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COMMUNICATION

GREATER ONE-HORNED RHINOCEROS *RHINOCEROS UNICORNIS* (MAMMALIA: PERISSODACTYLA: RHINOCEROTIDAE) POPULATION CENSUS IN THE RAJIV GANDHI ORANG NATIONAL PARK, ASSAM, INDIA

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Greater One-horned Rhinoceros *Rhinoceros unicornis* (Mammalia: Perissodactyla: Rhinocerotidae) population census in the Rajiv Gandhi Orang National Park, Assam, India

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Abstract: The complete-count of rhino or rhino census is an integral part of conservation and management of wild rhino-bearing areas of Assam. The direct count of rhinos in their wild habitat continues as the accepted method of determining rhino population. As a part of the periodic process, the Rajiv Gandhi Orang National Park (RGONP) organized a one-day direct rhino count on 2 April 2018. The results showed 1% increment of the population after a gap of six years. Such slow increment is considered to be a matter of concern. More research is necessary for better understanding of the population dynamics and identification of factors for better management of rhino population at RGONP.

Keywords: Complete-count, direct count, habitat management, Indian Rhino, trend.

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Author contribution: DKD has contributed to the field studies, scientific analysis, and the write-up. PK has critically analysed all findings.

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INTRODUCTION

The complete count of animals or animal census is arranged over a specified interval of time, at a specified point in an area (Overton 1971). This process is possible only if the area is relatively small and the animals are more or less conspicuous and easy to locate (Gopal 2012). The complete count of the Greater One-horned Rhino (GOR) *Rhinoceros unicornis* usually termed 'rhino census' is an integral part of conservation and management of wild rhino-bearing areas of Assam. The direct count of rhinos in their wild habitat continues to be an acceptable method of rhino census due to the following reasons (Lahan & Sonowal 1973):

(i) It is difficult to use the prescribed known method like 'sample count' because of the nature of the terrain, the tall, thick cover of the grassland habitat of the rhino.

(ii) The preferred habitat of rhinos is not evenly distributed; thus the distribution of rhino population is not even, as expected in a wild habitat.

(iii) Traversing in tall and thick grassland is difficult except with elephants.

The wildlife authority of India normally conducts a complete count or rhino census for each population in an interval of 3–5 years (Mukherjee & Sengupta 1999). Distribution and abundance of rhino population in Nepal is also being assessed by direct count methods every three years (Subedi et al. 2011). The complete count method is also conducted to count large mammals like Indian Elephants (Singh 1978; Nair & Gadgil 1980); Nilgiri Tahr (Davidar 1978); Barasingha (Schaller 1967); Blackbuck (Daniel 1967; Nair 1976) at intervals of 3–4 years.

On 2 April 2018, the Rajiv Gandhi Orang National Park (RGONP) conducted a total count of wild rhinos after a gap of six years. There were 100 wild rhinos counted in the year 2012 (Assam Forest Department 2014).

Study Area

The RGONP is situated on the southern bank of river Brahmaputra encompassing 79.27km^2 of riverine landscapes (Fig. 1). The word 'Orang' has its origin from the Assamese word 'Oor' which means 'the end'. Historically, it was the eastern boundary of the king Arimatta or Vaidyadeva's kingdom (bounded by the river Panchnoi).

The conservation history of Orang started as game reserve in 1915; later, it was proposed as a wildlife sanctuary encompassing 79.27km^2 in 1985. The proposed sanctuary was upgraded to a national park in the year 1999. It was declared the fifth tiger reserve of Assam in the year 2016. The Orang Tiger Reserve extends over a total area of 492.46km^2 in which 79.28km^2 is the core area and 413.18km^2 is the buffer area including a part of the Brahmaputra River.

This protected area is a part of the Brahmaputra riverine landscape and famous for its floral and faunal diversity like Indian Elephants *Elephus maximus*, Pygmy Hogs *Porcula salvania*, and Bengal Florican *Houbaropsis bengalensis* besides Greater One-horned Rhinos and Bengal Tigers. Because of its rich biodiversity and habitat similarity, Orang is also called Mini Kaziranga.

METHODS

The rhino census requires a properly skilled and motivated staff, a coordinated well designed planning, a system of control for data quality and logistical support (DNPWC 2009). RGONP authority had arranged sufficient logistics, and 32 enumerators were invited from different parts of Assam to volunteer for the smooth accomplishment of the process (Image 1). To carry out the rhino census, the entire RGONP area was divided into 16 counting sectors, each with an average size of 3–4 km^2. These sectors were serially numbered and indicated on a map and were commonly called blocks or compartments and delineated on the basis of habitat, accessibility and general distribution of rhinos (Fig. 2). Each enumerator was assigned one compartment for counting rhinos. The enumerators were provided a kit containing a GPS, a pair of binoculars, one data sheet, compartment map and necessary field guidance. A staff of the forest department was assigned with each enumerator and acted as a helping guide. Six senior forest officials were assigned to coordinate the rhino counting process by radio (wireless) and mobile phones with the enumerators.

Depending on the terrain, an elephant with a mahout or a vehicle was provided for counting the rhinos. Counting was done simultaneously from 05.30h to 09.30h, from a specified starting point for each enumerator and ended at another definite location, usually a specific anti-poaching camp. Rhinos normally graze actively in the morning hours (Laurie 1978; Hazarika et al. 2013; Dutta et al. 2017). Counting was arranged in the morning hours because it helps the rhino count during day time and also helps in the safe return of the enumerators from difficult areas of the park before dark. During the count, details regarding approximate age, sex, spatial information (like terrain, type of vegetations, water sources) and other related

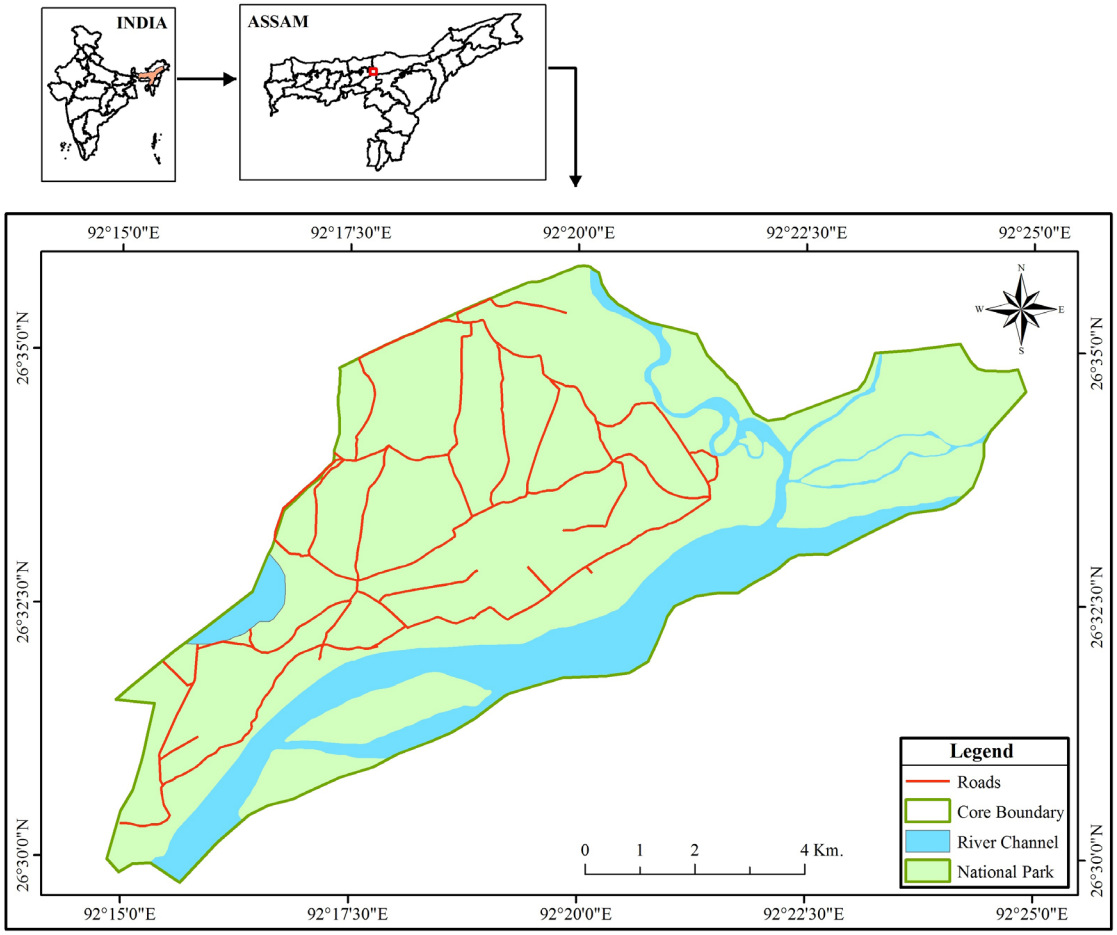

Figure 1. Rajiv Gandhi Orang National Park, Assam, India.

Figure 2. Rhino estimation blocks 2018 in Rajiv Gandhi Orang National Park in Assam, India.

Image 1. The mahout, enumerator, and guide on elephant back.

evidence like time of locations were recorded in the rhino enumerator sheet. The enumerators were advised to notice different features of the rhinos which made it possible to identify individual rhinos on the basis of sex, size, age, horn, ear shapes, skin folds, epidermal knobs, damaged tail, scars and other phenotypic deformities. The rhinos were categorised in the following three age classes, as accepted and adopted by the Asian Rhino Specialist Group (AsRSG) (IUCN/SSC AsRSG 2009).

1. Calves are new-born maximum up to about four years (dependant rhino with mother). A calf is associated with the mother, often moving ahead of the mother. The horn is protruding and the entire body is under developing conditions (Laurie 1978). In RGONP the calves were again segregated into two sub groups (a) below one year and (b) above one year, based on their body growth.

2. The 'sub-adults' are independent rhinos up to the age of six years. They have a small and clean body with undergrowth neck folds. The third neck fold near the shoulder is not distinct. Horns are not grown or protruding. Rump and shoulder folds are not well developed; ribs are buried and are not distinct. The sub-adults usually stay in small groups of 2–3 individuals (Laurie 1978).

3. The 'adults' are more than six years old. Their body is massive and well built. The neck folds are thick and well developed; the upper rump folds are thick and clearly visible; and the shoulder and lower rump folds reach down to the elbow and knees. Both sides of the rumps and shoulders contain distinct knobs. The ribs are distinct and the back is slightly lowered. The horn is fully grown and often eroded because of rubbing on tree trunks and searching for food. The cut marks are common on the ears. The adult female is generally aggressive while protecting the calf (Laurie 1978).

It is difficult to ascertain the sex of the rhinos, so the enumerators were advised to check properly on the basis of the size of the animal, horn shapes, ears, tail, skin folds, group composition and finally looking into external genitalia (IUCN/SSC AsRSG 2009). If an observer was unable to identify the sex, they were advised to put it into the category of 'unsexed' or 'uncertain sex' in each age group.

During the sessions of orientation given, all enumerators were requested to traverse dense grassland as much as possible in search of rhinos and also ensure necessary care and precautions to prevent an accident due to attack by rhinos or other wild animals.

The observer team in charge of the rhino enumeration finally collected all the data sheets immediately from each enumerator of the respective blocks. The final result of the status of rhino population in RGONP was declared after just two hours of enumeration.

RESULTS

For the four hours (05.30–09.30 h) of enumeration efforts, a total of 101 rhinos was recorded from the 13 rhino enumeration blocks of RGONP (Table 1). Three blocks, namely, Belsiri, Bogbeel, and Gaimari, did not record rhinos. In the Magurmari, Pabamari, and Satsimalu blocks more than 10 rhinos were counted. In Satsimalu, 25 rhinos were counted, which was the maximum number during this rhino census.

During enumeration, 66 adult rhinos (22 adult male, 37 adult female and 7 unidentified adults), 13 sub-adults (4 sub-adult males, 5 sub-adult females, and 4 unidentified sub-adults), 22 calves (4 calves below one year old and 18 calves above one year) were identified (Fig. 3). During the enumeration process 6.9% adults (n = 7) and 3.9% sub-adults (n=4) rhinos gender could not be ascertained due to dense vegetation, time lapse of observation and also due to uncomfortable distance

Figure 3. Census figures of Rhinos at Rajiv Gandhi Orang National Park, Assam, India.

Table 1. Rhino enumeration result of different compartments at Rajiv Gandhi Orang National Park, 2018.

	Block	Adult			Sub-adult			Calf		Total
		Male	Female	Unknown sex	Male	Female	Unknown sex	Below 1 year	Above 1 year	
1	Belsiri	0	0	0	0	0	0	0	0	**0**
2	Bogbeel	0	0	0	0	0	0	0	0	**0**
3	Chaila	2	1	2	0	0	1	0	0	**6**
4	Gaimari	0	0	0	0	0	0	0	0	**0**
5	Jhaoni	1	3	0	0	0	0	0	1	**5**
6	Magurmari	4	3	0	2	1	2	0	2	**14**
7	Mulamari	1	1	0	0	0	0	0	0	**2**
8	Oogil	1	2	0	0	0	0	0	1	**4**
9	Pabamari	3	5	0	0	1	0	0	2	**11**
10	Rahmanpur A	2	1	0	0	0	0	0	1	**4**
11	Rahmanpur B	0	3	0	0	1	1	0	2	**7**
12	Ramdas	2	1	0	0	0	0	0	0	**3**
13	Ramkong	0	1	4	1	0	0	0	0	**6**
14	Satsimalu	4	10	0	1	1	0	3	6	**25**
15	Solmari	1	4	0	0	0	0	1	3	**9**
16	Tinkona	1	2	1	0	1	0	0	0	**5**
	Total	**22**	**37**	**7**	**4**	**5**	**4**	**4**	**18**	**101**

between the animal and the enumerator.

DISCUSSION

The maximum numbers reported from three blocks of Magurmari, Satsimalu, and Pabamari could be due to the availability of fodder and wallowing sites for rhinos. Sarma et al. (2012) and Hazarika (2007) observed that rhinos preferred wet alluvial grassland all-round the year in RGONP. According to Sarma et al. (2012), wet alluvial grassland covers 56.69% in Satsimalu area, 37.33% in Magurmari, and 51.09% in Pabamari. Satsimalu & Magurmari are situated in mid-region of the park, and do not have external disturbance factors like domestic cattle grazing, illegal entry of villagers (for fishing, firewood collection and other non-wood forest products).

The visibility of Pabamari block was good as grasslands were burnt recently (Images 2,3). The Gaimari block adjacent to Pabamari also has a better habitat but the enumerator was unable to locate rhinos as the habitat was dense and visibility was very poor. It was very difficult to traverse the areas with an elephant. Both Belsiri and Bogbeel blocks are situated adjacent to village boundaries and rhino movement was minimum. As such, no rhino was counted there.

The process of enumeration is dependent on favourable habitat conditions. The invasion of alien species has degraded the lush green habitat of RGONP. According to Lahkar et al. (2011), *Mimosa* spp., *Mikania micrantha* and *Chromolaena odorata* have rapidly degraded the habitat condition in RGONP. *Mimosa* sp. has affected 11.56km^2 of the park. Thus, these invasive species may harmfully impact habitat utilization patterns as well as the health of rhinos and other wild herbivores. This may be another reason of uneven distribution of rhino numbers in all the blocks. Thus more scientific studies on the impacts of invasive species on the rhinos and the habitat are urgently required.

It was observed that the rhino enumeration process depends on factors like visibility of area and grassland burning (Lahan & Sonowal 1973; Debroy 1986; Hazarika 2007), level of experience of the guide, mahout and trained patrolling elephants, weather conditions and time of enumeration (Lahan & Sonowal 1973). The presence of other wild animals like tigers, wild elephants, buffaloes and enumerator experiences of rhino behaviour and habitat preferences are also factors to be considered. Besides, a sufficient budget is necessary to arrange all logistics without hampering the entire process (Bhatt 2011).

Compared to rhino census figures of 2012, there

Image 2. Habitat in Pabamari block of Rajiv Gandhi Orang National Park, Assam.

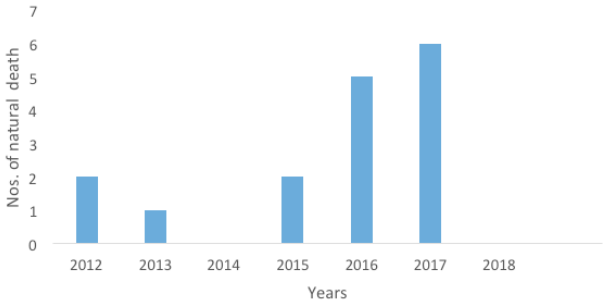

Figure 4. Natural deaths of rhinos in Rajiv Gandhi Orang National Park (2012–2018).

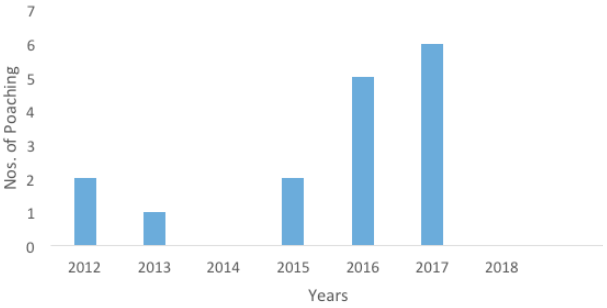

Figure 5. Rhino poaching in Rajiv Gandhi Orang National Park (2012–2018).

was only one additional individual (1%) during the 2018 census (Fig. 3); however, according to government records there were a total of 26 rhino deaths in RGONP in the years 2012–2018 (Figs. 4 & 5). There were 16 natural deaths and 10 deaths due to poaching. As there was no uniform and consistent record showing rhino births in the park itself, it would be difficult to elucidate the fluctuation pattern of rhino population that in turn

Image 3. An adult male Greater One-horned Rhinoceros in Pabamari Compartment of Rajiv Gandhi Orang National Park.

would directly influence the preparation of a population management strategy.

To assess the distribution and abundance of rhino population, uniform and consistent information of birth, death, aging and sex-wise composition is necessary (Laurie 1978). Periodic reports, half yearly or quarterly, may be useful to get the fluctuation patterns in the growth of the rhino population (Bhatt 2011). For a better understanding of population dynamics, more research is necessary to identify the factors for better monitoring of rhino population in the wild.

CONCLUSION

The rhino census or total counting involves every individual rhino in a particular habitat. Care has to be taken to eliminate possibilities of double counting or missing animals during the counting process. It is said that a combination of total count with some suitable sampling procedure is necessary to diminish such error (Gopal 2012). This exercise also supports strengthening of security conditions of the respective rhino-bearing areas due to uniform scans of the entire park areas and identification of probable threats (Barua 1998).

To enumerate and identify rhinos in the wild, a special rhino enumerator training for one week may be necessary for better understanding of rhino behaviour, age structure, sex composition and habitat preferences. The government of Assam or Government of India may develop special rhino enumeration protocol to enhance understanding of the process and to avoid errors.

In Gorumara National Park, West Bengal 43 rhinos were counted through sampling and genetic analysis of dung in the year 2011 (Borthakur et al. 2016). For small rhino populations unique identity based (ID) regular rhino monitoring, or 'sighting based monitoring' may be helpful (Laurie 1978; Patton 2007; Bhatt 2011; Subedi et al. 2011). The ID based rhino monitoring may be used to estimate population in a sighting-mark-resighting framework (Subedi et al. 2011). Regular monitoring of rhinos is essential to determine the progress towards achieving various managerial objectives.

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