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# Public Attitudes toward Monitor Lizards (*Reptilia: Varanidae*): A Conservation Challenge in the Human-dominated Ecosystems of Bangladesh

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### Authors' contributions

This work was carried out in collaboration between all authors. Author KMMR designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors IIR and MMHK managed the analyses of the study. Author MMHK managed the literature searches. All authors read and approved the final manuscript.

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## ABSTRACT

The present study investigated the public attitudes toward monitor lizards in the human-dominated ecosystems of sub-tropical Bangladesh. In this regard, a total of 100 participants between the age of 15-65 were randomly selected from five different parts (20 participants from each part) of Bangladesh. Based on participants' opinion, *Varanus bengalensis* is mostly known (58±2.20) and *Varanus salvator* is the least known (22±3.48) species among three monitor lizard species found in Bangladesh. Surprisingly, most of the participants (77±0.50) mentioned that monitor lizards are snakes. Though all the monitor lizards found in Bangladesh are non-venomous, a significant proportion (63±1.53) of the participants believe that monitor lizards are venomous and can attack and bite people. The participants' viewpoint throughout the country regarding the above-mentioned issues, however, were somewhat similar ( $\chi^2$  test,  $p > 0.05$ ). Despite their negative perception, most

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of the participants (71±1.27) agreed that monitor lizards play vital role in our ecosystems. The populations of monitor lizards are declining day by day at an alarming rate. Most of the participants (32±0.50) mentioned that retribution killing is the primary cause of the decline of monitor lizards. The highest proportion (56±1.35) of participants believe that there are no alternatives of awareness raising among local residents if we are to conserve monitor lizards in their natural environment that is shared by people.

**Keywords:** Participants; attitude; monitor lizards; ecosystems; conservation; Bangladesh.

## 1. INTRODUCTION

The diverse ecosystems of Bangladesh is the home of three different monitor lizard species namely Bengal monitor (*Varanus bengalensis* Daudin, 1802), yellow monitor (*Varanus flavescens* Hardwicke & Gray, 1827), and water monitor (*Varanus salvator* Laurenti, 1768) [1,2]. Among these three species, *V. bengalensis* and *V. flavescens* has been categorized as Near Threatened and *V. salvator* has been categorized as Vulnerable [3]. In Bangladesh monitor lizards have the status of protected species by Schedule-I of Wildlife (Conservation and Security) Act 2012 of Bangladesh [3]. Although the monitor lizards are protected by law, their populations are declining due to negative attitudes of people that has originated from wrong perception. The populations are also decreasing day by day as the habitats are shrinking due to anthropogenic factors including the development activities. Poaching of these species is also reported in some areas. In Bangladesh, it is difficult to ensure protection of monitor lizards due to public prejudices such as hate, fear, or incorrect assumptions about their danger, as well as ignorance of the fact that monitor lizards play significant role in maintaining the ecological balance [4].

Human attitudes towards animals are becoming of increasing importance in the areas of conservation and welfare [5]. Since attitudes encompass both feelings and beliefs, it has both affective and cognitive components. Feelings and beliefs are generally directed toward decision-making, and therefore are important elements of perception [6]. All over Bangladesh and throughout recorded history, monitor lizards have been regarded as the source of fascination and fear. Majority of the local people think monitor lizards are venomous and they kill monitor lizards very often. In human-dominated ecosystems where wild animals live in close vicinity of people, there is urgent need of change of public attitudes towards animals to ensure the coexistence.

Communities have an important role to play in biodiversity conservation [7]. Therefore, the understanding of public attitudes towards any wild animal is important when trying to develop a community-based management or restoration plan. Surprisingly, however, no systematic studies have ever done in Bangladesh regarding the public attitudes towards wild animals. This study assessed local residents' attitudes and opinions on monitor lizards, which will help future ecologists and conservationists to understand the problem, and develop and implement a management action plan regarding monitor lizards and other wildlife species facing similar threats.

## 2. MATERIALS AND METHODS

In order to investigate the public attitudes toward monitor lizards, we have chosen a sample of participants from five different parts of Bangladesh (northwest, southwest, central, northeast and southeast). In 2016, from each part of Bangladesh a total of 20 participants between the age of 15-65 years were selected randomly. Participants were informed that they were taking part in a study investigating human perceptions to monitor lizards, and they are free to express their personal views and beliefs. Peoples' attitudes, belief in myths, and knowledge of monitor lizards are measured by a set of questionnaires where a total of 9 questions were asked (Appendix - I). Some of the questionnaire sample including negative items were adopted from the Snake Phobia Questionnaire [8]. The traditional knowledge on monitor lizards was measured by the items that represent basic facts about the species. Photographs of each monitor lizard were used to examine the species level identification knowledge. The negative dimensions of the questionnaire were designed specifically to measure active avoidance of lizards because of dislike or fear. The scientific dimension measures interest in external characteristics and in gathering information about monitor lizards. The naturalistic dimension was designed to

investigate the participants' interest in direct experience with monitor lizards. The ecologic dimension was designed to investigate participants' concern about the role of monitor lizards in nature and inter-relationships between monitor lizards and humans. In addition, qualitative data was collected through focus group discussion with local people.

The effectiveness of the questionnaire was established through review by two professors in the field of wildlife biology as well as by two experts in biology field.

All statistical analyses were performed by using SPSS release 16.0 (SPSS Inc., 2007) with the level of significance set at  $p < 0.05$ . We used  $\chi^2$  test to verify the level of significance of different findings.

### 3. RESULTS AND DISCUSSION

#### 3.1 Species Level Identification Knowledge

All participants from different part of Bangladesh were able to recognize monitor lizard but their species level identification knowledge varied significantly ( $\chi^2$  test,  $P < 0.05$  Table 1, Fig. 1) based on their locality. The highest proportion (58±2.20) of participants mentioned that among monitor lizard species they just know *V. bengalensis*. On the other hand, a remarkable proportion (54±2.35) of participants replied that *V. flavescens* are found in their surrounding ecosystems, while only a small proportion (22±3.48) of participants answered that *V. salvator* is the only monitor lizard species which are available in their locality (Table 1). Regionally, however, 90 percent participants from central Bangladesh replied that only *V. bengalensis* is found in their surrounding ecosystems and no one noticed *V. salvator* in their locality. From northwest Bangladesh, 85 percent participants said that *V. flavescens* is the only species of monitor lizard that could be found

in their locality and they have never seen *V. salvator*. From southeast Bangladesh, 90 percent participants responded that *V. salvator* is the only species that is found in their surrounding environment. From northeast Bangladesh, 75 percent participants noticed *V. bengalensis* and 60 percent participants noticed *V. flavescens* in their nearby ecosystem.

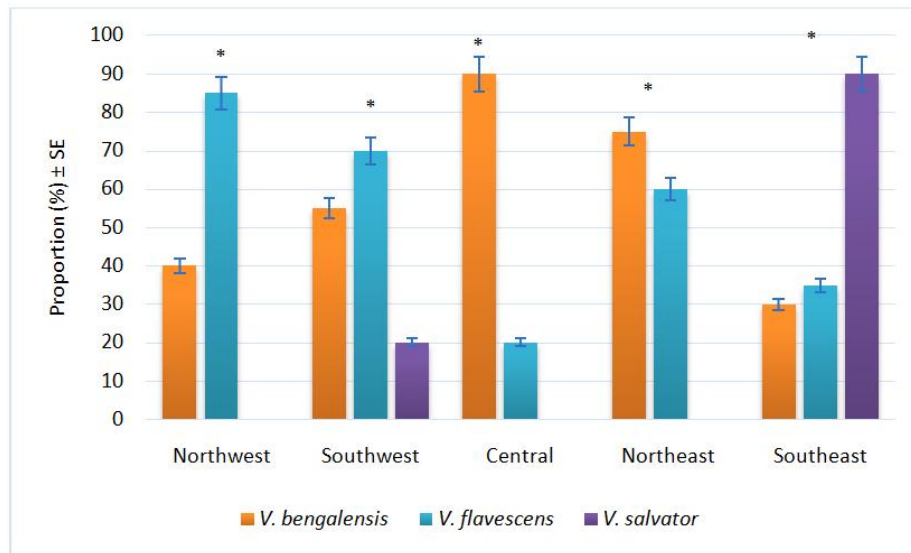
#### 3.2 Attitudes toward Monitor Lizards

The highest proportion of participants (77±0.50) mentioned that monitor lizards are snakes and a small proportion of participants (23±0.50) mentioned that they are not snake they are lizard. Interestingly, participants' viewpoints regarding these issues were not varied significantly both nationally and regionally ( $\chi^2$  test,  $p > 0.05$  Table 2). It was found that among all participants, major proportion (63±1.53) believe that monitor lizards are venomous and they can attack and bite people. Participants' viewpoint was not varied significantly based on their location in Bangladesh (southwest  $\chi^2 = 0.2188$ ,  $df = 1$ ,  $p = 0.64$ ; central  $\chi^2 = 1.977$ ,  $df = 1$ ,  $p = 0.16$ ; northeast  $\chi^2 = 1.977$ ,  $df = 1$ ,  $p = 0.16$ ; southeast  $\chi^2 = 1.977$ ,  $df = 1$ ,  $p = 0.35$ ). However, significant differences ( $\chi^2 = 5.49$ ,  $df = 1$ ,  $p = 0.02$ ) were found regarding the belief in the participants of northwest (Fig. 2).

The opinion of participants regarding the ecological importance of monitor lizards was immensely positive. Most of them (71±1.27) believe that monitor lizards play significant role in our ecosystems and only small proportion (29±1.27) of the participants responded negatively. It was also found that respondents' opinion based on their locality in Bangladesh did not vary significantly for northwest ( $\chi^2 = 3.80$ ,  $df = 1$ ,  $p = 0.05$ ), southwest ( $\chi^2 = 0.951$ ,  $df = 1$ ,  $p = 0.33$ ), central ( $\chi^2 = 0.008$ ,  $df = 1$ ,  $p = 0.93$ ), northeast ( $\chi^2 = 0.951$ ,  $df = 1$ ,  $p = 0.33$ ) and for southeast ( $\chi^2 = 2.142$ ,  $df = 1$ ,  $p = 0.14$ ) concerning the significance of monitor lizards in their respective ecosystem (Fig. 3).

**Table 1. The mean (± SE) proportion of participants having the identification knowledge of three different monitor lizard species**

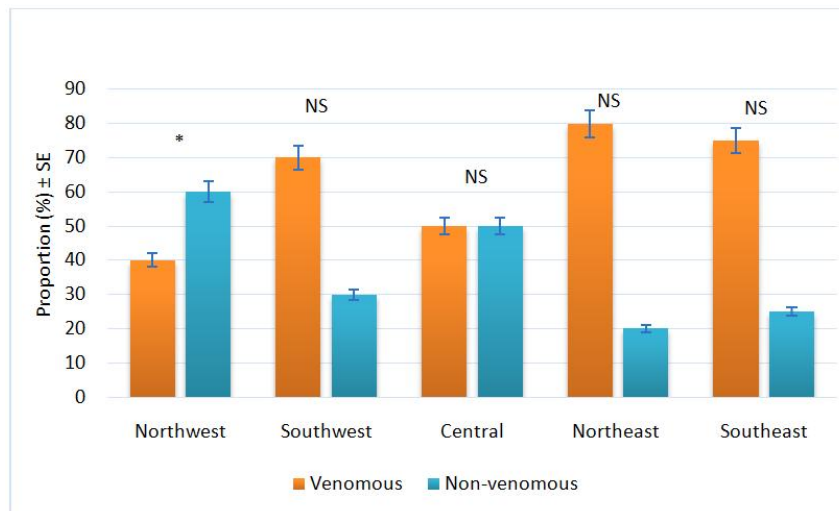
Species name	Yes	No	$\chi^2$	df	p value
<i>V. bengalensis</i>	58±2.20	42±2.20	20.41	4	0.0004
<i>V. flavescens</i>	54±2.35	46±2.35	22.40	4	0.0002
<i>V. salvator</i>	22±3.48	78±3.48	76.25	4	0.0001



**Fig. 1. Participants' species level identification knowledge regarding monitor lizards based on their locality. Asterisks denote statistically significant differences (\*  $p < 0.001$ )**

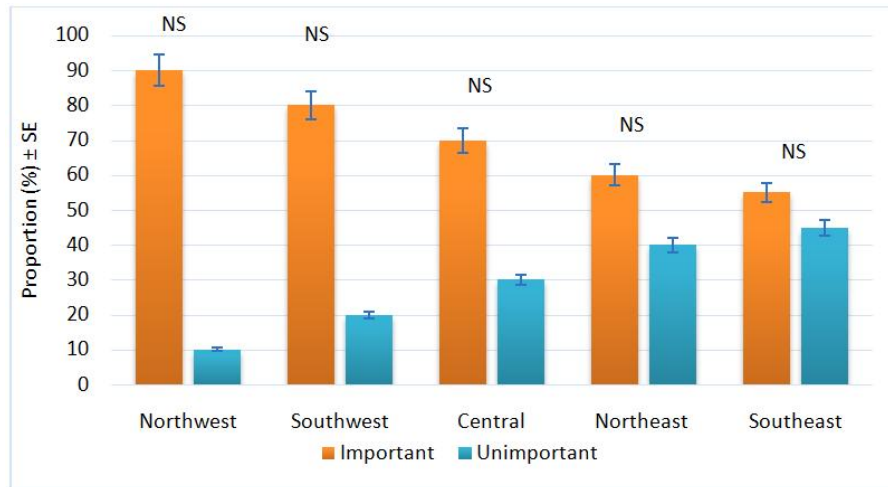
**Table 2. Participants viewpoint (%) - whether monitor lizards are snake or lizard**

Survey location	Proportion (%) of opinion		Test of significance		
	Lizard	Snake	$\chi^2$	df	p value
Northwest	25	75	0.044	1	0.83
Southwest	15	85	0.722	1	0.39
Central	30	70	0.553	1	0.46
Northeast	20	80	0.101	1	0.75
Southeast	25	75	0.044	1	0.83
Overall	23±0.50	77±0.50	1.464	4	0.83

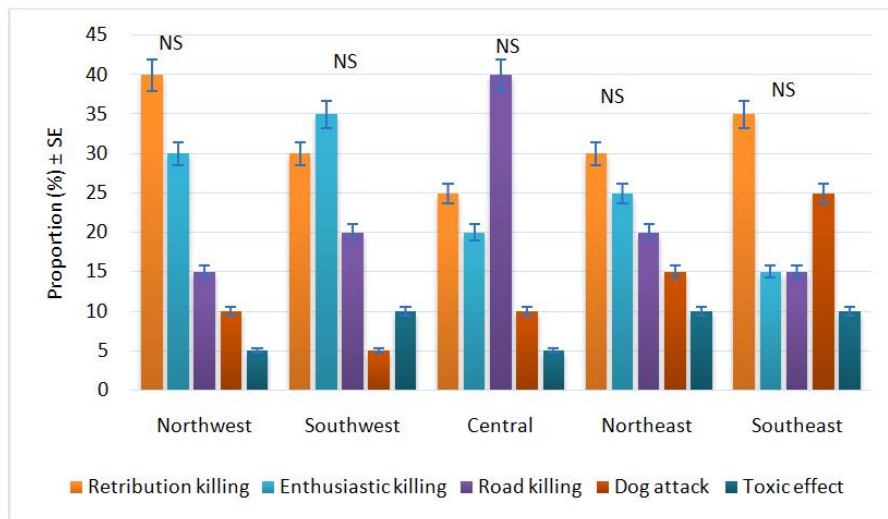


**Fig. 2. Differences between the perception of participants whether monitor lizards are venomous or not**

Note: Asterisks denote statistically significant differences, (\*  $p < 0.05$ ; NS = not significant where,  $p > 0.05$ )



**Fig. 3. Viewpoints of participants regarding the importance of monitor lizards**  
( $\chi^2$  test; NS = not significant where,  $p > 0.05$ )



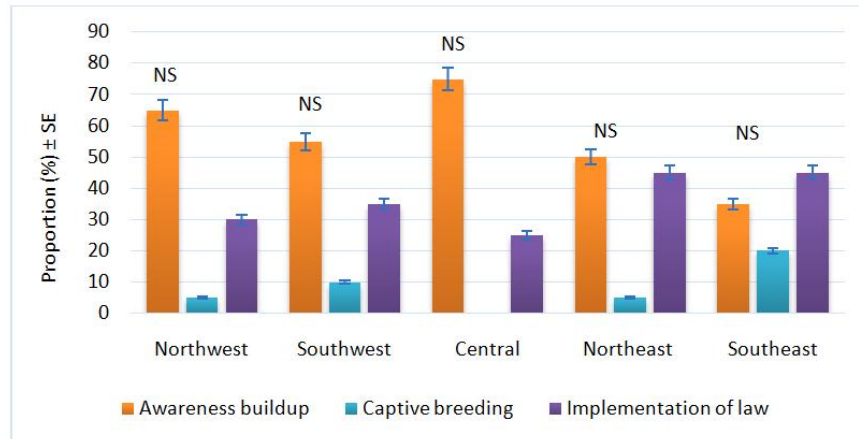
**Fig. 4. Views of participants regarding the potential threats to monitor lizard populations**  
( $\chi^2$  test; NS = not significant where,  $p > 0.05$ )

In questionnaire, we have mentioned several types of direct threat based on its respective impact on the monitor lizard populations. Regarding threat issue, it was found that nationally, highest proportion (32±0.50) of the participants believe that retribution killing is the primary cause of monitor lizards' population decline.

A considerable proportion of participants (25±0.71) mentioned that killing for fun is responsible for the decline of monitor lizard populations. Road killing is the third major threat according to (22±0.92) proportion of participants. Dog attack (13±0.68 percent) and toxic effect

(8±0.24 percent) are also responsible for the death of monitor lizards. Regionally, participants' viewpoint concerning threat issues was not varied significantly for northwest ( $\chi^2 = 1.6$ ,  $df = 4$ ,  $p = 0.81$ ), southwest ( $\chi^2 = 2.291$ ,  $df = 4$ ,  $p = 0.68$ ), central ( $\chi^2 = 4$ ,  $df = 4$ ,  $p = 0.41$ ), northeast ( $\chi^2 = 0.161$ ,  $df = 4$ ,  $p = 0.99$ ) and for southeast respondents ( $\chi^2 = 2.731$ ,  $df = 4$ ,  $p = 0.60$ ) (Fig. 4).

Regarding the conservation and protection issues of monitor lizards nationally, most of the participants (56±1.35) agreed that there are no alternatives of awareness building if we are to conserve them. Many (36±0.67 percent)



**Fig. 5. Opinions of participants regarding the conservation of monitor lizard populations**  
( $\chi^2$  test; NS = not significant where,  $p > 0.05$ )

participants responded that proper implementation and execution of law could be the solution, while only a small proportion ( $08 \pm 0.79$  percent) said that captive breeding and reintroduction programme could bring good result concerning the conservation of monitor lizards. In these cases, the participants opinions did not vary significantly based on their locality ranges from northwest ( $\chi^2 = 0.714$ ,  $df = 2$ ,  $p = 0.70$ ), southwest ( $\chi^2 = 0.1090$ ,  $df = 2$ ,  $p = 0.95$ ), central ( $\chi^2 = 3.561$ ,  $df = 2$ ,  $p = 0.17$ ), northeast ( $\chi^2 = 0.8035$ ,  $df = 2$ ,  $p = 0.67$ ) and southeast ( $\chi^2 = 5.625$ ,  $df = 2$ ,  $p = 0.06$ ) Bangladesh (Fig. 5).

The monitor lizards are easily seen and most frequently found in the human-dominated ecosystems of Bangladesh [9], but during our studies it was found that peoples' species level identification knowledge regarding monitor lizards varied significantly throughout the country. Most of the participants just identified them as their local name "GuiShap", but after seeing the photographs of all the three monitor lizards' species the people were able to answer whether the shown species exist in their locality or not. *V. bengalensis* is very common and widely distributed monitor lizard species of Bangladesh [1,2,10]. Our interview survey results also suggest that *V. bengalensis* is the most well-known species in Bangladesh. *V. flavescens* has been described as widely distributed in Bangladesh [1,2,3], whereas Reza & Sourav in a note reported that very few specific locations have been known due to its unclear distribution within the country and because virtually no published natural history information is available on the Bangladesh population [11]. Our study exhibit that though *V. flavescons* found in almost

all parts of the country, their occurrence was mostly seen in floodplains of northwest Bangladesh and less seen is the central part. According to published information, *V. salvator* is common in mangrove and coastal areas of Chittagong, Khulna and Barisal Divisions; rare in northeast, southeast forests, Manikganj and Keraniganj (Narayanganj) [12,3], but our participants from northeast, southeast and central Bangladesh answered that they have never seen *V. salvator* in their surrounding areas.

Though monitor lizards are not snakes, still not only the participants of this study but also most of the people of Bangladesh call monitor lizards by the name snakes. Why do peoples call them snakes? By discussed with the participants, it was found that they call them snakes because during forward movements monitor lizards flick their tongue like snakes and when they swim they look a lot like snakes too. Though all the monitor lizard species of Bangladesh are non-venomous but most of the local people believe that they are venomous, which is nothing but an outcome of the lack of proper knowledge regarding monitor lizards.

Monitor lizards are important in the food chain in their respective aquatic and terrestrial ecosystems, serving both as predator and prey [13,14,4]. In the present study, most of the participants agreed that monitor lizards play significant role in their surrounding ecosystems by controlling the populations of various harmful insects, venomous snakes and rodents. Monitor lizards are well known scavengers in different ecosystems of Bangladesh [15]. Our respondents also mentioned that monitor lizards

are playing significant role to keep our surrounding environment clean. But on the other hand, their number is decreasing throughout the world including Bangladesh at an alarming rate [16-18,3]. Several threats are directly affecting the monitor lizard population of Bangladesh and this has led to increasing mortality rates and eradicating in some parts of its range in the country [3,4]. In this study, we have consulted the local people and have identified several direct threats, most of which are anthropogenic in character and can be eliminated or controlled. The participants of this study in their life time also have witnessed different types of threats among which the most frequent threats can be categorized in the following order based on their potential impacts on monitor lizard populations: retribution killing, killing for fun, road killing, domestic dog attack, and toxic effect. Some direct threats of monitor lizard populations are presented in Fig. 6.

Perceptions, attitudes, and behaviors are related phenomena in the field of psychology [19]. An

attitude can generally be considered a disposition to think, feel, or behave, positively or negatively about something [20]. Human negative attitudes toward any wildlife species can be a great threat to that species. Age, gender, urban versus rural residency, ethnicity, socioeconomic level, professional activity, and education are some of the factors that can affect perceptions and attitudes [21-23]. In present study, it is revealed that most of the cases rural people killed monitor lizards just based on some myths and misconceptions and children often played the key role in killing. Though all three species of monitor lizards found in Bangladesh are non-venomous, people kill them just because they think monitor lizards are venomous and a threat to people. As human population is expanding and natural habitats are shrinking, people and animals are increasingly coming into conflict for living space and food. Sometime local peoples kill monitor lizards when they come to attack their domestic chicken, ducks and geese. Local fishermen also kill many monitor lizards every year just for some trivial reasons.



**Fig. 2. (A). *Varanus flavescens* killed by a local woman, (B). *V. flavescens* in search of food in human settlement, (C). *V. flavescens* stuck in a fishing net (D). Rescued *V. bengalensis* from deadly attack by a domestic dog**

Focusing the protected forest areas of Bangladesh, several conservation projects are going on for the protection of wildlife populations of different species including the monitor lizards, but monitor lizards are always treated as neglected animal groups in these types of conservation initiatives as they are more frequently found in the human-dominated ecosystems than in natural forest ecosystems.

#### 4. CONCLUSION

Anthropocentric pressures, whether directly or indirectly, are considered the primary threats to biodiversity loss across Bangladesh with animal numbers decreasing as a response to adverse ecological changes. However, some species, including monitor lizards, are more tolerant and flexible, which allow them to adapt to a wide range of ecosystems, including human-altered ecosystems [15]. There is an urgent need to raise consciousness among the local people regarding these species. Most of the people of Bangladesh have limited education and they really do not care what will happen or what is going to happen if some animals are wiped out from nature. Monitor lizards also have the status of protected species by Schedule-I of Wildlife (Conservation and Security) Act 2012 of Bangladesh [3], but most of the rural peoples even do not know the existence of this act let alone the punishment for killing wild animals including monitor lizards. Therefore, it is our responsibility to break the local peoples' misbeliefs and misconceptions toward monitor lizards by raising consciousness among the local people. Children are our future conservation leaders. Therefore, the government should pay more attention to conservation education programmes and add these in school curricula to raise the level of awareness to the children about the importance of wildlife conservation including the monitor lizards.

#### ETHICAL APPROVAL

We always pay close attention to the code, conduct and legislation for the care and use of animals for research purposes. As the present study was totally based on interview survey. So, during entire study period no animals were harmed or injured intentionally or unintentionally.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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## Appendix – I. Survey Questionnaire

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<b>Serial No.</b>		
Sex	<input type="checkbox"/> Male	<input type="checkbox"/> Female
Age	<input type="checkbox"/> Teenaged (12-17)	<input type="checkbox"/> Middle-aged (18-40) <input type="checkbox"/> Aged (40+)
Address		
Profession		

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1. Do you know this animal?

- a. Yes                      b. No

2. What do you call this animal?

3. Do you have these animal or similar ones in your locality?

- a. Yes                      b. No

If yes, where

4. How many types of Monitor Lizard found in your locality?

- a. One                      b. Two                      c. Three

5. What group of animals do they belong to?

- a. Snake                  b. Lizard

6. Are these animals poisonous or nonpoisonous?

- a. Poisonous              b. Nonpoisonous

7. Are these animals important?

- a. Yes                      b. No

If yes, why

8. Are these animals in trouble?

- a. Yes                      b. No

If yes, why

9. What could be done to protect these animals?

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