI while conducting her field work.

Note: Funding for radio collars and aerial surveys was provided by the Kenya Wildlife Service and the translocation itself (both stages) was funded by the Kenya government.

Retrieving collars:

All collars are due to drop off in July 31st 2007 and preparations for their retrieval are currently underway.

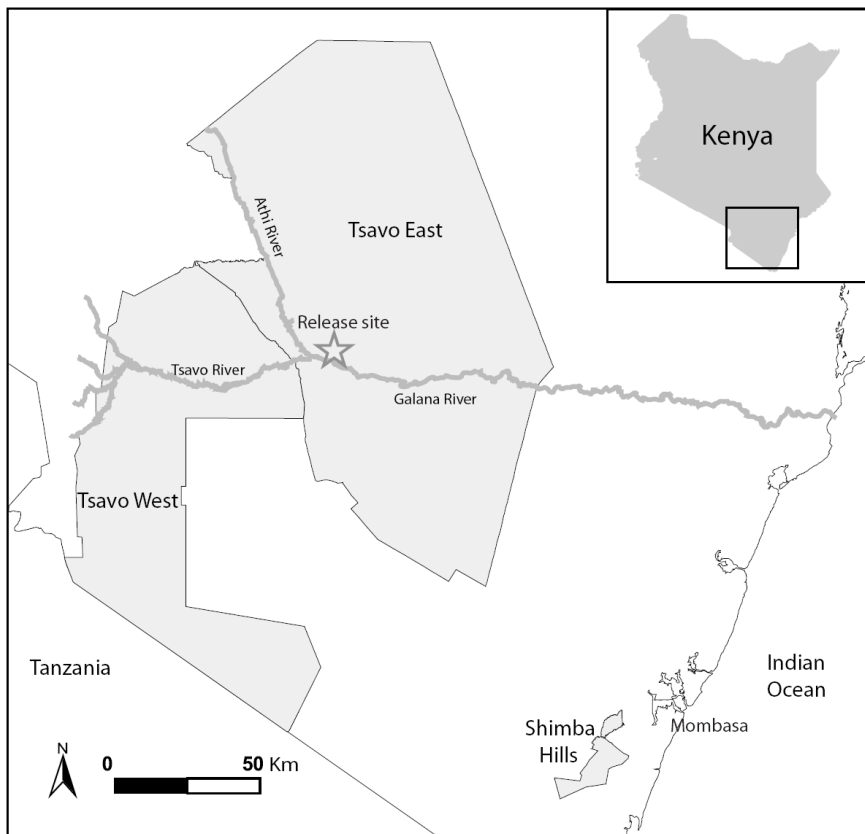
Data analysis:

The PI returned to UC Davis earlier this year to begin analyzing data and write papers. Preliminary data analysis (provided below) has been conducted. Three scientific papers are currently at different stages of preparation.

Hormone analysis of the dung samples, collected to measure stress levels post translocation, is currently being conducted by Sam Wasser's Lab at the Center for Conservation Biology at the University of Washington. Analysis should be completed by September 2007.

DNA analysis from samples taken during the translocation is currently underway at the Veterinary Genetics Lab at UC Davis. These samples will be used to assess the relatedness of individuals translocated in the same group and the effects of this relatedness on their behavior post translocation. The DNA analysis should be completed by August 2007.

Map 1: map of field site. Inset indicates location of field site within Kenya; light gray polygons represent the protected areas Tsavo East, Tsavo West, and Shimba Hills with Mwaluganje Elephant Sanctuary to the north; dark gray lines represent permanent rivers; release site is marked with a star.

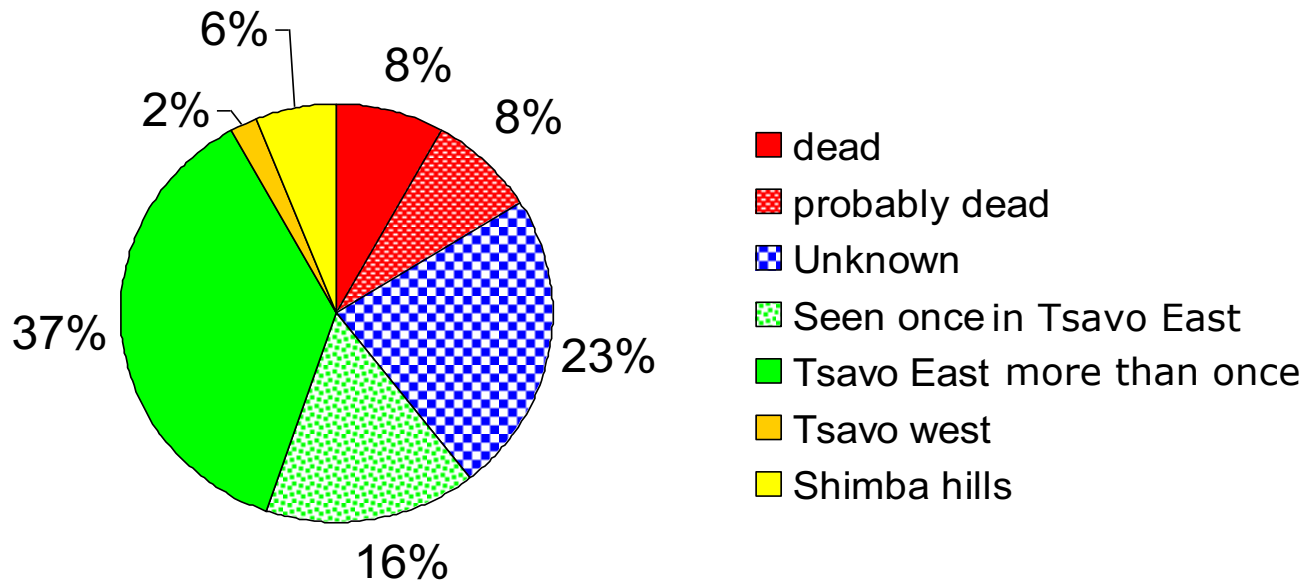


Preliminary Results:

Fate of the translocated elephants:

Of the 150 elephants moved in the first stage of the translocation, the fate of 116 is known (see figure 1). 12 elephants died during or after the translocation. 12 calves are presumed dead since they were never seen with their mothers in Tsavo East during the post-translocation monitoring. 9 elephants returned to Shimba Hills, 3 moved to Tsavo West and the remaining 80 elephants were seen at least once in Tsavo East (see figure 1). Of the 78 elephants translocated in the second stage of the translocation, 2 adult elephants died, 35 elephants were seen in Tsavo East at least once, and the fate of the remaining 42 elephants from this second stage is currently unknown.

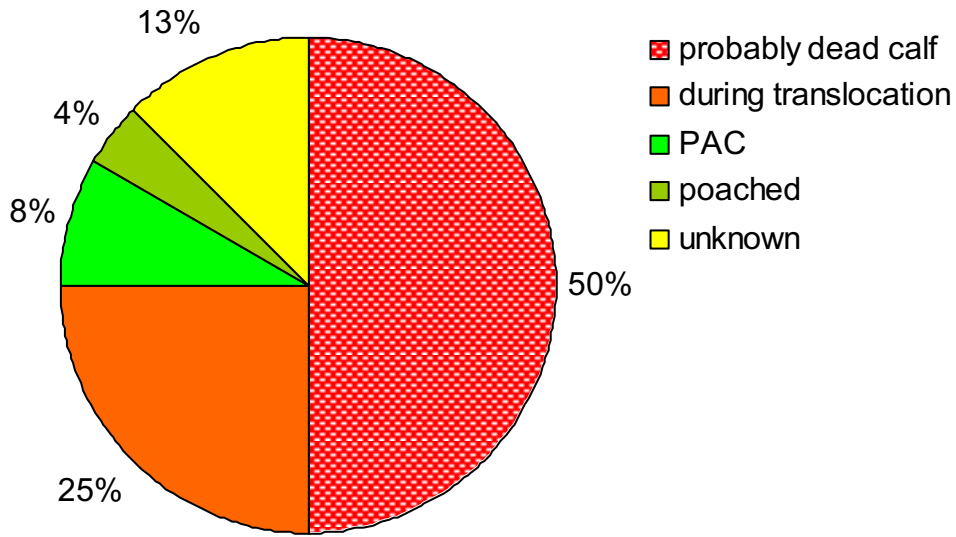
Figure 1: Fate of the translocated elephants (N=150).



Mortality:

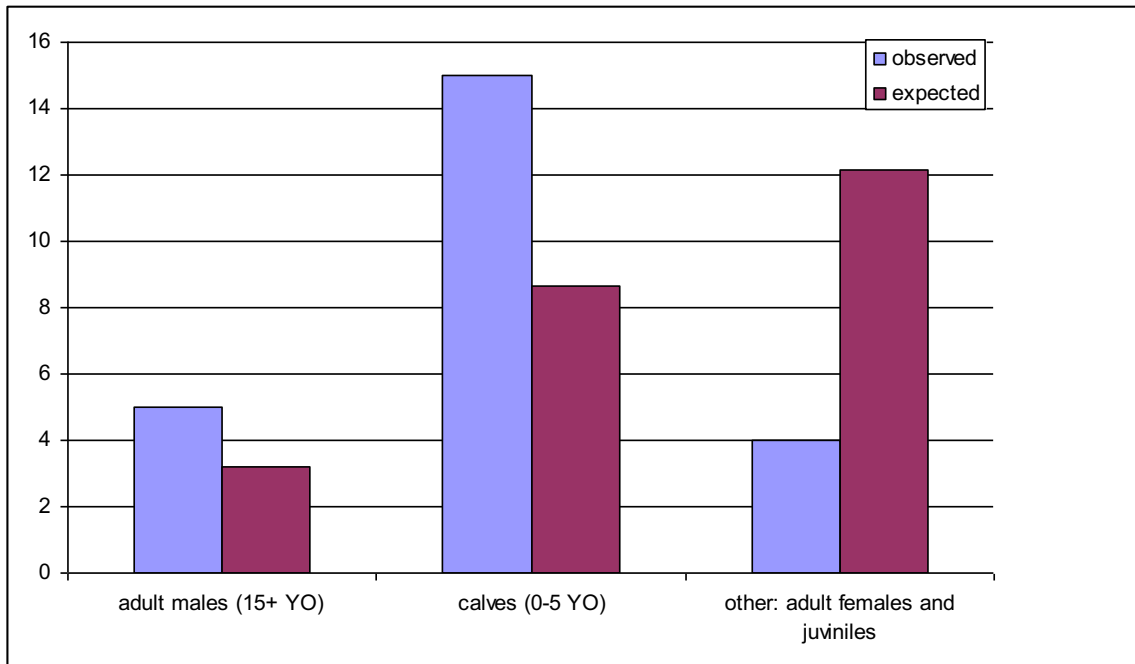
Of the 24 elephants that died in the first stage of the translocation, 6 died during the translocation and 12 calves are presumed dead. One translocated male was poached by a local villager who used a poison dart, probably to protect his field, and not for ivory, since the tusks were in place. Two bulls walked to the coast, where they entered human settlements and were shot by Problem Animal Control (PAC). The cause of death of three other individuals whose carcasses were found in Tsavo East is unknown (see figure 2). The two adult elephants from the second stage of the translocation that died were shot by PAC while entering human settlements.

Figure 2: Cause of death (N=24).



More adult males and young calves died than expected. Expected values were calculated according to the proportion of adult males, females, and calves within the translocated elephant population whose fate is known (this analysis was conducted only for the first stage of the translocation). (Chi square, $P < 0.01$, see figure 3)

Figure 3: Observed and expected mortality rates of three age and sex classes. Chi square $P < 0.01$.



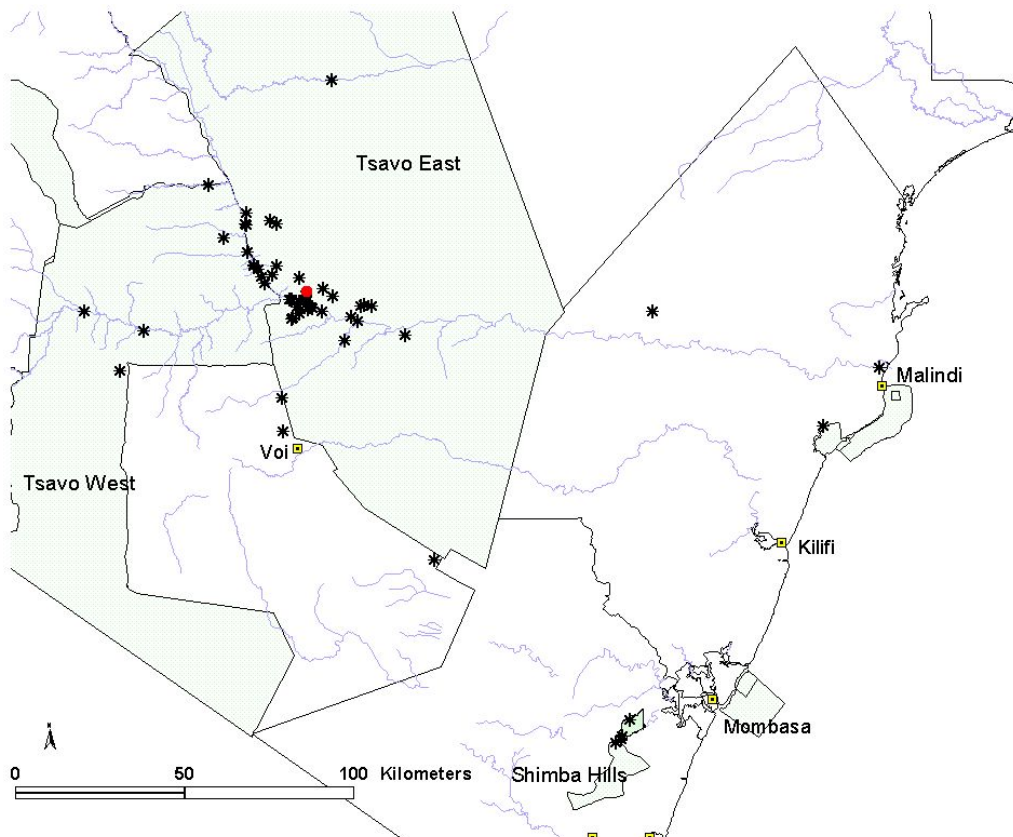
Movement patterns:

Overall, the translocated elephants dispersed widely from the release site (Map 2). 8 elephants left Tsavo East and either returned to Shimba Hills (Map 3) or went to the coast (Map 4). More males than expected rejected the release site (Chi square $P < 0.01$, see table 1). One of these elephants was shot by the KWS PAC unit upon reaching the coast and his collar was retrieved (the path he took can be seen in Map 4).

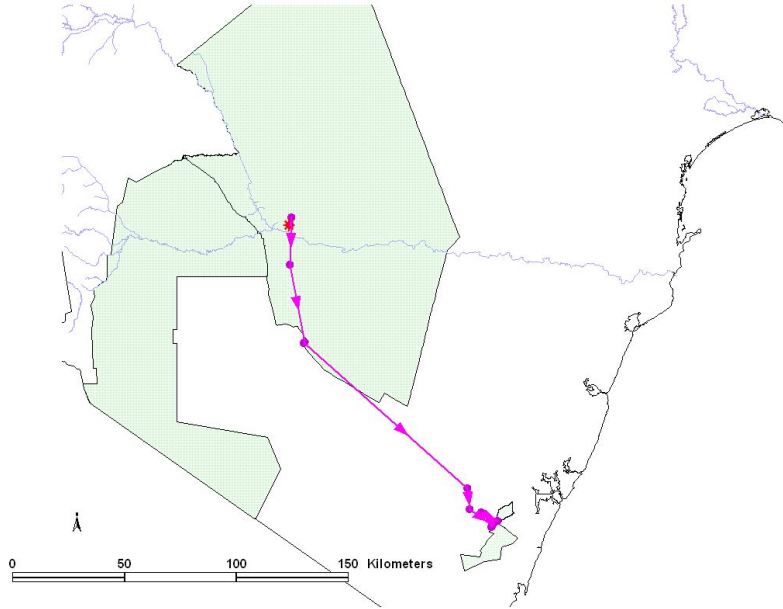
The ranging patterns of the collared elephants that did not reject the release site varied greatly as can be seen in the minimum convex polygon of their locations (Map 5). Some elephants retained small home ranges in the proximity of the release site while others explored widely, traversing much of Tsavo East and West. No correlation was found between group size or matriarch age and the amount of exploration exhibited. However, a strong correlation was found between boldness (exhibited by the minimum distance to observer) and exploration patterns. This correlation can be used when targeting individuals for future translocations (manuscript in preparation).

Further GIS analysis is currently underway to determine the effects of certain habitat features (vegetation type, water sources, and hills) on the settlement preferences of the translocated elephants to provide recommendations for future release sites.

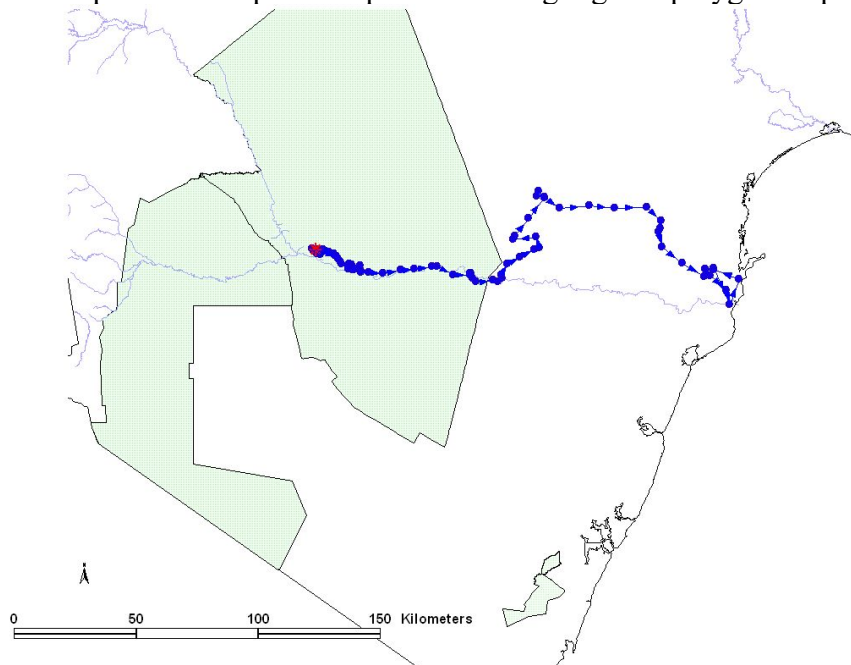
Map 2: Most recent location of all observed translocated elephants (collared and non collared). The red dot represents the release site. Black asterisks represent the location of one or more translocated elephants (groups seen at the same location are represented by only one asterisk). Light green polygons represent protected areas and blue lines represent rivers.



Map 3: The path of a translocated collared female elephant and her calf that rejected the release site. This female's movements were monitored closely shortly after her release. Pink dots indicate locations obtained during air and ground surveys and the line with arrows connecting them represents a possible path taken. Light green polygons represent protected areas.



Map 4: The path of a translocated collared male elephant that rejected the release site. This male was shot by PAC upon reaching the coast and his collar was retrieved. Blue dots indicate locations downloaded from his collar and the line with arrows connecting them represents the possible path taken. Light green polygons represent protected areas.



Map 5: Minimum Convex Polygons (MCP) of collared translocated elephants that did not reject the release site. Each empty polygon represents the 100% MCP of a different collared individual. Light green polygons represent protected areas and blue lines represent rivers.

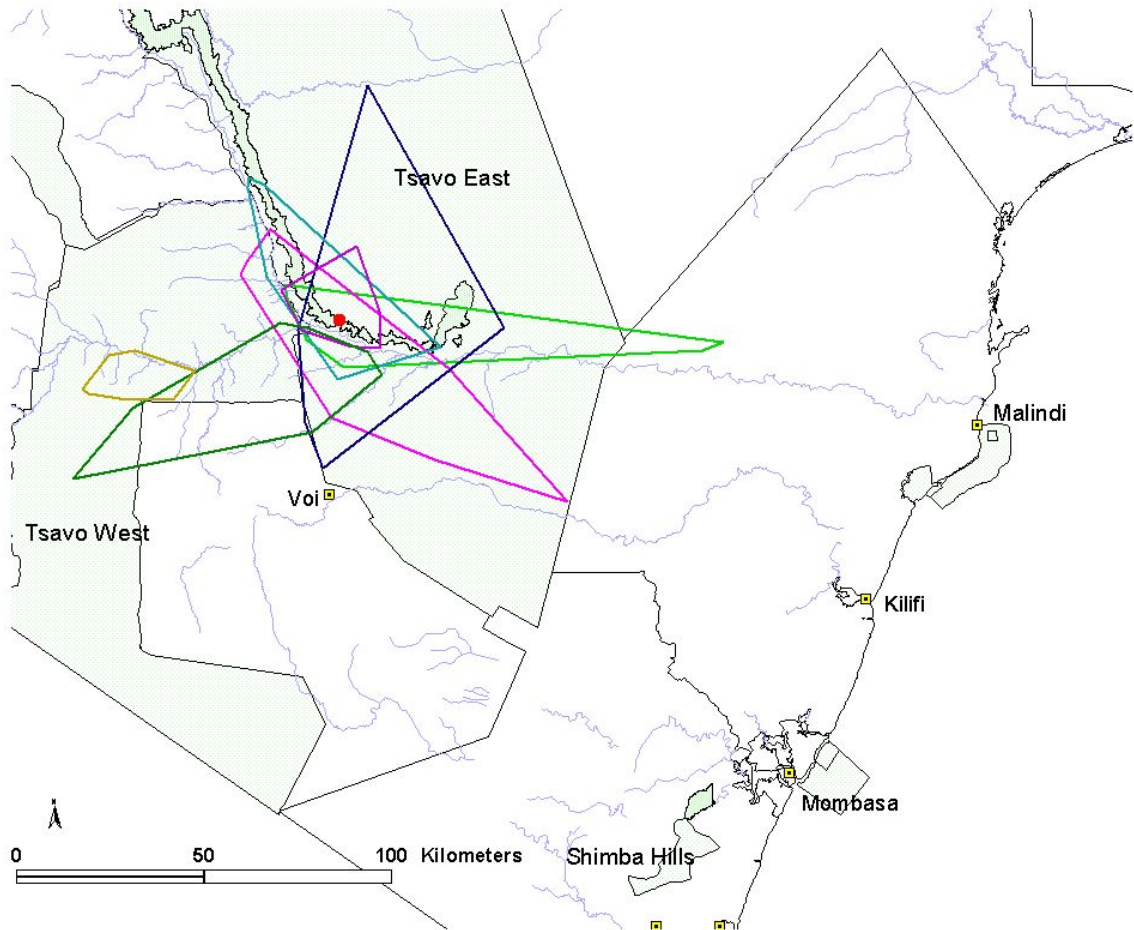


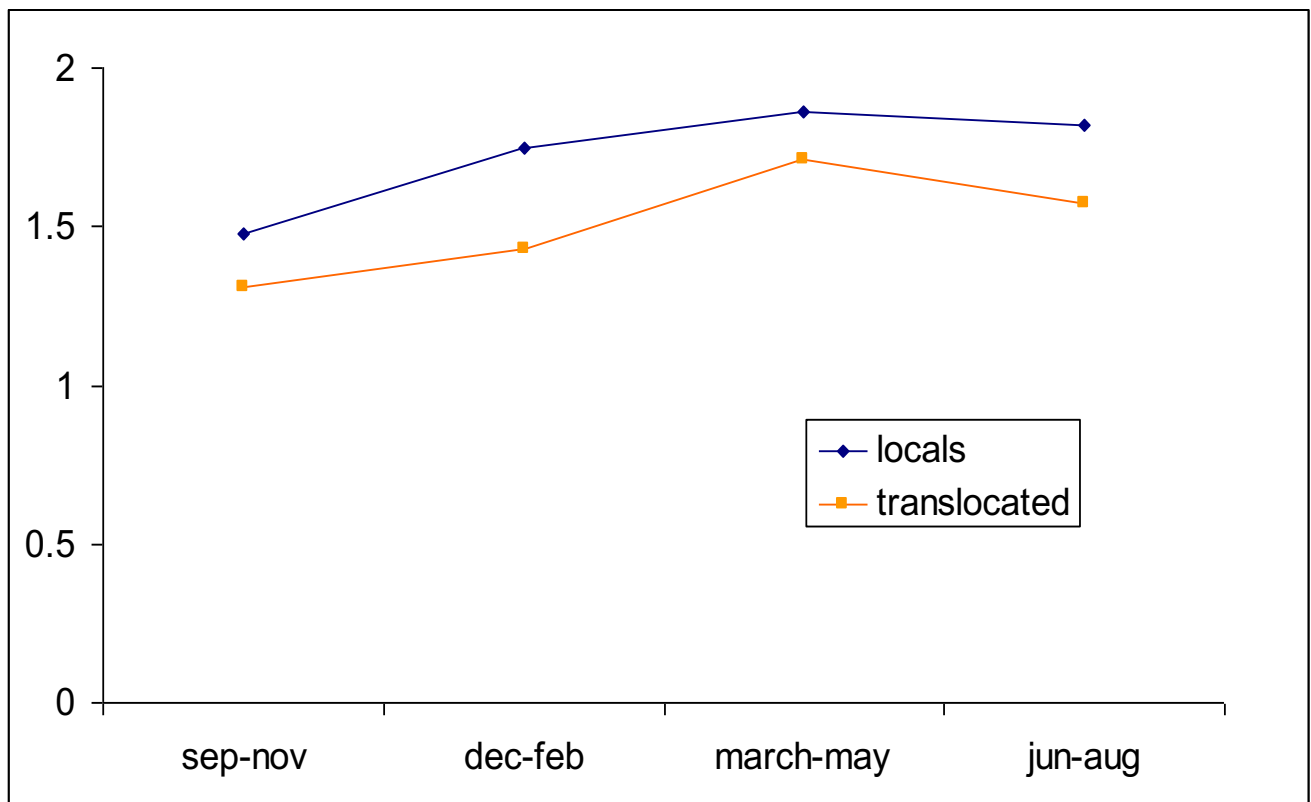
Table 1: Return to Shimba Hills: more males than expected chi square $P < 0.01$

Back to Shimba Hills or coast:	Observed	Expected
adult males:	4	1.100917
females and calves:	4	6.899083

Physical state:

Preliminary analysis of the physical state scores obtained during the ground observations indicates that translocated elephants are not as physically fit as the local Tsavo population (Figure 4). No convergence between the two populations is seen over time. This data will be supplemented when the hormone analysis will be completed, in fall 2007. The hormone analysis will provide information about stress levels, a physiological measure exhibited by cortisol levels. Results from the hormone analysis might provide an understanding of the underlying causes for the difference between these two populations.

Figure 4: Physical state measured as described in Wemmer et al (2006)¹ for translocated and local Tsavo elephants seen during ground surveys. Scores are averaged across each population and binned by season.



¹ Wemmer C., V. Krishnamurthy, S. Shrestha, L.A. Hayek, Myo Thant, and K.A. Nanjappa. 2006. Assessment of Body Condition in Asian Elephants (*Elephas maximus*) *Zoo Biology* 25:187–200

Updated Time Line:

Start date: August 2005

August 2005 – September 2005 - 1st phase of translocation – **completed**

October 2006 - 2nd phase of translocation – **completed**

August 2005 – December 2006 - post-translocation monitoring – **completed**

January 2007 – September 2007 – data analysis, hormone (fecal samples) analysis, and DNA analysis – **currently underway**

May 2007- June 2008 – completion of data analysis, and writing publications – **currently underway**

End of Study: June 2008

Overall time line of PI's PhD:

F = Fall quarter – October - December

W = Winter quarter – January - March

SP = Spring quarter – April - June

SU = Summer quarter – July – September

Year	03	2004				2005				2006				2007				2008	
Quarter	F	W	SP	SU	F	W	SP	SU	F	W	SP	SU	F	W	SP	SU	F	W	SP
Preparation (in the US):																			
course work	■	■	■	■	■														
Preliminary exam				■															
qualifying exam							■												
Field work (in Kenya):																			
Preliminary organizational trip				■															
field work set up							■	■	■										
1st stage of translocation								■	■										
2nd stage of translocation													■						
post-translocation monitoring									■	■	■	■	■						
Analysis and Completion (in the US):																			
hormone analysis in lab																			
DNA analysis in lab																			
data analysis																			
writing thesis and papers																			

Pictures:

Picture 1: translocating an elephant in Mwaluganje Elephant Sanctuary (note the collar on neck and yellow zip tie on tail)



Picture 2: transferring a translocated elephant to the loading site in Mwaluganje Elephant Sanctuary



Picture 3: releasing the translocated elephants in Tsavo East National Park



Picture 4: Monitoring the translocated elephants in Tsavo East through radio tracking from the ground



Picture 5: translocated elephants drinking and feeding on the Athi River in Tsavo East National Park two months after release (note the number 7 on hind and the zip tie on tail)



Appendix I: age and sex structure of translocated elephants:

Age:	FEMALES														female total	MALES										male total	total all
	0-1	1-2	2-3	3-4	4-5	5-8	8-10	10-15	15-20	20-25	25-30	30-35	35+	0-1		1-2	2-3	3-4	4-5	5-8	8-10	10-15					
GROUP C						1	1					1								2	2	5					
GROUP F				1					1	1			1			2		1			4	8					
GROUP H			1				1			1			1		1			1			2	6					
GROUP M								1			1		1					1			3	6					
GROUP I		1			2		1			2		2				2		2			4	12					
GROUP P1		1	1		1			1		1		2						1		1	2	9					
GROUP P2		2			1	1					1		1	1				2			2	9					
GROUP A					2						1			1							4	5					
GROUP G							1					1				1					2	3					
GROUP N			1					1			2		2				1	1	1		3	9					
GROUP T						1						1	1				1	2			3	8					
GROUP B		1		1		1					3										6	6					
GROUP Z					1				1	1						1			1		3	6					
GROUP J							1			1	2										4	7					
GROUP K				1					1			1									3	4					
GROUP D				1	1					1				1			1				4	5					
GROUP L					3		1		2	1	1		1								9	12					
GROUP O					1				1		1										3	4					
GROUP CH						1		1		1								2			3	6					
TOTAL	0	5	3	4	12	5	6	4	6	17	7	10	7	86	2	8	4	6	7	12	2	3	44	130			

Age:	15-20	20-25	25-30	30-35	35-40	40-45	45+	total
BULLS	2	3	3	2	3	4	3	20