Monitoring of the Javan rhino population in Ujung Kulon National Park, Java

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Abstract

A monitoring project of the Javan rhino was conducted so as to understand the extent to which the growth of this population has succeeded. Monitoring was conducted by making use of camera traps, which were strategically placed by using a stratified sampling method based on the area of concentration of Javan rhino. The population size of Javan rhino in 2013 was a minimal 58 individuals consisting of 8 calves and 50 sub adults or adults with a sex ratio of 35 males: 23 females. The birth rate was recorded at 13.79% while the mortality rate was 3.45%. We also recorded 4 new calves in 2013.

Résumé

Le suivi des rhinocéros de Java a été mené afin de comprendre la mesure dans laquelle la croissance de cette population a augmenté. Le suivi a été réalisé en utilisant des pièges photographiques qui ont été placés stratégiquement en utilisant une méthode d'échantillonnage stratifié en fonction de la zone de concentration des rhinocéros de Java. La taille de la population des rhinocéros de Java en 2013 était un minimum de 58 individus composés de huit bébés rhinocéros: 50 sous-adultes et adultes avec un rapport de sexe de 35 mâles: 23 femelles. Le taux de natalité a été enregistré à 13,79% tandis que le taux de mortalité était de 3,45%. Nous avons également enregistré quatre nouveaux bébés rhinocéros en 2013.

Introduction

The Javan rhino (*Rhinoceros sondaicus Desmarest* 1822) is the rarest among the fiveextant rhino species hence it is assessed as Critically Endangered by theInternational Union for Conservation of Nature (IUCN) Red List of Threatened Species (Van Strien, et al., 2008). The Javan rhino is also listed on the Appendix 1 of the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES) as a species with the fewest number of wild animals. In Indonesia, the Javan rhino is protected by Indonesian Law (Kemenhut, 1999). Currently, this population only exists in Ujung Kulon National Park situated on the western tip of Java.

One of the conservation programmes in Ujung Kulon National Park is to monitor the population of Javan rhino. Monitoring plays a central role in wildlife management (Lyons et al. 2008). The roles of monitoring include: providing managers with information on the status of wildlife populations before deciding on the appropriate course of conservation action to take;

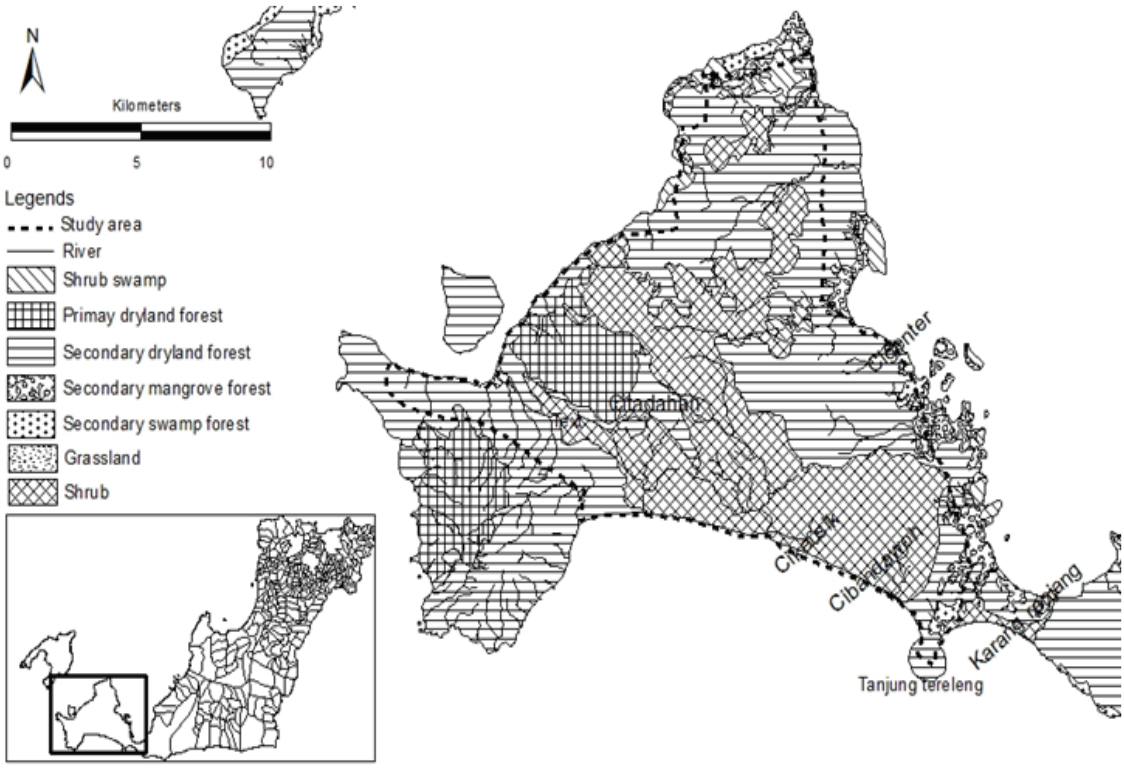

Figure 1. Location of study area

evaluating the effectiveness of management actions relative to stated objectives; providing the important feedback loop for learning about which actions lead to the success or failure of a particular conservation approach, in order to specifically inform and improve upon management practice in the future (Stokes et al. 2011)

Since 1967, the Javan rhino population in Ujung Kulon National Park has been monitored by using the footprints count method (Schenckel and Schenckel 1969); providing only an estimated population number. In 2010 using this method there was about 50-60 individuals, and this number has remained the same since 1994 (UKNP 2010).

In 2011, Ujung Kulon National Park Authority started to use camera video traps to monitor the Javan rhino population. This decision was taken considering the advantages in using camera traps. Camera trapping offers some advantages over direct field observations including being non-invasive with no observer bias, can operate for extended periods of time in remote locations and the method provides an unambiguous record of the species, date and time of detection (O'Brien et al. 2011), it can detect and count animals whatever their activity and without interruption (Engeman et al.2013) and it enables the identification of individual Javan rhino (Haryadi et al. 2011). It was expected that using camera traps, for the monitoring of Javan rhino would provide better results.

Considering that the Javan rhino is not only the most rare of the five rhino species, it is also one of the most threatened mammals in the world, this monitoring was established to understand the extent to which the population has increased. This monitoring is expected to provide information, which can be used to guide the management of this valuable population.

Materials and methods

Study area

Ujung Kulon peninsula is located on the western tip of Java with an area of ± 38,000 ha (figure 1). This

Table 1. Camera trapping of Javan rhino in Ujung Kulon National Park in 2012-2013

Year	Sampling period	Trap station	Total clips	Javan rhino		
				Total clips	Identified (clips)	Non identified (clips)
2012	March-December	40	4,613	899	689	210
2013	March-December	120	36,104	1660	1388	272

peninsula is composed of secondary mangrove forest, shrub swamp, primary dryland forest, shrub, secondary dryland forest, secondary swamp forest and grassland. Topography of this peninsula is flat to mountainous and the highest peak is Mount Payung (480 m). Many rivers flow in this peninsula including Citadahan, Cicakanggalih, Cibunar, Cikesik, Cibandawoh, Cigenter, Cikarang and Cijungkulon. These rivers provide a source of drinking water, and are used for wallowing and bathing by wildlife, which live in this peninsula. Currently, Ujung Kulon peninsula is the last habitat forJavan rhino. In addition, Ujung Kulon Peninsula is also habitat for wild cattle (*Bos javanicus*), barking deer (*Muntiacus muntjak*) and wild boar (*Sus scrofa*) as competitor and also the habitat for dhole(*Cuon alpinus*) and leopard (*Panthera pardus*) as predators.

Data collection

The monitoring was conducted from March to December 2013 using 120 camera traps which were set to 'video-mode' to record the movement and sound of Javan rhinos. The placement of camera video traps was strategic using a stratified sampling method based on the area of concentration of the Javan rhino such as Citadahan, Cikeusik, Cibandawoh, Cigenter, Tanjung Talereng and Karang Ranjang. In each area, the cameras were placed in the spots which were considered the most heavily trafficked by rhinos such as the feeding ground tracks, the defecating tracks, the wallow tracks and the tracks which were used by rhino moving from one site to an other. Camera traps were tied to the tree-trunks at a height of 1.4–1.7 m (4.6–5.8 ft) . Batteries and memory cards were replaced every 20 days.

Data analysis

Individual identification is a crucial step in making a population estimate (Trolliet 2014). Many large mammals have individual markings, which can be used for recognition (Krebs, 2006).We used Griffiths (1993) criteria to differentiate between the Javan rhinos including: size, horn shape, facial wrinkles, neck folds, skin pores, scars, neck plate profile, cheek profile, ears, pigmentation patterns and sex. Identification was then done by comparing the photos of Javan rhino with the camera video traps from 2011 to 2013. The total number of different individuals was used as a population size estimation.

Results and discussion

Results

In 2013, 1,660 video clips of Javan rhinoswere made; 83.6% of them (1,387 clips) could be used for identification purposes and 273 clips (16.4%) could not be used. The clips that were not clear were not used in data analysis. By using camera video traps, we could identify 60 different individuals of Javan rhino from 2011 to 2013. Because there was the death of a calf in 2012 and an adult female in 2013, the population size of Javan rhino in 2013 was a minimum 58 individuals with a sex ratio of 35 males : 23 females and age structure consisting of eight calves : 50 sub adults and adults.

Discussion

By increasing the number of cameras used, the population monitoring in 2013 resulted in a greater number of useable clips compared with the monitoring exercise in 2012 (table 1). In addition, there is an increase of clips of Javan rhinos which could be used for identification purposes (9%). It showed that the amount of cameras correlated with the probabality of the video images capturing Javan rhinos.

The ratio of male : female in Javan rhinos was 1:0.66 in 2013 and 1:0.76 in 2012. Too many males is one of the demographic problems, because this condition can lead to an increase in the competition for mates and harassment of reproductive partners resulting in sexual conflict (Ewen et al. 2011). It also increases

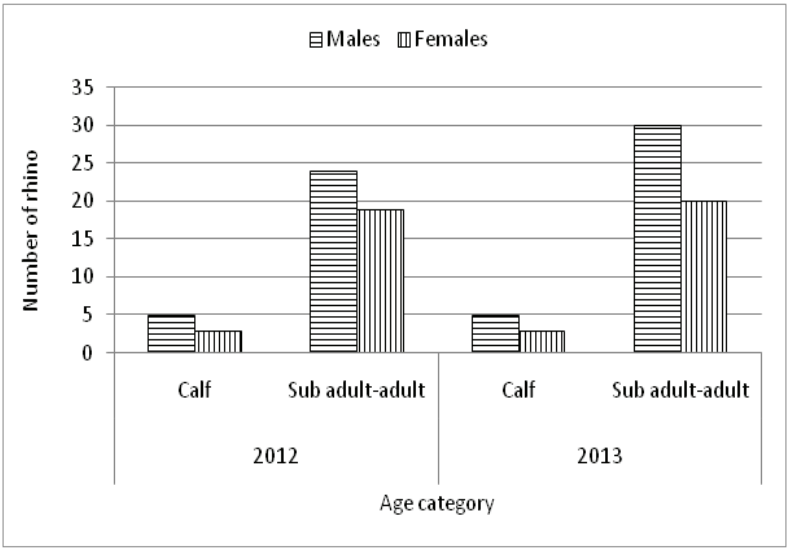

Figure 2. Age and sex structure of the Javan rhinos.

the negative effects of Allee effects and demographic stochasticity, sometimes leading to extinction. This is one of the reasons why conservation managers may have to potentially manipulate the population sex ratio (Wedekind, 2012). But, because the Javan rhino is the smallest and most endangered species in one population, it needs careful consideration and presents an important management strategy for the survival of a species on the brink of extinction. There are some factors which cause a skewing of offspring sex ratio in animals, e.g. the diet of the mother. The prediction in large ruminants was that females in better body condition would produce more male than female progeny (Rosenfeld and Roberts 2004). If sex determination is purely environmental, manipulating environmental factors in which sex is determined can be sufficient (Wedekind, 2012).

Some (13.8%) of the Javan rhino population increase in 2013 was due to the birth of four calves. The birth rate was recorded at 13.79% whilst the mortality rate was 3.45%. This finding showed the good growth rate of the Javan rhino population in Ujung Kulon National Park. It also indicated that the Ujung Kulon peninsula is still a suitable habitat for Javan rhinos.

One of the significant habitat components is availability of nutrients, because diet influences the growth and welfare of wildlife populations (Masy'ud et al. 2008). The variety of plant species preferred by the Javan rhino were reported by researchers to be 150 different species (Hoogerwerf 1970; Schenkel and Schenkel 1969); 190 species (Amman 1985); and 252 species (Muntasib 2002). In 2007, Rahmat found a new species of food consumed by Javan rhinos, adding to the list. Based on the amount of plant species consumed by the Javan rhino, it can be categorized as a generalist. Generalist species are more successful in surviving (Colles et al. 2009) because they have a wider niche breadth, each food species can be interchangeable (and importantly the animals are not dependent on only a few varieties of plant species).

The finding that the growth rate of the Javan rhino population was positive indicated that they can coexist with the other large herbivores in using the resources availability or the resources availability was abundant to support them. Wild cattle, barking deer and wild boar are also predated on by dhole and leopard, not only Javan rhinos.The presence of predators is one of the threats to the Javan rhinos existence in Ujung Kulon National Park. These predators and competitors overlap in space and time with Javan rhinos in some locations. (Plates 9 and 10; see centre page vi).

From 2012 to 2013, no poaching of Javan rhinos was reportedand it was one of the factors which also influenced their good growth rate. This condition is being achieved by the efforts of the Ujung Kulon National Park Authority (Rhino Monitoring Unit) and the Rhino Foundation of Indonesia (Rhino Protecting Unit). They collaborated to conduct the patrol in Javan rhino areas and also provided education to improve public awareness about the importance of Javan rhino conservation.

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