Conservation Status of Bengal Tiger (*Panthera tigris tigris*)- A Review

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Abstract: **Bengal tiger is one of the majestic carnivores found in regions of the Indian subcontinent. It possesses immense intrinsic values contributing significantly to the cultural and ecological aspects. However, a drastic decline in the population has been perceived for the past few years. Anthropogenic activities and fall in prey density are considered to be the major threats. Several conservation actions and plans have been executed to stabilize and increase the population. This review article summarizes ecology, threats to tiger population and its conservation strategies.**

Index Terms: **Anthropogenic, Carnivores, Conservation, Ecological and Population.**

I. INTRODUCTION

Bengal tiger, formerly known as Royal Bengal tiger (Pandit, 2012), belongs to the population of the *Panthera tigris tigris* subspecies, native to the Indian subcontinent (Kitchener et al., 2017). It is considered to be one of the largest carnivore mammals alive today (Heptner & Sludskii, 1992; Mazak, 1981). It is reckoned among the world's charismatic megafauna (Sankhala, 1978), and is the national animal of both India and Bangladesh (Lytton, 1841).

Felis tigris was the former scientific name of tiger, coined by Carl Linnaeus in 1758 (Linnaeus, 1758). Later, by Reginald Innes Pocock in 1929, it was subordinated to genus *Panthera* (Pocock, 1929). It is a member of the Class Mammalia, Order Carnivora, Family Felidae, Subfamily Pantherinae. It is one of the 9 known subspecies of tiger and is the most numerous (Dhandapani, 2014). It is indigenous to various parts of Asia, including Bangladesh, Nepal, Bhutan, majority in India (Dhandapani, 2014; Ghosh, 2020).

Tiger serves a significant contribution in the ecology. It is not just a flag-bearer of conservation but also an umbrella species, whose protection ensues conservation of other species, that are a direct or an indirect part of the tiger's food chain. It is a top predator, lies on the apex of food chain, and plays a vital role in

regulating and perpetuating ecological processes and system (Sunquist et al., 1999; Terborgh, 1991; WWF-INDIA, 2014).

Many scientists refer it as an ecological litmus paper as it acts as an indicator species from which various ecological changes in terms of species richness, equitability, size, biomass, etc. are determined. It helps in indicating the overall health of the ecosystems in South and South-East Asia (Mohammad, 2004). Despite its consequential role in ecological sustainability and services, tiger population is diminishing at an alarming rate all over its range (Mohammad, 2004; Wikramanayake et al., 2010). As per IUCN Red List of Threatened Species, it is evaluated to be an endangered species whose population in the Indian subcontinent declined drastically from 100,000 in 1900s to 3,600 in 2010 (Wikramanayake et al., 2010). Survey in India, in 2010, recorded an average count of 1411 tigers (Jhala et al., 2011).

This review article explores ecology, threats to tiger population and various conservation strategies needed to protect tiger population.

II. ECOLOGY AND HABITAT

Different subspecies and habitat determine the ecology and behavior of the tigers (Khan, 2004). There are varieties of habitat in which tigers are situated, tropical evergreen forests, rainforests, subtropical pine forests, dry deciduous forests, alluvial savanna, grasslands, broadleaf temperate forests, Mongolian steppe, Amur steppe, open woodland, thorn scrub and mangrove forests (Wikramanayake et al., 2010). They have also been located at altitudes higher than 3000 meters in Himalayas (Prater, 1971; Matthiessen, 2000), and are adapted to wide range of environments (Seidensticker & McDougal, 1993). Minimal requirements for a tiger habitat are thick vegetation, adequate ungulate population and water availability are (Sunquist & Sunquist, 1989). Currently, only 5% out of 1.5 million square kilometers supports tiger population (Karanth, 2001), due to anthropogenic activities and prey density deficit. The structure of prey community in terms of its abundance of different size class, determines the ecological density of tigers

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(Karanth & Sunquist, 1995).

Tigers prefer to prey on large sized animals like ungulates, boars, baby elephants, bulls, gaurs, rhinoceros, other carnivores like leopards, bears, and smaller animals like aves, fishes and reptiles (Karanth & Sunquist. 1992; Nowell & Jackson, 1996; Prater, 1971). They feed about 18 to 40 kgs of meat at once (Locke, 1954). They tend to drag their kills prior to the feeding (Schaller, 1967), which sometimes lengths up to 8 kms (Sankhala, 1978). Average amount of meat required for an individual, annually, is 3000 kgs (Sunquist et al., 1999), although, over the long term, tiger predation does not necessarily decrease the prey population (Sunquist & Sunquist, 2002). Old tigers and injured tigers have incorporated human flesh into their diet and actively hunt and kill humans (Corbett, 1957).

Tigers have adapted to become a nocturnally active species due to anthropogenic disruptions, however, when left unvexed, they are seen active during the day time as well (Sunquist & Sunquist, 2002). They are stalk and ambush predators; they take cover behind trees and rocks and launches the attack as the prey gets close (Sunquist & Sunquist, 2002). They are skilled hunters; they attack their prey on their neck, causing suffocation (Nowell & Jackson, 1996). The attack style differs with respect to the size of the prey (Nowell & Jackson, 1996). They are great swimmers (Khan, 2004), and can swim up to the distance of ten kilometers (Chaudhuri & Choudhury, 1994). When provoked, they can also climb trees (Sunquist & Sunquist, 2002).

III. DISTRIBUTION AND POPULATION STATUS

Origination of tiger was from eastern Asia (Kitchener, 1999). Several fossils were excavated in the regions of China, Java and Sumatra, which was considered to have been possible from late Pliocene to late Pleistocene (Hemmer, 1987). It was asserted that tigers traversed to India, from the eastern Asia region about two million years ago (Nowell & Jackson, 1996). Absence of tigers in Sri Lanka further suggests that tigers appeared later in India, after Sri Lanka dissociated with India due to the rise of sea levels during that period (Kitchener, 1999). They entered India either through northwest or northeast (Heptner & Sludskii, 1992).

Royal Bengal tiger, out of the eight other subspecies, is the most numerous. India, Indonesia, China, Vietnam, Myanmar, Bhutan, Bangladesh Cambodia, Russia, Nepal, Lao PDR, and Thailand are the thirteen countries that inhabits tigers, often referred as tiger range countries (Stoner & Pervushina, 2003). More than fifty percent of the total tiger population reside in India (Mondol et al, 2009). In 2006, about 1410 individuals were estimated, excluding the population of Sundarbans (Jhala et al., 2008). Survey conducted in the year 2010 exhibits the range of tiger population to be between 1571 and 1875, with an average of 1706 (Ministry of Environment and Forest, 2010). They are found in all range of forests, from cold Himalayan region in the north to tropical Western Ghats in south and Mangrove forests (Ranganathan et al., 2008).

IV. THREATS

Animal-human conflict, prey depletion, habitat loss and fragmentation are by far the most apparent threats to the tigers in the wild (Ramakrishnan et al., 1999). Found in 13 Asian countries, they have encountered severe environmental circumstance and degradation as a result of accelerating human population ensuing urbanization, economic growth, infrastructure development and climate change (Seidensticker, 2010). Sensitivity to poaching and hunting may induce the extinction of their population (Chapron et al., 2008), irrespective of the high prey density (Gopal et al., 2010). Human-tiger conflict has been a major sociological and conservational concern where demand for tiger's body parts in China, required for traditional Chinese medicines and other practices is fueling the poaching (Kenney et al., 1995). Population of tigers is directly proportional to the density of its prey (Karanth et al., 2004). Local communities are the main cause of declination of prey population, as they depend on forest for their livelihood (Madhusudhan, 2004). Domestic livestock of local inhabitants ecologically competes with the ungulates, thereby affecting the tiger population (Carbone & Gittleman, 2004). Rise of human population has augmented the demand of natural resource consumption which prompted in habitat depletion and fragmentation (Vitousek et al., 1997). Owing to exploitation of resources, quality of forests in India, unlike Africa, South-East Asia and Latin America, continues to degenerate (Chakravorty et al., 2000; Ghimere et al., 1979; Lele et al., 2000). Urbanization and change in land use pattern led to fragmentation and isolation of habitat (Barbier, 2001). In order to maintain genetic and demographic viability and to raise young ones, large scale of undisturbed landscapes with sufficient amount of prey population is required (Carbone et al., 1999; Karanth & Sunquist, 1995; Seidensticker & McDougal, 1993). Aforementioned threats are directly or indirectly associated to socio-political issues. Tigers are vicious predators spotted around the globe possessing high density but poor population (Dinerstein et al., 2006). In this framework, political challenges involving legal, historical, livelihood and management issues are readily involved in protecting tigers legally by the establishment of protected areas (Rastogi et al., 2012).

Establishment of several isolated reserves, implemented for conservation of tigers, may have prompted in the reduction of the immediate risk of population extinction, but will not sustain the ecology, genetics and behaviour of tigers (Rastogi et al., 2012). A severe genetic bottleneck has been observed in the tiger population residing in these isolated reserves, which pose threat to the future tiger population (Ranganathan et al., 2008). Anthropogenic disturbances are anticipated to exacerbate with the rapid proliferation of human population, giving rise to active or passive pressure on tiger population (Dhandapani, 2014).

V. CONSERVATION STRATEGIES

Having a steady growth of the tiger population is the ultimate goal of the conservation plans, by bringing down the pressure (Ministry of Environment and Forest, 2010). Seidensticker reported following sectors required to be included in the tiger conservation program (Seidensticker, 2010):

1. Improving tiger conservation policies
2. Preserving tiger conservation landscapes
3. Scientific management and monitoring
4. Engaging communities
5. Cooperative management of international tiger landscapes
6. Eliminating illicit transnational trade in wildlife
7. Persuading citizens to avoid tiger consumption
8. Improving the technical capability of policy-makers and practitioners
9. Establishing sustainable long-term tiger and
10. Wildlife conservation funding strategies

Tiger species and their prey must be handled on a land-scape scale that encompasses main protected areas, buffer zones, dispersion corridors, sustainable management and preservation of selectively logged forests (Linkie et al., 2008; Rayan & Mohamad, 2010). According to Ghosh-Harihar et al., the implementation of surveillance strategies for 'eco-sensitive zones' around protected areas and a strong focus on the protection of existing protected areas should be two key priorities for policy makers (Ghosh-Harihar et al., 2019). Effective conservation laws, government investment in tiger reserves and government reward programs that encourage local support, all of which brighten potential prospects (Ghosh-Harihar et al., 2019). Models of population projection, such as matrix and integral projection models, can also be used to interpret and inform conservation behavior of the possible consequences of anthropogenic stressors (Earl, 2019). Information on the vital rate and life history used to construct robust population models is often lacking or incomplete, rendering assumptions possible about parameters and population processes. Hence, it is essential to evaluate how expectations influence outcomes, particularly if the research is used to direct policy or management behavior (Earl, 2019). The ecosystem of Bhutan and neighboring northeast India is a promising tiger refuge and must be prioritized in large-scale conservation programs with low human density and large swaths of forest cover (Tempa et al., 2019). A significant long-term conservation strategy for endangered carnivores is recognizing and preserving habitat connections that bind source populations to sustain landscape-level gene flow (Yumnam et al., 2014). A major concern is the protection of these increasing populations within the continuously diminishing habitats, which can only be resolved by intensive landscape management planning through five major current Indian tiger landscapes (Biswas et al., 2020).

It is important not only to sustain populations at key habitat locations, but also to allow the species to survive over much wider environments in order to retain the tiger. To achieve this, it is crucial to create well-connected networks of habitats where tiger survival and reproductive sites are facilitated by dispersal and colonization opportunities (Gubbi et al., 2017). Providing local populations with an interest in tiger survival, such as a share in tourism profits, helps protect tigers. This will result in a rise in anti-poaching efforts manage by local communities (Begum & Gill, 2014). For the survival of tigers, a constructive approach reflecting the need for the introduction of effective protection initiatives and mitigation methods such as schooling, monetary reward and tiger tracking should be proposed (Bhattarai & Fischer, 2014).

CONCLUSION

It can be concluded that restoration of large prey population and little human interference are the key measures necessary for the effective conservation of tiger. It is vital to enable the species' survival through broader landscapes to sustain the tiger. The mechanism that makes the recovery of tigers must be assessed and monitored.

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