

The Lion-tailed macaque (*Macaca silenus*)

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Executive Summary

The Lion-tailed macaque (*Macaca silenus*) or "LTM" is a species of primate which is endemic to the rain forests of the Western Ghats. Presently it is estimated that 3000 to 4000 LTMs survive in the wild in the 3 South Indian states of Kerala, Karnataka and Tamil Nadu.

Factors such as habitat fragmentation, reduced patch size, and isolation of populations leading to inbreeding depression and vulnerability to random events makes the Lion-tailed macaque a highly endangered species despite its relatively large free-ranging population. The modelling exercise clearly indicated that intensive management, or manipulation, must be carried out on these small, wild populations in order to insure their survival.

Manipulation can take the form of translocation of (doomed) animals that cannot be protected or introduction of captive born animals, or their genetic material through assisted reproduction. About 570 LTMs are held in captivity around the world which can act as a crucial back up population. The captive population in Indian zoos in particular needs intensive genetic and overall management.

The Captive Husbandry Group has examined the captive breeding program both in globally and regionally. A Global Animal Survival Plan was created. It was strongly emphasized that the Indian captive population has to be managed genetically and demographically to ensure that all available genetic diversity is retained and appropriate age structure and sex ratio maintained.

The Census and Distribution Group, having assessed the state of information about LTM numbers and location, recommended a survey of all rain forest patches in the entire range of LTM to determine patch size, contiguity and the status of the LTMs within.

The Threats Group surveyed all the threats to the population. As a result of their deliberations as well as the output of the computer simulation, which indicated that the loss of a single individual due to poaching had a dramatic effect on population growth of the group for years to come, the Group recommended that all habitats holding viable LTM populations should be declared as "protected areas". These would have full legal protection as well as protection through forest management strategies.

Ecodevelopment projects should be implemented for the tribal and rural populations living in and adjacent to the LTM habitats to reduce their impact on the forests. In order to insure survival of Lion-tailed macaque and success of conservation projects within and around the forest areas where animals and human beings share space, a sustained education and publicity campaign will create awareness for conservation; for LTM particularly

The modelling exercise also indicated that a minimum of 30-40% breeding age females is crucial to insure stability and growth. The modelling group suggested supplementing populations lacking in breeding age females, which will also increase the percentage of heterozygosity and reduce the degree of inbreeding.

Research should be carried out in an aggressive manner for improving management. The carrying capacity of some patches needs to be ascertained. Some basic biological information with respect to fertility, mortality, and migration rates needs to be collected as well as sampling and screening done to determine parasite load, presence of virus and other pathogens. In addition, environmental events such as catastrophes needs to be more closely monitored. It was suggested that research partnerships between zoos, field managers, universities and research institutions be created for mutual assistance in study of LTM. It was also recommended that a field centre near a wild population be established for preparation of operations required for intensive interactive management of the species.

Recommendations

Census and Distribution

1. As LTM populations in most of the areas are yet to be reliably estimated, it is recommended that estimation should be taken up in the areas where information is lacking. It is vital to survey all rain forest patches (in LTM range) to determine patch size, contiguity, and status of LTMs. Methodology for population estimation should be standardized, using methods appropriate for differing areas.
2. The contiguity of the habitat of LTM across the Western Ghats need to be assessed in order to: identify distinct populations, critical habitats, and areas where corridors could be established. Vegetation maps, aerial photographs, satellite imageries, and field studies should be used for the this purpose.
3. It is recommended that a total group count of LTM be done in many areas as a cooperative project of Forest Department, researchers of identified institutions, NGO's, etc. who have been briefed or trained. This is to be followed by periodic monitoring of LTM done by the survey teams.
4. An assessment of various vegetation associations as potential LTM habitat need to be undertaken to determine what areas of the evergreen forest is LTM habitat, and a survey of LTMs should be carried out to reflect differences between vegetation association.
5. A central coordinating unit for Lion-tailed macaque may be established in one of the range states where a database of LTM distribution and population can be developed, surveys coordinated, and results collated for better management of populations within individual states and also overlapping populations. Other information, such as on disease problems and treatment may also be included in the database and shared with all field staff and researchers.
6. The modelling exercise has indicated that a minimum of 30 - 40% of breeding age females are necessary in any isolated population of LTMs to insure stability or minimal growth of the population. Monitoring of the demographic structure of populations should be done with this factor in mind, so that groups with less than 30% adult females can be made viable by supplementation.

Threats

7. The computer modelling demonstrated poaching to be one of the important factors to consider in LTM management, as a loss of one individual per group per year (as modelled), reduces the population dramatically, to numbers which cannot increase or be sustained for decades to come. All viable LTM populations should be included in the protected area network to ensure that all provisions of the Wildlife Protection Act (1972) for LTM are enforced effectively.
8. A variety of threats impinge on the potential survival of the LTM, which should be controlled. A complete and accurate record of all fire incidents for the purpose of mapping these should be done as prophylactic measure against threat of fire. Application of pesticides/fertilisers in and around LTM habitats has to be researched and monitored as well as the effect of fruit, liana and other MFP extraction on LTM ecology.
9. Ecodevelopment measures for the rural populations living in and adjacent to Lion-tailed macaque habitats and help to reduce their dependence on the forest are strongly recommended.
10. According to the modelling exercise, the amount of heterozygosity retained by any of the populations assessed is very low, with and without incorporation of inbreeding. The percentage of heterozygosity retained increases coincident of the number of individuals within each group or with an increase in heterozygous lethals. No population of LTM under any scenario modelled can retain 95% heterozygosity, then retention by manipulation must be carried out in order to save the wild population. Genetic material (from either captive or wild) should be continuously infused into wild groups of 20 - 30 individuals, adding one male and two female adult LTMs to a group every three years to maintain the level of heterozygosity and reduce inbreeding depression.
It is, therefore, necessary to identify and implement management strategies for the maintenance of genetic variability in long-term breeding populations of LTM both in captivity and in the wild. For captive LTMs these should include centralisation of all records on LTM and including basic information (origin, age, pedigree, behaviour, health record).
11. The collection of biological samples (blood, tissue, or hair) on 12-15 individuals sampled from the 2 extremes of the geographical range of the LTM may be organised by the Ministry of Environment and Forests taking the help of experienced scientists and observing due caution for the safety of the animals. The analysis of these samples will provide crucial information which can be used to determine geographic origins of captive LTMs where capture location is not known and assist the Indian Species Coordinator and

CZA in preparing their Breeding Plan as well as to effectively assess the genetic variability of the wild population.

12. The assistance of molecular biologists should be taken in sorting out genetic questions. As the CZA has funded the Centre for Cellular and Molecular Biology in Hyderabad for carrying out genetic analyses on different species of endangered wildlife, they may be requested immediately to initiate studies such as population genetic analysis, comparison of populations by estimating genetic distance between them, and estimation of the degree to which the wild population has broken down into genetically distinct, non-interbreeding sub-populations. Analysis of these results will suggest in general terms what needs to be done to preserve a genetically healthy LTM population over the long term.

Disease and Health

13. The Central Zoo Authority has codified regulations on animal care health and treatment as well as for basic veterinary facilities and enclosure design. These should be strictly followed. Further, zoo safety measures for LTM should be codified and implemented to prevent accidental injuries and stress.

14. Sustained research should be carried out on LTM to generate a data base on infectious and other diseases, both known and suspected, and health conditions affecting the species in the wild. This should include screening for viruses and parasite load. Zoo animals should be screened for opportunistic zoonotic as well as anthroponotic viral infections.

15. A courses on disease of LTM for zoo vets should be carried out with refresher course to incorporate new information and inform newly posted vets. An international, inter-institutional group may be formed to assist in organizing the training of Indian Veterinarians, zoo personnel, and scientists, and other aspects of technology transfer, research opportunities for undergraduate and graduate students and funding of same.

Reintroduction and Translocation

16. The computer simulation demonstrated that small populations of less than 7 individual of LTM are almost certainly doomed to extinction; they are not viable in the wild due to skewed sex ration or unbalanced demography. These should be either taken into captivity and used to strengthen existing captive population or translocated to supplement other wild populations.

17. The feasibility of "artificial migration" between small protected groups using captured males, and on the capture of whole, small groups of "living dead" or doomed animals and their relocation into zoos or other protected areas should be investigated.

18. The feasibility of collecting sperm samples from males in small populations that cannot be protected, for use in artificial insemination or in vitro fertilization should be investigated.

19. Introduction of 1.2 adults into a population of 20 - 30 animals should be done every 3 years. This improves the chance of survival of the group significantly by maintaining the level of heterozygosity, reducing the amount of inbreeding and increasing the percentage of breeding females.

20. The Education Working Group recognizes that both formal and informal education conducted by NGO's and clubs, directed toward local people living near LTM habitat and other target groups, are critical to the successful conservation of suitable habitat for the lion-tailed macaque. Education may include propaganda against poaching, use of the animal for medicine, etc. as well as practical instruction on protection of habitat against accidental fire, etc.

21. The Workshop recommends establishing the lion-tailed macaque (LTM) as a flagship species for the conservation of the entire region of the Western Ghats.

Captive Management and Husbandry

22. According to the Report of the Modelling Group, the maintenance of a healthy stock of LTM in captivity is crucial for intensive metapopulation management, e.g. providing genetic material for wild population by reintroduction of live animals or of germ plasm.

23. All breeding of LTM is to be conducted under the recommendations of the Regional Species Coordinator who will be responsible for liaisoning with the International Studbook Keeper and coordinating the eight zoos identified as Conservation Breeding Centres for the country. These Centres shall manage their LTMs according to the national coordinated Breeding Programme, observing genetic and demographic principles and cooperating with International efforts such as the Global Animal Survival Plan for LTM.

24. In order to achieve conservation management goals, each animal is to be individually marked, by a tattoo or transponder and each animal is to have an individual record card and veterinary history. A copy of this should accompany the animal being moved from one institution to another.

25. Husbandry measures for LTM should be in highest quality of modern management including regular veterinary screening of both LTM's and their keepers; enclosures designed with consideration of the behavioural and biological characteristics of the animals; inclusion of environmental enrichment devices; training in modern methodology for staff and keepers with regular updates; exchange of information between the facilities holding the species. Diet should ensure that all animals receive optimal nutritional requirements, especially animal protein as vertebrates and invertebrates make up 37.3% of the diet in the wild.

Research

26. The Modelling exercise calls for basic biological information such as fertility, mortality, and migration rates, and environmental influence such as catastrophes, which was not available with the researchers and field managers of LTM. For successful management of LTM and, for saving the species from extinction, research and monitoring to elucidate these aspects is crucial.

27. Partnerships between areas of expertise should be created and fostered: e.g., zoos wild-life biologists and research institutions. The latter may be requested to help create areas within each zoo for basic research with minimal equipment such as refrigerator and freezer

28. A field centre near a wild population may be established to study and determine the feasibility of acclimatize the animals for observation, monitor non-invasively the menstrual cycles, interbirth intervals etc., and prepare for further operations required for interactive management of this species.