

**STUDY ON BIOLOGY,
ECOLOGY AND
CONSERVATION STATUS
OF CAPTIVE ANIMALS
IN LAHORE ZOO**

2nd Edition

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**PHOTOGRAPHY
MR. AHMED HABIB**



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Research Centre**
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CAPTIVE ANIMALS IN
LAHORE ZOO**

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DEDICATED TO OUR CHILDREN



A child's empathy towards animals influences the goodness of their character. A child who learns to love and respect animals grows up to be a compassionate adult.

Applied Sciences Research Centre





The authors would like to acknowledge **Mr. Bader Munir** for his contributions towards the publication of this study. Mr. Munir is a renowned conservationist and a field sportsman who leads the Punjab Wildlife Department as the Honorary Game Warden and heads the Field Sports and Conservation Society of Pakistan as its Chairman.

Special Thanks



Dr. Zahid Iqbal Khan
Ex-Director Lahore Zoo

Dr. Zahid Iqbal is a passionate conservationist and fervent wildlife aficionado. He has worked as a wildlife manager for 27 years for conservation of key wildlife species and habitats in Punjab. He has performed surveys for wildlife resource assessment of protected areas and biodiversity hotspots. He has remained active after retirement and is involved in protection and preservation of the environment and wildlife. He is an experienced manager of ex-situ conservation sites, consisting of wildlife Parks and Zoos. Dr. Zahid was the key coordinator in publication and projection of this book. The authors earnestly thank him for his sincere and worthy efforts.



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Deputy Director (Engg.) Lahore Zoo

Mr. Muhammad Azam is currently serving as Deputy Director (Engg.), Lahore Zoo, Punjab Wildlife and Parks Department. He has a vast experience in Zoo architecture and has designed various animal housing facilities for Zoos all over the Punjab, notably the Lahore Zoo and Lahore Safari Park. He is responsible for building and maintenance of Zoo structures in relation to ex-situ conservation needs and has successfully executed numerous improvement schemes and projects for betterment of captive wildlife.



Ms. Kiran Saleem
Deputy Director Lahore Zoo (Additional Charge)
Education Officer Lahore Zoo

Ms. Kiran Saleem is working as Education Officer, Lahore Zoo under Punjab Wildlife and Parks Department and presently holding the additional charge for the post of Deputy Director Lahore Zoo. She is managing ex-situ conservation of wildlife and is responsible for general administration of Lahore Zoo. She is actively involved in ex-situ breeding, upkeep of animal health, research, organizing trainings workshops and seminars under Zoo Education and Awareness Program regarding animal keeping, Zoo animal welfare and health care aspects.



Mr. Ahmed Habib
Photographer

Mr. Ahmed Habib has a Mechatronics Engineering degree from NUST and an MBA from FAST-NU. He has accumulated over a decade of experience in marketing. Mr. Habib is a photography hobbyist and a passionate coffee brewer. He has been photographing and documenting wildlife for past 5 years.

AUTHOR



Prof. Dr. Farkhanda Manzoor is Post-doctorate from the Ohio State University, USA. She is an ardent believer in the future of eco-friendly solutions to urban pest management problems in Pakistan. She has served as the Chairperson at Department of Zoology and as the Director ORIC, Lahore College for Women University Lahore. She has published 12 International books, one monograph by HEC, contributed chapters in 5 books and has more than 150 publications at National and International level. Furthermore, she has completed 6 research projects as Principle Investigator from Higher Education Commission, WWF, FMC Corporation and Ensystex Australia.

She got Research productivity Award (2013) from Pakistan Council for Science and Technology and best teacher award from Higher Education Commission, Islamabad in 2016 and 2018. As an academician, she has 25 years of teaching, research and administrative experience. She has been imparting training to BS, MS and Ph.D students in the field of Zoology/Entomology/ Biodiversity. She is also working as Editor in-Chief for the Journal of Innovative Sciences (JIS) at LCWU. She is also member of Zoo Management Committee. Dr. Farkhanda is of the opinion that animals are agreeable friends. She has written program on Zoo animals “Dost Humaray” at PTV.

CO-AUTHOR



Dr. Najiya al-Arifa received her PhD in Zoology from GC University, Lahore through HEC Indigenous PhD Scholarship. She received HEC-IRSIP scholarship for split PhD at Asthma and Allergy Center, Johns Hopkins University, Maryland, USA. She was presented Roll of Honor and Medal for academic position in MSc Zoology by LCWU, Lahore. She is recipient of Fauji Foundation academic distinction award. She joined the Department of Zoology, LCWU in 2015 as visiting Lecturer and was appointed as Assistant Professor in 2017. Dr. Najiya is passionate about animal behavior studies, especially focusing on the occupation of niches in urban settings. She has studied animal behavior in captivity in Lahore Parks and Zoos. She is also an ardent photographer.

P R E F A C E

The systematic study of animals inhabiting the Zoo is called Zoo Biology. This book is aimed at providing Zoology students and professionals with an introduction of Zoo Biology, a better perception of how the Zoo community operates and the behavior of animals in the Zoo. It particularly emphasizes the role of Zoo in conservation, breeding and research of captive animals as well as educating the Biology and welfare of the animals by ensuring great standards. It is intended to help new professionals in the field of Zoo Biology. I expect that it will enlighten the knowledge of the students of animal associated studies such as Zoology, management and care of animals.

Zoo Biology is a vast subject however this book is short but it includes great knowledge for the students and concerns for new professionals associated with Zoo Biology. I hope that I have accomplished in providing the key principles and understanding of the role of Zoo and captive animals however the content in this type of short book is expected to compromise between what I should intend to include and what can practically added into this small book. This book provides guidance and inspires you to explore your area of interest in the Zoo subject.

I focus on the Lahore Zoo, however, this book has obtained the good working example of the Zoos all over the country. This does not mean that Lahore Zoo only include the great Zoo although this illustrates that there are many Zoos and Safari Parks in the country in which people are not working according to the basic principles of the existence of the Zoos and in this regard certain organizations are campaigning against them.

I have mentioned the animal behavior, captivity and information of animals observed in the Lahore Zoo but this should not be taken as the suggestions or commendation by the author and publisher. I have written this book according to the best of my knowledge and wisdom of the Zoology however readers may utilize or inspect sources when necessary as nature of the law may alter with passage of time.

AUTHOR

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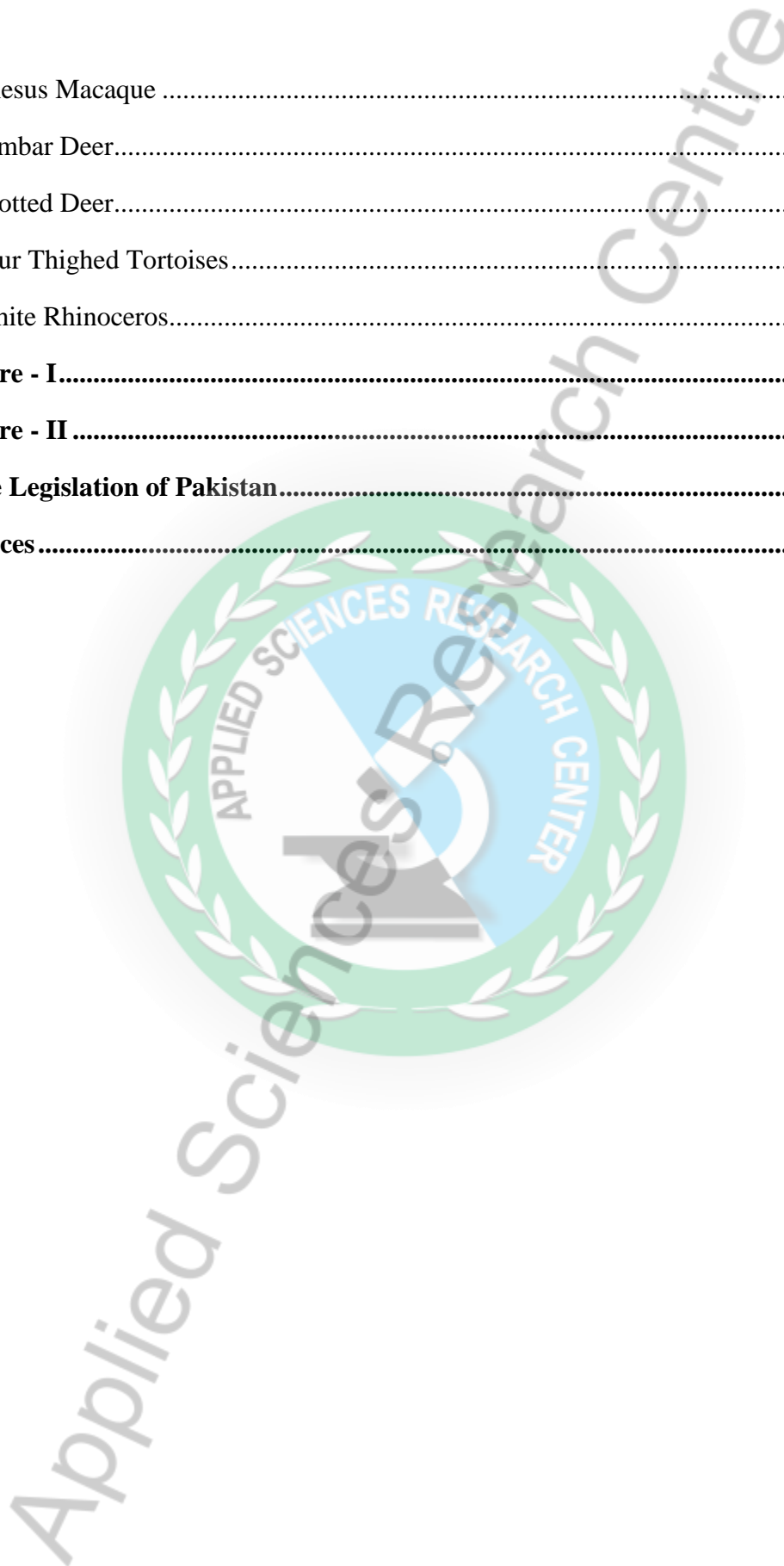
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INTRODUCTION

WHAT IS A ZOO?

The word Zoo is an acronym for Zoological Garden. It was firstly used in 1847 in England for Clifton Zoo Bristol in South West England. However within the European Union the official explanation of Zoo is as follows;

“All permanent establishments where animals of wild species are kept for exhibition to the public for 7 or more days a year, with the exception of circuses, pet shops and establishments” (Council directive 1999/22/EC (Zoos Directive)).

Therefore, this official statement classifies all animal establishments such as aviaries, safari parks, fish aquariums, birds of prey center, live insect collections, snake parks and all such parks and places which are accessible to the public as Zoos, although it eliminates circuses, laboratories and pet shops which also exhibit animals.

ROLE OF ZOOS

Animals play an exceptionally crucial part in our biodiversity. They have always captivated human imagination and appear profusely throughout the human history in literature, lore, tradition, arts and craft. Long term maintenance of captive animals has become a common perspective for conservation due to a rapid loss of habitat and species Worldwide. The captivity modules such as Zoos, Sanctuaries and Wildlife Parks serve as a place of education, research and recreation, apart from helping the main objective of conservation (McPhee, 2003). In wildlife management and conservation, Zoos play a crucial part and are the areas of ex-situ conservation. Zoos are regarded either as refuge areas or as conservation areas that preserve animals from the anthropoid actions. The development of captive breeding population of rare and endangered species is one of the

main priorities of several Zoos (Reade and Waran, 1996; Anderson *et al.*, 2003; AZA, 2008). Zoos have bred, raised and conserved IUCN (International Union for Conservation of Nature) listed endangered species in captivity (Conway, 2002). While Zoos focus on research, the majority of public still visits Zoos for recreational purposes (Ahmad *et al.*, 2015).

The inclement towards animal conservation and research are well known concerns which indicate the significance of Zoological culture (Patrick *et al.*, 2007). Zoos are powerful and perfectly placed tools to deliver awareness towards animal protection and preservation to general public. It also links the growing urbanized population with natural environment (Hancocks, 2001; Miller *et al.*, 2004; Patrick *et al.*, 2007). Zoos not only exhibit broad wild faunal and floral species but also provide an opportunity for people to interact with nature, develop empathy and learn about protection concerns (Hancocks, 2001; Kisling, 2001).

Due to rapid decline of biodiversity Worldwide, long term management of breeding animals has become a common approach to species conservation. Animal captivity models such as Zoos, Wildlife Parks and Sanctuaries serve as places of recreation, research and education besides their primary purpose of supporting key conservation objectives (McPhee, 2004). During 1940s, the implementation of captive breeding trainings permitted Zoos to save endangered species by addressing the community affairs and explaining the requirement of Zoos by connecting them in conservation and management plans (Peart, 1993). Furthermore, Zoos recognize a great demand for community participation in public awareness which is now rooted in Zoo mission statement and reflected as a major contribution towards society (Hancocks, 2001; Patrick *et al.*, 2007; Norton *et al.*, 2012).

The growing disconnection of urban populace with wild fauna and flora is becoming even more concerning in children, however Zoos seem like the only solution to

bridging the gaps between the modern World and wildlife (Knight and Herzog, 2009; Karanikola *et al.*, 2012). Thus by increasing the understanding of animals, visitors show more encouraging opinion towards animals in Zoo. Zoos are well known among people because they have gained a high degree of appreciation and recognition by children. Zoos provide outdoor educational and study resources as well as veterinary and therapeutic experiences. Zoo visitors watch animals closely which allows them to develop care and love for animals (Anderson *et al.*, 2003; Patrick *et al.*, 2007).

Although in animal welfare these Zoos are playing a key role by being sites of protection, foundation for research and public awareness on wildlife management and protection. Unfortunately, the aim and functions of the local Zoos are not accurately interpreted in Pakistan. As a developing nation, ecology exerts a great deal of burden, leading to the degradation and devastation of natural habitats of animals that ultimately threaten wildlife survival (Tribe and Booth, 2003). The survival of wildlife is therefore alarming due to enormous pressure on its ecosystem that has resulted from fragmentation and destruction of natural habitat of animals. Pakistan has 22 species of amphibians, 185 species of reptiles (Khan, 2006), 670 species of birds (Roberts, 1992; Khan, 2006) and 188 species of mammals (Roberts, 1997).

ANIMAL BEHAVIOR

Scientific study of animal behavior is called ethology. This term was first used by the French Zoologist Isidore Geoffroy Saint-Hilaire in the 19th century and then used afterwards with its current definition. Ethology is derived from the Greek word *ethos* which means character. European Ethologists indicated that animal behavior was a biological aspect and a product of evolution (Bolhuis and Giraldeau, 2005). This has been illustrated by utilization of the word *instinct* that refers to the innate behavioral components which likely resulted from natural selection. Social aggression, stereotypical behavior, coprophagia and self-injurious behavior can be subjected to behavioral

management techniques, depending on operating conditioning and the basic learning principles (Clay *et al.*, 2009; Martin *et al.*, 2011). Behavioral therapy is frequently an ideal way of changing animal behavior and avoiding the demand of risky involvement of pharmaceuticals.

LAHORE ZOO



Directional sign boards at Lahore Zoo



Spanish cherry tree

Lahore Zoo is located on Mall road in the historical city of its namesake and extends over an area of 25 acres (10 hectares). Lahore Zoo is one of the oldest Zoos in the World and the oldest Zoo in Pakistan. It is also the largest in Pakistan, becoming a spotlight attraction for thousands of daily visitors. It was established in 1860s as a menagerie during the British Raj, it was upgraded to the level of Zoo in 1872 after the addition of an aviary donated by Mr. Lala Mela Ram. Lahore Municipal Committee managed Lahore Zoo from 1872 to 1921. A Zoo advisory committee under the Lahore Commissioner managed the Zoo till 1962; afterwards its control was transferred to the West Pakistan Agriculture Department, then to the Department of Livestock and Dairy Development. Finally the Department of Wildlife and Parks was entrusted with the Zoo in 1982. Presently, the Zoo Management Committee (ZMC) governs Lahore Zoo constituted under Punjab Zoos and Safari Parks Rules, 2012.

Since its administrative exchange in 1982, Lahore Zoo has updated its display, format, finishing and turned into a self-funding corporation. The 2012 “Master planning Development and Improvement of Lahore Zoo” project had a cost of one hundred and twenty five million rupees. Lahore Zoo houses approximately 71 floral and 110 faunal species.



Map of Lahore Zoo

Lahore Zoo has following areas;

- Deer Park
- Elephant House
- Hippo House
- Lion House
- Monkey House
- Reptile House
- Walk-through Aviary
- Waterfowl Lake

BEHAVIOR OF CAPTIVE ANIMALS

When the captivity conditions or human made environments are unfavorable for animals to execute their natural or innate behaviors, they may develop abnormal behavior. This type of inflexible, repetitious behavioral influence with no aims and targets are known as stereotypies (Schultz *et al.*, 1996; Sikander *et al.*, 2015). These are linked with the environmental needs that enhance the frustration arousal or conflict in the animals which is thus reflected in their behavior. Under certain circumstances, a stereotypic response may also be evoked by boredom. According to the hypothesis, a stereotypic behavior occurs in response to a stressful condition indicating stress situation. In mammals, the stress response elicited by a series of endocrine and neural patterns is usually due to disturbances in homeostasis. The stress response generally involves the

discharge of catecholamines and adrenocortical glucocorticoids from sympathetic nervous system and adrenal medulla respectively thereby initiating endocrine responses such as inhibition hormones associated with growth, reproduction and anabolism (Sapolsky, 2002). Regardless of adapted situation, the chronic and persistent release of stress factors may have detrimental effect on physiology and behavior of animals (Abbott *et al.*, 2003). However the reduced reproductive behavior (Grønli *et al.*, 2005), developmental (Vyas and Chattaji, 2004), complexity of behavior (Rutherford^a *et al.*, 2004; Rutherford^b *et al.*, 2004) and freezing latency (Korte, 2001) may indicate chronic stress. Correspondingly, enhanced abnormal behavior (Carlstead and Brown, 2005), inhibit behavior (Vyas and Chattaji, 2004), alerting behavior and suppressing aggressive behavior (Morgan and Tromborg, 2007), frequency of fright and fearfulness (Boissy *et al.*, 2001) and freezing behavior (Korte, 2001) have been reported due to chronic stress.



Captive young male lion at Lahore Zoo

CASSOWARY



| | |
|---------|------------------|
| Kingdom | Animalia |
| Phylum | Chordata |
| Class | Aves |
| Order | Casuariiformes |
| Family | Casuariidae |
| Genus | <i>Casuarius</i> |
| Species | <i>Casuarius</i> |

| | |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Common name | Dwarf cassowary, کیسووری |
| Height | 59 - 79 inches |
| Weight | 25 - 59 kg |
| Body Color | Black having blue and red face |
| Habitat | Native to deep humid rainforests |
| Distribution | New Guinea, Northeastern Australia |
| Conservation Status | Not extinct |
| Diet | <ul style="list-style-type: none"> - Omnivorous (insects, fish, frogs, birds, rodents, carrion) - Frugivorous (fungi, flowers, fruits) |
| Locomotion | <ul style="list-style-type: none"> - Fast runner - Remarkable swimmer - Cannot fly - Lack keel bone which provides muscle strength for flight |
| Behavior | <ul style="list-style-type: none"> - Solitary except during courtship - Aggressive towards man and other animals |
| Sexual Characteristics | Female is larger than male |
| Mating Season | June to October |
| Incubation Period | Male bird incubates eggs for 50 - 52 days |
| Life Expectancy | <ul style="list-style-type: none"> - Wild: 12 - 19 years - Captivity: 40 - 50 years |

DESCRIPTION

Cassowaries belong to the ratite group of large flightless land birds (Latch, 2007). It is the largest native vertebrate in Australian rainforests (Crome *et al*, 1976). Adults grow to 2 meters tall with males up to 55kg and females are usually larger weighing up to 76kg (Westcott and Reid, 2002). It appears as an unusual mixture of turkeys and ostriches. The body is large having black feathers, red neck and blue colored skin. The head comprises of casque (helmet like crest) that is 17 cm in height 15 cm length. Casque is used for self-defense and helps inhibit skull damage during fights, it also facilitates effortless movement through thick vegetation (Mack and Jones, 2003). Cassowary possesses tremendous hearing sense and vision thus it can frequently perceive high and low pith sounds. Cassowaries generate high pitched sounds which can be heard from a three miles distance radius. Cassowaries do not fly because they lack the chest bones i.e., a keel on their sternum that provide strength to the muscles necessary for flight (Pycraft *et al.*, 1900). However they are efficient runners and swimmers and can swim to long distances. It can jump up to about five feet in the air and can run to a speed of thirty one miles per hour.

BIOLOGY

Cassowary behaviors have been well documented which includes, social organization, communication, activity and maintenance and social behavior (Crome *et al.*, 1976). *Casuaris*'s usual diet is fruits which the forage from low branches and ground (McKey *et al.*, 1975). The dietary dependency of cassowaries on fruit is so high that they require a wide extent of forest with perennial trees which provide fruit round the year. This bird also feeds on small animals like insects, frogs, snakes snail etc. and on mushrooms. The grinding of food in stomach is done by swallowing stones and drinking adequate amount of water frequently available in their natural habitat. Cassowaries are territorial birds and are known to be very wary of humans and domestic animals such as dogs (Marchant and Higgins, 1990). They are capable of inflicting serious or even fatal

injuries on provocation and thusly have been often labeled as the *World's most dangerous bird* (Kofron, 1999).

The mating season occurs in winter and spring months, both in the wild and in captivity. Female lays about three to eight green bluish colored eggs in the nest constructed by the male (Moore, 2003). The survival of young birds or eggs is not dependent on the mother, instead the females move on leaving the male to incubate the eggs and rear the chicks (Bentrupperbaumer, 1997). Males are also in charge for nourishing the young before they are one year old. Young cassowaries learn foraging and grooming from their male parent. The young bird's feathers are striped and brown colored. As the birds mature their plumage darkens along with the development of the wattles and casque and brightening of the skin color on the neck and wattles (Cho *et al.*, 1984; Crome and Moore, 1988).

HABITAT AND DISTRIBUTION

Cassowary distribution and biogeography is complicated by the fact that people have widely traded in these birds and hence transported them beyond their natural range (White, 1913). *Casuarius* are widely distributed in rainforest surroundings of Queensland, New Guinea and some of the Aru Islands (Davies, 2002). They occupy three wide habitats. Two habitats are in the Cape York and other in the Wet tropics. In Cape York, cassowaries exist in two different populations i.e. northern population in limited vast vine forests of Shelburne Bay and the southern population in the Iron ranges and vine forests of the Mcilwraith. They are extensively distributed from Paluma range to Cooktown in the wet tropics. The rest of the crucial territory that is almost 89% occurs in the protected regime in the Wet Tropics. The natural living of cassowaries is tremendously decreased due to clearance of land hence the number of cassowaries has also lessened. In spite of living generally in the rainforests they are also distributed in mangroves, melaleuca swamps, woodlands and surprisingly in beaches too so that they have periodic food supplies and have intercalated for territory with more areas. These

areas that are mosaic of these types of surroundings are close to the coast and liked by the cassowary.

ECOLOGICAL ADAPTATIONS

As cassowaries feed on hundreds of different rainforest fruits species so they play an efficient role in the ecosystem by dispersing seed in distances that range greater than a kilometer (Westcott *et al.*, 2005). The rate of seed germination of *Ryparosa* (a rare Australian rainforest tree) is increased by 92% after moving through the gut of a cassowary instead of the 4% rate that normally occurs. Cassowaries have remarkably gentle gut treatment and most items come through reasonably intact (Stocker and Irvine, 1983). Some fruits do not even lose their pulp (Wright, 2005).

STATUS AND CONSERVATION

Cassowary is an endangered bird according to Environment Protection and Biodiversity Conservation Act, 1999. The Southern cassowary is considered endangered in Queensland. The southern cassowary is endangered in Queensland. The decline of the species was evaluated by Kofron and Chapman in 2006 and the reason described is the loss of their natural habitat of which only 20-25% is left remaining. The southern population of Wet Tropics in Red list 2007 of International Union for Conservation of Nature is described as vulnerable whereas the Northern Cape York population is declared vulnerable according to Nature Conservation Act, 1992. The decrease in their numbers is due to clearance of land. Southern (Double-Wattled) Cassowary is generally held in Zoos and private facilities. The Northern Cassowary and the Dwarf cassowary are almost non-existent in captivity. Following measures are taken for the conservation;

- Avoidance of forest clearance
- Regeneration of deforestation and cyclone lands
- Short termed cyclone feeding station
- Habitat corridors protection
- Control of invasive plants in cassowary areas

CASSOWARY AT LAHORE ZOO

A solitary male cassowary was observed for its different behavioral activities at Lahore Zoo. The cassowary was housed in an enclosure (15 x 20 feet) containing natural forages, which is located in Ratite Area of Lahore Zoo. The cassowary enclosure had two distinct portions, a roofed enclosure to provide shade and shelter to the bird and an open area secured by fenced parameter. Cassowary had easy access to pelleted ratite feed and drinking water.

It was found during the observation period that cassowary spent most of its time in the indoor enclosure, eating, drinking and resting, exhibiting less locomotive and social behaviors. Cassowary was observed to spend most of its time in standing and resting conditions. Environmental interaction by rubbing of feathers and skin against enclosure wall were also noted. The cassowary spent most of the time outdoors, foraging while walking in morning. During afternoon, the ingestive behavior decreased as the bird spent most of the time standing or packing at the fence. While foraging, cassowary walked across the pens, pausing in between to nib at the grasses and other foliage inside the pen, picking up insects from the ground or simply pecking at the ground while foraging. All observed behaviors were found to be slightly affected by weather and other environmental conditions. Vocalizing and mating behavior could not be observed because there is only one cassowary in Lahore Zoo.

CHIMPANZEE



| | |
|---------|-------------------|
| Kingdom | Animalia |
| Phylum | Chordata |
| Class | Mammalia |
| Order | Primates |
| Family | Hominoid |
| Genus | <i>Pan</i> |
| Species | <i>trogodytes</i> |

| | |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Common Name | Common chimpanzee, ape, چمپنزی |
| Height | 36 - 60 inches |
| Weight | <ul style="list-style-type: none"> - Male: 40 - 60 kg in wild; 40 - 90 kg in captivity - Female: 27 - 50 kg in wild; 32 - 50 kg in captivity |
| Body Color | Brown and black having pinkish white face |
| Habitat | Native to forests and savannah of tropical Africa |
| Distribution | Africa |
| Conservation Status | Endangered |
| Diet | <ul style="list-style-type: none"> - Frugivore (fruits, blossoms, seeds, leaves, stems, resin) - Omnivorous (honey, insects, birds, eggs, mammals) |
| Locomotion | <ul style="list-style-type: none"> - Adapted for both terrestrial and arboreal locomotion - Quadrupedal and bipedal locomotion - Knuckle-walking and brachiation |
| Behavior | <ul style="list-style-type: none"> - Strict male-dominated hierarchy - Male aggression and Infanticide - Community living (20-150 members) - Presence of nursery and hunting groups |
| Sexual Characteristics | <ul style="list-style-type: none"> - Promiscuous mating behavior - Presence of courtship |
| Mating Season | Varies seasonally in a group |
| Gestation Period | 8 months |
| Life Expectancy | <ul style="list-style-type: none"> - Wild: 40 - 50 years - Captivity: 50 - 60 years |

DESCRIPTION

Chimpanzees are very closely related to humans, sharing 98% of DNA (Pickrell, 2003). Unlike humans though, the body of chimpanzee is entirely covered by rough black hair except on the face, palms of hands, fingers, toes and soles of the feet. Big toes are opposable and comparable to thumbs which allow grasping accuracy and dexterity. Chimpanzees are both arboreal and terrestrial. During day time, chimpanzees usually stay on the ground while at night they take to the trees. The conventional locomotive preference is quadrupedal movement. Contrary to the *palm walkers* such as that exhibited by orangutan who utilize outer edge of their palm (quadrupedal progression) the chimpanzees are known as *knuckle walkers*, which is similar to bonobo and gorilla. Chimpanzees walk by using their knuckles and soles of feet. Upright movement maybe utilized for short distances (Stanford and Nkurunungi, 2003).

BIOLOGY

Chimpanzees feed on variety of foods including both plants and animals (Newton-Fisher, 1999). They have 32 teeth which resemble Human teeth and are designed to facilitate omnivorous diet, molars for grinding up plant matter and long canines for chomping on fruits and animal flesh. A proportion of their diet includes flowers, seeds and seasonal fruits collected from the plants along with variety of insects such as termites and ants collected from their nests by using sticks and fingers. Feeding habit vary remarkably in accordance with the seasons and every population.

Chimpanzees live in small groups within well-defined territories, and only travel as a last resort, if food sources run low or due to predatory threats. If a group increases in size and becomes overly colonized, some chimpanzees will leave their group for a smaller group that will admit them. Chimpanzees exhibit intricate grooming behavior which involves removing pieces of dirt particles, plants, dried skin, and insects from their hair and from those of other chimpanzees. Grooming is used to release tension from

dangers and aggression in chimpanzees and may be used as to make up after a fight and to strengthen the future relations (Stanford and Nkurunungi, 2003).

Males are dominant over females. The females rest at the substratum while the alpha male sits at the top, and in between other males (Watts, 2002). Chimpanzees have sex around the year. Females can reproduce at the age of 13 whereas males mature later and reproduce at the age of 16. The skin close to genitalia becomes swollen and pink when female is on heat this is actually the sexual call signal to males. Male and female chimpanzees both evoke sex in bold way. Female place her bottom swollen on the male's face when she is attracted towards the male. Male shows attraction by displaying his penis to female or swings the branches of trees. Young chimpanzees learn nest building, foraging and tool preparation from their mothers, while playing with other younglings enhancing wrestling and grooming skills (Foerster *et al.*, 2016).

HABITAT AND DISTRIBUTION

Chimpanzees are widely spread between North, South and equatorial Africa. Chimpanzee live in vast diversity of habitat such as evergreen rainforests, woodland and savanna mosaic, montane ecosystem, dry savannas and swamp forests due to their extensive distribution (Stanford and Nkurunungi, 2003).

ECOLOGICAL ADAPTATIONS

Pan troglodytes are mostly found in the dry, moist forests and forest passages spreading into the savanna woodlands. They are social animals and can form community of five to one hundred and fifty animals. Range of habitation is bigger in mosaic woodland forest than the mixed forest. The average range is 12.5 km² while range varies from 5 to 400 km².

STATUS AND CONSERVATION

Chimpanzees are registered as endangered animals by IUCN and face the threat of extinction in their natural habitat (Humble *et al.*, 2016). It is expected that in Africa there

are as few as 100,000 individuals remaining. Over the past 30 years, continued deforestation and human interference has pushed chimpanzees into isolated, smaller and more confined areas of their once vast broad and vast natural territory which has led to further decline of populations.

World Wildlife Fund controls and reinforces many protected areas for chimpanzee in many countries. They save them by effective law implementation, anti-poaching and helping governments in developing and governing National parks. As a conservational effort, chimpanzees are allowed continual use of the forest resources in park neutral territories and their populations are also monitored.

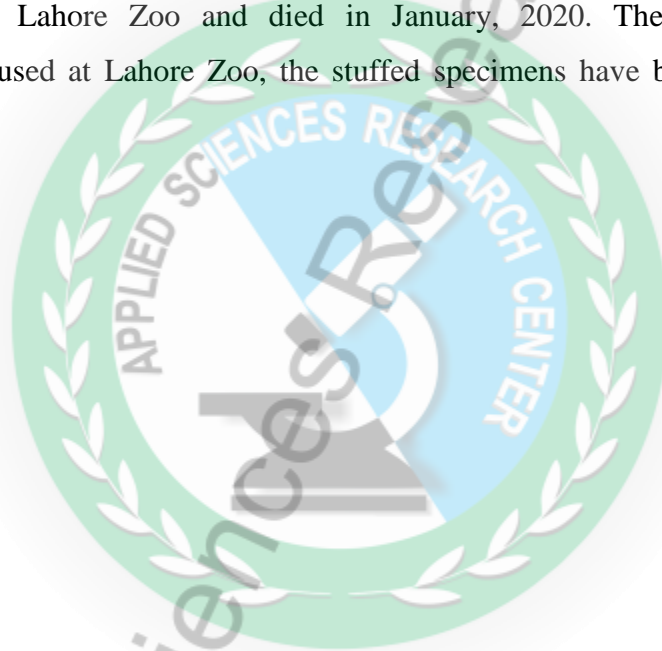
CHIMPANZEES AT LAHORE ZOO

A pair of chimpanzees affectionately named Romeo and Juliet was brought to Lahore Zoo in 1994. The male, Romeo had a temperament and was known to be aggressive, even towards his own offspring (Khan, 2014). The pair gave birth to their first child in April 2000, a male named Tinku who later died at the age of 4 (September, 2004) due to pneumonia related complications. The pair went on to have two more daughters, Pinky in 2001 and Honey in April, 2005. Romeo died on 17th September, 2008 at the age of 21 from a prolonged illness suspected to be either liver inflammation or tuberculosis. Juliet died in 2012, followed by Pinky who died at the age of 14 on 31st October, 2014 due to severe gastro enteritis, stomatitis and gingivitis after suffering from years of Upper Respiratory Tract infections and acute gastric problems (Ahmed, 2014).

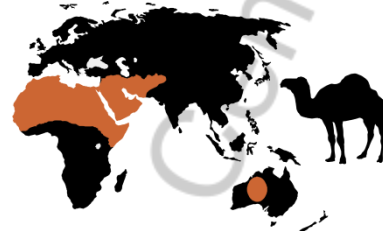
At the time of present study, Honey was the last surviving member of the chimpanzee family at Lahore Zoo. Honey was housed in a separate enclosure facilitated with indoor and outdoor areas. The indoor enclosure was 5 – 6 feet wide and was made up of cement and bricks; it was used by Honey for sleep or rest. The outdoor compound was 7 – 8 feet wide and made up of painted iron bars. A small shelf for resting and a tree for playing and climbing were provided. An air cooler and bath was also present. Honey spent most of the time eating and or drinking, resting or walking in her enclosure.

Interactions with Zoo visitors were documented. Honey was very active during day time and exhibited violent behavior in response to visitor provocation or jeering. Honey's aggression was attributed either to boredom or lack of inter-species interaction. Social and sexual behaviors could not be observed since Honey was the sole and solitary occupant of the enclosure. Stressful procedures and related indoor effects of single caging are probably to blame for increased stereotypes in captive chimpanzees.

Despite chimpanzees being highly social animals with a complex social hierarchy, Honey was a solitary chimpanzee. She had developed aggression probably due to boredom, stress and lack of any stimulating activities. These factors along with long term ailments may have contributed to the chimp's early demise. Honey, was the last of the chimpanzees at Lahore Zoo and died in January, 2020. There are currently no chimpanzees housed at Lahore Zoo, the stuffed specimens have been displayed in the Zoo museum.



DROMEDARY CAMEL



| | |
|---------|--------------------|
| Kingdom | Animalia |
| Phylum | Chordata |
| Class | Mammalia |
| Order | Artiodactyl |
| Family | Camelida |
| Genus | <i>Camelus</i> |
| Species | <i>dromedarius</i> |

| | |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Common Name | Arabian camel, Somali camel, اونٹ |
| Height | <ul style="list-style-type: none"> - Male: 70 - 79 inches - Female: 67 - 75 inches |
| Weight | <ul style="list-style-type: none"> - Male: 400 - 600 kg - Female: 300 - 540 kg |
| Body Color | Light brown and grayish |
| Habitat | Arid and semi-arid areas |
| Distribution | <ul style="list-style-type: none"> - Africa (Horn of Africa, Somalia, Sudan, Ethiopia) - Asia (India and Pakistan.) - Australia (introduced from Canary Islands, Spain) |
| Conservation Status | No special conservation status |
| Diet | Herbivorous (desert vegetation, dry grasses, thorny plants) |
| Locomotion | <ul style="list-style-type: none"> - Digitigrade stance - Large feet with soft flexible pads on soles |
| Behavior | <ul style="list-style-type: none"> - Dromedaries may blow out cud (spit) when excited - Aggressive; canine teeth used as weapons - Extreme fights can result in death of both combatants |
| Sexual Characteristics | <ul style="list-style-type: none"> - Males dominant over females - Sexual maturity Males 4 - 5 years; Females 3 years |
| Mating Season | Mating takes place in rainy seasons |
| Gestation Period | 15 months |
| Life Expectancy | 40 - 50 years |

DESCRIPTION

Dromedary is the largest camel second only to the Bactrian camel. It was probably the first domesticated animal in the Arabian Peninsula (approximately 5,000 - 9,000 years ago). The hair is particularly long and is centered on the neck, shoulders and hump. Coat color is sandy brown to white. They have a strong sense of scent and clear eyesight. Eyes are wide with prominent supra orbital ridges covered. The ears are narrow and rounded. Legs are long and the foot has two toes with soft leathery sole, this allows the animal to walk on sand without sinking into it (Gauthier-Pilters and Dagg, 1981). Sexual dimorphism and size varies in both sexes. Dromedary camel has a sluggish rate of growth and reaches sexual maturity at later years (Rahim, 1997).

BIOLOGY

The diet of dromedary camel mostly consists of foliage and dry grasses and is dependent on the available desert vegetation in the camel's natural habitat (Sambraus, 1994). The dromedary is specifically a browser with shrubs accounting for 70% of their diet in the summer season and 90% in the winter season. Age of sexual maturity varies widely. The female usually reaches sexual maturity approximately at three years of age and males at approximately four to five years. Mating takes place once a year and at the peaks in rainy season (Rahim, 1997). A single calf is produced after the gestation period of just over a year. Maternal care continues for one and half or two years.

HABITAT AND DISTRIBUTION

The dromedary camel is one of the most valuable domestic animals in the arid and semi-arid areas, because it is prepared to produce high-quality food at relatively low cost in excessively harsh environments (Yousif and Babiker, 1989). The dromedary camel is also known as Arabian camel which is found in North Africa and Middle East. The earliest fossils of camels were discovered from North America but they have been extinct there since the last glaciation. However the current distribution of camel is almost a remnant of a nearly cosmopolitan distribution.

ECOLOGICAL ADAPTATION

Dromedary camel is well adapted to life in deserts. The long evolution and adaptation has made it unique and highly adaptive to the disasters of its environments. In the course of history, pastoralists (traditional institutions) controlled and validated important indigenous knowledge of camel husbandry, behaviour, nutrition, commodity production and management, breeding and neonatal treatment, health and leisure, though facing many challenges (Saeed *et al.*, 2005).

STATUS AND CONSERVATION

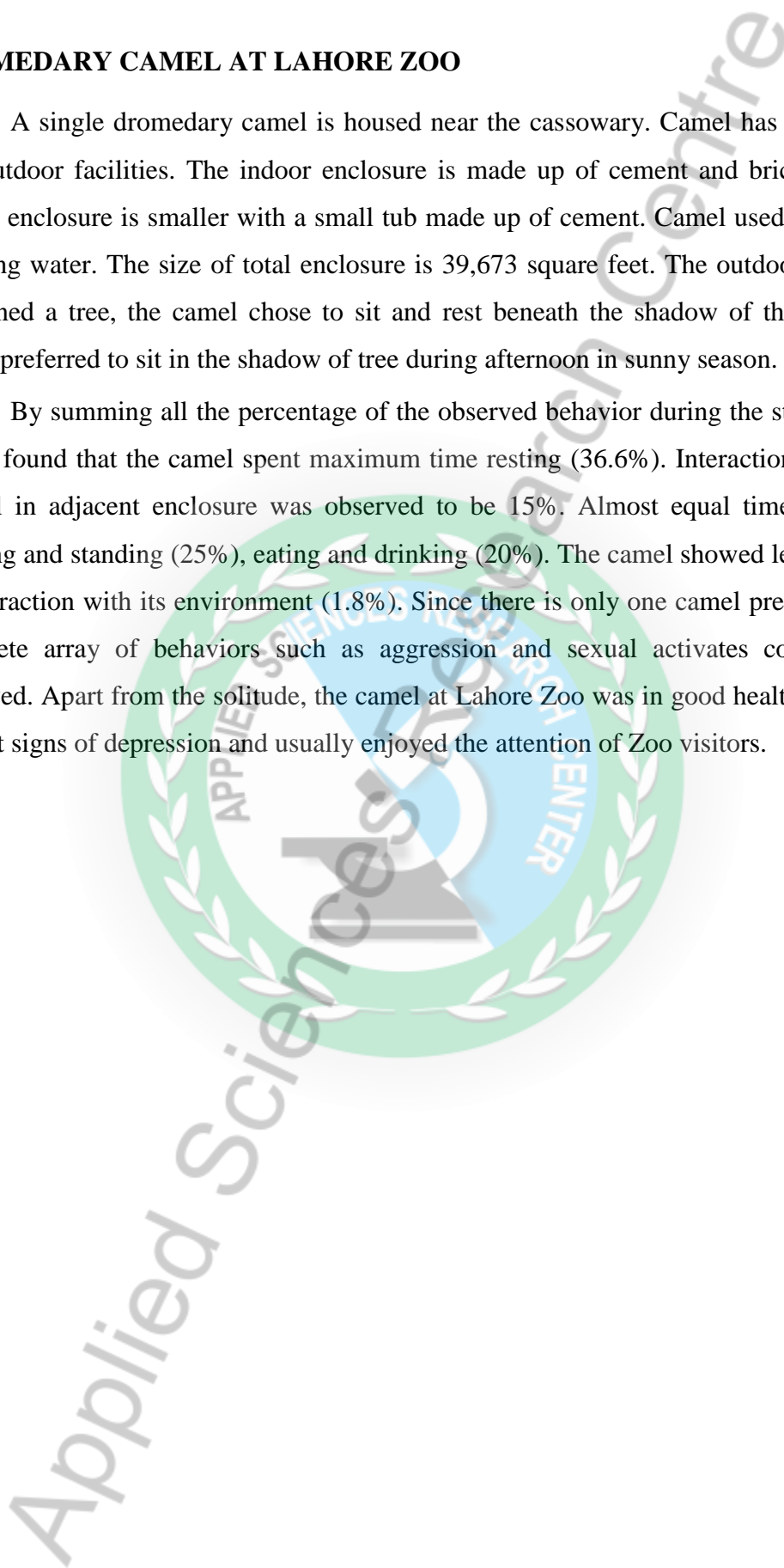
The dromedary camel is not endangered although the wild Bactrian camel is the only living wild population of *Camelus bactrians* and is considered the progenitor of the two-humped domesticated camel. The two species tend to be similar, but the wild camel is smaller and shorter, and has short, long, light brown fur as compared to the domestic species' dark brown, light yellow or grayish white fur. The shape of the humps is the clearest distinction between the two animals. The wild camel's two humps are narrower and more pointed than house camel's. Humps of domestic camels, which are larger and longer, can store fat weighing several tens of times more than that was deposited in their wild cousin's humps. The wild camel is an intelligent, quiet and quick-running animal with a keen sense of sound, sight and scent. They eat mushrooms, reeds and other plants in the desert and can drink salt water (Chilliard *et al.*, 2005).

Both the camels widely seen around the world are either dromedary (one humped) camels or Bactrian (two humped) camels and they are crucially domestic animals. This indicates that humans have had a great degree of impact on their development and treatment over time. For the survival of this magnificent species the breeding center is of critical importance. But the captive species must be closely handled for any of these factors to function so that they are balanced and genetically diverse.

DROMEDARY CAMEL AT LAHORE ZOO

A single dromedary camel is housed near the cassowary. Camel has both indoor and outdoor facilities. The indoor enclosure is made up of cement and bricks. But the indoor enclosure is smaller with a small tub made up of cement. Camel used this tub for drinking water. The size of total enclosure is 39,673 square feet. The outdoor enclosure contained a tree, the camel chose to sit and rest beneath the shadow of that tree. The camel preferred to sit in the shadow of tree during afternoon in sunny season.

By summing all the percentage of the observed behavior during the study period, it was found that the camel spent maximum time resting (36.6%). Interaction with other animal in adjacent enclosure was observed to be 15%. Almost equal time was spent walking and standing (25%), eating and drinking (20%). The camel showed least concern in interaction with its environment (1.8%). Since there is only one camel present in Zoo, complete array of behaviors such as aggression and sexual activates could not be observed. Apart from the solitude, the camel at Lahore Zoo was in good health. It did not exhibit signs of depression and usually enjoyed the attention of Zoo visitors.



FALLOW DEER



| | |
|---------|-------------|
| Kingdom | Animal |
| Phylum | Chordata |
| Class | Mammalia |
| Order | Artiodactyl |
| Family | Cervidae |
| Genus | <i>Dama</i> |
| Species | <i>dama</i> |

| | |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Common Name | Deer, برن |
| Height | <ul style="list-style-type: none"> - Male: 55 - 63 inches - Female: 51 - 60 inches |
| Weight | <ul style="list-style-type: none"> - Male: 60 - 100 kg - Female: 30 - 50 kg |
| Body Color | White, brown, reddish and grey |
| Habitat | Has the ability to survive wide range of habitats, forests, woodlands, meadows, marshes and agricultural areas |
| Distribution | <ul style="list-style-type: none"> - Native to Europe - Introduced globally (Asia, Middle East, America) |
| Conservation Status | Least concern |
| Diet | <ul style="list-style-type: none"> - Grazers (grasses, forbs, herbs, and sedges) - Browsers (trees and shrubs) |
| Behavior | <ul style="list-style-type: none"> - Social animals - Form big herds |
| Sexual Characteristics | Highly dimorphic |
| Mating Season | <ul style="list-style-type: none"> - Breeding season (rut) from September to January - Rut lasts approximately 135 days - Polygynous, formation of harems |
| Gestation Period | 231 - 245 days |
| Life Expectancy | <ul style="list-style-type: none"> - Wild: 12 - 16 years - Captivity: 20 - 25 years |

DESCRIPTION

Male fallow deer are called bucks. Female fallow deer are the doe and the young deer are the fawn. The name fallow comes from the light brown color of the deer. The Latin word dama or damma was used for roe deer, gazelles, and antelopes. Variations in the species exist based on their fur colors which vary from almost white to light chestnut or greyish brown. Sexual dimorphism exists. Only males have broad shovel shaped antlers which are absent in females (Rahim, 1997; McElligott *et al.*, 1998). Fallow deer don't live in groups except during the mating season when groups of 100 - 150 may be living together. Groups disperse after mating ends.

BIOLOGY

Fallow deer have a good sense of hearing and smell and very good vision. Fallow deer are found in a variety of habitats, ranging from dry and hot to wet and cool (Feldhamer *et al.*, 1988). The herd size is closely linked to the type of habitat. The fallow deer seem to have a preference for forest type ecosystem with areas of vegetation trees and grass. Sexes remain separate throughout the year forming smaller groups containing females with fawns or bachelor groups. The herds are largest during the rut when both sexes congregate (Putman, 2012).

Females reach sexual maturity (16 months) before males (48 months). Male fallow deer produce consistent low frequency groans from their oral and nasal cavities (Reby *et al.*, 2018), and maintain strict territories. Fallow Deer mating lasts from late September to late November (Thirgood, 1991). Before the start of rut, the males become very competitive against each other. Males struggle and fight aggressively for the right to suit maximum number of females. However it is normal for a buck to pursue a doe ready to mating through various territories, regardless of fighting other suitors to keep following her. They can also use various types of tail positions, touch, stiff-walking, and head positions for communication. Females bond with new born fawns. However males

do not participate in any parental activities (Thirgood, 1991). Nursing lasts an average of about 4 months and weaning is completed at around 7 months.

HABITAT AND DISTRIBUTION

The distribution of fallow deer before the last glaciations occurred in Europe, Asia Minor and the Mediterranean Sea along with areas as far as North Africa and Ethiopia. They were widely distributed to 38 countries in North and South America, the islands of Leeward, South Africa, New Zealand and Fiji.

ECOLOGICAL ADAPTATION

Fallow deer affect plant communities by browsing where they live influencing the ecosystem function. This hypothesis was tested in crop survival and retention study by feeding known amounts plant seeds from 25 species to four captive Fallow deer. Plant species were selected to test for ecological correlates and reflected large variations in seed form, size, longevity and overall habitat fertility. Fallow deer are also kept in the captivity for the meat production. Its relative domestication has led a path to easier breeding and confinement in Zoos. They are known to live up to 20 years of age when kept in the captivity. However, they exhibit aggressive behavior. Ruminating, grooming and other behaviors in the captivity are frequently observed.

STATUS AND CONSERVATION

The European Fallow deer are not an endangered species (Masseti and Mertzanidou, 2008). *Damadama mesopotamica* (Persian fallow deer) has historically been abundant in Western Asia and is currently listed as endangered in the IUCN Red List (Rabiei, 2008). The residual population was threatened in 1955 by habitat loss, and by animals and humans activities. In 1957, efforts were undertaken by the Opel Animal Preserve in Kronberg, Germany to conserve and assist breeding of this species. In Iran, the *Dama dama mesopotamica* species was granted full protection. In the late 1970s it was found that this wild population is well managed and is increasing in number.

Nonetheless, by 1988 the last wild population appeared to have gone missing. The species is also vulnerable in its natural habitat. They are reintroducing themselves in Northern Israel.

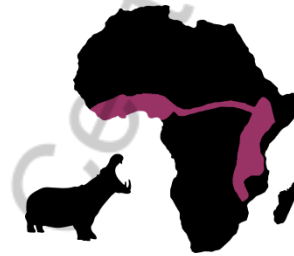
FALLOW DEER AT LAHORE ZOO

The fallow deer housed in Lahore Zoo have both indoor and outdoor facilities. The indoor enclosure is made up of cement and bricks. Fresh water and feeding troughs are provided. The size of the fallow deer's enclosure is 861 square feet.

By the summing all the observed behaviors it was found that the fallow deer spent more time in the outside enclosure than the inside enclosure. They engaged mostly in eating and resting (78%). The fallow deer usually (39.7%) showed interest and bold curiosity towards Zoo visitors, engaging in interaction such as petting and feeding by hand. Interaction with the environment was minimal (13.6%). Standing (27.3%) and elimination (15%) behaviors were observed as daily regimes. Fallow deer preferred to remain inactive, standing or sitting under the shade of the trees during the hot weather. Vocalization of fallow deer at Lahore Zoo is rare or non-existent.

Lahore Zoo has provided favorable conditions for fallow deer life in captivity. Normal behaviors exhibited in the wild such as grooming, feeding, ruminating and agonistic behaviors were also observed in captive animals. Animals did not show any signs of stress. Bucks and does approached Zoo visitors for food, whereas the fawns remained in the center of the enclosure.

HIPPOPOTAMUS



| | |
|---------|---------------------|
| Kingdom | Animalia |
| Phylum | Chordata |
| Class | Mammalia |
| Order | Artiodactyl |
| Family | Hippopotamidae |
| Genus | <i>Hippopotamus</i> |
| Species | <i>amphibius</i> |

| | |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Common Name | River hippopotamus, hippo, ہیپو |
| Height | 60 - 63 inches |
| Weight | <ul style="list-style-type: none"> - Male: 1,500 - 2,500 kg - Female: 1,300 kg |
| Body Color | Gray |
| Habitat | Mangrove swamps, lakes and rivers |
| Distribution | Africa |
| Conservation Status | Threatened and vulnerable |
| Diet | Herbivorous (grasses) |
| Locomotion | <ul style="list-style-type: none"> - Move by trotting on land and incapable of jumping - Can gallop up to speeds of 30 km/h - Not a good swimmer, prefers shallow water |
| Behavior | <ul style="list-style-type: none"> - Highly aggressive and unpredictable nature - Not territorial on land - Emerge at dusk to feed, solitary activity |
| Sexual Characteristics | Male is larger than the female |
| Mating Season | May to June |
| Gestation Period | 243 days |
| Life Expectancy | <ul style="list-style-type: none"> - Wild: 40 - 50 years - Captivity: 45 - 60 years |

DESCRIPTION

Hippopotamus is a semi aquatic, herbivorous ungulate native to Africa. It is a large and bulky animal notorious for being very aggressive. It is part of the surviving mega fauna on Earth, being the third largest terrestrial animal behind rhinoceroses and the elephant. It has small legs and feet which help it trot across the land. The feet are webbed which are useful when swimming in shallow water. Sensory organs such as eyes, ears and nostrils are located on the anterior side of the cephalic region; this adaptation allows the animal to be completely submerged in water without obstructing the senses. The jaw hinge is located at the back of the skull permitting it to open its mouth at 180° angle. Canine and incisor teeth are large and sharp. Teeth play no part in feeding; instead the powerful muscular lips are used to pull the grasses during grazing. Being amphibious herbivores hippopotamus feed by foraging on grasses.

BIOLOGY

Main diet is formed of leaves and roots of forest plants, grasses, fruits, herbs and ferns. They are completely dependent on vegetation near river bank and streams. They consume few aquatic plants but mostly graze on the land (Saikawa *et al.*, 2004). In captivity, hippopotamus eat grass fodder including all seasonal grass. Throughout the day hippos congregate in baths.

Mating System is polygynous. Reproductive success is dependent upon desirable territory occupied by the male. There is no evidence of sexual fluctuations in either males or females. Mating takes place in water and on land but usually occurs in dry conditions. Dominant males move with in herds. Courtship involves honking of male. Males smell posterior ends of females while searching for mates. The gestation period is eight months. Female is aggressive before giving birth. The baby develops into an adult in 3.5 years.

HABITAT AND DISTRIBUTION

Hippopotamus are found all over the World in Zoos. They are distributed in 37 countries of Southern Africa. Until about 30,000 years ago, *Hippopotamus amphibius* was widespread in Europe and Northern Africa during the Eemian and late Pleistocene (Van Kolfshoten, 2000). *Hippopotamus amphibius* is found abundantly in the Ethiopian region. They are also found in rivers throughout the African savanna, central Africa, West Africa, Sudan, Ivory Coast, Tanzania, Somalia, Kenya and Nigeria. They are extinct in Algeria, Egypt, Mauritania and Liberia. It has colonized Southern America and the rivers of Colombia. The reason for their vulnerability is the competition for land and its resources between man and hippopotamus. Hippopotamus now live in estuaries and on the lower side of the river.

ECOLOGICAL ADAPTATION

Hippopotami can play an important role as ecological engineers as carbon and nutrient vectors from savanna grasslands to aquatic environments via regular migration of feed (Subalusky *et al.*, 2015). Hippopotami urine and feces carry nutrients that vary in their stoichiometry, patterns of transport and lability. This indicates that the environment has different fates for these waste materials. Such incentives to animal-mediated capital may have a significant impact on the processing of nutrients, and their aggregate levels are a dynamic function of water level (group size decreases at higher flows) and human behavioral experiences.

STATUS AND CONSERVATION

According to the estimate of IUNC, hippopotamus is a vulnerable species (Kanga *et al.*, 2011). They are declining with great speed since the past ten years. Approximately 10% of species decline is expected and this rate will increase. The extinction of hippopotamus is due to the competition between man and his land, the loss of habitat and exploitation of resources. They are illegally hunted due to the damage they cause to agricultural crops.

Hippo has been on the list of endangered species since 2006. However, intensive hunting persists, since it is incredibly difficult to stop this activity and efficient application of legislation. Recently hippo ivory has been fetching as much revenue as elephants, which is a big factor behind their slaughter. Although there are provisions for reporting illegal killing and smuggling, many of the actions remain undetected. Furthermore, availability of sophisticated weapons allows swift and undetectable killing of a huge animal like the Hippo. It becomes impossible for hippos to maintain a spot because of the fact that they need to have a very large area for feeding and mating activities. They require deep water bodies and lots of green vegetation to survive. They don't do well sharing an area with other species. Coexistence with other species causes hippo aggressiveness which otherwise tend to maintain a healthy equilibrium in nature.

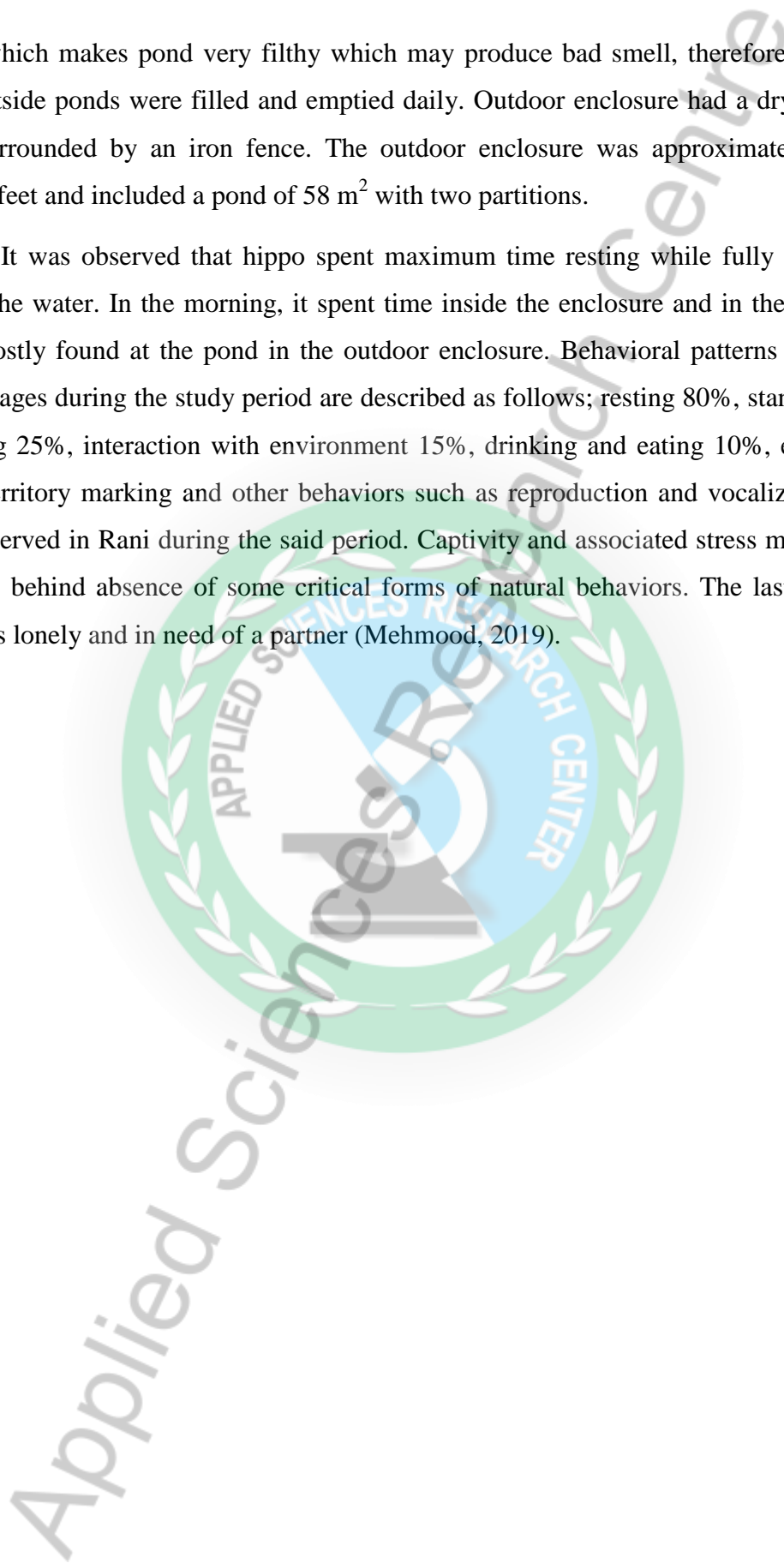
HIPPOPOTAMUS AT LAHORE ZOO

Lahore Zoo has only one surviving Hippopotamus, a female affectionately named Rani. Rani is a highly esteemed animal for the visitors of Lahore Zoo. She is housed near the elephant house. Rani is 16 years old and was brought to Lahore Zoo in 2006 from Africa when she is only 6 years old which is the age of sexual maturity. She weighs about 2,500 kg. The older male hippo Raja had died earlier in October, 2015 due to old age and deterioration of organ function. He was 51 years old at the time of his passing. He was brought to Lahore Zoo from Africa in 1974 when he was 10 years old. Rani was reported to be extremely concerned for the fellow captive, exhibiting nurturing behavior.

The Hippopotamus house at Lahore Zoo had both indoor and outdoor facilities. The enclosure sheltering the animal was divided in to the outdoor and indoor enclosures. The total area of enclosure was 8,901.8 square feet. The Indoor enclosure (including pool) was approximately 968.7 Square Feet and the outdoor enclosure (only landscape) was approximately 11302.1 Square Feet. The indoor enclosure was made up of cement and bricks with an area of 2,500 square feet including a large pond of 70 m². Permanent water tub made up of bricks and cement was also present. Hippos pass large amounts of

stool which makes pond very filthy which may produce bad smell, therefore the inside and outside ponds were filled and emptied daily. Outdoor enclosure had a dry moat and was surrounded by an iron fence. The outdoor enclosure was approximately 6,401.8 square feet and included a pond of 58 m² with two partitions.

It was observed that hippo spent maximum time resting while fully submerged under the water. In the morning, it spent time inside the enclosure and in the evening it was mostly found at the pond in the outdoor enclosure. Behavioral patterns in form of percentages during the study period are described as follows; resting 80%, standing 50%, walking 25%, interaction with environment 15%, drinking and eating 10%, elimination 3%. Territory marking and other behaviors such as reproduction and vocalization were not observed in Rani during the said period. Captivity and associated stress might be the reasons behind absence of some critical forms of natural behaviors. The last surviving hippo is lonely and in need of a partner (Mehmood, 2019).



INDIAN CRESTED PORCUPINE



| | |
|---------|----------------|
| Kingdom | Animalia |
| Phylum | Chordata |
| Class | Mammalia |
| Order | Rodentia |
| Family | Hystricidae |
| Genus | <i>Hystrix</i> |
| Species | <i>indica</i> |

| | |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Common Name | Indian porcupine, سیہی, خار پشت |
| Height | 24 - 36 inches |
| Weight | 11 - 18 kg |
| Body Color | Brown and black having white spines |
| Habitat | Tropical and temperate forests, shrubs and grasslands, plantations and gardens |
| Distribution | Europe, Africa, Asia |
| Conservation Status | Least concern |
| Diet | Herbivorous (green plants, herbs, leaves, twigs and bark) |
| Locomotion | <ul style="list-style-type: none"> - Excellent climbers - Arboreal locomotion - Capable swimmers |
| Behavior | <ul style="list-style-type: none"> - Nocturnal - Both adults and weaned juveniles spend an average of 7 hours foraging every night |
| Sexual Characteristics | Females are dominant over males |
| Mating Season | February to March |
| Gestation Period | 240 days |
| Life Expectancy | <ul style="list-style-type: none"> - Wild: 10 - 15 years - Captivity: 20 - 25 years |

DESCRIPTION

The crested porcupine is a large rodent. They are endothermic and bilaterally symmetrical. Porcupines possess customized hairs called quills covering their body. Quills are made up of keratin and are quite flexible (Raha *et al.*, 2015). Indian porcupine quills are white in color and are attached with muscles from the base. Porcupine raises its quills in defense at the time of danger. They have sharp edged (chisel like) incisors. It has long claws on hands and feet to help in burrowing. The burrows are often excavated under rocks, which then serve as the den's roof. Natural caves are also used as dens (Alkon, 1999). Permanent burrows as well as several others exist within their territory which may be used in times of danger.

BIOLOGY

Porcupines are primarily herbivorous. They feed on fruits, vegetables, nuts, bulbs, roots, bark etc. However, insects and small vertebrates are also a part of their diet (Hafeez *et al.*, 2015). They also chew on bones for extra nourishment. They are nocturnal like all old World Indian porcupines. They forage at an interval of seven hours daily. In winters, they bask in the sun. They rest in self-constructed burrows during daytime. The tunnel width fits that of the animal and has a large chamber at the far end. They usually live in pairs and use burrows for hiding during the day (since they are nocturnal) as well as for breeding. Newborn porcupines are weaned at 3 months but nibble food within several days of being born (Kadhim, 1997).

HABITAT AND DISTRIBUTION

Indian porcupine is native to the Middle East and South Asia. They are distributed widely in Central and Southeast Asia and in many regions of Middle East as well as countries like Turkey, Saudi Arabia, Yemen, Iraq, Iran, Pakistan, India, Sri Lanka, Nepal and Bhutan (Amori *et al.*, 2016). It is the largest species in order rodentia and belongs to old World porcupines. Indian porcupines have adapted to multiple environments. They

are ground dwellers, good swimmers and efficient climbers. They prefer tropical and sub-tropical grasslands, rocky hill-sides, mountains, forests and temperate scrublands.

ECOLOGICAL ADAPTATION

Porcupines are burrowing animals which function as ecosystem engineers by altering the biotic or abiotic environmental components and reshaping microhabitats (Wilby *et al.*, 2001). Porcupines play an efficient role in dispersion of seed and pollen (Gurung and Singh, 1996). Rodents, such as porcupines, are especially attracted to archaeological sites due to the presence of food debris and also since the archaeological sediments are often less densely packed than those of the surrounding area, making them eminently suitable for burrowing. This form of burrowing disturbance is common. Indian porcupine burrows can be 15 m or longer and have one or more openings.

STATUS AND CONSERVATION

In 2008, the IUCN listed Indian porcupine as species of least concern due to its adaptability to various habitats and food types. The Indian crested porcupine is protected under the law. The porcupine habitat is declining due to pesticide use, urbanization and infrastructure development. In many places they are common and considered a pest. They are hunted because they cause destruction of gardens and agricultural crops. Therefore measures are taken to control habitat destruction caused by them.

INDIAN PORCUPINE AT LAHORE ZOO

There were two porcupines housed at Lahore Zoo at the time of this study. The porcupine enclosure was not open for viewing by the general public. Such precautionary measures were taken to provide disturbance free environment to the animals since they can easily become stressed and erect their quills if threatened. The porcupines were housed in an indoor enclosure. All porcupines were kept in the same enclosure. The enclosure size was about 238.9 square feet. The interior of the enclosure was designed to resemble porcupine's natural habitat. The enclosure looked like a rock as porcupines

prefer to live in caves and rocky mountains. There was a small water tub made up of cement with fresh water. The enclosure itself was made up of bricks which were made to look like rocks. There were 4 - 5 cement pipes present inside the enclosure which mimicked burrows. Porcupines used these pipes for the purpose of resting during the day time.

Porcupines at Lahore Zoo spend a great deal of their time resting and did not respond to any Zoo visitors. Elimination was not observed but droppings were observed at the mouth of the burrows in early hours of the morning. During the observation time all porcupines were not active. Often they were in a lazy mood and did not exhibit aggression towards each other. They walked around in the enclosure, often sniffing at the ground or eating but mostly they spent their time in sleeping and resting.



INDIAN GAZELLE



| | |
|---------|------------------|
| Kingdom | Animalia |
| Phylum | Chordata |
| Class | Mammalia |
| Order | Artiodactyla |
| Family | Bovidae |
| Genus | <i>Gazella</i> |
| Species | <i>bennettii</i> |

| | |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Common Name | Chinkara, چنکارا |
| Height | 26 inches |
| Weight | 23 - 25 kg |
| Body Color | Brown, reddish and white |
| Habitat | Hills, plains, deserts, dry scrub and light forests |
| Distribution | Afghanistan, Bangladesh, India, Iran and Pakistan |
| Conservation Status | Protected |
| Diet | Herbivores (frugivores and folivores) |
| Locomotion | Running and leaping |
| Behavior | <ul style="list-style-type: none"> - Shy and solitary - Nocturnal feeders - Avoid human habitation - Male are territorial |
| Sexual Characteristics | <ul style="list-style-type: none"> - Horns on both sexes - Male horns are curved and larger than females - Females are shorter and lighter in weight than males |
| Mating Season | August-October and March-April |
| Gestation Period | 5 - 5.5 months |
| Life Expectancy | <ul style="list-style-type: none"> - Wild: 12 - 15 years - Captivity: 10 - 12 years |

DESCRIPTION

Chinkara is also known as the Indian gazelle (*Gazella bennettii*) and is native to the sub-continent (Mallon, 2008). It is a slender and graceful mammal. It almost looks like a deer but has its own unique appearance distinguished by sandy colored fur and a characteristic white stripe on each side of the face. It is approximately 65 cm in height and weighs about 23 kg; females are shorter and lighter in weight than males (Prater, 1971; Rahmani, 1990). They have beautiful horns in both sexes which range in length to about 30 to 40 cm and persist throughout lifetime. Females have smaller ring less horns and are straight or uncurved whereas the males have larger ringed horns (Prater, 1971). Chinkara has medium sized tail with dorsal crest of black hairs and a characteristic cluster of hair growth on the knees (Roberts, 1977). It can run at great speeds of between 50 - 60 kilometers. Studies suggest that chinkaras can live up to the 12.3 years in captivity but in wild their longevity is mostly unknown (de Magalhaes and Costa, 2009; Dookia, 2009).

BIOLOGY

Chinkara has the minimum diverse food habit (Solanki and Naik, 1998). They defend their resources by using their horns. Their food mainly consists of grass, leaves and fruits such as pumpkins and melons. Their frugivore habit makes them important in seed dispersal. They can get sufficient hydration from the dew and plants which allows them to survive without water for days. They also have a high level preference for legumes (Solanki and Naik, 1998).

Chinkara reach sexual maturity at the age of 2 years. Typically they are polygamous. During mating season males compete against other males aggressively and defend females before mating. They breed throughout the year that takes place between March and end of April and then again from late August to early October. The gestation period is 5 to 5.5 months. It has been frequently reported that the females may give birth to twins but generally one offspring is produced. Birth rate is higher in April. Direct

maternal care is prevalent, the young may stay with their mother for up to 12 months after which the mother may produce further offspring (Arshad and Gill, 2010; Mallon, 2008).

HABITAT AND DISTRIBUTION

Chinkara lives in desert areas, hills, plains, grassland, dry scrub and light forests of Bangladesh and Pakistan and in some parts of Iran. It is widely distributed in nine Indian states namely Rajasthan, Madhya Pradesh, Gujrat, Uttar Pradesh, Haryana, Bihar, Karnataka, Andhra Pradesh and Maharashtra. Studies suggest that the Pakistan's population is very fragmented and hunting has significantly reduced the population. Iran population is scattered too and in Afghanistan Chinkara are possibly very rare (Rahmani, 1990; Dookia and Jakher, 2013).

STATUS AND CONSERVATION

Chinkara population is reduced to the point of extinction, along the eastern border of Pakistan in the desert regions due to the extensive hunting and poaching also in Iran and Afghanistan. In India this species is not at risk of extinction; however they are very rare in the Thal desert. In 1950s they were threatened due to the hunting and habitat loss (Khampariya and Singh, 2011). They were considered vulnerable in 1994 and also a species of lower risk in 1996. Since then it has recovered and is now regarded by the IUCN (International Union for the Conservation of Nature) as a species of least concern.

Chinkara exists in over 80 protected zones, 9 in Iran and 5 in Pakistan. In some parts of western India, villagers protected them for their religious reasons. This species in Pakistan, India and Iran is protected completely by rules and regulation under the wildlife protection act schedule. India's Ecology and Rural Development Society constantly undertakes immense research on Indian gazelles. Anti-poaching operations are conducted from time to time to keep hunters at bay. Workshops are also held to raise awareness among people about the significance of chinkara in society and environment.

CHINKARA AT LAHORE ZOO

At the time of present study, there were 7 chinkaras at Lahore Zoo, 3 females including a fawn and 4 males. The chinkaras were housed in the deer park. They had an indoor facility as well as an outdoor facility. The indoor enclosure was made up of cement and bricks, whereas the outdoor enclosure had a small permanent cemented trough and a khurli from which the chinkara drank water and ate fodder respectively. The total area of enclosure was approximately 6720.6 square feet. Two males were kept separately and shared the pen with hog deer because of their aggressive and dominant behavior. The ages of these captive animals were unknown.

All the activities and behaviors of chinkaras at Lahore Zoo were observed and it was determined that the male chinkaras spent maximum time walking and marking their territory, during that time they exhibited environmental sniffing, agonistic behavior (without direct body contact) with the Black buck in the adjacent enclosure and with the Zoo visitors. The chinkara males were more active before the sunset. Whereas the females spent their day foraging and standing idly during morning but in the evening they spent most the time walking. Eating, drinking and elimination were also performed while standing. Other behaviors such as foraging, observation, stereotypic behavior and ruminating were also observed. Both males and females were found mostly lingering near the outdoor enclosure; the indoor enclosure was used for resting or as shelter from sun.

Chinkaras at Lahore Zoo preferred to stay in the center of the enclosure far away from the boundary parameters and Zoo visitors. Although the presence of visitors did not seem to bother them, however they preferred to engage in mutual social activities instead of interacting with the visitors. A few bold bucks could be lured with food and coaxed to allow petting.

INDIAN ROCK PYTHON



| | |
|---------|----------------|
| Kingdom | Animalia |
| Phylum | Chordata |
| Class | Reptilian |
| Order | Squamata |
| Family | Pythonidea |
| Genus | <i>Python</i> |
| Species | <i>molurus</i> |

| | |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Common Name | Indian python, rock python, Asian rock python, اژدها |
| Height | 352 inches in length |
| Weight | 35 - 55 kg |
| Body Color | Yellowish or whitish with tan or brown pattern |
| Habitat | Marshes, swamps, grasslands, woodlands, rocky foothills, river valleys and open forests |
| Distribution | Pakistan, India, Bangladesh, Nepal, Sri Lanka and Bhutan |
| Conservation Status | Threatened |
| Diet | <ul style="list-style-type: none"> - Predator - Carnivorous (birds and mammals) |
| Locomotion | <ul style="list-style-type: none"> - Movement in straight line - Rectilinear progression |
| Behavior | <ul style="list-style-type: none"> - Sluggish movement - Timid and non-aggressive - Excellent swimmers - Solitary species except for mating season |
| Sexual Characteristics | Female is larger than male |
| Mating Season | February to March |
| Gestation Period | 60 - 90 days |
| Life Expectancy | <ul style="list-style-type: none"> - Wild: 20 - 30 years - Captivity: 15 - 40 years |

DESCRIPTION

Members of Pythonidae family (8 genera and 26 species) are amongst the largest snakes of the World. Most famous genus is python. Indian python or Indian rock python are timid and non-aggressive by nature. They have long slender bodies and can grow to enormous lengths, weighing up to 12 kg. These snakes are venom less. Indian rock pythons are lighter in color while Burmese python are darker in color. Burmese pythons have very brown blotches that extend up to their tail. They prefer to live in wet and hot environments. They are good swimmers as well as good climbers (Reynolds *et al.*, 2014).

BIOLOGY

Like all other snake species Indian pythons are strictly carnivorous and feed mostly on reptiles and mammals. Some may prey on birds, their chicks and eggs (Mehrtens, 1987). In wild, Indian python calmly lies in wait for the prey to come close to it. To hide from its prey, the Indian python uses its skin patterns as camouflage. As the prey comes closer to it, the python suddenly attacks with reflex movement of its body muscles. The inwardly shaped teeth help the python to grab the prey and prevent it from escaping. Live prey is constricted in the coils made from the snake's body and killed by suffocation. The prey is swallowed whole without chewing. Jaws are free moving and not joint which allows the python to engulf prey much larger than itself.

Indian python are a solitary species and pairs are only observed during mating season. They are dimorphic. Python attain sexual maturity at 3-4 years of age. Sexually mature pythons exhibit courting behavior. They are oviparous. Females after mating have a gestation period of about 60-90 days after which she laid eggs. Females can lay up to 100 eggs (Mehrtens, 1987). The incubation period is 2-3 months.

HABITAT AND DISTRIBUTION

Pythons are non-venomous snakes, found in Asia, Africa, and Australia (McDiarmid *et al.*, 1999). In Asia they are found in Pakistan, India, Bangladesh, Sri

Lanka, Nepal, Nicobar Islands, Myanmar, Hong Kong, Southern China and Hainan. Also found in Malayan region of Indonesia and Philippines. In Africa they are found in south tropical region of Sahara but are absent from the South African Western tip and Madagascar.

ECOLOGICAL ADAPTATION

Python are a threatened species largely due to destruction of its natural habitat. The jungle habitat of Python is rapidly declining as trees are cut down for timber, firewood, agricultural growth and to allow way for human settlements. Indian pythons are feared by the local human populations, and are sometimes killed on sight. However, pythons play major ecological role by keeping bird and mammalian populations under check. As the population of Indian pythons has declined in many places, the rodent population has elevated, becoming major domestic pests.

STATUS AND CONSERVATION

Pythons are feared animals. The Indian python and other species of pythons have long been hunted and caught for the pet trade. All types of snakes are killed for their commercial potential for venom, milk and blood that are claimed to have medicinal qualities. In Thai markets, live snakes are killed to order, so that consumers can drink their fresh blood, which is claimed to offer vitality. Python leather is made into trendy items such as shoes, purses, belts and even dresses. Snakes are often skinned alive, so that the skin is not marred, which is extremely painful and cruel for the victims. Pythons were considered a trophy animal long before snakeskin boots became popular, and were extensively hunted by Europeans. They have been more recently sought after for the pet trade and Zoos.

Indian pythons are considered an endangered species and are now protected by law in accordance with other python species, which bans trade in live pythons and python products. However, smuggling also poses a significant threat. India has built several

wildlife reserves where Indian pythons are legally protected but it is difficult to police the limits of these reserves.

INDIAN PYTHON AT LAHORE ZOO

One female and one male Indian rock python were studied in Lahore zoo. Lahore Zoo has three male and one female Indian rock pythons. The age of the pythons was unknown. Indian pythons were housed in the snake house. They had separate enclosures covered by glass from two sides so that visitors could have clear view of them. The ground surface was laid with soft sand. The enclosure contained a water bath for drinking and swimming. Enclosure also had a bracket fan for cooling the pythons in summer. Pythons are reptiles which is why they needed proper temperature. There was no outdoor area in the enclosure. The total area of python enclosure was not measured by the Zoo but the total area of the snake house was 6,000-10,027 square feet.

The pythons were mostly seen resting. They only moved a little inside the enclosure and preferred to rest in a corner of the enclosure in curled up position. Elimination was also observed which was in a form of thick white tubular cord-like droppings with irregular surface. Male python marked his territory by use of fecal materials. They were seen interacting with each other by curling upon each other. During summer the snakes were seen swimming and resting in the enclosure pool to regulate their body temperatures. In winter season they moved very little to none at all.

INDIAN WOLF



| | |
|---------|--------------|
| Kingdom | Animalia |
| Phylum | Chordata |
| Class | Mammalia |
| Order | Carnivora |
| Family | Canidae |
| Genus | <i>Canis</i> |
| Species | <i>lupus</i> |

| | |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Common Name | Arabian wolf, Himalayan wolf, بھیریا |
| Height | 40 - 60 inches |
| Weight | <ul style="list-style-type: none"> - Male: 19 - 25 kg - Female: 17 - 22 kg |
| Body Color | Light brown to greyish and reddish |
| Habitat | Scrub lands, grasslands and forests |
| Distribution | Pakistan, Afghanistan, India, Bhutan, Nepal, Turkey, Israel, Syria and Iran |
| Conservation Status | Endangered |
| Diet | <ul style="list-style-type: none"> - Predator - Carnivorous (ruminants, rodents, lagomorpha) |
| Locomotion | <ul style="list-style-type: none"> - Terrestrial, Cursorial mammal - Exceptional speed and endurance |
| Behavior | <ul style="list-style-type: none"> - Nocturnal, pack hunters, lure and ambush strategy - Notorious for attacking human children - Predators of domestic livestock - Pack leaders are alpha male and female - Altricial with maternal care |
| Sexual Characteristics | Male is larger than female |
| Mating Season | October - December |
| Gestation Period | 62 - 75 days |
| Life Expectancy | <ul style="list-style-type: none"> - Wild: 6 - 8 years - Captivity: 13 - 17 years |

DESCRIPTION

Indian wolf is a subspecies of the Grey Wolf. There is a similarity in size between the Tibetan and Arabian wolf, which lacks the luxuriant winter coat of the former as it lives in colder conditions. Minor morphological skull variations in Iranian wolves have been reported however their genetic lineage has not been verified, this and lack of further evidence does not support them belonging to a separate subspecies (Khosravi *et al.*, 2012). The Indian wolf resembles the European wolf in overall shape, but is thinner, slightly more built and has shorter fur with little or no underfur. Like the Arabian wolf, it has short, thin fur in summer, but even in summer, the hair on the back stays long, an adaptation believed to be protective against solar radiation. The hair is usually greyish-red with black highlights or reddish-white. The hairs, particularly on the back, are grizzled with black, which sports a dark V-shaped patch across the shoulders. The arms are paler than the rest of the body and the subparts are almost white (Jhala and Giles, 1991).

BIOLOGY

The Indian wolf moves in smaller packs and is less vocal and aggressive than other grey wolf types and has a reputation for being a cunning animal (Saad *et al.*, 2015). The Indian wolves are exclusively carnivorous and their food source is dependent upon their geographic location. If they hunt in a pack their food includes large ungulates such as moose, American bison, reindeer, muskox and yak. When they hunt alone each wolf hunts for its own food, their diet mainly comprises of small birds and mammals, mostly rodents such as rabbits, raccoons and rats. (Lokhande and Bajar, 2013). A wolf can eat up to 9 kg meat at a time. They usually consume the entire carcass that includes bones and even some hairs. They can also survive on rubbish or carrion if other food sources are unavailable.

Wolves attain sexual maturity at the age of 2-3 years. This fact is dependent on food availability and population statistics. The male create their territory by marking it. Wolf territory is the area where a specific mating pair lives, expelling other wolves.

During pregnancy the female lives in the peripheral zone of this territory. Pups are born with sooty-brown fur having milk-white spots on the chest which disappear with age.

HABITAT AND DISTRIBUTION

Indian wolves are identified in India, Pakistan, Afghanistan, Nepal, Bhutan, Israel, Turkey, Iran and Syria. Israel has made considerable effort towards the conservation of Indian wolf and has succeeded in maintaining a moderately sized population which has also radiated into neighboring countries (Gómez-Sánchez *et al.*, 2018). About 7,000 wolves have taken up refuge in Turkey, which is the last remaining Syrian population (Pierre and Lise, 2006). Northern regions of Pakistan, India, Afghanistan and Kashmir are important refuges for the Indian wolf. They live in open grasslands, trees with thorns and scrublands.

ECOLOGICAL ADAPTATION

Wolf habitat loss is caused by high human population, extension of farming practices, urbanization, weeding demand, forest clearing and low supply of wild preys (Jhala, 2003). If natural preys are scarce, wolves routinely cross into domesticated regions such as agricultural lands located close to forests, feeding on livestock and farm animals. This causes human-wolf conflicts and wolf persecution since human population density is high in these areas. Wolves are reported to cause fatal attacks on human children and even adults, resulting in hatred for the animal and its unprovoked killing by organized hunting parties (Michael, 2002).

It is not uncommon for locals to exaggerate the magnitude of Indian wolf depredation and tell tales of their predatory wiles, contributing to hatred of the animal. As wolves are carnivores, their presence is important for regulating pest rodent populations.

STATUS AND CONSERVATION

The Indian wolf has been protected under wildlife laws since 1972 and is classed as endangered. However many wolf populations either linger in low numbers or forced to

live in areas populated by humans. Habitat destruction due to domestication of forests, loss of prey and unregulated hunting has made it vulnerable, with an estimated population of only 2,000-3,000 (Yadvendradev *et al.*, 1991).

Reducing human-wolf conflicts and managing those that arise will be important steps if humans and wolves are to coexist peacefully. Through education, tourism, and effective management, WWF is working to enhance the acceptance of wolves (Saad *et al.*, 2015).

INDAIN WOLF AT LAHORE ZOO

Indian wolf at Lahore Zoo is a female named Lilly. Lahore Zoo has only one female Indian wolf. The age and weight is unknown. She was housed alone in single enclosure. The enclosure had no indoor facility, only an outdoor enclosure secured with metallic bars. Food and water were provided in the outdoor enclosure, where she fed, rested and slept. A small permanent tub was provided at the side of enclosure from which Lilly drank water. The enclosure was sealed with double grating which was present to protect the visitors. The whole enclosure was ventilated and made with bricks and cement.

Since wild wolves are social animals and live in packs, Lilly exhibited clear signs of aggression due to stress caused by loneliness and Zoo visitors. She spent most of her time running or fast pacing from one corner to the other corner inside the enclosure. It engaged very little in eating and drinking, instead spent more time in running from one side to other in constant stress.

JUNGLE CAT



| | |
|---------|--------------|
| Kingdom | Animalia |
| Phylum | Chordata |
| Class | Mammalia |
| Order | Carnivora |
| Family | Felidae |
| Genus | <i>Felis</i> |
| Species | <i>chaus</i> |

| | |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Common Name | Swamp cat, reed cat, جنگلی بلی |
| Height | 14 inches |
| Weight | 2 - 16 kg |
| Body Color | Sandy, yellowish, brownish and grey |
| Habitat | Swamps, wetlands, grasslands, littoral and riparian areas |
| Distribution | Middle East, central and Southeast Asia, Southern China |
| Conservation Status | Least concern |
| Diet | <ul style="list-style-type: none"> - Predator (small prey) - Carnivorous (fish, amphibians, reptiles, birds, mammals) - Partially omnivore (frugivorous in winter) |
| Locomotion | Climber, high leaps, efficient swimmer, swift sprinter |
| Behavior | <ul style="list-style-type: none"> - Diurnal, solitary and territorial - Mating behavior akin to the domestic cat - Vocalization similar to small roars |
| Sexual Characteristics | <ul style="list-style-type: none"> - Male is larger and dominant over female - Sexual maturity for both sexes at 1 year age |
| Mating Season | January to March |
| Gestation Period | 60 days |
| Life Expectancy | <ul style="list-style-type: none"> - Wild: 12 - 14 years - Captivity: 15 - 20 years |

DESCRIPTION

Jungle cat is larger than the domestic cat. It is the largest species in the genus *Felis*. The jungle cat is very slim and has long slender legs. Ears are rounded with black tuft of hair present on tips. The face is narrow and slim with a white muzzle. Special white markings are present above and below the eyes. Dark spots are also present near the nose. The coat color of jungle may be reddish, sandy, brown or tawny grey (Sunquist and Sunquist, 2002). Coat is usually plain without any pattern or spots. The jungle cat may have several stripes on legs. The stomach is lighter than the rest of the body. Many narrow black rings are present near tip of tail. The domestic cat has longer tail as compare to the jungle cat.

BIOLOGY

They can jump high and sprint very fast due to its long legs and overall agility. It can perform high leaps in air to grasp flying birds. It is also an accomplished swimmer which allows it to catch fish. The jungle cats are carnivorous hunters and primarily feed on rodents such as rabbits, hares and gerbils; however they may also feed on insects, fish, birds, smaller amphibians, reptiles such as snakes and frogs (Mukherjee *et al.*, 2004). Jungle cat are often found in higher numbers where excess rodents are present.

Females are smaller and lighter as compared to males. Sexual maturity in both sexes is reached after one year. Young jungle cat have many stripes or spot which are marked on birth and remained present until they attain sexual maturity (Pacifci *et al.*, 2015). Mating is usually recorded in February till March in Central Asia and October in India. Males mark territory by urination. When mating season comes, fights occur during males for dominance. The mating behavior of jungle cat is similar to local cat. Female is perused by the male while in the estrus and grasped by the collar of neck. Vocalization is prominent during mating. Gestation period lasts for 2 months. Litters typically comprise of 2 to 5 kittens. Kittens remain under the mother's protection for 8 to 9 months, after which they leave.

HABITAT AND DISTRIBUTION

Jungle cat occurs widely in tropical and subtropical Asia, including southern China and the Himalayan foothills, but not the Malay Peninsula (Tohme´ and Tohme´, 2000). They keep away from woodlands and rain forests (Hunter, 2015). The jungle habitat is commonly found in thick vegetation with less water like wetlands and marshy areas. Reeds and tall grasses are their typical habitat. Jungle cats occur mainly in farmlands such as in fields of beans and sugar cane. They are not found in cold areas and cannot survive in cold habitat. Jungle cats are diurnal which means that they are active during the day time and can hunt throughout the day but their activity decreases during hot noon hours. They are solitary in nature and prefer to rest in burrows, grass, thickest and scrub. The jungle cat has been recorded in Turkey (Avgan, 2009), Palestinian territories (Albaba, 2016), Iran (Sanei *et al.*, 2016), India (Mukherjee and Groves, 2007) and Nepal (Shrestha *et al.*, 2020). In Pakistan, Jungle cat has been photographed in Dera Ismail Khan, Haripur, Sialkot and Langh Lake Wildlife Sanctuary (Anjum *et al.*, 2020).

ECOLOGICAL ADAPTATION

Jungle cats are very beneficial for humans especially in agricultural areas because rodents destroy food and cash crops causing considerable economic loss. They commonly feed on rodents. They hunt small prey which usually weigh less than one kilogram and may include mammals as bigger as young gazelles (Kingdon *et al.*, 2013). They are a nuisance for poultry farm owners and have an overall negative impact on the poultry industry because they destroy poultry animals such as chicken, ducks and geese. This predatory behavior allows them to be labeled as pests, as result they are typically targeted through poisoning by the farmers.

STATUS AND CONSERVATION

Major threats to jungle cat are habitat loss or destruction, trapping, poisoning or persecution by humans. The human population increases rapidly therefore more land is cultivated thus natural habitat is converted to farmland. The jungle cats are highly

adaptable; when natural prey is not present they feed on livestock, bringing them to a clash with the landowners. As a result they are often targeted by traps or poison. The jungle cats are also threatened because of their fur and black market demand in fur trade. Jungle cat skins were export from India in large numbers; however this practice has since been made illegal.

Following measures are being taken as efforts towards conservation of jungle cats

- Monitoring and *insito* research
- Formation of protected areas and habitat protection
- Conservation of land or water sources in protected areas
- Management of biodiversity by export controls and international legislation
- Educational awareness

JUNGLE CAT AT LAHORE ZOO

At the time of current study, Lahore Zoo had two male jungle cats confined in the same enclosure. The enclosure was made up of cement and bricks. The total area of the enclosure was 648 square feet. It was almost 10 feet high. Three sides of the enclosure were made up of bricks and metal grill bars made up the front side of the enclosure. There was a water tub at one side and two windows situated parallel to the water tub where jungle cats were often observed to be sitting. Jungle cats were mostly seen resting since there were no interactive objects inside the enclosure for other activities.

Mostly they ignored the Zoo visitors however sometimes they responded in a friendly manner, exhibiting mood shifts. One of the males was very shy as compared to other jungle cat and usually preferred to stay in the corner of the enclosure. The second male frequently exhibited aggressive behavior towards Zoo visitors in response to jeering or disturbance. This male exhibited cleverness and responded with affection when treated with kindness. It purred and meowed when spoken to through the bars. Both males were most active before and during feeding time which was between 11:30 – 11:45 am in the morning. They started jumping on the window due to the smell the food before serving and ate almost immediately. Both cats did not fight and sat silently separately. They did not interact with each other.

NILGAI



Kingdom
Phylum
Class
Order
Family
Genus
Species

Animalia
Chordata
Mammalia
Artiodactyl
Bovidae
Boselaphus
tragocamelus

| | |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Common Name | Blue bull, نیل گائے |
| Height | 40 - 60 inches |
| Weight | <ul style="list-style-type: none"> - Male: 109 - 288 kg - Female: 100 - 213 kg |
| Body Color | <ul style="list-style-type: none"> - Male: Bluish grey - Juveniles and Females: Orange to tawny |
| Habitat | Scrub forests, grassy plains and agricultural lands |
| Distribution | <ul style="list-style-type: none"> - Northern India, Nepal and Pakistan - Introduced and established in Southern Texas |
| Conservation Status | Least concern |
| Diet | Herbivorous browsers (woody plants, grasses and herbs) |
| Locomotion | Hind legs, galloping |
| Behavior | <ul style="list-style-type: none"> - Diurnal and territorial - Tame, social, timid and cautious - Tactile communication - Males become aggressive for dominance |
| Sexual Characteristics | <ul style="list-style-type: none"> - Sexual maturity Males: 4 years; Females: 2 years - Only males possess horns |
| Mating Season | December to March |
| Gestation Period | 244 - 274 days |
| Life Expectancy | <ul style="list-style-type: none"> - Wild: 10 - 12 years - Captivity: 12 - 20 years |

DESCRIPTION

Nilgai is the largest of the Asian antelopes. It is pervasive throughout the Indian sub-continent. It is a sturdy antelope with thin slim legs. It is a diurnal animal. Breeding bulls often prefer to live alone, but can sometimes live temporarily with herds. Females with young calves live in separate herds away from the bulls and juveniles. Young males and females occasionally accompanied by one or more older males and females live in herds of 15 to 20 or more (Gautam, 2015). Only males possess horns although some females may also have them. During the entirety of the year, females and males live separately, with the exception of for when the male joins the females for breeding.

BIOLOGY

Nilgai is a timid animal and may run away if threatened. Males produce grunting noises when alarmed (Leslie, 2008). Maternal behavior is prominent. Females with young calves stay away from the males. Blue bull has the feeding behavior of both a grazer and browser, but their preferred diet consists of grasses (Khan, 1979; Sankar and Vijayan, 1992). They exhibit an elaborate defecation process by spreading its legs apart and lowering the rump while the tail is raised vertically upwards. Defecation is less elaborate in female.

Females mature at the age of 18 months but the complete sexual maturation occurs at the age of 3 years. Very little mating takes place before 3 years. Males mature at age of 2 ½ years but attain a dominance for mating at the age of 4 years. There seems to be no definite breeding time of year, but October to February and March to April are the most active mating months when optimum foraging conditions prevail (Sankar *et al.*, 2004). Males are territorial in behavior. Males engage in sparring fights for territory and breeding rights. One leading male recognizes a territory and tries to keep maximum number of females within it. Both sexes mark the area with fecal piles. The gestation period lasts for 240-258 days. Twins are common among Nilgai antelopes. Females give birth to one or two babies.

HABITAT AND DISTRIBUTION

Nilgai is more or less extinct in Pakistan and reported extinct in Bangladesh. Majority of the World's Nilgai populations are in India and on the bottom of the Himalayas stretching from Pakistan to the Bay of Bengal. It does not live in heavy forests and inhabits the savannahs with grass and patches of scrub. It often runs into farming regions and raids crops before harvest.

In Pakistan, the Blue Bull is found in Sindh. Solitary Nilgai populations can be found in the Eastern parts of Pakistan. Nilgai has also been introduced to the Changa Manga plantation. In 1999, the Sindh Wildlife Department in the Tharparkar district counted 220 Nilgai i.e. Eastern Pakistan and Northern India south to Bombay and Mysore (Rahmani, 1997). Nilgai has been introduced and established in south of Texas, where now free, their populations roam ranging on several large ranches (Schmidly, 2004).

ECOLOGICAL ADAPTATION

Nilgai is the major antelope introduced in open scrub forest in and all over the wild life reservations. Naturally occurring populations are one of the major reasons behind crop destruction. Preferred tree shelters consist mainly of *Acacia senegal*, *A. nilotica*, *Prosopis juliflora*, *P. cineraria*, *Euphorbia caudicifolia* and *Capparis decidua*. Nilgai use these plants not only to seek shelter and to hide themselves but sufficient amount of foraging is provided by these plants (Goyal and Rajpurohit 2000). They often invade and destroy agricultural crops. They are capable of crossing relatively high (6-7 feet) barriers established to defend the crops. Due to their grazing and browsing habit they can eat all types of agricultural crops (both autumn and spring crops). They also destroy crops by squashing the plants and shoots under their hooves through trampling (Singh, 1995). Therefore farmers consider Nilgai as a pest and use numerous ways to deter or even kill them (Girish and Deepak, 2010).

STATUS AND CONSERVATION

IUCN has declared Nilgai as a species of least concern. However, it is also considered one of the endangered wildlife existing in close vicinity to human settlements (Mallon^b, 2008). Rahmani (2001) has estimated that Indian Nilgai population is more than hundred thousand. Their numbers are very low in Pakistan and Nilgai is rare in the country. Reintroduction programs are in place and it is hoped that these will be released in the wild to secure the few remaining herds.

NILGAI AT LAHORE ZOO

A total of 8 Nilgai were kept at Lahore Zoo. Nilgai females, their calves and juvenile males were housed together in one enclosure while the adult male bull was housed temporarily with the camel due to its aggression towards the rest of the herd. Both enclosures had indoor and outdoor facilities. The indoors were made up of cement and bricks and had three permanent tubs which were made of cement and bricks in which fresh water was provided for the Nilgai. There were large trees whose shade they used to sit under during hot days. There was also some grass growing in the enclosure which the Nilgai grazed. The total area of enclosure was 13,784.9 square feet.

Nilgai spent most of their time resting or running in small circles around the enclosure. Rest of the time was spent eating, drinking and standing. The bull was more responsive to the Zoo visitors as compared to the female. He exhibited cleverness by innocently approaching the visitors then suddenly striking his head against the cage boundaries of the enclosure. He was aggressive and at times territorial. The females and younger males either completely ignored the Zoo visitors or exhibited generally positive response. Females did not seem frightened by the visitors but choose to remain very close to her calves. They were often observed grooming the young calves. Nilgai did not exhibit signs of any stress and seemed happily adjusted to the Zoo life.

OSTRICH



| | |
|---------|------------------|
| Kingdom | Animalia |
| Phylum | Chordata |
| Class | Aves |
| Order | Struthioniformes |
| Family | Struthionidae |
| Genus | <i>Struthio</i> |
| Species | <i>camelus</i> |

| | |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Common Name | Ostrich, شترمرغ |
| Height | <ul style="list-style-type: none"> - Male: 74 - 110 inches - Female: 68 - 72 inches |
| Weight | 63 - 145 kg |
| Body Color | <ul style="list-style-type: none"> - Male: Black with white tail and primaries - Juveniles and Female: Light brown to greyish and white |
| Habitat | Desert, semi-arid plains, savanna and open woodlands |
| Distribution | Northern and Southern Africa, Sahara and Asia |
| Conservation Status | Least concern |
| Diet | Omnivorous (invertebrates, seeds, shrubs, fruits and flowers) |
| Locomotion | <ul style="list-style-type: none"> - Flight less, terrestrial, high speed runner - Fastest two legged terrestrial animal - Moves on the tips two hoof-like toes |
| Behavior | <ul style="list-style-type: none"> - Diurnal, nocturnal on moonlit nights - Solitary or pairs in winter season - Large nomadic groups form during mating season - Aggressive if threatened |
| Sexual Characteristics | <ul style="list-style-type: none"> - Males larger than females with distinct plumage - Sexual maturity reached at 2 - 4 years age |
| Mating Season | March to September |
| Gestation Period | 42 days |
| Life Expectancy | <ul style="list-style-type: none"> Wild: 40 - 45 years Captivity: 40 - 50 years |

DESCRIPTION

Ostrich is a species of large flightless birds native to Africa. Male ostrich has black feathers with the white ends at wings and tail while females are greyish brown and white. Color of their skin is variable depending upon the sub species. Ostrich head is kept at 1.8 - 2.75 meters above the ground with the help of long neck and legs. The broad and shaded eyes of Ostrich are considered to be the largest eyes of any earth vertebrate. Eyes help them to detect predators from great distances. Ostriches can see predators from long distances and prefer to run away at high speed. They can also hide from predators by laying down their necks and feet, resembling mounds of dirt or sand from afar due to their protective wing colorations. If threatened and confronted, ostriches may resort to fighting and can cause serious harm from its powerful legs. Strong legs of ostrich are scaled and unfeathered with just two toes present on each foot. The larger toe has a nail resembling to a hoof and the other toe lacks a nail. This is a unique adaptation that aids in running. Ostrich is the fastest two legged terrestrial organism, exceeding speeds up to 70 km/h. Wing span reaches over 2 meters and are used to shade the chicks and also for mating display. Ostrich lacks a keel on its flat sternum, in flying birds the flight muscles are connected by the sternum; this is why ostrich is a less bird-like flight. Beak is long and smooth. Three stomachs are present. Unlike other living birds it eliminates urine separately from feces (Makanya *et al.*, 2012).

BIOLOGY

Ostriches are mainly diurnal, but may become active during moonlit nights. The highest activity is recorded early in the morning and late during the day (Davies, 2003). Ostriches feed on seeds, fruits, shrubs and flowers. They also feed on insects such as locusts. Because of lack of teeth, pebbles may be swallowed to facilitate crushing and grinding of food in the gizzard. During feeding they filled up their gullet with food and then pushed down in the shape of a bolus to their esophagus. Ostriches are adapted for survival in the harsh environment and can go without water for several days.

Ostriches become sexually mature at the age of 2 - 4 years. Mating season starts in March and ends in September. Territorial males protect their territories and harem two to seven females, but only pair with a single big female. Male executes alternating wing beats as part of courtship display before he finds a partner. Female incubates the eggs and these eggs are protected by male at night because; males are darker in color so they can better defend their nests at night. Females also defend their eggs during the day; since they are sandy colored which helps them to hide from predators.

HABITAT AND DISTRIBUTION

Ostrich is the only surviving member of the family ratite and genus *Struthio*. The common ostrich shares this order with the kiwis, emus, rheas and cassowaries (Mitchell *et al.*, 2014). Local ostriches formerly inhabited North and South Africa of the Sahara, North Africa, South Africa of the rainforest region and most of Asia Minor. With its distinctive size and speed it is the land's largest and fastest bird. It lays the largest eggs of any living species.

ECOLOGICAL ADAPTATION

In Egypt Ostriches are considered an important and inspiring part of culture and civilization for the past 5,000 years. Hunter gatherers used their egg shells as water containers by punching holes in their shells. Ostrich bones and shells were also used in pre-historic jewelry which suggests that ostriches were an important part of early human life.

Ostrich farming is a recent emerging industry in the last couple of years. Avian agriculture industry across the globe can open up new evolutionary insights with ostrich meat, feathers and fur. Pakistan has access to cheap manual labor and cheap feed, with these resources the country can easily establish high-production ostrich farms (Abbas *et al.*, 2018). Ostrich meat is dark cherry red in color. It is tasteful and akin to lean beef. It is low in fats, cholesterol and high in calcium, proteins and iron. Farming of ostrich feathers

for ornamental purposes is also an established industry. Ostrich skin is used in leather production. It is believed that the ostrich produce strongest leather that is used for making hats and leather bags.

STATUS AND CONSERVATION

Over the last 200 years, wild ostrich population has plummeted significantly. Most living birds around the World are now on farms. Yet their range remains wide (9,800,000), due to which the IUCN and Birdlife International have regard this species of least concern. However the Arabian ostrich has become extinct since 1996 and to date no sightings have been reported.

The Northern Niger's Air Mountains are a vast area of uplands, plateau and broad sandy valleys. This land was a site for three ostrich conservation projects which harbored ostrich populations in wild for eventual release. This was the largest remaining population of about 1,500 birds until the early 1990s. Nevertheless, in 1992 a military uprising killed almost the entire population. State security units fired at whole flocks of ostriches. Despite the negative effects of overgrazing, habitat destruction and disruptions on the survival of ostriches, this was likely the main reason for their dramatic decrease in that region.

OSTRICH AT LAHORE ZOO

Male and female ostriches were housed in the same enclosure near the cassowary at Lahore Zoo. The size of ostrich enclosure was 7391 square feet. Both indoor and outdoor facilities were provided in the enclosure for improving their adaptability in captive environment. A wide tub made of bricks and cement has been constructed for drinking water. Separate bowls for fruits and fodder were located on one side of the enclosure. The ostriches were usually found outdoors rather than indoors. They spent most of their time in observing their surroundings including the Zoo visitors, eating and

walking. Ostriches exhibited friendly behavior towards the visitors and even seemed to enjoy human company.

Birds such as sparrows and crows had frequent interactions with ostriches by opting to sit on them and groom them, possibly even removing arachnid parasites. Such types of interactions are quite common in the Wild. The resting and sitting behavior was observed mostly in the female ostrich. The male occasionally liked to performed dance shows which the visitors enjoyed. Resting, eliminating, walking and standing behaviors were normal and noted to occur at predicted intervals.



PEAFOWL



| | |
|---------|------------------|
| Kingdom | Animalia |
| Phylum | Chordata |
| Class | Aves |
| Order | Galliformes |
| Family | Phasianidae |
| Genus | <i>Pavo</i> |
| Species | <i>cristatus</i> |

| | |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Common Name | Common peafowl, Indian peacock, مور |
| Height | <ul style="list-style-type: none"> - Male: 77 - 89 inches - Female: 35 - 37 inches |
| Weight | <ul style="list-style-type: none"> - Male: 4 - 6 kg - Female: 3 - 4 kg |
| Body Color | Multicolored due to mutations and hybridization |
| Habitat | <ul style="list-style-type: none"> - Deciduous and open forests - Human habitations and cultivated regions |
| Distribution | <ul style="list-style-type: none"> - Native to the Indian subcontinent - Introduced to many regions |
| Conservation Status | Least concern |
| Diet | Omnivorous (seeds, fruits, insects, small mammals, reptiles) |
| Locomotion | <ul style="list-style-type: none"> - Flightless birds, legs endowed for running - Visual and tactile communication |
| Behavior | <ul style="list-style-type: none"> - Male displays extravagant feathers and courtship behavior - Loud calls during breeding season - Polygamous and territorial |
| Sexual Characteristics | Distinct differences in plumage |
| Mating Season | April to September |
| Incubation Period | 28 days |
| Life Expectancy | <ul style="list-style-type: none"> - Wild: 10 to 20 years - Captivity: 10 to 25 years |

DESCRIPTION

Peacock belongs to a species of brightly colored birds native to the sub-continent. Male usually has blue colored head while the neck and breast are mixed shades of green and purple. Feathers of tail are metallic green in color. The extensive blue plumage has quills which fall behind as long fabricated train of large upper tail plumes. The tips of tails are adorned with shining dark eyespots. The male displays tail plumes with a strong tremble as the quills are constructed into a showcased fan. Females are brownish and tan colored having white feathers underneath and a green feathery neck. Trains are not present in females instead they have rounded cocoa plumage. Both sexes have a projecting crest on top of their heads. Studies have suggested that peacock plumage is associated with sexual selection and mating choices made by the peahen.

BIOLOGY

The natural habitat of peafowl is mostly in the open woodlands. They are omnivorous. They scavenge on grains and berries in addition to hunting reptiles such as frogs and snakes, and small mammals such as rodents (Parveen *et al.*, 2018). Peafowls are threatened by predators like wolves, lions and tigers. There is safety in numbers, therefore they forage in groups. Their distinct boisterous vocals make them easy to recognize. Peafowl prefer to move by walking and generally abstain from gliding; however peafowl can fly and perch on tall trees.

Peafowls reach sexual maturity at 2 - 3 years of age. Breeding season is from April to May. Males display their plumage in front of females. However it is noteworthy that male plumage displays can occur without the intent of mating. Females may choose to ignore males. Shallow nests are made on the ground and lined with various types of debris such as sticks, leaves and stones. The clutch consists of 4 - 8 eggs, incubated exclusively by the female. Eggs hatch after almost a month.

HABITAT AND DISTRIBUTION

Their common habitat is clammy and dry deciduous timberlands, however they may adjust living in developed districts, need human homes and typically where water is accessible. Peafowl are well adapted to live with human beings. In Pakistan peafowl is found mostly in South Eastern areas of the Sindh province in Tharparker. They extend from East of Pakistan through India and Nepal to Srilanka (Ramesh and McGowan, 2009).

Peafowl is protected in India especially in the Northern regions because of religious beliefs. It has been proposed that they were brought to Europe by Alexander the great. It has subsequent spread to numerous parts of the world. Its distribution is both wild and domestic. Other than its endemic population, peafowl has been introduced to Mexico, Reunion, Colombia, Argentina, Brazil, Indonesia, New Guinea, Uruguay, Madagascar, Honduras, Suriname, Guyana, Australia, United States and South Africa. It is the National bird of India. Indian peafowl are not found in severe climatic conditions, for example, in Canada (especially the Northern areas).

ECOLOGICAL ADAPTATIONS

Peafowl live in temperate forest areas. Peafowl also live in prairie biomes. They can also be found in Scrub lands. Peacocks usually live in dry deciduous timberlands or grasslands. Peafowl live in these sorts of ecosystems because it has the food sources suited for the omnivorous diet, furthermore at high noon and night time, peacocks roost up in the trees.

STATUS AND CONSERVATION

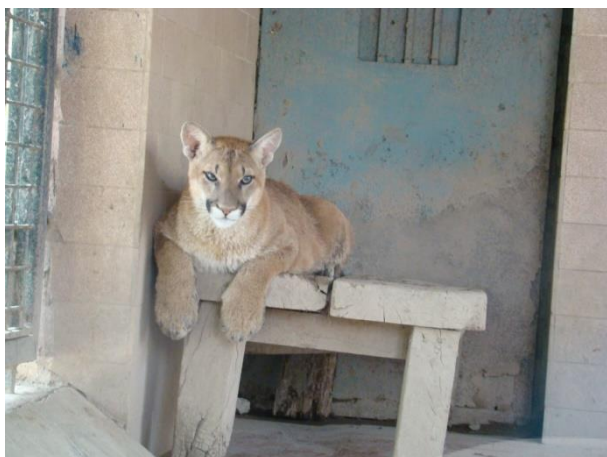
Peafowl is ranked as the least concern in the International Union for Conservation of Nature red list. White peafowl is produced in captivity by the selective breeding of Indian peafowl and thus frequently mistake as an albino or mutant peafowl. Java peafowl (*Pavo muticus*), once a protected bird species, is now identified as nationally

endangered species by the International Council for Bird Preservation check list. This species is regarded more attractive than the blue peafowl. They are not promptly habituate to human settlements and also difficult to conserve in captivity. Congo peafowl also known as African peafowl is categorized as vulnerable. It is the only member of family *Phasianidae* that are found outside of Asia and have colonized rainforests of central Africa (Kimbal *et al.*, 1997).

PEAFOWL AT LAHORE ZOO

There are several peafowls in Lahore Zoo, housed at various locations throughout the park. However, only one male and one female peafowls were studied to better understand their behaviors under captive conditions. The male and female peafowls lived in the same enclosure made up of bricks and cement and had both indoor and outdoor facilities. Observed peafowls frequently interacted with other peafowls in friendly manner. They mostly spent their days either standing or resting. The studied pair was curious and did not shy away from Zoo visitors. Vocalization was frequently observed. The male often displayed his plumage while interacting with the visitors and this exhibition created joyous sensation in the visitors especially amongst children. Visitors flocked to the enclosure for a better look and photographic opportunities. The peafowls seemed to enjoy the attention and didn't mind the crowd.

PUMA



| | |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Common Name | American cheetah, cougar, mountain lion, امریکی تیندوا |
| Height | <ul style="list-style-type: none"> - Male: 7 inches - Female: 6.7 inches |
| Weight | <ul style="list-style-type: none"> - Male: 52 - 100 kg - Female: 29 - 64 kg |
| Body Color | Brownish yellow to greyish red |
| Habitat | Deserts, grasslands, tropical jungles and forests |
| Distribution | Northern and Southern America |
| Conservation Status | Least concern |
| Diet | <ul style="list-style-type: none"> - Powerful Predator - Carnivorous (fish, birds, mammals) |
| Locomotion | <ul style="list-style-type: none"> - Climbers, leapers and high speed runners - Hind legs are slightly longer and stronger than front legs |
| Behavior | <ul style="list-style-type: none"> - Communication through vocalization - Solitary, territorial, avoid human settlements |
| Sexual Characteristics | <ul style="list-style-type: none"> - Sexual maturity Male: 3 years; Female: 2.5 years - Male larger than female |
| Mating Season | Year round but mostly between December to March |
| Incubation Period | 120 days |
| Life Expectancy | <ul style="list-style-type: none"> Wild: 10 - 15 years Captivity: 12 - 18 years |

DESCRIPTION

Puma is a large predatory cat, also known as the mountain lion due to its preferred habitat. Its fur color is light brown which helps it camouflage itself against the surroundings. The thick coat protects it against cold mountainous climate. It is a solitary animal. Pumas are territorial and patrol large home ranges in search of food (Rabinowitz, 2009). The Puma have muscular hind legs that are slightly longer and stronger than the front legs and hence a powerful predator. They also have powerful jaws to capture and hold struggling prey. The Puma are not only able see directly ahead in front of them, but they can also see afar for some distance around them because of their wide-set eyes (Nowak and Walker, 1999; Mukherjee *et al.*, 2010).

BIOLOGY

Puma can detect prey in the dark due to night vision and pointed ears which confer acute hearing. Puma are often silent with minimal communication through vocalizations outside of the mother-offspring relationship. Puma diet consists of small animals like fish, birds, mice, rats and rabbits. Puma is a powerful carnivore and can also hunt bigger animals such as domestic cats and dogs, raccoons, goats and sheep (Shaw *et al.*, 2007).

Females reach sexual maturity at about two and half years while male reach it at about three years. Breeding season occurs between Decembers to March. During their mating season when looking for a mate, pumas are known to make a variety of different sounds particularly when warning another pumas to steer clear from their territory. After three months gestation period, up to six cubs may be born. Cubs stay with their mother (Mellen, 1993).

HABITAT AND DISTRIBUTION

Throughout mountains of South and North America puma inhabit pastures slightly lower than the slopes occupied by grazing herbivores. Puma are found in variety of habitats including tropical jungles, forest, desert regions, grasslands and are extremely

adaptable (Wozencraft, 2005). Puma have a thick coat of fur because they found in more mountainous region and it helps them keep warm in the freezing winters. Their fur varies in color from brown-yellow to grey-red. Those occurring in warmer areas have red tinge to their fur while those present in colder region have greyer tones.

ECOLOGICAL ADAPTATIONS

Puma plays an important role in ecosystem through predation. Prey recognition is a learned behavior and they do not generally recognize humans, their attacks on humans are very rare (McKee, 2003). Over the past 70 years, the general extinction of pumas from Zion National Park area has led to a drastic rise in deer populations, resulting in significant ecological disruptions, cottonwood blossoms, eroding stream banks and decreasing biodiversity. Investigators call it a "trophic cascade" of environmental degradation. Trophic cascade means that some species disrupts the balance in nature and occupy higher trophic level (Rabinowitz, 2009).

STATUS AND CONSERVATION

Puma will become extinct in its natural environment in the near future due to being pushed into smaller regions from their vast historical range. Pumas are mainly threatened by habitat loss (Wainwright *et al.*, 2010). Puma have the ability to adapt a number of different environments that is why the population is still as numerous as it is. With hunting banned in most of Argentina and all of Brazil, Bolivia, Chile, Colombia, Costa Rica, French Guyana, Guatemala, Honduras, Nicaragua, Panama, Paraguay, Suriname, Venezuela and Uruguay and hunting regulations in place in Canada, Mexico, Peru and the United States, Puma is protected throughout most of its range. Conservation groups collaborate on human-puma reduction projects.

- Puma plays a key role in preserving healthy habitats as a keystone predator
- Puma helps keep deer populations in check
- Keeping herbivores from overrunning the landscape and damaging the soil cover
- Puma killed carcasses help feed hundreds of other species

Puma also act as a leading indicator for the habitat needs of other species, since it requires such wide home ranges. Any habitat or corridor conservation plan successful for pumas would probably also help several other species. While the challenges are immense, it is believed that with concerted effort and highly collaborative strategies degradation of local puma populations and eventual loss of the natural environments can be maintained and sustained, for their long-term safety and survival.

PUMA AT LAHORE ZOO

At the time of this study, there was a breeding pair of pumas kept captive at Lahore Zoo. The male was named Moti and female Billi. The puma pair had been brought to Lahore Zoo in 2008 through an International Jungle Exchange Program (Ahmed, 2008). Moti and Billi were the first pair of pumas to be added to the Zoo collection since 1986. The puma family was kept in enclosure provided with indoor and outdoor facilities. A cemented water tub was also present for drinking and bathing. Pumas spent most their time in the indoor enclosure but went to the outdoor enclosure at sunset or when the weather became cooler. Pumas were mostly active during the dawn and dusk times in summer season. They spent the rest of the day being lazy, walking, grooming or lying down. High temperature may have influenced the mountain lion to shift toward nocturnal activity in the summer. Excessive day time temperature may have limited mountain lion movements and reduced their ability to exploit resources.

After conclusion of current study, the male puma Moti died in May, 2015. The cause of death was acute trypanosomiasis (Ghani, 2015; Staff Reporter, 2015). Moti had contracted the disease since January of that year but succumbed to it even after treatment. A week prior to its demise, Moti was reported as exhibiting signs of lethargy and had stopped eating altogether. Post-mortem examination at University of Animal and Veterinary Sciences revealed that the animal had deteriorated and weakened immune system due to old age. Captive puma live longer as compared to their wild counterparts.

RED DEER



| | |
|---------|----------------|
| Kingdom | Animalia |
| Phylum | Chordata |
| Class | Mammalia |
| Order | Artiodactyl |
| Family | Cervidae |
| Genus | <i>Cervus</i> |
| Species | <i>elaphus</i> |

| | |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Common Name | Elk, European red deer, سرخ برن |
| Height | <ul style="list-style-type: none"> - Male: 69 - 98 inches - Female: 63 - 83 inches |
| Weight | <ul style="list-style-type: none"> - Male: 160 - 240 kg - Female: 120 - 170 kg |
| Body Color | Rusty red or reddish brown |
| Habitat | Open deciduous, woodlands and grasslands |
| Distribution | North Africa, Asia, Europe, Australia and New Zealand |
| Conservation Status | Least concern |
| Diet | Herbivorous (shrubs, grasses, sedges and herbs) |
| Locomotion | <ul style="list-style-type: none"> - Cursorial mammal - Hindlimbs used for locomotion |
| Behavior | <ul style="list-style-type: none"> - Mostly live in single-sex groups - Ruts form during mating season - Competitive males - Distinctive male roar during rut |
| Sexual Characteristics | Male are larger with big antlers |
| Mating Season | September to October |
| Incubation Period | 240 - 262 days |
| Life Expectancy | <ul style="list-style-type: none"> - Wild: 10 - 14 years - Captivity: 15 - 20 years |

DESCRIPTION

Red deer is a big animal, being the fourth largest European deer. The male red deer is called stag or hart. The female red deer is called hind. Only the male has antlers. Antler velvet is produced by the red deer to protect the newly formed antlers during the Spring season. The velvet is shed when the antlers stop growing. This velvet is gathered and traded in the market, used for natural medicines, decorative purposes, and used for works of art, furniture and other pieces of novelty. The mane in male grows during the Fall season. Manes are absent in females.

BIOLOGY

Red deer are ruminants. Their diet typically consists of leaves, grasses, berries and mushrooms. They are divided into three groups based on their feeding behaviors; browsers, grazers and intermediate feeders (which are both browsers and grazers). It is able to distinguish salt but discrimination of other minerals is controversial even though they are also essential and often limiting (Ceacero *et al.*, 2010).

Red female deer achieve sexual maturity at age two (Clutton-Brock and Coulson, 2002). Adult deer live in unisex groups for almost the entire year except during rut or the mating season (McComb, 1991). Mating season lasts from August through early winter in October. Males compete for breeding rights and territory. Antlers are used for violent sparring. The dominant male tries to bring maximum number of females in its territory. The male may have up to 20 females and keeps them away from other, less desirable rival males. Females are kept only by adult dominant males. Calves join the herd two weeks after being born.

HABITAT AND DISTRIBUTION

Red deer is one of the most widely distributed and economically important game species in Europe, with the highest continuous wild population (Apollonio *et al.*, 2010). Red deer habitat is Europe, the area of the Caucasus Mountains, Asia Minor and parts of

Western and central Asia. It is also present in the Atlas Mountains region in North-Western Africa, between Algeria and Tunisia. Now Red deer has also been found in areas like New Zealand and Argentina.

ECOLOGICAL ADAPTATIONS

Unlike other *cervids* red deer rarely live in their introduced ranges. They often cross into suburban areas and cause problems. Vehicular accidents and high speed collisions due cumbersome deer crossing roads has resulted in death for those vehicle drivers. U.S. farmers record annual crop damages and losses because of this incredibly massive deer feeding on them (Coomes *et al.*, 2003; Forsyth *et al.*, 2015).

STATUS AND CONSERVATION

IUCN has described red deer as species of least concern (Lovari *et al.*, 2016). Despite conservation efforts in progress, the spike in collisions between deer and humans continues to grow. In certain cases, the regulated killing appears to be the only way to keep their population under control and away from human settlements. The number of hunting licenses available for hunting is associated with their population numbers. When there are fewer, the number will be decreased and no licenses are given out even during hunting season.

RED DEER AT LAHORE ZOO

Red deer housed in the Lahore Zoo had both indoor and outdoor facilities. The indoor enclosure was made up of cement and bricks while the outdoor enclosure was covered with iron fence. Permanent water tub is present for drinking water. The total area of enclosure both indoor and outdoor is 4450.3 square feet. Males and females ignored each other most of the times. The two males were kept in separate enclosures to discourage aggression amongst them. Red deer did not shy away from the Zoo visitors, but preferred to spend most of their time standing, eating and walking.

RHESUS MACAQUE



| | |
|---------|-----------------|
| Kingdom | Animalia |
| Phylum | Chordata |
| Class | Mammalia |
| Order | Primates |
| Family | Cercopithecidae |
| Genus | <i>Macaca</i> |
| Species | <i>mulatta</i> |

| | |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Common Name | Rhesus monkey, بندر |
| Height | <ul style="list-style-type: none"> - Male: 21 inches - Female: 19 inches |
| Weight | <ul style="list-style-type: none"> - Male: 7.7 kg - Female: 5.3 kg |
| Body Color | Brownish grey with pink face |
| Habitat | Himalayas, dry and hot areas of plains and forests |
| Distribution | Pakistan, Afghanistan, Bangladesh, Nepal, Thailand, Northern India, Southern China, Vietnam and Burma |
| Conservation Status | Least concern |
| Diet | <ul style="list-style-type: none"> - Herbivorous (fruits, buds, bark, roots, seeds, cereals) - Omnivorous (spiders, insects, crustaceans fish, bird's eggs) |
| Locomotion | Quadrupedal, arboreal, active swimmer |
| Behavior | <ul style="list-style-type: none"> - Social animal, live in large exclusive troupes - Diurnal and nomadic, communication is vocal |
| Sexual Characteristics | <ul style="list-style-type: none"> - Polygynandrous - Males larger and dominant over females |
| Mating Season | October to December |
| Incubation Period | 166 days |
| Life Expectancy | <ul style="list-style-type: none"> - Wild: 15 - 20 years - Captivity: 20 - 30 years |

DESCRIPTION

Rhesus is an old World monkey native to Central and South East Asia. It is brownish in color and has a red face. Short and tidy hair is present on the head that highlight the extremely powerful countenances. They have a long tail. Fingers on both hands are long and dexterous. Males are dominant and larger than the females. They are diurnal and arboreal as well as terrestrial in addition to being good swimmers.

Rhesus live and travel in groups called troupes. These troupes have more females and infants since juveniles are chased out by the dominant male. Different male and female hierarchies exist in the group. They are known to exhibit distinctly advance and complex cognitive behaviors. They are self-aware and demonstrate expressive moods which are indicators of mental states. Communication is vocal and through facial expressions. Grooming behavior is elaborate.

BIOLOGY

This species is generally herbivorous, sustaining mostly on organic product, additionally ingesting barks, roots, buds, seeds, fruits and grains. It is assessed that monkey devour about ninety nine diverse plant species of forty six families. Small animals like ants, termites, grasshoppers and beetles also make up a part of their diet.

When females are three years old they are fully grown while the male reaches sexual maturity a year later than female. Subsequent to breeding the birth of young takes place after 164 days (Walker and Herndon, 2008). The normal length of these pregnancies is 166.5 days. The established females with higher equalities have fundamentally more pregnancies and essentially heavier newborn children than other females. Different elements, including infant's sex, month of conception, maternal regenerative history and fatherly character, have no reliable impact upon incubation length and mortality (Maestripieri, 1998).

HABITAT AND DISTRIBUTION

Rhesus monkey is native to Pakistan, Bangladesh, Nepal, northern India, Afghanistan, Southern China, Vietnam, Thailand, Burma and other zones. This species has the most extensive geographical scope than another non-human primate involving incredible assorted qualities of elevations all through South East, South and central Asia. They prefer dry, open land, prairies, forests and especially hilly areas. They usually like swimming; for instance, the babies that are few days old can swim and grown-ups can swim over a half miles between islands. However they are also frequently discovered drowned where water is either insufficient or too little.

ECOLOGICAL ADAPTATIONS

It is observed that this species has tendency to move from rustic to urban territories depending on food condition or challenges from human beings. Rhesus adjust efficiently near human and domestic structures (Kumar *et al.*, 2013). *Macaca mulatta* may inhabit a diverse habitat i.e. forests, arid grasslands and near to human habitat.

Rhesus has a predominant scientific history associated with humans and is used frequently in therapeutic and experimental examinations. Scientists have since recognized a variety of human blood assortments from the antigens found in the blood of monkey.

STATUS AND CONSERVATION

The *Macaca mulatta* is one of the most well-known species. There are a number of factors for grouping the species as least concern in the Red List of Threatened Species of International Union for Conservation of Nature. These includes tolerance of a broad range of habitat, wide distribution and assumed large population,

The destruction of natural habitat of monkeys is the reason for the reduction of population and their subsequent migration to human settlements. Conservational efforts are thoroughly focused on reducing changes in their natural territory. Many programs are exercised to have as many young's population back up as they can in their natural

environment. In this regard, the breeding programs are effective in reinforcement of numbers. Educating farmers and teaching them to grow crops at other places rather than clearance of natural habitat will be favorable for the monkey's growth. Moreover, locals collect the young and sell them as invasive pets. Laws should be implemented to make the selling of monkeys illegal and take action on it.

RHESUS MONKEY AT LAHORE ZOO

When present study was carried out, there were four species of monkeys in Lahore Zoo including olive baboon, chimpanzee, capuchin monkey and rhesus monkey. Monkey enclosures could be seen when entering the main gate of Lahore Zoo. Lahore Zoo has plenty of places for recreation but majority of people especially children enjoy seeing the monkeys and a large crowd is always present near this enclosure.

There were two male Rhesus monkeys, both were placed in the same enclosure. It is almost ten feet high and the total area of enclosure was about 408.37 Square Feet. Both monkeys spend most of their time in resting and eating. They mostly ignored Zoo visitors around them and only responded when they were in a favorable mood. One male was aggressive and exhibited this behavior towards the second and the Zoo visitors. The second male usually stayed in the corner of the enclosure. He also ignored the visitors but sometimes showed a friendly response. The rhesus monkeys were fed once in the morning between 11:30 – 11:45 am and once in the evening between 3:30 – 4:00 pm. They both rushed towards the gate when the food was about to be place in their enclosure. During hot weather both males spent their time near the water tub in shade. In winter season they climbed the enclosure and sunbathed near the top.

SAMBAR DEER



| | |
|---------|-----------------|
| Kingdom | Animalia |
| Phylum | Chordata |
| Class | Mammalia |
| Order | Artiodactyl |
| Family | Cervidae |
| Genus | <i>Rusa</i> |
| Species | <i>unicolor</i> |

| | |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Common Name | Indian sambar, <i>سامبر</i> |
| Height | 40 - 63 inches |
| Weight | 100 - 350 kg |
| Body Color | Light brown |
| Habitat | Tropical and subtropical forests, grasslands and rainforests |
| Distribution | Indian subcontinent, Southern China and Southeast Asia |
| Conservation Status | Vulnerable |
| Diet | Herbivorous (foliage, grasses, fruits and water plants) |
| Locomotion | <ul style="list-style-type: none"> - Hindlimbs - Remarkable bipedalism |
| Behavior | <ul style="list-style-type: none"> - Territorial - Nocturnal or crepuscular - Small herds with harems (several females and one male) - Communication by foot stamping and scent marking |
| Sexual Characteristics | <ul style="list-style-type: none"> - Polygynous - Only males have antlers - Males use scent and vocal signals to lure females |
| Mating Season | September to January |
| Incubation Period | 246 days |
| Life Expectancy | <ul style="list-style-type: none"> - Wild: 10 - 12 years - Captivity: 20 - 28 years |

DESCRIPTION

Sambar is a large deer native to the sub-continent. Sambar's morphology and size varies greatly across their distribution, which in the past has led to substantial taxonomic confusion; over forty separate scientific synonyms for the genus have been used. They commonly weight more than 500kg (Bohra *et al.*, 1992). In general, at the shoulder they reach a height of 102 to 160 cm, larger specimens can grow to weigh as much as 546 kg, but on average remain 100 to 350 kg. Fur is short and yellowish grey-brown in color. The tail is longer than a typical deer. Males are larger than the females. Only males have antlers. Antlers are typical, starting out as narrow beams and branching out after forming a fork. Males possess a short dense mane (Clutton–Brock and Coulson, 2002).

BIOLOGY

Sambar deer are herbivores, consuming various grasses, flowers, seeds, nuts, water plants, vegetables, buds, berries, bamboo, stems and bark, and a large range of shrubs and trees (Ceacero *et al.*, 2010; Leslie, 2011). They enjoy eating various types of fruits at other times of the year. They are polygynous, multiple females mating one male. At breeding season the males become very aggressive. They defend their breeding territories and use vocal signals and scent to lure female deer. There is no single breeding season, but it most usually occurs between September and January. Usually only one fawn is born, after around nine months of gestation. Calves are very involved at birth. They have dark hair with lighter streaks, which will quickly fade. Adult males and pregnant or lactating females have an odd hairless, blood-red patch about half way down their throats. This oozes a white liquid occasionally and is evidently glandular in nature (Geist, 1998)

HABITAT AND DISTRIBUTION

Sambar deer is native to Pakistan, India, Ceylon, Burma, Sri Lanka, the Philippines, southern China, Borneo, Malaysia, Taiwan, Sumatra, and Java. They have already been introduced successfully in Australia, California, New Zealand, Florida and

Texas. They dominate both the gentle slopes and the steeper portions of the wooded hills. They tend to live near agricultural areas such as gardens and plantations, where they can find food, but are also seen in swamp woods, thick woodland and open scrub (Semiadi *et al.*, 1993).

ECOLOGICAL ADAPTATIONS

The Sambar's principal ecological task is seed dispersal. They often feed on plant seedlings, fruits, or seeds. Adult male sambar deer will seriously damage plants by thrashing their antlers on shrubs and sapling trees to kill most branches on certain shrubs, and occasionally girdling trees. They leave territorial markings for declaration of their territory.

STATUS AND CONSERVATION

IUCN Red List and other sources do not include the overall population size number for the Sambar. According to the University of Michigan (Museum of Zoology), this species' population size in India approaches approximately 50,000 individuals, and more than 5,000 individuals in Australia. Since 2008, Sambar deer has been listed as vulnerable (VU) on the IUCN Red List and their numbers are still dwindling today (Timmins *et al.*, 2015). Work at the Belum-Temengor Forest Complex conducted by WWF in 2013 also found that there were more tigers where there were more sambar deers, therefore concluding that *Rusa* were needed to save the tiger. Therefore, saving the sambar deer is vital to saving the Malayan tiger, of which only 250 to 340 are believed to exist in the wild.

Although civil defense is provided poaching is still occurring, as is obvious from recent Department of Wildlife and National Parks progress in apprehending three sambar deer poachers red-handed (Loh, 2016). The Government is therefore planning to invest in additional rangers and equipment to protect wildlife. Poaching should therefore be treated as a serious offence and those found guilty should be disciplined with full might of the

law. Such steps will help discourage poaching of sambar deer and other endangered species.

SAMBAR DEER AT LAHORE ZOO

Lahore Zoo has three Sambar deer. One aggressive male is kept in a separate enclosure while one male and female deer pair was kept in the same enclosure. Their ages are unknown. All three deer indoor and outdoor facilities made up of bricks and cement. The indoor facility is for providing shade and sleeping area. The Sambar males were observed spending most of the time outdoors while female found preferred the indoors. The male housed with the female spent maximum time walking and marking his territory however he was active before the sunset. Whereas the female spent her day foraging and standing vainly during morning but in the evening both deer spent time walking. Eating, drinking, fecal elimination and aimless standing were exhibited. Other behaviors such as foraging, stereotypic behavior, observing the visitors and stretching were also observed. Interaction amongst the deer pair was constant. However, the solitary male was seen roaming its enclosure aimlessly. It eagerly approached Zoo visitors and struck his antlers against the parameter fence. The solitary male accepted offer of food without aggression.

SPOTTED DEER



Kingdom
Phylum
Class
Order
Family
Genus
Species

Animalia
Chordata
Mammalia
Artiodactyl
Cervidae
Axis
axis

| | |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Common Name | Chital, axis deer, چیتل |
| Height | 35 inches |
| Weight | <ul style="list-style-type: none"> - Male: 65 - 85 kg - Female: 45 - 55 kg |
| Body Color | Golden and rusty with white spots |
| Habitat | Tropical |
| Distribution | India and Sri Lanka |
| Conservation Status | Least concern |
| Diet | <ul style="list-style-type: none"> - Browsers and grazers - Young shoots, grasses, foliage, shrubs, herb and fruits |
| Locomotion | Running and leaping |
| Behavior | <ul style="list-style-type: none"> - Vocalization is by alarm barks and coarse bellows - Marking behavior in males - Weaning period is 3 - 6 months |
| Sexual Characteristics | Females are smaller than males |
| Mating Season | Throughout the year |
| Gestation Period | 225 - 235 days |
| Life Expectancy | <ul style="list-style-type: none"> - Wild: 5 -10 years - Captivity: 20 - 22 years |

DESCRIPTION

Chital is a moderately sized deer. Chital have a rust colored coat with white spots. The upper part of the body is golden and coated entirely in white spots. Fawns are born spotted with shaggy coats that make their spots less pronounced than adults. The spots on adults are brighter. The chest, ears, throats, rump, tail and inside of legs are all white in color. Males have more noticeable broad white patch on the throat. Males also have hard antlers and can be found all over the year especially from April to May (Geist, 1998). Antlers are three pointed, curved in a lyre shape, nearly one meter long and shed annually. Females are smaller than the males and are sexually dimorphic but antlers are present only in males (Pathak *et al.*, 2001). Chital usually rest in shaded areas during the mid-day heat. They are highly alert animals and make sharp alarm calls at any sign of a predator.

BIOLOGY

Like other deer, chital are also grazers, thus they mainly feed on grasses throughout the year. They choose young shoots in the absence of which high and bristle grasses are crumbed off at the tips. Chital feed as browsers in winter months. Browsing includes herbs, shrubs, fruits and fords. Fruits eaten by chital include *Ficus* species, *Cordiamyxa* and *Syzygiumcumini*. Chital reach tall branches usually by standing on their hind limbs. They drink water once or twice a day. During the dry season they prefer to live in forest (November to May) and in monsoon rains they prefer to live in grasslands (Sankar and Acharya, 2004).

Spotted deer live in large herds of 30 - 50 females with a few males called Stags. They are tropical but do not follow seasonal ruts. Chital does not have a defined breeding season. Males do not support gynaecium but rather actively protect estrous female from other suitors. Fawns stay with nursing mother for the first two weeks.

HABITAT AND DISTRIBUTION

Chital is distributed in India and Sri Lanka. Although chital was extensively found in Pakistan, it has become extinct because of rampant poaching and hunting (Robert, 1997). Being a very resilient species, it grows in several forms of forest habitat, from dry thorn forests to evergreen forests and mangrove swamps as well as in humid forests. Population density is usually 20 to 50 deer per km² and in good habitat they may reach up to 200 deer such as in Bardia National Park, Nepal.

ECOLOGICAL ADAPTATION

Chital affect agricultural crops, pastures, factory plantations and gardens. Chital can harm the natural ecosystem by polluting water, eating natural vegetation and causing seed dispersal, harming trees. Furthermore, loss of irrigation systems, harm to forestry seedlings, horticulture and cultivation crops, groves and crops of commercial flowers and hurdles have been reported (Dave, 2008). In farmlands, deer often prefer eating ring bark trees and newly growing saplings, contributing to the likelihood of a compact farmland and in desiccated season chital can compete with cattle for grass and additional feed.

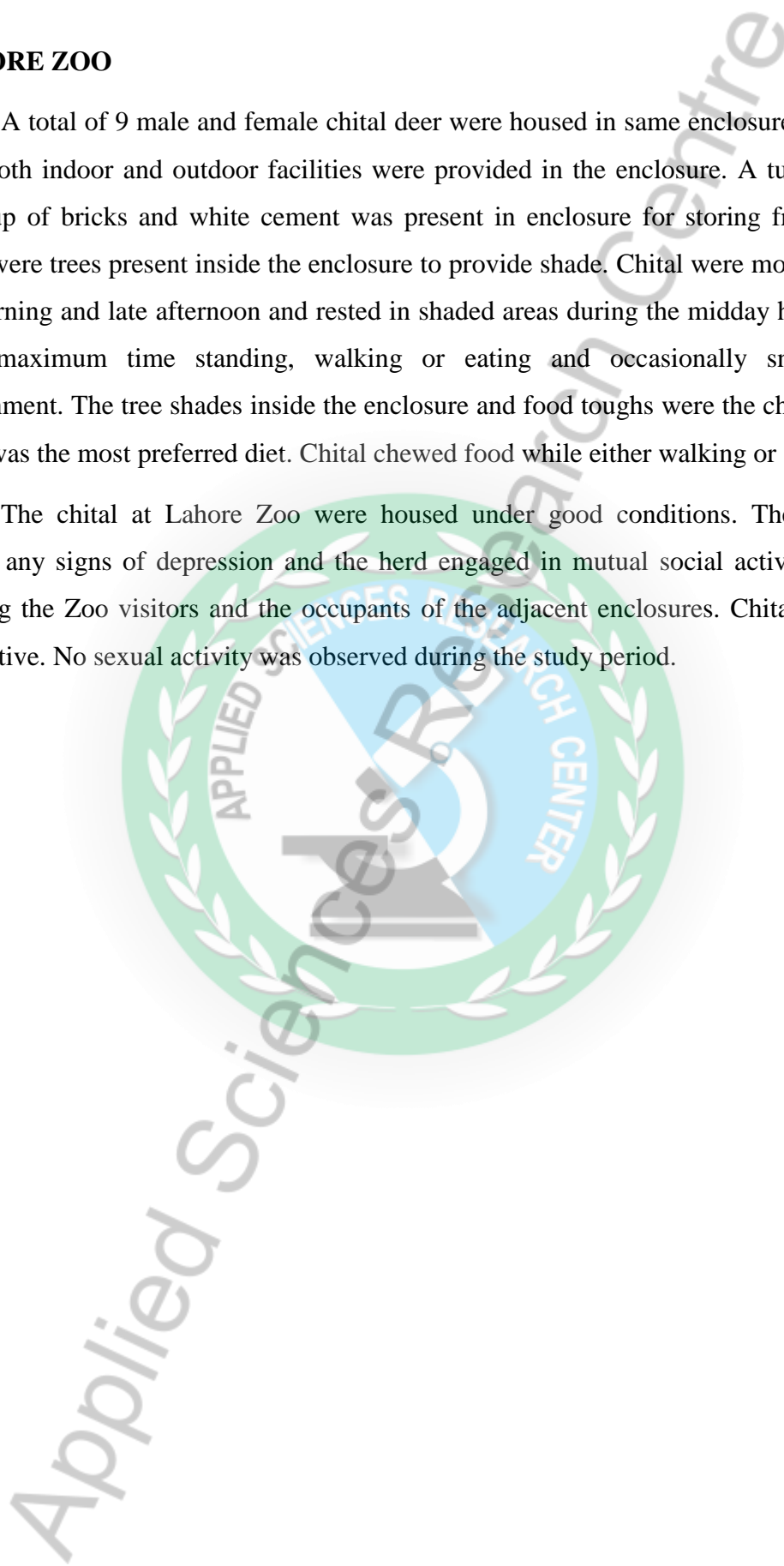
STATUS AND CONSERVATION

IUCN has listed chital as species of least concern due its large populations occurring in wide ranges. Chital are faced with no immediate threats and are mostly confined to protected areas. However, hunting for meat and trophies and competition with domestic animals has reduced population densities in many regions (Duckworth *et al.*, 2015). The Indian Wildlife Protection Act (1972) (Choudhury, 1994) and Wildlife Preservation Amendment Act (1974) of Bangladesh (Duckworth *et al.*, 2015) protect chital. Chital has been introduced to Argentina, Australia, Brazil, Chile, Mexico, Paraguay, United States and the Uruguay as exotic alien species (Sponchiado *et al.*, 2011).

LAHORE ZOO

A total of 9 male and female chital deer were housed in same enclosure at Lahore Zoo. Both indoor and outdoor facilities were provided in the enclosure. A tub of water made up of bricks and white cement was present in enclosure for storing fresh water. There were trees present inside the enclosure to provide shade. Chital were most active in the morning and late afternoon and rested in shaded areas during the midday heat. Chital spent maximum time standing, walking or eating and occasionally sniffing the environment. The tree shades inside the enclosure and food troughs were the choice spots. Grass was the most preferred diet. Chital chewed food while either walking or standing.

The chital at Lahore Zoo were housed under good conditions. They did not exhibit any signs of depression and the herd engaged in mutual social activities while ignoring the Zoo visitors and the occupants of the adjacent enclosures. Chital were not very active. No sexual activity was observed during the study period.



SPUR THIGHED TORTOISES



| | |
|---------|----------------|
| Kingdom | Animalia |
| Phylum | Chordata |
| Class | Reptilia |
| Order | Testudines |
| Family | Testudinidae |
| Genus | <i>Testudo</i> |
| Species | <i>graeca</i> |

| | |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Common Name | Greek tortoise, کچھوا |
| Height | 5 - 8 inches |
| Weight | 4 - 5 kg |
| Body color | Light yellowish with dark margins |
| Habitat | Deserts, tropical semi-arid grasslands, forest and savannah |
| Distribution | Southern Europe, Northern Africa and Southwest Asia |
| Conservation Status | Vulnerable |
| Diet | Herbivorous (leafy plants, herbs, flowers, lettuce) |
| Locomotion | <ul style="list-style-type: none"> - Shell fused - Four legged, small movements - Widely stretched spinal plates |
| Behavior | <ul style="list-style-type: none"> - Docile and shy - Male tortoises are violent and aggressive - Subspecies can interbreed |
| Sexual Characteristics | <ul style="list-style-type: none"> - Male tortoises are normally smaller than females - Female can lay eggs multiple times after single mating - Eggs laid in dug in soil |
| Mating Season | April to May |
| Incubation Period | 78 - 114 days |
| Life Expectancy | <ul style="list-style-type: none"> - Wild: 70 - 100 years - Captivity: 80 - 120 years |

DESCRIPTION

Tortoises can grow up to 5 to 8 inches. A few specimens have been recorded at 10 or 11 inches but it's rare. Male Greek tortoises are normally smaller than females, although variations are reported. Most Greek tortoises are no more than an inch long at hatching. They can grow rapidly when overfed and it's normal to see those exceeding 4 inches in less than two years (Anadón *et al.*, 2006). They are known for their longevity, surviving for 125 to 200 years. They are also illegally traded for their potential as pets. Removing tortoises from their natural habitat has unsustainable impacts on the environment. Tortoises are also vulnerable to other mortality factors due to their slow development, delayed maturity and high natural mortality in both the egg and the juvenile stages of life (Rodríguez-Caro *et al.*, 2013).

BIOLOGY

Tortoises are herbivorous and their primary diet consists of low protein, high fiber plants and grasses. They enjoy eating dandelion leaves among other leafy species. While they do love consuming lettuce, but, due to a lack of nutrition the tortoise requires to survive, it is not recommended for them.

Environmental disturbance or habitat destruction can reduce reproduction. Such factors may also decrease recurrence of population leaving pairs of females and males apart. Breeding is easier in captivity. In captivity, when there are several males in a pen one takes a dominant position. If there are more males in a pen than females, the males may kill each other to mate with the female. Females get particularly restless one or two weeks before laying eggs, jumping around to smell and dig in the dirt, sometimes sampling it, before finding the ideal place to lay the eggs. The female takes on an aggressive, dominating posture one or two days before egg-laying, mounting others as for copulation and producing the same squeaking sound as the male makes during copulation. The aim of this action is to create respect in the tortoise group so that the other does not bother the female during the laying of eggs.

HABITAT AND DISTRIBUTION

Spur thigh tortoise is endemic to North Africa's Sahara Desert and Sahel, a tropical eco-region with semi-arid grasslands, forest, and savannah (Anadón *et al.*, 2012). It is widespread on the Caucasus Black Sea coast (from Russia Anapa to Southern Abkhazia Sukhumi), as well as in Georgia, Armenia, Azerbaijan, France and England.

ECOLOGICAL ADAPTATION

Their abundance is closely correlated with environmental factors such as rainfall and temperature within its original distribution range because terrestrial tortoises, as ectotherms, appear to respond heavily to changes in their climate (Kaspari and Valone, 2002).

STATUS AND CONSERVATION

Thigh spur tortoises are now classified as vulnerable by IUCN, the largest conservation group in the World. Habitat destruction and over-collection for pet trade have endangered them. International management policies are focusing their efforts on decreasing tortoise potential in the pet trade along with the major challenge of the collapse of the species population due to the loss of habitat.

SPUR THIGHED TORTOISE AT LAHORE ZOO

Tortoises can tolerate climatic conditions because of their shell and thus they are placed in outdoor enclosure in Lahore Zoo. Tortoises spend maximum time eating or drinking, however, they also interacted with each other. Resting and walking were also observed while standing behavior was minimal. Tortoises were generally very inactive during the observation time. A lot of critical behaviors such as mating or vocalization were not observed. Wild tortoises exhibit a wider spectrum of behaviors than in captivity.

WHITE RHINOCEROS



| | |
|---------|----------------------|
| Kingdom | Animalia |
| Phylum | Chordata |
| Class | Mammalia |
| Order | Perissodactyla |
| Family | Rhinocerotidae |
| Genus | <i>Ceratotherium</i> |
| Species | <i>Simum</i> |

| | |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Common Name | White rhino, سفید گینڈا |
| Height | <ul style="list-style-type: none"> – Males: 67 - 73 inches – Females: 63 - 69 inches |
| Weight | <ul style="list-style-type: none"> – Males: 2,300 - 3,600 kg – Females: 1,700 - 3,000 kg |
| Body color | Yellowish brown to greyish |
| Habitat | Grassy plains of Africa |
| Distribution | South Africa, Namibia, Kenya, Botswana, Uganda, Eswatini, Zambia and Zimbabwe |
| Conservation Status | Near threatened |
| Diet | Mega-herbivorous grazer (grasses) |
| Behavior | <ul style="list-style-type: none"> – Bulls are usually solitary and territorial – Majority of the day is spent in grazing and resting – Protective maternal behavior – Vocal communication over long distances |
| Sexual Characteristics | <ul style="list-style-type: none"> – Sexual maturity Male: 10 - 12 years; Female 6 - 7 years – Females aggressive during mating |
| Breeding period | Occurs throughout the year |
| Gestation period | 487 - 547 days |
| Life Expectancy | <p>Wild: 30 - 35 years</p> <p>Captivity: 40 - 50 years</p> |

DESCRIPTION

All rhinos are grey or brown in color. The White Rhinoceros is grey in color, but when it wallows in the mud it may appear brownish grey. White Rhinoceros is the second largest terrestrial animal second only to the elephant. It is different from black rhino in that its larger in size, has a hump on its back and the mouth is broad. It has barrel shaped body with thick and short limbs. Rhino's feet have three short toes with broad nails. Whole of its body is hairless except for the tip of the tail, eyelashes and ear fringes. The hairlessness of rhinos is in fact an adaptation to loose heat quickly in tropical climate. The skin of rhinoceros contains numerous folds on front shoulders and on upper part of limbs. They have two horns on their head, the long one in front and short one behind. The horns are composed of hair like material called keratin and are not attached to skull bone. The front horn is generally longer and thicker in females than males, and the mothers use their horn to defend their babies against predators. White rhino has a long face it is an adaptation to reach grasses. To lift its heavy head its neck muscles are well developed. Rhino cannot see well beyond about 15 meters but this is compensated by an acute hearing. White Rhino like to wallow in mud; this is a behavioral adaptation to cope with heat stress. This also helps it in getting rid of external parasites, the dried mud layer chips off along with ticks and mites. White Rhino is a social animal and it roams in herds (Player, 2013).

BIOLOGY

White rhinoceros occur in savannah and grassland ecosystems. These herbivorous are true grazers by consuming the shortest blades of grass. If water is available it drinks twice a day but if conditions are dry it can survive without water for four or five days. It spends about half the day eating, and the rest in resting or other activities. Herds contain up to fifteen rhinos, mostly made of females and calves. Bulls are solitary. They mark territories with urine sprays and elaborately piled feces. Bull constantly patrol their territories and fight off intruders with ferocious aggression.

Males reach sexual maturity at 10 -12 years whereas females mature early at 5 - 6 years of age. Bulls clash violently during mating season. Breeding pairs stay together for 15 - 20 days. Gestation period lasts for 16 months. Maternal care is exclusive; any older siblings are chased off by the mother. White rhinoceros can breed comfortably in captivity.

HABITAT AND DISTRIBUTION

The white rhino is found in the grasslands of southern Africa and northeast Zaire. There are four basic habitat requirements of white rhinoceros these are: availability of short grass, adequate water for drinking and wallowing, thick bush covers, and, flat terrain.

ECOLOGICAL ADAPTATIONS

The white rhino is one of the largest pure grazers. It is an important component of southern African grasslands as they are very helpful in dispersal of seeds and in preventing the encroachment of woody plants. Absence of this mega fauna is shown to have catastrophic cascading effects on the ecosystem.

STATUS AND CONSERVATION

The Northern White Rhinoceros is listed critically endangered by IUCN, which means that this species has 50% or greater probability of extinction within 10 years or 3 generations (IUCN, 1994). The last Northern male Sudan died in 2018 in Ol Pejeta Conservancy in Kenya at the age of 45 years. The two remaining females are maintained under armed guard (Svenska *et al.*, 2019). The Southern White Rhinoceros is listed conservation dependent by IUCN, which means that without the conservation programs the species would be threatened with extinction.

Humans kill rhinos mercilessly for their horns because it is thought that its horn has medicinal value, although this fact is not yet been scientifically proven. Rhino horn is also used as decorative dagger handles in the Middle East. IUCN and World

Wide Fund (WWF) are actively involved in conservation efforts to protect them by opposing illegal trade in rhino horn and by supporting Parks and Reserves that harbor rhinos. They are not aggressive in captivity and total 777 captive rhinos occur across the World.

WHITE RHINOCEROS AT LAHORE ZOO

Lahore Zoo had two Southern White Rhinoceros; a 16 year old male named Jojo and a 20 year old female named Kavo. Jojo and Kavo were brought from San Diego Zoo in California, USA in July, 2006, Kavo died in summer of 2014, before the start of current study. Present study was conducted after Kavo's death.

Jojo was housed in the elephant house. It had both indoor and outdoor facilities. The indoor enclosure was made up of cement and bricks and had a small permanent tub made up of cement from which Jojo drank water. The indoor enclosure was approximately 1377.7 Square Feet and the outdoor enclosure (along with water body) was approximately 6307.6 Square Feet.

It was observed that Jojo spent maximum time (36.6%) either eating or drinking. Interaction with other animals, Zoo surroundings and Zoo visitors was about 25%. Resting and walking were 18.7%. Standing was only 13.4%. The percentage for elimination was 0% and not observed during the study period, however feces were observed in the enclosure. Jojo exhibited clear signs of loneliness and isolation, apparent from its aimless roaming in the enclosure. It habitually kicked up dirt, ignored the Zoo visitors and never attempted to interact with humans. Rhinos are social animals that live in herds; although bulls are solitary Jojo has been lonely for half a decade. It was reported that Jojo had stopped eating for a short while after Kavo's death (Mehmood, 2019). This continued isolated existence may put Jojo at the risk of mental disease, as has been previously reported in case of male rhino at Laal Suhanra National Park, Bahawalpur (Gill, M^a. 2019; Gill, M^b. 2019).

ANNEXURE - I

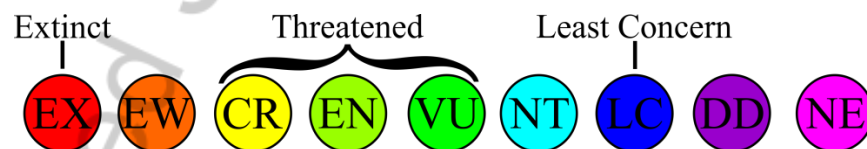
CONSERVATION STATUS

The conservation status of a species is an indicator of their populations in wild and or captivity and how likely in the near future are they to become extinct. The conservation status is used to estimate the number of remaining individuals and threats to their populations due to geographic distribution, breeding failure and success, habitat destruction, hunting and poaching, wildlife trade etc.

IUCN RED LIST OF THREATENED SPECIES

The best Worldwide system for ranking conservation status of species is the IUCN Red List of Threatened Species. A total of nine criteria are set forth by IUCN;

- **Extinct (EX)** – No living members of the species remain
- **Extinct in Wild (EW)** – Only living members are kept in captivity
- **Critically endangered (CR)** – Extreme risk of extinction in the Wild
- **Endangered (EN)** – High risk of extinction in the Wild
- **Vulnerable (VU)** – High risk of endangerment in the Wild
- **Near threatened (NT)** – Likely to become endangered in the near future
- **Least concern (LC)** – Lowest risk; abundant members exist
- **Data deficient (DD)** – Insufficient data for definitive assessment
- **Not evaluated (NE)** – Not yet evaluated



ANNEXURE - II

Daily food regimes for captive animals at Lahore Zoo

| Sr. | Animal | Food Material | Amount |
|-------------|------------------|-----------------------------------------------------------|-----------|
| 1. | Cassowary | Seasonal fruits | 2kg |
| | | Oats | 0.5kg |
| 2. | Chimpanzee | SUMMER Seasonal fruits early in the morning | 4 - 6kg |
| | | Apple | |
| | | Banana | |
| | | Mango | |
| | | Water melon/Melon | 4 - 6kg |
| | | WINTER Seasonal dry fruits early in the morning | |
| | | Peanuts/ Nuts/ Dry fruits | |
| | | Cashew/ Pistachew | |
| Oily grains | | | |
| 3. | Dromedary Camel | Green fodder | 20 - 30kg |
| | | Oats | 10 - 15kg |
| 4. | Fallow Deer | Green fodder | 3.5kg |
| 5. | Hippopotamus | Green fodder | 80kg |
| | | Seasonal fruits | 10kg |
| 6. | Indian Porcupine | Chapatti | 0.2kg |

| | | | |
|-----|---------------------------|--------------------|----------|
| | | Seasonal fruits | 0.5kg |
| 7. | Indian Gazelle | Green fodder | 3 - 5 kg |
| 8. | Indian Rock Python | Rabbits | 2/week |
| 9. | Indian Wolf | Beef | 1kg |
| 10. | Jungle Cat | Chicken meat/ beef | 0.25kg |
| 11. | Nilgai | Green fodder | 16kg |
| | | Mixed grains | 0.5kg |
| 12. | Ostrich | Seasonal fruits | 3kg |
| | | Green fodder | 2kg |
| | | Grains | 0.5kg |
| | | Oats | 0.5kg |
| | | Javi | 1kg |
| | | Chokar | 0.5kg |
| | | Roti | 0.5kg |
| 13. | Peafowl | Poultry food | 0.16kg |
| | | Spinach | 0.04kg |
| | | Onion | 0.007kg |
| | | Parched gram | 0.03kg |
| 14. | Puma | Beef | 3kg |
| | | Chicken meat | 1 kg |
| 15. | Red Deer | Green fodder | 10kg |
| | | Mixed grains | 0.5kg |

| | | | |
|-----|------------------------------|---------------------|--------------|
| 16. | Rhesus Macaque | Banana | 1 - 2kg |
| | | Tomato | 1 - 2 pieces |
| | | Watermelon | 3 - 4 pieces |
| | | Cucumber | 1 - 2 pieces |
| 17. | Sambar Deer | Green fodder | 15kg |
| | | Mixed grains | 0.5kg |
| 18. | Spotted Deer | Green fodder | 3.5kg |
| 19. | Spur Thighed Tortoise | Seasonal fruits | 0.75kg |
| | | Seasonal vegetables | 1-2kg |
| 20. | White Rhinoceros | Green fodder | 100kg |
| | | Breads/ roti | 1kg |
| | | Mixed grains | 2kg |
| | | Oats | 1kg |
| | | Javi | 3kg |
| | | Chokar | 1.5kg |
| | | Seasonal fruits | 2kg |

WILDLIFE LEGISLATION OF PAKISTAN

Introduction

Wildlife is defined as any living entity including all plants, animals and micro-organisms excluding domesticated animals, plants and crops. Wildlife legislation consists of certain rules and regulations for protection of wildlife. Pakistan has a distinct geographic distribution ranging from Himalayas to the Arabian Sea. It is the land of diverse biodiversity due to its varied and exclusive ecological landmarks. The country is endowed with various wildlife species such as hawks, sharks, eagles, big cats, wild goats and sheep, falcons, dolphins, vultures, turtles and many others.

History

The history of preserving particular regions for particular reasons has its origins in the beginning of civilization. Past rulers frequently established protected areas for preservation and availability of an adequate quantity of game animals for hunting and sports. Early Hindu and Muslim rulers proposed rules and regulations which limited hunting in many areas (Somuncu *et al.*, 2009).

First Legislation

The rules and regulations developed in Sindh under the Indian Forest Act, 1887 and then later incorporated in the Bombay Forest Manual were among the first part of legislation which directly benefited wildlife. Under this law, animal conservation covered forests from grazing but hunting was not strictly regulated. Subsequently, hunting and another types of resource exploitation were managed in areas designated as protected forests or reserves under the 1927 Indian Forest Act, whose title was changed to the 1927 Pakistan Forest Act following Pakistan's adoption in 1947 (Ferguson, 1978; Rao, 1984; IUCN, 1990).

Independence of Pakistan

At independence Pakistan inherited a number of British period laws and regulations that remained valid after partition.

West Pakistan

In addition to prohibiting the killing of certain species of fauna, the West Pakistan wildlife protection law 1959, rules 1960 and legislation provided for the declaration of game reserves in which hunting was licensed and game sanctuaries in which hunting was prohibited although did not protect the habitat from cultivation, settlement, weeding and other types of manipulation (Grimwood, 1969).

Inter Alia Conservation Legislation

The legislation was drafted by this committee and afterwards implemented at the provincial level by the provision of numerous regulations and laws namely the 1972 Sindh Wildlife Protection Ordinance, Punjab Wildlife Protection, Conservation and Management Act 1974, Baluchistan Wildlife Protection Ordinance 1974, NWFP Wildlife Protection, Preservation, Conservation and Management Act 1975.

Northern Areas and Kashmir

The separated laws for the Northern areas (Gilgit Baltistan), Azad Jammu and Kashmir and Islamabad were passed which are as follows; Northern Areas Wildlife Preservation Act 1975, Azad Jammu and Kashmir Wildlife Act 1975 and Islamabad Wildlife Protection, Preservation, Conservation and Management Law 1979 (Rao, 1984).

The 1973 Constitution

Moreover, since the independence of Pakistan, new policies regarding wildlife protection have also been formulated. The parallel legislative list of Pakistan's 1973 constitution includes ecology and environmental protection (Mumtaz, 1989).

Environmental Protection Ordinance

In 1983, Environmental Protection Ordinance was a landmark in Pakistan's legislation and reflected official acceptance of a systematic approach to environmental issues (Mumtaz, 1989). It allows pollution control and the maintenance of a robust national environmental policy, as well as for the preparation of thorough environmental impact statements by project promoters likely to adversely affecting the ecosystem. Existing laws are not implemented according to international standards. There are many shortcomings and deficiencies in the implementation of the legislation regulated (IUCN, 1990).

SAARC conference in Pakistan

The fourth SAARC conference was held in Islamabad, Pakistan in 1988 and was attended by prime ministers of Pakistan and India, kings of Nepal and Bhutan and president of Bangladesh, Sri Lanka and Maldives. The conference addressed the basic needs and issues including environmental protection, shelter, food and education by the end of twentieth century.

SAARC Biodiversity Conservation Agreement

The SAARC biodiversity conservation agreement provided the significant provision to the Biological diversity convention. This simplify thorough assessment of the region's biological diversity, delineating protected areas, mapping and creating corridors of biodiversity ensured safe journey for migratory species (Hassan *et al.*, 2012).

Directorate for Biodiversity

In 1997, the National Assembly unanimously enacted the Environmental Protection Act. In order to enhance environmental values in a steady manner, a Directorate for Biodiversity within the Ministry of Environment, Pakistan has also been formed since 2005.

Punjab Wildlife Act

Punjab Wildlife (Protection, Preservation, Conservation and Management) Act, 1974 extends over the whole Punjab province and implements into force instantly and considered to have come into force on and after the day of the Punjab Ordinance Temporary Enactment Act, 1973 (Punjab Act No. VI of 1973). This act enacted the provision of the Punjab Wildlife (Protection, Preservation, Conservation and Management) ordinance, 1972, (Ordinance No. XXI of 1972) expired. Nothing hereafter authorized any person to hunt in the reserved or protected forests as constituted and declared in accordance with the provision of the 1927 Forest Act (Act XVI, 1927).

Wildlife and Park Department, Punjab

In 1934, the Punjab Wildlife and Park Department was founded as the game department. It functioned under various departments in this competence and was finally given the status of an attached Department of Wildlife, Forestry, Tourism and Fisheries in 1973. Accordingly, the departmental duties under the Punjab Wildlife Protection, Preservation, Conservation and Management Act, 1974 were reestablished from sport hunting to full emphasis on the environmental management, conservation, propagation and protection of wildlife. With significant share of wildlife diversity from the world's wildlife diversity, the Department has given priority to the function determined under the wildlife act:

- i. Protection against illegal hunting and poaching
- ii. Preservation of species and captive breeding
- iii. Conservation and ensured survival of wildlife in natural habitat

Wildlife Diversity of Punjab (Global comparison)

| Species | World | Pakistan | Punjab |
|----------|--------|------------|-----------|
| Reptiles | 5,500 | 174 (5.5%) | 69 (40%) |
| Birds | 8,700 | 666 (7.7%) | 434 (65%) |
| Mammals | 4,327 | 188 (4.3%) | 56 (30%) |
| Total | 18,527 | 1,028 | 559 |

Protected Areas in Pakistan

| Category | Number | Associated Wildlife |
|----------------------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| National Parks | 04 | Snow Leopard, Common Leopard, Song Birds, Snakes, Lizards, Falcons, Barking Deers, Francolin, Urial, Monkey, Chukar and Partridge. |
| Wildlife Sanctuaries | 37 | Porcupine, Hare, Monkey, Urial, Common Leopard, Snow Leopard, Spoon Bill, Snakes, Partridges, Lizards, Cranes, Storks, Wolf, Waterfowl and Song Birds. |
| Game Reserves | 24 | Houbara Bustard, Great Indian Bustard, Chinkara, Porcupine, Hare, Monkey, Caracal Cat, Urial, Common Leopard, Snow Leopard, White Headed Duck, Spoon Bill, Snakes, Partridges, Cranes, Fox, Storks, Wolf, Waterfowl, Lizards, Song Birds And Nilgai, |
| Total | 65 | |

Wildlife Breeding Centers or Zoos in Punjab

| Category | Number |
|---------------|--------|
| Wildlife Park | 12 |
| Zoos | 03 |
| Safari Zoo | 01 |
| Total | 16 |

First National Wildlife Policy

In Pakistan, illegal hunting, climate change, import and export of animals presents many threats to wildlife. There is also a lack of a safe atmosphere for over consumption and industrial activities thus these threats are causing many precious wildlife species to become endangered. As previously, some serious measures for the protection of wildlife in Pakistan that includes the establishment of Wildlife Inquiry Committee in 1968 and later the formulation of a National Council for Wildlife. Some provincial wildlife legislation was also done during the same years although real steps to protect wildlife in Pakistan are missing at the national level. The Federal Minister for climate change senator Mushahid Ullah khan ordered the Forest and Wildlife Department of the ministry of climate change to develop Pakistan first national wildlife policy. There are some provisions regarding wildlife management in Pakistan's latest forest policy. In this regard, the first meeting of all federal and provincial stakeholders was held at the Ministry of climate change on December, 2017 to discuss the formulation of Pakistan's first ever wildlife policy.. It is also stated that national wildlife policy is intended to act as a mechanism for revising the wildlife regulations in all provinces during current

government term. Pakistan will be among the few countries in the world with its own National Wildlife Policy.

The Concept of Protected Areas

The definition of protected areas has grown globally on a broad scale over the last few years. Many various concepts have arisen about meanings and forms of protected areas. International Union for Conservation Nature (IUCN) has agreed upon a single definition of a protected area as follows:

“An area of land or sea especially committed to the conservation and preservation of biological diversity and natural and related cultural resources and maintained by legal or other efficient means” (IUCN, 1994).

To help enhance understanding and advance knowledge of protected areas uses, IUCN has established a six category protected area structure defined by its primary management target.

Category I (a): Strict Nature Reserve

Protected area managed mainly for science which can be defined as an area of land and/or sea, possessing some outstanding or representative ecosystems, geological or physiological features and/or species, available primarily for scientific research and/or environmental monitoring.

Category I (b): Wilderness Area

Protected area managed for protection of the wilderness and defines as a large area of unmodified or slightly modified land and/or sea retaining its natural character and influence without permanent or significant housing that is protected and managed to preserve its natural state.

Category II: National Park

Protected area managed for the conservation and recreation of ecosystems which

is characterized as a natural area of land and/or sea designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude the development or occupation for the purposes for designating a region.

Category III: Natural Monument

Protected areas maintained primarily to conserve specific natural features that can be defined as an area containing one or more particular natural or environmental/cultural features of exceptional or special importance due to their intrinsic rarity, symbolic or esthetic quality or cultural significance.

Category IV: Habitat/Species Management Area

Protected area managed primarily for conservation by management action and identified as an area of land and/or sea subject to active management action to ensure habitat preservation and/or meet specific specie requirements.

Category V: Protected Landscape/Seascape

Protected area managed primarily for the conservation and recreation of landscapes/ seascapes and defined as land area with coast and sea as necessary where the relationship between people and nature over time has created an area of distinct character with significant scenic, ecological and/or cultural value and often with high biodiversity.

Category VI: Managed Resource Protected Area

Protected area controlled primarily for the sustainable use of natural resources and named a region comprising largely unmodified natural systems, controlled to ensure long-term conservation and preservation of biodiversity while at the same time ensuring a sustainable flow of natural products and services to meet the needs of the community (Chape *et al.*, 2003).

Policies and Institutions for Environment Protection and Protected Area Development

| Year | Legislation / Objective | Concerned Institution |
|------|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| 1959 | Pakistan Wildlife Protection Ordinance | Game Department |
| 1968 | To review existing conservation legislation | Wildlife Enquiry Committee |
| 1974 | To manage protected areas and biodiversity particularly National Parks | National council for Conservation of Wildlife |
| 1975 | To address environmental concerns after the United Nations Conference on Environment and Development held in Stockholm | Environment and Urban Division, Ministry of Urban Affairs |
| 1983 | Environmental Protection Ordinance | Pakistan environmental Protection Council |
| 1992 | National Conservation Strategy | Ministry of Environment |
| 1997 | Pakistan Environmental Protection Act | Pakistan Environmental Protection Agency |
| 2000 | Pakistan Biodiversity Action Plan | Government of Pakistan, IUCN |
| 2001 | National Environmental Action Plan | Ministry of Environment |
| 2005 | Implementation of Biodiversity Action Plan | Directorate of Biodiversity |

Protected Areas of Pakistan

Punjab

- [Ayub National Park](#)
- [Bajwat Wildlife Sanctuary](#)
- [Changa Manga](#)
- [Chashma and Taunsa Barrage Dolphin Sanctuary](#)
- Chinji National Park
- [Cholistan Wildlife Sanctuary](#)

- [ChumbiSurla Wildlife Sanctuary](#)
- [Jinnah Park](#)
- [LalSuhanra National Park](#)
- Lehri Nature Park
- [Liaqat National Bagh](#)

Sindh

- [Drigh Lake](#)
- [Hub Dam Wildlife Sanctuary](#)
- [Keenjhar Lake](#)
- [Kirthar National Park](#)
- [MarhoKotri Wildlife Sanctuary](#)
- [Mehrano Wildlife Sanctuary](#)
- [Nara Desert Wildlife Sanctuary](#)
- [Rann of Kutch Wildlife Sanctuary](#)

Balochistan

- [Chandragup mud volcanoes](#)
- [Hazarganji-Chiltan National Park](#)
- [Hingol National Park](#)
- [Hub Dam Wildlife Sanctuary](#)

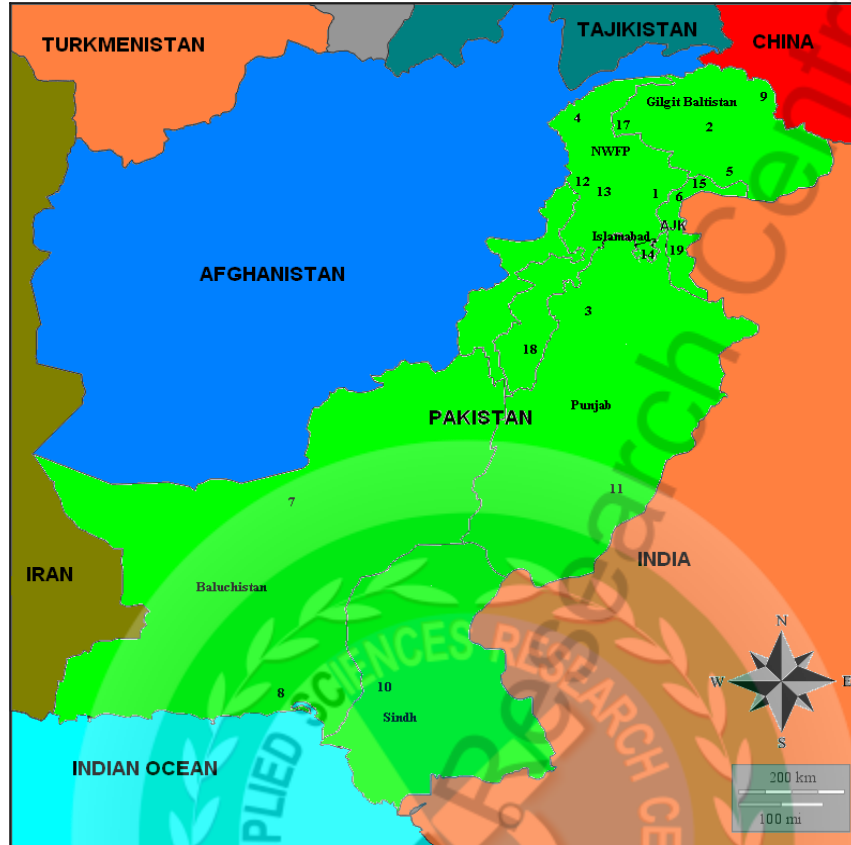
Khyber Pakhtunkhwa

- [Ayubia National Park](#)
- [Broghil Valley National Park](#)
- [Chitral National Park](#)
- [Lulusar-Dudipatsar National Park](#)
- [Manglot National Park](#)
- [SaifulMuluk National Park](#)
- [Sheikh Badin National Park](#)



NATIONAL PARKS IN PAKISTAN

| No. | Name of National Park | Province/Territory | IUCN Category | Area (ha) | Year of Declaration | Characteristics |
|-----|-----------------------|--------------------|---------------|-----------|---------------------|------------------------------------------------------------------------------------------|
| 1. | Ayubia | KPK | V | 1,684 | 1984 | It is important for wildlife Conservation. |
| 2. | Central Karakorum | GB | ? | 13,90,100 | 1995 | It comprises the Baltoro, Panmah, Biafo and Hispar glaciers and their tributary glaciers |
| 3. | Chinji | Punjab | II | 6,095 | 1987 | It is important place for wildlife conservation. |
| 4. | Chitral Gol | KPK | II | 7,750 | 1974 | Markhor goats and snow leopards are important Animals found in this park. |
| 5. | Deosai Plains | GB | ? | 3,58,400 | 1993 | It provides natural habitat for the Himalayan brown bear. |
| 6. | Ghamot | AJK | ? | 27394 | 2004 | It provides natural habitat for wildlife. |
| 7. | Hazarganji-Chiltan | Balochistan | V | 15,555 | 1980 | It is important habitat for Wildlife. |
| 8. | Hingol | Balochistan | II | 165,004 | 1997 | A number of animals and Birds species are protected in this park. |
| 9. | Khunjerab | GB | II | 226,913 | 1975 | It provides protection for Wildlife. |
| 10. | Kirthar | Sindh | II | 308,733 | 1974 | Kirthar provides important habitat for wildlife. |
| 11. | LalSohanra | Punjab | V | 87,426 | 1972 | It provides natural habitat for Wildlife. |
| 12. | Lake Lulu Sar | KPK | ? | 30375 | 2003 | It provides protection to Wildlife. |
| 13. | Lake Saiful Muluk | KPK | ? | 4867 | 2003 | It is important for natural and cultural biodiversity. |
| 14. | Margalla Hills | Islamabad | V | 17,386 | 1980 | It is important for wildlife Habitat. |
| 15. | Machiara | AJK | ? | 13,593 | 1996 | It is important for wildlife conservation. |
| 16. | PirLasora | AJK | ? | 5625 | 2005 | It provides natural habitat for Biodiversity. |
| 17. | Shandur Hundrup | GB | ? | 1,64,000 | 1993 | It is important for Biodiversity conservation activities. |
| 18. | Sheikh Buddin | KPK | ? | 15540 | 1993 | It provides natural habitat for Markhor. |
| 19. | ToliPir | AJK | ? | 5045 | 2005 | It is important for wildlife conservation. |



National Parks in Pakistan
(Government of Pakistan, 2009)

Applied Sciences Research Center

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