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### RESEARCH ARTICLE

#### EFFECT OF HUMAN SETTLEMENTS ON CHITAL (*Axis axis*) POPULATION IN MUKANDRA HILLS TIGER RESERVE.

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#### Abstract

Human settlements and its effects resulted in natural wild habitat degradation and destruction due to increased land use by human population. Chital is an ecological important species in Mukandra Hills Tiger Reserve. Due to notified as tiger reserve in 2013, Chital population during last five years have recovered from a sharp declines in past caused by human settlements in and around the study area. Human settlements presently continued to threaten Chital population in spite of the strict laws under study area due to wildlife habitat destruction. Chital is the most abundant prey species in study area. Major factors which declined or affected the Chital population in the study area were land use for agriculture, deforestation, poaching and hunting, grazing competition with livestock, pollution, roads and train network.

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#### Introduction:-

Mukandra Hills Tiger Reserve (MHTR) includes 30 villages. There are 14 villages in buffer area and 16 villages inside core area of MHTR. Human settlements, directly or indirectly influenced the biodiversity. Human settlements have affected biodiversity irreversible. Human settlements inside forest area frequently used natural resources, caused natural habitat destruction and their economy was mainly based on agriculture. Habitat destruction is most important cause of wild species declination worldwide.

Chital (*Axis axis*) is a medium sized deer species which is distributed all over in india and also native of Nepal, Srilanka, Bangladesh (Prater, 1934; Schaller, 1967). Its population is declined outside protected areas but inside protected areas its population is increasing. Chital is included under Schedule III of wildlife protection act and listed as least concern in IUCN (Duckworth et al, 2015). Poaching and hunting of Chital is prohibited under schedule III of Wildlife (Protection) Act 1972. Mukandra Hills Tiger Reserve is suitable habitat for Chital due to open grassland adjacent to dense forest which is most favored habitat by Chital. Chital follows fission fusion system of fluid group formation (Fuchs, 1977; Mishra, 1982; Barrete, 1991). The average group size changes temporal, monthly and seasonally (Sharatchandra and Gadgil, 1975, 1980; Khan et al., 1996) as well as according to habitat (Karanth and Sunquist, 1992). Chital has been also studied in Ranthmbhore (Bagchi et al., 2003, 2003, 2004, 2008), Corbett (De and spillet, 1966; Tak and Lamba, 1984), Gir (Dave, 2008), Hawaii (Graf and Nicholas, 1966), Bandipur (Johansingh, 1983), Mukandra (Sultana, 2007; Khan, 2015), Sariska (Sankar, 1994; Chandra, 2013), Guindy (Raman, 1997, 1998), Mudumalai, Tamilnadu, (Varman and Sukumar, 1995), Pench (Sartaj et al., 2010), Karnali

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Bardia, Nepal (Dinerstein, 1980; Moe, 1993; Moe and Wegge, 1994; Wegge et al., 2009), Wilpattu, Sri Lanka (Eisenberg and Lockhart, 1972), Western Ghat (Ramesh et al., 2012, 2013). Chital constituted the bulk of tiger's diet as reported by several studies (Biswas and Sankar, 2002; Joahnsingh, 1992; Karanth and Sunquist, 1995; Stoen and Wegge, 1996).

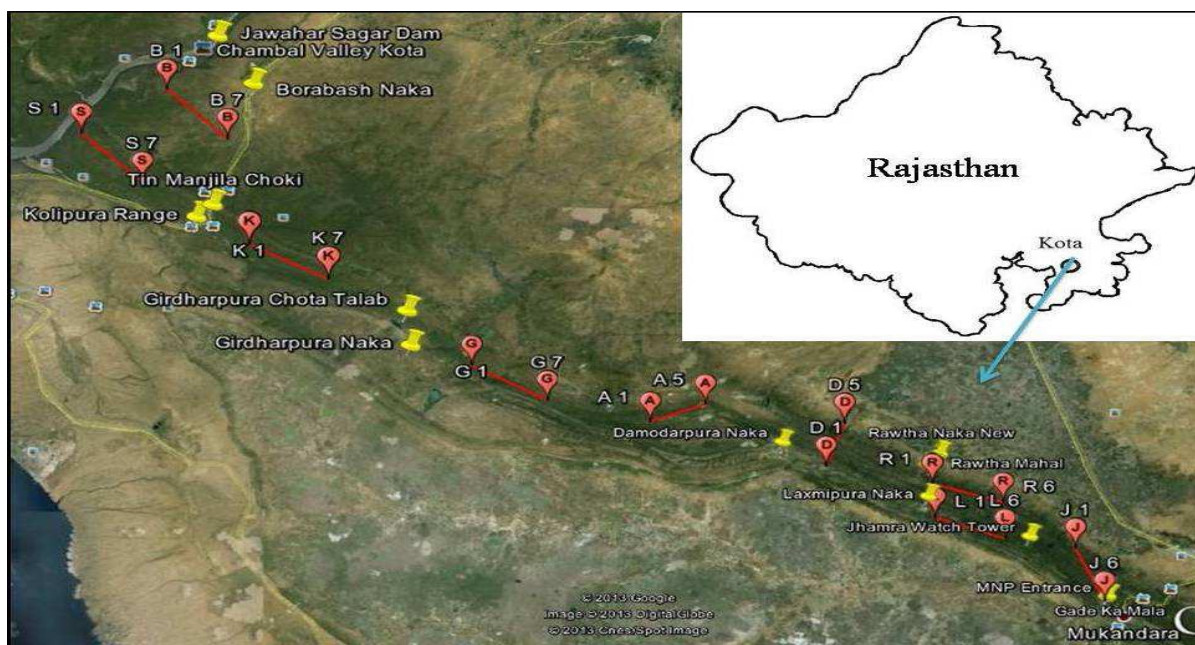
#### **Study area:-**

MHTR includes 417.17 square km core area and 342.82 square km buffer area with a total 759.99 square km area. There are 16 villages inside core area and 14 villages in buffer area of MHTR. It is located in the south east part of Rajasthan of India. As for boundary information Chambal, Ahu and Kalisindh River situated at west, south and east boundary of MHTR. Delhi-Mumbai Train-Line and Jaipur-Jabalpur National Highway passing through Darrah fragmented MHTR in two parts. Kota-Rawatbhata State Highway also fragmented the western part of MHTR (Nama et. al., 2013). Darrah Wildlife Sanctuary supports rich biodiversity but due to biotic pressure resulting in destruction of forest and reduction of biodiversity during late 20th century (Sultana, 2009; Sultana, 2009).

Human settlement and Land use around the Park: - There are a large number of human populations living in and around MHTR. Gurjar, Bhil, Meena, Kathodi and Rajput community are living in this area. Cattle and Human population of these villages exert tremendous biotic pressure on the adjoining forest area. Villages coming inside core area were proposed to be relocated. Agriculture, animal husbandry, collection of NTFPs, Labour work etc. were the main occupation. Irrigation facilities were not properly developed. The intricate relationship of the tribal with forest was remarkable. They fully depend on forest for housing, fencing material, fodder, wild fruits and agricultural implements.

MHTR meet out ecological, biological and ethological requirement of different wildlife. Different animal prefer different type of habitat for food and shelter. MHTR was once famous all over the country for Tiger. Tiger was found till late seventies. Last roar of Tiger was heard in 1978. In the month of April 2003 a tiger suddenly appeared in the area. It stayed in Selzer area but sadly lost its life in a fatal train accident in darrah, on 15<sup>th</sup> July 2003. Here **Panther** was at the apex of ecological pyramid in the absence of Tiger till 3<sup>rd</sup> April 2018 when **Tiger** was reintroduced in MHTR.

In the wild ungulates mainly Chital (*Axis axis*), Sambhar (*Cervus unicolor*), Nilgai (*Boselaphus tragocamalus*), Chinkara (*Gazella gazelle*) and Wild Pig (*Sus scrofa*) were present. Prey species total biomass per square kilometer was 794.71 kg/ sq. km as per census report of 2013. Chital was the most abundant ungulate in MHTR and Chital population was consistently increasing since the declaration of Mukandra National Park in 2012 and Mukandra Hills Tiger Reserve in 2013. Lantana and Parthenium grasses were main hazardous weed in MHTR specially in core area where Chital population was most abundant but Lantana also provide site for escape during danger in wild habitat hence also proved beneficial for Chital.



**Figure 1:-**Map of study area MHTR-(Source: Nama et al., 2013)

### Material and Methods:-

During present study, information was collected by direct visual observation in and around study area regarding trend of Chital population and human settlement effect which can decline Chital population. Study was conducted during October 2017 to September 2018. The observations were made for 1 week in a month at different selected sites. Most of the observations were made from hides or watch towers at places near feeding ground, waterholes like ponds for Chital population assessment. A Nikon binocular and Canon camera was used during the study for observation and Photographs of the study animal in the study area.

### Results and Discussion:-

Chital exhibit clear sexual dimorphism and males are clearly distinguished from female by their antlers, which ranges from 6 inches long spike up to 3 feet in length. Females and fawns are without antlers. The Chital population distribution was analyzed during this study in Mukandra Hills Tiger Reserve. Most of the animals were observed around Laxmipura chauki, Jhamra water point, Selzer chauki and from Kollipua to Girdharpura village. Mostly mixed herds of male, female and fawns were observed but all male herd (bachelor herd), all female herd and solitary animals were also sometime observed. The group size ranges from solitary animals to 65 individuals in a herd.



**Figure 2:-**Chital mixed with the surrounding Lantana in MHTR

**Table 1:-MHTR- Chital Census Data (Source: DCF office, MHTR)**

CENSUS YEAR	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
POPULATION	121	143	203	215	219	310	352	349	616	844

**Habitat used for agriculture:**

Wild habitat used for agriculture was the biggest threat for Chital population due to habitat degradation. Mukandra Hills Tiger Reserve is open grassland with adjacent dense forest and hills also and is used for agriculture in and around the villages with fertile land. The natural habitat is degraded due to agricultural activities and hence Chital population is restricted in small patches of study area.

**Deforestation:**

Forest plays very important role in management of natural habitat environment. Deforestation is the major cause of habitat degradation and environmental destruction. People living in villages inside and around study area exerts tremendous pressure on forest for timber and fuel wood. Exploitation of important resources such as fodder for their livestock is another major threat to quality of habitat used by Chital.

**Chital and livestock:**

Local people in study area have a very high livestock population mostly buffalo, goat and cow. Milk of these animals was the main source of their income. These domesticated animals were fully dependent on scrubland and grassland for fodder which was the main foraging area for Chital also. Thus livestock living inside and around the study area were the tough competitor for grazing to Chital.

**Poaching and Hunting:**

Human have been exploited wild animals for game from past decades and centuries and now commercialization of hunting has triggered the wildlife depletion rapidly. Chital population had decreased due to excessive poaching throughout the country during early twentieth century but poaching has been strictly banned in late twentieth century under the laws (Abson and Termansen, 2010). Poaching caused reduction in Chital population especially in hunting dominated area inside the study area. Reduction in population size negatively affects the wildlife tourism spots.

**Pollution:**

Pollution was also a major threat for study area due to anthropogenic activities caused by human settlements living in and around study area. Climatic change in environment plays important role in degradation of biodiversity and hence chital population also degraded due to use of fuel wood, burning of waste and increased transportation (Anand et al., 2010).

**Conclusions:-**

Wildlife biodiversity has been a crucial link in survival of human and hence an important subject of research. Wildlife species such as Chital were under severe pressure due to human settlements in and around study area hence effective conservation and management of wild animals is of great importance. The future of Chital population depends on interaction between livestock and Chital population. Demographic variation in Chital distribution also affected the Chital population. Due to threats observed in study area by human settlements local communities and forest department must develop a model for natural habitat management for conservation of Chital population in the study area.

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