Exploring market-based wildlife trade dynamics in Bangladesh

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SUPPLEMENTARY TABLE 1 Observation checklist used to collect information in the market survey.

Ref no:	Date:	Time:	Market Name:		
Location: City/Village/Park border/Inside park					
Presence of LEM office: Yes/No **Road communication** **Highway/Marine highway/Village Road/No Road**					
Ports close to the market:		**Distance from port:**		**Surveyor ID:**	
Observations					
1	Name of observed species				
2	Taxa of observed species				
3	Conservation Status of the observed species	IUCN Categories		CITES Appendix	
4	Type of animals	Live		Byproducts	
5	Number of individuals/Products(As a whole animals)	As live whole animals		As by-products	
6	Origin of observed wildlife	District	Division	Foreign	
7	Destination of wildlife				
8	Price of the wildlife				
9	Source of wildlife	Wild		Captive breed	
10	Harvest methods				
11	Transportation methods				
12	Motivation of trading				
13	Picture ID for the Observation				

SUPPLEMENTARY MATERIAL 1 Questionnaire used to interview respondents (this is a translation from the original questionnaire in Bangla).

ID NUMBER	

QUESTIONNAIRE
DATE: _____
INTERVIEWER _____
UNION: _____

Coordinate	X	Y

SECTION-1: ORAL STATEMENT AND CONSENT FORM

I am Nasir Uddin a PhD student of Xishuangbanna Tropical Botanical Garden, Chinese Academy of Sciences. I would like to talk with you about your opinions on the environment, biodiversity of Bangladesh because you are a citizen of Bangladesh with having possible experiences and information about the environment of Bangladesh. I am trying to understand what the status of wildlife and threats to them is and how people think about all those threats and possible mitigation approaches. For this reason, I would like to ask you several questions. There are no wrong answers to any questions I ask you.

Your personal information never is associated with the answer you will be provided. Information you will be provided will be in your control. I will give your interview only a reference number, nothing else which is at the top of the questionnaire. The location of your home, your family status and personal information will not be taken with me. I will take the information you will provide and will take back those with me and will analyze with information from other media and sources. No raw information will be shared with any authorities, only published papers and suggestions generated through this information will be shared with government, conservation communities and research communities for better policy formation and conservation planning.

You may choose not to participate in the interview, or can say not to answer any questions if you think. If you do not understand any questions please ask me, I will be happy to clarify at any time. You must be at least 18 to participate in this interview process.

Are you happy to complete this survey? (Tick (√) if YES; cross (X) if NO)	

Quick notes for interviewer
This questionnaire will act as a template to ask questions to respondents. Respondents will be selected from those who are already involved with wildlife trade events like hunting/poaching, trading/smuggling and use/consumption. Primary list of probable respondents will be selected from government records and sampling number will be reached by following snowball sampling methods. So, all five categories of behaviour related questions will ultimately assess respondent's behaviour what will be analyzed to see drivers of wildlife trade. Later on, open-ended questions will be asked to assess comparative scale, nature, trend, purposes, law enforcement gaps and intervention measures to prevent wildlife trade in Bangladesh.

SECTION-2: STRUCTURED QUESTIONS

Ice breaking questions:

	Please indicate how much you agree or disagree with the following statement:					
	Statement	Strongly agree	Agree	Neutral (neither agree nor disagree)	Disagree	Strongly disagree
1	I like cricket more than football					

		Strongly agree	Agree	Neutral	Disagree	Strongly disagree
2	Spicy food is tasty than non-spicy food					

A: KNOWLEDGE ABOUT WILDLIFE AND LAWS

	"This first section of questions is focused on local wildlife and wildlife rules." By wildlife I wanted to mean animals that live in forest and seas and not domesticated. Wildlife has been protected by the local government and by roles and l was I wanted to mean the practices or procedure government following to protect and conserve forest and wildlife. Please indicate how much you agree or disagree with the following statements:					
	Statement	Strongly agree	Agree	Neutral (Neither agree nor disagree)	Disagree	Strongly disagree
1	I am afraid about the disruption of ecological services in my area					
2	I am afraid about the future extinction of certain wildlife					
3	I am aware of national law and regulations of wildlife protection					
4	I am aware of global laws and regulations of illegal wildlife trade					
5	I think that protected species trade has been legally restricted nationally and internationally					
6	I think that wildlife trade is a punishable offence in Bangladesh					
7	Wildlife trade is one of the main causes of global biodiversity loss					
8	Wildlife handling can transmit diseases to humans					

B: LIVELIHOOD

	Livelihood denotes means of securing the basic needs of human life. In this section you will be asked a couple of questions about your livelihood and their interaction with wildlife trade. Please indicate how much you agree or disagree with the following statement:					
	Statement	Strongly agree	Agree	Neutral (neither agree nor disagree)	Disagree	Strongly disagree
1	Most of my earnings come from natural resource trade					
2	Lack of effective income generation activities influence wildlife trade in my area					
3	Wild animals (Mammals, birds, reptiles, amphibians and some marine species) trade can make more money than any other business					
4	Financial transaction faces no problem in wildlife trade					
5	Recruiting hunter/poacher is easy with small wages					
6	I think wildlife parts can be transported at low cost					

C: RISK, EFFORTS AND LAW ENFORCEMENT

	Risk denotes chances of being exposed to law enforcement/authorities while committing any trade events. Efforts denote attempts, time, financial involvement and other activities to complete a trade event. Law enforcement denotes detection, arrest, confiscation (items), prosecution and conviction by any law enforcement agencies for any trade associated personnel or trade items. Please indicate how much you agree or disagree with the following statement:					
	Statement	Strongly agree	Agree	Neutral (neither agree nor disagree)	Disagree	Strongly disagree
1	I believe that detection of wildlife trade is not so easy by present law enforcement system					
2	There are little chances of being arrested while poaching wildlife					
3	There are little chances of being arrested while trading wildlife					
5	There is little chance of being arrested while transporting wildlife in Bangladesh					
5	There is little chance of seizure of wildlife in airports					
6	There is little chance of seizure of wildlife in seaports					
7	The severity of penalties of poaching in Bangladesh is very low					
8	The severity of penalties of wildlife trade in Bangladesh is very low					
9	Chance of prosecution of wildlife criminals is very low in Bangladesh					
10	Chances of being convicted for wildlife trade is very low in Bangladesh					

D: DEMAND

	Demand means the desire of people to buy and spend money on wildlife and wildlife parts. Demand maybe in locally, nationally or from international communities. In this section we will discuss about the demand for wildlife parts in your locality, within the country and outside the country. Please indicate how much you agree or disagree with the following statement:					
	Statement	Strongly agree	Agree	Neutral (neither agree nor disagree)	Disagree	Strongly disagree
1	Getting customers for wildlife products is very easy					
2	There is the demand for bushmeat inside Bangladesh					
4	There is the demand for bushmeat from outside the country					
5	There is the demand for wildlife parts for antiques inside Bangladesh					
6	There is the demand for wildlife parts for antiques outside Bangladesh					
7	People like to keep wildlife as a pet in Bangladesh					
8	People use wildlife parts as traditional medicine					

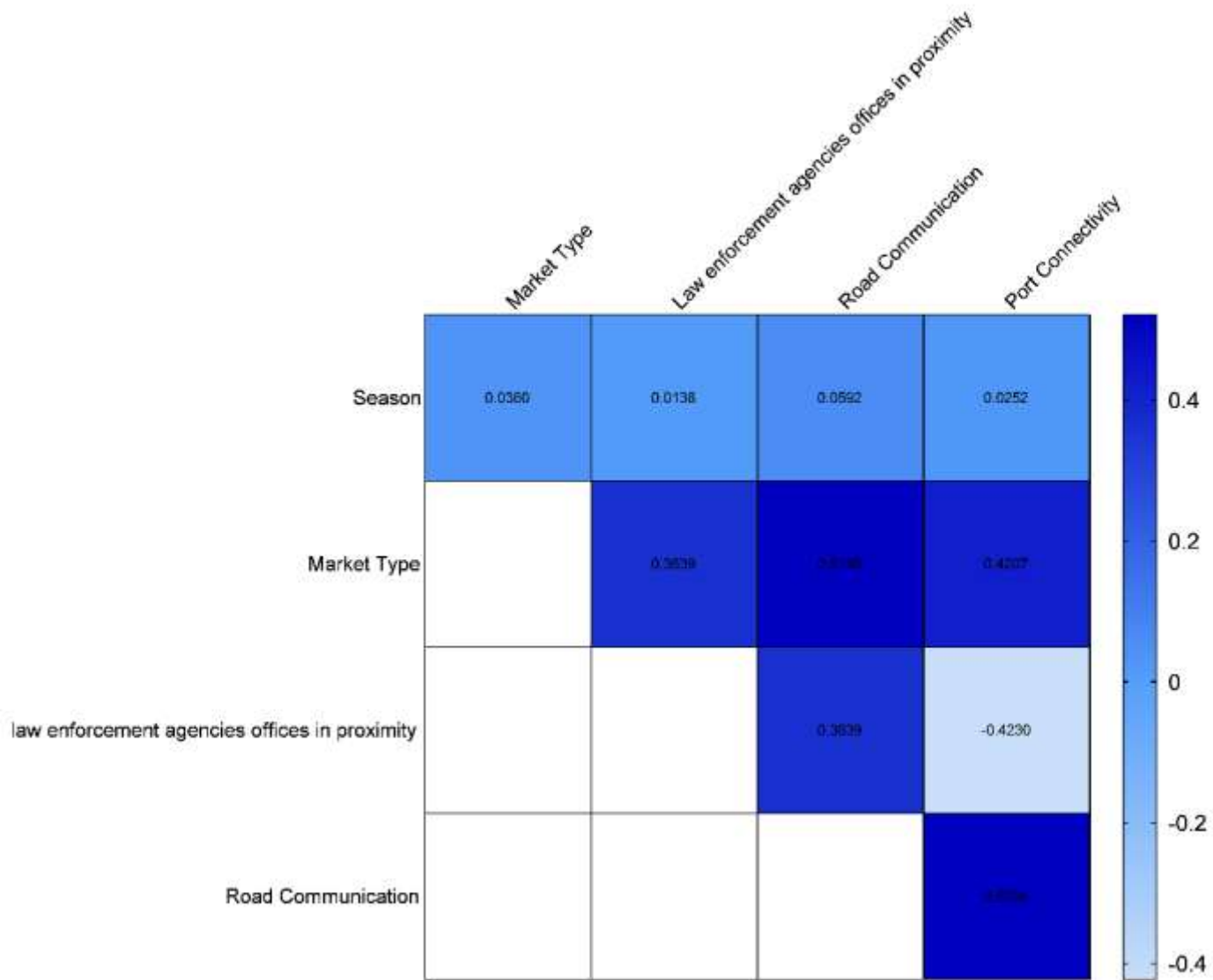|		Strongly agree	Agree	Neutral (neither agree nor disagree)	Disagree	Strongly disagree
9	Traditional medicine production in Bangladesh requires wildlife parts.					
10	Wildlife can be easily sold from any places of Bangladesh					
11	There is the demand for wildlife trade on social media					

E: CULTURE

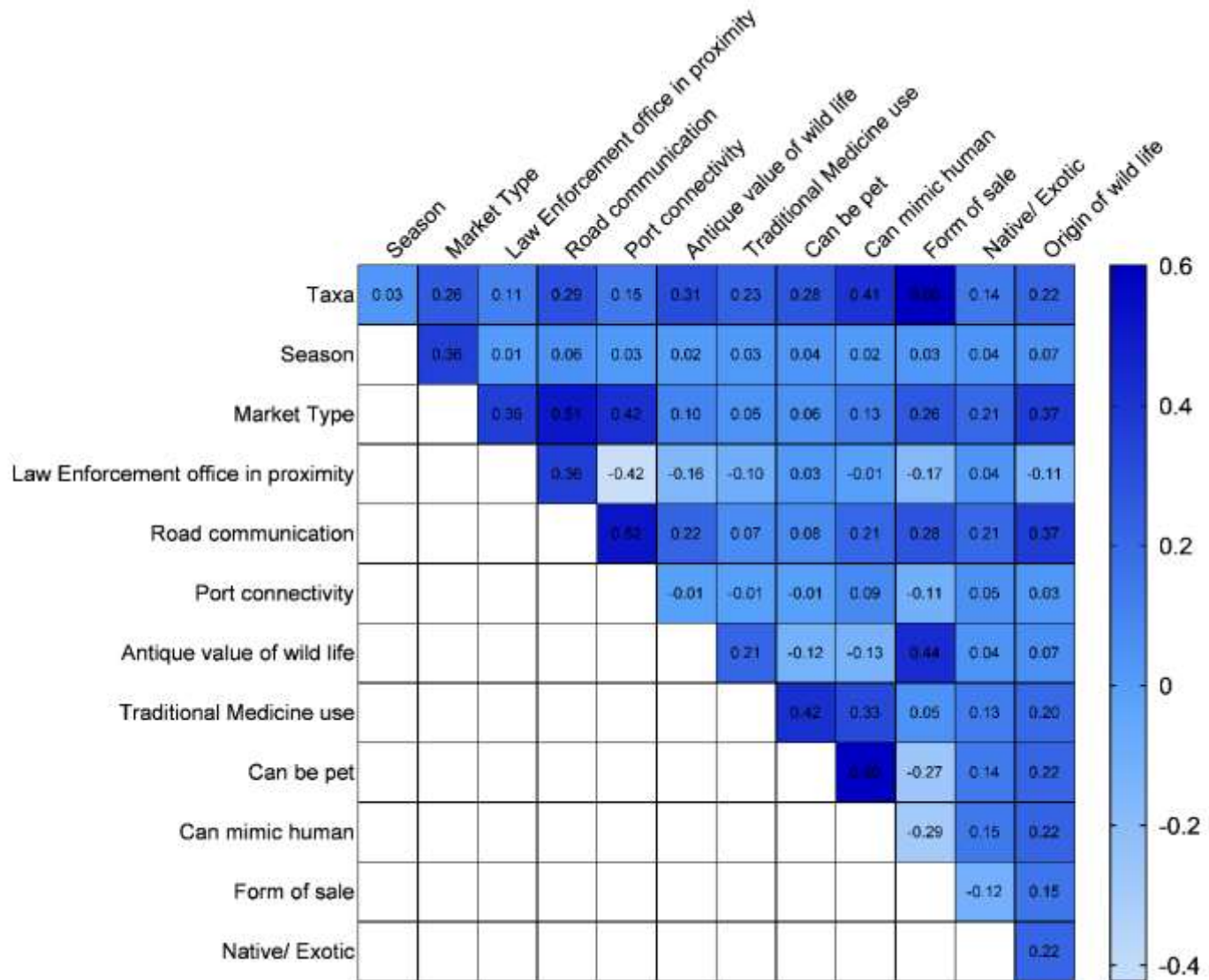|	Culture means ideas, customs, hobbies and social behaviour of a particular people or society. Please indicate how much you agree or disagree with the following statement:					
	Statement	Strongly agree	Agree	Neutral (neither agree nor disagree)	Disagree	Strongly disagree
1	Hunting wildlife is a traditional practice of mine					
2	I use bushmeat as a traditional diet					
3	I use/hunt wildlife as a norm of my ethnicity or cultural custom					
4	Keeping wildlife is considered prestigious in our culture					
5	Poaching and use of wildlife is related to cultural events of us					
6	50% of my family medicine comes from wildlife and wildlife parts					
7	Wildlife trade is my main business					

OPEN ENDED QUESTIONS:

- **Poaching**
    - o Are there poaching activities going on in this area?
    - o Approximately number of households that depend on wildlife poaching?
    - o What forces/motivates people to poach in this area? (For subsistence, sale, sport/game, others?)
    - o Do people poach independently or as a group? As a group, how did you coordinate with each other?
    - o Do the people poach work for other individuals/ bosses/ Taukes?
    - o What animals do they poach? Any target species? If so, who are they and where are they from? *(d)*
    - o How do they choose where to poach? *(b)* And when?
    - o How many times do they go to the park in a month?
    - o How do they get into the forest? Are there any tactics?
    - o What type of weapons/gears/snares/poison do they use to kill animals?
    - o How do they prepare to go poaching in the park?
    - o How do they collect information about wildlife locations?
    - o
- **Snaring**
    - o Do they use snares?
        - ▪ Which type of snares do they use
        - ▪ Can you describe how they set snares? (How many people needed, when is best to check?)
        - ▪ What animal was targeted, typically caught with these snares?
- **Precautions to detection, awareness of arrests**
    - o Are there patrols/forest patrolling where they poach?
    - o What precautions do they take to avoid discovery by the patrol team?

- o Why do they take the risk in your opinion?
- o Have you heard of any poachers being arrested in the forest? Can you tell me about those cases you have heard of?
- ▪ **Market**
  - o Who are their customers - consumer profiles? *(h)* And what key species or products are traded? *(e)*
  - o How much do they sell it?
  - o What modalities of sale? (Online, in markets, through intermediaries, direct sales to know buyers?) *(g & e)*
  - o What transport methods and routes are used (logistics)? *(f)*

- ▪ **General knowledge and Prevention methods**

  - o Do you know selling wildlife is illegal according to Bangladesh? Tell us detail
  - o Tell as five reasons why you are doing wildlife trade
  - o Tell us the name of five wildlife that's buyers like most in your areas
  - o Tell us the methods you use to hunt wildlife
  - o How do you transport wildlife from hunting to the market?
  - o How do you hide wildlife from local communities and law enforcement agencies wile transporting?
  - o What are the common financial transection methods you use for wildlife trade?
  - o Which season do you hunt most wildfire and why?
  - o Have you faced any challenges by law enforcement agencies while hunting and trading wildlife?
  - o Tell us about the origin of your wildlife
  - o What are the key opportunities/facilitators criminals use to move product? (i.e.: What are the weaknesses in the LE system?)
  - o Enlist some opportunities to prevent poaching preparation
  - o Enlist some opportunities to prevent pooching
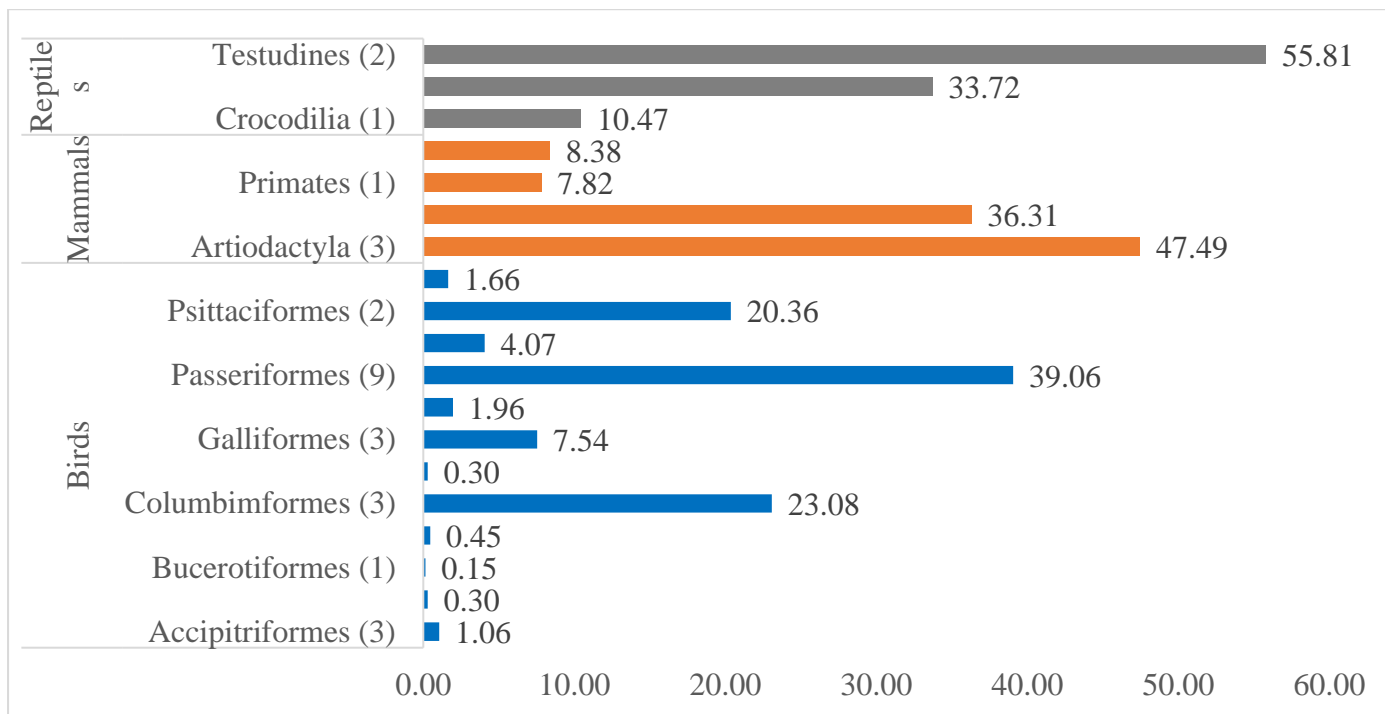 - o Enlist some opportunities to local trade Enlist some opportunities to prevent international trade

SUPPLEMENTARY FIG. 1 Collinearity checking among independent variables using Crammer's V.

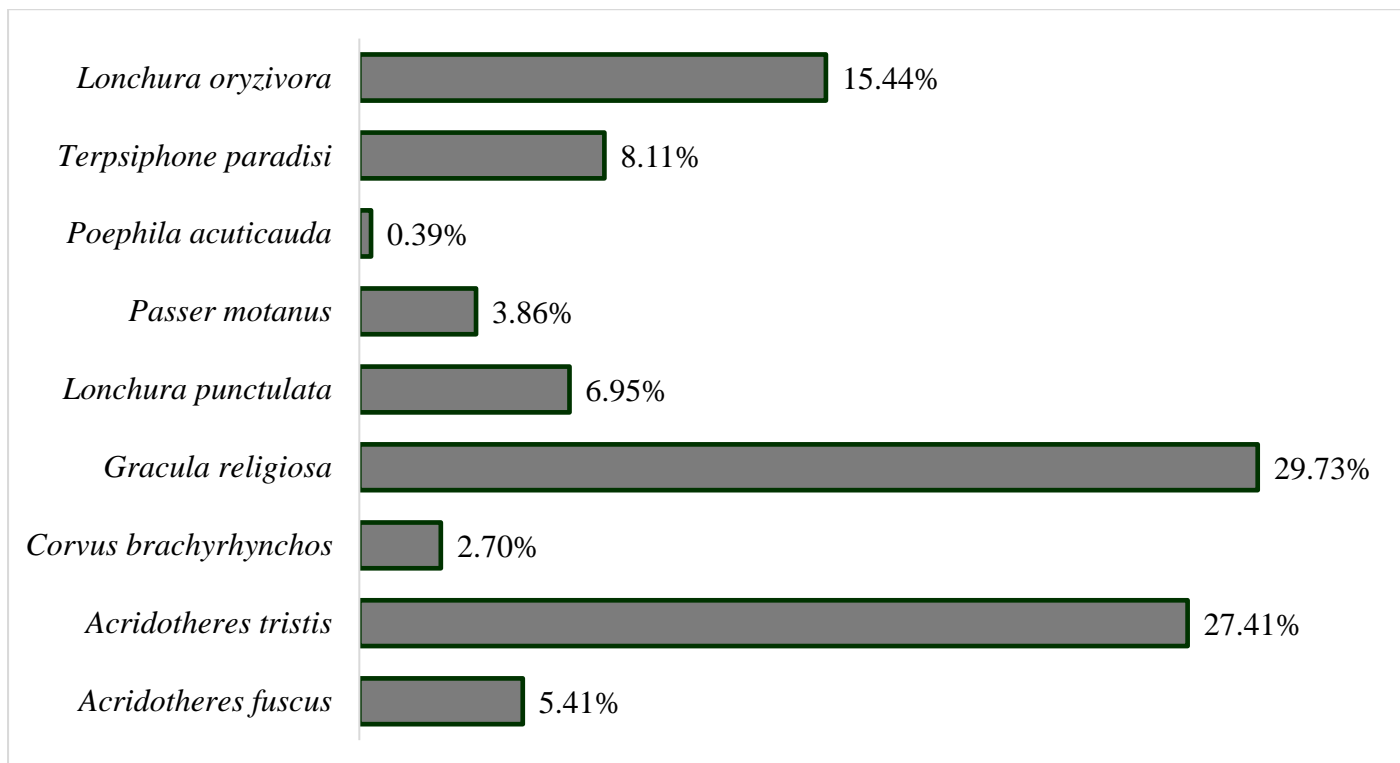|	Season	Market Type	Law Enforcement office in proximity	Road communication	Port connectivity	Antique value of wild life	Traditional Medicine use	Can be pet	Can mimic human	Form of sale	Native/ Exotic	Origin of wild life
Taxa	0.03	0.26	0.11	0.29	0.15	0.31	0.23	0.28	0.41	0.56	0.14	0.22
Season		0.36	0.01	0.06	0.03	0.02	0.03	0.04	0.02	0.03	0.04	0.07
Market Type			0.36	0.51	0.42	0.10	0.05	0.06	0.13	0.26	0.21	0.37
Law Enforcement office in proximity				0.36	-0.42	-0.16	-0.10	0.03	-0.01	-0.17	0.04	-0.11
Road communication					0.52	0.22	0.07	0.08	0.21	0.28	0.21	0.37
Port connectivity						-0.01	-0.01	-0.01	0.09	-0.11	0.05	0.03
Antique value of wild life							0.21	-0.12	-0.13	0.44	0.04	0.07
Traditional Medicine use								0.42	0.33	0.05	0.13	0.20
Can be pet									0.60	-0.27	0.14	0.22
Can mimic human										-0.29	0.15	0.22
Form of sale											-0.12	0.15
Native/ Exotic												0.22

SUPPLEMENTARY FIG. 2 Collinearity checking among independent variables using Crammer's V.

SUPPLEMENTARY TABLE 2 Proportion of trade observations and number of animals/animal parts of wildlife observed across different types of markets.

Count of Taxa						
Type of market	Taxa	Total observation	Percent of observation	Total individual	Percent of total	Number of species
Hill market	Birds	88	13	1441	20.74	9
	Mammals	82	46	473	64	10
	Reptiles	33	38	535	8	7
Hill market Total		**203**		**2449**		**26**
Peri-urban Market	Birds	210	32	1470	21	18
	Mammals	55	31	170	23	7
	Reptiles	36	42	5575	83	3
Peri-urban Market Total		**301**		**7215**		**28**
Urban Market	Birds	365	55	4037	48	22
	Mammals	42	23	96	13	9
	Reptiles	17	20	639	10	2
Urban Market Total		**424**		**4772**		**33**
Grand Total		928				

SUPPLEMENTARY FIG, 3 Percentage of wildlife in trade in each class. Percentages are given at the end of the bar as the percentage of items within that order fall into each family, the number following the family name indicates the number of species in trade within that family.

SUPPLEMENTARY FIG. 4 Species composition within Passeriformes. The highest percentage of individuals traded for any taxa was *Gracula religiosa* followed by *Acridotheres tristis.*

SUPPLEMENTARY TABLE 3 Result of bivariate analysis to assess factors associated with Taxa of wildlife trading in surveyed markets. Results from Pearson's Chi-squared test.

Variables	Categories	Class			p-value
		Birds n (%)	Mammals n (%)	Reptiles n (%)	
Season	Summer	168 (74.67)	39 (17.33)	18 (8)	
	Wet	260 (70.46)	72 (19.51)	37 (10.03)	
	Winter	235 (70.36)	68 (20.36)	31 (9.28)	0.790
Market Type	Hill market	85 (41.87)	85 (41.87)	33 (16.26)	
	Peri-urban Market	210 (69.77)	55 (18.27)	36 (11.96)	
	Urban Market	365 (86.08)	42 (9.91)	17 (4.01)	0.001
law enforcement agencies offices in proximity	No	61 (65.59)	29 (31.18)	3 (3.23)	
	Yes	602 (72.1)	150 (17.96)	83 (9.94)	0.002
Road Communication	District Connected Road	124 (62.63)	51 (25.76)	23 (11.62)	
	Metro connected road	365 (86.08)	42 (9.91)	17 (4.01)	
	National Highway	124 (78.48)	20 (12.66)	14 (8.86)	
	Village road	47 (31.76)	69 (46.62)	32 (21.62)	0.001
Port Connectivity	No	379 (66.26)	124 (21.68)	69 (12.06)	
	Yes	281 (78.93)	58 (16.29)	17 (4.78)	0.001

row %; P<0.10 considered significant for Pearson's Chi-squared test.

SUPPLEMENTARY TABLE 4 Results from Pearson's Chi-squared test. Variables associated with trading IUCN Threatened species. (Bivariate analysis).

| Variables | Categories | IUCN threatened status | | p-value |
		No n (%)	Yes n (%)	
Taxa	Birds	506 (76.55)	155 (23.45)	0.368
	Mammals	142 (80.68)	34 (19.32)	
	Reptiles	69 (81.18)	16 (18.82)	
Season	Summer	178 (79.11)	47 (20.89)	0.802
	Wet	285 (77.87)	81 (22.13)	
	Winter	254 (76.74)	77 (23.26)	
Market Type	Hill market	133 (67.51)	64 (32.49)	
	Peri-urban Market	265 (88.04)	36 (11.96)	
	Urban Market	319 (75.24)	105 (24.76)	<0.001
Law Enforcement office in proximity	No	83 (89.25)	10 (10.75)	
	Yes	634 (76.48)	195 (23.52)	0.005
Road communication	District Connected Road	140 (70.71)	58 (29.29)	
	Metro connected road	319 (75.24)	105 (24.76)	
	National Highway	149 (94.3)	9 (5.7)	
	Village road	109 (76.76)	33 (23.24)	<0.001
Port connectivity	No	426 (75.27)	140 (24.73)	0.021
	Yes	291 (81.74)	65 (18.26)	
Antique value of wild life	No	686 (77.25)	202 (22.75)	0.055
	Yes	31 (91.18)	3 (8.82)	
Traditional Medicine use	No	532 (77.44)	155 (22.56)	0.683
	Yes	185 (78.72)	50 (21.28)	
Can be pet	No	504 (76.48)	155 (23.52)	0.112
	Yes	213 (81.3)	49 (18.7)	
Can mimic human	No	511 (78.62)	139 (21.38)	0.386
	Yes	206 (76.01)	65 (23.99)	
Form of sale	Live animal	589 (76.39)	182 (23.61)	0.024
	Wildlife byproduct	128 (84.77)	23 (15.23)	
Native/ Exotic	Exotic	37 (82.22)	8 (17.78)	0.461
	Native	680 (77.54)	197 (22.46)	
Origin of wildlife	Bred	70 (71.43)	28 (28.57)	0.111

	Wild	647 (78.52)	177 (21.48)	

*row %, p<0.10 considered statistically significant.

Market type, law enforcement office proximity, road communication, port connectivity, antique value of wild and form of sale found significantly associated with trading IUCN threatened animal at 10% significance level.

Rates of trading IUCN threatened animals is highest in hill areas (32.49%), in close proximity to law enforcement agencies offices (23.52) where there is no port connectivity (24.73%), for those animals have no antique value (22.75%) and when sold as live (23.61%).

SUPPLEMENTARY TABLE 5 Proportion of observation of IUCN threatened species sold in different types of market.

Market Type	No Observation	% No of Observation	Number of individuals	% No of individuals
Hill Market	64	47	1548	62
Per Urban Market	36	26	641	26
Urban-Market	37	27	300	12
Total	137	100	2489	100

SUPPLEMENTARY TABLE 6 Observed species and the number in trade in surveyed markets.

Family	Scientific name	CITES Status	IUCN Status	Native/Exotic	Price/Piece	Cat._IUCN	Wet	Summer	Winter	Total observation	Live	Dead (as byproduct)
Sturnidae	*Acridotheres fuscus*	Non CITES	LC	Native	500	Not threatened	5	2	7	14	169	0
Sturnidae	*Acridotheres tristis*	Non CITES	LC	Native	1000	Not threatened	26	19	26	71	524	0
Alcedinidae	*Alcedo atthis*	Non CITES	LC	Native	1500	Not threatened	0	2	0	2	4	0
Rallidae	*Amaurornis phoenicurus*	Non CITES	LC	Native	500	Not threatened	4	2	4	10	31	0
Anatidae	*Anas albogularis*	Non CITES	VU	Native	1000	Not threatened	1	1	0	2	5	0
Mustelidae	*Aonyx cinerea*	Appendix-ii	EN	Native	30000	Not threatened	1	2	2	5	17	0
Ardeidae	*Ardea goliath*	Non CITES	LC	Native	500	Not threatened	11	8	8	27	71	0
Hystricidae	*Atherurus macrourus*	Non CITES	DD	Native	2000	Not threatened	2	3	1	6	1	11
Cervidae	*Axis axis*	Non CITES	LC	Native	20000	Not threatened	16	10	17	43	10	361
Geoemydidae	*Batagur kachuga*	Appendix-ii	EN	Native	100	Not threatened	24	8	16	48	0	3
Bucerotidae	*Buceros bicornis*	Appendix-I	VU	Native	25000	Not threatened	0	1	0	1	0	17
Elapidae	*Bungarus caeruleus*	Non CITES	LC	Native	5000	Not threatened	0	1	0	1	1	0
Cacatuidae	*Cacatua galerita*	Appendix-i	CR	Exotic	75000	Not threatened	1	1	4	6	11	0
Sciuridae	*Callosciurus erythraeus*	Non CITES	LC	Native	500	Not threatened	3	3	3	9	66	0
Corvidae	*Corvus brachyrhynchos*	Non CITES	N/A	Native	1000	Not threatened	3	1	3	7	13	0
Crocodylidae	*Crocodylus porosus*	Appendix-ii	EN	Native	500000	Not threatened	3	2	4	9	17	0
Accipitridae	*Erythrotriorchis buergersi*	Appendix-ii	EN	Native	20000	Not threatened	1	0	2	3	11	0
Phasianidae	*Gallus gallus*	Appendix-ii	LC	Native	1500	Not threatened	7	6	10	23	241	0
Gekkonidae	*Gecko gekko*	Appendix-ii	LC	Native	500000	Not threatened	3	0	5	8	66	30

Family	Species	CITES	IUCN	Origin	Number	Status						
Columbidae	*Geopelia cuneata*	Non CITES	LC	Native	300	Not threatened	14	5	9	28	412	0
Columbidae	*Geopelia placida*	Non CITES	LC	Native	500	Not threatened	19	8	11	38	1630	0
Sturnidae	*Gracula religiosa*	Appendix-ii	LC	Native	15000	Not threatened	29	19	29	77	559	0
Ursidae	*Helarctos malayanus*	Appendix-i	CR	Native	200000	Threatened	0	0	1	1	0	3
Herpestidae	*Herpestes auropunctatus*	Appendix-III	LC	Native	5000	Not threatened	13	5	9	27	57	0
Accipitridae	*Ichthyophaga ichthyaetus*	Appendix-ii	LC	Native	10000	Threatened	0	1	0	1	10	0
Ciconiidae	*Leptoptilos javanicus*	Non CITES	VU	Native	5000	Not threatened	2	1	0	3	3	0
Estrildidae	*Lonchura oryzivora*	Appendix-ii	EN	Native	400	Threatened	19	10	11	40	514	0
Estrildidae	*Lonchura punctulata*	Non CITES	LC	Native	1000	Not threatened	9	3	6	18	143	0
Phasianidae	*Lophura leucomelanos*	Appendix-iii	VU	Native	2000	Not threatened	2	0	1	3	10	0
Cercopithecidae	*Macaca mulatta*	Non CITES	VU	Native	2000	Not threatened	7	1	6	14	23	2
Moschidae	*Moschus leucogaster*	Appendix-i	EN	Native	200000	Not threatened	4	2	5	11	0	22
Elapidae	*Naja naja*	Appendix-ii	NT	Native	12000	Not threatened	0	1	1	2	2	0
Felidae	*Neofelis nebulosa*	Appendix-i	CR	Native	1000000	Not threatened	0	1	0	1	1	0
Accipitridae	*Nisaetus cirrhatus*	Non CITES	LC	Native	30000	Not threatened	0	1	2	3	3	0
Felidae	*Panthera pardus*	Appendix-i	CR	Native	1000000	Not threatened	3	0	0	3	0	5
Felidae	*Panthera tigris*	Appendix-i	CR	Native	2000000	Not threatened	4	2	4	10	0	10
Viverridae	*Paradoxurus hermaphroditus*	Appendix-iii	LC	Native	2000	Not threatened	0	2	3	5	5	0
Passeridae	*Passer motanus*	Non CITES	LC	Native	200	Threatened	3	2	5	10	28	0
Estrildidae	*Poephila acuticauda*	Non CITES	N/A	Native	500	Not threatened	1	0	0	1	2	0
Phasianidae	*Polyplectron bicalcaratum*	Appendix-ii	VU	Native	40000	Threatened	10	8	6	24	106	144

Rallidae	*Porphyrio porphyrio*	Non CITES	LC	Native	1000	Not threatened	1	0	2	3	6	0
Felidae	*Prionailurus viverrinus*	Non CITES	EN	Native	25000	Not threatened	0	0	1	1	1	0
Psittaculidae	*Psittacula krameri*	Appendix-ii	LC	Native	2500	Not threatened	50	32	47	129	2134	0
Pythonidae	*Python bivittatus*	Appendix-ii	VU	Native	5000	Not threatened	3	2	2	7	5	10
Columbidae	*Spilopelia chinensis*	Non CITES	LC	Native	2000	Not threatened	36	25	26	87	922	0
Suidae	*Sus scrofa*	Non CITES	LC	Native	10000	Not threatened	14	5	12	31	2	115
Monarchidae	*Terpsiphone paradisi*	Non CITES	LC	Native	3000	Not threatened	3	7	11	21	89	0
Tytonidae	*Tyto alba*	Appendix-ii	LC	Native	3000	Not threatened	3	3	5	11	15	0
Varanidae	*Varanus bengalensis*	Appendix-I	NT	Native	5000	Threatened	4	4	3	11	314	32
Canidae	*Vulpes bengalensis*	Appendix-iii	VU	Native	10000	Not threatened	5	3	4	12	2	19