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ORIGINAL ARTICLE

Estimating abundance of some wild faunal elements of Jasrota Wildlife Sanctuary, India

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Abstract Perpetually increasing human population has kept natural resources and biodiversity under a continuum of anthropogenic pressures compelling wildlife managers to keep a count of what and how many are there to be conserved and protected. We present here baseline information about the abundance of some wild faunal species counted on predetermined belt transects of varied lengths on three consecutive days during summer 2012 in the Jasrota Wildlife Sanctuary, Jammu & Kashmir. Rhesus macaque (*Macaca mulatta*) was the most abundant species with the highest mean ecological density (individuals/km^2) of 146.9 mean ± 1.47 90% CI followed by the red jungle fowl (*Gallus gallus*) (46.46 ± 0.84 90% CI). Amongst the ungulate species observed, the muntjac (*Muntiacus muntjak*) had the highest mean density (9.49 ± 1.52 90% CI). Bounded Count method used to estimate population size produced the highest estimate for macaques as 135 individuals (90% CI: lower bound = 117 and upper bound = 279) whereas the smallest population estimate obtained was 5 individuals (90% CI: lower bound = 3 and upper bound = 21) for the wild pig. The highest grouping tendency was found for the rhesus macaque (10.88 mean ± 5.74 SD) followed by the red jungle fowl (2.65 ± 2.07) and the Indian peafowl (2.26 ± 1.72). The Indian muntjac was observed either solitary or in very small groups (1.26 ± 0.45). The abundance estimates obtained in the study area can be considered conservative and may be helpful in developing future management strategies. We discuss about the limitations and precision of the abundance estimates obtained.

1. Introduction

The Himalaya is the highest and the youngest mountain system in the world (Devan, 1988). The formation (~70 million years ago) of the Himalaya resulted in new barriers and corridors leading to the creation of ideal habitats for a variety of floral and faunal species. The richness in biological diversity in this region owing to its variable climatic conditions and habitats (Rau, 1975), ultimately led it to become one of the

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global biodiversity hotspots (Myers et al., 2000). The western Himalaya contains several species which are endemic to this region only. Of the 137 species of endangered Himalayan plants listed so far in the Red Data book, 56 species are from the Western Himalaya (IUCN, 2015). 11 species of endemic birds including the Cheer pheasant (*Catreus wallichi*) and the Western Tragopan (*Tragopan melanocephalus*) (Statersfield et al., 1998) are found in this region. Endemic mammals like Kashmir markhor (*Capra falconeri*), Asiatic ibex (*Capra sibirica*), Kashmir red deer (*Cervus elaphus hanglu*), Tibetan antelope (*Pantholops hodgsonii*) and Eurasian lynx (*Lynx lynx*) are found exclusively in the Western Himalaya (Macdonald, 2001; Rodgers and Panwar, 1988).

In the face of continuous anthropogenic pressures due to the increasing human population, the fragile Himalayan ecosystem is undergoing rapid degradation which has serious long term repercussions. The factors attributable to this environmental degradation include unsustainable harvesting of biological resources like firewood, non timber forest products (NTFP), timber, large-scale developmental projects, extensive livestock grazing, illegal extraction of rare and threatened plants and poaching of endangered animals. Moreover, all these pressures have resulted in fragmentation and degradation and even loss of wildlife habitats making some of the forests empty of their wildlife in south-east Asia (Datta et al., 2008; Steinmetz et al., 2013) as well as the Himalaya (Shehzad et al., 2014).

Biological diversity is viewed as the potential resource capital of a state or region that possesses it. Loss of the biodiversity worldwide has become a major political and social concern (Lele et al., 2010) with *in situ* conservation prevailing as the model adopted to reduce biodiversity loss (Eken et al., 2004). Effective conservation and management of biodiversity is of paramount importance and requires prior knowledge of species diversity, distribution and abundance so as to detect significant changes for appropriate management interventions. Consequently, efficient and reliable methods for rapid assessment of species richness and abundance are required in determining conservation priorities (Silviera et al., 2003).

The basic information pertaining to distribution, abundance and ecology for many species in the Himalayan ecosystem is limited due to rugged terrain, low accessibility, extreme weather conditions, etc. (Schaller, 1977) leaving a void in the sound understanding of wildlife ecology. We do not even know the status of some existing species and lag behind in exploring and reporting unrecorded species in the state. Keeping these points in mind the present study was undertaken to quantify the faunal diversity of a north western Himalayan protected area. We document the estimates of abundance or abundance indices of some faunal elements that were observed during the survey in the Jasrota Wildlife Sanctuary, Jammu and Kashmir (J&K), India. This study may serve as baseline information for future management interventions as we provide abundance estimates of the species observed during the survey.

2. Material and methods

2.1. Study area

Jasrota Wildlife Sanctuary (hereafter JWS; 10.04 km^2; 32° 27′–32° 31′ N, 75° 22′–75° 26′ E; elevation 356–643 m above sea level) is situated on the right bank of the Ujh river (District Kathua, J&K) (Fig. 1). The climate is generally dry sub-humid (average annual precipitation around 1000 mm). Summer runs from April to mid-July, with maximum summer temperatures ranging between 36 °C and 42 °C. Winter runs from November to February and spring between mid-February and mid-April. The vegetation is comprised of broad-leaved associates, namely *Lannea coromandelica*, *Dendrocalamus strictus*, *Acacia catechu*, *A. arabica*, *Dalbergia sissoo*, *Bombax ceiba*, *Ficus religiosa*, *Zizyphus jujuba*, etc. along with shrubs like *Adhatoda vasica*, *Lantana camara*, *Parthenium hysterophorus*, *Calotropis procera*, etc.

The area comprises a small population of ungulates such as Indian muntjac (*Muntiacus muntjak*), spotted deer or chital (*Cervus axis*), sambar (*Rusa unicolor*) and wild pig (*Sus scrofa*). The JWS is believed to be the northern most limit of some species (e.g. chital and sambar) distribution range in the wild in the J&K state. The sanctuary is a home to more than 50 species of birds including genetically threatened red jungle fowl (*Gallus gallus*).

2.2. Sampling

We conducted a three-day (June 29–July 1, 2012) sampling using belt transects (Sutherland, 1996) in the study area. A total of nine transects were pre-marked by the Forest Department prior to the survey covering almost all major habitat types/vegetation of the study area. Since, the study area mostly consisted of forest and detections beyond 20 m were not possible, we fixed the width of each transect to total 0.04 km but the length was variable (1.5–2.8 km). A 2–3 member team (pre-trained and acclimatized with sampling methodology) walked transects in the morning hours (0600–0800 h) to observe/record the number of animals of different species. Each transect line was walked once a day for three consecutive days in order to maximize data collection.

2.3. Data analysis

Data obtained through this sampling were used to estimate encounter rates (defined as the total number of individuals of a species observed during a sampling day divided by the total distance (km) walked during that period) as an index of abundance. The abundance analysis was undertaken adopting three approaches.

2.3.1. Density estimation

We calculated animal densities per unit area on a given day as the total number of groups of a species seen on a particular day divided by the total area of all transects following Hilaluddin and Naqash (2013). We first estimated the mean group densities (D_g, number of groups per km^2) and its standard error (SeD_g) for each species. From this, the mean ecological density (D, number of individuals per km^2) and its standard error (SeD) were derived using the following equations (see Drummer, 1987; Karanth and Sunquist, 1992):

$$D = D_g \times Y$$

$$SeD^2 = SeD_g^2 \times SeY^2/n + SeD_g^2 \times Y^2 + SeY^2/n \times D_g^2$$

where Y = mean group size of a species, SeY = standard error of the mean group size and n = number of groups of a species detected.