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Are conflict-causing tigers different? Another perspective for understanding human-tiger conflict in Chitwan National Park, Nepal

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ABSTRACT

We analyzed characteristics of the problem-causing tigers in Chitwan National Park (Nepal) to determine if specific groups or individuals in the source population have higher probability to get involved in conflicts with humans. From 2007 to 2016 we identified a total of 22 such tigers including 13 that killed humans, six serial livestock killers and three tigers that threatened human safety (with no reported human and livestock casualty). Thirteen of these tigers were controlled or killed and four were relocated. We compared a subset of 15 'problem tigers' involved in conflict between 2009 and 2013 with the Chitwan's tiger population obtained from three different sessions of camera trapping (2009, 2010 and 2013). We found that <5% of this source population (tigers recorded in camera trap) were involved in conflict. We conclude that transient tigers without a territory or physically impaired animals are more likely to be involved in conflict and recommend an early warning system be adopted to anticipate conflicts before they occur. This system should include regular monitoring and timely identification of problem tigers followed by decisive management action to either remove the tiger or encourage local people to modify their behavior to reduce the risk of conflict.

1. Introduction

Along with legal and institutional protection of endangered species like tigers (*Panthera tigris*), support is needed from local communities living in fringes of protected areas (Inskip et al., 2014). Such support is especially important in locations

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where tigers occurs in small isolated protected areas in human dominated landscape (Wikramanayake et al., 2004). Local tolerance can quickly be compromised if tigers repeatedly threaten humans and their livestock (Goodrich, 2010). To gain local support, managers need to respond quickly and decisively (Barlow et al., 2010). The Terai Arc Landscape (TAL) in Nepal and India is a typical example of the challenges. In recent years, increased tiger population with reduced poaching and forest regeneration in community forests in buffer zones has increased the possibility for human-tiger conflict (Wegge et al., 2016; Chanchani et al., 2014; Gurung et al., 2008). One of the core tiger areas in TAL, the Chitwan National Park (CNP), currently supports >100 tigers (Walston et al., 2010; Karki et al., 2015). The high-quality tiger habitat in CNP serves as a source for tigers dispersing into more marginal habitat adjacent to human (Smith, 1993).

Human-tiger conflict (HTC) is generally expressed in three forms - i) tiger attacks on humans, ii) tiger attacks on livestock and iii) threat to human safety from tigers living in close proximity to human habitation (Goodrich, 2010). Human deaths by tigers in and around CNP have increased six folds from an average annual deaths of 1.2 (1979–1998) to 7.2 (1998–2006) (Gurung et al., 2008). Between 2007 and 2014, an average of 4 persons have been killed and 2.7 injured per annum. In the same period an average of 44 livestock killed per annum (Dhungana et al., 2017). These deaths and conflicts reduce support for tiger conservation (Goodrich, 2010) and in retaliation people kill tigers by poisoning or physical attacks with guns or spears (CNP, 2012). The government has initiated a program to identify and promptly respond to problem individuals; this effort may reduce retaliatory killings.

Studies on human-tiger conflicts have analyzed factors that contributed to human tiger-conflict and also assessed their socio-economic impacts (Dhungana et al., 2017; Silwal et al., 2016; Bhattarai and Fischer, 2014; Gurung et al., 2008). Many factors like season, distance to park boundary, number of livestock and community attitude have been identified as related to the level of conflict (Van Bommel et al., 2007). However, only a few studies have focused on the individual characteristics (e.g. age, sex, physical condition, territorial behavior) of problem causing animals and their management (Barlow et al., 2013). Most previous studies regarded the entire tiger population as conflict causing with the general assumption that when a population increases, conflict also intensifies.

Protected areas in Nepal and India are typically surrounded by buffer zones with marginal habitats and high human density (Spiteri and Nepal, 2008; Gurung et al., 2008). Younger tigers are often pushed out of the core areas of reserves into buffer zones by mature, resident tigers (Smith, 1993; Kolipaka et al., 2017). Older and weaker male tigers are also driven from their territories by dominant males. Both these younger and the older post-reproductive tigers living in marginal habitat are the most likely to come in conflict with humans. However, despite frequent reports of conflict caused by tigers (Gurung et al., 2008; Silwal et al., 2016) from Chitwan NP, Sunquist (2010) described explicitly that by nature tigers are very adaptive and can live very close to people but stay un-noticed in areas with sufficient prey, space and cover. Carter et al. (2012) suggested that, in Chitwan, temporal separation allows humans and tigers to use the same area at a fine spatial scale. These apparent contradictory findings about tiger behavior and their interactions with people have evoked a debate among conservationists about the balance between conflict and coexistence (Karanth et al., 2013; Harihar et al., 2013). In a study that focused on livestock killing, Linnell et al. (1999) suggested that a specific subset of animals were responsible for most of the human-carnivore conflict and they proposed intensive monitoring of movement and predatory behavior to identify these animals.

Our study examined human-tiger conflict in greater depth and tested the hypothesis that conflict causing tigers differ in individual characteristics (age, sex, territorial behavior and physical condition) from the other tigers in the population. We anticipate that not all individuals in a tiger population are equally involved in conflict. Instead we suggest most conflict results from the behavior of specific group of animals which are pushed out of the core areas and adopt the human or livestock killing activities (Linnell et al., 1999). We used camera trap data to compare problem tigers to the general tiger population of Chitwan.

2. Methods

2.1. Study area

Chitwan National Park (27°16.56′- 27°42.14′N and 83°50.23′ - 84°46.25′E; area 953 km^2), designated in 1973 as the first national park of Nepal, has a monsoon dominated sub-tropical climate with an average monthly maximum temperature between 24 °C and 38 °C, monthly minimum temperature between 11 °C and 26 °C, annual rainfall ~ 2250 mm and relative humidity 89–98% (2000–2010). It is a World Heritage Site (UNESCO, 2016) with a unique assemblage of rare and threatened fauna which include approximately 70 mammal species, over 600 bird species, 56 species of reptiles and amphibians, 156 species of butterflies and 120 species of fish (CNP, 2017). Chitwan is a priority tiger conservation area with a population of >100 tigers (Dhakal et al., 2014). CNP also supports the world's second largest population of the greater one-horned rhinoceros (DNPWC, 2015; Subedi et al., 2013).

Situated in the south central lowlands in the inner Terai (Fig. 1), the park is dominated by forest (80%) including sal forest, riverine forest and mixed hardwood forest. In addition, there are grasslands (12%), exposed surface (5%) and water bodies (3%) (Thapa, 2011). The park is drained by three major rivers systems, i.e., Narayani, Rapti and Reu rivers. The Narayani River marks the western boundary, the Rapti River marks the northern boundary, Reu River and the international border with India along the Valmiki Tiger Reserve marks the southern boundary for CNP (Fig. 1). Parsa National Park is contagious with the boundary of CNP. A corridor forest, Barandabhar, connects park with the northern hill forest (Fig. 1).