MANAGEMENT OF DEER IN CAPITIVITY

L.N. Acharjyo

INTRODUCTION

Sambar, swamp deer, chital, hog-deer and barking deer are a group of six fascinating cervids or true deer in peninsular India belonging to the Family: Cervidae and Order: Artiodactyla. They are the most common and popular ungulates on display as exhibits in many of the captive rearing facilities/ zoological and deer parks because they instantly attract public attention due to their varying colour, sizes and forms, agility, behaviour, calls, instincts and peculiarities in antler formation which differ greatly in different species and also with age. Brow antlered deer, though the species is not of peninsular India, but has been included for comparision.

This article is primarily intended to discuss briefly about the biology and management issues of five species of deer in captivity viz. Sambar (*Cervus unicolor*), chital or spotted deer (*Axis axis*), hog-deer (*Axis porcinus*), barking deer or muntjac (*Muntiacus muntjak*) and brow-antlered or thamin deer or sangai (*Cervus eldi eldi*) of north-east India.

BIOLOGY

Detailed knowledge on biological features/behaviours/functions of captive wild animals are essential for their successful management. It will be appropriate to give an outline of salient anatomical and biological features of these deer hereunder. The cervids or deer are terrestrial and herbivorous in nature. These ungulates are even-toed and hoofed, each foot has two functional toes. Though they are devoid of upper incisors, poorly developed canines or tushes are present in the upper jaw except in barking deer where upper canines in the male are well developed for self-defence. The gastrointestinal tract has a four-chambered stomach accompanied by long and tortuous intestinal canal and are classed as true ruminants. An interesting feature is that these animals are devoid of gall bladder. The female deer has two pairs of mammae. Aforementioned species have facial glands below each eye which become active during mating season.

Antler Cycle

The most distinguishing feature of the deer is presence of antlers in males. They appear as bony appendages of the skull and grow from permanent skin covered base known as pedicel.

The first set of antlers borne by young deer are always simple and as single spike. As the deer grow, these antlers are shed and a new set of antlers grow again from the pedicel with a branch or tine at the base. While growing, the antlers are covered with fine haired vascular skin known as "velvet" and on attaining full size, the velvet dries up and later rubbed off against tree trunks or other convenient objects making the antlers clean of velvet and hard, a condition coinciding with the onset of rutting season. The hard antlers are shed annually following the breeding season and the cycle continues every year till the antlers attain maximum species-specific size and number of tines. Normally each antler of a full grown sambar, chital and hog-deer has three tines or branches but the brow-antlered deer has three or more branches or tines including the main beam. However, the antlers of barking deer are small with only the beam without branches or with a short brow-tine at the base.

The details of different aspects of antler cycle were observed in sambar, chital, hog-deer and barking deer at Nandankanan Zoological Park (NKZP), Bhubaneswar (Acharjyo 1983, Acharjyo and Patnaik 1983, 1984, 1988) and of brow-antler deer observed at Alipore Zoological Gardens (AZG), Kolkata (Das 1988) (Table 1).

REPRODUCTIVE BIOLOGY

Reproductere biology of cervids in capativity has been published based on the work undertaken at NKZP (Acharjyo and Misra 1971, Acharjyo and Mishra 1980, 1981, Acharjyo and Mohapatra, 1977), National Zoological Park (NZP) New Delhi (Desai and Malhotra 1978, Sankhala and Desai 1969) and AZG (Das, 1988) (Table 2).

LIFE SPAN

Walker *et al.* (1964) have reported the usual life span of *Axis* sp. to be 10-15 years, and that of *Cervus* sp. and *Muntiacus* sp. as 15-18 years and about 10 years respectively.

Table 1. Antler cycle in five species of deer of Peninsular India

Details of antler cycle	Sambar	Chital	Hog-deer	Barking deer	Brow-antlered deer
Period of antler casting (Peak period of antler casting)	6-mo period Mar - Aug (Apr-June)	9-mo period Aug-Apr (Nov-Jan)	6-mo period Oct-Mar (Nov-Feb)	3-mo period Mar-May (Apr-May)	4-mo Period May-Aug (June-July)
Period of velvet rubbing (Peak period of velvet rubbing)	8-mo period Aug-Mar (Sept-Oct)	8-mo period Jan-Aug (Mar-June)	9-mo Period Nov-July (Feb-May)	4-mo period Aug-Nov (Aug-Sept)	Dec
Duration of antler casting (Duration of antler casting of majority of antlers of both sides)	Within 1-6d (within 1-3d)	Within 1-5d (within 1-2d)	within 1-5d (within 1-3d)	within 1-4d (within 1-2d)	within 1-8d (within1-2d)
Span of antler growth i.e. interval between antler casting and rubbing of velvet	40-55 mo	35 - 55 mo	30 - 40 mo	45 - 65 mo	45 - 70 mo
Inter-casting period of antlers	330-378 days	322-382 days	338-383 days	-	334 -371 days
Age at first-antler casting	1yr 5 mo-1yr 10 mo	1yr 11 mo 2yr 1 mo	1yr 25 mo	-	1yr 7 mo 1yr 8 mo
Maximum length (weight) of single spike antler	295 cm (151 gm)	125 cm (31600 gm)	90cm (23200gm)	-	120 cm (28 gm)
Maximum length (weight) of largest cast antler	940 cm (3078 gm)	820 cm (840 gm)	430 cm (271 gm)	110 cm (252 gm)	1143 cm (1600 gm)

Yr-Year; mo-month; d-days; Jan-January; Feb-February; Mar-March; Apr-April; Aug-August; Sept- September; Oct- October; Nov-November, Dec-December; cm-Centimeter; gm-grams

Table 2. Some aspects of reproductive biology of five species deer of Peninsular India

Details of antler cycle	Sambar	Chital	Hog-deer	Barking deer	Brow-antlered deer
Fawning season	All the months of the year except May	All the months of the year	All the months of the year	All the months of the year	September - December
Age of sexual maturity	1 year and 6 months (Female)	1 year and 6 months (Female)	-	-	2 - 3 years (Female) 3 - 4 years (Male)
Gestation period	8 months	70 - 75 months	8 months	6 months	236 - 244 days
Litter size	1 rarely two	1 rarely two	1 rarely two	1 rarely two	1
Sex ratio at birth (Number of males to 100 females)	738 : 100	1043 : 100	50 : 100 (limited data)	1138 : 100	11875 : 100
Weight at birth in kg	7000- 12300	2200 - 4000	2000 - 2740	1200 - 2010	4540 - 4650
Length (tip to tip) at birth in cm	880 - 1070	650 - 770	540 - 600	450 - 560	715 - 737
Inter- parturition interval in days	368	344 - 385	253 - 397	-------	356 - 393

MANAGEMENT OF CERVIDS IN CAPATIVITY

There is an increased recognition of the varying need and instincts of different species of wild animals in captivity and the temperamental differences between individuals within a species. It has also been appreciated and emphasized that optimum living conditions and upkeep of any species of captive wild animal could ensure their well-being, long life and propagation. These objectives can only be accomplished for different deer species through good management practices involving housing, feeding, sanitation, routine management procedures and healthcare measures outlined as follows:

Housing

The deer are maintained in captivity in spacious outdoor open enclosures or paddocks bounded on all sides usually with 2.0-2.5 meters high fence with chain- link mesh or partly with wet/ dry moat on the viewers' side and chain-link mesh fence/ wall on the other sides or with wet/ dry moat all around the enclosure. Stand-of-barriers are provided on the viewers' side to keep the visitors at bay. The important aspect for housing is that enclosure should be so designed to prevent the entry of stray dogs and other predators like jackal into the enclosure or to prevent the escape of the deer out of the enclosure. The area of the enclosure depends upon the species and number of deer to be displayed. The "Recognition of Zoo Rules, 1992" stipulates the minimum prescribed size of outdoor open enclosure for a pair of brow-antlered deer/ hangul/ swamp deer as 1500 square meters with an extra area of 125 square meters for each additional animal. Similarly the minimum prescribed size of feeding/ resting cubicle/ night shelter for these species has been specified as 3.0 x 2.0 x 2.5 metres. These specifications hold good for all large sized Indian deer. The enclosure may be established on a high ground to facilitate good drainage and should be away from carnivorous animals for stress less peaceful living. The ground should not be too soft for hoofed animals to prevent abnormal overgrowth of hooves which may otherwise necessitate surgical interference involving risk. Sufficient number of trees, plants and bushes are desirable inside the enclosure to provide cover, shade, privacy and for rubbing of antlers. Wherever necessary tree guards may be provided to trees/plants to minimize damage due to nibbling and rubbing of antlers. The sambar and brow-antlered deer enclosures need to have adequate and free access to water sources like ponds/ water moats and wallow to meet some of their biological needs.

Feeding

The deer are ruminant herbivores feeding on their choicest food items like grass, leaves, fruits, twigs, and young shoots of edible trees and plants available in the wild. In contrast, the same animals in captivity are dependant upon the food offered to them. Incidentally the digestive system and food habits of deer are similar to cattle, sheep and goat and we could adopt same nutritional principles in absence of information on the precise nutrional requirements of different species of deer in captivity and the diet of these animals can be compounded on the basis of our knowledge on feed requirements of domestic ruminants.

The deer in captivity are fed with concentrates in the form of mash (consisting of crushed grains like barley, oats and ragi; crushed pulses like horse gram and Bengal gram, crushed oil cake, common salt and vitamin and mineral supplements) or dry cattle/ goat ration or pelleted cattle feed. The concentrate formulae of deer mash of NZP (Desai and Malhotra 1978) and of NKZP (Acharjyo *pers. comm.*) are as follows:

Ingredients	NZP	NKZP
Wheat Bran	22%	10%
Rice Bran (fine)	-	24%
Horse gram (whole/ crushed)	12%	25%
Maize (whole)	13%	-
Barley (crushed)	16%	-
Oats (crushed)	8%	-
Ragi (crushed)	-	20%
Groundnut Oil Cake (Crushed)	26%	19%
Turmeric Powder	1%	-
Salt	1%	1%
Mineral mixture/ supplement	1%	0.980%
Vitamin AD3 supplement	-	0.020%

The daily ration for each adult deer at NKZP is 2.500 kg (sambar), 1.000 kg (chital), 0.750 kg (hog deer and barking deer) and 2.000 kg (brow-antlered deer) of concentrate deer mash in addition to grass and green fodder given *ad libitum*.

The concentrates are fed in the forenoon plus seasonal fresh grass and green fodder in the afternoon. The quantity of food requirement of an individual is determined according to species, age, sex, size, weight and

physiological status of the animal like state of pregnancy and nursing status, young and growing animals etc. Deer replacing antlers and pregnant does have high demand for minerals especially calcium. The ruminants need large amount of roughages to keep the gastrointestinal canal healthy, mobile and efficient. Lack of sufficient roughages may lead to stasis of bowel and telescoping of the intestine.

In nature, the deer spend much time in foraging. Providing most of the diet to such animals in the form of concentrates without foraging facilities may upset digestion. It has been observed that depriving them of foraging time leads to abnormal behaviour like lip, neck and tongue movements, etc. The deer in captivity are group feeders. Therefore, they need to be provided with sufficient feeding space enabling them to have their full share of food and exercise besides chances of avoiding infighting. Inadequate and poor quality of food may give rise to nutritional stress manifested by deficiency diseases.

Sometimes accidental ingestion of foreign bodies/ objects like nails, wire, plastics, rubber etc., toxic paints, insecticides and pesticides used inside zoo premises cause health hazards and has to be scrupulously guarded against.

Hygienic storage and daily inspection of all food items for quality and quantity before feeding, regular and timely distribution of fresh and nutritious food must be ensured to prevent diet related risks. Clean water from protected water supply system may be provided daily. Salt licks are always made available inside the enclosure to avoid mineral deficiency.

Sanitation

Maintenance of proper sanitation and hygiene of the deer enclosures as well as the surrounding areas are of utmost importance for their health and well-being. The excreta, left over food items, foreign materials like plastic carry bags, etc. if any has to be collected daily and properly disposed off at appropriate places. The pools and moats (both dry and wet) should be cleaned and disinfected regularly. The food and water troughs have to be properly cleaned daily before serving food and water.

ROUTINE MANAGEMENT PROCEDURES

Commencement of day's routine work begins with checking of all the deer enclosures to identify problems of management and to detect births and deaths if any. It is advisable to maintain a small note book by the person- in- charge of pens/ enclosures so that none of the routine identified work is skipped.

Experience has shown that majority of deaths occur within a month of birth or on arrival of the animals, therefore, special attention to such animals during this crucial period is essential. Traumatic injuries from fighting during rutting season, feeding time, fighting due to incompatibility among animals, capture operations etc. are responsible for about 20 to 25 per cent of total deaths in captive wild ruminants including deer. Improved methods of capture and management may be able to minimize the casualty.

The deleterious consequences of inbreeding like still-births, congenital anomalies, early mortality, abortions etc. can be eliminated by planned breeding which is not practicable in deer living in groups. Hence, it is always advisable to introduce unrelated and fresh blood (animals) frequently amongst captive deer to avoid any inbreeding. If required, the animal injectable transponders can be used for identifying individual deer.

If it is unethical to keep single specimens of any species of deer as it may lead to boredom, captivity stress, psychological problems and even infertility. Feeding of deer by visitors should be discouraged as otherwise it may lead to over feeding and digestive disorders. Various kinds of vandalism to animals by visitors such as disturbances during feeding/ mating/ resting time, feeding unsuitable articles, inflicting injuries etc/ should be prevented. Over crowding can be a chief source of nuisance and managemental hazard. It should be avoided by implementing population control measures in the light of prolificacy of breeding in some species e.g. chital.

The deer stags with hard antlers specially during rutting season and hand reared adult male specimens with hard antlers are invariably dangerous and attack the keepers and others suddenly without provocation. Keeping this in view, one must be cautious and take special precautions to avoid imminent danger while entering deer enclosures in case hard antlered adult animals are present.

Few of the many managemental problems have been described above which one would come across as a routine which could be minimized with effective, efficient and timely intervention in animal management.

HEALTH CARE MEASURES

One of the mandates of any captive rearing facility is to maintain the collection of wild animals in optimum health. It can only be achieved by good management practices coupled with health care/ disease control

programmes. The deer in captivity suffer from variety of infectious and non-infectious diseases like sister domestic ruminants.

Regular health monitoring by trained deer keepers in detection of illness at the initial stage like change in over all appearance, behaviour, defecation, urination, appetite, feed intake, water consumption, rumination, change in activity pattern, discharges from natural orifices etc, shall help in taking prompt action to initiate diagnosis, treatment and to correct managemental error if any.

There must be a well equipped Veterinary Hospital under the charge of specially qualified and experienced veterinarian to attend the sick deer and initiate prophylactic/ curative measures to optimize health condition. Zoo should be equipied with facilities for controlling the animals by blow pipe, capture gun with required equipments, drugs, chemicals etc. and pathological laboratory to carry out routine clinical tests and surgical equipments to conduct operations.

Morbidity due to parasitic infestations have a great damaging effect on the well being of resident animals and when coupled with mortality specially in young deer could be devastating. Therefore, a de-worming schedule consisting of planned programme of examination of faceal samples to detect the parasitic infestation followed by administration of appropriate anthelmintics at regular intervals is necessary to lessen the incidence of parasite disease problems in deer.

Under the prevailing management practices, FMD Quadrivalent vaccine is being only given to a few sambar, chital and hog deer at very few captive rearing locations in India. No other vaccines are being administered to captive deer in India at present. But as a precautionary measure, domestic ruminants available around such locations should be given vaccine against common infectious diseases.

There should be quarantine enclosure for housing all newly received deer for a period of thirty days and an isolation ward to accommodate the resident deer suffering from infectious diseases.

A well equipped post-mortem room for conducting post-mortem examination (PME) of all dead animals and a carcass disposal facility (incinerator/ pit) for effective disposal of dead animals after PME should be in place away from animal display areas and Veterinary Hospital Complex.

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