

Wildlife Hunting and Utilization in Ulu Baleh, Sarawak, Malaysian Borneo

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Abstract Poaching is one of the greatest immediate threats and a serious conservation challenge facing wildlife in Borneo. Medium- to large-sized mammals, while charismatic, are hunted for consumption and sale. This study focuses on wildlife hunting and utilization of selected communities in a remote area in Sarawak, conducted using interview surveys within communities who hunt wildlife in Ulu Baleh. The calculated hunting pressure index in Ulu Baleh (2.24) is considered low compared to other parts of Sarawak. Local communities are dependent on wildlife protein and medicine. Even though the common hunting offtake included the bearded pig and deer species, for the hunter's own consumption, hunters were opportunistic in taking non-target species and selling surplus meat. Lack of awareness of the implications of unsustainable hunting and difficulty in monitoring by the relevant authorities appear to be the main challenges to wildlife conservation in the area. This paper highlights the lack of research documenting wildlife utilization in the Ulu Baleh region and the implication of these results are particularly important for future adaptive wildlife management, especially for species of conservation importance in Sarawak.

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Introduction

Hunting can be unsustainable in many areas, including in indigenous hunting areas when hunting pressure is unacceptably high (Pangau-Adam et al. 2012; Robinson and Bennett 2000). Humans have used animals for food, medicine, garments, tool manufacturing, as well as cultural-religious practices (Bennett et al. 2000; Melo et al. 2014; Mohd-Azlan and Fauzi 2006). Likewise, terrestrial vertebrate fauna have been utilized for various reasons, including subsistence, economy, pest control, as well as cultural needs (Bennett et al. 2000). Such uses have often affected targeted species, sometimes leading to their endangerment, especially those with low density and/or slow reproductive rates (Melo et al. 2014; Pangau-Adam et al. 2012). Moreover, increases in human population, improved hunting techniques and gear,

modern transportation, ease of accessibility along logging road networks, and increased economic benefits have led to increased hunting pressures (Bennett et al. 2000; Pangau-Adam et al. 2012). Human innovations in technology have fueled cultural advancement, but also expanded wildlife utilization in tropical forests (Chin 2001).

Three pieces of legislation exist for wildlife conservation in Malaysia: the Sarawak Wild Life Protection Ordinance (SWLPO) 1998 in Sarawak, Wildlife Conservation Enactment (WCE) 1997 in Sabah, and Wildlife Conservation Act (WCA) 2010 in Peninsular Malaysia. The WCE and WCA are rather comprehensive and have been recently amended, whereas SWLPO is currently being reviewed by the relevant authorities (Mohd-Azlan 2014). Local communities in Sarawak are allowed to hunt unprotected species (e.g., bearded pig [*Sus barbatus*],

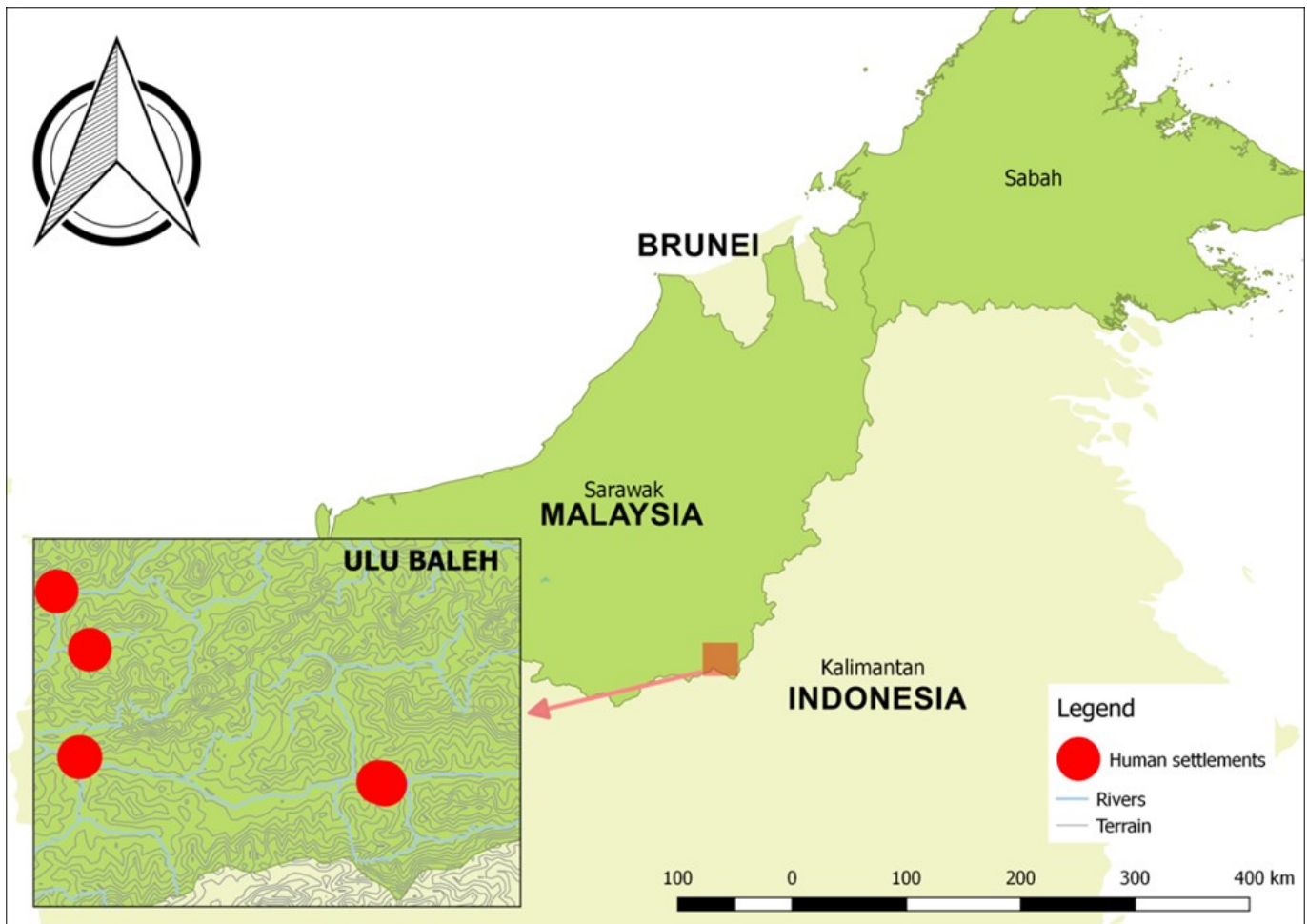


Figure 1 Map showing the study sites that includes one long house, two huts, and a logging camp in the Ulu Baleh region bordering Kalimantan, Indonesia.

deer [*Rusa unicolor*], muntjacs [*Muntiacus* spp.], and mousedeer [*Tragulus* spp.] outside protected areas for personal consumption under the SWLPO 1998.

Many anthropological and ethnographic hunting studies have been conducted in tropical forest regions. Hunting pressure for subsistence tends to decrease with economic improvement of local communities, along with changes in traditional culture, which in turn has the potential to reduce hunting pressure on the target species, which can be especially important in fragile forest patches (Byers et al. 2001; Wadley and Colfer 2004). Some local communities, however, are dependent on wildlife in the interior parts of Sarawak (Ka-Yi and Mohd-Azlan 2018). By undertaking interviews and surveys with local communities, information on wildlife distribution, hunting pressure, and dependency of the communities on these mammals can be obtained. Previously, we compared

hunting intensity in the interior regions of Sarawak (Ka-Yi and Mohd-Azlan 2018). In the present communication, we examine wildlife usage and levels of dependency by local communities in the Ulu Baleh region, as there is limited information on the subject in this area.

Methods

Study Location

Baleh is accessible by both land and river (Figure 1). Transportation has recently improved, with logging roads entering the area since the early 2000s. The fastest and more affordable mode of transport takes eight hours (depending on river flow) on an express boat from Sibul, with a transit stop at Kapit town, before heading towards the Baleh River and reaching Putai (the final stop of the commercial express boat). Another few hours are spent overland in an off-road

vehicle, depending on the destination. A large area in Ulu Baleh towards the Kalimantan border has been gazetted as the Baleh National Park (Mohd-Azlan et al. 2019). Logging activities were previously operational within the area and there is a proposal to build a hydropower dam with an elevation of 220 m around Putai, located after Entawau.

Indigenous tribes such as the Iban and Kenyah populate this area, although the population and number of longhouses are sparser than in the Kapit region. Wildlife and non-timber forest product utilization can be seen around the study area, where the villagers hunt and collect natural resources, such as rattan and timber. There is a single logging camp and long house with several farm huts near the study area. The logging camp consists of both locals and outsiders who occasionally hunt in this area. Even though anthropogenic activities can be seen around the longhouses, higher impact occurs from conventional commercial logging concessions, such as alteration of natural forest structures by harvesting trees and the construction of logging roads and skid trails.

Most of the riverine forest is in pristine condition due to the fulfilment of buffer zone requirements, although there are traces of old and active logging activities near some areas. The river water becomes clearer as one moves upriver to Ulu Baleh; it becomes muddier, however, when it rains due to logging activities upriver. The types of vegetation differ between logging concessions and forests near longhouses. The logging concessions consist of logged mixed dipterocarp forests, where logging activities were ongoing during this study, including some forests that had been logged multiple times by a logging company. The forests surrounding the longhouse are mostly *Temuda*, secondary forests or planted with crops, including rice and both vegetables and fruit-bearing trees: e.g., durian (*Durio* spp.), black olive or *dabai* (*Canarium odontophyllum*), cassava (*Manihot esculenta*), star gooseberry (*Phyllanthus acidus*), and sweet leaf (*Sauropus androgynus*).

Data Collection

The survey asked about hunting patterns by the communities in Long Singut, Ulu Baleh, which consist mainly of Sarawakian indigenous peoples, with the Kenyah being the majority in this study. The hunting interview involved the completion of a guided questionnaire (Supplementary Material) in conversation with all individuals with recent hunting

experience (within the last 2 weeks) within the study areas, in order to obtain information on hunting patterns, the importance of hunting to their livelihoods, and any issues related to hunting activities. The elderly and women were excluded from the interviews, as they no longer hunted or were not involved in hunting, respectively.

Two types of community data were collected: demographics and individual hunting pattern data. Interview structures follow according Chin (2001). Interviews were carried out between May 2015 and March 2016.

Illustrations from *A Field Guide to Mammals of Borneo* by Payne et al. (2007) were used for identification of animal species. The interviews were conducted rather informally in the local native language, accompanied by an interpreter, or in Malay. Individual hunting interviews were conducted in an attempt to obtain more accurate details on the hunting patterns in a community (e.g., hunting effort and yield). Each interview involved the completion of a questionnaire administered to the hunter referring to both recent hunting trips and prior hunting trips in general; this questionnaire is attached as Supplementary Material.

The interview was structured to focus on (1) hunting technique, (2) hunting duration, (3) hunting intensity, (4) weapon used, (5) distribution of cryptic animal species, and (6) socio-demographics.

Analyses

Data from interviews on hunting were processed using Microsoft Excel 2010 and IBM SPSS Statistics Version 21 to produce relevant diagrams and pie charts. Hunting area was assessed from the interviewees based on maps, distance, and time taken on average for the hunters during their trips. The hunting areas were estimated according to the time taken for a hunter to cover the hunting ground. One hour of travel approximates a distance of one kilometer travelled in hill forests, when averaged to include stops, from which the approximate size of a hunting area was estimated (Chin 2001). An index of estimated relative hunting pressure was used to assess the relative intensity of hunting in an area. It is derived by estimating the number of hunters who have access to an area and dividing it by the square of the distance from their settlements to the nearest edge of their hunting area (Bennett et al. 2000). The distance is squared because the condition acknowledg-

Table 1 Hunting pressure in Ulu Baleh, list of major ethnicity, size of population, percentage of hunters of the local population that hunt, and approximate distance from hunting ground.

Ethnicity	Population	% of hunters	Mean distance from hunting ground (km) ¹	Std. Dev. ²	S.E.M. ³	Hunting pressure index
Kenyah, Iban, *Chinese, *Melanau	170	8.24	2.5	2.5	1.45	2.24

¹The distance to hunting ground was taken from the mean range of overall time taken to hunt.

²Standard deviation.

³Standard error of the mean.

*The Chinese and Melanau were employed by logging companies.

es that individuals scatter over an area, not in a single straight line. The assumptions are: 1) hunting pressure is equal in all directions from each community, and 2) hunting pressure decreases uniformly with increasing distance from the settlements. Thus, hunting pressure on an area of the community (H) is population of community \times % community who hunt / (average distance of community from hunting area)² (Table 1).

Results

A total of 28 respondents were interviewed in Ulu Baleh, focusing on male respondents who have hunting experience. Respondents were approached with the help of a local guide, who knows the hunting communities well. The majority of village community members have emigrated to the nearest town; due to urban migration, there are not many families still living in the interior of Ulu Baleh. The full community normally will only come back during festive seasons such as *gawai* (the harvest festival) or over Christmas. All of the respondents were non-Muslims (Christians, Buddhists, or folk religions). The mean size of the respondents' families during normal days is four (ranging from 1 to 6; Table 2). On average, the families in the surveyed areas earn

approximately USD 270 (range between USD 120 to USD 480) per month, with monthly expenses of USD 177 (range between USD 24 to USD 400).

The respondents reported that a majority do not have stable incomes (68%), i.e., they are self-employed (small grocery shop owners) and farmers (mainly corn, pineapples, paddy, sweet potatoes, and cassava). Most villagers work on the farm or hunt for their family's subsistence. However, 32% of the respondents work or have worked in the past with the private sector (e.g., oil and gas, logging, and plantation companies).

In general, many hunters hunted consistently throughout the year while less than half of the respondents depended on prior knowledge for hunting. Most of the hunters hunt whenever they want (89%), i.e., without specific seasons, during their spare time. Only 4% of hunters hunt specifically during paddy season, partly for pest control. Hunting duration was difficult to determine, as the hunters return once they have killed an animal or target species. However, a considerable number of the respondents spent over one day in hunting (52%). The hunters use several hunting methods: traditional hunting methods (spears, nets, snare traps, or cage traps, categorized together at 25%) and firearms

Table 2 Socio-demographic characteristics of the respondents. Value in parentheses is the approximate exchange rate for USD during the study period.

Parameters	Mean	Min ¹	Max ²	Std. Dev. ³	S.E.M. ⁴
Size of household	4	2	6	1.1	0.21
Household income in MYR/month (USD)	1100 (260)	500 (120)	2000 (480)	739.37(177.80)	139.73(33.60)
Monthly expenses in MYR/month (USD)	739 (177)	100 (24)	1700 (400)	788.97(187.72)	149.10(35.85)

¹Minimum value.

²Maximum value.

³Standard deviation.

⁴Standard error of the mean.

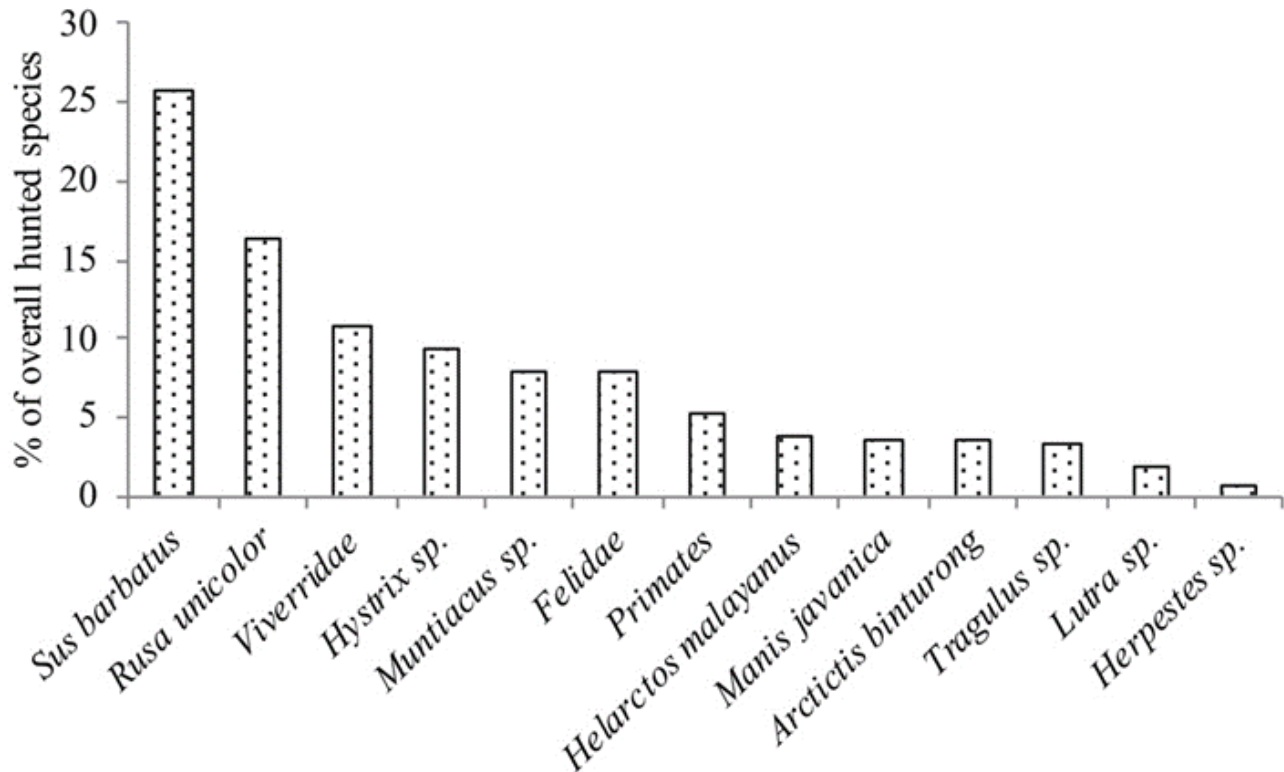


Figure 2 The frequency of overall hunted species from the respondents reported in percentages.

(purchased or self-made shotguns). Hunting dogs were also observed throughout the survey, where two to nine dogs were brought together during hunting. Hunting dogs were useful in detecting and flushing out animals and easing the capture or killing of these animals. Several transport types (boat, car, and motorcycle) were used, incorporated with walking for several hours after reaching hunting areas. Many hunted for personal use (subsistence and cultural, 85%).

In general, the bearded pig is the main target species (Figure 2); its meat is more sought after for consumption as well as sale. Bearded pigs have been the most preferred prey and a major form of bushmeat consumed by non-Muslims (Caldecott 1986; Corlett 2007; Kirupaliny and Mohd-Azlan 2012). According to most of the respondents, bearded pigs and deer were hunted the most, mainly because of their body mass and taste. An adult bearded pig and Sambar deer would earn the hunter approximately USD 720 and USD 900, respectively. Other species killed during hunting expeditions can be considered as non-target species that are killed opportunistically.

Knowledge of the use of rhino (*Dicerorhinus sumatrensis*) parts as medicine in this area indicates the perception and past dependency of the local community on this species despite its local extinction for decades (Labang 1987). At least three species of mammals were utilized for medicinal purposes by local communities: porcupine (*Hystrix brachyura*), binturong (*Arctictis binturong*), and sun bear (*Helarctos malayanus*) (Table 3). The gall bladders of these three species were believed to be a panacea, especially for curing pain from injuries or gastric conditions. Chinese medicine was also included in the table as the pangolin's scales (*Manis javanica*) and porcupine's body parts (e.g., quills, bezoar stone) were hunted for sale to Chinese buyers, who act as traders, according to the interviews conducted. Despite the differences in ethnicity, the methods used in preparation of the animal derivatives appear similar in Sarawak (Kirupaliny and Mohd-Azlan 2012; Mohd-Azlan and Fauzi 2006).

Whole pangolins can fetch up to USD 16 per kg and sometimes range from USD 25 to USD 28 per kg. Pangolin scales can be sold for up to USD 300 per kg

Table 3 Roles of several mammal species utilized as zotherapeutic sources according to the local communities from the surveyed areas.

Common	Local (ethnic)	Scientific	Parts used	Methods	Medicinal value	SWLPO 1998	IUCN status ¹
Porcupine	Landak (Iban) Setung buang (Kenyah)	<i>Hystrix brachyura</i>	gall bladder	boil hot water, dip the dried gall bladder into the water, then drink	Gastric	Protected	LC
Pangolin	Tengiling (Iban) Am (Kenyah)	<i>Manis javanica</i>	gall bladder stone (or bezoar)	scales	Panacea for cancer, fever, infections ³	Protected	CR
Binturong	Enturun (Iban) Kitan/kitan buang (Kenyah)	<i>Arctictis binturong</i>	gall bladder	boil with hot water and honey, then drink	Cure pain (from falls)	Protected	VU
Sun bear	Jugam (Iban) Buang (Kenyah)	<i>Helarctos malayanus</i>	gall bladder	soak in hot water, then drink	Gastric, and cure pain	Protected	VU
Rhino ²	Temedo/ Pemeto (Kenyah)	<i>Dicerorhinus sumatrensis</i>	horn	scratch a bit into warm water, then drink	Fever	Totally Protected	CR

¹IUCN Red List Status: Least Concern (LC), Critically Endangered (CR), Vulnerable (VU).

²Last official record in Sarawak was tracks found in Ulu Baram at the border with Kalimantan in 1987 by David Labang, but the tales of its medicinal value being passed on to the current older generations.

³TCM or Traditional Chinese Medicine.

(USD 300 to USD 190) in the black market. Typically, pangolins are caught using a net, which is long and about a meter tall, set up from the ground along ridges or animal pathways, sometimes reaching 30 m in length. These nets were set opportunistically and non-target species, such as muntjac, mousedeer, porcupine, or even juvenile bearded pig, can occasionally be strangled and sometimes killed.

The gall bladders of sun bears were kept for private use or sold illegally for USD 36 each. On many occasions the hunters reported that they would run away from sun bears, as they were known to be more aggressive, especially during parenting periods.

However, sun bears that come to farms or in chance encounters are shot, as the hunter believes an injured sun bear can become hostile. The meats are smoked and can be sold for USD 2 to USD 4 per kg.

Clouded leopards (*Neofelis diardi*) were killed opportunistically. The skins were kept by the hunters as trophies, but the canines and claws were sold for USD 24 and USD 5 each, respectively. Clouded leopard skins can fetch from USD 50 to USD 500 each and their skulls with teeth attached can be sold for up to USD 500 on the local black market (Mohd-Azlan et al. 2017).

Bezoar or “stones” from animals such as porcupines, tufted ground squirrels (*Rheithrosciurus macrotis*), and langurs (*Presbytis* spp.) were sold for USD 14 per inch, depending on the quality and size of the bezoar. One hunter in Ulu Baram was given USD 7,200 for a large bezoar he got from a porcupine. The probability of the animal bearing the bezoar is higher if the fur or quills of the animals appear to be unhealthy. Therefore, the hunter will not burn the fur or quills of these animals. Porcupines are hunted by dogs, which can detect the nest, and the hunter then smokes out the porcupines. Cage traps baited with cassava or local cucumber were also used to catch porcupines.

Discussion and Conclusions

The communities in Ulu Baleh hunt in nearby areas. This might be due to the availability of animals or the ease of accessibility due to prior logging activity. The hunting pressure index in Ulu Baleh (2.24; Table 1) is lower compared to Pelagus (14.68) and Ulu Baram areas such as Ba'buboi (7.34), Long Main (3.96), and Long Sabai (2.89) (Chin 2001; Ka-Yi and Mohd-Azlan 2018). Factors behind this difference may include the reduced extent of logging in Ulu Baleh, which is recent compared to Ulu Baram, and differences in human population densities. Activities associated with logging can significantly increase animal harvest rates and the probability of unsustainable hunting (Bennett and Robinson 2000; Robinson et al. 1999). Improvement of local economies can lead to increases in commercial hunting, as areas become more accessible with the building of roads and increased networks to urban areas (Bennett and Robinson 2000; Milner-Gulland and Bennett 2003). In the past, indigenous people used traditional techniques to hunt for subsistence. The use of modern firearms improves hunting efficiency; hence many non-target wildlife species are hunted opportunistically. Therefore, it is important to regulate and monitor such activities at many levels. In view of this, understanding the community's knowledge regarding the use of animals is a crucial step in designing conservation strategies, as this knowledge reflects the values and attitudes adopted by a community or population regarding local fauna (Melo et al. 2014). Approximately 62% of animals hunted received protection status from SWLPO 1998. Killing any totally protected or protected animal in Sarawak can result in a maximum fine of USD 12,000 or USD 2,400, respectively, under SWLPO 1998. Thus, some interviewees may not have

disclosed all of their activities, as some of the hunting could have been illegal, involving protected species. Therefore, species that receive protection status from SWLPO 1998 are potentially underrepresented in this study.

Local villagers are, however, allowed to defend themselves and their property from wildlife under Section 42 of the Ordinance, provided that they give the information to the nearest officer as soon as possible. Failure to do so will be penalized with three months in jail and a fine of USD 240. The apparent reasons for local communities' use of zootherapeutic sources included lack of knowledge about medical resources, difficulty in accessing other medicines, as well as belief in zootherapeutic effectiveness in curing diseases. All of the respondents stated that they learned about the use of zootherapeutic agents from the elderly, who may have gained the knowledge from the Chinese who have worked in the past at the logging concessions nearby. Private ownership of lands in Sarawak was instituted in the form of leases in 1875, mainly for the benefit of timber enterprises which included the Chinese (Kaur 1998). The locals who know the value of these zootherapeutic parts of the animals sell them to agents in the nearest town (Putai or Kapit) for cash. The excess meat of these animals is used as a protein source.

The communities studied are generally dependent on the wildlife near their area for meat, as accessibility of commercially available meat sources is relatively difficult in these areas. Many individuals surveyed also appear unaware of the protection status of many wildlife species. However, the data from this study cannot be used to fully understand the correlation between hunting and hunted animals throughout Ulu Baleh as the hunting efforts were not observed over multiple seasons. There are several areas in which more study is needed to fully understand the hunting system along with its effects on wildlife populations and their habitats in this remote area. A systematic survey would help in determining the impact of hunting and effects of forest use on wildlife populations, which includes the need to know about the extent of recent cultural transformation (i.e., loss of traditional ecological knowledge especially amongst the youth, exposure to world religions, and consumerism) and how those changes relate to wildlife use.

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Declarations

Permissions: The manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. Informed consent was given by all interviewees involved in the study.

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Conflicts of Interest: None declared.

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