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Short Case Study

Assessment of captive environment management practices in National Zoological Park, Delhi, India: a case study on conservation breeding programme of endangered Manipur brow-antlered deer (*Rucervus eldii eldii*)

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Abstract

A study has been carried out about Conservation Breeding Programme of the Endangered Manipur Brow-antlered deer in National Zoological Park, Delhi. The aim of this study was to examine the conservation breeding status and to measure the impacts of existing management practices on the captive stock position. Observations were carried out from September 2015 to September 2017 i.e., during pre-rut, rut and post-rut periods under captivity. Scientific data collection was also done for the same period on population status, behaviour, food preferences and health conditions. The study revealed some gap areas between existing management practices and the standard guidelines of Central Zoo Authority of India. Recommendations have been made on population management, feeding pattern, behavioral enrichment and enclosure design for sustainable conservation management practices as per Central Zoo Authority guidelines as well as the best practices being adopted in participating zoos of India. This study will play a significant rolein the development of demographically stable, healthy and self-sustaining population to reduce the risks of catastrophic loss. This sustainable stock Manipur Brow-antlered deer under Conservation Breeding Programme in National Zoological Park, Delhi will further act as insurance for captivity as well as sustainable stock for reintroduction in wild habitat.

Keywords: Conservation breeding programme, Manipur brow-antlered deer, national zoological park, central zoo authority of India, management practices.

Introduction

In India, Zoos are regulated as per the Recognition of Zoo Rules, 1992/2009 which is under the provision of the Wild Life (Protection) Act, 1972 considering the policy incorporated under the National Zoo Policy, 1998. A Central Zoo Authority was created in 1992 to supervise the functioning, management, and development of all zoos in the country. Conservation breeding programmes have been initiated[1] to prevent the collapse of the imminent wild population of threatened species by the means of scientific approaches to conserve their genetic diversity in the zoos. The contribution of zoos to conservation and protection by the means of captive breeding is crucial especially for species which are threatened in the wild[2]. The main aim is to prepare self-sustaining population for zoos as well as for their reintroduction in the wild. Thus, Conservation Breeding under *ex situ* management is one possible choice that can contribute to the preservation of threatened species[3].

National Zoological Park (NZP) has been selected by the Central Zoo Authority as one of the Participating Zoos under the Conservation Breeding Programme of Manipur Brow-antlered Deer *(Rucervus eldii eldii).* It is recognized as "Endangered" under the IUCN Red List of Threatened Species[3], having protection under the Schedule I of the Indian Wildlife (Protection) Act, 1972. NZP is a large zoo which is currently holding the largest stock position in India under *ex situ* conservation. Though, it has successful captive births than any other zoos in the country but still, some gap areas exist between existing management practices and the standard guidelines of Central Zoo Authority of India. Scientific observation and identification of those existing gaps would be able to recommend better management practices to the present *ex situ* condition. It is essential that captive managers should have a well scientific knowledge of population management, behaviour, feeding and nutrition; housing, husbandry and animal care practices[4]. The scientific based approach will ultimately lead to improvement of the potential of the zoo and further strengthen the efforts towards the Conservation Breeding Programme of captive Manipur Brow-antlered Deer population in National Zoological Park, Delhi.

Methodology

Observations were carried out from September 2015 to September 2017 i.e., during pre-rut, rut and post-rut periods

under captivity. Scientific data collection was also done through on-field observation and zoo inventory records regarding sex-wise distribution, date of birth and death, causal factors of death; health conditions, date of acquisition and disposal, population status, general behaviour and captive management practices. Pilot studies were also conducted regarding *ex situ* management practices in Assam State Zoo cum Botanical Garden, Guwahati and Alipore Zoological Garden, Kolkata (Participating Zoos), Manipur Zoological Garden, Imphal (Coordinating zoo) which are also under the same Conservation Breeding Programme of Manipur Brow-antlered deer. These pilot studies were used to made recommendations for Conservation Breeding Programme of Manipur Brow-antlered in National Zoological Park.

Results and Discussion

Population status: The population of Manipur Brow-antlered deer in NZP reported 23 births, 5 deaths, 8 disposals and zero acquisition for the period of September 2015 to September 2017 (Figure-1). More births and less number of deaths indicate successful conception and parturition in favourable conditions under captivity. Maximum births were reported during pre-rut (October to January) period and with peak during the months of October and November. The most favourable time for birth is in the months of October and November under captivity[5]. Population growth in captivity depends upon the number of fertile male and female, successful conception, less deaths, healthy pregnancy as well as care and upkeep of pregnant females[6]. Understanding the reproductive biology of captive species, husbandry and animal care practices is necessary to develop a viable stock position in terms of good population management[7].

Figure-2 represents the sex-wise distribution of Manipur Brow-antlered deer. It indicates that National Zoological Park is holding a surplus stock position, which is exceeding the targeted number, i.e., 5 males: 15 females. For maintenance of a sustainable population of Manipur Brow-antlered deer large zoos, the required number of individuals should not exceed 5:15[1]. There were only 8 disposals and zero acquisition during the study period (Figure-1) which indicates that only transfer of individuals to the other zoos was done. Tagging / marking was not done in the herd which prevents identification of the individuals suitable for breeding purpose. In order to maintain genetic diversity, active exchange of additional numbersas well as their genetic materialneeds to be done across the different zoos in the country[6]. Tagging or marking of animals should be done to identify the individuals showing their important role in progeny[6]. An important goal of captive population management is to maintain the desired/targeted number of individuals, so that appropriate measures can be taken for resource allocation or for adjustments in population planning[8].

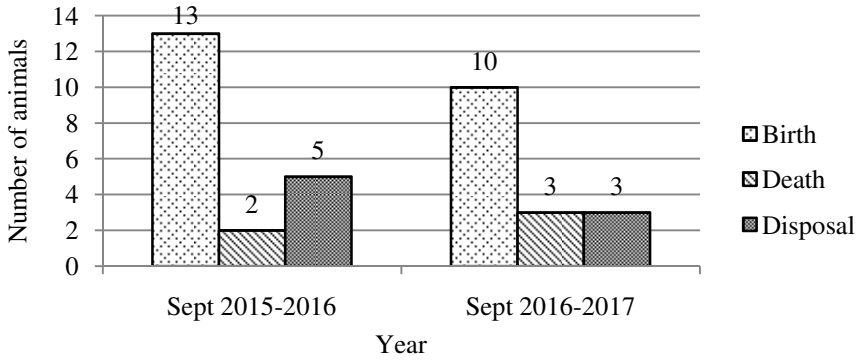

Figure-1: Showing Birth, Death, and Disposal of Manipur Brow-antlered deer *(Rucervus eldii eldii)* in National Zoological Park, Delhi (September 2015-2017)[1].

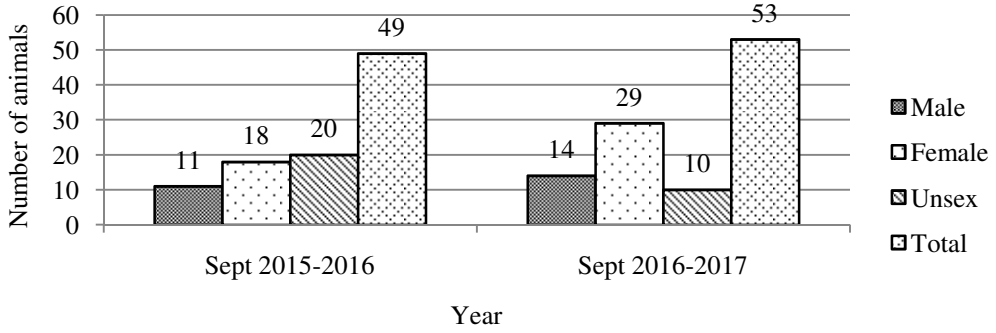

Figure-2: Showing sex-wise distribution of Manipur Brow-antlered deer *(Rucervus eldii eldii)* in National Zoological Park, Delhi (September 2015-2017)[1].

General behaviour and enclosure enrichment: Scientific observations on behavioural patterns of captive behaviour of Manipur Brow-antlered deer were done by focal sampling and an ethogram was prepared. General behavioural patterns like resting, ruminating, feeding, foraging, locomotion, inactive standing and other behavioural events were observed and recorded in the datasheet during pre-rut, rut and post-rut periods. Deer were found to display normal behavioural patterns and no abnormality has been detected in terms of identifying abnormalities and stereotypic pattern. Focal sampling is one of the defined methods used in animal behavioural studies[9]. An ethogram serves as an inventory of the behaviours of a species, in which behaviours are defined and organized into categories[10]. It was reported that this species perform well in captivity in various zoos across the country[11].

Enclosure (8006 square meters) is surrounded by chain linked fence with large arena, keeper's gallery, two kraals and moat on viewing side with a number of *Prosopis juliflora* trees. Segregation of aggressive males has been done during every rut period in order avoid infighting and death. During summer, sprinklers were installed inside the enclosure in order to make the surface wet and cool. In winter, straw bed were spread in different areas inside enclosure in order to provide warmth and comfort. Adults along with their neonates were spotted many times utilizing these enrichment facilities. The enrichment practices reduce neonatal exposure to the environmental elements like wind, rain, extreme hot and cold weather and thereby increasing the survival rates[6]. Also, addition of marshy area along with the bed of grasses should be done inside the enclosure to give the existing captive environment a more natural exhibit[6].

Food and health condition: Observations have been made on food and feeding behavior in order to know the food habits and food preferences, which would be helpful for creating the required and simulated conditions under captivity. Deer were found to feed actively on the provided ration as well as the natural vegetation growing inside the enclosure. They show their preference more towards mashthan tree and green fodder. Addition of food supplements in daily ration was done under veterinary supervision on monthly basis. As ration was provided in only one feeding station inside the kraal, monopolization of food by dominant individuals was observed. This is due to the lack of more feeding stations or feeding areas inside the enclosure. Different feeding stations inside the arena provide equal chances of food intake by the animals, thus prevent monopolizing behavior under captivity[6]. Scientific understanding of food habits and food preferences enhances the health, reproductive performance, and prevention of malnutrition of captive population under *ex situ* conditions[12].

During the study period, a total of 5 deaths due to injury were reported. The causal factors behind injury were infighting during rut, stumbling upon the shrubs and stones present inside the arena. There also exist some undetermined/unknown causes behind injury which needs to be addressed. No disease outbreak and death due to any disease has been reported. Injury mostly occurs due to the infighting caused by inter-male aggression and self-destructive behaviour, especially during the rut period[6]. Regular surveillance of health condition should be done in order to assess those unknown causal factors behind injuries which could help in evaluating and eradicating ill effects inside suboptimal environment[6].

Recommendations: Recommendations have been made on population management, feeding pattern, behavior, enclosure enrichment and health status of Manipur Brow-antlered Deer for its sustainable conservation management practices as Per Central Zoo Authority guidelines as well as the best practices being adopted in Participating as well as Coordinating zoos of India: i. Addition of more naturalistic environmental enrichment within the enclosure should be done which imitate their natural habitat. Recognizing the importance of enclosure enrichment in stimulating the overall growth and development is essential in reintroducing the concerned species to their natural environment. ii. Tagging/marking of individuals is necessarily required for the identification of an individual for selective breeding purpose as well as for scientific management under captivity. iii. Active exchange of animals along with genetic material (semen or embryos) among the various zoos and acquisition of animals from wild should be practiced in order to maintain heterozygosity in the population once the surplus population is achieved. iv. Feeding stations in different places should be established inside the enclosure in order to prevent monopolization or engrossment of provided ration by the dominant individuals. v. Creation of sufficient space for wallowing in the arena should be done which can be able to prevent infighting to some extent during the breeding season. Increase in the wallowing area will results in the sticking of the hooves of aggressive males in the muddy region and will reduce fighting.

Conclusion

This study provides meticulous information of the present scenario of Conservation Breeding Programme of Manipur Brow-antlered deer population. It identified the gap areas in existing management practices by making scientific observations on population status, behaviour, enclosure enrichment, food and health condition. In order to fill those gap areas, recommendations have been made by integrating the best management practices observed during the pilot studies and as per standard Central Zoo Authority guidelines. These recommendations, if incorporated with the present management practices, will lead to the development of physiologically and psychologically healthy, and viable population in captivity which can act as insurance for future exigencies and for reintroduction in the wild. The study concluded that a more systematic and effective approach must be taken into account in terms of Conservation Breeding Programme of Manipur Brow-antlered deer for their sustainable population growth and development in National Zoological Park, Delhi.

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