



## Short Communication

Responses of Captive Ostrich *Struthio camelus* to Zoo Visitors at Central Zoo, Lalitpur, Nepal

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## ABSTRACT

Zoos are established to engage the general public in informal education, research and conservation, as well as maintaining their role as attractive places for entertainment and recreation. Zoos provide home for different animals that are of common occurrence, geographically rare species, attractive species, trafficked animals seized by the authorities, and injured and orphaned animals. The presence of visitors and their activities affect the behavior of animals in the zoo due to the structural design and the attractiveness of animals. The more attractive bird, ostrich *Struthio camelus* in Central Zoo of Nepal is suffering from visitors' activities. Both male and female ostrich turn their heads many times towards visitors while they are resting and moving. The female ostrich was less affected by visitors' presence while resting due to the structural design of the cage/enclosure than the male ostrich. Visitors influenced both male and female ostrich activities while moving. As the visitors' presence affects the behavioral activities of ostrich, we recommend to extend the cage/enclosure to give space to the birds to avoid closer contact with the visitors OR raise a tinted glass partition between the Ostrich (both female and male) and the visitors through which only visitors could see the ostrich.

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## Authors' Contribution

HPS designed the study, analyzed the data and wrote manuscript. HPS, SA, YR, RS, SC, MK, RTM, AH, KBK, MK, SB, SB and SP performed field work. HPS, SA, YR, RS, SC, MK, RTM, AH, KBK, MK, SB, SB, SP, RS and CPP collected data, helped in manuscript writing and revision.

## Key words

Ostrich, Ostrich behavior, Zoo visitors' activity, Zoo

Modern zoos are typically designed to engage the general public in informal education, research and conservation, as well as maintaining their role as attractive places for entertainment and recreation (Tribe and Booth, 2003; Mellish *et al.*, 2019). Zoos have undergone significant changes since the late 1800s, when they existed primarily as menageries and amusement parks (Mearns and Liebenberg, 2018). Today, zoos have a major role in wildlife conservation. Many of the 140-mammal species (Ripple *et al.*, 2019) considered to be at risk of extinction across six continents have captive breeding programs within zoos. Zoos have also helped to maintain the genetic diversity of rare and threatened species (Lacy *et al.*, 2019). Furthermore, zoos are often obliged to provide homes for trafficked animals seized by the authorities, and injured and orphaned animals. Information and resources are shared among the global network of zoos to ensure best practices and effective population management (Ferrer and McDuffie, 2019).

Improved conservation outcomes can result from researching the characteristics and behavior of captive animals (Hall *et al.*, 2018) within zoos. A clear understanding of animal behavior is one of the major pre-requisites for effective management of both wild and captive populations (Gill and Sutherland, 2000; Aarts *et al.*, 2008), and formulating strategies to improve the survival, growth and reproduction of species for long term conservation.

Ostrich *Struthio camelus* is categorized as 'Least Concern' in the International Union for the Conservation of Nature (IUCN) Red List (IUCN, 2018). Ostrich is being kept at the Central Zoo in Kathmandu, Nepal for recreational and educational purposes. The zoo has organized a "Friends of Zoo" through which the species' information is regularly disseminated to the school as well as college students. The zoo also facilitates visitors in providing updated information on the species being maintained in the zoo.

Ostrich is naturally distributed in the semi-arid desert regions of several African countries, where it is distributed in a range of open arid and semi-arid habitats such as savannas and the Sahel, both north and south of

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the equatorial forest zone. (Brown *et al.*, 1982; del Hoyo *et al.*, 1992). In Nepal, the species is farmed to produce meat, hide, eggs and feathers. In addition, some individuals are kept in zoos. In the wild, ostrich typically live in mixed communities (Bertram, 1992). Cooper *et al.* (2010) reported that 75% of the interactions of ostrich with other naturally occurring species were neutral or undertaken in order to evade close contact. The behavior of this species is particularly difficult to study in its natural habitat (Bertram, 1992).

Ostriches, like other ratites are flightless and characterized by their very long neck, and well-developed leg muscles for running. The legs are featherless and there are only two toes, which is the adaptive characteristic for fast running. The top speed of ostrich has been recorded as 70 km/hour (Brown *et al.*, 1982).

Ostrich exhibits sexual dimorphism in feather coloration: the tail feathers of males are distinctly black and white; whereas in females the tail is greyish-brown and white (Davies and Bertram, 2003). The neck of both male and female ostrich is bare, with only a thin layer of down. The thighs and neck of the female are pinkish grey (Davies and Bertram, 2003).

Ostriches spend most of their time eating, standing and walking (Menon *et al.*, 2014). They prefer to live in groups, except during courtship (Burger and Gochfeld, 1988). Herds of ostrich may be as large as 10 to 20 individuals; an adult sire or dame will typically lead the group (Sauer and Sauer, 1966). The ratio of males and females in a group in the wild generally ranges from 1:1 to 1:4 (Musi *et al.*, 2008). Ostrich display characteristic vigilance behavior, turning their heads to the horizon while eating and resting (Sauer and Sauer, 1967).

The behavior in the wild however is changed in captivity as the animals are not in their natural habitat and they have to lead a forced solitary life or at the most as a single pair accommodated in a small enclosure.

The number of visitors, and their behavior and activities are the source of stimulation for zoo animals (Margulis *et al.*, 2003; Wells, 2005). The disturbance from the high visitor numbers generally poses the negative impacts on the behavior of zoo animals (Margulis *et al.*, 2003; Stevens *et al.*, 2013). The effect of disturbance on animals is frequently measured in terms of changes in type or extent of behavior. The magnitude of these changes in behavior is often used as a measure of the relative susceptibility of the species to disturbance; for example, species that show strong reactions to human presence need higher levels of protection from disturbance compared to those which do not.

The Central Zoo in Kathmandu, Nepal is situated in Jawalakhel, Lalitpur, within Province 3 (27.6733° N,

85.3107° E). It occupies a six-hectare area and is a popular recreational destination for local people and tourists. Originally established in 1932 by Prime Minister Juddha Shamsheer Rana as a private zoo, the Central Zoo was administered under His Majesty's Government of Nepal from 1950-1995, when responsibility for management of the zoo was handed over to the National Trust for Nature Conservation. The Central Zoo accommodates 870 individual animals, including fish, birds, mammals and 109 species of reptiles.

One male, and one female, ostrich are being kept at the Zoo. Their separate enclosures attract many visitors. The enclosure housing the male ostrich is larger (323 m<sup>2</sup>) than that of the female (41 m<sup>2</sup>). The male ostrich, now five years old, was brought from Rupandehi district of Nepal (where a large ostrich farming facility has been established), at the age of about 4 months on 30 October 2013. The female was received at the zoo on 3 November 2000 at the approximate age of 3 months, and is now 18 years old. The ostriches are fed twice a day with maize, gram (chickpeas), peas and green grass. The male and female ostrich are being kept in separate open enclosures separating the visitors by erecting a railing.

This study aims to identify the behavioral response of captive ostriches to zoo visitors in an attempt to determine whether and how the birds are affected by the presence of visitors.

#### *Materials and methods*

We studied the response of two captive ostriches (one male, one female) towards visitors in Nepal's Central Zoo from 24 June to 7 August 2018, during the rainy, summer season in Nepal. The average daytime temperature was 27.5 °C during this time of the year. Observations on ostrich behavior were recorded for three hours twice a week between 2:10 pm and 5:10 pm continuously on Sundays and Tuesdays for six weeks. In our preliminary study between 20<sup>th</sup> and 26<sup>th</sup> May 2018, we noticed that the fear was found to be one of the causes to turn ostrich's head towards visitors. We noted how often the ostriches turned their heads towards visitors while resting and moving (natural phenomenon) due to disturbances from visitors during a total of 2160 minutes of observation in the six-week study period. Head turns were recorded every time they occurred (all occurrences). We ignored the head turn of ostrich while they looked around more when locomoting, whether or not visitors were present. In addition, we recorded the duration of time that the ostrich watched visitors after being disturbed by them, and the length of time each ostrich spent looking towards visitors. We recorded the number of visitors at every 10 minutes interval of the observation bout because in our preliminary

study we noticed that ostrich remained disturbed until 10 minutes of the presence of visitors.

We compared the effect of visitors on male and female ostriches while at rest and moving. Our data were not normally distributed, therefore we performed Mann-Whitney U test to determine the differences in number of visitors observing male and female ostrich. We compared the time spent by male and female ostrich while turning their head towards visitors. In addition, we performed Chi-square test to understand the effects of visitors' presence and absence on head turning behavior in both male and female ostrich. We compared the number of head turns with or without visitors' presence. The response variable for this study was the number of times head was turned towards visitors while resting and moving (walking or running), and the explanatory variable was the presence of visitors. We performed analysis in R Program (R Core team, 2017).

### Results

We observed the number of visitors and ostrich behavior at both male and female ostrich enclosures for a total of 2160 minutes (three hours of observation twice a week for six weeks). Altogether 2378 visitors observed the sample ostriches (male and female). Among them 1439 visitors observed the male and 939 observed the female during the study period. The maximum number of visitors observing ostriches at one time was 25 (range: 0-25 for male; 0-10 for female) in 10 minutes of observation (Fig. 1). Fewer visitors were observed at the female ostrich enclosure (female: median = 1.00; male: median = 3.00;  $W = 32802$ ;  $p < 0.001$ ).

Both male and female ostriches turned their heads many times towards visitors while resting (male: median = 2.00; female:  $W = 22273.5$ ,  $p = 0.410$ ; Fig. 1). The female ostrich looked towards visitors less minutes than the male while resting (male: median = 0.6 minutes; female: median = 1.00 minute;  $W = 22734$ ,  $p = 0.643$ ). The male ostrich turned its head towards visitors more often than the female while moving/running (male: median = 2.00; female: median = 1.00;  $W = 27205$ ,  $p = 0.002$ ; Fig. 1). The male ostrich also spent more time looking at visitors while moving, compared to the female (male: median = 1.00; female: median = 0.02;  $W = 28628.5$ ,  $p = 0.001$ ).

The presence of visitors was found to affect the male ostrich activities while resting ( $\chi^2 = 69.211$ ,  $df = 1$ ,  $p < 0.001$ ) but not the female ostrich activities ( $\chi^2 = 1.0775$ ,  $df = 1$ ,  $p = 0.299$ ). Visitors' presence significantly influenced the activities of both the male and female (male:  $\chi^2 = 5.4162$ ,  $df = 1$ ,  $p = 0.02$ ; female:  $\chi^2 = 6.4856$ ,  $df = 1$ ,  $p = 0.011$ ; Fig. 1) while moving.

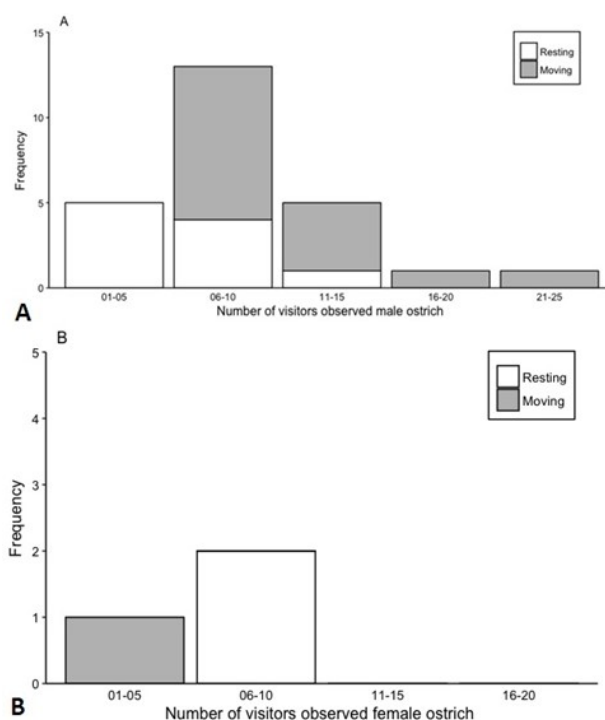


Fig. 1. Number of zoo visitors watching male (A) and female (B) ostrich and head turned towards visitors by the ostrich during the study period.

### Discussion

The Central Zoo of Nepal is one of the most popular recreational destinations for people who visit the Kathmandu valley. In our visual observations among the birds in zoo, the ostrich is one of the most attractive exhibits due to its unusually large size, and the recent initiation of ostrich farming in Nepal. In addition, more visitors are enjoying through observing the activities of another attractive mammal species Siamang (*Symphalangus syndactylus*) which was exotic to Nepal.

The enclosure size of the male ostrich at the Central Zoo is larger and compared to that of the female, gives visitors a clearer view of the occupant. Both the male and the female ostrich turned their heads in response to visitors' presence while they were resting. Generally, the ostrich responds to the activities near to it probably due to stressor (Paxton *et al.*, 1997). Other animals such as primates show agnostic behavior due to visitors' presence (Glatston *et al.*, 1984; Chamove *et al.*, 1988).

The female ostrich gets less disturbed while resting, probably being more familiar with visitors than the male due to the location and design of the enclosure. However, she spent less time observing visitors than the male. It is probably due to the expectation of male to get food from visitors (even though it is prohibited). Feeding of ostrich

in captivity in the designed area is more frequent than from the floor (Paxton *et al.*, 1997), therefore they would expect food from the visitors. Visitors presence also influenced female ostrich activities while moving due to their expectation of food from visitors. From these observations, we found that visitors' presence and activities affected the behavioral activities of ostrich. Male ostrich became aggressive towards the female when they were kept in the same enclosure probably due to more stress on the male from visitors. This behavior might prevent the breeding of this pair in the zoo. Therefore, more improvements are needed in the existing conditions of Nepalese Zoo captive environment. We recommend some structural design improvements in the zoo. The Enclosure may be extended to give space to the birds to avoid closer contact with the visitors OR raise a tinted glass partition between the Ostrich (both female and male) and the visitors through which only visitors could see the ostrich.

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#### Statement of conflicts of interest

The authors have no conflict of interest to declare in relation to this work.

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