

Interim Report – IEF, November 2015

Project Title: **Comparative Study of Wild Elephant Social Behavior in Sri Lanka**

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Summary

During this period we continued long term monitoring in Uda Walawe National Park (UWNP) and in July conducted our second year of follow up observations in Minneriya National Park (MNP). At Uda Walawe, we used our multi-year data as the basis for demographic models to evaluate population trends. In Minneriya, we are still adding to our photo catalogue of elephant IDs. This year we re-sighted some of the individuals seen last year as well as several new individuals, for whom the photographs are still being sorted. Dr. de Silva could not travel on site this year as she had a baby, however the field staff consisting of Mr. U.S. Weerathunga & T.V. Pushpakumara performed all their work as anticipated.

The Udawalawe Elephant Research Project

Demographic Models

Many zoos are concerned about whether captive elephant populations can be made self-sustaining. Here we examine whether wild populations are themselves viable. We used data from previous years to create simulations of the Uda Walawe elephant population. The goal was to model population trends based on age structure and rates of reproduction. We used VORTEX software to implement individual-based models.

Model description

The annual survival probability for adult females was based on de Silva et al. 2011,¹ which was estimated to be 0.95 with lower and upper confidence intervals at 0.89 and 0.97 respectively. Mortality is 1-survival therefore annual probability of mortality is estimated to be 0.05 [CI = 0.03, 0.11]. In de Silva et al. 2013² we reported that males were at least three times more likely to be killed or injured through human activity. We therefore set mortality rates for all age classes of males conservatively to be twice as high as for females. Because mortality rates for the juvenile age classes are still unknown, we based them on Leimgruber et al. 2008.³

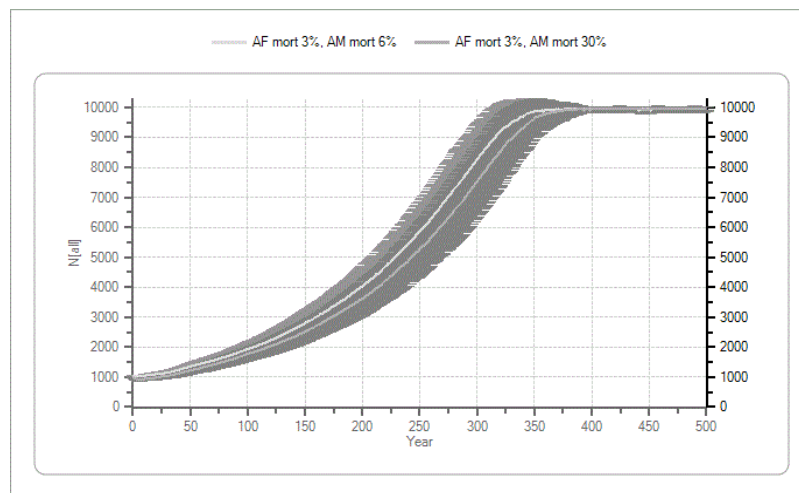
Another critical variable is the percent of females who breed in any given year. The probability that a female can breed depends on whether or not she has a calf. The minimum interval between births is 3 years, however the optimal is 4 years if calves are healthy; in Uda Walawe it is typically 6 years or longer. We calculated the probability that a female breeds based on these inter-birth intervals, testing a range of values.

To make the model realistic we imposed the condition that whenever a female dies, any of her offspring aged four years or less would also die. This is based on our observations in Uda Walawe that when a calf loses its mother at these young ages, it does not grow well and is unlikely to survive to maturity.

Model results

1) Adult female mortality vs. adult male mortality

If we consider the optimistic case that birth intervals are 5.9 years, female mortality is only 3% and male mortality is 6%, the population grows. If we increase male mortality to 30%, so



that it is now ten times higher than female mortality, there is very little change in the rate of population growth. This is not surprising given that only a few breeding males are necessary given the mating system of elephants.

Figure 1: As long as female mortalities are low, extremely high male mortality has little impact on the population growth rate.

2) Female mortalities

When female mortalities are at 5% (the rate estimated for Uda Walawe), the population declines and goes extinct between 500 and 1000 years. What could change the trend of this population? Decreasing the birth interval from 5.9 years (25% of females breeding) to 5.6 years (33% of females breeding) allows the population to sustain a 5% mortality level and still increase slowly (Figure 2).

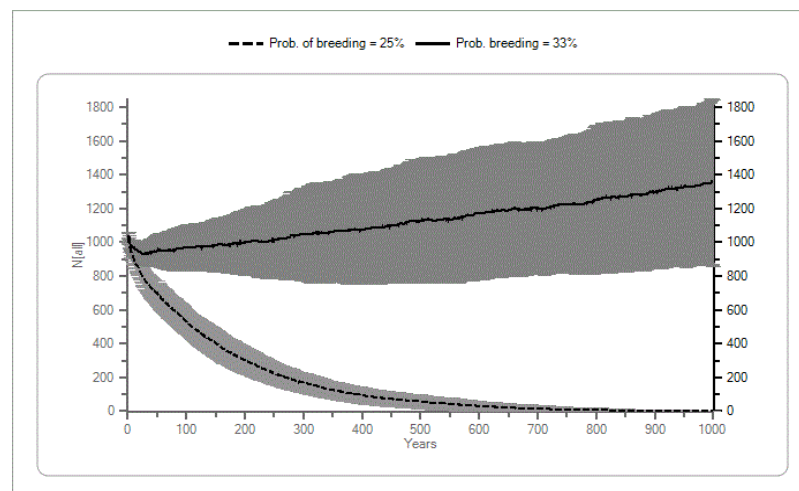


Figure 2: All females cannot breed every year, since some are pregnant and others are nursing calves. With a mortality rate of 5%, the population goes extinct if only one quarter of the females are breeding each year. But the trend becomes positive if one third of the females are breeding.

Conclusions:

We can make some general conclusions from these models not only about the Uda Walawe population but about any Asian elephant population with comparable attributes.

- **Male mortalities (e.g. due to conflict etc.) have negligible effect on the population growth rate.** However, as males disperse between populations it would likely affect the overall gene flow.
- **Elephant populations are extremely sensitive to female mortality rates.** It has been claimed that the number of elephants in Sri Lanka is increasing, based on island-wide surveys, and is widely assumed to be true due to the high levels of HEC currently being experienced. It is possible that elephant populations are increasing only if mortality rates are above five percent, and/or birth intervals are less than six years. These simulations are modelled on Uda Walawe, where the estimated mortality is 5% and over half of all monitored females have birth intervals that are six years or longer; **these models suggest that such a population is in fact decreasing.** Calf rescue efforts cannot make up for such annual mortalities in breeding females.
- **Elephant populations are also extremely sensitive to female reproductive rates.** lengthening the average birth interval by just three or four months (5.6 yrs to 5.9 yrs) can change the population trend from increasing to decreasing.

Management Implications

Female mortalities and birth intervals are the two most critical variables which determine whether an elephant population will survive. Loss of breeding females due to conflicts or management actions (fences, drives) should be avoided. This can potentially be controlled by active management. However birth intervals cannot be controlled directly. Birth intervals will lengthen if females do not have adequate nutrition. Therefore it is vital to ensure that breeding females have access to adequate resources and range in order to prevent our populations from going extinct. Currently, we still do not know what the actual mortality rates are nationwide, such estimates would be critical. These findings are being prepared for publication.

Observations from Uda Walawe

10 calves were born from June – December 2014, bringing the total to 23. These consisted of 11 males, 8 females and 4 for which the sex had not been determined, out of which two are missing and assumed dead. 12 calves were born from January – June 2015, consisting of five females, five males and

two of unknown sex. One male calf is dead. Two calves born in 2013 are also missing and assumed dead. By tracking these calves over time, in future we hope to be able to do cohort-based analyses or evaluate the impact of environmental conditions, including anthropogenic activities.

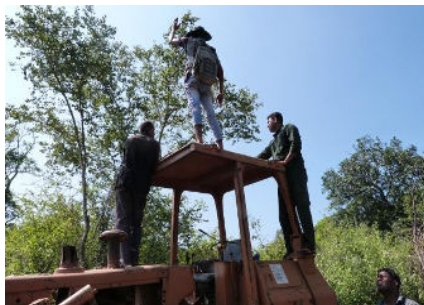
A male calf of estimated age 7 to 10 years has been seen with a snare injury. He was first seen in September, and has been seen again in October. Although the veterinary staff was informed, the animal still could not be found for treatment.



Above: Snare injury seen on 15/9/2015. Below: Same individual on 18/10/2015



Other activities in Uda Walawe



Mr. Weerathunga and Mr. Pushpakumara of the Uda Walawe Elephant Research Project assisted in planning and surveying the routes along with park warden Mr. Pathirana and staff from the Department of Wildlife Conservation.

The Minneriya Elephant Research Project

Our team again received a good welcome from the National Park staff and also the veterinary officer. This year we conducted observations in Minneriya National Park from July 2-26 over a period of 20 days. Our goal was again to update our photo identification files and assess how many were new individuals as opposed to re-sightings from the previous year. This photographs are still being sorted.

In addition we documented some issues impacting this elephant population: garbage dumping and human-caused injuries. In addition to reporting injuries that were spotted, they assisted the veterinary staff during darting and treatment of an injured calf. This calf, which had a swollen jaw, may have ingested some sharp object such as barbed wire. Another subadult was seen with a snare wound, but could not be located for treatment. Snare wounds pose a risk of septicemia but are not necessarily fatal. We will use these images in public talks in Sri Lanka to show people the effect of such devices and discourage their use. We would also like to use media and other forms of communication to make people aware of this problem, and create social pressure against the use of snares for hunting (a practice that is already illegal).



Snare injury seen on 7/2/2015 but could not be located again for treatment.



Field team assists veterinary personnel in treating calf with jaw injury.



Adult male showing faint signs of musth at a garbage dump not far from MNP 7/9/2015.

References

1. de Silva, S., Ranjeewa, A. D. G. & Weerakoon, D. Demography of Asian elephants (*Elephas maximus*) at Uda Walawe National Park, Sri Lanka based on identified individuals. *Biol. Conserv.* **144**, 1742–1752 (2011).
2. de Silva, S. *et al.* Demographic variables for wild Asian elephants using longitudinal observations. *PLoS One* **8**, e82788 (2013).
3. Leimgruber, P. *et al.* Modeling population viability of captive elephants in Myanmar (Burma): implications for wild populations. *Anim. Conserv.* **11**, 198–205 (2008).