

## ENUMERATING THE ETHNO-ORNITHOLOGICAL IMPORTANCE OF PHILIPPINE HORNBILLS

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**ABSTRACT.** – The ethno-biological value of hornbills in the Philippines are largely scattered in the local literature, and this paper represents a compilation of these local traditions and practices. Various ethno-linguistic groups emulate the significance of hornbills in their language and artifacts, which show similarities with other cultures in Asia and Africa. Importance of nine endemic species hornbills is well established among a number of different indigenous people in the Philippine islands. Their value varies from a basis for telling time or bringer of bad omen, to a source of food and local medicine. Among indigenous tribes of Northern Luzon, hornbills adorn headdresses (Yangnoh, Panglao), used as jewelry (Batling) and as basis for ceremonial dances (Tariktik). Hornbills are also found in several literary accounts such as fables, poems and songs, but are limited and require further research. Local beliefs are often patterned from behavior and have either negative or positive effects. Derivatives of vernacular names appear to be varied across major regional languages, from the onomatopoeic Tariktik to the widely used Kalaw. Official Filipino names for all 15 Philippine hornbills are proposed. The significance of these diverse uses and traditions may have implications to the conservation of these endemic Philippine hornbills.

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**KEY WORDS.** – Hornbills, Philippines, ethno-ornithology, local communities.

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### INTRODUCTION

There are scattered traces of hornbills in culture, in the Philippines and neighbouring parts of Southeast Asia. The publication by Maramba (1998), for example, contains photographs of these colourful adornments of the Ilonggot and Ifugao tribes taken by M. Yokoyama. Postcards have been produced showing tribal artifacts called Batling and Yangnoh that were adorned with beaks of the Rufous hornbill (*Buceros hydrocorax hydrocorax*). A webpage exists showing photographs of native dancers taken during a recent Ifugao festival. Each performer had worn the Yangnoh, and each had a real Rufous hornbill skull. Another webpage featured photos of a self-proclaimed Ifugao princess wearing another Yangnoh (normally worn by men), which was decorated with the skull of a Luzon Tariktik hornbill (*Penelopides manillae manillae*). These are merely fragments of the inimitable ties binding endemic hornbills with the traditions of the equally unique indigenous people of the Philippine islands.

A question exists whether these time-honoured practices of the Ifugao have had any influence on the decline of hornbills

in the Central Cordillera region of Luzon. Does this change from traditional use to commercial tourism have any future impacts on remaining hornbill populations? Recent surveys and birding reports have indicated far fewer sightings of hornbills from both Benguet and Mountain provinces, which are the domain of the Ifugao people. The Natural History Museum in Tring holds several skins of Rufous hornbills collected by John Whitehead in 1894 from La Trinidad, Benguet and Mount Data. Such localities no longer harbour any hornbills, but this is largely due to habitat loss. However, these historical accounts provide evidence of past associations between Ifugao tribes and hornbills.

This paper represents a compilation of human-hornbill associations noted from the Philippines, with particular emphasis on the traditions and beliefs of indigenous people, including the documentation of human-hornbill associations among indigenous tribes within the Northern Sierra Madre Natural Park.

## METHODS

This paper represents a meta-analysis of different human-hornbill interactions compiled from various sources, primarily from notes taken from taxonomic reviews, status reports, expedition reports, field guides and handbooks. A fairly extensive literature search of both biological and anthropological references was carried out in three key ornithological libraries, namely the Alexander library (Oxford), Birdlife International library (Cambridge) and Natural History Museum bird library (Tring). Additional data were downloaded from e-journals and digitally scanned archival papers readily accessed from the internet. Supporting accounts were derived from incidental field notes taken from informal interviews of local people during past biodiversity expeditions in the Philippines. Documented artifacts and other cultural practices were also sourced from specific web pages and on-line auctions. A compilation of different hornbill interactions with indigenous people were classified based on utilization (e.g., adornments, food) and traditional beliefs (e.g., folklore, arts, language).

## RESULTS AND DISCUSSION

### Ethno-ornithology

“Birds & People: Bonds in a Timeless Journey” is a key publication that would best illustrate the strong association between man and birds (Collar et al., 2007). It shows the rich historical, cultural and scientific relations that have fueled our continued fascination with birds and how this has fostered global efforts to protect them. Ethno-ornithology has gained interest in recent years given the necessity to document and conserve both threatened birds and indigenous cultures.

Defined as the study of relationships between people and birds (Wikipedia, 2008), this more specific branch of ethnobiology can help to describe how human societies perceive, use and manage birds. Although it is often more associated with anthropological and linguistic approaches, there has been a noticeable growth in research carried out by ornithologists and conservation biologists. Online discussion groups have been created to provide a venue for people working in ethno-ornithology to network and share ideas, such as the Society for Ethnobiology and the Ethno-ornithological Research Study Group (ERSG).

Ethno-ornithology serves as a platform for studying specific relationships between indigenous cultures and endemic birds to help increase local awareness of traditional knowledge. Increasing concerns on sustainable-use and community-based strategies also emphasise the importance of ethno-ornithology, and its implications for biodiversity conservation. Apparently, the same endearing qualities in morphology and behaviour that have attracted many hornbill researchers have also influenced a variety of interesting associations between hornbills and indigenous cultures in Asia and Africa.

### Hornbills and Man

Studies on human-hornbill relations have been documented for several species, but such associations have not been reported for other isolated hornbill taxa in both Africa and Asia. There is a need to fill in these gaps and document these relations before both hornbills and indigenous cultures are lost. In recent years, several papers have started to compare the varied associations across different local tribes. Among these, studies conducted by Bennett et al. (1997) in Borneo and by O'Brien & Kinnaird (2000) in Sulawesi have described the differences in traditional practices across ethnic groups, and their consequent impacts on local hornbill populations. In order to illustrate these diverse associations, I have enumerated a handful of more popularly known human-hornbill relations from Africa and Asia.

Some tribes in Cameroon have been reported to fashion a gruesome-looking stalking decoy, festooned with a preserved skull of a Northern Ground Hornbill (*Bucorvus abyssinicus*), which they use as camouflage during hunting ploys. For a more convincing disguise when staking game, Sudanese, Cameroonian and Hausa hunters wear stuffed hornbill headgear and imitate their crouched gait (Kemp, 1995). This technique allows hunters to approach game animals by masquerading as a ground hornbill. The Huli tribe from New Guinea uses a combination of bird plumages together with a hornbill's upper bill to make their colorful warrior necklace. Blyth's hornbill (*Rhyticeros plicatus*) is probably the only known source for hornbill mandibles around New Guinea (Collar et al., 2007). Other tribes make effigies of hornbills to emulate its presence and traditional use. Blyth's hornbill was depicted in many spiritual or village icons, including wood carvings of hornbills from New Ireland.

The use of Hetung or hornbill ivory was popularized a century ago in China and Japan (Perrins, 2003). A strong but pliable bone-like material slowly thickens on the upper front edge of the casque of Helmeted hornbills (*Rhinoplax vigil*). This gradual build-up of keratin over the casque strengthens the bill for use in head-butting (Camman, 1951; Kinnaird et al., 2003). Also referred to as “golden jade”, the ochre color on their bills results from stains of yellow oily secretions derived from the preen gland. Prior to this popularity as a jewelry resource, it was presumed that local tribes from Borneo collected Helmeted Hornbill heads for local spiritual purposes. Subsequent interactions with Chinese traders initiated this discovery and demands for intricately carved Hetung may contribute to this hornbill's current decline (Kemp, 1995).

The Nishi tribe from Northeast India had high regard for the Great Indian Hornbill (*Buceros bicornis*), and value its bill as a symbol of male maturity. This probably recognizes the strong fraternal duties of male hornbills that are essential to successful breeding. The upper bill and casque are primarily used to decorate the traditional men's cane helmet, often bestowed to young men as right of passage to manhood. Over-exploitation has led to the decline of Great Indian Hornbills within localities occupied by the Nishi, but effective

conservation strategies have been recently developed. Fiberglass replicas are now being used as alternatives to real bills, and have been well accepted (or even favored) by several Nishi tribes (Loma, 2005).

Aside from having a diverse assemblage of hornbill species, Borneo also cradles a diverse group of indigenous cultures. Bennett et al. (2000) described traditional practices in northwest Borneo that directly affect wildlife (including hornbills), but putting emphasis on hunting and the feasibility of sustainable use. An earlier account compared the impacts of hunting hornbills between certain tribes in northern Borneo, focused on how both can continue to co-exist (Bennett et al., 1997). Hornbill feathers are collected to adorn head-dresses, capes or used to make dancing fans. Feathers play a primary role in the Orang Ulu's ceremonial dances, where approximately 40 feathers are needed to make a costume for an individual dancer. The "Gawai Kenyalang" of the Iban tribe is probably one of the most well-known hornbill festivals in Asia, and depicts hornbills as the focal point of their celebration.

Hornbills are also recognized as spiritual symbols, either regarded as harbingers of disease or as a guide to the afterlife. The Murut tribe has a strict taboo on hornbills, with the belief that they bring sickness. The Ngaju tribe honour their dead in a ceremony that is closely linked with nesting activities of hornbills. The Dayak people have emulated hornbills through their cultural practices as shown in their hornbill inspired tattoos, hornbill-shaped tattooing implements and elaborate carved wooden hornbill effigies or totems (Bennett et al. 1997). Surprisingly, some of these beliefs and traditions involving hornbills in Borneo have similarities with practices of several indigenous people in the Philippines.

### Philippine hornbills

The Philippines harbours only a small percentage (17%) of the world's 54 hornbill species, and a third (29%) of all the Asian hornbills (Kemp, 1995; Kinnaird & O'Brien, 2007). However, all nine species are entirely endemic and often restricted to certain group of islands within the archipelago. Some 15 endemic taxa (species and subspecies) are currently known and all are largely dependent on lowland rain forests. Their distribution closely follows a general biogeographic pattern within the archipelago, with specific taxon representing major faunal regions or endemic bird areas (EBA) formed by Pleistocene island aggregations (Bibby et al., 1992; Gonzalez, 2007).

This inherent limited distribution coupled with the rapid population decline caused by extensive habitat loss and hunting has led to most hornbills in the Philippines being classified as threatened. Currently eight of the 15 known taxa are of significant conservation concern, with five species categorized as threatened (Collar et al., 1999) and two subspecies also known to be threatened (Asian Hornbill Network, 1991). Sadly, it was too late to save the Ticao Tarictic Hornbill (*Penelopides panini ticaoensis*) which was

recently confirmed to be functionally extinct on the small island of Ticao. Only a small patch (< 10 ha) of degraded lowland rainforest now remains on this island of about 362 sq km. This is the first record of a hornbill going extinct in Asia, and two other taxa (from Basilan and Tawitawi) share very similar problems. Although the status of seven remaining taxa appears less critical, all 15 Philippine hornbills currently experience a rapid decline due to continued forest degradation and human encroachment (Collar et al., 1999).

The Philippine hornbill assemblage comprises members of four Asian genera (*Buceros*, *Anthracoseros*, *Aceros*, *Penelopides*) and has close relations with Wallacean hornbills. Both assemblages have resulted from island colonization by Sundaic (Indo-Malayan) and Palearctic (mainland SE Asia, China and India) hornbills. Rufous Hornbill (*Buceros hydrocorax*) is the largest, with three distinct races distributed among the eastern Philippine islands. It appears to be closely related to the more widespread Great Indian Hornbill. The Palawan (*Anthracoseros marchei*) and Sulu Hornbills (*A. montani*) each have close affinities with two other Sundaic hornbills (*A. albirostris* and *A. malayanus*) and both have restricted distribution on the western islands closest to the Sunda shelf (Kinnaird & O'Brien, 2007).

The recently split Rufous-headed (*Aceros waldeni*) and Wreathed Hornbill (*A. leucocephalus*) are restricted to a few southeastern islands, and are closely related to Sundaic (*A. corrugatus*) and Wallacean (*A. cassidix*) Wrinkled Hornbills. All four are closely allied to the Rufous-necked Hornbill (*A. nipalensis*) of Indochina and northeast India. Similar splits now recognize four species of Tarictic Hornbills (*Penelopides*) in the Philippines, which closely resemble the Sulawesi Tarictic Hornbill (*P. exarhatus*) from Wallacea. Consequently, the Luzon Hornbill (*P. manillae*) occurs in the Luzon Endemic Bird Area (EBA), the Mindoro Hornbill (*P. mindorensis*) represents the Mindoro EBA, the Visayan Hornbill (*P. panini*) occurs in the West Visayan EBA, and the Mindanao Hornbill (*P. affinis*) is found in lowlands of Mindanao and East Visayan EBA (Kemp, 1995; Gonzalez, 2007).

### Indigenous people in the Philippines

The Philippine archipelago is composed of over 7,100 islands and islets, wherein only about 48 islands (0.7%) are inhabited by hornbills. This is in sharp contrast to the extensive human population of approximately 80 million which has inhabited more than half the islands. The majority of the population is represented by Filipinos of mixed backgrounds (Malay, Chinese and European descent). However, a small fraction (0.7%) of the population is composed of the "original" inhabitants representing different groups of indigenous people (Malay, Indochinese and Austronesian descent). Some 90 different ethno-linguistic groups found in the Philippines represent a high level of cultural diversity, comparable to its exceptionally high biological diversity. A similar pattern of geographical distribution known for hornbills is observed on major groups of indigenous people. Ethnic groups allied to

Igorots and Agtas are restricted to Luzon, while Mangyans are limited to Mindoro, whereas Tagbanuas occur only on Palawan, and a variety of Lumads inhabit Mindanao and Sulu islands.

According to current statistics of the National Commission on Indigenous People, some 556,103 Filipinos are registered under 90 ethno-linguistic groups. Indigenous people in the Philippines are also undergoing rapid cultural change, and often with serious consequences on their distinct traditions and beliefs. Habitat loss and rapid urbanization of major islands equally threatens the country's rich biodiversity and unique cultural diversity. A total of 171 living languages are currently spoken in the Philippines, but several of these languages are slowly being lost to cultural degradation (Grimes, 2000). Given the scale of undocumented potential interactions between numerous ethno-linguistic groups and hornbills in the 48 known hornbill-inhabited islands, I had chosen two key islands as representative subset to illustrate ethno-ornithological relations.

Some seven basic tribes of Mangyans currently reside on Mindoro Island, each with a number of sub-tribes differentiated from distinct changes in the local dialect. All seven Mangyan tribes (Iraya, Alangan, Tadyawan, Batangan, Hanunuo, Buhid and Ratagnon) have the potential interaction with the island-endemic *Penelopides mindorensis* (Gonzalez et al., 1999). Although the drastic decline in forest cover on Mindoro has limited the distribution of this hornbill to a few key localities. Theoretically, each tribe has the potential to generate cultural traditions and beliefs referring to the Mindoro Tarictic Hornbill. Sadly, only a few bits of data had been found that reflects traditional Mangyan knowledge on the Mindoro Hornbill. This paucity of information probably indicates the very limited ethno-biological documentation done in Mindoro, and would warrant future field interviews. With hornbills becoming rare, subsequent generations may have limited encounter with hornbills which prevents any transfer of traditional knowledge. It may also be a result of cultural erosion due to the influence of Tagalog and Illongo migrants that led to changes in indigenous Mangyan knowledge. This was observed in the use of local names, wherein both Mangyan and non-Mangyan guides had interchangeably used the name Taliktik or Tarictic derived from Tagalog for most parts of Mindoro, and the name Talosi derived from Illongo in southern parts of Mindoro. Ethno-biological interviews of four out of the seven tribes did not reveal any distinct Mangyan name for hornbill.

A community of Agta-Dumagats in northeast Polillo represents the only known indigenous people on the island group. However, it is not clear whether they are the original inhabitants or are recent migrants from mainland Luzon. The Polillo Tarictic Hornbill (*Penelopides manillae subnigra*) is restricted only to the two larger islands of Polillo and Patnanungan. Agta-Dumagats, Tagalog (Katanawan dialect) and Bicolano migrants from mainland Luzon all use the local name Tariktik or Taliktik for this taxon. Both Agta-Dumagats and local migrant settlers admitted to have used hornbills as opportunistic sources of protein and hunted

them extensively in the past. Prior to any conservation work on Polillo, hunters claim to bag dozens of hornbills for the bush-meat trade, due to their popularity as a local delicacy. Aside from hunting, no other specific interaction was known between indigenous people and endemic hornbills. Given their very limited distribution, rapid deforestation and high hunting pressure, the Polillo Tarictic Hornbill was classified as critically endangered by Miller (1991). Subsequent expeditions and conservation activities (around 1996) have been effective in promoting local awareness and reducing threats such as hunting. A community-based warden scheme has been established to protect the few remaining forest patches and safeguard habitats for these rare hornbills (PIBCFI, 2006).

### Human-hornbill interactions in the Philippines

Wildlife biologists in the Philippines generally classify the anthropogenic importance of wildlife into five categorical values (Gonzalez et al., 1995). Certain species may have several uses and fall within several categories, pertaining to both traditional and contemporary uses: (a) Economic – used as food/game or sources of raw materials; (b) Biomedical – usage pertaining to traditional medicine and biomedical testing; (c) Ecological – contributory roles in pollination, seed dispersal and pest control; (d) Aesthetic – symbolic use in art, recreation or kept for local exhibition; and (e) Socio-cultural – used in traditional practices and local beliefs. Likewise, hornbills can be utilized in several ways and follow multiple categories. However, in the interest of evaluating threats, they are largely hunted for the purpose of food/subsistence and sold in the live bird trade, with a proportionally high degree of usage (>50%). Other hornbills are used proportionately (<50%), mainly kept for local exhibition or used as adornments, and as trophy for sport hunting (Fig. 2). Hornbills play a significant role in some local Filipino traditions and certain species are often depicted in the art, language and beliefs of several ethno-linguistic groups. In this section, I have enumerated several key interactions noted for hornbills and indigenous people in the Philippines.

**Hornbills as adornments.** – Jewelry and other forms of adornments are worn for their aesthetic or decorative purpose. Diverse use of natural materials and display of patterns are often unique and help identify ethno-linguistic groups. Some items are used specifically to define age or gender, while others can define rank or wealth within the community. Certain artifacts even have an amuletic value and their usage may denote prestige or bestow mystical powers to the bearer. Like other indigenous cultures in Africa and Asia, hornbills have been used as symbolic décor in the Philippines, particularly amongst head-hunting tribes of northern Luzon.

The Yangnoh is a head-dress worn by the Ifugao tribes of the central Cordillera, northern Luzon. Also called “Ha-ngon pu-ngot”, it is a beaded wicker hat decorated with colorful woven cloth and feathers (usually from hackles and tail of

male junglefowl). Tribal elders usually wear a basic feathered head-dress, often during important gatherings or festivals, and some may be decorated with shells, macaque skulls and wild pig tusks. However, a more elaborate version of the Yangnoh is specifically used during weddings. The bright scarlet bill and casque of the Rufous Hornbill adorns the head-dress of the groom, while the bride wears a head-dress with a carved wooden effigy of “bul-ul”, the fertility god. With the decline of Rufous Hornbills in the central Cordillera, some head-dresses now adorn skulls of the Luzon Tarictic Hornbill. The reason for using hornbill skulls as a symbol for the groom is not fully known, but it is plausible that Ifugao value the unique role of male hornbills as a primary provider to the nesting female. There seems to be some parallelism with the hornbill-feathered head-dresses used by Iban and Orang Ulu tribes of northern Borneo, with the hornbill helmet of Nishi tribes from northeast India, and decorative hornbill head-dresses in Sulawesi (White & Bruce, 1986).

The Batling is an intricate pair of dangling earrings worn by men of the Illongot tribes of northeast Luzon. Primarily derived from carved red bills of the Rufous Hornbill, it is festooned with beads, metal rings and shell pieces or blunt spines of the pencil-spined urchin. It symbolizes masculine prestige and believed to provide head-hunting powers to its bearer. It is worn only by warriors during ceremonial gatherings to signify their successful headhunt. Only men who had taken at least two heads are allowed to wear these hornbill earrings. A similar head-hunting tradition of wearing earrings is also known from the Dayak tribe from Borneo.

The Panglao is the Illongot headhunting headgear worn only by men who have taken two heads. This rather large (50 cm) gaudy head-dress has an entire ornate skull of the Rufous Hornbill attached to wickerwork, decorated with seeds, beads, shell or pieces of mother-of-pearl. It identifies a triumphant head-hunter and notches added to red bill records all his successful hunts. The prestige of wearing this elaborate headgear indicates maturity and affirms reverence. These qualities may be associated with the majestic Rufous Hornbill, since Illongot tribes regard them as a symbol of head-hunting. It is unclear why Rufous Hornbills were chosen for this tradition, but we can suggest that the blood red colour of its bill may be linked to the bloody act of retrieving human heads. The Illongot term Kayaw which means “to headhunt” has an uncanny resemblance to the local name *Kalaw* generally used for Rufous Hornbills.

Both the Batling and Panglao are worn together during rituals and ceremonies. This garish display of male fitness indicates that each adult male requires the use of two hornbills to complete his ensemble. Rosaldo (1980) noted that 90% of all Illongot men over the age of 20 had head-hunted, and presumably many of them had successfully taken more than one head. Apparently, an equal number of hornbills and enemies' heads are sacrificed for this tradition. This is unlike the Yangnoh which can be passed on as family heirlooms for use in succeeding weddings. In Borneo, Orang Ulu tribes similarly wear Helmeted Hornbill skulls and feathers

during rituals after a successful headhunt (Bennett et al., 1997), while Dayak tribes keep preserved hornbill heads and casques (Kemp, 1995). The Ifugao and Illongot tribes are the only known indigenous people in the Philippines that utilize hornbills as part of their traditional garments (Pastor-Roces, 2000).

Evidently, head-hunting is now outlawed and no longer practiced by all head-hunting tribes in northern Luzon, and both have become curious artifacts for collectors. Like many cultural artifacts of indigenous people, a Panglao head-gear was recently posted for bidding on webpage specializing on tribal art. This warrior's heirloom was reputedly sold at this on-line auction for US\$ 7,000 equipped with a CITES permit and certification of authenticity from the Philippine National Museum. Sadly, poverty and the ban on head-hunting had forced several Illongot families to sell their prized heirlooms. On the lighter side, this ban may have indirectly reduced the demand for new hornbill skulls for use in making the Batling and Panglao. Influences of modern living may have urged some impoverished clans to auction them to collectors and tourists.

However, tourism may have reshaped the way Ifugaos traditionally use the marital Yang-noh. I had chanced upon promotional photos of an Ifugao maiden and young boys wearing the hornbill head-dress. Apparently, a dozen Ifugao dancers were performing in front of spectators during a festival, and each wore a hornbill head-dress. This probably is taboo, since women and children are not supposed to wear a groom's hornbill head-dress. Breaking customs for purposes of tourism no longer justifies the right to hunt hornbills for traditional use. A recent report of fresh Rufous Hornbill heads being dried outside a shop in Baguio City seems alarming. Alternatives are available to augment the demand for hornbill skulls. A Filipino dance troupe had used paper mache hornbills for their Ifugao costumes. On keeping with a more realistic look, Ifugao tribes can replace real hornbill heads with carefully painted fiberglass replicas. This conservation strategy was used successfully by Nishi tribes of northeast India.

**Hornbills as food.** – The exponential increase in human population have severe impacts on natural resources in the Philippines, given that impoverished communities living near remaining forest patches may illegally hunt wildlife to supplement their diet. A number of indigenous people living within these forests still practice traditional hunting and gathering, thus are dependent on large game for bushmeat, including hornbills. An anthropological account made by Walker (2006) on the Aetas of Florida Blanca, Pampanga described how they regularly hunted both Rufous and Luzon Tarictic Hornbills with steel-pointed arrows in the forests of the Zambales mountain range, northwest Luzon. Both hornbills and Aetas suffered severe losses when Mount Pinatubo erupted in 1994. The Agta tribes of northeast Luzon were known to hunt hornbills opportunistically and had been observed to use hornbill feathers for their arrows (Griffin pers comm., 2009).

Preference for hornbill meat among certain communities in the Philippines is not widespread, but rather restricted to a few small islands. It is usual practice to prepare spicy meat dishes as delicacy to accompany alcoholic beverages especially during social gatherings. The preference of using bush-meat for preparing “Pulutan” is shared by both the rich and poor. Hornbills have been documented to be used as a delicacy in several island communities such as Basilan and Polillo. Both harbours an endemic hornbill and are therefore vulnerable to overexploitation. Four specimens of Basilan Tarictic Hornbills were observed being prepared for a holiday feast (Lint & Stott, 1948). A hunter interviewed in Polillo claims that hornbills are delicious and taste better than other birds. By contrast, some communities in Mindoro and Samar islands claim that hornbills are actually distasteful and often avoided. This lack of consistency cannot address the question of whether hornbills taste good or not. African Pied Forest Hornbills (*Ceratogymna*) are heavily hunted in Cote d’Ivoire, Cameroon and Congo, but are not eaten by Wabali and Bandaka tribes of Zaire (Kemp, 1995).

Although Polillo Tarictic Hornbills were once regarded as a local delicacy, public awareness helped convince local people to ban hunting and protect their island endemic hornbill. No longer hunted as a delicacy, it is now regarded as a municipal emblem and an annual Tarictic festival was created to celebrate its recovery. Unfortunately, this is not the case for the Basilan Tarictic Hornbill where conservation efforts have not been implemented due to continue insurgency problems. Little is known about the status of this endemic hornbill due to the lack of any recent surveys. Collar et al. (1999) noted an account about Sulu Hornbill nestlings being collected from the nest and eaten by local hunters. Given their extremely limited distribution, dwindling forests and added hunting pressure, the plight of the Sulu Hornbill is definitely not promising. However, on-going conservation projects are aimed to protect the few remaining lowland forests in Tawitawi Island, and the last stronghold for the Sulu Hornbill.

**Hornbills as traditional medicine.** – Different species of hornbills, both adult and young are used in traditional medicine in India either dried or as hornbill oil (Datta, 2007). Kemp (1995) noted yearly harvest of hornbill chicks from Orissa and many adults shot in Assam for this purpose. Little is known about the use of hornbills in traditional medicine in the Philippines. However, the preference of hornbills as a delicacy in some communities are often linked with the notion that they serve as an aphrodisiac. This belief that eating hornbills would provide vigor to the male libido or help in sexual endurance is clearly unsubstantiated. A single account made by a hunter in Polillo cannot support this claim that Tarictic Hornbills are used traditionally as an aphrodisiac (Gonzalez & Dans, 1996). One interesting account of hornbills being used as a medicine originates from Marinduque Island. This small island south of Luzon harbors both Rufous and Luzon Tarictic Hornbills. Some locals believe that pieces of nest sealant taken from hornbill nests can be used to prevent fever, but the details on how it is administered is not known (M. Sanchez pers comm., 2007).

**Hornbills for local exhibition and live bird trade.** – The elaborate bills and attractive plumage of hornbills makes them prime targets for poachers and bird collectors. However, these birds require specialized husbandry care and do not make ideal pets. Being canopy frugivores, Philippine hornbills are difficult to catch as adults. Often nestlings are taken from the wild to be sold as either household pets or kept for local exhibition at business establishments. Some prominent families and politicians also have a private collection of birds. In remote villages, some birds are poorly kept in small wire cages or tied with a nylon string to nearby tree. They are usually fed with rice porridge or bananas. Most do not survive for long in captivity, and those that reach maturity develop deformed bills and feet. In addition to direct extraction of nestlings from nest cavities, some incidental captures are made from felled nest trees due to logging or forest cleared for agriculture. Nestlings that survive the ordeal of transport eventually reach bird hawkers or local pet shops, and few reach the popular shops of Cartimar and Aranke in Manila.

Due to their proximity to remnant forests, some indigenous people have been known to engage in poaching and helping supply the illegal wildlife trade. The Aetas of Bicol peninsula and Zambales are well known for their traditional hunting methods. Bird hawkers selling live wildlife along an old highway in Camarines Norte usually employ Aeta hunters to poach wildlife, including fledglings of Rufous and Luzon Tarictic Hornbills. Maing-kik bird hunters of Dalton Pass in northeast Luzon use large nets and bright lights to attract and catch birds flying over the high mountain ridges, although they rarely capture hornbills. Some Tagbanua tribes in Palawan engage in poaching tall nest cavities for parrot and myna chicks using forest vines, and occasionally encounter hornbill nestlings.

**Hornbills in traditional beliefs.** – The loud calls and unique nesting behavior have made hornbills a prominent fixture in African and Asian folklore. In local bird lore, hornbills have become a major part of myth, ritual worship, deification, iconography, story-telling and superstition. This belief system transcends into more creative outputs such as traditional customs and tribal art. Hornbills are popular themes among many indigenous cultures, usually in visual art (sculpture, effigies), literature (fable, poem, song), ceremonial dance and adornments. Hornbills also play an important role in the development of ethnic languages, since indigenous people often have specific names to help differentiate species.

Hornbills are also perceived differently by local people, and their presence may either have good or bad in their belief system. A comparison of these local beliefs in the Philippines reveals an equal percentage of both negative and positive implications. Some indigenous cultures welcome hornbills in their communities and regard them as natural “Time-keepers”, often preferred over the farmyard rooster. The Rufous Hornbill in Samar is referred to as Orasan, which in Filipino means a clock. The old Spanish name used in colonial times to refer to hornbills was Reloj del Monte, which translates to clock of the mountains (McGregor, 1907).

Natives usually claim that hornbills call on the hour, although naturally these birds have no true notion of measured time. However, hornbills regularly call from their communal roosts during sunrise and sunset, sometimes audible to about 1.5 km (DuPont & Rabor, 1973). Hornbills are also revered as gods or spiritual messengers in many Asian and African societies, with some regard to have an amuletic or totemic function. Head-hunters in Northern Luzon believe that wearing hornbill jewelry gives them head-hunting prowess (Rosaldo, 1980).

Other indigenous cultures do not welcome hornbills in their community, but rather consider them as bad omen. The Palawan Hornbill is usually associated with fever or death amongst the Tau-batu tribe. When a hornbill arrives to their farmplot, they will abandon their home and constructed a new hut far away from the old house (Peralta, 1979). This is very similar to the beliefs of the Murut people of Borneo, which consider hornbills as strict taboo and would bring diseases (Bennett et al., 1997). White-crowned Hornbills (*Berenicornis comatus*) are an important omen to Kayans in Sarawak, Borneo (Hose, 1893 in Kemp, 1995). Local people in Gambia have a less passive approach to negative beliefs on hornbills. They regard seeing Northern Ground Hornbills (*Bucorvus abyssinicus*) not in flight as bad luck, thus to change their luck, they chase them into flight. Whereas, Pied Forest Hornbills (*Ceratogymna*) are avoided by Wabali and Bandaka hunters of Zaire because of local taboo (Kemp, 1995).

**Hornbills in indigenous art.** – The garish bill and casque, loud raucous calls and unique nest-sealing behavior had

drawn man’s attention to hornbills, earning a prominent part in most Asian and African cultures, particularly in emblems, lores and ceremonial dances (Kemp, 1995). Indigenous Filipinos often derive many ritual dances from nature, mostly from birds. The Tarictic dance from tribes of the central Cordillera is copied from the movements of the Luzon Tarictic Hornbill. Similar ceremonial dances depicting hornbills are practiced in Nagaland and several tribes in Borneo. The Dayak dance imitates the rapid jumping habit on tree branches by Rhinoceros Hornbills when threatened (Kemp, 1995).

Accounts of oral traditions and literary arts about hornbills made by indigenous cultures in the Philippines are extremely rare, which warrant further search in historical archives or additional field documentation. I was able to find a few post-colonial and contemporary Philippine literature featuring hornbills. “Ang Maya at ang Kalaw” is a comedic poem from Mindanao about the friendship between a sparrow and a hornbill. A similar poem about hornbills was modified into a song in Cebuano, called the “Kalaw”. Two recent books had taken into account fables about the hornbill which were probably derived from oral traditions of ethno-linguistic groups. “Iclog iti calao bolig iti lima” is an Ilokano fable translated as “The Calao’s egg is five parted”. However, what is referred to as the egg in this story, probably refers to the elaborate casque (Starr, 1909). Another fable was featured as the main title of a children’s book written by Menez (1993), which is collection of fables in the Philippines, which was entitled “Why the *Kalaw* wears a casque and other stories for children”. An illustrated children’s book by Perez (2007) entitled “How Tala found her courage”, describes the life of a family of Rufous-headed Hornbills at the Mari-it Wildlife conservation park.

Hornbills in Filipino tribal art are equally rare, although a number of carvings and woven baskets made by indigenous people did feature hornbills. The Tagbanua tribes of Palawan are known for their fire-etched wooden carvings of wildlife, including a few hornbills. Expert Hiligaynon weavers from northern Panay can fashion thin strips of Nito (*Lygodium* fern) vine into baskets and intricate wicker art, which includes woven figures of the Dulanagan or Rufous-headed Hornbill. Although not directly described as hornbills, wood carvings and effigies of the mythical Sari-manok of Maranao tribes

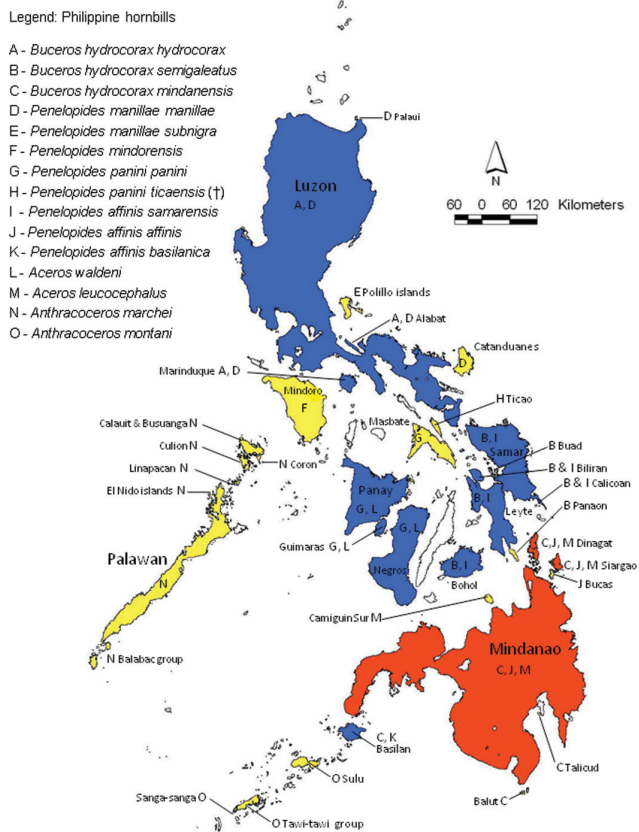


Fig. 1. Distribution of Philippine hornbills.

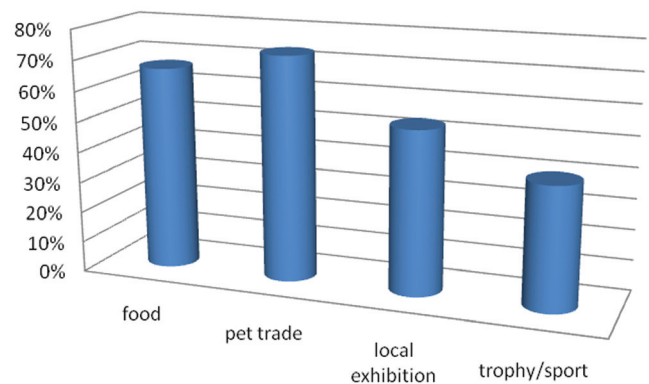


Fig. 2. Utilization of Philippine hornbills by indigenous people.

Table 1. Some local names used for Rufous hornbill on Luzon Island.

Local name	Language or dialect
Kalaw/Calao	Tagalog, Filipino
Kalaw/Calao	Bicolano
Angaw	Ifugao (Ayangan dialect)
Kango	Ifugao (Guhang dialect)
Gasalo	Ayta (Mag-Indi)
Kalo	Aeta (Dinapigue)
Kalaw/Calao	Ilocano, Ibanag
Reloj del Monte	Spanish (colonial period)

of Mindanao and Sulu appear remarkably as hornbills, noted from the long curved bill and prominent casque. The name “manok” often easily translates to fowl or chicken, but the earlier Moro name actually refers to a more general use for bird. However, the Sari-manok is not unique to the Philippines and is generally shared with other indigenous Muslim groups in Southeast Asia.

**Hornbills in languages and dialects**

There are 175 living languages in the Philippines as documented in Ethnologue, Languages of the World. Of this total, 171 are considered as living languages and four are now regarded as extinct languages. About 40 living languages are now threatened by cultural erosion (Headland, 2003; Grimes, 2000). By contrast, there are only 14 extant hornbill taxa and a single extinct hornbill taxon in the Philippines, of which seven taxa are considered to be threatened. A comparison of Philippine languages and hornbill taxa, shows that hornbills are proportionately more threatened but less diverse than language. Hornbills are being lost more to extinction than the disappearance of endemic languages (Fig. 3).

Generally, there are eight major languages commonly spoken in the Philippines, each with many different dialects. There are also several foreign languages introduced by migrants and colonialists, such as Chinese, Spanish and English. Pilipino

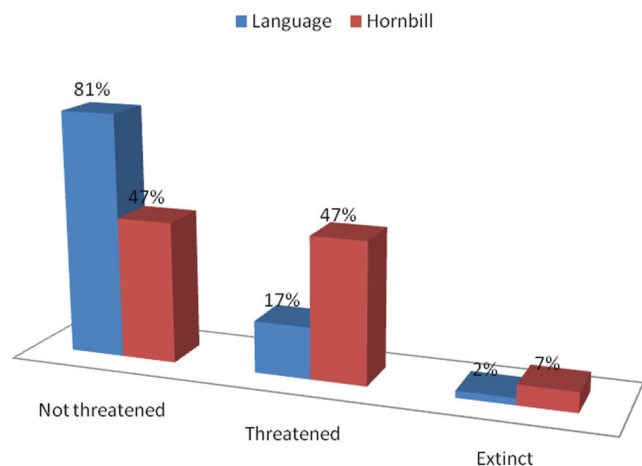


Fig. 3. Status of Philippine languages and endemic hornbills.

(or Filipino) is the national language, which was created and taught extensively in schools to serve as the official spoken language between the many different ethno-linguistic groups. By comparison, there are nearly equal proportions of endemic languages and hornbill taxa in each major island group in the Philippines, with the exception of Luzon. Luzon Island distinctly contains too many different ethno-linguistic groups, but only two species of hornbills (Fig. 4). We therefore expect for Rufous and Luzon Tarictic Hornbills to have more diverse human interactions than all other taxa of Philippine hornbills. The Rufous Hornbill is generally known as Kalaw or Calao in most languages and dialects, but in Luzon, other ethnic groups have more diverse and definitive local names for this species (Table 1). It is known as Angaw or Kango amongst Ifugao tribes of central Cordillera, north-central Luzon (Numbanal & Ackiangan, 1958; Purvis, 1982). But it is also called Gasalo by Ayta Mag-Indi tribes of Florida Blanca in Zambales range, NW Luzon (Walker, 2006) and Kalo by Agta tribes of Dinapigue in Sierra Madre range, NE Luzon (B. Griffin pers comm., 2009).

**Hornbill linguistics**

Most local bird names in the Philippines, regardless of ethno-linguistic affinity usually have onomatopoeic origins or are descriptive of the bird’s appearance, coloration and behavior. This is exemplified by the name “pok-pok” given for the Coppersmith barbet and “mananahi” given for tailorbirds, wherein the local name is translated as “tailor”. This is equally true for many of the local hornbill names. Notably, the English name Tarictic which refers to taxa under the genus *Penelopides* was taken from its widely used onomatopoeic local name “tarik-tik”. Kemp (1995) described *Penelopides* to utter soft squeaking calls “te-rik-tik-tik-tik”, reminiscent of a baby’s squeeze-toy. However, we need to ask the question, do all local hornbill names follow an onomatopoeic origin? To determine this, I made a comparison of known local names for each Philippine hornbill taxa with their syllabilised vocalizations in Table 2 (Kennedy et al., 2000).

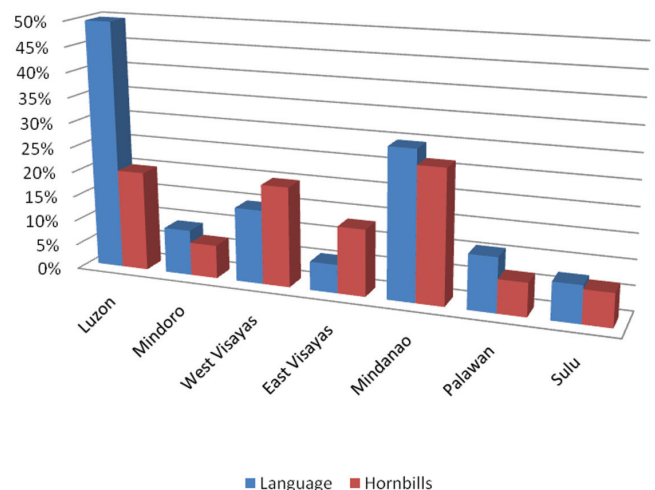


Fig. 4. Distribution of Philippine languages and hornbills within island groups.



Table 2. Local names of Philippine hornbills and their possible onomatopoeic origins.

Hornbill taxa	Local names	Syllabicated vocalizations
<i>Buceros hydrocorax hydrocorax</i>	Kalaw/Calao, Kalo, Gasalo, Angaw, Kango	Kaaaww/aaw/ Kanhaw, ke-haw-haw
<i>Buceros hydrocorax semigaleatus</i>	Kalaw, Reloj del Monte, Cau	Kaw, kaw
<i>Buceros hydrocorax mindanensis</i>	Kalaw	Kaaaww/aaw/ Kanhaw, ke-haw-haw
<i>Aceros waldeni</i>	Dulungan, Kalaw	Awawawawk
<i>Aceros leucocephalus</i>	Tuhok, Kalaw	Awwk
<i>Anthracoceros marchei</i>	Talusi	Kuk,kuk,kak/kuk-kuk ka/ caaawww, kreek-kreek
<i>Anthracoceros montani</i>	Talusi, Teugsi	ghaakh/ghaak-ghaak gaak/ gagagaakh, ghaakh
<i>Penelopides manillae manillae</i>	Tariktik, Taliktik, Talisi, Talactic, Kango	eenk/ tik, tiktika-tik
<i>Penelopides manillae subnigra</i>	Tariktik, Taliktik	tik-tik, tikitiki-tik
<i>Penelopides panini panini</i>	Tariktik, Talusi, Taosi, Taric	tarik-tik, tarik, tariktik
<i>Penelopides panini ticaensis</i>	Terek	tirik, tirik
<i>Penelopides affinis affinis</i>	Talusi, Tao-si	Toot-toot, tut-tut
<i>Penelopides affinis samarensis</i>	Talusi, Tausi, Tao-si	tarik-tik, tarik, tariktik
<i>Penelopides affinis basilanica</i>	Talusi	Not known
<i>Penelopides mindorensis</i>	Tariktik, Talusi	tirik, tirik

The majority of the local names were probably based on their voice as shown by their call syllabication. This is evident for nearly all Tarictic Hornbills, except for the *Penelopides affinis* complex, which in most Visayan dialects are called “talosi”, and is vaguely onomatopoeic. The name “kau” or “ka-law”, which is often used for large hornbills, has an onomatopoeic origin, possibly derived from their resonating crow-like calls. The local name Dulungan used specifically for the Rufous-headed Hornbill was derived from the Hiligaynon term for “watching from vantage point”, possibly referring to the male’s behavior of perching atop tall branches near its nest.

Despite the diversity of indigenous Philippine languages, very few local hornbill names are documented. There is a need to conduct interviews of each of the major tribes about the local vernaculars they use for hornbills before they are lost to cultural erosion. Migration between islands has caused some communities to adopt different names for their hornbills. This was observed in Mindoro, wherein most Mangyan tribes use the Tagalog name “tariktik” for the Mindoro hornbill due to the influence of Tagalog migrants from Luzon. But in the southern part of the island, the Visayan name “talosi” is now used, due to the influence of Ilonggo migrants from Panay.

Surprisingly, Philippine hornbills have official names translated into several foreign languages, particularly in English, Japanese, Dutch, German, French, Polish and Spanish. However, given the variety of local names for different taxa, currently there is no official name known in Filipino. Apparently, all birds in the Philippines currently do not have any official Filipino names. We are forced to use scientific names and English names to refer to hornbills across different indigenous languages. Comparing all the known names for each taxon in literature, it appears that there are more foreign names available than there are local Philippine names (Fig. 5). Even among English names, some

hornbills are given many different monikers. The Rufous Hornbill for example, is also referred to as the Philippine Brown Hornbill, Great Philippine and Flat-casqued Hornbill (Elliot, 1882).

Given the absence of any official Filipino names for all hornbills in the Philippines, I have compiled all known local names for all 15 taxa from available literature and derived a set of names considered to be consistent to most major languages and dialects (Table 2). The name “kalaw” often refers to all large hornbills like *Buceros* (and *Aceros*) in most Philippine languages and is used consistently for Rufous Hornbills within its range. Likewise, the name “tariktik” appears to be constant for all forms of *Penelopides*. However, the name “talusi” has been used interchangeably for both *Penelopides* and *Anthracoceros*, but appears to be constant for *Anthracoceros* within its range. The name “dulungan” is rather distinct for *Aceros waldeni*, but I had taken some liberty in extending this to its congener (*Aceros leucocephalus*), which had a less appealing name of “tuhok”. I had also refrained from using the same name “kalaw” for *Aceros*, to provide some distinction with *Buceros*. I had adapted a similar system of adding a geographical reference

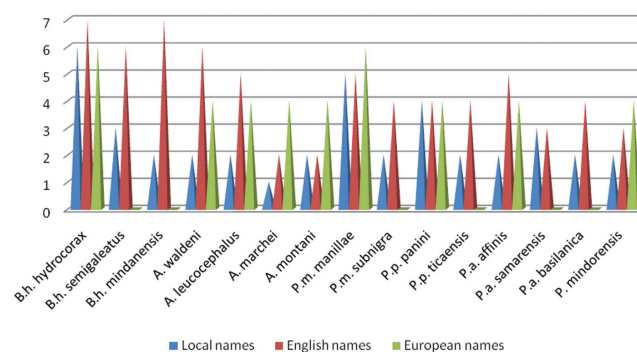


Fig. 5. Proportion of local and foreign names of Philippine hornbills.

Table 3. Proposed official Filipino names for Philippine hornbills.

Hornbill taxa	English name	Official Filipino name
<i>Buceros hydrocorax hydrocorax</i>	Luzon Rufous Hornbill	Kalaw ng Luzon
<i>Buceros hydrocorax semigaleatus</i>	Samar Rufous Hornbill	Kalaw ng Samar
<i>Buceros hydrocorax mindanensis</i>	Mindanao Rufous Hornbill	Kalaw ng Mindanao
<i>Aceros waldeni</i>	Rufous-headed Hornbill	Dulangan ng Panay
<i>Aceros leucocephalus</i>	Writhed Hornbill	Dulangan ng Mindanao
<i>Anthracosceros marchei</i>	Palawan Hornbill	Talusi ng Palawan
<i>Anthracosceros montani</i>	Sulu Hornbill	Talusi ng Sulu
<i>Penelopides manillae manillae</i>	Luzon Tarictic Hornbill	Tariktik ng Luzon
<i>Penelopides manillae subnigra</i>	Polillo Tarictic Hornbill	Tariktik ng Polillo
<i>Penelopides panini panini</i>	Visayan Tarictic Hornbill	Tariktik ng Panay
<i>Penelopides panini ticaensis</i>	Ticao Tarictic Hornbill	Tariktik ng Ticao
<i>Penelopides affinis affinis</i>	Mindanao Tarictic hornbill	Tariktik ng Mindanao
<i>Penelopides affinis samarensis</i>	Samar Tarictic Hornbill	Tariktik ng Samar
<i>Penelopides affinis basilanica</i>	Basilan Tarictic Hornbill	Tariktik ng Basilan
<i>Penelopides mindorensis</i>	Mindoro Tarictic Hornbill	Tariktik ng Mindoro

used for English and other foreign bird names to distinguish between species and subspecies. This system applies well for Philippine hornbills, considering that all congeneric taxa exhibit an allopatric distribution. The decision to use Panay, Mindanao and Samar as the prime geographical references for *Penelopides* and *Aceros* hornbills occurring in multiple islands is based on the rule of seniority. Borrowed from taxonomy, this refers to the original location where the taxon was described or its type locality. Table 3 enumerates the proposed official Filipino names for all 15 Philippine hornbills, which hopefully bridges all languages and provide some degree of consistency of nomenclature across the islands.

### Contemporary human-hornbill relations

Most interactions between indigenous people and hornbills in the Philippines are based on traditions and beliefs passed on through generations. There are some relationships which had evolved more recently, and have been the basis for the development of conservation activities. The Tarictic festival of Polillo was initially organized in 2002, following increased local awareness for the plight of the island's endemic Polillo Tarictic Hornbill. Previously regarded as a delicacy, it is now protected by municipal law and often used a local emblem. A concrete statute of this hornbill was erected at the entrance to the town plaza to welcome visitors to Polillo town (PIBCFI, 2006). Other hornbills in the Philippines were similarly recognized as official emblems, often taking a geopolitical role. The Rufous-headed Hornbill or Dulangan is now being used as a local emblem in Iloilo Province. Hornbills are used as charismatic flagship species for conservation and eco-tourism (Oliver & Wilkinson, 2007). They have widely contributed to increased bird-watching tours in the Philippines, being ideal subjects both for nature photographers and serious birders. The attraction of Philippine hornbills has been immortalized in numerous lithographs and

scientific illustrations, some reproduced as stamps, prints and postcards, including those by P. Castañeda, W. Oliver, R. Aquino, E. Poole, O. Figuracion, M. Woodcock, W. Cooper, T. Espinosa, S. Kobayahsi, E. Cruz and J. Pierce.

The revitalized tourism program in the country had highlighted traditional cultures and festivals of many Philippine indigenous people. Among these, came the popularity of dances from the central Cordillera, sometimes implemented by less traditional (or non-tribal) dance troupes. To add on to the elaborate costumes, the use of the Yangnoh headdress has been extended beyond its original marital purpose and now being showcased as part of tourism experience. For some dance troupes, paper maché hornbill heads would suffice, but in one festival held in Benguet Province, real hornbill heads were used to adorn headdresses of young street performers. It is rather questionable, where and how the organizers were able to amass so many authentic Yangnoh hats.

Taxidermy trophies resulting from sport hunting have not been fully addressed in the Philippines, although several prominent families have been known to have a collection of wildlife trophies, and apparently hornbills are rare in these collections. Hornbills are more popular as live additions to a private collector's backyard wildlife menagerie than they are stuffed as display trophies. However, there is a rich collection of Philippine hornbill specimens in various museums throughout the world. Some of these specimens are now deposited in prominent collections like the Natural History Museum in Tring and the Field Museum in Chicago, where some of the type material are deposited. Bills of hornbill skins are often characterized by their riddled appearance, usually resulting from shotgun pellets. Due to their traditional use in Igorot and Illongot headgears, there are several hornbill heads kept as cultural artifacts in anthropological and art museums. Others are also auctioned by galleries to collectors of tribal art.

Study skins provide important historical accounts on the distribution of hornbills in the Philippines, particularly for extirpated populations and threatened taxa. A review of skins kept at Tring and Paris museums, indicated historical specimens collected from Sulu, Guimaras, Camiguin Sur and Panaon islands, all of which no longer harbor any hornbills at present (Gonzalez, 2007). From Whitehead's collection of Rufous Hornbills from Mount Data and La Trinidad, Benguet indicated the occurrence of this species within the domain of Igorot tribes, to which none currently occur. Curio (1995) described how the inherently rare Ticao Tarictic Hornbill had slowly succumbed to extinction, where three individuals from this very sparse island population were collected in July 1971. A similar scenario was observed for the Sulu Hornbill, wherein it is now extirpated on Sulu and a handful survive in Tawitawi. Bourns and Worcester had collected 14 specimens from Tawitawi and Sulu during the 1900s, and another 7–9 specimens were collected by Rabor on Tawitawi in the 1970s (Dickinson et al., 1991). Although both collections are extremely important, their impact on the genetic viability of the species has not been evaluated. The value of these specimens now extends to modern genetic studies such as phylogeny, paternity and phyloforensics. The same is true for other earlier collections of Asian hornbills derived from past expeditions of eminent naturalists, particularly by Wallace, Hose, Steere and Moseley.

### CONCLUSIONS

The use of hornbills in traditional practices and beliefs of indigenous people in the Philippines shows parallelism with other Asian and African cultures. Although not as rich and diverse as India and Malaysia, there are some apparently distinct and interesting practices. In particular, the use of hornbill heads in the elaborate adornments of head-hunting tribes of northern Luzon. Human-hornbill interactions are relatively rare in the Philippines, despite the diversity of hornbill taxa and ethno-linguistic groups in the islands. This scarcity of accounts is more attributed to limited documentation done for both, and the potential interactions are enormous given that over 90 indigenous people and 15 endemic hornbill taxa occur. Urgent documentation is needed to account for these varied interactions, centered on islands with hornbills, since both hornbills and people (their culture and language) are now threatened with extinction. The apparent lack of any official Filipino name given to Philippine hornbills indicates the limited studies made on hornbill linguistics, and hopefully the proposed official names would be acceptable for national use. We also need to emphasize the potential contributions of these traditions and beliefs to community-based conservation. Merging biodiversity concepts with local knowledge may be advantageous in preserving both culture and nature. In this regard, the conduct of ethno-ornithological surveys is vital in order to document indigenous knowledge about Philippine hornbills, such as local names, oral traditions, art and beliefs.

Hunting and poaching are still important prevailing threats to hornbills in the wild, but we need to measure how much impact occurs from hunting pressure, particularly from indigenous people. From this, we can further understand human-hornbill interactions and possibly adapt this use of hornbills in traditional culture and beliefs to conserve hornbills. I intend to apply these concepts on human-hornbill interactions in my future research on Philippine hornbills. I hope to conduct an ethno-ornithological survey of indigenous people residing within the Northern Sierra Madre Natural Park, focused on their utilization of two sympatric hornbills (*Buceros hydrocorax* and *Penelopides manillae*). I plan to compare the effects of traditional use of two different tribes on hornbill populations within the park, namely, the Ilongots/Ifugao which regard hornbills to have a symbolic role in their culture and the Agta which primarily hunt hornbills for subsistence. I hope to find congruent practices between these two tribes and use this as a basis for developing community-based conservation strategies.

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