

**FACTORS MODIFYING WELFARE IN  
CAPTIVE LION-TAILED MACAQUES  
(*Macaca silenus*)**

**Thesis submitted in accordance with the  
requirements of the University of Liverpool for  
the degree of Doctor in Philosophy**

**by**

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## **Declaration**

I hereby declare that this thesis is of my own composition, and that all assistance has been acknowledged. The results presented in this thesis have not previously been submitted towards any other degree or for any other qualification.

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# FACTORS MODIFYING WELFARE IN CAPTIVE LION-TAILED MACAQUES (*Macaca silenus*)

## ABSTRACT

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The lion-tailed macaque (*Macaca silenus*) is endangered due to habitat destruction with less than 3500 individuals remaining in isolated fragments of South-West India. Lion-tailed macaques do not reproduce readily in captivity and captive breeding may be relied upon for future conservation. Poor welfare can have negative effects on reproduction so it is important that lion-tailed macaque welfare is examined in captive groups.

The aims of this thesis were to understand certain aspects of lion-tailed macaque welfare (behaviour and HPA physiology) in captive populations, with the view to making suggestions for management to promote the species' welfare and reproduction. Behaviour (188 hours), urine (n=133) and faecal samples (n=294) were collected from 38 lion-tailed macaques housed in four groups at the North of England Zoological Society (Chester Zoo), Bristol Zoological Gardens, Assiniboine Park Zoo and San Diego Wild Animal Park. The study successfully developed and validated assays to detect cortisol in lion-tailed macaque urine and faeces. The assays were then subsequently used to explore behaviour and HPA activity in these endangered primates. The institution in which the individuals were housed and basic life history parameters (age and sex) were explored to further understand the interplay between behaviour and physiology. Social relationships were assessed by measuring proximity (inter-individual distances and time spent in "arms-reach"). Finally the effect of visitors on behaviour, HPA activity and enclosure use was explored.

There was significant variation between institutions in behaviour and HPA activity but not proximity. The age of lion-tailed macaques modified their behaviour, but not their HPA activity or proximity. The sex of lion-tailed macaques did not modify behaviour, HPA activity or proximity. The effect of visitors on lion-tailed macaques in the current study is not clear and confirms previous research on the visitor effect on captive primates.

It can be concluded from this research that lion-tailed macaques are sensitive to the environment in which they are housed, indicating factors which may have negative effects on their captive breeding rates and ability to cope with habitat fragmentation for population's in-situ. The study has highlighted the need for each captive and wild group of lion-tailed macaques to be considered and monitored separately with regard to welfare and breeding.

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