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IN SEARCH OF OWSTON'S PALM CIVET AND ASSESSMENT OF LOCALS' KNOWLEDGE AND IMPACTS ON WILDLIFE IN PU MAT NATIONAL PARK

Pham Van Thong, Pham Minh Phuong, Trinh Thi Mai, Nguyen Van Thai

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CHAPTER 1 – Introduction

Owston's palm civet (*Chrotogale owstoni*) is well-known as the last present of its genus with on going to decline of small-scale distributions in northern to central Vietnam, Annamite ranged western Laos and southern China (Can & Trai, 2010). Since its restricted population and warning alarm in conservation status, Owston's palm civet has been listed as Endangered on *The IUCN Red List of Threatened Species* since 2015; also recorded in Decree 64 of Vietnamese government on the criteria for the identification and management of endangered, rare and precious species of priority for protection and Decree 06 of the authors on the management of endangered, precious and rare species of forest fauna and flora and the observation of the Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES) which are the two highest recent legislation to protect wildlife in Vietnam. Even though massive efforts were taken to detect this species in Vietnam in many years, Owston's palm civet was not found in any field observation or camera trapping in Ke Go Nature Reserve and Khe Net proposed Nature Reserve of Ha Tinh and Quang Binh province from 2006 to 2010 (Willcox et al., 2014) or in Saola Nature Reserve of Thua Thien Hue and Quang Nam province (WWF unpublished data) since 2012 (Gray et al., 2014), except the announcement of Can & Trai (2010) indicated that its distribution extended to a part of Southern Vietnam while it was found in Chu Yang Sin National Park (Dak Lak province) by only one single of this species observed. In Vietnam, despite of Owston's palm civet conservation program started by The Carnivore and Pangolin Centre (CPCP) in Cuc Phuong National Park in very early year of 1995, none of any conservation program focusing on this species though. Meanwhile, its population has been rapidly going down as illegal hunting and trade and habitat loss-driven reasons (Willcox et al., 2020).

Pu Mat National Park covers an area of total 164,805 hectares, including 94,804 hectares of core areas and near 70,000 hectares of buffer zone areas (Dang et al., 2020). Owing a rich and varied biodiversity of abundant and precious fauna and flora, Pu Mat National Park is located in Southwest of Nghe An province (Dang et al., 2020), which is one of four provinces in Central Vietnam determined for a present of the newest large mammal found in the world, Saola (*Pseudoryx nghetinhensis*). According to MARD (2022), Nghe An province is covered by 58.41% by mountainous areas, which is home to many other unique regional wildlife species living safely and extending their populations such as Asian elephants (*Elephas maximus*), Truong Son muntjac (*Muntiacus truongsonensis*) and Northern white-cheeked gibbon (*Nomascus leucogenys*) which are mostly found in Pu Mat National Park. Therefore, this very important wildlife conservation site is one of the consideration living areas of endangered Owston's palm civet. On the other hand, none of the community surveys around Pu Mat National Parks was carried out with one of main contents focusing on Owston's palm civet research since this species was categorized from Vulnerable to Endangered of the conservation status on *The IUCN Red List of Threatened Species* in 2015.

Thus, this study aims to clarify information collected from communities in buffer zones of Pu Mat National Park related to local biodiversity, the ecological knowledge of Owston's palm civet (*Chrotogale Owstoni*) including its diets, habitats and behaviors, hunting techniques, the most common hunting hotspots in the protected area, threats to wildlife apart from hunting activity and local awareness of Vietnamese wildlife protection law.

CHAPTER 2 – Research method

2.1 Field research

A structured interview survey was conducted with total 201 interviewees who are local residents in 17 villages of 7 communes of two districts in the buffer zones of Pu Mat National Park in Nghe An province. These places were chosen to conduct survey as a high number of wildlife violations were recorded in SVW's database. All first interviewees were picked based on village leaders' recommendations and had knowledge of wildlife and insights of hunting activities. These first participants then acted as informants for the next potential interviewees. This snowball sampling method was applied to specify interviewees until planned interview sample sizes were collected enough in each community.

A set of questions were prepared for local residents aimed at gaining information of Owston's palm civet existence, its behaviors, habits, distributions; addressing its key living sites, habitat; as well as assessing human impacts on wild animals in local areas showing through hunting and trade activities, and interviewees' awareness about Vietnamese wildlife protection law. During the interviews, questions were flexibly requested based on information given by locals. As some of questions are quite sensitive, one-by-one interviews were prioritized and taken place in the interviewees' private houses which gave them psychological safety and familiar feelings to share their thoughts, opinions, and knowledge. Recordings were used during interviews, then participants' demographic data were noted including recording names written down in Survey123 at the end of the interviews to match data from two applications for the data analysis process. All interviews were conducted with full awareness of participants' private information confidential and their agreements to join the survey.

An interview survey was carried out for 8 days started from October 27 to November 3, 2022 in Tuong Duong and Con Cuong district of Nghe An province by three members of SVW's Conservation Research Team with support of three volunteers who were trained basic information about wildlife and ensured to follow the interview protocol of social research. Six interviewers divided into three teams with different villages were assigned to each team. Each team was created by one SVW's staff and one volunteer to ensure assistance from SVW's staff with unexpected situations and make sure volunteers' ways to carry out the survey following social research rules.

2.2 Data analysis

Qualitative data is presented on excel based on questions of five main parts prepared for the survey such as existence confirmation, behaviors, and habits of Owston's palm civet, as well as information of local people's stories about this species, their impacts on wildlife in general with particularly hunting activity, along with the local awareness of wildlife protection legislation in Vietnam. All recordings were listened to during data written down process and before data cleaning and analysis were implemented.

Surveyed participants were initially categorized by gender, age groups, ethnicity, residentials, occupations and educations. This data gives an overview of the potential groups of people who likely go to the forest and have chances to see wildlife frequently, including Owston's palm civet.

2.3 Limitations of the research

- Due to strengthening law enforcement in wildlife protection in Vietnam recently, there are some limitations to conduct sensitive questions and get the answers from interviewees, particularly actions that breaks the law such as wildlife hunting and selling. Thus, some questions with no answers provided were still recorded as no answer (NA) and used for data analysis process in this research.
- A majority of interviewees were Thai ethnic minority ranging over 46 years old and familiar with local language in conversation and did not have many chances to pursue education, influencing

various elements on the study. Most notably, the local name of Owston's palm civet is variety which makes interviewers hard to clarify the accurate one. In addition, due to interviewees' misunderstanding in Vietnamese language, the survey process took longer time as questionnaires are sometimes complicated for locals to understand.

- It was noticed that the interviewees were more collaborated to answer questions with the present of the local government during interview time. However, this would cause withheld or misled collected information happened by providing false intelligences from locals.
- Some questions were answered with too many different responses which are hard to completely analyze and synthesize. Thus, only the most common responses to these questions stated by interviewees were mentioned in the results section of the study.

CHAPTER 3 – Results

3.1 Demographics

The interview was conducted in 17 villages of 7 communes including Chau Khe, Luc Ha, Mon Son and Yen Khe communes of Con Cuong district and Tam Hop, Tam Dinh, and Tam Quang communes of Tuong Duong district (Nghe An province). In total, 201 interviewees were interviewed with 106 interviewees residing in Con Cuong and 95 interviewees living in Tuong Duong. In which, the survey focused on Tam Hop (36 interviewees) and Chau Khe, Mon Son and Tam Dinh with 35 interviewees for each commune. Since Luc Da commune is the place having only one village chosen to conduct the survey, this commune has the least survey sample size among 7 surveyed communes with 14 participants.

A majority of participants were male (88.56%), farmers (81.09%) and in the age groups of above 55 years old (42.79%) and from 46 to 55 years old (27.36%). 75.12% of interviewees (151 participants) were Thai ethnic minority which is a majority ethnicity in the surveyed areas. Only 3 interviewees were Kinh ethnicity (1.49%).

Most of interviewed people did not get much chances to pursue education as 43.78% respondents completed elementary (83 interviewees), 36.82% interviewees graduated at junior highschool (74 interviewees), and 12.94% participants did not go to school (26 interviewees) (Table 1).

Table 1. Distribution of interviewees by age groups, gender, residential areas, ethnicity, occupations and educations

Variable		N	%	
Age	18-25 (1998-2005)	1	0.5	
	26-35 (1988-1997)	15	7.46	
	36-45 (1978-1987)	38	18.9	
	46-55 (1968-1977)	55	27.36	
	>55 (= <1967)	86	42.79	
	NA	6	2.98	
Places	Con Cuong district	Chau Khe commune (3 villages)	35	17.41
		Luc Da commune (1 village)	14	6.97
		Tam Hop commune (3 villages)	36	17.91
		Mon Son commune (3 villages)	35	17.41
	Tuong Duong district	Tam Dinh commune (3 villages)	35	17.41
		Tam Quang commune (2 villages)	24	11.94
		Yen Khe commune (2 villages)	22	10.95
Gender	Male	178	88.56	
	Female	17	8.46	
	NA	6	2.98	
Ethnicity	Thai	151	75.12	
	Dan Lai	17	8.46	

	H'Mong	12	5.97
	Kinh	3	1.49
	Other	12	5.97
	-	6	2.98
Occupation	Farmer	163	81.09
	Seasonal labor	7	3.48
	Doctor	1	0.50
	Officers and employees	9	4.48
	Retired	7	3.48
	Unemployed	1	0.50
	Other	5	2.49
	Small business/ Household business	2	1.00
	NA	6	2.99
Education	Junior high school	74	36.82
	Highschool	9	4.48
	Elementary	83	43.78
	College	1	0.50
	Not going to school	26	12.94
	Other	1	0.50
	Vocational training, intermediate	1	0.50
	NA	6	2.98

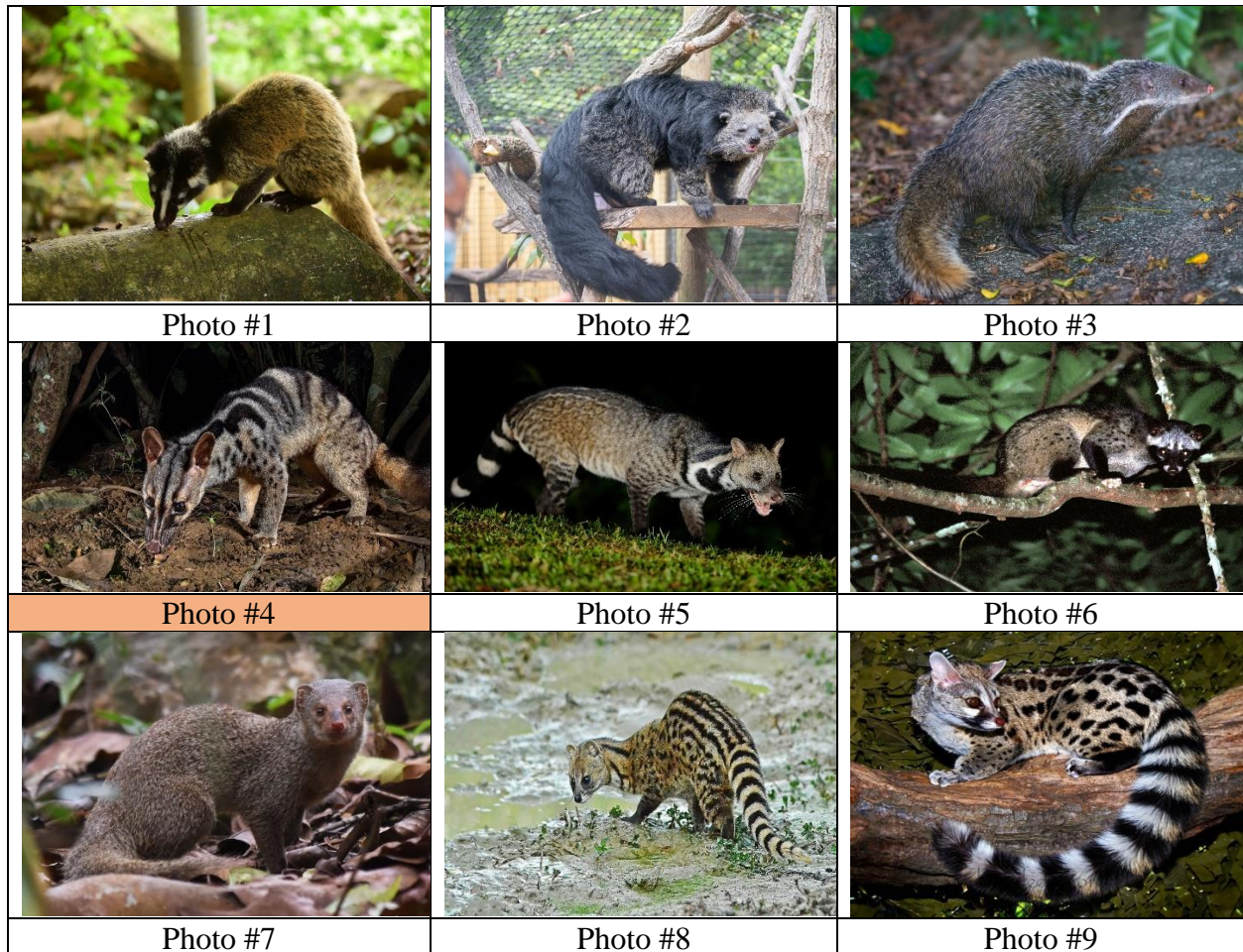
3.2 The ecological knowledge of Owston's palm civet (*Chrotogale owstoni*)

3.2.1 Owston's palm civet's existence affirmation and local culture-relating information

On this research, basic questions related to Owston's palm civet were prepared to gain information of its existence and local culture-relating to this species such as local names, local stories and traditional belief, as long as its habitats, diets and behaviors. Especially, researchers prepared pictures of Owston's palm civets and other civets to show interviewees. In total, 9 pictures were prepared aimed at local residents' identification skill and information assessment about Owston's palm civet given by participants.

Collected data shows majority of interviewees chose Photo number 4 for the Owston's palm civet identification (142 responses) which is the accurate one. In addition, interviewees were asked to identify other civets in the rest eight photos. About one-third of interviewees were successful in civets' identification (62 responses), 75 participants failed in this challenge and 64 responses were not recorded.

Image 1. Photos were showed to assess locals' identification skill for Owston's palm civet



Most respondent confirmed the existence of Owston's palm civet in the buffer zones of Pu Mat National Park with 148 responses (73.62%), only 4.48% of participants claimed that this species did not distribute in the areas while 2.99% did not know about it and 18.91% did not give their answers to this question (Figure 1).

Regarding local fable stories, majority of interviewees don't know any stories or faiths related to Owston's palm civet (49.25%) or cannot give any answers for this question (42.29%). Only five interviewees (2.49%) said this species were mentioned in their local culture including Thai ethnic minority's traditional song and praying (Figure 2). All answers to say Owston's palm civet mentioned in local culture were given by interviewees who are above 55 years old, 4 out of 5 are Thai ethnicity.

Figure 1. Locals’ confirmation about existence of Owston’s palm civet

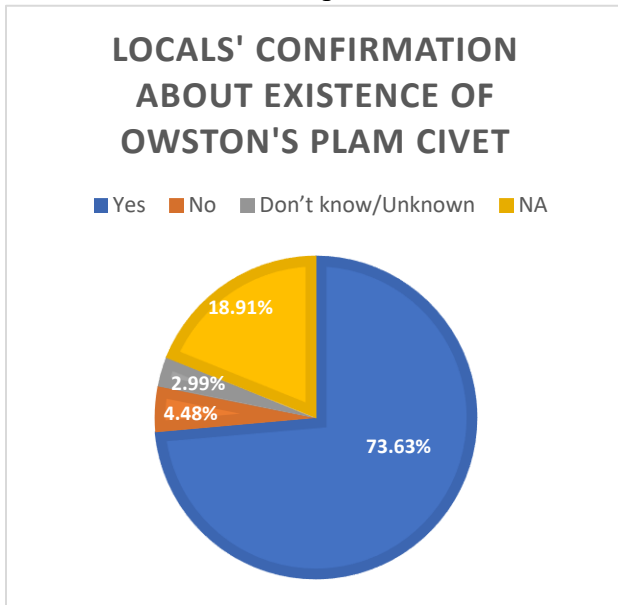
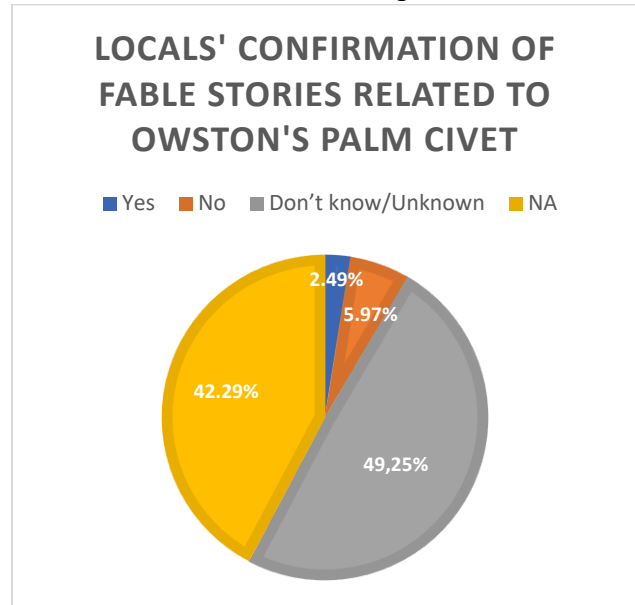


Figure 2. Locals’ confirmation of fable stories related to Owston’s palm civet



Owston’s palm civet has many different local names. Among various names listed by participants, we conducted the crosscheck with photos and interviewees’ descriptions to assess what is accurate and what is not. As a result, three accurate local names of Owston’s palm civet collected were “Den can tao” (Dền cần tao/ Dên cần táo), “Den meo” (Dền mèo) and “Den can pong” (Dền cần póng/Dên cần pong) with total 37 respondents. In which, “den” (dén/dên) is “chon/cay” (chôn/cây) meaning “civet” in Thai ethnic minority language. It is noticed that “den chua thau” (dén chừa thâu) was also mentioned by many participants (Table 2). However, there is no evidence to affirm that this local name is accurate as some of participants who gave the name also chose the wrong photos prepared by interviewers.

Table 2. Local names of Owston’s palm civet mentioned by interviewees.

Local names	N	Accurate	Inaccurate	Unidentified
Dền cần tao/Dên cần táo	37	x		
Dền mèo	5	x		
Dền cần póng/Dên cần pong	6	x		
Dén chừa thâu	7			x
Chôn/Nghên/Dín	9		x	
Dên han	4		x	
Dên hom	3		x	
Cây hương	3		x	
Tô dên	5		x	
Tô nác	1		x	
Dên khum/Dên khi khum	3		x	
Others	32		x	
NA	93			

3.2.2 Habitat and behaviors

Table 3. Owston's palm civet living behavior

Solo or living by group	Number of responses	%
Solitary	99	49.25
Group of two individuals	46	22.89
Three individuals or more	38	18.91
Don't know/Unknown	38	3.98
NA/Blanks	8	18.91

Owston's palm civets is seen the most while living solitary (49.25%). 22.89% respondents (46 responses) stated this species often live by pairs and herb of three individuals above were claimed by 18.91% of 38 respondents (Table 3).

Table 4. Owston's palm civet living lifestyle

Living lifestyle	Number of responses	%
Cave	18	8.96
On the tree	115	57.21
Others	15	7.46
Don't know/Unknown	16	7.96
NA/Blanks	46	22.89

More half of participants indicated tree hollows, nests and branches are where Owston's palm civet prefer the most to live (57.21%), followed by those living in variety caves such as stone cave, soil cave or small cave which were claimed by 18 respondents (8.96%) (Table 4).

Owston's palm civet live widespread around Pu Mat National Park. However, the most ideal place to live is in the primary forests with many big trees (41.79%) and a small number of it would be met living in the areas which are close to rivers or streams (8.96%) (Table 5).

Table 5. Owston's palm civet's habitats

Habitats	Number of responses	%
Primary/dense/thick forest	84	41.79
Near stream/river	18	8.96
Near residentials	2	1.00
Forest where has many fruit trees	10	4.98
Caves	4	1.99
Hills	7	3.48
Others (bamboo/savanna/young forest, rice field, borderlines, etc)	20	9.95
Don't know/Unknown	5	2.49
-	67	33.33

When being asked about active time in a year of Owston's palm civet, participants provided many different answers which are listed into three groups as months, seasons and weather for data analysis process. Collected data shows that Owston's palm civet often active in summer (78 responses), mostly from April to July as rains occur more frequently and fruits ripen during this time. In addition, winter is also considered as an active time of Owston's palm civet with 64 responses collected. Especially, this species was claimed by few interviewees not to have specific active time as it can be seen as frequent every time in a year (33 respondents) (Figure 3).

Seasons also relate to Owston's palm civet's giving birth activity. Summer is found as the most highly active time in a year for Owston's palm civet and inter is not a season for the civet to active the most, however, this season is the most popular time for its mating and reproduction, with mostly happens on August to November, reaches peak in October (Figure 4). How long the gestation taking is not included in this study.

Figure 3. Highly active time of Owston's palm civet by seasons and weather

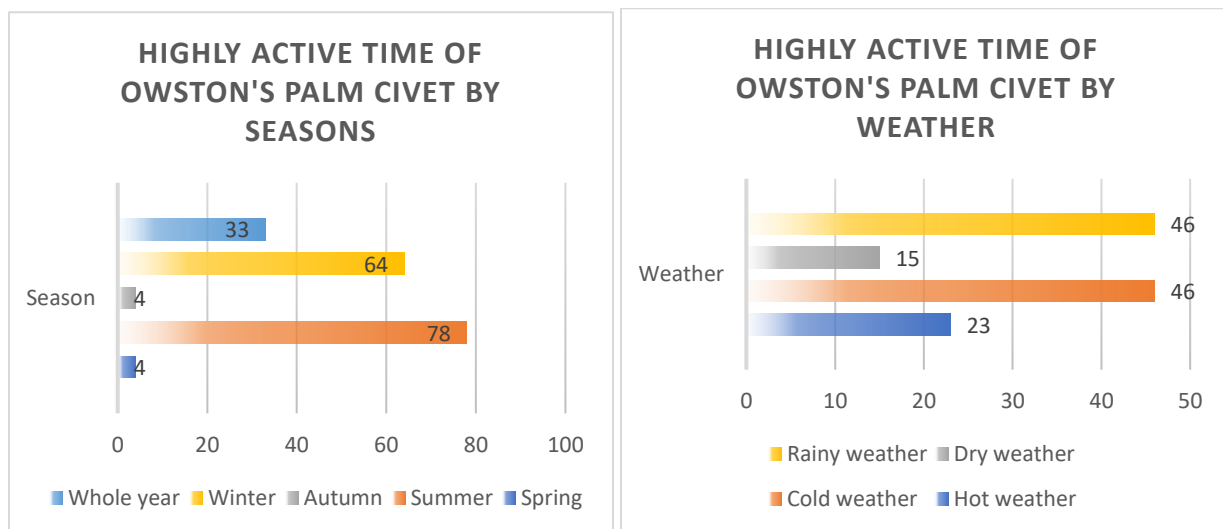
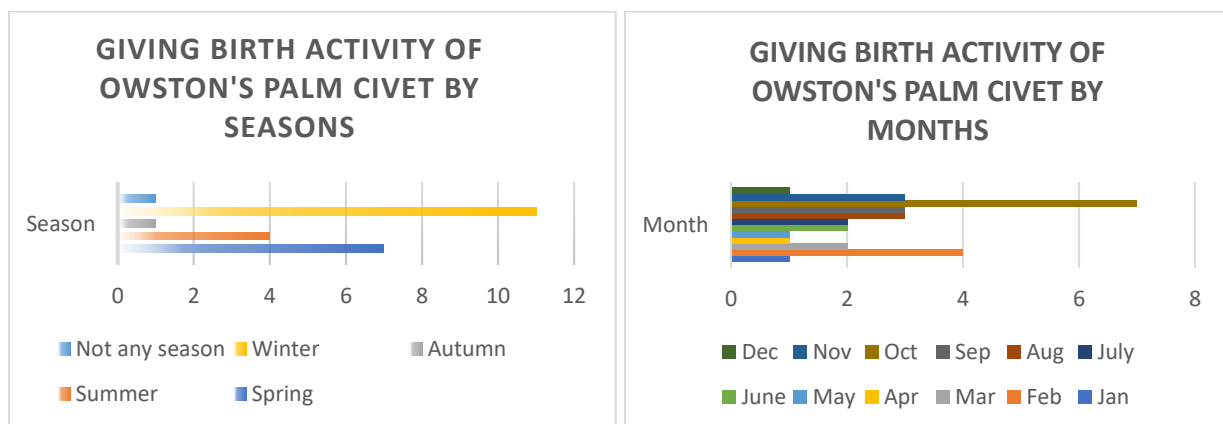


Figure 4. Giving birth activity of Owston's palm civet by seasons and months



It is acknowledged that minority of participants have deep insights about Owston's palm civet which is specially clearly noticed when some questions relating to reproduction were asked. All

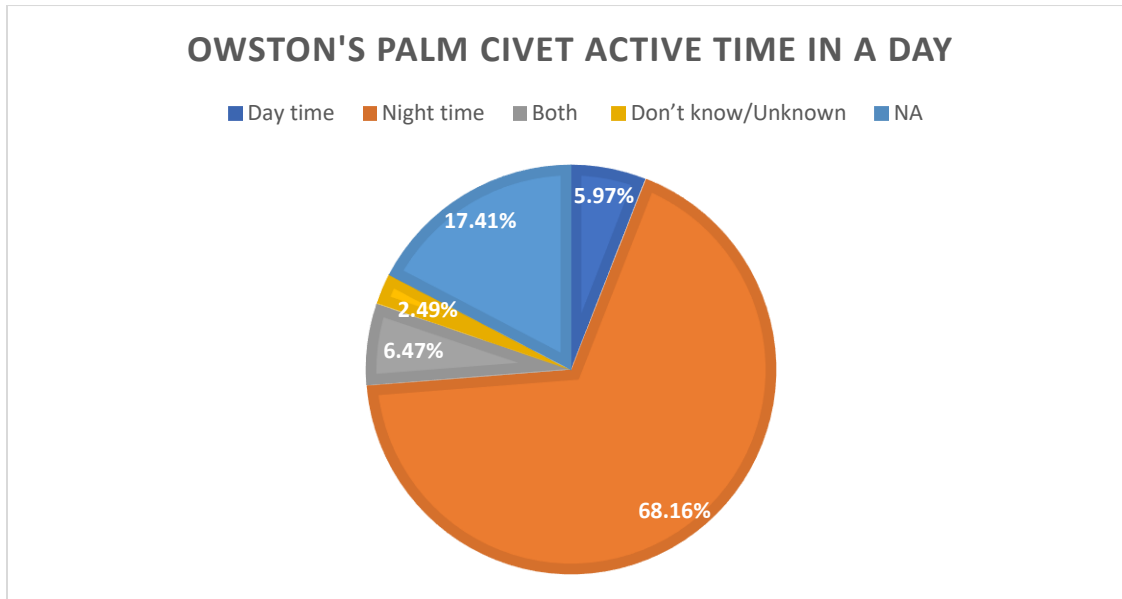
the useful collected answers were listed in the Table 6, showed that Owston's palm civet mostly give birth once or twice a year, with at least two individuals for each time. Tree hollows are the most ideal place for breeding (43.28%). Before reproduction, this species tends to find places and make nests to give birth (Table 6).

Table 6. Questions relate to reproduction activities of Owston's palm civet

Questions	Responses	N	%
How frequency that Owston's palm civet give birth in a year?	Once	27	13.43%
	Twice	10	4.98%
	Thrice a year	1	0.5%
	Once or twice every two years	2	1%
How many pups that Owston's palm civet give birth each time?	One	1	2.49%
	Two to three	54	26.87%
	Above three	22	10.95%
What is Owston's palm civet often do before breeding?	Choose place to give birth	3	1.49%
	Making a nest	3	1.49%
	Collect fruit to the nest	1	0.5%
What are the common places that Owston's palm civet gives birth?	Cave	9	4.48%
	Tree hollow	87	43.28%
	Rock hollow	5	2.49%
	On the ground	1	0.5%
	Branches	1	0.5%
	Underbush	4	1.99%
	On the tree	1	0.5%
	In the burrow	3	1.49%

Similar to the majority of wildlife, Owston's palm civet tends to active during night time with 137 respondents (68.16%) (Figure 5).

Figure 5. Collected data about Owston’s palm civet active time in a day.



The civet was claimed mostly to try to escape when it feels or meets dangers (n=126, 62,69%). Other defensive behaviors were mentioned with only a couple responses such as biting, standing still, walking, and threatening back (Table 7).

Table 7. Owston’s palm civet’s defensive behaviors when meeting dangers

Defensive way	N	%
Biting	7	3.48
Escape/running away	126	62.69
Stand still/do not run	2	1
Depend on situations	1	0.5
Walk	1	0.5
Threaten	2	1
Don't know	3	1.49
NA	69	34.33

3.2.3 Diets

Regarding food, it is seen that Owston’s palm civet would eat variety kind of food. In this study, all the mentioned food was categorized into different groups including fruits, plants, insects, live animals, carrions/carcasses, and meat. In which, the most common edible food is fruits such as banana, fig, papaya, chestnut, nut, plam fruit; and live animals such as squirrel, chicken, frog, snake, snail, bird, fish, and rat with 61,19% and 33.83% responses, respectively. In contrast, the less common food eaten by Owston’s palm civet are plants with 3.48% of 7 responses and meat with 3.98% of 8 responses recorded (Table 8).

Out of 201 interviewees, 77 people chose fruit as Owston’s palm civet’s favourite food (38.31%), which is the highest chosen food group. Banana was mentioned the most among

different fruits listed by interviewees. In addition, live animals are also preferred with 34 responses (16.92%), in which, rat and chicken were stated the most (Table 8).

Table 8. Edible food for owston’s palm civet and its favourite food.

Food	Owston’s palm civet’s food		Owston’s palm civet’s favourite food	
	N	%	N	%
Fruit (banana, fig, papaya, chestnut, nut, palm fruit)	123	61.19	77	38.31
Plants (sapling, tree roots, root of <i>Nadhuca pasquieri</i> , leaf, fungi, potato)	7	3.48	3	1.49
Insects (cricket, centipede, worm, termite, cockroach, locust, grasshopper)	37	18.41	8	3.98
Live animals (small animals, frog, bird, snake, snail, omnivorous, rat, crab, terrestrial prey, squirrel, breed chicken, wild chicken, fish)	68	33.83	34	16.92
Carrion/carcasses	12	5.97	1	0.5
Everything but fruit	1	0.5	1	0.5
Meat	8	3.98	6	2.99
Don’t know/Unknown	9	4.48	6	2.99
NA	22	10.95	74	36.82

3.3 Wildlife hunting activity

In this study, a couple of questions related to illegal wildlife hunting activity were prepared aimed to clarify wildlife hunting trends and methods of locals in general and Owston’s palm civet in particular, then clear out any hotspots and special purposes, tips or tools needed for local wild animals and Owston’s palm civet hunting.

3.3.1 General wildlife hunting activity

In total, there are 161 out of 201 participants giving useful answers for a hunting style question. In which, more half indicated local hunters often go hunting by groups made up by at least two persons (48.26%). 20.4% of 41 interviewees stated both solo hunting and groups of hunting happening in the area. Solo hunting is the least common hunting style with only 11.44% (23 responses) (Table 9).

The majority of respondents stated local hunters go hunting occasionally (70.15%) once a week, mostly in the winter when they are free with field works. Only 6 out of 201 respondents claimed there were professional hunters in the area (2.99%) (Table 9). Participants who claimed about

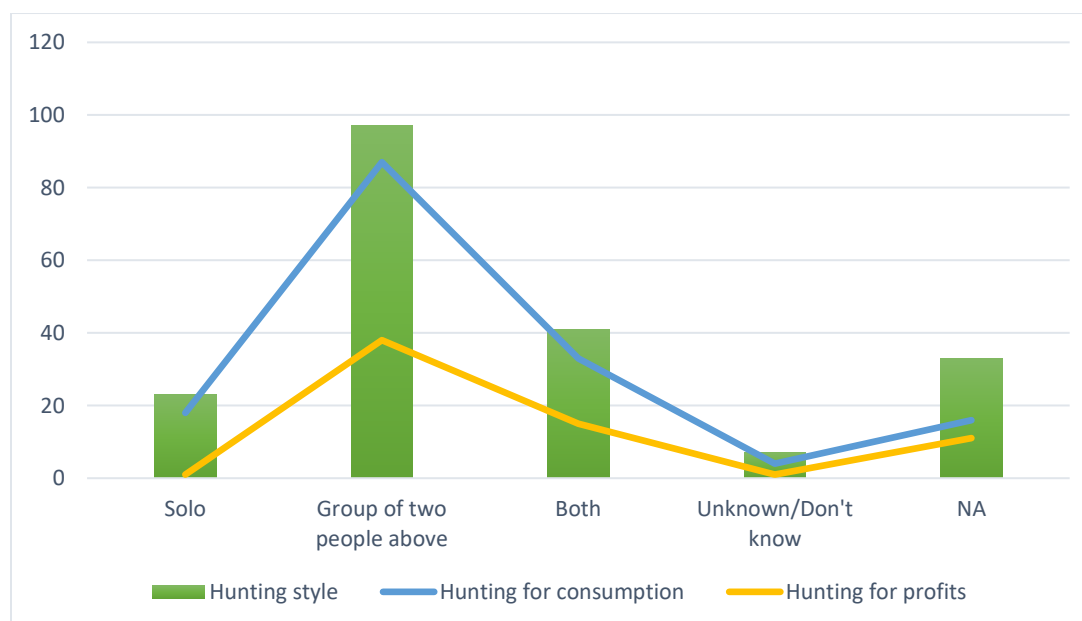
professional hunters in the areas are living in Tam Hop (3 respondents), Mon Son, Yen Khe and Tam Quang commune (1 respondent each).

Table 9. Hunting style of local hunters around Pu Mat National Park

Hunting style			Professional hunter(s)		Occasional hunter(s)		Unknown	
	N	%	N	%	N	%	N	%
Solo	23	11.44%	0	0%	20	9.95%	3	1.49%
Group of two people and above	97	48.26%	3	1.49%	77	38.31%	17	8.46%
Both	41	20.4%	2	1%	32	15.92%	7	3.48%
Don't know/Unknown	7	3.48%	0	0%	3	1.49%	4	1.99%
-	33	16.42%	1	0.5%	9	4.48%	23	11.44%
Total	201	100%	6	2.99%	141	70.15%	54	26.87%

Looking from an overall perspective, hunting wildlife to provide food for consumption is claimed more popular in all types of hunters. However, it is noticed that the higher number of respondents for each hunting style claimed, the higher number of answers for wildlife hunting purposes in both consumption and profits collected. Particularly, hunters who hunting by groups were claimed the most with both consumption (n=87) and profits (n=38) purposes, which are more twice higher than those who go hunt by both solo and hunting groups with same purposes. Meanwhile, it is discerning that most solo hunters claimed to go hunting wildlife for consumption (n=18), only one interviewee stated that the main purpose of solo hunters is selling for profits (Figure 6).

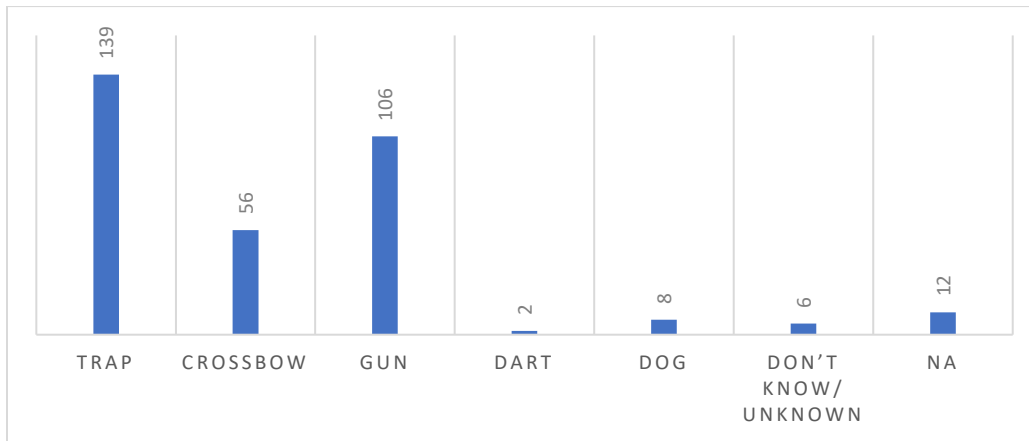
Figure 6. Wildlife hunting purposes by hunting style



Traps are the most common hunting tools applied by local hunters (n=139), especially snare traps and brake line traps due to the affordable prices of materials used to make these ones. Handmade-guns, surprisingly, were mentioned by 106 respondents which is also used popularly by hunters. Crossbows are less common than traps and guns, however, it is often being applied with poison. The materials to make poison used with crossbows and how local hunters would buy bullets for their guns was not cleared in this research (Figure 7).

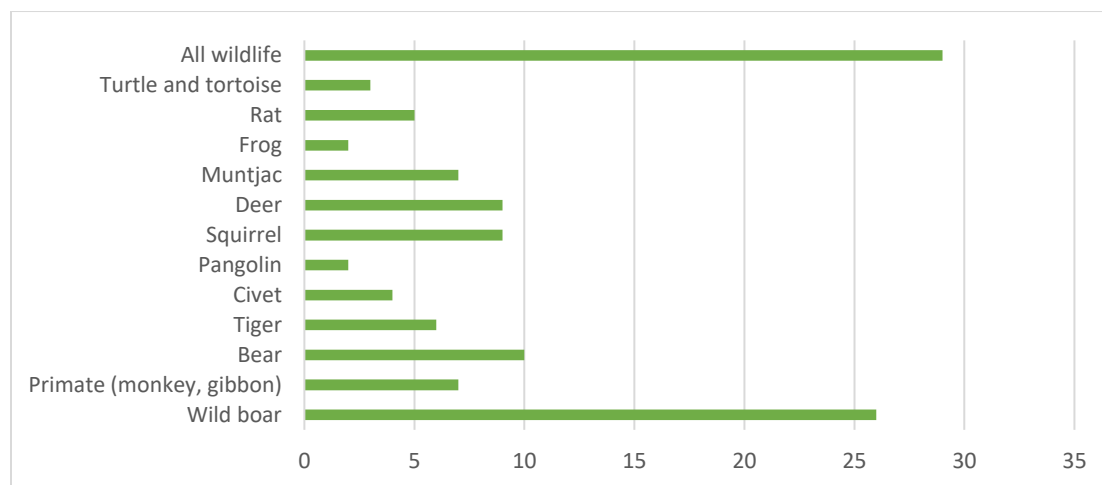
It is acknowledged that 8 out of 8 respondents giving answers that dogs are trained to help local hunters find and catch wildlife (Figure 7), also stated that all hunters using dogs to go hunting by groups.

Figure 7. Wildlife hunting tools claimed by respondents.



Wild boar, bear, squirrel, deer, muntjac and tiger are the most commonly hunted wild animals, respectively. It is seen that some other species such as civet and snake seemed less preferred by local hunters residing in the buffer zones of Pu Mat National Park. On the other hand, the number of respondents giving answers about hunted endangered species such as bear (n=10), tiger (n=6) and muntjac (n=7), surprisingly, was quite high (Figure 8). No special tools or reasons and specific time for these endangered and rare species hunting were addressed from local interviewees in this research.

Figure 8. Commonly hunted wild animals by local hunters



To get deeper insight of relative perspective related to highly endangered species hunting information collected from participants, data about types of hunters, hunted endangered species and hunting method were combined in the Table 10.

Combined data displays apart from tiger, most endangered and rare species was hunted by occasional hunters. Tiger was the only wild animals claimed that being hunted not only by occasional poachers but also professional ones by using guns. It is clearly seen that guns and traps were used the most for all mentioned precious wildlife by occasional hunters. Dogs were used for bear and gibbon detection, and crossbows (properly with poison) were specially used for gibbon and muntjac poaching (Table 10).

Table 10. Combine collected data of endangered hunted species, types of hunters, hunting styles and hunting tools claimed by respondents

Species	Responses	Type of hunters	Hunting style		Hunting tools			
			Solo	Group of hunters	Guns	Traps	Dogs	Cross-bows
Pangolin	2	Occasional hunters		x	x	x		
Bear	10	Occasional hunters	x	x	x	x	x	
Tiger	6	Occasional hunters		x	x	x		
		Professional hunters			x			
Gibbon	1	Occasional hunters		x	x	x	x	x
Muntjac	7	Occasional hunters	x	x	x	x		x

Turtle and tortoises	3	Occasional hunters	x	x	x	x		
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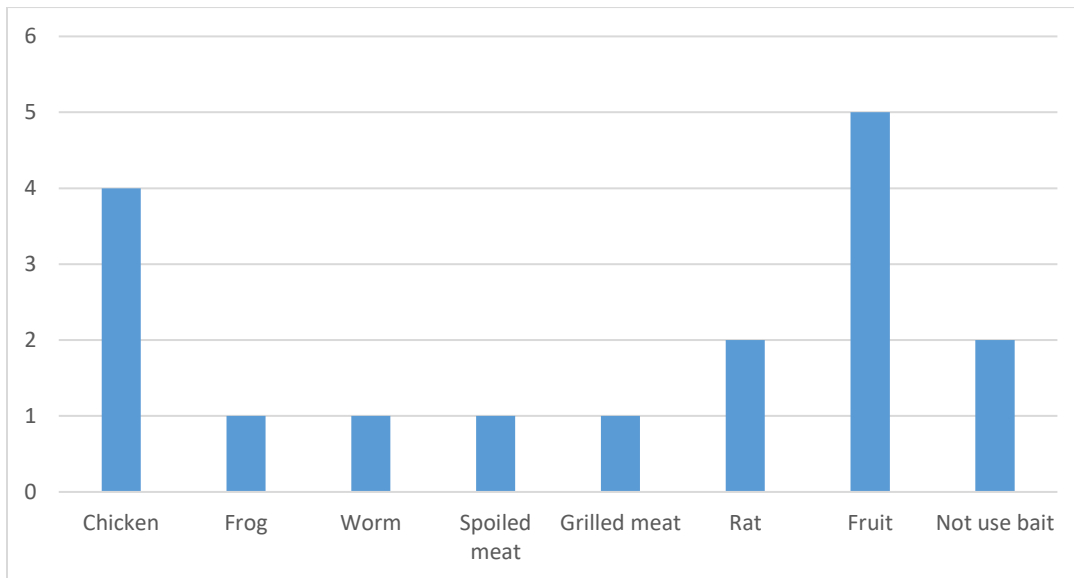
An analysis of table reveals consumption drives the most in endangered wild animals hunting activity. Gibbon hunting seems mostly for food as no respondents claimed local hunters hunt this species for profits. Regarding to hunting seasons, local hunters were claimed to go hunting the most in winter. Summer was also preferred as rains come more frequent that wild animals tend to go out for food, and fruit ripped during this time (Table 11).

Table 11. Combined collected data of hunting purposes and hunting seasons related to endangered species from respondents (the season with higher number of respondents was marked as double “x” character).

Species	Type of hunters	Hunting purposes		Hunting seasons			
		Consumption	Profits	Spring	Summer	Autumn	Winter
Pangolin	Occasional hunters	2	2				x
Bear	Occasional hunters	9	1		x		xx
Tiger	Occasional hunters	5	0		x		xx
	Professional hunters	1	1				x
Gibbon	Occasional hunters	1	0				x
Muntjac	Occasional hunters	6	1	x	x	x	xx
Turtle and tortoise	Occasional hunters	3	3		x		xx

Fruit, chicken and rat were used the most as baits for wildlife hunting (Figure 9).

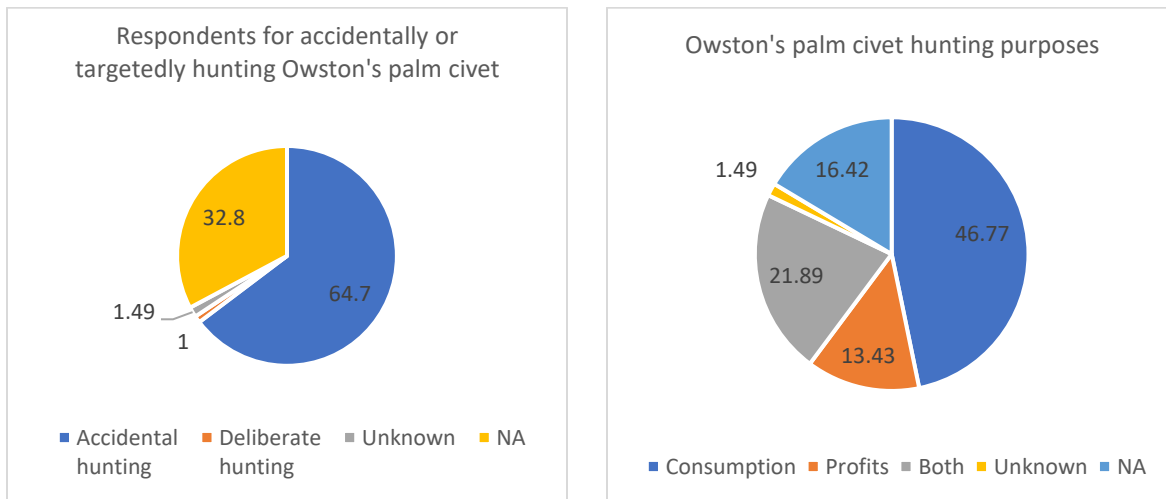
Figure 9. Baits used for attracting wildlife



3.3.2 Owston's palm civet hunting activity

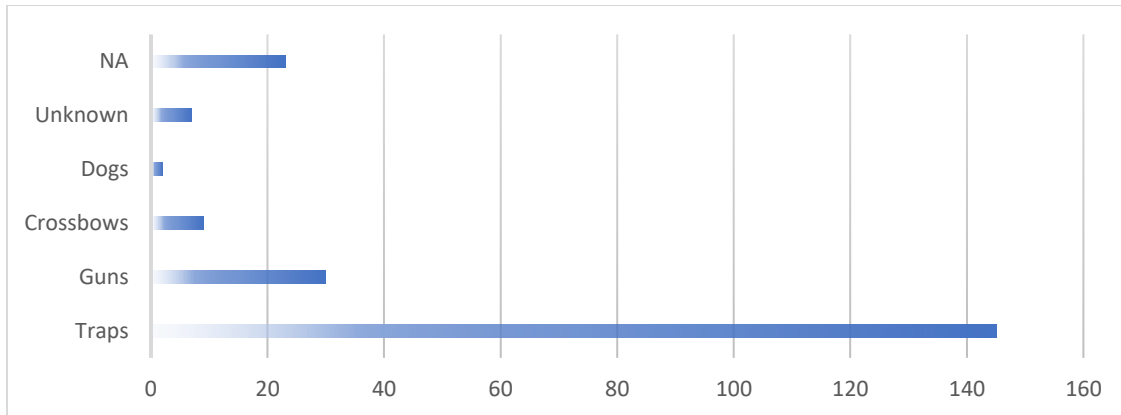
A large number of participants stated Owston's palm civet's hunting is mostly accidental with 64.7% (n=130). Only 1% of 2 respondents indicated that local hunters target to hunt this species. Sharing the similar trend with wildlife hunting purposes, most hunted Owston's palm civet were claimed for consumption (n=94, 46.77%), about twice times higher than those for both consumption and selling purposes (n=44, 21.89%), and 13.43% of 27 interviewees claimed hunted Owston's palm civet would be sold for profits (Figure 10).

Figure 10. Hunted Owston's palm civet by accidentally or targetedly and hunting purposes



The most common tool for Owston's palm civet hunting is traps (n=145) which are mostly unidentified by respondents (Figure 11). Identified traps clarified by respondents were snare trap (n=10), falling trap (n=3), brake line trap and grip trap (n=2 each), wire trap and net (n=1 each).

Figure 11. Tools used for Owston’s palm civet hunting



As the hunting activities still happening locally, the locals’ awareness of Owston’s palm civet population change was assessed, which aims at the species population status evaluation in the area. Results of data analysis illustrates there is just a bit gap between respondents claimed that Owston’s palm civet decreases and those stated the opposite opinions with 39.2% (79 respondents) and 30.85% (62 respondents), respectively (Table 12). In which, at least four respondents indicated that this species population is significantly going down. Hunting activity was the main reason for the species decline (n=110), along with other reasons such as degradation and habitat loss made by human (n=12), wildlife trade (n=6) lack of food (n=2), the civet’s behaviors such as killing offsprings (n=1). Meanwhile, the most respondents stated the civet’s population increases also gave answers pointing out places this species mostly seen such as local streams (n=25) and in Pu Mat National Park (n=17). In addition, it is recorded that one respondents gave a detail answer of about 20 individuals of Owston’s palm civet living around his village recently (0.5%) but refused to give his opinion about the population change of the civet (Table 12).

Table 12. Population change of Owston’s palm civet in survey area

Population changes	N	%
Decrease	79	39.3%
Increase	62	30.85%
Not change	4	1.99%
Other	1	0.5%
Unknown	16	7.96%
NA	39	19.4%
Total	201	100%

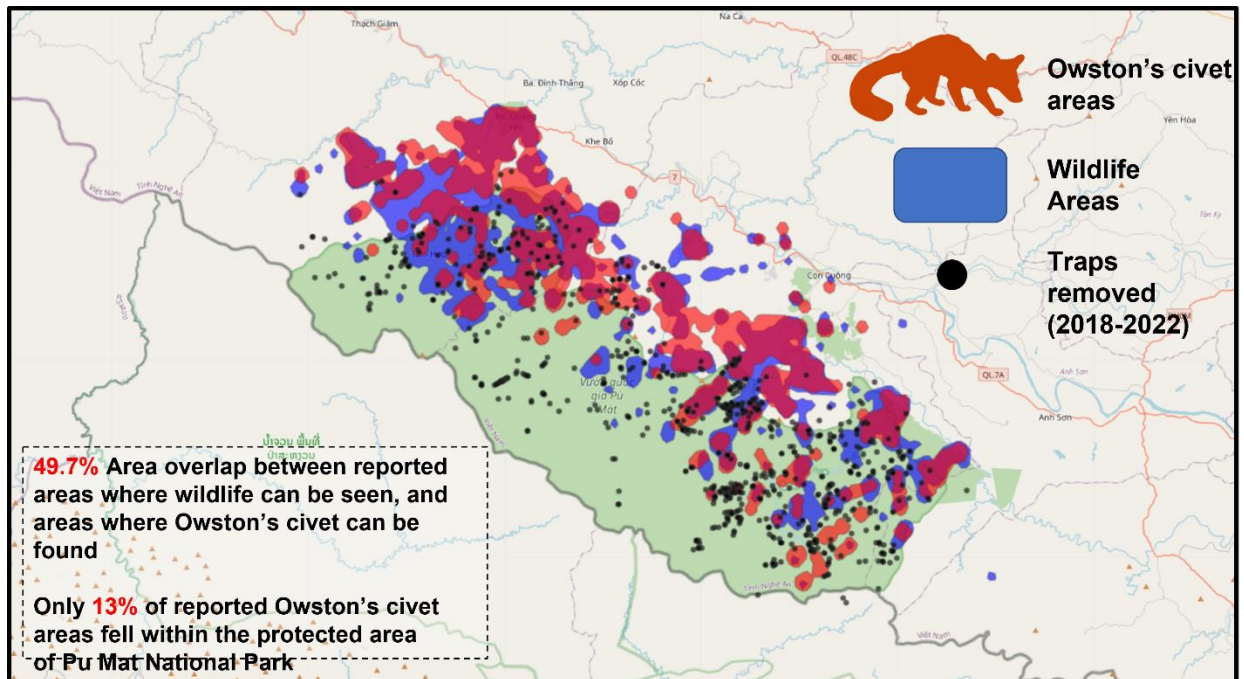
Bearings (the 360 degree compass direction) were recorded from respondents when asking to point to the direction where the most wildlife lived, and again to point to the areas where Owston's civets could be found. A line was drawn using GIS techniques and intersected with one another to generate a series of new point locations indicating shared areas where local people believed both Owston's civets and other wildlife to be. A kernel density estimate was then

generated using the Least Square Cross Validation (LSCV) method at 95% isopleth contour. The polygons were then overlapped with each other to determine if there were differences in the reported wildlife areas vs. the reported Owston's civet areas.

Collected data shows that Owston's palm civet can be mostly seen in Tam Hop, Tam Dinh and three-crossroad of Tam Thai, Khe Thoi station in Tam Quang commune (Tung Hung, Tan Huong and Lien Huong village) and Yen Khe communes (Trung Chinh, Trung Huong and Trung Thanh village). Meanwhile, a lot of wildlife can be met in the Northern area of Pu Mat National Park and its buffer zones (Image 2).

Traps locations were reported via SMART among 4 years from 2018 to 2022 showed 9304 traps removed from all over places around Pu Mat National Park (Pu Mat National Park, 2020). However, traps were likely to be found and removed in Southern areas where has Yen Khe and Mon Son communes of Con Cuong district.

Image 2. Combine bearing and distancing to wildlife and Owston's palm civet information collected from local interviewees and traps locations from SMART around Pu Mat National Park



3.4 Understanding of Vietnamese wildlife protection law and wildlife conservation propaganda

67.16% of 135 respondents agreed that all wildlife was protected and banned from hunting activity and 5.47% of 11 interviewees stated that almost wildlife could not be hunted as hunting is illegal. 9.45% respondents believed only critically endangered species were prohibited from hunting (n=19) (Figure 12).

Regarding to Owston's palm civet, majority of participants knew this species was categorized in Vietnamese wildlife protection law (83.58%, n=168). Only one respondent said the civet was not listed as protected wild animal (Figure 12).

Figure 12. Locals' awareness of banned wildlife from hunting activity and Owston's palm civet protection regulated in Vietnamese law

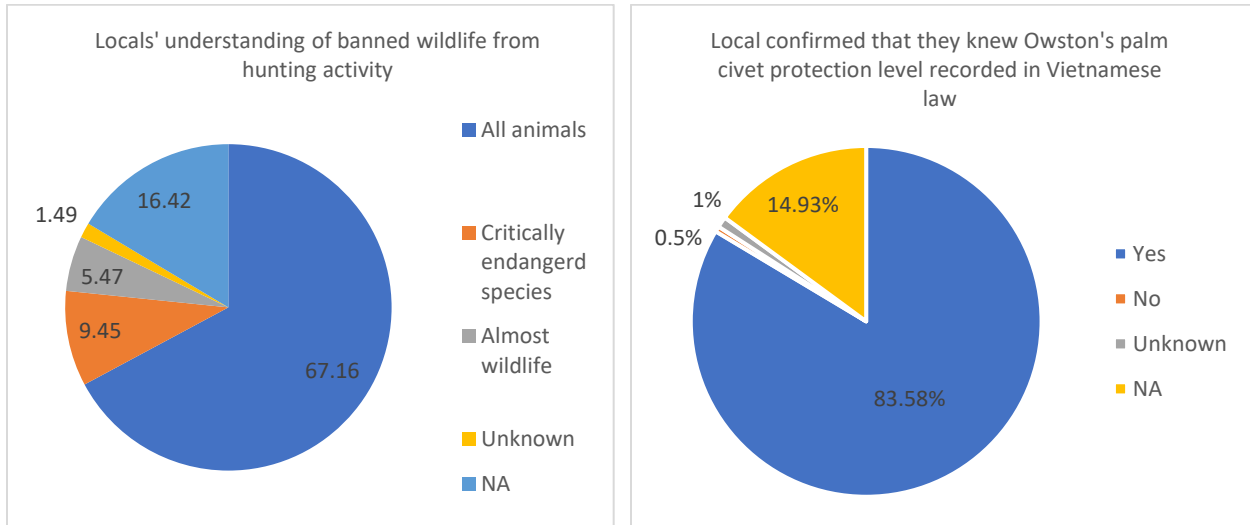
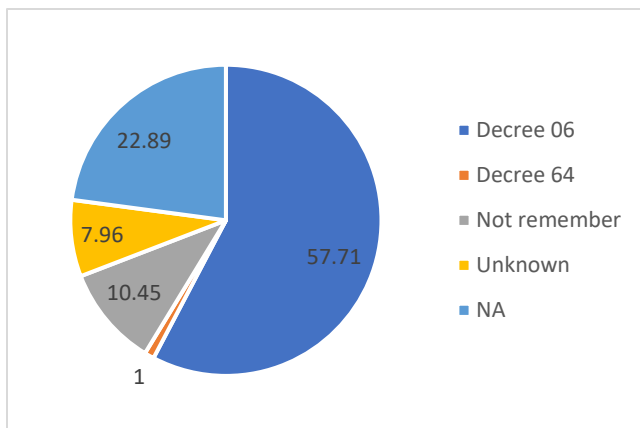


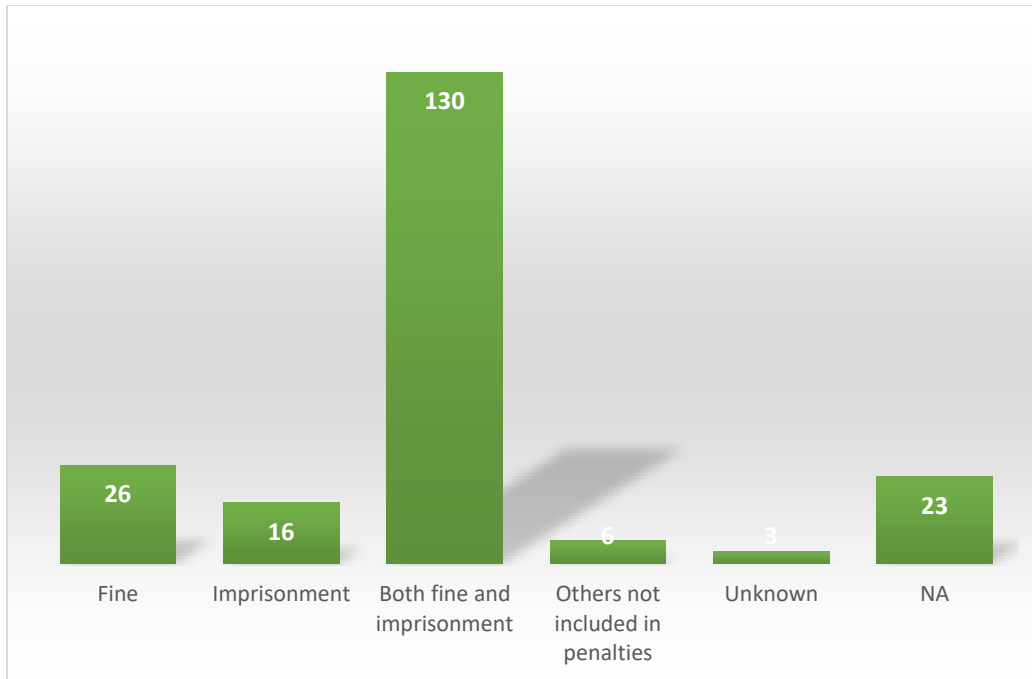
Figure 13. Vietnamese regulations related to wildlife protection mentioned by interviewees



Being asked about the recent law documents that are in place to protect wildlife in Vietnam, more half interviewees answered Decree 06 with 116 responses. It was seen that only two responses mentioned about Decree 64 were collected (Figure 13).

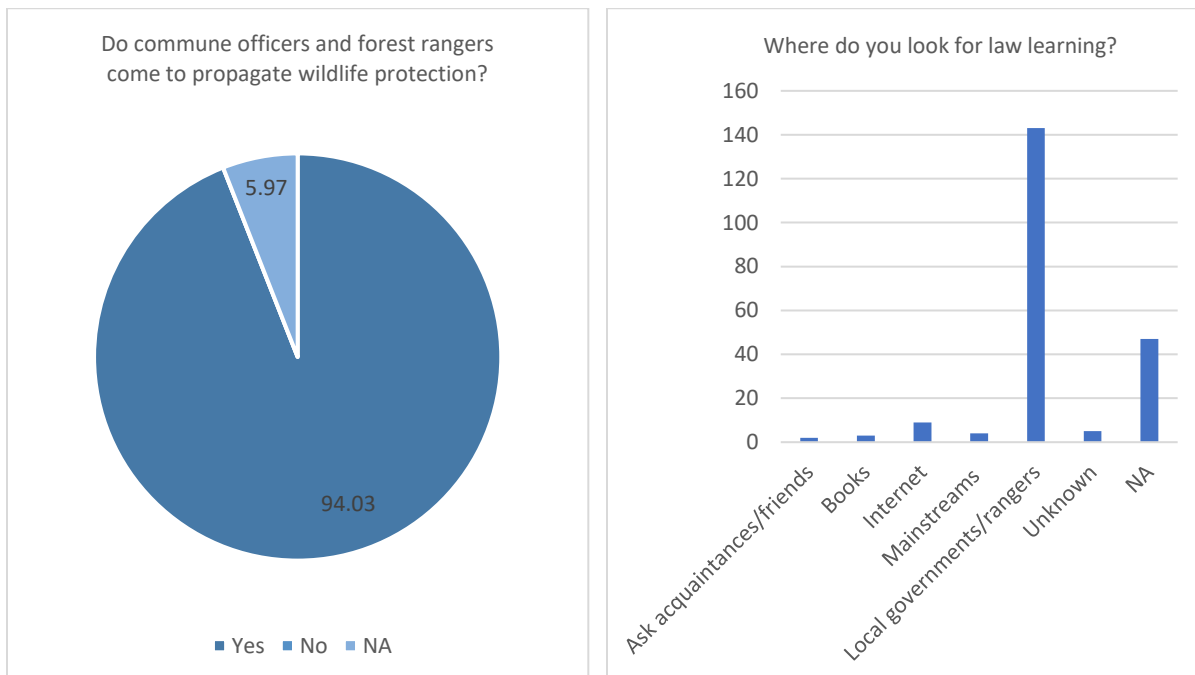
Fine and imprisonment were acknowledged the most by participants. 130 respondents answered both when being asked about punishments that hunters may face to for their hunting activity. Fine and imprisonment were separately mentioned by 26 and 16 respondents, respectively. Meanwhile, six interviewees gave answers which were not included in four penalties in Vietnamese criminal law (Figure 14). Probation and suspended sentence were two punishments that no participants mentioned in this survey.

Figure 14. Punishments for hunting wildlife mentioned by respondents



Almost interviewees confirmed that local governments and rangers came to propagate about wildlife protection in the area (94.03%, n=189). Thus, information sources from local governments and rangers is also accessed the most by interviewees with 143 responses collected (Figure 15).

Figure 15. Responses for respondents' confirmation about wildlife protection propagated by local governments/rangers and sources that locals look for to learn law



The logos of Pu Mat National Park and wildlife conservation organizations attached in local propaganda facilities were showed to interviewees for recognition. Results illustrate more half participants recognized Pu Mat National Park logo with 55.22% (111 respondents), followed by SVW and FFI's logos with 16.92% (34 respondents) and 14.43% (29 respondents), respectively (Table 13).

Table 13. Responses of logos recognition of interviewees residing in buffer zones around Pu Mat National Park

Logos	N	%
SVW	34	16.92%
FFI	29	14.43%
Pu Mat National Park	111	55.22%
Not selected	64	31.84%
NA	18	8.96%

3.5 Other important information collected

One of the most fascinating information collected in the survey is the confirmation of participants about existence of one of the most rare, endangered and mysterious species in the world, Saola (*Pseudoryx nghetinhensis*) as at least one respondent claimed he hunted this precious species more than 20 years ago. According to the respondent, Khe Bung (Mon Son commune) and Trung Chinh (Yen Khe commune) were two areas where used to have Saola. In which, Khe Bung is the name of a local village and its nearby stream. The gap between two areas were about 40 kilometers. According to Grieser Johns (2000), Saola was trapped by camera twice from October to November of 1998 in natural spring of hot water in the Khe Bong valley (Con Cuong district). A part from Khe Bong, Khe Huoi Chat was also claimed by locals where Saola quite prevalent. No reports from any locals residing in Tuong Duong district about the absence of this rare mammal (Grieser John., 2000).

During this survey, it was reported by respondent that Saola used to live in herds nearby waterholes and along streams and its horn would fall by its own in the right season in its later life. However, all information experts gained about Saola from camera traps were limits and only one individual was trapped by hidden camera in the forests for each finding time in many years (Squirrel & Son), a part from Robichauds and Timmins (2004) stated that this precious species just travelled by groups of a mother and its offspring but not in a herd. Thus, this information can be considered to use as a crosscheck reference for the future Saola conservation research.

CHAPTER 4 - Discussions

- There are many local names for Owston's palm civet located in the area, although majority of respondents were Thai ethnic minority. The reason clarifying why this species does have too many different local names has not been pointed out in this survey. However, this information is an important source to use for future community surveys related to this endangered species conservation.
- It is seen that the education level of most of respondents were low, as majority of participants were over 36 years old. Since Pu Mat is a remote area, it is hard for locals to pursue education and go out from their living areas. Thus, wildlife hunting and consumption is a way for them to survive. It seems that wildlife consumption is implemented more frequently than wildlife hunting as majority of interviewees is in the old age, which does not allow them to often go to forest and hunt due to adverse health condition while long time staying in the forest request a better physical health. Besides, not having chances to pursue education and frequent local language usage made participants hard to understand and answers some survey questions as misunderstanding in Vietnamese.
- There are many questions that its answers were not given by respondents, especially some specific questions about species such as Owston's palm civet's reproduction even though most of respondents were males and pointed out by snowball method which aimed to find out respondents who often go to the forest for exploitation and have deep knowledge about biodiversity.
- It is seen that Owston's palm civet has been recorded in local fable stories and culture. However, it seems to have faded as only 3 respondents knew about it and both are about 60 years old.
- Many local names of Owston's palm civet were collected in this study. Three of the mentioned names were confirmed as accurate ones. The rest were unidentified. Thus, this is an important piece of information for conservationists on the way conduct community survey in effective way to get more intelligence about the civet from locals.
- April to July is the ideal time to set camera traps to capture Owston's palm civet around Pu Mat National Park as rains occur more frequently during this time and they would go out for food. On the other hand, winter which starts from October was claimed to be Owston's reproduction time which would be a good time for conducting field research to observe and learn more about this species. Besides, some collected responses claimed the Owston's active in whole year, this may because two common active time of this species (summer and winter) are becoming longer as the adverse consequences of climate change.
- Traps are claimed as the most common hunting tool used by local hunters. However, it is noticed that hand-made guns are also commonly used for wildlife hunting. The facts that how local hunters would buy bullets for their guns or what they use to make bullets for the guns are still an unexplainable question in this research.
- Among list of hunted wild animals claimed by participants, bear, tiger, pangolin, gibbon and muntjac were also mentioned with quite high responses. This piece of information is important as these species are rare and endangered wild animals with the highest level of

protection regulated by Vietnamese government. Therefore, it is likely that not only the core areas of Pu Mat National Park but also its buffer zones are home to many wildlife, especially endangered species.

- At least five professional hunters were claimed in the survey by 3 respondents residing in Tam Hop commune and 3 respondents living in Yen Khe, Mon Son, and Tam Quang commune (one interviewee each). These places were also indicated where Owston's palm civet often seen in the Northern area (Tam Hop and Tam Quang communes, Tuong Duong district) and Southern area (Yen Khe and Mon Son communes, Con Cuong district). In addition, wildlife in general was claimed to be often met in the area of Tam Hop, Tam Quang and Tam Thai commune.
- Decree 06 (the management of endangered, precious, and rare species of forest fauna and flora and the observation of the Convention on the International Trade in Endangered Species of Wild Fauna and Flora) was the most commonly known by local people. Most participants knew about fines and imprisonment when being asked about recent punishments. None of them mentioned probation or suspended sentence as types of punishments that local hunters might face to if they are arrested for hunting activity.
- Most respondents knew that Owston's palm civet was protected in Vietnamese law and if hunters hunt it, it mostly by accident.
- Consumption is the main driver for wildlife hunting around Pu Mat National Park in recent.
- The information of Saola (*Pseudoryx nghetinhensis*) was collected with a respondent stated he hunted this precious species more than 20 years ago and informed it was seen in Khe Bung and Trung Chinh areas which locates in Mon Son and Yen Khe commune (Con Cuong district). However, this rare, precious and mysterious species was trapped twice by camera traps in mineral springs near Khe Bong area (Con Cuong district) and reported to be familiar with Khe Huoi Chat (Grieser Johns, 2000). All listed areas including Khe Bung, Trung Chinh, Khe Bong and Khe Huoi Chat are in Con Cuong district which is Southern of Pu Mat National Park.

CHAPTER 4 - Conclusions and Recommendations

- Overall, more half interviewees confirmed the existence of Owston's palm civet locally in recent and could identify Owston's palm civet comparing with other civets, also had general knowledge about this species. The collected information reveals the Owston's live widespread. However, it is considered to mostly live solitary or by group of two individuals on the trees. Its favorite habitat is old-growth or dense forests where has many massive and old trees. This species is seen in places near streams/rivers sometimes by local residents. What mentioning is Owston's palm civet was claimed to live and be seen near residential, which means its living habitat might be tightened and it is facing high risks of being hunted by local people. A combined data of bearing and distancing to wildlife and the Owston's used GIS techniques to address places that wildlife and the Owston's often seen showed that the Owston's commonly met in the buffer zones, not deep in the forests where camera traps are usually installed. Thus, urgent actions need to be taken to find out the places where they live near residential areas by camera setting in these areas, extend the strictly protect areas in these places and raise locals' awareness of this species protection.
- Recommend setting camera traps from April to July annually as the Owston's was claimed to active the most during this time and from October to January if research focusing on the civet's mating and reproduction. The places for camera setting might be nearby residential and not deep in the core areas of Pu Mat National Park.
- Hunting is still happening in the surveyed areas. Local hunters are likely to hunt by groups, occasionally and mostly in winter or in their free time after field seasons. Few professional hunters found in the survey were likely to live in Tam Hop, Mon Son, Tam Quang and Yen Khe. Collected data showed lots of endangered wild animals claimed by respondents have been hunted. Thus, it is necessary to strengthen law enforcement in arrested cases related to hunting activities, along with enhance patrols for protect the forestry organisms and detect illegal activities. The patrol routes should be focused on Mon Son and Yen Khe (Con Cuong district), Tam Hop and Tam Dinh (Tuong Duong district), Co Phat village and Khe Thoi stream. Tam Thai commune was not one of surveyed areas, however, this place can be considered to be one of the buffer zones needs to be put attentions for patrolling as the Owston's and other wild animals often met by respondents here.
- Consumption is the main reason driving local hunters' hunting motivation. Thus, it is necessary to run wildlife and its product demand reduction campaign in buffer zones of Pu Mat National Park.
- Traps and handmade guns are the most common hunting tools used by local hunters. The reason how locals would buy bullets for their guns from such remote areas or what materials they used to make bullets were not cleared in this study. This might be considered for deeper future research about local hunters' hunting life and experience.
- Promote education campaign in raising locals' awareness and identification skill of precious, rare, and endangered wild animals (such as what is difference between the Owston's and other civets), provide information of punishments that local hunters might

face to if hunting these species, along with strengthening law enforcement in preventing hunting activity and prosecuting criminal cases related to endangered species.

- SVW's conservation research team might consider the buffer zone of Tam Hop, Tam Dinh and Khe Thoi stream to set camera traps for Owston's palm civet detection.
- Strengthen law education about four types of punishment that local hunters might face to for their hunting activity as only fine and imprisonment were commonly noticed by respondents while none of participants mentioned about probation and suspended sentence.
- Local governments and rangers are highly trusted and the main information sources for locals. The survey results reveal that a great number of locals recognized the logo of Pu Mat National Park which is much higher than those who knew SVW and FFI's logos. Recommend SVW continue to collaborate with Pu Mat National Park to conduct education outreach and demand reduction campaign to widespread every local resident in the area, along with conducting patrols for traps removed and hunting detection.
- May conduct research about natural condition in two specific areas of Khe Bung (Khe Bung village and stream) and Trung Chinh village to compare the differences to other places around Pu Mat National Park as these places were claimed to have presence of Saola (*Pseudoryx nghetinhensis*).

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