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A SURVEY ON MASS MOVEMENTS OF THE VULNERABLE PLAIN-POUCHED HORNBILL IN THE BELUM-TEMENGOR FOREST COMPLEX, PENINSULAR MALAYSIA

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***ABSTRACT.* –** Annually, hundreds of Plain-pouched Hornbills, *Aceros subruficollis,* are seen in the Temengor Forest Reserve between the months of August and September. The Malaysian Nature Society (MNS), an environmental non-government organization (NGO), conducted a 64-day survey with assistance from volunteers to count the daily numbers of *A. subruficollis* present at dawn and dusk during their mass movements over Pos Chiong. The Plain-pouched Hornbill flocks were observed heading north-east during the dawn surveys and south-west during the dusk surveys. The highest number of *A. subruficollis* counted during the survey was 3,261 individuals whilst the lowest number was 595 individuals in a single count.

This paper was presented at the 5th International Hornbill Conference jointly organised by the National Parks Board (Singapore) and the Hornbill Research Foundation (Thailand), in Singapore on 22nd–25th March 2009.

***KEY WORDS.* –** Plain-pouched Hornbill, *Aceros subruficollis*, Malaysia, conservation.

INTRODUCTION

The Belum-Temengor Forest Complex, which is located in the northern part of Peninsular Malaysia, consists mainly of the Royal Belum State Park (117,500 ha) and Temengor Forest Reserve (148,670 ha). It is the second largest contiguous partially protected rain forest in Peninsular Malaysia and is linked to two protected areas in southern Thailand, the Hala-Bala Wildlife Sanctuary and Bang Lang National Park. Within this forest complex exists the Temengor Lake (172 km^2), a consequence of the 1970's damming of several rivers for the purposes of irrigation, water catchment and hydro-electric power generation (Yeap et al., 2005). This forest complex is also one of Malaysia's Important Bird Areas (Yeap et al., 2005). The forest complex is also home to local indigenous people of the Jahai and Temiar groups.

The Malaysian Nature Society (MNS) organized two scientific expeditions into the forest complex in 1994 and 1998 to record its abundant biological diversity, and proposed for it to be gazetted as a protected area. Subsequently, the Forestry Department Peninsular Malaysia (FDPM) organized a third expedition in 2003, which further consolidated earlier findings. These expeditions revealed that within this forest complex, there were healthy populations of large mammals such as Asian elephants (*Elephas maximus*), tigers (*Panthera tigris*), Malayan tapir (*Tapirus indicus*), gibbons (*Hylobates* spp.) and leaf-monkeys (*Presbytis* spp.), birds (e.g., pheasants, hornbills, trogons, broadbills, etc.), reptiles and amphibians and many others. In addition to that, plants were also found to be highly diverse and some are endemic to the forest complex.

Ten species of hornbills occur in the Belum-Temengor Forest Complex, six of which are globally near-threatened, namely the Rhinoceros Hornbill (*Buceros rhinoceros*), Great Hornbill (*Buceros bicornis*), Helmeted Hornbill (*Rhinoplax vigil*), White-crowned Hornbill (*Berenicornis comatus*), Wrinkled Hornbill (*Aceros corrugatus*) and Black Hornbill (*Anthracoceros malayanus*). Three other species, the Oriental

Pied Hornbill (*Anthracoceros albirostris*), Bushy-crested Hornbill (*Anorrhinus galeritus*) and Wreathed Hornbill (*Aceros undulatus*) are of least concern whereas the Plain-pouched (or Tenasserim) Hornbill (*Aceros subruficollis*) is globally vulnerable (Birdlife International, 2001).

Through these expeditions, MNS had unearthed the astonishing movements of thousands of Plain-pouched Hornbills. The species is very similar to the Wreathed Hornbill but it is smaller, has a shorter bill with brownish base and lacking corrugations, and has a black streak on the gular pouch (Robson, 2000).

Mainly seen during their dawn and evening flights, these hornbills moved in continuous 'waves' that generally lasted between one and a half to two hours. At the time of the MNS expeditions, the hornbill population was estimated to be about 2,500 individuals.

Thus, recognizing the importance and value of Belum-Temengor, MNS embarked on a long-term conservation programme using hornbills as a flagship species in 2004. Through this program, the Society is involved in hornbill research, education and awareness activities, policy and lobbying activities for greater, more comprehensive protection for the forest complex.

In 2008, seeing that a concerted effort to monitor and document the large number of individuals in the flocks was needed, MNS initiated a pilot volunteer programme spanning from 1st August to 26th September 2008. A total of 34 people volunteered to participate in this programme under the supervision of four experienced MNS Coordinators.

METHODS

Observers were positioned at strategic locations in Pos Chiong, Temengor, an area that has been identified as the habitual flight path of the Plain-pouched Hornbills. Surveys were conducted twice a day throughout the months of August and September 2008, in the morning from 0700 to 0900 hrs followed by the evening survey at 1730 to 1930 hrs, to record the number of individuals seen. Additional information such as the flight direction, sex, and weather were documented whenever possible. Field equipment such as binoculars (Bushnell 8 x 42 Field 6.0º 105m/1000m) tally counters and spotting scopes (Leica APO–TELEVID 77, T77: 20x–60x, T62: 16x–48x) were used to assist in counting, species identification and sexing of individuals. As a guiding tool, to ensure the observers recorded all the crucial information as stated above, a standard data sheet was distributed to each observer.

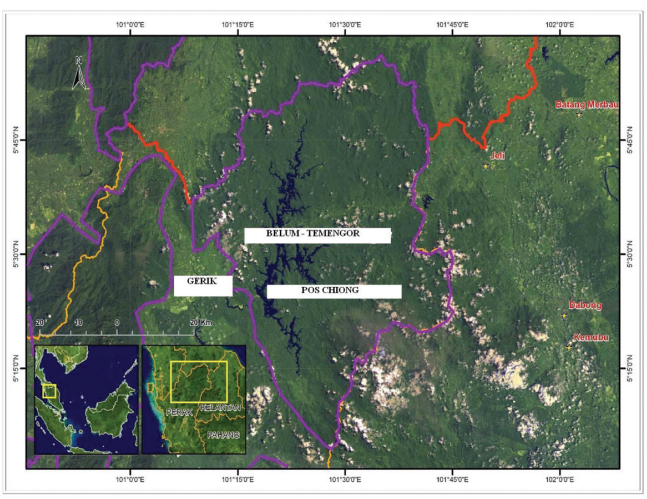

Fig. 1. Survey locations within the Belum-Temengor forest complex. The Thai-Malaysia boundary is represented with the thick yellow line. The thinner yellow line represents Important Bird Area boundaries. The red points represent surveyed areas.

RESULTS

The survey was conducted over a span of 64 days. During that time, observers experienced 11 days of poor weather. At the beginning of the survey in August, the observers experienced poor visibility due to haze.

Based on Fig. 2, in the month of August the morning counts ranged between 731 individuals (on 7th August) and 2844 individuals (on 29th August). In the month of September, the morning counts ranged from 3261 individuals (on 14th September, the highest number documented during any morning survey) and 1,520 individuals (on 20th September).

Based on Fig. 3, in the month of August the evening counts ranged from 1,135 individuals (on 18th August) to 2,383 individuals (on 22nd August). In the month of September, the evening counts ranged from 529 individuals (on 4th September) to 2681 individuals (on 14th September, the highest number documented during any evening survey.

Thus, the number of individuals seemed to build up steadily in August and reached a peak in the middle of September. Then there was a gradual decrease in numbers towards the end of September.

Generally, the flocks were observed to head north-east during the morning surveys and south-west during the evening surveys. The flocks were seen moving in a continuous stream

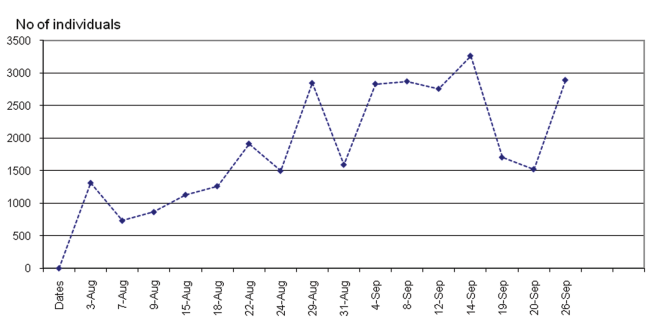

Fig. 2. Morning flight surveys of the *A. subruficololis* flocks in Pos Chiong, Temengor during the months of August and September 2008.

with different flight formations: 'V' formation (Fig. 4), single line formation (Fig. 5) and dispersed (Fig. 6). At times flocks flew directly over observers, seemingly undisturbed by their presence. During the survey, observers noted that the calls used were either two short notes 'ehk-ehk' or three short notes 'ehk-ehk-ehk', and this may be important in distinguishing them from Wreathed Hornbills.

Eight other species of hornbills were sighted and/or heard during the 64 days, including all those known to be present in Belum-Temengor (and in Peninsular Malaysia as a whole) except for the Wrinkled Hornbill.

Several difficulties were faced by the observers such as poor visibility due to the appearance of haze, an occurrence present during the beginning of August. Many flocks of Plain-pouched Hornbills were not visible and thus not counted, resulting in very low counts. It was observed that under such conditions the hornbills tended to fly low under the mist and haze, closer to the tree line and through valleys, more distant birds thus flying out of sight. Surveys conducted during clear and sunny weather on the other hand, revealed them to fly higher than usual.

A few volunteers were inexperienced in handling equipment such as binoculars and spotting scopes. This sometimes interfered with their ability to count the hornbill flocks. Thus, the MNS coordinator would handle the counts for the first day or two, while the volunteer observers became accustomed to

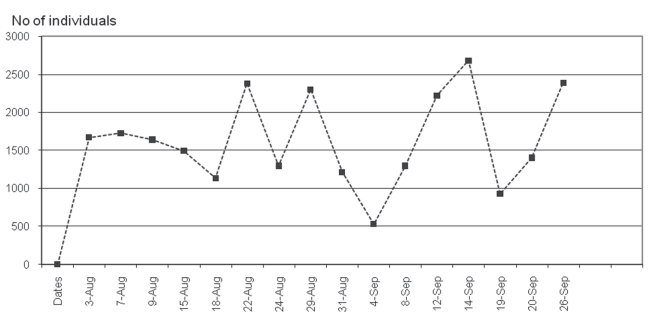

Fig. 3. Evening flight surveys of the *A. subruficolollis* flocks in Pos Chiong, Temengor during the months of August and September 2008.

Fig. 4. Plain-pouched Horbills in a 'V' shape formation.

Fig. 5. Plain-pouched Hornbills in a line formation.

Fig. 6. Plain-pouched Hornbills in a dispersed formation.

the methods. To avoid disruption in the counts, in the event a volunteer was unable to perform, the MNS coordinator would replace the volunteer and continue the counts on the volunteer's behalf.

DISCUSSION

***History.* –** The mass movements of hornbills of the genus *Aceros* were first discovered in August 1992 when 300 individuals were seen at Tasik Kenering, during dawn and evening flights (Ho & Sutari 1993). Prior to 1999, the flocks were generally accepted as Wreathed Hornbills (*A. undulatus*), a common species in the Malay Peninsula (Ho & Supari 2000). However, there were speculations that the flocks may have been Plain-pouched Hornbills (*A. subruficollis*) based on their three-note calls (Davison et al. 1995); calls of the various species are described by Lekagul & Round (1991). Then during the MNS's Heritage and Scientific Expedition to Belum in 1993–1994, 2421 hornbills in flight were recorded followed by 1277 hornbills in 1994 (Yaacob, 1994). In 1998, during the MNS Belum Expedition Phase II to an area further north, flocks of up to 233 hornbills were observed (Lim, 2000).

Plain-pouched and Wreathed Hornbills are very similar morphologically, and in the past the Plain-pouched has sometimes been considered the juvenile plumage of the Wreathed Hornbill (Rasmussen, 2000). The indigenous people in Temengor, the Jahai, were unaware of the differences between these two species and thus have only one name in their native language to describe both species, *Sang Kor*.

The Plain-pouched Hornbill lacks corrugations on its bill and it does not possess a black bar on the gular pouch, unlike the Wreathed Hornbill that possesses both these features (Wells 1999). Even a nestling Wreathed Hornbill possesses a black bar on its gular pouch (Frith & Douglas, 1978). The Plain-pouched Hornbill is smaller, with longer and narrower wings than the Wreathed (Kemp & Woodcock, 1995). The Plain-pouched also possesses a more rufous head (Kemp, 1988). All these features could be confirmed repeatedly in the population in the Belum-Temengor area.

In 1999, species in these flocks were revealed by Ho Hua Chew and Sutari Supari to be Plain-pouched Hornbills. This record was then submitted to the Records Committee, Bird Conservation Council, Malaysian Nature Society and subsequently was accepted as the tenth species of hornbill for Malaysia (Malaysian Nature Society, 2000).

***Possible reasons for seasonal flocking.* –** There are three kinds of hornbill flocks; ephemeral flocks, foraging flocks and communal roosting flocks. Ephemeral flocks occur when individuals congregate at a fruiting tree, though they may arrive and leave separately. Foraging flocks occur when a group of individuals continually travel together as a social unit in search of food. The communal roosts occur when foraging flocks convene in the evening to roost in a particular area (Kinnaird et al., 2007). Such behaviour of foraging in flocks and communal roosting are typical behaviour of the Plain-pouched Hornbill. Oates in 1883 reported large flocks of Plain-pouched Hornbills in their hundreds, seen in the morning and evening, travelling long distances to feed and roosting with Wreathed Hornbills in bamboos (Kemp & Woodcock, 1995).

Mass movements of hornbills are not regarded as true migration, as the proportion of individuals involved and direction are not necessarily the same each year. Though hornbills are omnivorous, these movements seemed to be governed by fluctuations in the availability of fruiting trees. The Wreathed Hornbill for example has been reported to cover an area spanning 100km² in search of food in a single day. They have even been reported to fly between islands such as Java and Bali and to travel 30km across open country (del Hoyo et al., 2001).

The Plain-pouched Hornbill flocks have been observed yearly in high numbers in Temengor during the months of August and September. This occurrence may be largely due to the fact most wild fruit trees in Temengor from the family Anacardiaceae, Bombacaceae, Euphorbiaceae, Meliaceae, Moraceae, Rutaceae, Sapindaceae are fruiting during these two months (A. Latiff et. al., 1995). Wreathed Hornbills have been reported to be able to track short term peaks in fruiting of lipid rich species in local habitats over a large area (Leighton, 1982; Kinnaird et al., 1996). In Borneo, flocking by *Aceros* hornbills was attributed to their specialised diet of lipid rich fruits. Lipid rich fruiting trees are patchy in space and time, therefore *Aceros* hornbills may track the food resources over a greater area than do hornbills of other genera (Leighton, 1982).

The Jahai people of Temengor have also commented that the presence of the hornbill flocks coincides with the fruiting season. However, the understanding of the fruiting phenology of Belum-Temengor is currently incomplete, making clear correlations difficult. The movements of the hornbills coincides with the emergence of thousands of mayflies (Ephemeroptera) from the Temengor lake, and the hornbills have been seen engaged in aerial feeding on these newly emerged mayflies by MNS observers (Yeap et al., 2005).

The arrival of large flocks of hornbills in August and September each year, followed by their apparent disappearance from the Belum-Temengor Forest Complex, may be due to their breeding cycle. In Thailand this species has been reported to nest between January and May; nine nests studied were within this date range (Poonswad et al., 1998). Their nesting time and ecology have yet to be documented in Malaysia (Wells, 1999).

As for their behaviour of moving in large numbers, this may prove beneficial in terms of foraging efficiency, as individuals within the group are able to take advantage of the whole group's foraging ability and experience of recent food sources (Ward & Zahavi, 1973).

***Possible Roosting Site*. –** Plain-pouched Hornbills are known to prefer lowland river valleys in tall evergreen and mixed deciduous hill forest (Kemp & Woodcock, 1995; Round, 1988; del Hoyo et al., 2001). These birds have been recorded up to 1,000 m above sea level (Yeap et al., 2005).

In 1993, up to 2421 *Aceros* individuals were documented during their evening flights flying towards the south and south-west, along the Perak River (Davison et al., 1995). In this study, it had been observed that the Plain-pouched Hornbills tended to head north-east during the morning surveys and south-west during the evening surveys. Based on their consistent evening flight direction over the years since 2004, the MNS team estimates that the roosting site may be located south of Sungai Jut towards Gunung Ramin (Yeap et al., 2005).

During this survey in 2008, a few hornbills were seen flying in other directions, away from the large flocks. Closer observation through the spotting scope revealed that the individuals were in fact Wreathed rather than Plain-pouched Hornbills.

***Overview of Previous Surveys 2004–2007*. –** MNS has previously conducted surveys from 2004 to 2007 to document the number of Plain-pouched Hornbills to observe their flight path and their general behaviour (Fig. 7). Throughout these years, flocks occurred mainly at Pos Chiong, Temengor, and were seen in large numbers during August and September. The highest numbers of individuals during this period of time were selected for comparison.

In 2004, the highest counts for morning surveys revealed 1,072 individuals, and for the evening surveys 989 individuals. In 2005, the highest counts for morning surveys revealed 191 individuals. In 2006, the highest counts for morning surveys revealed 1,549 individuals, and for the evening surveys 1,555 individuals. In 2007, the highest counts for morning surveys revealed 203 individuals, and the evening surveys 76 individuals.

The low numbers documented during 2005 and 2007 (Fig. 7) may have been due to disturbance to the forested area around Pos Chiong. Disturbance in the form of land clearing by indigenous people, and logging by commercial concerns,

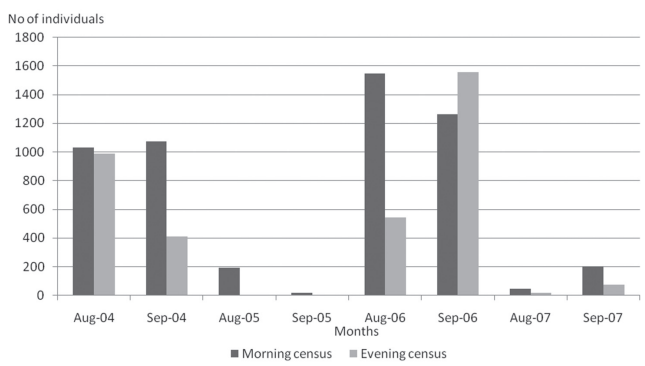

Fig. 7. Previous surveys on *A. subruficollis* carried out from the year 2004 to the year 2007 by Malayan Nature Society.

may have influenced the hornbills into changing their flight path, hence leading to a lower count than usual.

***Recommendations*. –** Contrary to what had been observed by Ho & Sutari (2000), the MNS coordinators did not find the Plain-pouched Hornbills wary of human presence. In fact, flocks flew directly over the observers based in a village, day after day without dispersing. Some individuals tilted their heads to view the observers but continued to fly over the noisy village without showing any signs of fear. One evening, the MNS coordinators were surprised to find two Helmeted Hornbills fly in and perch on a tree very near to the noisy village area. The behaviour of these hornbills seems to indicate the lack of fear, suggesting that threats from human beings such as hunting, only occur on a small scale.

Interviews with the Jahai revealed that the Jahai are opportunistic people and will hunt and consume almost any wild animal. There has also been the discovery of a partly charred bill of a Plain-pouched Hornbill obtained from the Jahai at Pos Chiong, strong evidence that hornbill hunting exists (Ho & Supari, 2000).

The major threat faced by the hornbills in Temengor is deforestation. Currently, the northern region of the Belum-Temengor Forest Complex, the Royal Belum State Park is a protected area however the southern region, Temengor Forest Reserve, is mainly a production forest. Selective logging removes large trees that are required for hornbill nesting purposes (larger than one metre in diameter), hence severely affecting the larger species of hornbills such as *Buceros* and *Aceros*. As an example of how intolerant the hornbills are to deforestation, Rasmussen's visit to Toungoo in the Sittang plain, Myanmar in year 2000, the species' former stronghold, revealed no sightings of hornbills, after conducting observations over several days. The original forest cover had apparently been cleared for the purposes of rice cultivation. (Birdlife International, 2001).

MNS strongly recommends that the Temengor section of the forest complex is protected as this would then create a single large trans-boundary protected area spanning southern Thailand and northern Peninsular Malaysia. Many species will benefit greatly residing in a large contiguous rainforest such as the Plain-pouched Hornbills which apparently depend on such vast areas while foraging.

Lastly, the mass movements of *Aceros* in Temengor hold a national and international importance, as they have been considered unique to this area (Davison et al., 1995). It is an awe-inspiring and an exciting phenomenon, hence it has great potential to be marketed as a tourist attraction for the purpose of monetary gain.

ACKNOWLEDGEMENTS

Thus, recognizing the importance and value of Belum-Temengor, MNS embarked on a long-term conservation programme using hornbills as a flagship species in 2004.

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