

ASSESSMENT OF EFFECTIVENESS OF CONSERVATION ACTION ADOPTED FOR HORNBILL SPECIES IN ARUNACHAL PRADESH, INDIA: THE GREAT INDIAN HORNBILL (*BUCEROS BICORNIS*)

Awadhesh KUMAR*, Bhanu RIBA

Department of Forestry, North Eastern Regional Institute of Science and Technology,
Deemed University, Nirjuli-791109 (Itanagar), Arunachal Pradesh, India

Abstract

Nine species of hornbills have been recorded from India, of which five are found in the tropical forests of Arunachal Pradesh. All species of hornbills particularly Great Indian Hornbill (*Buceros bicornis*) are facing serious anthropogenic threats in form of hunting as well as habitat loss throughout the state due to use of casque and feathers in decoration of traditional headgear of the Nyishi tribe of the state. The present study was aimed to assess the effectiveness of artificial hornbill beak adoption programme introduced in Arunachal Pradesh with the aim of conserving and protecting existing population of hornbill species. The data were collected from the Nyishi people living in and around the capital complex area of Papum Pare district in the state of Arunachal Pradesh by using pre-structural questionnaire method. Results showed that beak of *Buceros bicornis*, was most preferred (52%) over *Rhyticeros undulatus* (27%) and *Aceros nepalensis* (21%). Again the percentage of original, artificial and both, original and artificial preference were found to be 30%, 55% and 7% respectively. Wildlife Trust of India (WTI) and Arunachal Pradesh Forest Department have jointly taken the initiative of conservation of hornbill by introducing artificial beak made of fibreglass or wood for replacing original hornbill beak. The Nyishi people have increasingly accepted the artificial beak that was introduced as an alternative in early 2003s to prevent persecution of hornbills for beaks to adorn the traditional headgear. More than 43% people have shown their direct interest for conservation of hornbill species by not using the original beak in headgear. By comparing the literate and illiterate people of Nyishi community, the literate people (68.28%) have shown more interest on using the artificially decorated beak headgear than illiterate people (32.50%). Thus, Nyishi community in the state have accepted the artificial beak concept and shown more interest using the artificial beak made by either fibreglass or wood in their headgear in place of original beak to protect the wild population of hornbills.

Keywords: *Hornbill; Conservation; Adoption; Anthropogenic threats; Fiberglass beak; Hunting; Nyishi tribe; Traditional headgear.*

Introduction

Hornbills are large and conspicuous birds of the tropical forests of Asia and Africa. Due to their predominantly frugivorous diet, hornbills have always been considered important agents of seed dispersal in the tropical forest [1-4]. Of the 54 species of hornbills known to occur globally [5], nine species have been recorded from India, which are found in Western Ghats, from Koloba to Tenmalai; also along the base of the Himalayas, from Uttar Pradesh to north-

* Corresponding author: tpileatus@gmail.com

east India. Of which five species are found in the tropical forests of Arunachal Pradesh [6-8]. These five species are Oriental Pied Hornbill (*Anthracoceros albirostris*), Great Indian Hornbill (*Buceros bicornis*), Wreathed Hornbill (*Rhyticeros undulates*), Rufous-necked? Hornbill (*Aceros nepalensis*) and Brown Hornbill (*Ptilolaemus tickeli*). These species are mostly distributed in Pakke Wildlife Sanctuary (WLS) and Namdapha National Park (NP) with high density of population in addition to their population distribution in other protected areas of the state such as Mehao WLS, Kamlang WLS, Tale Valley WLS, Itanagar WLS, Mouling (NP) and some Reserve Forests areas of the state [4, 9].

Hunting is reported vital conservation threat for hornbill species in northeast India in general and Arunachal Pradesh particular due to its traditional value of their feathers, beaks, casques, bushmeat and supposed medicinal value of their fat [7,8,10-13]. In addition, the recent accelerated habitat loss and land-use change pattern due to selective logging, shifting cultivation, pasture development, conversion of forestland into permanent agricultural, settlements and development lands [13], population of Arunachal's hornbill species particularly Great Indian Hornbill and Wreathed hornbills are very much effected in entire distribution range of Arunachal Pradesh, India. Among the hornbill species found in northeast India, the Great Indian Hornbill (*B. bicornis*) is one of the most traditionally hunted species because of their body parts namely beak, casque (the horny growth where the bird's forehead meets the beak) and feathers used in decoration of traditional headgear (*Pudum*) used by Nyishi tribes of state [15]. Because this species is a large bird, growing up to 4ft in length and with a wingspan of around 5 ft. and has a bright yellow beak and a brighter yellow and black casque [15]. Thus, most of the hornbill species found in Arunachal Pradesh is placed under threatened categories of IUCN and Schedule I of the Indian Wildlife (Protection) Act, 1972.

In response to threats faced by hornbill in the state, Mr. Chuku Loma, former Divisional Forest Officer (DFO) of Pakke Wildlife Sanctuary (PWLS) came up with the idea of fabricating fiber-made replicas of the beaks in 2000 [16, 17] to save and protect the natural population of hornbill species particularly Great Indian Hornbill. In 2003-2004 hornbill conservation programmes was started by Arunachal Forest Department in collaboration with the Wildlife Trust of India (WTI) by distributing the fiberglass made hornbill beaks to Nyishi people inhabited in the hornbill's distribution range who extensively hunted the species for its body parts. Presently a majority of the Nyishi have endorsed and supported Loma's suggestion. A conservationist, Loma, even now pursues his aim to protect threatened bird species and had retrieved about 500 original hornbill beaks and distributed the fiberglass made beaks in Nyishi dominated Itanagar-capital complex area in last few years . Another significant move to conserve the hornbills was the recent launch of Hornbill Nest Adoption Programme, a novel idea of Mr. Tana Tapi, present DFO of Pakke Wildlife Sanctuary, Arunachal Pradesh to conserve and protect hornbill nests in forest areas outside the sanctuary, Arunachal Pradesh [16].

In this study, we report the success of adoption of artificial hornbill beak by Nyishi community with the aim to reduce the uses of original beak of hornbill species particularly Great Indian Hornbill species in Arunachal Pradesh, India. The results are compared with earlier uses of original hornbills' beak and present uses of artificial beaks in order to assess the effectiveness of the restriction of original hornbill beaks and introduction of artificial beak at reducing the threat to Arunachal's hornbill populations particularly Great Indian Hornbill.

Materials and Methods

The present study was carried out between December 2011 to April 2012 in Itanagar Capital Complex Areas (ICCAs) of Papum Pare District of Arunachal Pradesh. Seven places of ICCAs: *Itanagar, Naharlagun, Poma, Nirjuli, Doimukh, Lekhi and Karsingsa*, based on the density of Nyishi population, were selected and visited for conducting survey. Field data was

collected by using pre-structured questionnaire survey followed by personal discussion among Nyishi people inhabited in selected places. Questions like preference of beak of hornbill species, source of beak, cost of beak/headgear, material of artificial beak, duration of beak, occasion of uses of headgear decorated by hornbill beak, importance of headgear decorated by hornbill beak in Nyishi culture, reason of not using the headgear decorated by original beak, peoples opinion toward conservation of hornbill spp. etc. were asked during pre-structured questionnaires survey. In addition, data was also collected during the festival celebration namely *Nyokum*, which is one of their major cultural festivals when Nyishi people wear the headgear decorated by hornbill beak and feathers. Nyishi people' responses were analyzed to know the effectiveness of adoption of headgear decorated by artificial beaks in order to reduce the uses of original beak to safe and protect the natural population of hornbill spp. in Arunachal Pradesh, India.

Results

Preference of Hornbill species for beak

Out of five hornbill species reported to occur in Arunachal Pradesh, three hornbill species viz, Great Indian Hornbill (*Buceros bicornis*), Wreathed Hornbill (*Rhyticeros undulates*) and Rufous-necked Hornbill (*Aceros nipalensis*) are recorded for use in the headgear decoration by Nyishi community. Among these 3 species, *Buceros bicornis* was most preferred (52%) followed by *Rhyticeros undulates* (27%) and *Aceros nipalensis* (21%) (Fig.1a).

Preference and sources of headgear decorated by beaks

We recorded maximum (60%, n = 71) Nyishi people preferred headgear decorated by artificial beak either made by fiberglass or wood made beak followed by original beak (33%, n = 39) and both artificial and original (8%, n = 9) (Fig. 1b). The sources of beaks were documented and it was found that in case of original beak, maximum (42%, n = 24) respondents obtained the beak from their ancestors or self-hunted followed by purchased from market (40%, n = 19), received as gift (10%, n = 5) and hunted from jungle (8%) (Fig. 1c). But in case of artificial beak, the percentage of respondents who had purchased from market, received as gift and self-made are 89% (n = 71), 5% (n = 4) and 6% (n = 5) respectively (Fig. 1d).

Cost of headgear

The original and artificial beak headgears are purchased at different prices by the different respondents. Thus the prices paid by the respondents for headgear decorated with original and artificial hornbill beak were documented. The price of headgear decorated with original Great Indian Hornbill's beak was on average Rs. 6542/- ranging from 3000-12,000/-. However, artificially beak decorated headgear was purchased on average Rs. 3562/- ranging from 1000-6000/-. The artificial beaks used by respondents were made by either fiberglass or wood. Of the 96 respondents, 68% preferred wood made beak than the plastic fiber (32%) because of low price.

Occasion of headgear usage and its importance in Nyishi culture

It was recorded that the headgear is only used by the male members of the Nyishi community in various occasions such as festivals, marriage ceremonies, and social gathering/meetings. Importance of headgear was documented and a maximum 41% people said that it is traditionally important followed by culture identity (29%), decoration (20%) and ethical value (10%) (Fig. 1e).

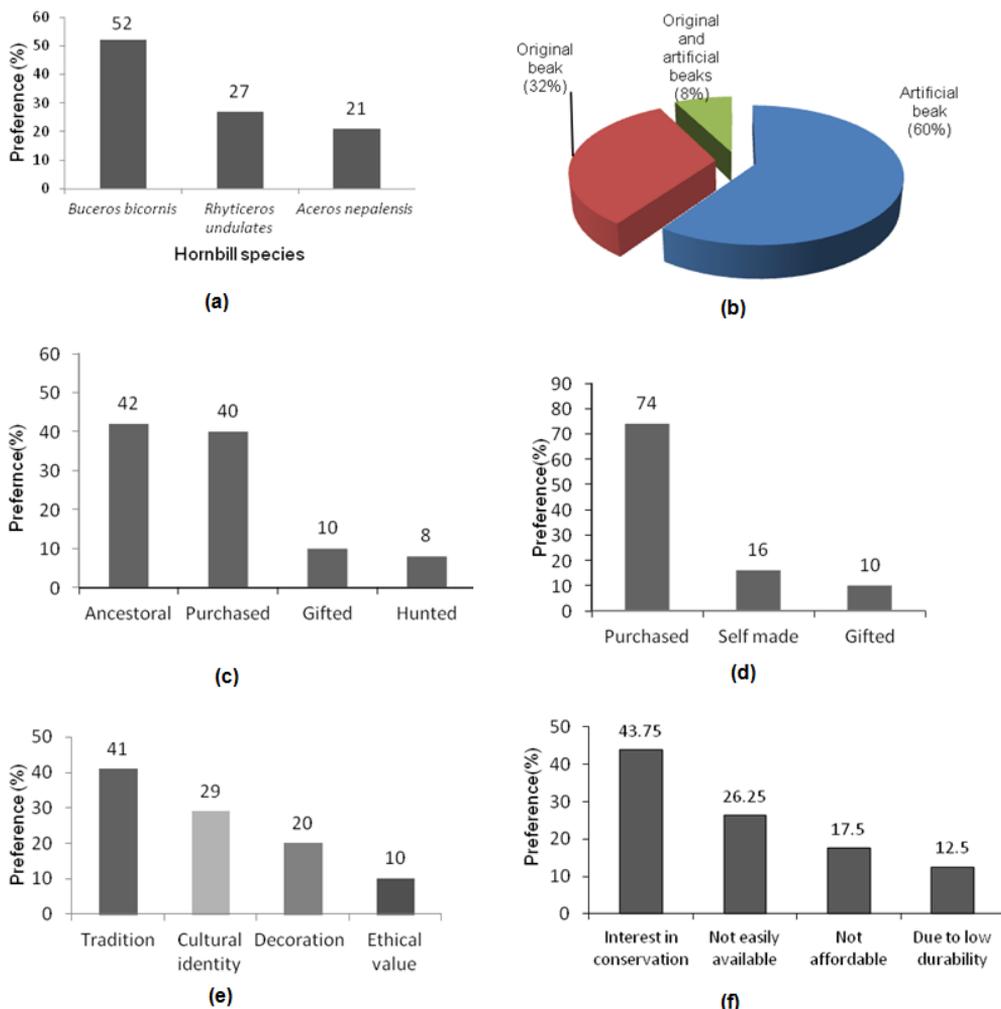


Fig. 1. Percentage of preference of hornbill species for decoration of headgear (a), Percentage of preference of headgear decorated by beaks (b), Sources of original hornbill beak (c), Sources of artificial beak (d), Various occasions when hornbill beak decorated headgear is used by Nyishi tribesman (e) and Reasons for not using original beak in the study area (f)

Reason for not using original hornbill beak

Four reasons were documented for not using original hornbill beak presently by the Nyishi people. Out of 80 respondents, maximum (43.75% (n = 35) expressed their interest in the conservation of the hornbill followed doesn't use original beak since it is not easily available in the market as well as hunting of hornbill spp. from forest become very challenging due to low sighting rate (26.25%), preferred artificial beak due to durability (17.50%) and 12.50% people responded that they were unable to afford due to high price of headgear (Fig. 1f).

People's opinions towards the conservation of species

We documented the 149 (n = 93 literate and n = 56 illiterate) Nyishi people opinions towards protection and conservation of hornbill species (Table 1). Most of the respondents (34%) expressed that strict implementation of wildlife law to control the illegal hunting of

species followed by conducting the awareness programme among the local community (28%), promotion of artificial plastic or wood made beak (22%) and discouraging uses of original beak (16%) (Fig. 2). A correlation has been made between literacy and the usage of original or artificial beak among the respondents (Table 1). It was recorded that literate people (68.82%) have shown more interest on using the artificially decorated beak headgear than illiterate people (37.50%). However, just opposite trend has been recorded in case of illiterate people.

Table 1. Education and usage percentage among the respondents

Education status	No. of respondents		Total no. of respondents	% of respondents	
	Original	Artificial		Original	Artificial
Literate	29	64	93	31.18	68.82
Illiterate	35	21	56	62.50	37.50

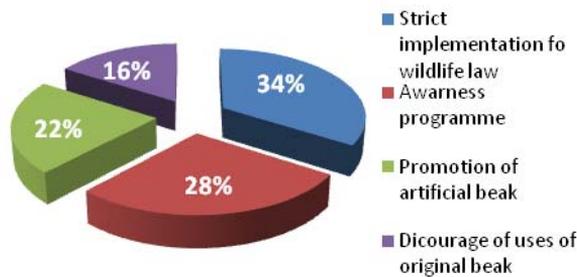


Fig. 2. Percentage of people's opinions towards taking the conservation.

Discussions

As per the responses of Nyishi people, hornbill headgear is compulsory for Nyishi men. It is a sign of tribal identity and manhood, and helps in maintaining their traditions, culture and identity. It is mostly worn during occasions viz. festivals, marriages and social meetings. The headgear decorated with hornbill beak is usually worn by the priest during spirit worship as it helps in spirit attraction. Besides the hornbill beak and feathers, Nyishi headgear also consist of other animal body parts viz., bear fur, eagle claw and feather, peacock feather and dragon's tail, etc. Thus a priest wears a headgear decorated with all these animals' body part. This provides him the required powers during spiritual worship as he has to enter the spiritual world, where his spiritual power has to be enhanced and to protect himself. In the past only the priest and some socially rich and important person used to wear headgear but later on it got popularized among the all age group people. As a result of which it became customary for every Nyishi tribesman to wear headgear.

As a consequence of large scale of hunting of hornbill species particularly Great Indian Hornbill in the past few decades in the state, the population of species has been declined drastically. Even species' occurrence has become very rare and locally extinct from some parts of their former ranges in the state. Of the five species of hornbills recorded from Arunachal Pradesh, only three species namely Great Indian Hornbill, Wreathed Hornbill and Rufous-necked Hornbill are used in decoration of Nyishi headgear. Among these species Great Indian Hornbill was most preferred because of its wider distribution and abundance in the state as well as beauty and size of beak (Fig. 3) compared to other two species. Due to more preference of

Great Indian Hornbill for beak as well as for bushmeat make it the most threatened species in the state.



Fig. 3. The use of Hornbill products: **a** and **b** - Great Indian Hornbill; **c** and **d** - marketing of artificial hornbill beak in local market, **e** - Team member conducting interview with hornbill beak user, **f** - Comparing the original and artificial hornbill beak, **g** - Fibreglass made hornbill beak, **h** - Original hornbill beak, **i**, **j** and **k** - Young youth used artificial hornbill beak decorated headgear, **l**- Nyshi people celebrating Nyokum festival by bearing headgear decorated by hornbill beak.

The increasing threat to the hornbill species became the cause of concern among the forest officers and wildlife experts. There was a need to find an alternative so that not only the hornbill can be protected from rampant killing but also the culture and traditions of the local community can be preserved and maintained. With these views Mr. Chuku Loma former DFO,

Pakke Wildlife Sanctuary who initially brought out the conservation concept of artificial beak usage in the Nyishi headgear in early 2000's [16-18]. This conservation programme was initiated in 2003-04 by State Forest Department in collaboration with Wildlife Trust of India (NGO), Arunachal Wildlife and Nature foundation (NGO) and National Museum of Natural History [19]. Initially artificial beaks were distributed among the Nyishi community in 15 villages located around Pakke Wildlife Sanctuary, East Kameng District of state. Following an early success of this conservation programme, the implementers were distributed about 500 more artificial beaks between 2006-2010 in Nyishi dominated areas of state including Itanagar capital complex area (Table 2 and 3) and organized training in synthetic beak fabrication for 20 local artisans, for sustainability [20].

Table 2. Distribution statistics of artificial hornbill beak in Papum Pare district.

Sl. No.	Year of distribution	No. of beaks distributed
1.	2006-2007	100
2.	2007-2008	200
3.	2008-2009	100
4.	2009-2010	100
Total		500

Source: Wildlife Sanctuary Division, Naharlagun, Arunachal Pradesh, India. (Information was collected in 2012)

Table 3. Distribution record of artificial hornbill beaks distributed in Arunachal Pradesh

Place	No. of beaks distributed	Place	No. of beaks distributed	Place	No. of beaks distributed
1. Basar Nallah	56	10. Poma	20	19. Karoi	8
2. Jote	8	11. Gumto	10	20. Nimte	6
3. Rakap	16	12. Doimukh	4	21. Yapso	6
4. Khamir	10	13. Rono village	7	22. Bhat	13
5. Deb	13	14. Seijosa	185	23. Ganga	13
6. Moin	5	15. Tollang	14	24. Naharlagun	8
7. Borum	20	16. Tarajuli	1	25. Emchi	5
8. Niorch	4	17. Itanagar	35		
9. Mirku	8	18. Pech	4		

Source: Wildlife Sanctuary Division, Naharlagun, Arunachal Pradesh, India. (Information was collected in 2012)

In our survey we find that Nyishi people are using more headgear decorated by artificial beak in compare to original beak which directly conveys the effectiveness adoption of conservation step taken up. This trend can also be linked with literacy of the Nyishi people and their interest towards the conservation hornbills. Literate Nyishi people have shown more emphasis on using the headgear decorated by artificial beak then the Illiterate person who have shown more interest on original beak headgear. During the survey, two types of artificial hornbill beaks were recorded; one is made by plastic fiberglass and another is wood made. Both types of beaks are available in the local market Naharlagun now-a-days. Nyishi people have shown more preference on headgear decorated by wood or plastic fiberglass in compare to original beak because of its low price. The price of headgear decorated by original beak are ranging from Rs. 3000-12000/- headgear in compare to artificial on (Rs. 1000-6000/-). Educated Nyishi people have responded more interest in purchasing the headgear decorated by artificial beak in compare to original one. This preference is evaluated and we found that maximum Nyishi peoples are concern about the conservation of hornbill species as hornbill population is declining day by day. They suggested that strict implementation of wildlife law,

promotion of awareness programme and artificial hornbill beak might be an option to control declining rate of hornbill population in the state.

In addition adoption of artificial beak, Nyishi chiefs ensured that no hornbills were killed, imposing a fine of Rs 5,000 for snaring the bird with the aim to stop the killing of hornbills and replace the beaks with artificial look-alikes. Following an early success of the adoption of artificial hornbill beak, in 2004, the implementers along with Nyishi Indigenous Faith and Cultural Society organised training in synthetic beak fabrication and trained 20 local artisans, for sustainability.

Conclusions

Based on the our survey and observation on the Nyishi community in the areas, we conclude that Nyishi people has accepted the artificial beak concept and shown more interest using the artificial beak made by either fibreglass or wood for decoration of their headgear in place of original hornbill beak. The following recommendations are suggested for making conservation programme more effectiveness.

- a. Artificial beak should be promoted more through advertisements and by displaying in exhibitions/posters/banners.
- b. Some more training programmes on synthetic (fiberglass) or wood beak fabrication is required to train local human resource so that sufficient supply of artificial beaks can be available in the market on reasonable prize. In our survey 92% respondents have shown their interest in undertaking training for artificial beak manufacture, if offered to them. This can be an option for good source of livelihood.
- c. Price fixation of artificial beak is necessary. Affordable price will encourage people to buy headgear decorated with artificial beak instead of the costly headgear decorated with original beak.
- d. Population status of hornbill species should be regularly monitored in fixed time interval to check the population trend in both protected and non-protected areas of the state after mass introduction of artificial beak adoption programme.
- e. Laws and policies related to wildlife conservation and protection should be implemented and monitored strictly in those areas which are very susceptible to Hornbills hunting.
- f. More awareness programme about the significance of Hornbills species for forest conservation should be emphasized by showing movies and presenting findings of hornbill studies on seed dispersal and regeneration to the local communities during various occasions like Nyokum festival, etc.

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References

1. K.D. Whitney, M.K. Fogiel, A.M. Lamperti, K.M. Holbrook, D.J. Stauffer, B.D. Hardesty, V.T. Parker, T.B. Smith, *Seed dispersal by Ceratogymna hornbills in the Dja Reserve, Cameroon*, **Journal of Tropical Ecology**, **14**, 1998, pp. 351–371.
2. S. Kitamura, T. Yumoto, N. Noma, P. Chuailua, T. Maruhashi, P. Wohandee, P. Poonswad, *Aggregated seed dispersal by wreathed hornbills at a roost site in a moist evergreen forest of Thailand*, **Ecological Research**, **23**, 2008, pp. 943–952.
3. P. Balasubramanian, R. Aruna, C. Anbarasu, E.S. Kumar, *Avian frugivory and seed dispersal of Indian Sandalwood Santalum album in Tamil Nadu, India*. **Journal of Threatened Taxa**, **3**(5), 2011, pp. 1775–1777.
4. A. Datta, R. Naniwadekar, M.O. Anand, *Hornbills, hoolocks and hog badgers: long-germ monitoring of threatened wildlife with local communities in Arunachal Pradesh, North - East India*, **Final Report to the Rufford Small Grants Program** (UK), 2008, pp. 80.
5. A.C. Kemp, *Conservation of Asian hornbills and their habitats: An introduction*, **Manual to the conservation of Asian hornbills** (Editors: P. Poonswad and A.C. Kempeds), Hornbill Project, Mahidol University Bangkok, 1993, pp. 4-23.
6. A. Datta, *Hornbill abundance in unlogged forest, selectively logged forest and a plantation in western Arunachal Pradesh*, **Oryx**, **32**(4), 1998, pp. 285-294.
7. A. Datta, M.O. Anand, R. Naniwadekar, *Empty forests: large carnivore and prey abundance in Namdapha National Park, north-east India*, **Biological Conservation**, **141**, 2008, pp. 1429-1435.
8. K.M.B. Selvan, *Survival of Great Pied Hornbills in Arunachal Pradesh*, **Current Science**, **99**(5), 2010, p. 60.
9. A. Datta, G.S. Rawat, *Foraging patterns of sympatric hornbills during the nonbreeding season in Arunachal Pradesh, northeast India*, **Biotropica**, **35**(2), 2003, pp. 208-218.
10. G.S. Solanki, *Socio-cultural and faunal diversity of Arunachal Pradesh*, **Himalayan Journal of Environment and Zoology** **16**(2), 2002, pp. 159-170.
11. G.S. Solanki, B. Chongpi, A. Kumar, *Ethnology of Nyishi Tribes and wildlife of Arunachal Pradesh*, **Arunachal Forest News**, **20**, 2004, pp. 74-86.
12. G.S. Solanki, P. Chutia, O.P. Singh, *Ethnozoology of Nhishi tribe and its impact on biodiversity*, **Arunachal University Research Journal**, **8**(1), 2005, pp. 89-100.
13. P. Chutia, *Ethnozoological study of Nyishi, Monpa and Apatani tribes of Arunachal Pradesh*, **Ph.D. Thesis**, North-Eastern Hill University, Shillong, Meghalaya, India, 2006.
14. M. Krishna, K. Sarma, A. Kumar, *Rapid Assessment of Wreathed Hornbill *Aceros undulates* (Aves: Bucerotidae) populations and conservation issues in fragmented lowland tropical forests of Arunachal Pradesh, India*, **Journal of Threatened Taxa**, **4**(14), 2012, pp. 3342-3348.
15. A. Banerjee, **The Nyishi and the hornbills**, <http://www.livemint.com/Politics/Z5LU09eXYcF5jzckMfWRHJ/The-Nyishi-and-the-hornbills.html.2012> (accessed on February 25, 2014).
16. * * *, **Artificial beaks save hornbills from extinction**, <http://zeenews.india.com/news/eco-news/artificial-beaks-save-hornbills-from-extinction>. (accessed on February 07, 2012).

17. A. Gupta, **Artificial beaks help save the hornbills.**, <http://indiasendangered.com/artificial-beaks-help-save-the-hornbills> (accessed on February 16, 2015).
18. J.R. Platt, *Artificial Beaks Helping to Save Hornbills from Extinction in India*, **Scientific American**, 2012, <http://blogs.scientificamerican.com/extinction-countdown/2012/02/09/artificial-beaks-helping-save-hornbills-extinction-in-india/> (accessed on February 16, 2015).
19. ***, *Beak reprieve for hornbill*, **The Telegraph**, Calcutta, India, October 18, 2007, http://www.telegraphindia.com/1071018/asp/northeast/story_8443419.asp (accessed on February 16, 2015).
20. * * *, *Synthetic beaks distributed for hornbill conservation in Arunachal Pradesh*, Wildlife Trust of India – Archives, April 29, 2010, <http://www.wti.org.in/oldsite/archives/2010/04/29/synthetic-beaks-distributed-for-hornbill-conservation-in-arunachal-pradesh/> (accessed on February 16, 2015).

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