

## Human-wildlife conflict along the edge of the Sundarbans mangrove forest in Satkhira, Bangladesh

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### Abstract

This paper describes the scenario of human-wildlife conflict along the edge of the Sundarbans mangrove forest in Satkhira, Bangladesh. In and around the Sundarbans mangrove forest human-wildlife conflict occurs in the category of crop and material damage, depredation of domestic animal, human laceration and human death. The animals that were mostly involved in human-wildlife conflict are tiger, crocodile, snake and monitor lizard. Due to human-wildlife conflict, a total of 172 people and 10 tigers died during the period 1990-2018. Among the total claimed human death, 97.6% (n=168) of victims were killed by tiger, 1.7% (n=3) by crocodile and 0.6% (n=1) by snake. On the other hand, among the killed tigers, the higher proportion (80%, n=8) was male and the lower proportion (20%, n=2) was female. Most of the victims (90%) were assaulted by tigers during hours of sunlight, mainly from 10:00 am to 12:00 pm (40%) and 7:00 am to 9:00 am (25%). The generation approaching middle age (age 45-59) were most commonly assaulted (33%), but the attack was also high in 30-44 age class (26%). The attacks on different professional classes comprise honey gatherers (60%), woodcutters (22%) and fishermen (18%). Tiger attacks mostly took place in Gabura (59%, n=98), Koikhali (21%, n=35), Ramjannagar (10%, n=18), Munshiganj (7%, n=11) and others places (3%, n=6). Rested on the evidence of killed (97.6%, n=168) and wounded (78%, n=247) humans by tigers, 60% of the killed people were partially consumed while 30 % were not consumed when the bodies of victims were recovered. Departed bodies were found to have been dragged a distance of 300-800 m inside the deep forest from the initial spot of attack. Human wildlife conflict hampers the animal conservation initiatives in the natural ecosystems and poses the most serious challenges to the persistence and survival of wildlife. Therefore, there is an urgent necessity to develop a conducive environment for all concerned stakeholders to rectify the situation, and to revive their capacities in the most productive and successful way.

**Key words:** Tiger, people, conflict, kill; attack, Sundarbans.

### INTRODUCTION

Human-wildlife conflict, coexistence and interaction are priority concerns for many communities, organizations and countries across the world. Human number out bursting, agronomical escalation and capital formation have confined the occupying place and resources for both anthropoid and non-anthropoid animals, creating friction (Schwerdtner & Gruber, 2007). Human casualties, crop raiding and domestic devastation are the most consequential scenario of dispute among all (Ogra & Badola, 2008; Inskip & Zimmermann, 2009). Besides these, the succeeding is also considered as antipathy between humans and wildlife; when accident with automobiles and animals happen, when aerodyne hits avifauna, and when sick wildlife chew (Messmer, 2000). Generally, anthropogenic mortalities of unfarmed animals, including illegal hunting for vending of body parts, can

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be considered as human-wildlife conflict (Muhammed *et al.*, 2007). The final result of human-wildlife conflict is often the disappearance of human life (Gurung *et al.*, 2008). Such retributive oppression in defense of domestic animal and protection of agronomical cultivations threatens the existence of this unfarmed animal that comes into conflict. Due to the human-wildlife conflicts, many large carnivores have already gone extinct and the tiger (*Panthera tigris*) has declined substantially (Treves & Karanth, 2003).

The conditions causing human-wildlife conflict are especially marked in economically growing world (Seoraj-Pillai & Pillay, 2016). Like other economically emergent countries, Bangladesh has adapted exponential human population out bursting in last few decades, from around 70 million people in 1971 to 162.7 million people in 2018 (BBS, 2019). Massive flesh-eaters, humans and their domestic life form have co-occurred for millennia, but contemporary decades have experienced a substantial expansion in the recurrence of human-carnivore frictions (Graham *et al.*, 2005). The anthropoid community around the Sundarbans is deliberately dependent on biodiversity facilities of the Sundarbans for their maintenance (Brown, 1992). On account of their closeness to the forests, they are opened to a unique set of animate danger ranging from snakebites to tiger attacks. Occurrences of feral straying into the villages are also on the rise. This level of friction leads the way to opposition towards the wildlife conservation initiatives.

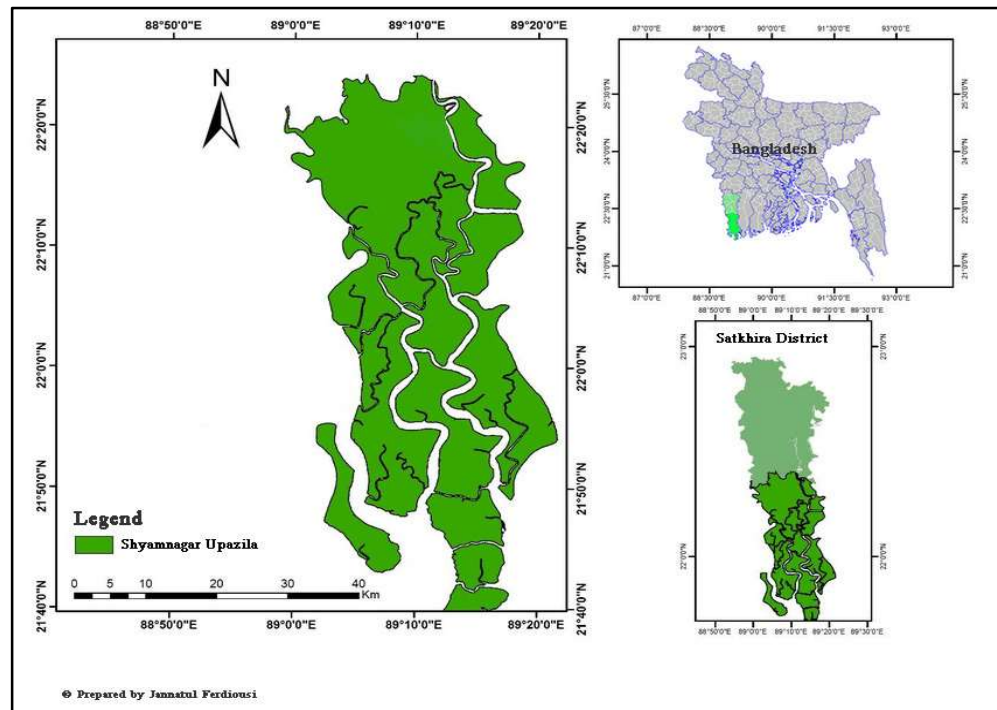


Fig. 1. Bangladesh map showing the study area-Shyamnagar Upazila of Satkhira district

This study was not set just to prove or disprove theories on the causal factors for the large number of tiger attacks in the Sundarbans. Though the factors behind tiger attacks are analyzed and discussed, the aim of the study was to gain a better perception of the impact of wild animals' attacks on people and to come up with practical recommendations which, if followed, could reduce the loss of life and the negative impact of such attacks on the families of the victim.

## MATERIALS AND METHODS

**Study sites:** For the present study, field work was carried out from August 2018 to May 2019 along the edge of the Sundarbans under the Shyamnagar upazila of Satkhira district (22°19'50.16" N, 89°6'10.08" E) (Figure1). Shyamnagar upazila is the biggest upazilas in South East Asia which is surrounded by Kaliganj (Satkhira) and Assasuni upazilas to the north, the Sundarbans and Bay of Bengal to the south, Koyra and Assasuni upazilas to the east and the Indian state of West Bengal to the west. The Shyamnagar upazila part of Sundarbans mangrove forest is surrounded by 11 unions namely Bhurulia, Kashimari, Nurnagar, Koikhali, Ramjannagar, Munshiganj, Iswaripur, Burigoalini, Atulia, Padmapukur and Gabura. The Upazila has 46,592 families with total area of 1968.24 km<sup>2</sup>. A significant number of Shyamnagar populations largely dependent on Sundarbans for their livelihood.

Several methods were employed to conduct this research. Primary data was collected by interviewing local people through a set of questionnaires. About 90 human beings were questioned throughout this work. Experienced older people got importance. The people who had firsthand experience of wildlife attack or who had observed wildlife attacks on other people got special preference. Relevant newspaper (both Bengali and English) reports, Bangladesh Forest Department records and information from different national and international NGOs were also used as sources of secondary data. Apart from these, qualitative data was collected through target group meeting with domestic people. All statistical analyses were analyzed using SPSS release 16.0 (SPSS Inc., 2007) and Microsoft Excel for easy analysis of findings from the survey questionnaires.

## RESULTS AND DISCUSSION

**Dimension and nature of human-wildlife conflict:** Due to human-wildlife conflict, a total of 172 people have died during 1990-2018. Among the total claimed deaths, 97.6% (n=168) of victims were killed by tiger, 1.7% (n=3) by crocodile and 0.6% (n=1) by snake. On the other hand, we documented 317 incidents of human injuries due to human-wildlife conflict. Most of the cases (78%, n=247) tigers were the responsible animal for human injuries and snake was the second most common source (20%, n=63) of injures. Among the wildlife species, monitor lizards were not responsible for any kind of human injuries or death during this study (Table 1).

**Table 1. Summary of human-wildlife conflicts around the Sundarbans mangrove forest**

Wildlife species	Human casualties (%)		Damages (%)		
	Injury	Death	Crop damage	Property damage	Livestock depredation
Tiger	78	97.7	100	54.5	42
Crocodile	2	1.7	0	13.7	14
Snake	20	0.6	0	0	21
Monitor lizard	0	0	0	31.8	23
Total	100	100	100	100	100

Considering damages, tigers were the sole animal responsible for crop damage (100%, n=35). In the case of property damage, 54.5% (n=12) of incidents were caused by tiger, 31.8% (n=7) by monitor lizard, 13.7% (n=3) by crocodile and no damages were done by snake. Though all of the mentioned species were responsible of livestock depredation in some extent, but most of the cases (42%, n=75) tigers played the leading role for the livestock depredation, followed by monitor lizard (23%, n=42), snake (21%, n=37) and crocodile (14%, n=25) (Table 1).

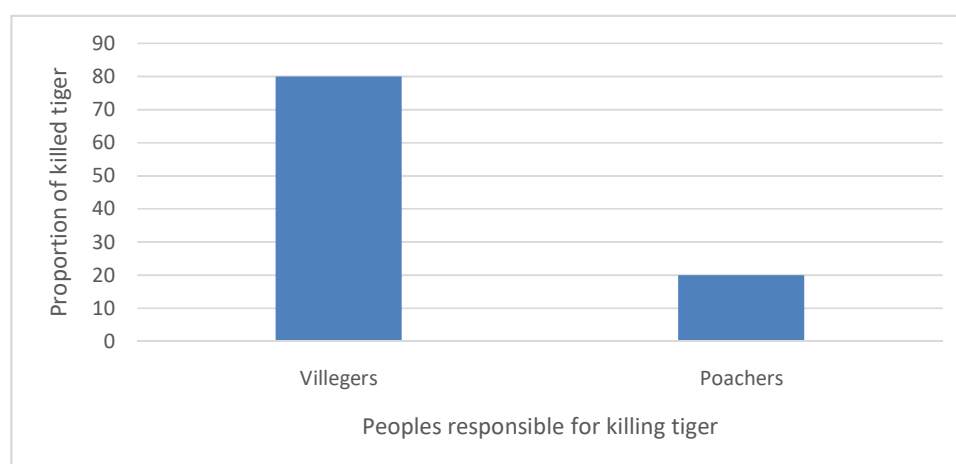
**Human-tiger conflict:** In the Bangladesh Sundarbans and the adjoining region, ten tigers were killed in the course of 1990 to 2018. Our study result shows that in winter, tigers were killed by domestic people much higher (60%, n=6). As no remarkable data about tiger kill were found in different months, no statistical analyses were done to look into their significance. Male tigers were killed more (80%, n=8) than females (20%, n=2) (Table 2). Eight of ten tigers were killed in the villages close to the Sundarbans and the two of ten were inner side of the Sundarbans.

**Table 2. Proportion of tigers killed by local peoples during 1990 to 2018 in and around the edge of Sundarbans mangrove forest, Bangladesh**

Age Group	Proportion of Sex (%)		Seasonal Killing (%)	
	Male (n=8)	Female (n=2)	Summer (n=4)	Winter (n=6)
Young	0	10	0	10
Middle aged	80	0	30	50
Old	0	10	10	0
Total (%)	80	10	40	60
Grand Total (%)	100		100	

People killed tiger for several reasons. Among them, the prime reason was the attack on people along with domestic animals.

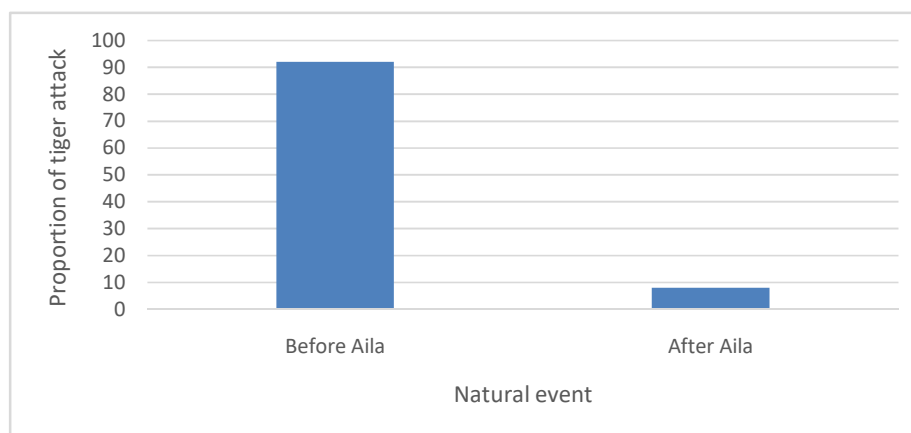
During this study, villagers killed 80% (n=8) tigers due to the charge on human and livestock. Illegal hunting (poaching) is another major danger to the tigers and a major cause of killing tigers. During this study, 20% (n=2) tigers were killed inside of Sundarbans by the poachers (Figure 2).



**Fig. 2. Proportion of tigers killed by the people in and around the Sundarbans mangrove forest**

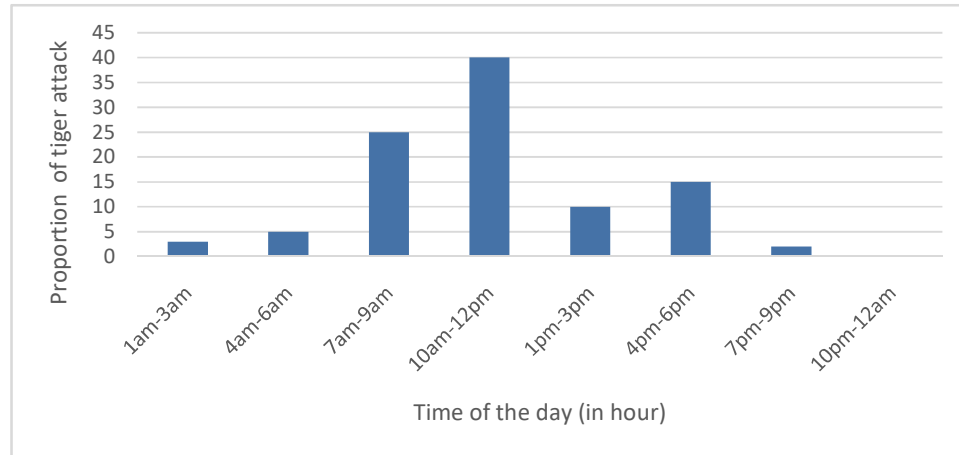
The most common way of killing tiger by poachers is to poisoning the partially consumed food of tiger. Along with this, firearms like gun also are used directly or set it on the way of tiger trail which is activated by the tiger itself.

Considering total tiger attack on human during 2010 to 2018 time period, it was found that most of the tiger attacks (92%, n=156) occurred before the cyclone Aila in 2009 and rest of the attacks (8%, n=12) after Aila (Figure 3).

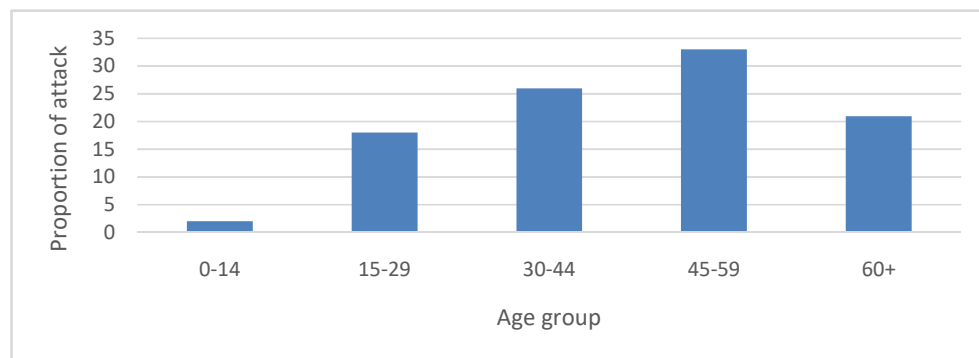


**Fig. 3. Proportion of people killed by tigers before and after the cyclone Aila**

Tiger attack varies importantly during different parts of the day. Greater part of the victim population (90%) was ambushed in the course of daylight mainly at 10:00 am -12:00 pm (40%) and 7:00–9:00 am (25%), respectively, when they remain active in the forest or in a narrow creek. For safety purposes, at night people paused their daily activity and took rest mainly on boat in the middle of the river or in a safeguarding residence, and hence no tiger attack was recorded during 10:00 pm -12:00 am. Despite of security, few tiger attacks were recorded during late night (Figure 4).

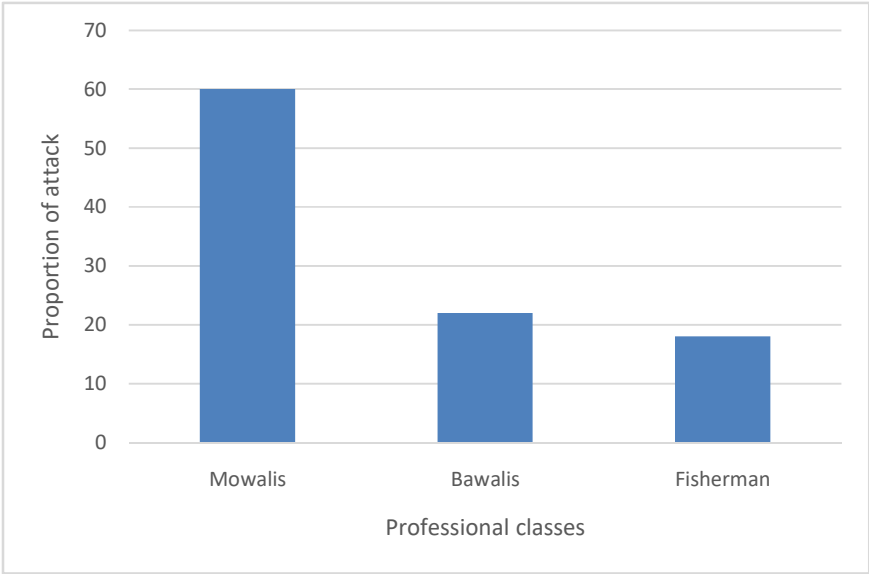


**Fig. 4. Recorded tiger attacks across different part of the day**

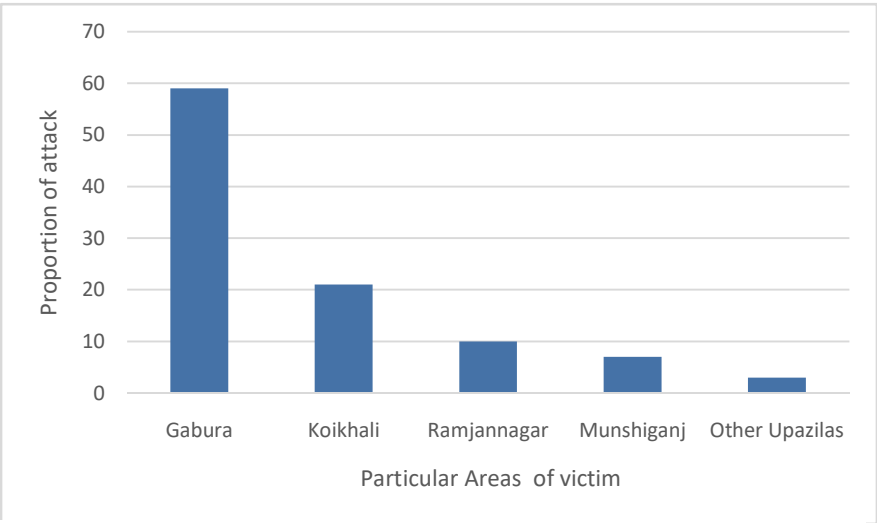


**Fig. 5. Relative selection of age group by the tigers of Sundarbans mangrove forest**

The proportion of suffered (killed/injured) humans (n=168) in several peer group and different occupation were compared to estimate whether the large carnivore has any fondness for humans as a targeted prey. The comparative study divulged that middle-aged people (age 45- 59) were very common victims (33%) of tiger attack as the individuals of this age classes went the forest again and again for their livelihood, followed by 30-34 age class (26%), 60+ age class (21%), 15-29 age class (18%) and 0-14 age class (2%) (Figure 5).



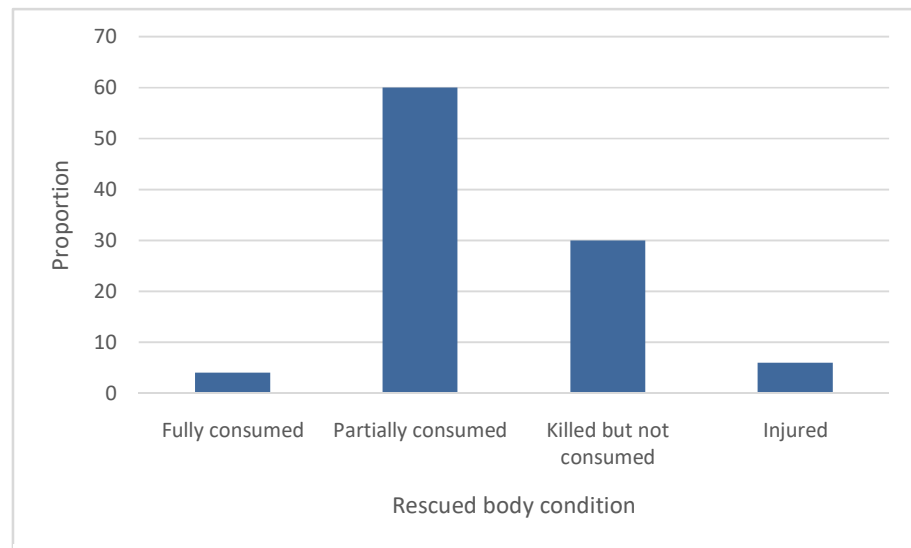
**Fig. 6. Tiger attacked on different professional classes in and around the Bangladesh Sundarbans**



**Fig. 7. Tigers attack in different parts of Shyamnagar Upazilla of Satkhira in the Sundarbans landscape**

Based on the pounces on people of different occupation, it was found that most of the attack were on mowalis (honey gatherers) (60%) as they go even into deep forest for searching of honey comb and bawalis (woodcutters and other plant product harvesters) (22%) and fishermen (18%) (Figure 6).

In the Satkhira range of Sundarbans, tiger attack was the highest (59%, n=98) in Gabura union because of its adjacent location to the Sundarbans, followed by 21% (n=35) in Koikhali (Golakhali and so), 10% (n=18) in Ramjannagar, 7% (n=11) in Munshiganj, 3% (n=6) in other areas of Shyamnagar (Figure 7).



**Fig. 8. Body condition of the rescued victims of tiger attack**

From the instances of both killed (n=168) and injured (n=247) population, 60% of killed people were partially consumed while 30% killed but not consumed, 6% injured, 4% fully consumed (Figure 8). The reasons for that kind of rescued body condition may be the family members and group members of victim came back to rescue them with proper measure and tigers left the spot remaining the half-eaten body. Killed human bodies were revealed to have pulled a distance of 300-800m inside the deep forest from the initial spot of attack.

Human-wildlife conflict is appearing as a significant wildlife management concern in the endmost decade. The consequences of conflict effects in awful impacts on communities in different grade of crop depredation, material damage, loss of domestic lives, human injury and human killing (Sekar, 2013). Our study also revealed that in and around the Sundarbans human-wildlife conflict occurs in different multitude of crop and material damage, domestic life depredation, human injury and human killing. In our study areas, the animals that were involve in human-wildlife conflict mostly were tiger, crocodile,



snake and monitor lizards. In a study Rahman *et al.* (2017), it is found that all the monitor lizard species occurring in Bangladesh are non venomous but most of the inhabitants believe that they are poisonous and harmful, which is the result of their traditional belief and ignorance regarding monitor lizards. Our study also revealed that except monitor lizards, all other wildlife species were directly involved in human death and injuries. Tigers were not directly responsible for crop and property damage. Actually, the damages occurred when the locals chased the tiger to kill. Karanth and Gopal (2013) in a study pointed out that in conflict situations, local rivalry against tigers often issues into a crucial difficulty. On the other hand, crocodile and monitor lizards very often damaged the fishing devices of the local peoples.

Now human-tiger conflict is spreading worldwide especially in South Asia (Bhatta *et al.*, 2007). Of all conservation landscapes of Bangladesh, it is in the Sundarbans that human death by tiger is the highest. The conflicts are increasing as the human populations rise. The cause of killing tiger by the villagers was due to the destruction of livestock and to injure the local people. This kind of retributory killing of predators are very normal throughout the world (Ahearn *et al.*, 2001; Nyhus & Tilson, 2004, Gurung *et al.*, 2008).

From the study of Khan (2004), it is evident that in the Bangladesh Sundarbans the exact number of carnivores spoiled every year is more or less twice that documented officially by the Forest Department. Siddiqui & Choudhury (1987), Helalsiddiqui (1998), Ahmed (2002a, 2002b, 2002c), Reza *et al.*(2002b) and Gani (2002) revealed tiger demise rates and some other aspects of tiger-human interactions in the Bangladesh Sundarbans, but all of these evidences were mostly rested on the same official (Forest Department) records, which is not the factual representation.

From the study of Helal Siddique (1998) it is evident that around 7-11 tigers are poached every year which is much higher than the official records. Both Helal Siddiqui (1998) and Ahmed (2002a, 2002b) indicated that the extirpation of tigers due to anthropogenic cause are rising day by day. From 1984 to 2000 three tigers were killed per year, mentioned by Reza *et al.* (2002b) which is based on the authorized documents, and from the records Gani (2002) mentioned that 23 tigers extirpated during 1996 to 2000. The exact statistics of casualties which are discussed in the results section of this paper, are very different from the authorized records. From the study we found that 78% of big cats' extirpation happened in the parish-pump close to the mangrove forest Sundarbans and the remaining part in the core of the Sundarbans which is close to Khan's (2004) and Gani's (2002) records (68% and 65% tiger demises in the village respectively).

In winter, people killed more tigers than in other months which is near the record of Khan (2004). Winter is the propagation period of tigers and in this time, they get more topographical conflicts among male mate partners and probably this was the reason of more tiger killed in winter (Khan, 2004) and also this is the constant cause for kill of male tigers which is supported by Hendrichs (1975) in a 19-year period (1950 to 1974), 58.5% were males.

Most of the extirpated tigers were young and in good condition, which notifies that, at least in the Sundarbans, a tiger can become a man-eater for a reason that falls in none of the properly-believed three main reasons (Corbett 1954, Rabinowitz 1986, Linnell *et al.* 1999): wounds and infirmity, old age, and loss of home range to other tigers.

The people were killed along the Sundarbans were largely caused by the tiger attack. Most of the occurrence on human took place inside the Sundarbans and close the edge of the forest. Human death also occurred due to crocodile attack and snake bite. Among all recorded tiger attacks most of the attacks happened before cyclone Aila (2009) and rest occurred after Aila. Proportion-wise the number of attacks on people of different professions follows the seasonality of resource extraction in the Sundarbans. In our finding, the tiger attack victims were mostly honey gatherer, woodcutter and fisherman. Fisherman, woodcutter, and honey gatherer comprised the bulk of tiger victim among eight professional classes Reza *et al.* (2002b).

The frequency of attacks over a day varied a great deal. The largest concentration or attacks occurred during daylight between 6am-6pm. Only around very few attacks took place at night between 9pm-3am. The reason for this could be that resource extractors take great care to anchor their boats well away from the riverside at night. Maximum tiger attacks on domestic people occurred at the time of their arrival to the operating site during 0600-1000 h (36%) and the time of their coming back to their safeguard zone in the dusk during 1400-1700 h (31%). The interviewed man said that tigers sometimes pounce human on boats in the river or creek, but this type of pounce happened rarely at midnight.

The age of the victims plays a significant role in the selection of individual people by tigers. Our study results exposed that middle-aged people (age 45-59) were mostly affected while the people in the age group between 0-14 and 15-29 are the least vulnerable. The reason for that kind of selection may be the people of this peer group frequently engaged to the forest. Among seven age groups, 26-35 age class and 36-45 age class were at risk to tiger attacks in Bangladesh Sundarbans, Ahmed (2002a) and Reza *et al.* (2002b). Our study results also support the findings of Khan (2004) and Nyhus & Tilson (2004).

This study recorded that the potential areas of the Sundarbans which are most vulnerable to the tiger attacks are Gabura, Kaikhali, and Ramjannagar. Evidently there are certain areas that are more sensitive to tiger incursions than others, in contrast to the situation within the Sundarbans, in the villages, more attacks seem to occur in the areas bordering the southwest part of the Sundarbans. On the other hand, there are villages that are prone to tiger attacks even with the presence of rivers separating these villages from the Sundarbans. Usually, these villages are located in a piece of land that is sticking out into the forest with forested land on both sides. These villages become more vulnerable to tiger incursions because of their location.

This study elucidates that tiger after killing the prey drag it into the forest. The neck-head bite from the back is the prominent strategy of the tiger for pounce on human (Khan, 2004). In Nagarhole, India, the dragged distance up to 350 m, though the usual was

around 50 m (Karanth, 2001). In the Sundarbans, maximum dragging distance (mean=1,364 m) was observed (Khan, 2004) and this was probably because tigers wanted to proposing sufficiently far away to avoid any kind of irritation from followers of the victim. In present study it was recorded 300m-800m dragged distance of inside the deep forest from the initial spot of attack.

**Conclusions:** Protection of biodiversity and wildlife conserves cultural heritage and natural ways of living. It is fundamental for Bangladesh, because the impacts of biodiversity degradation and the resulting loss of ecosystem services have a mass impact on the overall wellbeing of the population living around the Sundarbans. Human-wildlife conflict can have a bad impact, especially on domestic inhabitants, so far causing monetary damage amounting to millions of dollars. Severe crop damage and the rising frequency of animal attacks on both humans and their livestock have made communities less tolerant towards wildlife, mainly due to the sentimental stigma attached. Decrease of human-wildlife conflict is thus becoming one of the key issues of concern for both wildlife managers and the scientific communities. Therefore, there is an urgent necessity to develop an enabling surrounding for them to address the situation, and to strengthen their capacities in the most productive and successful ways.

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