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Illegal wildlife trade in local markets of Feuang and Mad districts of Vientiane Province, Lao People’s Democratic Republic

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Original Article

Introduction

The Lao People’s Democratic Republic (Lao PDR) is a landlocked country in Southeast Asia surrounded by Myanmar, Thailand, Vietnam, Cambodia, and China that covers 236,800 square kilometers. Because of the heterogeneous habitat, tropical climate, forest, and watershed areas, it is rich in biodiversity. Altogether, 178 species of mammals, 740 species of birds, 189 species of reptiles, and 5,005 species of plants are reported to inhabit the Lao PDR (IUCN 2007; Luu et al. 2013; Zhu 2017; Avibase 2018). The biodi-

versity in the Lao PDR is exposed to several threats that have led to a decline in the native flora and fauna and the extinction of many species. The exploitation of natural resources, expansion of agriculture and infrastructure, illegal hunting and trapping, and wildlife trade are the major activities threatening biodiversity (Ounchith 2015). Between 1998 and 2015, the flora and fauna in the Lao PDR have been continuously threatened, and the number of threatened and near-threatened species has increased from 100 to 168 species (IUCN 2016). In addition to biodiversity loss, wildlife trapping and trading support the spread of zoonotic diseases. It is estimated that more than 72% of the emerging zoonotic diseases originate from wildlife species, which poses a serious risk to humans and domestic animals (Jones et al 2008). There is a long tradition of wildlife hunting in the Lao PDR. The majority of the inhabitants live in rural areas and are dependent upon harvesting wild products and hunting wild animals for their livelihood and traditional medicine (Johnson et al 2010; Singh 2010). Hence, numerous wildlife species are in trade at local and international markets, regardless of their conservation status, making the country a hub for illegal trade (Ghos 2010; Schweikhard et al 2019). Various studies have reported that the Lao PDR is part of an international transit system for trading wildlife parts, such as...
elephant’s ivory, tiger’s skin, and rhino’s horns from Africa and Asia to supply China, Vietnam, and Thailand. Therefore, the country is being scrutinized for its role in global wildlife trade (CITES 2016; Vigne et al. 2017).

The government of the Lao PDR has developed a law called “The Wildlife and Aquatic Law 2007” (WAL 2007) for governing wildlife protection and trade in the Lao PDR. They also developed Penal Law 1990, which describes penalties and the duration of custody for violating the law. However, articles 34, 35, and 36 under the WAL 2007 permit wildlife holding for breeding and business purposes. Articles 38 and 40 define the establishment of farmhouses for breeding and commercial trade and categories of animals that can be farmed and traded after the second generation. Similarly, article 71 of WAL 2007 describes the illegal hunting of rare, nearly extinct animals, as well as the illegal import, export, reexport, and transport of wildlife as criminal activities. Penalties for violating the law range from imprisonment of three months to two years, and the maximum fine for this offense, which applies to repeat offenders, is 600,000 LAK (72 USD).

Several studies have reported that illegal wildlife trade is increasing in the Lao PDR and threatening the native biodiversity (Nooren and Claridge 2001; Foley et al. 2011; Singh 2014; Livingstone et al. 2018; Rasphone et al. 2019). Most of these studies reported that wildlife trade occurred in either the northern border or central parts of the country, focusing on particular seasons. In this study, we reported wildlife trade that occurred in the Feuang and Mad districts of the Vientiane Province in the southwestern part of the country, which are rising as new trade zones for domestic and international trade. This study provided an assessment of local markets and recorded the animals in trade during winter and summer seasons between 2017 and 2018.

Material and methods

This study was conducted in the Feuang and Mad districts of the Vientiane Province of the Lao PDR (Figure 1) from December 2018 to June 2019. The study was performed in the local markets, roadides of urban areas, and surrounding villages of the Feuang and Mad districts. Direct observation and questionnaire surveys were conducted in the winter and summer seasons to collect data on the wildlife trade, including species names, numbers, sources, and potential use. Three teams with two to five members were involved in the field observations, and questionnaire surveys were performed at each visit. Photos of wild animals were taken for species identification and counting. A questionnaire survey (Supplementary file 1) was conducted among the local people, wildlife harvesters, wildlife traders, government officials, school teachers, and wildlife researchers.

The conservation status of each species was assessed based on the Convention on International Trade in Endangered Species (CITES) and the International Union for Conservation of Nature (IUCN) Red List of Threatened Species categories. The Student t test in IBM SPSS 26.0 (IBM Corp. Armonk, NY, USA) was used to assess the significant differences between the two seasons.

Results

Altogether, 23 genera and 22 species (N = 602 specimens) belonging to 21 families were recorded in this study (Table 1). The highest proportion of identified specimens was insects (49.8%), followed by amphibians (23.9%), mammals (15.9%), birds (7.8%), and reptiles (2.4%). Dung beetles, frogs, toads, and rats were the major species sold in the wildlife markets.

The identified species were classified according to the IUCN Red List categories, of which 17 species, such as shrew mouse (Mus pahari), brown hawk-owl (Ninox scutulata), and green paddy frog (Hyalorana erythraea), are the least threatened, and three species, including binturong (Arctictis binturong), northern pig-tailed macaque (Macaca leoninae), and black-rayed soft-shelled turtle (Amyda cartilaginea), are vulnerable. Similarly, two species, Austen’s brown hornbill (Anorrhinus austeni) and the blossom-headed parakeet (Psittacula roseata) are near threatened, and the keeled box turtle

Figure 1. Study area. Mad and Feuang districts of Vientiane Province of the Lao People’s Democratic Republic.
(Cuora mouhotii) is an endangered species (Table 1). Similarly, eight species such as the black-rayed soft-shelled turtle, brown hawk-owl, and northern pig-tailed macaque are listed in Appendix II, one species (binturong) is in Appendix III, and the remaining 14 species, including Boie’s wart frog (Fejervarya limnocharis), the ruddy shelduck (Tadorna ferruginea), and the large bamboo rat (Rhizomys sumatrensis), are considered not counted under the CITES categories (Table 1).

The wildlife species were found both alive and dead. The live species were kept inside cages, and dead bodies either were found

| Taxon | Family | Species name | Common name | Status | Specimen no. | Average price (USD) |
|-------|--------|--------------|-------------|--------|--------------|---------------------|
| Insects | Scarabaeidae | Heliocopris | Dung beetle | LC | ~ 300 | 0.25 75 |
| Amphibians | Ranidae | Hylarana erythraea | Green paddy frog | LC | 72 | 2 144 |
| | Dicroglossidae | Fejervarya limnocharis | Boie’s wart frog | LC | 49 | 1 49 |
| | Bufonidae | Dartophyllum melanoostictus | Asian common toad | LC | 23 | 1 23 |
| Reptiles | Trionychidae | Amyda cartilaginea | Black-rayed soft-shelled turtle | VU | 4 | 12 48 |
| | Gepemydidae | Cuora mouhotii | Keeled box turtle | EN | 8 | 84 672 |
| | Varanidae | Varanus salvator | Water monitor lizard | LC | 3 | 18 54 |
| Birds | Strigiformes | Strix leptogrammica | Brown hawk-owl | LC | 6 | 55 330 |
| | Accipitridae | Accipiter gularis | Japanese sparrow hawk | LC | 3 | 15 45 |
| | Ptilidae | Ptilidea rostrata | Blossom-headed parakeet | NT | 11 | 2 22 |
| | Anasini | Anas querquedula | Ruddy shelduck | LC | 12 | 12 144 |
| Mammals | Viverridae | Arctictis binturong | Binturong/Bear cat | VU | 3 | 300 900 |
| | Cercopithecidae | Macaca leonina | Northern pig-tailed macaque | VU | 4 | 150 600 |
| | Rhizomyidae | Rhizomyus sumatrensis | Large bamboo rat | LC | 14 | 10 140 |
| | Leporidae | Lepus peguensis | Burmese hare | LC | 6 | 28 168 |
| | Rhinolophidae | Rhinolophus thomasi | Thomas’s horseshoe bat | LC | 20 | 2 40 |
| | Hipposideridae | Hipposideros rutilus | Laotian leaf-nosed bat | LC | 12 | 3 36 |
| | Muridae | Mus musculus | Shrew mouse | LC | 18 | 2 16 |
| | Murinae | Mus musculus | Shrew mouse | LC | 18 | 2 16 |
| | Sciuridae | Callosciurus inornatus | Inornate squirrel | LC | 9 | 10 90 |

LC: least concerned; VU: vulnerable; EN, endangered; NT: near threatened; NC: not counted; IUCN: International Union for Conservation of Nature; CITES: Convention on International Trade in Endangered Species.

Figure 2. Wild mammals in trade. The Arctictis binturong, Rhizomyos sumatrensis, and Macaca leonina were live and kept inside the cage.
as whole carcasses or dried parts. Mammalian species such as binturong, the northern pig-tailed macaque, and the large bamboo rat; avian species such as the brown hawk-owl, blossom-headed parakeet, and Japanese sparrow hawk (*Accipiter gularis*); reptiles such as the keeled box turtle; and amphibian species, such as the green paddy frog, were sold alive. However, Edwards’s long-tailed giant rat (*Leopoldamyus edwardsi*), inornate squirrel (*Callosciurus inornatus*), and jungle fowl (*Gallus gallus*) were sold as whole carcasses either cooked or fried. Some representative images of wild species are shown in Figures 2 and 3.

The selling price of these wild species varied from place to place. Here, we estimated the average selling price of each species based on market surveys in the summer and winter seasons (Table 1). The estimated cost for a dung beetle was 25 cents, amphibians (1–2 USD), reptiles (8–84 USD), birds (2–55 USD), and mammals (2–300 USD). Threatened species such as the keeled box turtle, brown hawk-owl, binturong, and northern pig-tailed macaque had average selling prices of more than 50 USD.

The wildlife market study and questionnaire survey revealed that wild animals were in trade for various purposes, such as food, leather, traditional medicine, curio production, and pets (Figure 4). The highest proportion of wildlife species was traded for food purposes (45.4%), followed by traditional medicine (30.6%), curio production (12.7%), pets (3.6%), and other (7.2%). Wild species, such as the large bamboo rat, the Asian red-cheeked squirrel (*Dremomys rufigenis*), jungle fowl, green paddy frog, and Asian common toad (*Duttaphrynus melanostictus*), were in trade for food. Similarly, the keeled box turtle, Thomas’s horseshoe bat (*Rhinolohus thomasi*), and the ruddy shelduck were in trade for medicine. The northern pig-tailed macaque and water monitor lizard (*Varanus salvator*) were in trade for leather, and blossom-headed parakeets were in trade for pets.

A comparison of individuals in five taxonomic classes recorded in the winter and summer seasons is illustrated in Figure 5. Although mammals and birds were traded at a higher proportion in the winter season and amphibians, reptiles, and insects in the summer season, there were no significant differences in trade between summer and winter (Student t test, *p* > 0.05).

**Discussion**

The wildlife market is expanding due to domestic and international demands for wildlife and their products. Various studies have reported that international trade was closely related to economic benefit (Johnson et al 2010; Singh 2010; Greatorex et al 2016; Krishnasamy et al 2018). The increasing demand and price of wildlife products in other East Asian counties such as China, Thailand, and Vietnam have aggravated wildlife hunting in the Lao PDR. The wildlife trade in the Lao PDR is not only associated with
the livelihood of the local people but also closely related to culture and tradition. People believe that consuming wildlife products increases virility, social status, luck, and health (Due and Broad 1995). Many traditional medicines use wildlife parts such as liver, skin, gall bladder, and muscles as ingredients, and this practice is still in place (Table 2).

Globally, the disease implications of wildlife trade have received less attention over the decade. However, it is a significant threat to human health (Greatorex et al. 2016). Open markets and poor biosafety enhance the transfer of zoonotic diseases or pathogens from wildlife to humans. Our observation of local markets correlated risk with the presence of wildlife known to carry globally significant zoonotic agents. The higher volumes of Muridae (rats), Sciuridae (squirrels), and Hipposideridae (bats) are of special concern as these families are reservoir hosts of several zoonotic pathogens ranging from hantavirus and Nipah virus to SARS (Severe Acute Respiratory Syndrome) and Ebola (Chua et al. 2002; Lau et al. 2005; Kim et al. 2009; Olival et al. 2013). Different from mammals, most birds and reptiles act as intermediate hosts rather than definitive hosts (Mendoza-Roldan et al. 2020). Approximately, 2.7 million human deaths and 2.5 billion human illnesses are attributable to zoonotic diseases globally (Gebreyes et al. 2014).

In contrast to Middle Eastern countries, the demand for mammals is high in Laos compared with birds and herpetofauna (Eid et al. 2011; Abi-Said et al. 2018). This is consistent with results obtained from neighboring countries such as China, Vietnam, Thailand, and Mongolia, where mammals constitute the majority of species in trade (Schweikhard et al. 2019). Most species in trade were of local origin and a few of them were carried from long distances, which fall under IUCN and CITES categories. Rats, squirrels, lizards, and frogs were the most common species observed in the market and were selling at low prices. The price of binturong and northern pig-tailed macaque was relatively high compared with small mammals, birds, amphibians, and reptiles. We did not see the large and charismatic species, such as bears, tigers, and elephants, and their products (skin, horns, antlers, and tusks) in the market as reported by Krishnasamy et al. (2018) and Schweikhard

Table 2. Some medical uses of animals products.

| Species   | Derivative/parts used | Applications                                      |
|-----------|----------------------|---------------------------------------------------|
| Primates  | Balm made from bones | For lack of appetite, insomnia, anemia, and so on. |
|           |                      | Improve body strength.                            |
| Birds     | Stomach and liver membrane | Relieve cough and pain, headache, cure paralysis. |
| Snakes    | Gall bladder and meat | Cure asthma.                                      |
| Monitor lizards | Gall bladder            |                                                    |
| Turtles   | Plastron              | Heal joint problems                               |
| Toads     | Mucus from dorsal glands | To relieve pain, treat skin inflammation, and boils. |

Source: CRES (1993)
et al. (2019). Low populations, difficulties in capturing, and high cost could be the possible reasons. Previous studies revealed that the CITES-listed species had high selling prices compared with the non-CITES species (Courchamp et al. 2006).

Although our study was performed in two seasons, we visited local markets and covered only two districts. Therefore, we could not record large mammals. The border areas of China, Vietnam, and Thailand express highways connecting to neighboring countries are popular sites for wildlife trade (Johnson et al. 2010; Krishnasamy et al. 2018). This suggests that trade is not limited to certain periods but continues year-round. A case study in Laos reported that hunting frequency varied due to seasonal differences in labor, such as planting or harvesting of crops (Johnson et al. 2010).

The trade of herpetofauna was higher in the summer season than in the winter season, which was related to their abundance. As summer is accompanied by rain, the availability of groundwater creates a suitable habitat for their metabolic activity (Pradhan et al. 2014), making them easily accessed by hunters.

A trade chain encompasses flexible distribution lines that are often highly creative. Trafficking is facilitated both by domestic and international specialists involved in stockpiling, handling, transporting, marketing, and retailing wildlife products. The hunting scene for traded species with traders, who predominantly inhabit rural areas and have economically weak livelihoods. Harvesters are usually active at night and use local and traditional weapons, such as snares, and bows and arrows for hunting small mammals and birds but use modern firearms for hunting large mammals (Nash 1997).

Usually, youth and adult men are involved in hunting and the transportation of wild animals and selling to local dealers and wildlife traders coming from other districts. They sell either live animals or dry meat, carcasses, skin, and horns. The traders transport wildlife products to other markets inside the country or border areas for exporting to other countries. In local markets, we observed young children and adult women involved in trade, selling small mammals, amphibians, and reptiles on a small scale, where their earnings were used for purchasing daily needs such as food, clothing, and other grocery items.

Wildlife traders change their routes of transportation continuously to take advantage of new infrastructures, reduce costs, or avoid detection by authorities. Open borders, accessible markets, and better transportation and communication have led to a situation where wildlife moves almost unimpeded across the borders of Laos and Thailand (Chong Mej), Laos and Cambodia (Veun Kham), Laos and Vietnam (Namcan), and Laos and China (Boten Mohan). Krishnasamy et al. (2018) and Srikosamatara et al. (1992) reported Boten and Yunnan, respectively, for trading wildlife. With its booming economy, China is the biggest market for wildlife products (Butler 2009), followed by Hong Kong, Taiwan, South Korea, and Thailand (Kemf 1994). Most of the species exported to Vietnam are further exported to China (Jenkins 1995).

The wildlife trade in the Lao PDR depends upon two factors, supply and demand. Trade will not end until the demand from consuming countries is reduced. Rapid development and growing affluence creates demand from China, Thailand, and Vietnam, and addressing them to control trade seems ineffective. Similarly, the supply side is more critical as trade restrictions eliminate a source of income for the rural poor. Since 2004, the Lao PDR has become a party to CITES (Nijnman and Shepherd 2012). However, the capacity and resources to implement CITES are often inadequate. Cross-border trade has continued, with the Lao PDR being a country of origin for traded species. This effectively means that the Lao PDR is unable to implement CITES, despite being a party to the convention (CITES 2016; Krishnasamy et al. 2016). The lack of regulations, monitoring, and law enforcement at border towns has made it a popular hub for cross-border wildlife trade. Although complex, the Laothian government needs to address the supply by clarifying laws and strengthening enforcement through the training of wildlife authorities and costume authority. The government of the Lao PDR should develop wildlife policies for the sustainable harvesting of wildlife based on their conservation status. There is an urgent need to close the loopholes in wildlife law increasing wildlife trade and implement effective law enforcement to prevent the exploitation of natural resources. In addition, alternative income sources are required for the citizens who are completely dependent upon wildlife products for their livelihood. Public awareness and community-based participatory conservation programs could be effective for controlling illegal wildlife trade in the Lao PDR.

Conflict of interest

The authors declare that there is no conflict of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.japb.2020.07.006.

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