The Distribution of *Buceros rhinoceros* and Awareness of Its Conservation Status

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Abstract A rapid survey on the distribution of hornbills in Santubong National Park, Sarawak, East Malaysia, was carried out in April 2013 using point sampling technique at various locations around the park. Only the Rhinoceros hornbill, *Buceros rhinoceros*, was recorded, with a total of 45 independent calls and 15 observations at 10 locations around the protected area, mostly during early mornings and late evenings from 162 h of survey. Most of Rhinoceros hornbills were observed in pairs (73 %), while a single observation recorded at least ten individuals at a location. Additionally, local communities were interviewed to collect information on the occurrence, status, ecology and perception on Hornbill conservation in Santubong National Park. A standard questionnaire was designed to meet the purpose of this study. This survey was conducted on local communities from five local villages around Santubong National Park, local and international tourist visiting touristic areas in Santubong peninsula. In general the awareness on the conservation needs and status of the hornbill is high suggesting that the communities are interested and supportive of conservation related activities. Based on the socio-economic and ecological survey, the surrounding habitat of this protected area need to be protected through park extension that will increase connectivity between nearby forest patches which in turn may ensure the long term viability of the Rhinoceros hornbill in Santubong National Park.

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1 Introduction

Sarawak constitutes approximately 17 % of Borneo, the third largest island in the world, that covers 746,337 km^2 and supports one of the richest assemblages of flora and fauna in Sundaland. A substantial proportion of Sarawak's wildlife is endemic to Borneo. This includes approximately 19 % of mammals (5 % of 98 bats species, 5 primates, 3 carnivores, 21 rodents and 2 large mammals), 20 % of snakes and 6 % of birds.

The family Bucerotidae represents the Asian Hornbills, consisting 54 species (Kemp 2005). Sarawak boast eight species of hornbills (15 % of the species), namely, Bush-crested hornbill, White crowned hornbill, Wrinkled hornbill, Wreathed hornbill, Black hornbill, Pied hornbill, Rhinoceros hornbill and Helmeted hornbill. Among these species, the Rhinoceros hornbill is regarded as Sarawak's state bird, and appears in the State's coat of arms. This species is also important in local culture, being part of ceremonies, folklores, legends, and beliefs (Bennett et al. 1997). The male Rhinoceros hornbill has reddish orange irises while the female whitish, with the tip of the casque curving upwards. This species can be easily identified in flight as it has a white tail with a black band.

Hornbills are excellent seed dispersers in tropical rainforest where declines of these species have affected large seeded tree species in this region (Chaisuriyanun et al. 2011; Kitamura 2011; Kitamura et al. 2011, 2008). Whereas isolated and fragmented forests created by logging activities alongside with illegal hunting of hornbills have caused major decline for these species in this region (Bennett et al. 1997; Poonswad et al. 2005).

This species is considered Near Threatened, according to the IUCN Red List (2015) and listed as Totally Protected in Sarawak in accordance to Sarawak Wild Life Protection Ordinance 1998, whereby offenders are liable to a fine of 25,000 Malaysian Ringgits (RM) and imprisonment for 2 years. In Peninsular Malaysia, this species also receives totally protected status under the Wildlife Conservation Act 2010, whereby offenders are liable to a maximum of 100,000 RM fine or imprisonment for a term not exceeding 3 years or both. In Sabah this species receives only Protection status where a maximum fine of 50,000 RM or imprisonment for 5 years or both. The Rhinoceros hornbill is listed in CITES Appendix II since 1990 which restricts international trade.

This large bird has a historic distribution from southern Thailand and Peninsular Malaysia, to the islands of Sumatra, Java, Borneo; the species is thought to be extinct in Singapore. This species have been recorded in tall secondary forest, mixed dipterocarp forest and swamp forest (Bennett et al. 1997; Kitamura et al. 2011; Poonswad et al. 2005). Past surveys in Santubong National Park have recorded Rhinoceros hornbill but little is known of its distribution in this protected area.

Despite the fact that the species is threatened and recognized as the State bird, little is known on its population ecology and distribution in Sarawak. Therefore a systematic study combining secondary information and field observation was initiated in Santubong National Park to identify the distribution of hornbills and to

understand the perception and conservation awareness of the community. The major reason for use of interview surveys are the perceived time and cost savings and to provide a direct forum to discuss conservation issues with local communities (Mohd-Azlan et al. 2013).

2 Materials and Methods

2.1 Study Site

Gunung Santubong National Park, situated in the Santubong Peninsula, was gazetted as a National Park in 2007, and has an area of 14.1 km^2. The Park is covered mainly by mixed dipterocarp forest with patches of Kerangas and beach forest, with a mountain peak of 810 m above sea level. It is partly surrounded by privately owned forest. Santubong peninsula is a popular tourist spot among local and foreign visitors. The attractions in Santubong Peninsula include several Malay fishing villages (Kampung Santubong, Kampung Buntal, and Kampung Pasir Pandak), Sarawak Cultural Village, golf courses, Permai Rainforest Resort and the adjacent beach resort area.

2.2 Survey and Analyses

Field surveys were carried out by students and staff from the Department of Zoology, Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, the Protected Area and Biodiversity Conservation Unit of the Sarawak Forestry Corporation and Permai Rainforest Resort in Santubong National Park for a duration of 4 days from 5 to 9 April 2013. The survey used the point sampling technique, areas being strategically identified to cover as much ground as possible within the boundaries of the protected area. Observers were stationed at four to six localities simultaneously throughout the day to observe bird activities and to record calls. The date, time and GPS position where an observation and calls of hornbill were recorded. These data were later compared and scrutinized to remove similar observation and calls.

The survey on local community's perception and awareness was conducted around the protected area. This survey adopted a face-to-face interview of local communities from five local villages around Santubong National Park- Kg. Santubong (17 %), Kg. Buntal (12.7 %), Kg. Lumut (8 %), Kg. Pasir Pandak (13 %) and Kg. Pasir Panjang (3.7 %), local (40.1 %) and international tourists (5.6 %) visiting the Damai Central and Permai Rainforest Resort. The questionnaire was intended to gather information including, socio-economic characteristics, awareness and conservation of hornbills in Santubong National Park from respondents. All analysis was conducted using Statistical Package for Social Sciences (SPSS) version 21.0.

3 Results

A total of 162 h of observation from six different locations around Santubong National Park (Teluk Arang, Putri trail, Teluk Belian, Tanjung Salih, Teluk Kerangan, Red and Blue trails) translates to an average of 7.6 h surveyed per day. During this survey at least 81 species of birds including both observations and calls of the Rhinoceros hornbill were recorded. A total of 45 independent calls and 15 observations of Rhinoceros hornbill were recorded at 10 locations (Fig. 1).

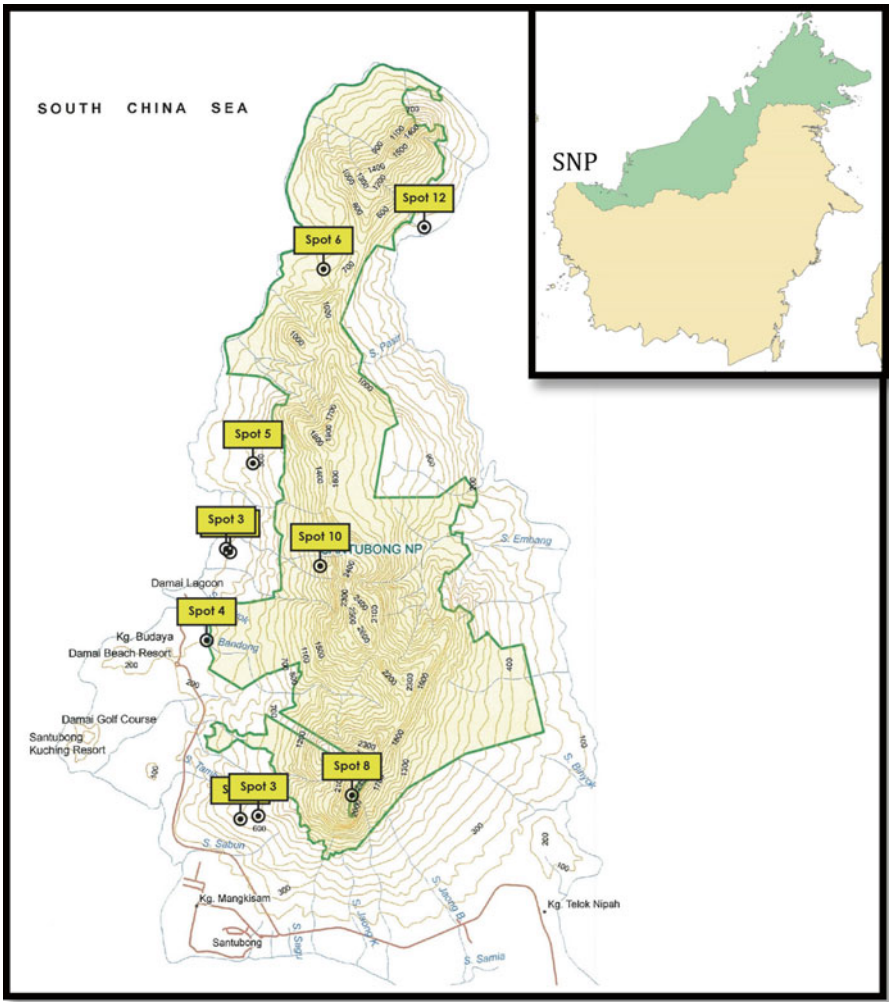

Fig. 1 Locations of Rhinoceros hornbill at Gunung Santubong National Park, Sarawak, during surveys from 5 to 9 April 2013

Peak observations and calls of the Rhinoceros hornbill were recorded during early mornings and late evenings. Most of Rhinoceros hornbills were observed in pairs (73 %), which suggest breeding season, while a single observation recorded at least ten individuals flying towards a lower elevation from Puteri trail (Fig. 1, Spot 9).

An observation of ten individuals on nearby fig tree suggesting breeding season during the survey period. A total of 323 respondents comprising 187 males (57.9 %), 136 females (42.1 %) were interviewed from various locations surrounding the protected area. Majority of the respondent were local resident (54.3 %). Most respondents had some form of formal education while only 6.5 % did not have any exposure. Respondents were mostly employed (75.6 %) and in most cases provided reliable answers, while there are several cases of unwillingness to participate in this survey. Average age of the respondents are 40.3 years old (SD = 16.3) where the majority of the respondent were from the age category of 21–40 years old (45.7 %) with a small proportion of elders aged 60 years old and above (12 %) (Table 1).

Most of the respondents felt that hornbills are synonymous with Sarawak (88.6 %), and has helped create a distinct image of the State. Most respondents felt that hornbill conservation is important because it serves as Sarawak's emblem (89.2 %) and can act as an umbrella species, whereby the protection of hornbills will help to protect other habitats and species (77.2 %), besides being a major attraction in the State (85.5 %).

Approximately 82 % of the respondents know that the hornbills are protected in Sarawak and 74 % acknowledges that it is illegal to trade hornbills or any of its parts, while 82 % understand the fact that it is illegal to hunt and keep them as pets, which suggest that a majority of the local communities are aware of related legislation.

Anecdotal reports from several elderly correspondents confirm the presence of at least seven species in the late 1940–1950s in that area. Only two of the respondents surveyed have eaten at least one species of hornbill in the past, while some of the younger respondents do not even know that hornbills exist in the area. More than 90 % of the respondents, mostly from younger generation, have not seen White crested, Bushy crested, Wrinkled, Wreathed, Black, Pied and Helmeted hornbill in this area. The only commonly reported species was the Rhinoceros hornbill (49 %), which was most frequently observed in the Santubong area (54.3 %). Most of these observations were of single individual (65 %) while the remaining records were of small groups. However, 47 % of the respondents feel that it is difficult to see a hornbill in the rainforests while 34 % think otherwise. Absence or small populations of other hornbill species in the Gunung Santubong National Park may be a reason why a majority of respondents only observed Rhinoceros hornbills. These reports are consistent with our field surveys, and suggest that hornbill identification by the local community is reliable.

Almost two-thirds (over 60 %) of the respondents somewhat agree that hornbills are threatened in Sarawak, while a small proportion think that it is not (17 %). Similarly, slightly more than half (54 %) of the respondents think that hornbills will become extinct if no conservation measures are taken, while 20 % think that horn-

Table 1 Socio-demographic profile of respondents interviewed around Gunung Santubong National Park, Sarawak

Variables	Categories	Frequence	Percent	Variables	Categories	Frequency	Percent
Gender	Male	187	57.7	Occupation	Unemployed	79	24.4
	Female	137	42.3		Self-employed/business	130	40.1
	Total	324	100.0		Public sector	34	10.5
Age group	20 years old and below	28	8.6		Private sector	38	11.7
	21–30 years old	92	28.4		Others	43	13.3
	31–40 years old	56	17.3		Total	324	100
	41–55 years old	81	25.0	Origin	Locals (Santubong, Buntal, Pasir Pandak)	176	54.3
	56–60 years old	28	8.6		Kuching	31	9.6
	Above 60 years old	39	12.0		Other places in Sarawak	62	19.1
	Total	324	100.0		Sabah	5	1.5
Income group	Below RM 800	192	59.3		Peninsula Malaysia	32	9.9
	RM 801–1000	45	13.9		Other countries	18	5.6
	RM 1001–1500	41	12.7		Total	324	100.0
	RM 1501–2000	17	5.2	Education level	No formal education	21	6.5
	RM 2001–5000	23	7.1		Primary school	60	18.7
	Above RM 5000	6	1.9		Secondary school	171	53.3
	Total	324	100.0		Diploma, etc	37	11.5
					University	32	10.0
					Total	321	100.0

bills are not in any danger. In relation to this, 29 % of the respondents do not feel that the existing protected areas will protect hornbills, while 32 % think that it is adequate.

Besides, over 80 % of the respondents feel that seeing hornbills in the wild gives them a satisfying experience and it is their responsibility to protect them for future generations (88.6 %) through financial aid (80 %) and most are willing to donate (73.8 %) and participate in volunteering programs (74 %) for conservation purposes in Sarawak. This indicates that most respondents, especially local communities, are concerned and willing to support effort towards conservation and protection of hornbills in the Santubong Peninsula. Many people feel that stiffer penalty (81 %) and more strict law enforcement (86 %) will enhance the protection of hornbills in Sarawak. Respondents are supportive of intensifying law enforcement and engaging deterrent punishment to ensure better protection of the hornbills in Sarawak. Similarly, 86 % of the respondents think that it is important for the related departments to organize programs to educate local residents and visitors to understand and support hornbill conservation in Sarawak. Essentially, there is a need to ensure and enhance effective dissemination of knowledge on conservation of hornbills in Sarawak to local communities and visitors. Eighty-seven percent of the respondents agreed that hornbill conservation in Santubong National Park would generate income through ecotourism industry and provide employment opportunities to local residents.

4 Discussion

The secondary information gathered from the interview survey appears to be reliable and consistent with the field survey. Throughout the survey only one species of hornbill, Rhinoceros hornbill was identified despite our intensive sampling. Even though the Black hornbill was reported in this area (Rahim Bugo pers. com.) it was not recorded during this survey suggesting that this species may occur at very low densities or may have become locally extinct.

Each breeding pair of Rhinoceros hornbill have been reliably estimated with a home range of 2.3 km^2 (Leighton 1986). Based on this it can be conservatively estimated that Santubong National Park could potentially accommodate only six breeding pairs. Given the fact that isolated and fragmented forest patches may not support hornbills over a long period of time, the viability of Santubong National Park to support populations of Rhinoceros hornbill in perpetuity is of question. Therefore protection of large tracts of adjacent forest patches including secondary and degraded forest within the ranging distance of this species from Santubong National Park need to be protected.

According to elders from the local community around the area, at least seven species of hornbills were frequently seen at the Santubong Peninsula, including along Santubong river. However, only the Rhinoceros hornbill was reported by local communities and visitors during our interviews. These suggest that Santubong Peninsula provides suitable habitat to support Rhinoceros hornbill and this species

is relatively tolerant to fragmentation compared to other hornbills, which was previously thought to exist in this area.

In reality, accelerated land conversion to agriculture, agro-forestry and urban development has confined the residual biodiversity to protected areas and human-modified or secondary habitat (Mohd-Azlan and Lawes 2011). With protected areas being fragmented and isolated, even minor threats to these areas could potentially have large impacts on hornbills. The ability of hornbills to persist within such remnants is an issue of concern. Based on past and present experience, a decisive approach to conserving the remaining population hornbills throughout Sarawak is urgently needed. Therefore further studies are required to understand the population dynamics of hornbill in protected areas for long-term conservation and management. Restoration of degraded habitat around protected areas to increase connectivity between protected areas, which will allow movement of hornbills, is important to sustain a viable population.

Most local residents and visitors in Santubong Peninsula acknowledges the importance of hornbill conservation and are supportive of effort and programs on conservation of hornbills. Likewise, majority of the local residents and visitors are aware of laws and regulations pertaining to protection and conservation of hornbills in the State. Furthermore, the majority of local residents and visitors also realized socio-economic contribution of tourism. Precisely, this explained that empowering local residents through ecotourism is regarded as a useful tool to effectively foster environmental conservation (Amat and Abdullah 2004). Moreover, the relationship between ecotourism development and conservation in Santubong Peninsula is seen to reflect a symbiotic relationship (Budowski 1976) and potential appropriate use of environmental resources (Butler 1991).

Although the majority of local residents and visitors are aware of the importance of conserving hornbills, many feel the need to further embark on programs such as awareness campaigns and conservation exhibition, and activities including interpretative talks and tours, to better educate local residents and visitors. Obviously, this is considered a vital strategy to impart knowledge to obtain wider support and to further enhance effective conservation and protection of hornbills in the Santubong peninsula.

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