RESEARCH ARTICLE:

Factors Influencing the Pattern of Wildlife Product Consumption in Indochina: Case Study of Lao PDR

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Abstract

The illegal wildlife trade is the most significant direct threat to biodiversity in Indochina. This problem will likely worsen without immediate and effective measures to control wildlife consumption. This study determines the socio-demographic factors and knowledge of consumers on wildlife animals and the pattern of wildlife consumption in Laos. The framework constructed is based on a theory of planned behaviour. About 200 consumers from major markets in northern, middle, and southern parts of Laos were interviewed using a structured questionnaire to collect information on gender, age, ethnicity, religion, level of education, occupation, income, frequency of wildlife consumption, etc. Multinomial logistic regression results showed that consumers' places of birth and education levels have a significant relationship with the pattern of wildlife consumption. The results indicate that local consumers with a high education are more likely to buy wildlife products as a gift than those with low education who are more likely to consume wildlife products as a source of medicine/food. Regarding the use of wildlife products on occasions of traditional ritual/release, local consumers with high education levels are less likely to consume wildlife products than those with lower education levels. The findings suggest that the government should target local people and collate different propaganda for people with varying levels of education to reduce the use of wildlife products.

Keywords: *socio-demographic factors; wildlife consumption pattern; Laos*

Introduction

The demand for wild animals and their products has been increasing in many countries. Wild species are used as a source of various goods, including food, medicine, pet, displays, fashion and cultural items, and household items (USAID, 2017). The use of wild species can be looked at on a local scale, such as in hunting meat for direct consumption, or for sale at local markets, and wildlife products pass through a complex chain of processing and trade from hunter to consumer (Traffic, 2008). Southeast Asia is a center for consuming wildlife products and a major supplier worldwide. Similar to other Southeast Asian countries, Laos serves as an important source for the wildlife trade. The trade involves many native species, which are declining due to unsustainable and often illegal harvesting (WB, 2005). Overexploitation in domestic and international trade has been recognised as the most significant threat to biodiversity in many Southeast Asian countries (Baltzer *et al*., 2001; Shepherd *et al*., 2007; Nijman, 2010). Over the past decade, Southeast Asia has become an important center for wildlife trade in the Asian region. Wildlife and its related products from Laos, Cambodia, Myanmar, Thailand, Malaysia, and Indonesia are smuggled through Vietnam to mainland China, Taiwan, South Korea, Hong Kong, and Singapore (Compton and Le, 1998; Nooren and Claridge, 2001; Nguyen, 2003; Lin, 2005; Sterling *et al*., 2006). This may be because wildlife and wildlife products can more easily cross the border into China with support from a sophisticated trade network (Nguyen, 2003; Roberton *et al*., 2004).

The illegal wildlife trade has been increasing in Laos and poses a threat to native biodiversity (Foley *et al*., 2011; Singh, 2014; Livingstone *et al*., 2018; Rasphone *et al*., 2019). The wildlife trade takes place in northern, middle, and southern Laos. The wildlife trafficking in Laos is diverse, including the trade of live turtles, the sale of monkeys

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as pets, and the sale of bears to farms for bear bile. Sales of popular animal products, such as tiger bone wine, are linked to many of the country's tiger farms. Many wildlife species are being traded in local/domestic and international markets, making the country a hotspot for illegal trade (Schweikhard *et al*., 2019). Laos is considered a part of a global transit system for wildlife trade for items such as ivory, tiger skin, and rhino horn from Africa and Asia, products then being moved to supply China, Vietnam, and Thailand (CITES, 2016; Vigne *et al*., 2018). Rapid economic development in the region has also increased the purchasing of wildlife goods in Southeast Asian countries. The domestic market continues to expand to meet the growing demand for bushmeat meat and wildlife products (Shepherd *et al*., 2007; Nijman, 2010). It is expected to increase in the coming years as the domestic economy develops (World Bank, 2005; TRFFIC, 2008). The wildlife trade involves many different taxonomic groups. Turtles, pangolins, and snakes have been mostly traded in the international market; animals commonly consumed domestically include civet, muntjac, bear, primate, sambar, otters, and serow (Nguyen, 2003).

In addition, wildlife hunting in Laos for the livelihood of local people and for traditional medicine has existed for a long time (Johnson *et al*., 2010; Singh, 2010). Nowadays, meat and wildlife products are not only consumed for the subsistence of the poor, but also used as a luxury for city people (Godoy *et al*., 2010; Shairp *et al*., 2016). Wildlife trade has increased in urban areas as the urban economy has developed and expanded (Zhang and Yin, 2014). Most hunting products are consumed in villages, rural towns, and neighboring cities, rather than in international markets (Harrison *et al*., 2016). Wildlife consumption varies across regions, politics, and cultures (Brashares *et al*., 2011). For example, people in northern Laos prefer wild bear bile even though they are less reliant on it. They believe that bear bile has medicinal value and that wild bear bile is better than farmed bear bile (Davis *et al*., 2016). Furthermore, the level of wildlife consumption depends on the consumer's income. Godoy *et al.* (2010), in a study on the impact of income on wildlife consumption, shows that income is positively and strongly influenced to wildlife consumption. High-income consumers are more likely to consume wildlife products (Brashares *et al*., 2011). While, for traders, the pressures of poverty could be a factor that drives trader groups selling traditional South African medicine to shops to trade products derived from endangered wildlife (Nguyen and Roberts, 2020).

Income, occupation, and gender have the most important relationship with wildlife consumption, while age and education level has no significant association with the consumption of wildlife products (Drury, 2011). Conversely, there is also research showing that education level and occupation has an important relationship with wildlife meat consumption (Shairp *et al*., 2016). A study on hunting and rat consumption in Laos showed that age, occupation, and ethnicity were statistically significant to wildlife consumption (Suwannarong *et al*., 2015). In addition to socio-demographic factors, consumer knowledge about wildlife conservation also has a significant relationship with wildlife consumption (Zhang and Yin, 2014). There are many issues related to the pattern of wildlife consumption in Indochina, including countries such as Vietnam, Laos, and Cambodia, such as a high demand, low consumer awareness, and traditional beliefs. These issues have yet to be elucidated. Therefore, the patterns, scale, and drivers of wildlife consumption should be well understood to improve and better target biodiversity conservation in Indochina, especially in Laos.

Methodology

Deciding to consume or trade wildlife animals or their products is often perceived as an individual's choice. While all such decisions are bound by social context, they are probably even more prominent for those whose society and culture frame many choices. The Theory of Planned Behavior (TPB), developed by Ajzen, considers the individual's attitude, social norms, and perceived control as accurate predictors of behavioral intentions (Ajzen, 1991). Behavioral intention is then mainly affected by attitude, subjective norms, and perceived behavioral control; therefore, TPB is selected as the basic theoretical framework of this study. The theoretical framework of planned behavior is an open analytical framework. This study reviews the existing literature, expands on the theoretical framework of TPB, and constructs an analytical framework to study socioeconomic factors influencing the consumption or trade of wildlife meat or other wildlife products.

The conceptual framework (Figure 1), as follows, is developed based on literature reviews and TPB:

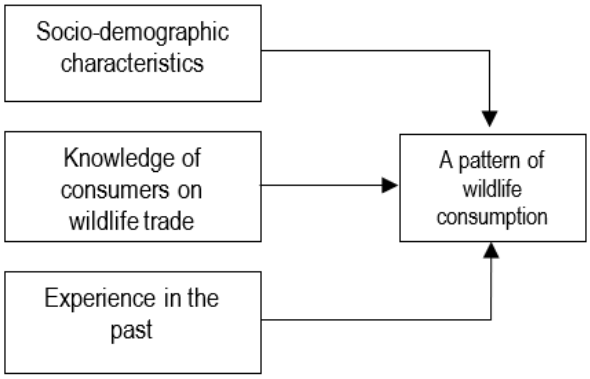

Figure 1: The relationship between independent and dependent variables

The conceptual framework describes the characteristics of respondents and their knowledge concerning the popularity level of wildlife consumption and the rareness of wildlife species (independent variables) that may influence the pattern of wildlife products (dependent variable). The description and measurement scale of variables have been given in Table 1 below:

Table 1: Operational definition of variables

Variables	Description	Measurement scale
Dependent variable		
A pattern of wildlife consumption	In what context do consumers buy wildlife products: Medicine/Food, Gifts, and Ritual tradition	Nominal
Independent variables		
Gender	Gender of interviewee: Male, Female	Nominal
Ethnicity	Ethnicity of interviewee: Lao-tai, Mon-khrameer, Hmong-yunmien (Yao)	Nominal
Place of birth	Where interviewee was born: Origin and nearby areas, another province	Nominal
Education	Highest level of education completed: Primary school, Upper secondary school, bachelor's degree, or higher	Ordinal
Occupation	Occupation of interviewee: Agriculture/Farmer, Trader/Owner of a business, Government servant, Others:	Nominal
Income	Monthly income of respondent: Low (below 1,500,000), Middle (1,500,001-10,000,000), Upper-Middle (10,000,001-20,000,000), and High (More than 20,000,000)	Ordinal
Experience in the past	When respondent consumed last time: Don't remember, a Short time ago (a few days ago, one or two weeks ago), Long time ago (three weeks or one month ago), or Very long time ago (a few months ago or more than six months)	Ordinal
Knowledge of the popularity of wildlife meat/products	Respondent's opinion on the consumption of wild meat and wildlife products becoming more or less popular or staying the same: More popular, Less popular	Nominal
Knowledge of the rareness of Muntjac	Respondent's opinion on the rareness of Muntjac: Rarer, Hard to find, and More common in the market	Nominal
Knowledge of the rareness of Lorises	Respondent's opinion on the rareness of Loris/Monkey: Rarer, Hard to find, and More common in the market	Nominal

This study follows Drury (2009) in designing structured questionnaires for market surveys. The questionnaire contains mostly closed questions to complete in a relatively short period of time, allowing for larger overall sample sizes. Information, such as kinds of bush meat consumed, socioeconomic backgrounds of consumers, and the scale of the trade, were obtained. Structured questionnaires were used to survey major markets in northern (Xiengkhuang), middle (Thongname), and southern parts (Sekong and Thateng) of Laos (Figure 2). Individuals were approached. A face-to-face interview was carried out to collect information on gender, age, ethnicity, religion, level of education, occupation, income, consumption of wildlife, frequency of wildlife consumption, the purpose of consumption, the market price for wildlife animals, kind of wildlife used for local/domestic or international trade.

The responses also covered around ten animals traded in and from Laos under various markets. The researchers performed 200 interviews in total. All interviews were anonymous and interviewees were asked for their verbal consent and were told they could stop the interview at any time. The questionnaire data were analysed at an aggregate level to give a picture of the wildlife trade overall, and detailed case studies were produced for Lorises, Muntjacs, Turtles, Deer, Squirrels, Porcupine, Large Bamboo Rats, Bangal Monitors, Snakes, and Wild Boar to elucidate the socioeconomic factors underlying the trade.

Figure 2: Map of Laos indicating surveyed markets

Bivariate analysis was used to study the relationship between the pattern of wildlife product consumption and characteristics of consumers, consumers' knowledge on the popularity of wildlife species, and knowledge on the wildlife products and wildlife trade. Multivariate analysis was done to examine the specific factors among consumers regarding their characteristics and the knowledge of consumers regarding the pattern of wildlife product consumption. To estimate the influence of consumers' backgrounds, the knowledge of consumers and the pattern of wildlife product consumption as an dependent variable were used in this study. A nominal scale dependent variable was constructed to indicate what context consumers buy wildlife products as medicine/food, gifts, or for ritual traditions. Because the indicator was measured at nominal scale, a multinomial logistic regression model was estimated (Pampel, 2000). Multinomial logistic regression models make it possible to estimate the probability of buying wildlife products for their purposes, conditional on the independent variables included in the model.

In addition to interviewing, the researchers also gathered data through observation. The data are compared with data available in literature to infer the trade trend through time. These surveys will also help to understand the patterns, scales, and trends of the wildlife trade in Laos.

Results and Discussion

Most of the individuals interviewed were male, accounting for 74 percent, compared to the 26 percent which were female respondents. The surveyed people were mainly under 60 years old, and 31- to 40-year-olds were the leading group, accounting for 34 percent of the respondents, while those 41 to 50 accounted for 29.5 percent, following groups of those below 30-year-old and over 51-year-old, which were 22.5 percent and 14 percent, respectively.

Table 2: Demographic characteristics of respondents

Demographic characteristics		**Percentage (%)**
Gender	Male	74.0
	Female	26.0
Age	Below 30	22.5
	31-40	34.0
	41-50	29.5
	Over 51	14.0
Ethnicity	Lao-tai	48.5
	Mon-khrameer	21.5
	Hmong-yunmien (Yao)	30.0
Occupation	Agriculture/Farmer	47.5

	Trader/Business Owner	22.5
	Government servant	17.0
	Others	13.0
Education	Primary school	50.0
	Upper secondary school	37.5
	Bachelor and higher	12.5
Income	Low	8.0
	Middle	48.0
	Upper-Middle	15.5
	High	28.5

Lao-tai were found to be the most predominant ethnic group represented (48.5%), followed by Hmong-yunmien (30%), and Mon-khrameer (21.5%). The most predominant occupation were agriculture/farmers (47.5%). The second most common occupation was trader/business owner (22.5%). The third most common occupation was as a government servant (17%). Among the respondents, 50 percent had their highest educational level being primary school. The proportion of those who completed secondary school was 37.5 percent, and the proportion of bachelor's and master's degree holders was 12 percent and 0.5 percent. Regarding the income of surveyed people, nearly half of the respondents' monthly incomes (48%) was around 1,500,000-10,000,000 LAK. Compared with the characteristics of the Laos Statistical Yearbook 2020, the sample data of this study is similar in terms of age and education, but there were some inconsistencies in the gender and income structure. That may reflect demographic differences among wildlife product consumers.

The relationship between independent variables and dependent variables was observed, namely socio-demographic characteristics of consumers, consumers' experience as to when the last time they consumed wild meat or wildlife products, consumers' knowledge of the popularity of wildlife trade, their knowledge regarding the rareness of species such as muntjac, lorises/monkey (independent variables), and their decision to buy wildlife products and in what context (dependent variable). A Chi-square test significant level of .001, .01, and .05 is used to examine the association between independent variables and dependent variable. The results are presented in Table *3*.

Table 3: Percentage distribution of independent variables by the dependent variable

Independent variable	Buying wildlife product		
	Medicine/Food	Gift	Traditional ritual/ Release
Socio-demographic factors			
Gender		p< .005	
Male	46.6%	36.5%	16.9%
Female	21.2%	61.5%	17.3%
Ethnicity		p< .001	
Lao-tai	21.6%	56.7%	21.6%
Mon-khrameer	53.5%	30.2%	16.3%
Hmong-yunmien (Yao)	60.0%	30.0%	10.0%
Place of birth		p< .001	
Origin and nearby	50.0%	42.3%	7.7%
Another province	21.4%	44.3%	34.3%
Education		p< .005	
Primary school	48.0%	30.0%	22.0%
Upper secondary school	36.0%	52.0%	12.0%
Bachelor and higher	20.0%	68.0%	12.0%
Occupation		p< .005	
Agriculture/Farmer	45.3%	30.5%	24.2%
Trader/Business Owner	26.7%	62.2%	11.1%
Government servant	29.4%	52.9%	17.6%
Others	57.7%	42.3%	0.0%
Income		p< .001	

Low	75.0%	25.0%	0.0%
Middle	59.4%	17.7%	22.9%
Upper-Middle	22.6%	61.3%	16.1%
High	7.0%	80.7%	12.3%
Experience in the past			
Experience		p< .001	
Do not remember	29.6%	22.2%	48.1%
Short time ago	8.3%	75.0%	16.7%
Long time ago	37.8%	51.1%	11.1%
Very long time ago	56.5%	32.6%	10.9%
Knowledge of wildlife trade			
The popularity of wildlife products		p< .005	
More popular	54.7%	29.3%	16.0%
Less popular	31.2%	51.2%	17.6%
Rareness of Muntjac		p< .001	
Rarer	90.0%	5.0%	5.0%
Hard to find	36.5%	49.0%	14.6%
More common in the market	32.1%	45.2%	22.6%
Rareness of Lorises		p< .001	
Rarer	15.0%	70.0%	15.0%
Hard to find	44.7%	40.2%	15.2%
More common in the market	53.6%	17.9%	28.6%

From the results of the bivariate analyses, above, a strong relationship between ethnicity, place of birth, income, experience from the past, knowledge of the rareness of species, and willingness to buy wildlife products have been found in this study (p< .001). Other factors, such as gender, education, occupation, and knowledge of the popularity of wildlife products, are statistically significant in the willingness to buy wildlife products (p< .005). The results indicate that men are more likely to purchase wildlife products as medicine or food (46.6%) than for other purposes, while most women buy wildlife products as gifts (61.5%). Male or female consumers consume different wildlife products for various purposes. Much of the evidence shows that women mainly buy wild products for beauty while men often drink soaked alcohol and consider it a health-promoting drug (Zhou, 2000; USAID, 2022). Ethnicity shows a considerable difference in what context people purchase wildlife products. Among the Hmong-yunmien ethnic group, about 60 percent buy wildlife products as medicine/food compared to 21.6 percent of the Lao-tai ethnic group who were born there or nearby, only 18.8 percent came from another province. Place of birth plays an important role in the pattern of trade (p< .001). Local people are more likely to buy wildlife products for medicine/food (50%), while people from other provinces buy them as gifts (44.3%). These results are in accordance with other studies that showed that ethnicity influences the selection and use of wildlife products (Boakye, 2018; Kyophilavong, 2019).

Regarding education, people with a low education seem to buy wildlife products for medicine/food (48%). A few people with bachelor's degrees buy wildlife products as for traditional ritual/release (12%), while many (68%) buy wildlife products as gifts. Those with a lower level of education are more likely to purchase wildlife products as gifts (68%). People with a high level of education may have received knowledge directly via professional training or indirectly through the media, which encourages them to gain a higher awareness of quality and safety for food consumption. They also consider ethical concerns (Kılıç, and Bozkurt, 2020). Those with a higher education are able to access information sources that are consistent with education (Shairp *et al.*, 2016). As with education, the income of consumers also has a strong relationship with the pattern of the wildlife trade. The proportion of low-income people buying wildlife products for their medicine/food is very high (75%), while only seven percent of high-income people make the same decision. Consumers' experiences regarding the last time they bought a wildlife product has statistical significance with the pattern of wildlife products they buy. Around 75 percent of consumers who usually buy wildlife products as gifts also bought wildlife products a short time ago (a few days/one day, two weeks ago).

Similarly, there is a significant relationship (p< .005) between consumers' knowledge about the popularity of wildlife products and buying wildlife products. Consumers who consume wildlife products as medicine/food are more likely to answer that wildlife product consumption has become more popular in recent years at the local and national levels (54.7%). An in-depth interview explains that the reasons are the influence of Chinese and Vietnamese consumption in Laos and the traditional Laotian beliefs. Lao traditional medicine is similar to traditional Chinese and Vietnamese medicine in that it uses parts of wild species as ingredients. Vietnam's influence can be clearly seen in Lao traditional medicine because most of the healthcare staff, doctors, and pharmacists were trained in Vietnam (Compton *et al.*, 1998). Even in consuming wildlife products as medicine/food, most of them (90%) realized that muntjac is becoming rarer in the market compared to a few years ago, while 53.6 percent answered that lorises are more common in the market than a few years ago.

A bivariate analyses of wildlife consumption patterns by socio-demographic characteristics is examined, as is the nature of the association among these factors and the pattern of the wildlife trade. Several associations are significant in the bivariate analysis. However, the bivariate association does not present a strong relationship. Therefore, a multivariate analysis was also applied to specify which factors best explain and predict the pattern of wildlife meat and its products. The multinomial logistic regression results predicting the pattern of wildlife product consumption are interpreted. The model for the dependent variable, being buying wildlife products, was fitted for all respondents. Coefficients, standard errors, and odds ratios are presented in the model. Moreover, multinomial logistic regression is also used for groups of independent variables to predict the change of probabilities of buying wildlife products.

The logistic regression model estimates a model of the form:

$$logit\ \pi_c = \alpha_r + \beta_c X_c$$

where π_c is the estimated probability of a particular event occurring to an individual with a given set of characteristics X_c

α_r is a constant that defines the probability π_r for an individual with all X_c set to zero,

β_c is the estimated coefficients

Many individual characteristics appear to be associated with the pattern of wildlife product consumption. Thus, the multinomial regression model was used to examine the specific effects of independent variables on the pattern of wildlife consumption. All independent variables which have a significant association in the bivariate analysis were included in the model. The results of the multinominal logistic regression showed that consumers' places of birth, education, and knowledge regarding the rareness of wildlife species have significant relationships with the pattern of wildlife consumption. A separate model was run to test the significance of these independent variables on the pattern of wildlife consumption. Surprisingly, the significant relationship between knowledge of the rareness of wildlife species disappeared. Education and place of birth remain the most effective factors in the model. The final model, which included selected independent variables, such as place of birth and education level of consumers, was analysed to measure the strength of independent variables that influence the probability of buying wildlife products for specific purposes. The results of final model are presented in Table 4.

Table 4: Multinomial logistic regression results: Factors influencing the pattern of wildlife consumption

Pattern of wildlife product consumption[a]		B	Std. Error	Sig.	Exp(B)
Medicine /Food	Intercept	.238	.745	.749	
	Origin or near by	2.474	.495	.000	11.871
	Another province®	0[b]	.	.	.
	Primary school	-.894	.821	.276	.409
	Upper secondary school	-.777	.883	.379	.460
	Bachelor and higher®	0[b]	.	.	.
Gift	Intercept	1.597	.631	.011	
	Origin or nearby	1.812	.477	.000	6.121
	Another province®	0[b]	.	.	.
	Primary school	-2.207	.727	.002	.110

Upper secondary school	-1.213	.771	.116	.297
Bachelor and higher®	0[b]	.	.	.

a. The reference category is: Traditional ritual/Release
b. This parameter is set to zero because it is redundant

Based on the Likelihood Ratio Test, it can be said that the model containing the full set of predictor represents a significant improvement in fit relative to a null model [LRX²(6)=45.596, p<.001]. The Pearson and Deviance Chi-square tests suggest a good fitting model (p=.125 and p=.097).

The "Origin and nearby" predictor is a positive and significant association with the pattern of wildlife consumption while the "Primary school" predictor is a negative and significant relationship with the pattern of wildlife consumption. Exponentiating a beta parameter provides the multiplicative effect of that predictor on the odds, controlling for the other variables. The formula for the probability itself is:

$$\pi_1 = \frac{\exp\,(\alpha_1 + \beta_1 X_1)}{1 + \exp(\alpha_1 + \beta_1 X) + \exp\,(\alpha_2 + \beta_2 X)}$$

$$\pi_2 = \frac{\exp\,(\alpha_2 + \beta_2 X)}{1 + \exp(\alpha_1 + \beta_1 X) + \exp\,(\alpha_2 + \beta_2 X)}$$

$$\pi_{\text{reference}} = \frac{1}{1 + \exp(\alpha_1 + \beta_1 X) + \exp\,(\alpha_2 + \beta_2 X)}$$

Based on the results of multinomial logistic regression and the formula above, the predicted probability of a wildlife consumption pattern by education for local consumers has been calculated (Table *5*).

Table 5: Predicted probability of wildlife consumption pattern by education level for consumers "Origin or nearby"

Variables	Medicine/food	Gift	Traditional rituals / release
Primary school	58.74%	31.72%	9.54%
Upper secondary school	40.94%	53.15%	5.91%
Bachelor or higher	32.53%	65.31%	2.16%

Among local consumers, people who graduated primary school have a 58.74 percent probability of buying wildlife products as medicine/food. In comparison, people who graduated from upper secondary school and hold a bachelor degree or higher have a 40.94 percent and 32.53 percent probability of buying wildlife products for their medicine/food. Buying wildlife products for traditional ritual/release purposes is the least likely outcome among local consumers who graduated with a bachelor degree or hold a higher level of education compared to almost 10 percent or 6 percent probability in the groups of local consumers having primary school and upper secondary school. Local consumers with bachelor's or higher education levels have a 65.31 percent probability of consuming wildlife products as gifts. It is much more likely than those educated at primary school (31.72%) and upper secondary school (53.15%).

Conclusion

The Laos government's efforts to reduce the demand of wildlife products to achieve the government's goal of reducing the wildlife trade face many challenges (Davis and Glikman, 2020). Despite the biodiversity conservation programs implemented in Laos to improve the knowledge on wildlife protection in recent decades, the use of wildlife products remains high (MoNRE, 2016). While many factors contribute to biodiversity conservation, the use of wildlife products is widely recognised as a significant causal factor (TRAFFIC, 2008). This study has examined the socio-demographic characteristics of consumers that influence the pattern of wildlife product consumption. The results of the model of multinominal logistic regression found that education and place of birth remain the most effective factors in the final model. The results indicate that local consumers with a higher education are more likely to buy wildlife products as gifts than those with a lower level of education. Local consumers with low education levels are more likely to consume wildlife products for their medicine/food sources. Regarding the use of wildlife products for traditional rituals/release, local consumers with high education levels are less likely to consume wildlife products than those with lower education levels. This study recommends that the government should target local people to promote public awareness to stop consuming wildlife products and specify different propaganda for local people with varying levels of education to reduce the use of wildlife products. Future efforts should build on these

findings and combine them with other studies in Cambodia and Vietnam to fully understand the factors influencing wildlife product consumption patterns in Indochina to contribute to developing strategies to prevent wildlife use and trade in the region.

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