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ELEPHANT CAPTURE IN MEGHALAYA, NORTH EAST INDIA - THE PAST AND THE FUTURE

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INTRODUCTION

The fragementation and degradation of elephant habitats in India has led to rising levels of elephant - human conflict. Factors beyond the control of wildlife managers, e.g. high human population growth rates, have made the task of finding solutions to the conflict impossible. Under such a scenario it is desirable to reduce the number of elephants or keep the population size more or less constant for specific problem elephant populations. Capturing of elephants from populations involved in high rates of conflict for domestication has been suggested before as a strategy to achieve the above objective. This has to be done in a manner which does not endanger the viability of the population. Sukumar (1993) suggests that a population of about 100 to 300 elephants would have a high probability (>99%) of survival for the next hundred years. Wildlife managers should try to maintain these minimum sizes even in problem elephant populations (*op. cit.*). This is so because options might emerge in the future to help solve the elephant - human conflict.

The west Garo hills district in the north- east Indian state of Meghalaya is a place with high rates of elephants - human conflict (Williams & Johnsingh, 1996). A small population of about 160 elephants is spread over an area of 1000km^2 (Williams & Johnsingh, 1996). Much of this area is under shifting cultivation (*jhum*). As *jhum* settlements are interspersed with forest areas, elephants encounter crop fields, which have little or no protection, and raid them as the crops provide an easy source of highly nutritious food (Sukumar, 1991). The prospect of finding a solution to the conflict in this region is directly related to finding an alternative to the practice of *jhum*.

The human population in Meghalaya, has increased by 32% between 1981 and 1991 (Anon, 1992). This kind of high population growth rates will further reduce the already short *jhum* cycles thus further degrading the habitats and increasing patchiness in the area. Studies suggest that a *jhum* cycle of at least 10 years is considered necessary for *jhum* to be viable economically and energetically (Ramakrishan, 1992). It was found that more that eighty percent of the villages surveyed in west Garo hills had a *jhum* cycle less than 10 years (Williams & Johnsingh, 1996). The results of that study suggested that current level of *jhuming* in West Garo hills is unviable. However the chance of finding an alternative to *jhum* seems to be bleak in this region. Hence it is in the wildife manager's interest to reduce or atleast prevent the elephant-human conflict from increasing. One of the ways this could be done is to reduce or keep stable the current elephant numbers by capturing. Requests to reduce problem elephant populations by capture have already come from the various state Governments (Anon, 1994;1995).

A number of studies have been carried out, using mathematical models and computer simulations, to explore the effect of increased mortality in the various age - sex categories on the elephant population growth rates (Sukumar, 1991; Hanks, 1981, Hanks & Mclntosh, 1973). However since reducing elephant populations has been a sensitive subject in India, no one has looked at the effects of removal of elephants, by capturing, on a population.

In this paper,we present details about the age-sex structure of elephants captured during the 1980 *mela-shikar* operation in Meghalaya and discuss the implications of allowing the practice to resume in the west Garo hills to combat elephant - human conflict using a modelling approach.

METHODS

Elephant capture, using the traditional *mela-shikar* method was carried out in this elephant range till 1982. Information on estimated age, shoulder height, sex of the elephants and place of capture were got from the Meghalaya Forest Department records. The ages of these elephants were estimated from shoulder heights as given by Sukumar, Joshi & Krishnamoorthy (1988).

The west Garo hills elephant range lies approximately between 90°0'E and 90°25'E and25°25'N and 25°55'N. Further details about the area and elephants can be found in Williams & Johnsingh (1996). To explore the effects of capturing elephants of various age - sex categories, the program **VORTEX** (Lacy, 1993; Lacy, Hughes & Kreeger, 1995) was used. The following parameters were used; The birth probability was taken as 0.20/ adult female/ year. The annual age - specific mortality rates were as follows (see Sukumar, 1993 for more details);Female elephants; 10% (age 0-1 year), 4% (age 1-5 years), 2% (age 5-15 years)and 1.5% (5-15 year). Male elephants: 15% (0-1 year), 8%(5-15 years), 6% (>15 years).

The deterministic growth rate (r) of the population as calculated from life table analysis of the female segment using the above parameters was 0.02. This means that the population was growing at the rate of about 2% a year. Then the adult female mortality constant was held at 1.5% and the mortality rate for all other age - sex classes was dobled. This gave a deterministic growth rate (r) of 0.007, i.e. the population is growing at the rate of 0.7%. Environmental stochasticity is built into the model which samples from binomial probability distributions, where the standard deviation (SD) specifies the yearly fluctuations. SD in birth probability was taken to be 25% of the mean and SD in annual mortality rates for the various age-sex classes were taken as 20% of the mean. We also modelled a catastrophe such as a disease epidemic with 0.5% chance of occurrence and which would reduce the survival to 90% of its' orginal value. The Meghalaya Forest Department census figure of 166 elephants for this area (Anon ,1994) was used as the starting population. The carrying capacity was set at 400 elephants which was more than twice the population's starting size. It has also been assumed that in the case of sufficient animals not being available, in some of the years in the harvested age-sex classes, animals from other age-sex classes will not be captured.

The following scenarios were modelled;

1. Capturing 10 juveniles or sub-adult elephants (6 females: 4 males) every alternate year for ten years,
2. Capturing 10 adult females every alternate year for ten years and,
3. Capturing 10 adult elephants (6 females: 4 males) every alternate year for ten years.

For all the scenarios modelled it was specified that the capture should take place every alternate year as it would provide sufficient time for training and disposal of captured elephants. We have modelled captures only for ten years with the hope options to manage them otherwise would be available in ten year's time. All the population projections were for 100 years and were run 1000 times.

RESULTS AND DISCUSSION

We got complete records for 23 elephants which were captured during the year 1980; Five of the captures were in south Garo hills and 18 captures were from Mylliem and Khyriem Syiemship in the Khasi hills. The age-sex structure of the captured animals can be seen in Fig. 1. There seems to be a clear preference for elephants in the younger age classes. This may be due to the fact that younger animals are easy to capture and domesticate.

The male: female ratio of the captured animals is 1:1.3. However, the tusker: makhna (tuskless males) ratio is 1:1.5. Makhnas when young, are difficult to distinguish from females in the field and one suspects that young makhnas were misidentified as females and captured. If this is true then there seems to be a preference for female elephants. Adult male elephants go into *musth* for about two to three months every year. They are usually tied up during this period as they become uncontrollable and this represents a substantial loss of working days for the owners. This is not the case with female elephants and that may be one of the reasons for preferring female elephants, if such a preference exists.

The results of the various scenarios modelled under different deterministic growth rates can be seen in Tables 1&2. It can be seen for a population which is growing at around 2% annually, capturing only juvenile and sub- adult elephantss or capturing adult elephants (6 females: 4 males) produce identical results. The 10th year population is about 85% of the population size at year 1. However if only adult females are captured, the 10 th year population size is only about 75% of the population size at year 1.

When the growth rates fall to little over half a percent due to increased mortality in the various age-sex classes, with the exception of adult females, the three scenarios produce vastly different results (Table 2). The 10th year population sizes under scenarios 2 and 3, when deterministic $r = 0.007$, are about 65% and 58% of the population size at year 1. However, capturing juvenile and sub - adult elephants produces identical population sizes at year 10 under different population growth rates (Tables 1 & 2).

TABLE 1. Results of the scenarios when deterministic r = 0.02

Scenario	r	SD (r)	Population size				P(S) at Year 100
			Year 10		Year 100		
			N	SD (N)	N	SD (N)	
1	0.022	0.031	146	12.79	397	6.97	1
2	0.02	0.032	127	12.73	396	7.47	1
3	0.022	0.031	144	14.47	396	7.15	1

r-Stochastic r, P(S) - probability of survival

TABLE 2. Results of the scenarios when deterministic r = 0.007

Scenario (stochastic)	r	SD (r)	Population size				P(S) at Year 100
			Year 10		Year 100		
			N	SD (N)	N	SD (N)	
1	0.007	0.043	145	15.55	256	65.13	1
2	0.005	0.046	108	13.19	192	60.47	0.99
3	0.004	0.048	97	11.85	199	63.88	0.98

r-Stochastic r, P(S) - probability of survival

The results of the modelling exercise point to the various options available to the wildlife manger. If the objective is to keep population numbers stable, the best option would be to capture juvenile and sub-adult animals. Therefore capture by traditional *mela shikar* would be the ideal method, especially in hilly terrain like the west Garo hills. This may not necessarily reduce elephant - human conflict , but would prevent the conflict from increasing. However, if the objective is to reduce the current intensity of conflict by reducing the elephant population, capturing of young adult females would probably be the best option. The west Garo hills population under all the scenarios, excepting scenario 3 in Table 2, has greater than 99% chance of surviving to 100 years. The results did not differ significantly from that of scenario 1, when we modelled a preference for female juvenile and sub-adult elephants (2 male: 8 females).

As mentioned earlier, the west Garo hills is place with high density of humans (109 person /km^2) in the important elephant areas and the human population is currently growing at around 3% a year (Anon, 1993). The practice of *jhumming* is degrading the habitat further and the ability of the area to support elephants is probably reducing drastically. Under such a scenario, if the elephant population in west Garo hills is allowed to grow, the elephant - human conflict can only increase. This will have disastrous consequences for elephants in this region. Our modelling suggests if the annual adult female mortality increases suddenly beyond 6% from1.5% (when determinstic r=0.02) and 2.5% from 1.5% (when deterministic r$\geq$ 0.005), the population would start declining. If people start shooting at elephant groups which raid crops, it is likely that adult female mortality would go up. Adult females with young ones are more likely to feel threatened and they may charge when attempts to chase them from crop fields are made.

Elephant capture programmes can also be turned into a public relations exercise, where the forest department is shown as taking a sincere effort to solve the elephant human-conflict. Therefore for elephant populations threatened by high rates of elephant human-conflict, the capture programmes may actually result in buying much needed time. This time is required in case options to manage these elephants and to solve the conflict arise in the near future and also because every elephant population deserves such a chance. We conclude by emphasizing that this is only a preliminary modelling exercise and that any decision to implement elephant capture programmes must involve much more detailed analysis of actual field data of the population involved.

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REFERENCES

Anon 1992 *Statistical Handbook.* Directorate of Economics and Statistics, Shillong, India.

Anon 1994 *Meghlaya Project Elephant Document.* Wildlife Wing of Meghalaya Forest Department. Shillong, India.

Anon 1995. *Assam Project Elephant Document.* Wildlife Wing of Assam Forest Department. Guwahati, India.

Hanks, J & Mclntosh, J.E.A. 1973 Population dynamics of the African elephant *(Loxodonta africana). Journal of Zoology*, London 169: 29-38.

Hanks, J. 1981. *A Struggle for survival - the elephant problem.* Country life Books, Feltham, England.

Lacy, R. K. A. Hughes & Kreeger, T.J. 1995 Vortex users manual Ver. 6.0,11 edition, Chicago Zoological Society, IUCN SSC CBSG, Species Survival Commision.

lacy, R. 1993. Vortex A computer simulation model for population viability analysis. *Wildlife Research* 20:45-65.

Ramakrishnan, P.S. 1992 . *Shifting agriculture and sustainable development.* Man and biosphere series: V. 10. UNESCO, Paris.

Sukumar, R. 1991. *The Asian Elephant: Ecology and management.* Cambridge University Press.

Sukumar, R. , Joshi, N.V. & Krishnamurthy, V. 1988. Growth in the Asian elephant. *Proceedings of the Indian Academy of Sciences (Animal Sciences)* 97: 561 - 71.

Sukumar, R. 1993. Minimum viable populations for Asian elephant conservation. In: *A week with elephants.* eds. J. C. Daniel, Hemant S. Datye. BNHS, Oxford University Press, Bombay. pp: 279-288.

Williams, A.C. A.J.T. Johnsingh 1996 *A status survey of elephant (Elephas maximus),* their habitats and an assessment of the elephant - human conflict in Garo hills, Meghalaya. Wildlife Institute of India, Dehra Dun, India.

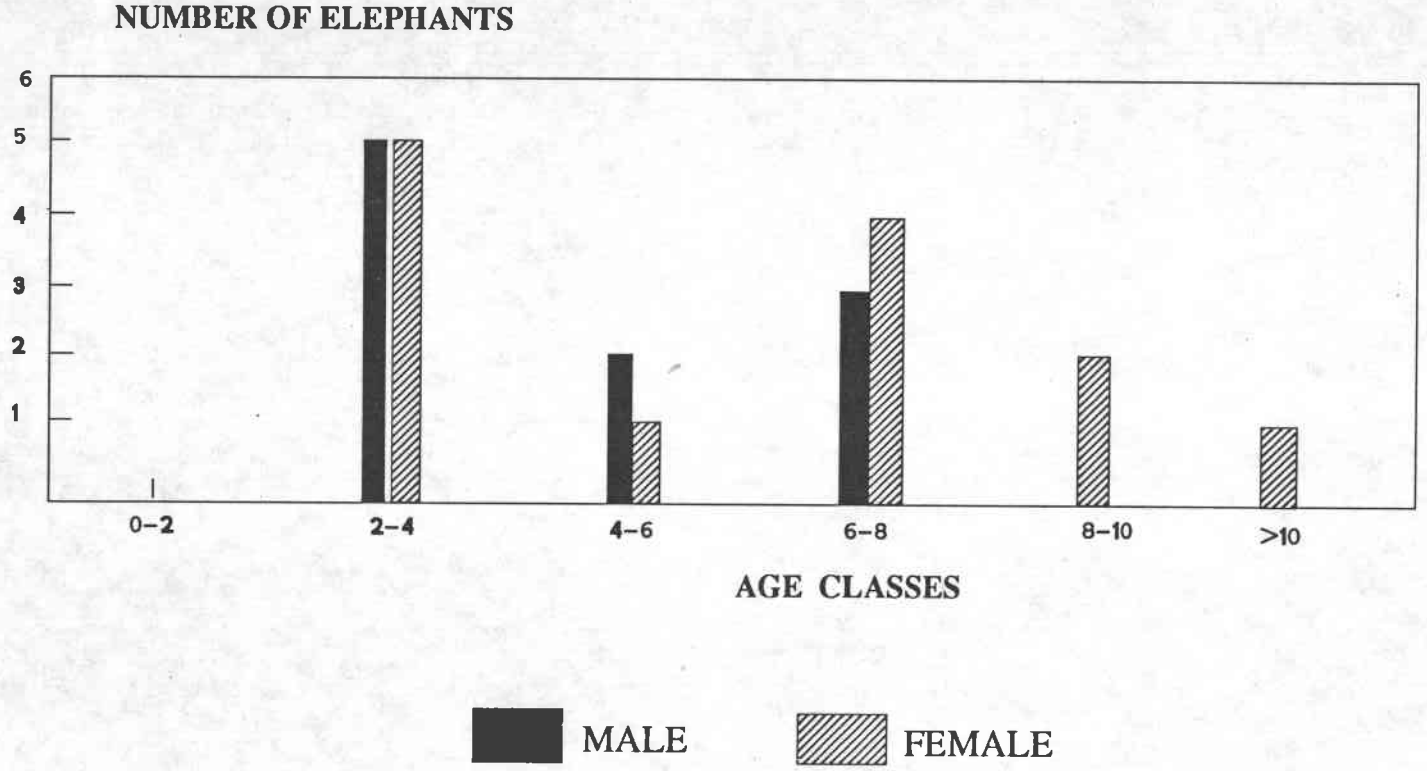

Fig. 1. Age - sex structure of captured elephants