Monitoring standards for the Greater One-Horned Rhinoceros population in India

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Monitoring standards for the Greater One-Horned Rhinoceros population in India

(Prepared by Amit Sharma[1], Deba Dutta[1], Parikshit Kakati[1] and Samrat Mondol[2])

Regular monitoring of species is necessary to have an understanding of the absolute or relative abundance over time and space, their distribution and also to evaluate the effectiveness of management intervention. It is also necessary to understand the demographic, gfenetic and health dynamism within and between populations.

The complete count of the Greater One-horned Rhino (GoH), *Rhinoceros unicornis,* usually termed 'rhino census' is an integral part of the conservation and management of wild rhino-bearing areas. The direct count of rhinos in their wild habitat continues to be an acceptable method of rhino census (Lahan & Sonowal 1973, Dutta & Kakati, 2019). The rhino PA's in India normally conducts a complete count or rhino census for each population in an interval of 3 to 5 years (Mukherjee & Sengupta 1999). Distribution and abundance of the rhino population in Nepal are also being assessed by direct count methods every three years (Subedi et al. 2013). 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.

Review of the ongoing rhino census and monitoring procedures

The most commonly used method to count rhinos adopted in both India and Nepal for the GoH is the direct count method. For the direct count method, the protected area is divided into some counting sectors (commonly called blocks or compartments) which are delineated based on the habitat, terrain, accessibility and potentiality of encountering rhinos. Each counting sector or compartment is allotted a single enumerator who counts the rhino's encountered within his respective compartment within a specified time. The enumerator covers the block normally starting early morning following a single forward movement but the path followed can be wavy as well for covering all possible areas of the compartment and also to negotiate the terrain and vegetation. For large sized PAs' (Protected Area) where covering the entire network of compartments is not possible in a single day / effort, the entire area is divided into multiple sections and all the blocks in a section are covered in a single day and the subsequent sections are covered similarly in the following days till the entire PA can be covered. In some occasions, double count in the same area is also practiced to minimize errors. Prior to the actual count, team members are trained in the procedure and at times habitat management is also carried out for ease of movement and for improving visibility. Rhinos encountered are usually recorded in a pre-designed data format and where possible the geo-coordinates are recorded and photographic evidences also collected. The rhinos are recorded based on their sex and age and in some instances where individual rhinos are identified by following the IUCN AsRSG guidelines the records are collected at the individual ID level.

[1] - WWF INDIA;   [2] - Wildlife Institute of India (WII) – 04/05/2020

The rhino census through the total count method requires properly skilled and motivated staff, coordinated well-designed planning, a system of control for data quality and logistical support (DNPWC 2009). It is said that a combination of the total count with some suitable sampling procedures like annual birth & death records, regular monitoring records is necessary to diminish error to find actual count (Gopal 2012).

DNA analysis procedures have been also successfully tested to estimate the population of GoH rhinos in India. This is a non-invasive method where fresh rhino dung samples are collected in the field by adopting standard sampling techniques and DNA fingerprinting is done adopting standard procedures in the laboratory. Even though this method is time consuming and needs a higher amount of skill and resources, it has been tested to be successful to identify numbers reliably. In Gorumara National Park, West Bengal, 43 rhinos were counted through this method in the year 2011 (Borthakur et al. 2016).

The RhoDIS (Rhino DNA Index System) program implemented in India with an objective of better management of the rhino population in India, the protocols have been standardized with all robustness and the fingerprinting tested to identify rhino numbers successfully (RhoDIS report, August 2017). The primary objective of RhoDIS is to generate a DNA database establish as a sampling procedure to estimate rhino population. It could be learnt that all the dung samples do not yield the desired DNA and the success rate of obtaining DNA from dung is around 70% highlighting the need for a proper sampling methodology to estimate population. However from the single event of sampling covering the PA's – Dudhwa in UP, Pobitora and Manas in Assam and Jaldapara and Gorumara in West Bengal the method has been found to be very effective in determining rhino numbers by identifying unique genotypes. From the single assessments done till date, 38 individuals could be identified in Dudhwa, 27 individuals in Manas (from a probable 33 known rhino individuals) and 92 unique individuals in Pobitora out of a probable 102 rhino individuals counted during the rhino census of 2018 (RhoDIS report, July2019). This dung based method has shown the potentiality to be adopted by working out a proper sampling method to achieve reliability through the standard capture and recapture technique for the whole population to be covered.

Further for small rhino populations unique identity based (ID) regular rhino monitoring, or 'sighting based monitoring' may be helpful (Laurie 1978; Paton 2007; Bhatt 2011; Subedi et al. 2011). The ID's for the rhino populations in Dudhwa NP and Manas NP has been created based on the IUCN AsRSG guidelines. The ID helps in identifying the rhinos which are marked and then recorded by the monitoring teams in pre-designed formats which helps to provide as idea about the ranging of the rhinos as well as keep a daily record on the rhino numbers sighted by a monitoring team or by the field teams.

Further camp based rhino monitoring based on an ocular daily count is also maintained by the staff at Pobitora WLS. This has been followed for the last few years to understand the daily

concentration of rhinos and to adjust the protection plans accordingly. This recording also helps to identify the occurrences of stray to the periphery areas or nearby villages.

In Assam the rhinos translocated to Manas under the Indian Rhino Vision 2020 program was radio collared to monitor their movement and understand their adaptation to the new habitats. Seventeen rhinos were successfully monitored using telemetry equipment's ranging from the VHF (Very High Frequency) to the satellite based technology. The radio collared based monitoring has helped in understanding the ranging of the rhinos as well as in understanding their use of the habitats and also manage any stray incidence effectively. The radio collars that were used were providing reliable service for about 12 months on an average. On a couple of occasions it was also observed that the radio collars got dislodged or damaged due to the intra-species fight for dominance.

Probable methods for future conduct of rhino census and monitoring

The monitoring of the rhino population is essential to understand the long-term population dynamics and habitat parameters. In the case of rhinos our primary goal till now is to understand the abundance at a point of time and also to get the trends over a period of time. In addition couple of recent needs identified are to understand the demographic dynamics in the population and also to record the health status as these will be helpful for formulating appropriate management strategies.

The monitoring of the rhino population is very essential to develop an understanding in regards to the variation of abundance and availability of animals over space and in a time scale. The monitoring can be designed to either work on the rate of change over time or to get the trends. It may also be designed to find the abundance at a point of time over different spaces providing us the measure of abundance at that moment across various spaces. In the case of rhinos our primary goal till now is to understand the abundance at a point of time and also to get the trends over a period of time. In addition the monitoring also needs to address the need to understand the demographic dynamism in the population and also to record the health status as these will be helpful for formulating appropriate management strategies.

The final selection of a method for rhino census should consider a number of factors like budget / finance availability, manpower (skilled and experienced), equipment, aim and time.

As total count is the tested and preferred method since history to count the GoH rhino population, this method should be continued in all the rhino bearing PA's of India. It is also necessary to maintain the uniformity in the approach for the count so that the population trends remain comparable to assess the trends of the population in an area. To be uniform and comparable a mutually agreed approach for the total count has to be adopted in all the PA's of India. However the challenges faced in adopting the total count method viz.- the total areal coverage of the PA within a limited time and detection error that crops in due to human factors

are common. As such necessary modifications should be made to address the identified limitations to make the outcome more reliable.

In terms of the total count method to be adopted, the following can be considered for a better result –

1. The count should be conducted when the visibility and terrain conditions in the PA's are likely to be at its best and this maybe in the second half of February. Need based management of the habitats and maintenance/ clearing of the movement tracks should be done prior to the count to facility safe and easy movement of the enumeration teams.
2. The count should be conducted in all the rhino bearing PA's of India once every four years through a uniform approach and this can be started from 2021 (MoEFCC F.No. 4-58/2018 WL dt. 28.06.2019).
3. The entire rhino ranging areas in and around the rhino PA needs to be divided into uniform blocks / grids of 2X2 kms, dimension. These enumeration grids / blocks should be fixed for all future counts for comparability.
4. The detection error should be worked out in all the PA's and an average factor worked out for all the rhino PA's of India to estimate the population numbers from the actual count. This can be done by testing the count in consecutive 2 days in the same area by the same team. This can be repeated in all the PA's and an average can be calculated as a probable error of detection.
5. The spatial coverage of the PA's needs to be improved, for this through a prior exercise all remote blocks or blocks with accessibility challenges should be identified. These blocks should be planned to be covered using technology like drone based imaging on the same day as per the block plan. The flight paths for the drone assisted count should be pre-fixed and tested prior to the actual count.
6. All the enumerators should be adequately trained and equipped. An APP based approach may be adopted to record the count during the exercise in addition to pre-design formats for all the rhino PA's of India.
7. While declaring the census estimates it is necessary to contribute to the species information requirements of the IUCN Species Red list categorization. In the case of rhinos it is not only necessary to come up with population estimates but it is also necessary to estimate the area of occupancy for the species in a PA.

The next successful method tested till date in terms of counting rhinos is the dung based DNA finger printing. The protocols for extraction of DNA from rhino dung samples have been already standardized under the RhoDIS program in all the rhino bearing PA's of India. Even though dung is considered to be of an inferior quality sample for DNA extraction, the RhoDIS program already achieved a success rate of 70% from field-collected dung samples.

The next successful method tested till date in terms of counting rhinos is the dung based DNA finger printing. The protocols for extraction of DNA from rhino dung samples have been already

standardized under the RhoDIS program rolled out in all the rhino bearing PA's of India. Even though dung is considered to be of an inferior quality sample for DNA extraction both the field as well as the laboratory protocols are already established providing a success rate of 70% meaning if 100 dung samples are collected the DNA could be successfully extracted from around 70 of those.   This calls for testing and adopting the most efficient sampling approach.

For small populations, a comparison between DNA-based mark recapture and spatially explicit capture recapture (SECR) approaches should be evaluated to select the most efficient. For example, if we test this for a small population like Pobitora, then we can try a 6 – 10 days sampling effort (considering each day as a sampling session for mark-recapture and the total effort as SECR) and then generate individual level data and compare the estimates from both. If the test shows that both the estimates are similar then we can follow the SECR approach. Again for larger areas like Kaziranga NP as prescribed for the total count approach the entire park have to be divided into grids to design the field sampling and then cover the whole area in a phased manner.

In addition to the above, other methods used for other species, like line / transact sampling, camera trapping (random encounter model) and drone based count may also be tested in the case of small populations like Dudhwa NP and Pobitora WLS. The approaches that we have as option that can be best improvised to be adopted for estimating or counting rhino can be assessed for efficacy after preparing appropriate methodologies and testing them in the ground.

In addition to the rhino estimation to be conducted at an interval of a few years by the adopted methodology it will be necessary to undertake regular monitoring of the rhinos by the staff based in the various camps. This will help in documenting the demography and population which can be used to verify the results of the actual count. In addition the regular monitoring should be designed to record the death and birth rates as well as the health conditions which will be very helpful for the management of the population. Body scoring matrix for the Indian rhinos can be worked out separately for keeping a record of the general health of the population and these can be strengthened further by working out a SoP for monitoring the health condition through non-invasive techniques. The regular monitoring of the rhinos can be also integrated into the LEM protocol followed by the various PA's or may be introduced by the PA as found feasible.

It will be further helpful if ID's can be assigned by following the IUCN guideline to all the rhinos in a small population to record the daily monitoring events with respect to every individual. This will help in understanding the ranging of an individual and attempts can also be made to estimate the population by using the principles of mark recapture approach.

Lastly there can be a radio collar based study to understand the habitat use and ranging of the rhinos in all the major PA's by selecting a few individuals for the monitoring. The telemetry based study can provide very critical information about the needs of the species in different spaces and time periods that can help formulate better management strategies. Specially for understanding long ranging events of rhinos particularly using the trans-boundary areas radio collars can be used to understand the movement pattern and trends that can help in the management of the

critical connectivity or habitats and also to help improve security in gap areas. All rhino individuals to be translocated to occupy a new habitat freely should be radio collared and monitored using telemetry techniques.

For active management of the isolated and small rhino population it is also necessary to understand the genetic health and also analyze the inbreeding risks. To monitor the genetic health of the rhino populations necessary genetic studies to find out inbreeding scenario can be conducted in all the rhino populations of India at least once every five years.

[1] - WWF INDIA;   [2] - Wildlife Institute of India (WII) – 04/05/2020