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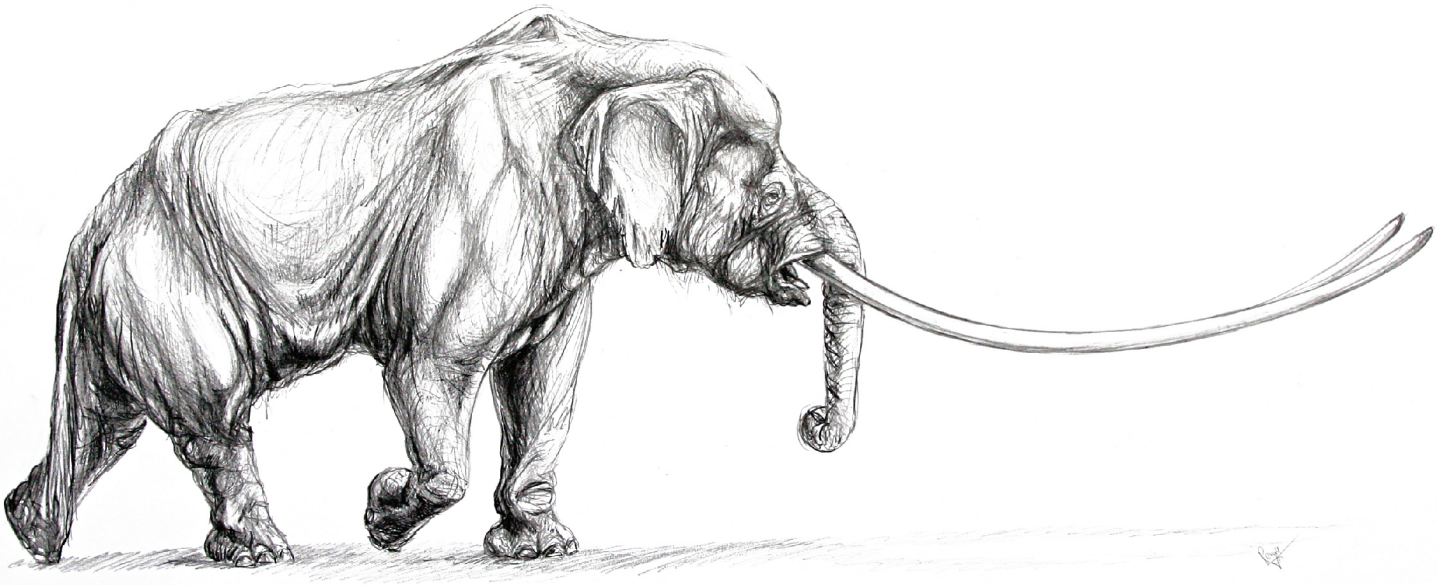

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ABSTRACT BOOK

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How many Asian elephants are killed illegally for ivory and in conflicts?

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The poaching of African elephants (*Loxodonta africana* and *L. cyclotis*) for ivory has attracted worldwide attention from conservationists but, in contrast, little is known of this problem among Asian elephants (E*lephas maximus*). In Asian elephants only males may possess full-grown tusks and are usually selectively targeted for ivory, resulting in artificially skewed sex ratios. Highly skewed sex-ratio may affect the viability of a population therefore a serious conservation concern. Both male and female Asian elephants are however killed in the process of conflicts with agriculture. The extent of such illegal killing of Asian elephants is only partly known because of incomplete detection and under reporting of carcasses in dense forested habitat. A population modeling approach is therefore necessary for estimating unknown harvest rates.

We have described a method to infer unknown harvest rates from crude current age and sex ratios of an elephant population (Chelliah, Bukka and Sukumar 2013). The ratios are adult (>15 years) female to male ratio, male old-adult to young-adult ratio, and proportion of adult males in the population, henceforth referred to as population signature ratios. We modeled an elephant population as Jensen's (2000) 2-sex, density-dependent Leslie matrix model. We simulated various combinations of male and female harvest regimes operating for 200 time steps (1 time step = 5 years) on a population assumed to be at a stable state (w.r.t. to age structure and size) initially. At each time step we compared the signature ratios of the simulated population with observed ratios from field data of a population and logged the male and female rates along with the time step at which the simulated and observed ratios matched closely. This brute force search algorithm would typically yield multiple harvest regimes that could possibly produce the current observed signature ratios in a population. The solution set, however, is of tractable size and some knowledge about the history of harvest in the population under scrutiny will help in identifying the most likely harvest regime.

We applied the above method of reverse engineering harvest rates to several Asian elephant populations in India with adult sex ratios varying from about 1:2.5 to 1:60. Mortality rates in adult male elephants were enhanced by only 17% due to illegal killing in populations such as Kaziranga in northeastern India, not much affected by ivory poaching because >50% of bulls are tuskless. In contrast, southern Indian elephant populations where tusked bulls constitute >90% of male phenotype showed enhanced adult male mortality by over 300% at places such as Periyar. When results from the six sampled sites are extrapolated across the country, our model indicates that about 125 adult male elephants have been killed annually on average for ivory and in conflicts since the 1980s. Ivory poaching has declined noticeably in the past decade.

Reference

Chelliah, K., Bukka, H. and Sukumar, R. (2013). Modelling harvest rates and numbers from age and sex ratios: a demonstration for elephant populations. Biological Conservation 165, 54–61.

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