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A REVIEW OF ELEPHANT NUMBERS IN SABAH

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INTRODUCTION

The Asian Elephant Action Plan (Santiapillai & Jackson, 1990) estimates the total elephant population in Sabah as between 500-2000. This unacceptably wide range is indicative of a lack of real knowledge of elephant numbers in this East Malaysia State of 73,619 km² situated on the northern tip of Borneo. Sabah's terrain is mostly mountainous and densely covered with dipterocarp rain forest, making any form of objective wildlife census extremely difficult.

The present population has a very patchy distribution mainly as a result of fragmentation of its habitat by forest clearance for agriculture crops such as oil palm. Many elephants have been displaced from their traditional ranges and elephants returning along old migration paths destroy young stages of planted crops. Electric fencing of planted areas is the most effective deterrent measure. An additional threat to the Sabah elephants in recent years has come from isolated bouts of poaching, the motivation for which is not clear.

Beginning in 1992 the Sabah government began to undertake systematic censuses in the key areas of the species' range. Initial results of the first such census was reported at the last metting of the AESG in Bogor, Indonesia (Dawson, 1992). Subsequently in 1993 and 1994 two further censuses have taken place (Dawson *et al,* 1993; 1994). The results of these censuses have contributed to management planning for protected areas, as well as to a species management plan for the Sabah population which was completed in 1994 (Sale, 1994).

CENSUS AREAS

The elephant population in Borneo is largely confined to eastern Sabah. The areas censused were Tabin Wildlife Reserve (=Tabin or TWR) stretching across 1200 km² of the central portion of the Dent peninsula; the proposed Lower Kinabatangan Wildlife Reserve (=Kinabatangan or KWR) south of Sandakan Bay covering a total area of 787 km² and Forest Management Unit 19 (FMU19) which

comprises Dermakot Forest Reserve (550km²), Segaliud - Lokan Forest Reserve (570 km²) and Tangkulap Forest Reserve (270 km²) which is found to the west of Kinabatangan Wildlife Reserve.

The primary vegetation in all the areas is lowland dipterocarp forest which is dominated by *Parashorea* species whose principle associate species are *Shorea leptoclados, Dryobalanops lanceolata and Dipterocarpus caudiferus.* There are some patches of freshwater swamp forest, a small amount of mangrove forest and nipah stands are found in the low lying areas, while riverine forests extend up to 500 m on either side of major rivers. The topography in all the census areas is undulating with some isolated steep patches in central parts, flattening out in riverine areas. Mild seasonality is experinenecd with annual temperatures ranging between 23° C and 31° C. Rainfall is experienced throughout the year and ranges between 2200 mm to 2900 mm. Maximum rainfall is experienced between November and February, while it rains least in March and April.

METHODOLOGY

The dung count method, first described by Barnes & Jensen (1987) for censusing forest elephants in Africa, and subsequently tested and adapted for Asian conditions (Sale *et al.* 1989; Dawson, 1990) was used in all the three study areas. Assuming that the environment is in steady state with regard to dung thorugh equal rates of deposition and decay, the method correlates the density of dung in an area to elephant density by correcting for these two factors. The census areas were stratified according to elephant use patterns and sampling intensity was proportional to size of each stratum.

TABLE 1

Dung densities and estimated elephant numbers

Site	*Size* (km²)	*Sample size*	*Density ± 95% CL*	*Elephant numbers (range)*
Tabin	1,200	80 replicates 118 km	0.204 ±0.040	245 (194 - 296)
Kinabatangan	787	115 replicates 192 km	0.190 ±0.060	150 (103 - 197)
FMU 19	980	105 replicates 207 km	0.184 ±0.050	180 (127 - 225)

ELEPHANT DENSITIES AND NUMBERS

Elephant densities were calculated by stratum (ecological density) as well as combined for the entire study area (crude density). Sampling effort in terms of replicate transects and total kilometers walked to estimate dung density is given in the table below.

In Tabin 6 cohotrs of dung ranging between 5 and 25 samples were monitored for 28 weeks to obtain a dung decay rate of 0.0068± 0.0005. In Kinabatangan three cohorts with samples ranging between 24 and 52 were monitred and a dung decay rate of 0.00071 ±0.0013 was obtained. This rate was also used for FMU 19 as it is contiguous with the Kinabatangan and climatic factors (rainfall and humidity) were similar. Defaecation rates used for all three sites came from sampling done in the rainforests of southern India where the data was collected during a similar season and where environmental conditions were fairly similar. Ecological density of elephants varied greatly within study sites. In Tabin it ranged between 0.84 to 0.17; in Kinabatanga the range was 0.36 to 0.13, while in FMU 19 it was 0.28 to 0.14. However, in all three areas the combined density (crude density) showed remarkable similarity as shown in the Table 1. This suggests that all three populations are probably in a state of equilibrium with their habitats and relatively free of major disturbance from, for example, illegal hunting. Furthermore, these recently obtained Sabah densities are in precise accord with that of Olivier (1978) for rainforests of Peninsular Malaysia of 0.18/km^2. These findings indicate that the range 0.18- 0.02/km^2 represents a typical elephant density for the dipterocarp rainforests of southeast Asia and may also represent the elephant carrying capacity of such forests.

The recent evidence for a typical elephant density in Sabah's forests allows us to attempt at estimating the State's total elephant population. The only other major area within the species' range in Sabah not yet censused is the Ulu Segama forests including the Danum Valley Conservation Area, totalling approximately 1500 km^2. In addition, one should add a figure of 10% of the total to take account of small scattered groups of elephants in and around plantation areas. Thus a sum for elephant numbers based on present knowledge of elephant densities appears as follows:

Tabin Wildlife Reserve	245
Lower Kinabatangan	150
FMU 19	180
Ulu Segama & DVCA (1500 km^2 x 0.19)	285
Total	860
Add 10% for scattered groups	86
Estimated population for Sabah	946

Thus a figure of around 1000 appears, at presnt, to be a reasonable estimate of elephant numbers in Sabah. Once a dung - based estimate is done for the Ulu Segama forests including the Danum Valley Conservation Area, a more precise estimate for the whole of Sabah will be possible.

CONCLUSIONS

The quality of the results obtained in Sabah provide an endorsements for the use of the dung - based method of estimating elephant densities in the dipterocarp rainforest habitats of south-east Asia. Togethere with data from two other estimates, they indicate a typical density for such habitats of 0.18-0.20 elephants /km^2. This range is generally lower than typical elephant densities for both rainforest and dry woodland or savanna densities in India and Africa.

Extrapolation from existing Sabah data derived from dung density estimates to as yet uncensued areas leads to an estimated total population for the State of appromaxitely 1000 elephants. This constitutes a considerable refinement to the precision of the existing estimate of 500 - 2000.

There is an urgent need to gather objective data to estimate the population density in the Ulu Segama area and those found in scattered herds around oil palm plantions, so that the precision of the estimate reported can be further improved. Sabah would then become the first range-state to produce a statistically robust estimate using one of the two methods recommended by the Asian Elephant Specialist Group. To maximise the usefulness of this study the Wildlife Department needs to begin the process of repeating the census in all three areas in order to monitor population trends.

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