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Wildlife diversity of the Padma River islands, Rajshahi, Bangladesh with special notes on the operation of sand snake (*Psammophis condanarus*) (Merrem, 1820) (Reptilia: Squamata: Lamprophiidae)

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Abstract
The islands of the river Padma of Rajshahi district, Bangladesh is rich in various plants and wild animals and adorned with natural beauty. Here, wildlife is facing severe threats due to constant river erosion, flood, and human-environment conflict. Poor communication system and a lack of stable land, the Padma islands have been considered one of the safest zones for wildlife. Despite the remoteness of the area, a few insufficient and scattered research works have been done previously. In the present study, we found three plants, six snakes, eight birds, one frog, one wild animal (evident by its footprint), and the presence of a yock. Most importantly, our dissected sand snake (*Psammophis condanarus*) was anesthetized by using Ketamine Hydrochloride bp in live conditions which might be the first record in Bangladesh, so far. Later, we took fresh liver tissues (multiple about 5 x 5 x 5 mm pieces) from this dissected snake and fixed them separately in 99.5% ethanol. Furthermore, the whole specimen of *P. condanarus* was also preserved in 99.5% ethanol for further morphological and genetic analyses. This article gives a brief overview of the beautiful wildlife ecosystems that have developed in the remote areas of the Padma River islands in the Rajshahi region as well as to acquire knowledge about the complete operating system i.e., removal of liver from the lives sand snake.

Keywords: Wildlife survey, biodiversity, Sand Snake

Introduction

Geographically Rajshahi is situated within Barind Tract, 23 m above sea level and lies at 24°22′26″N 88°36′04″E (Wikipedia). Rajshahi district is bounded on the south by India, on the west by Chapai Nawabganj, on the east by Natore district, and on the north by Naogaon district. The Padma River carries the long history, heritage, and culture of both Bangladesh and Indian people. It enters into Bangladesh near the Shibganj Upazila of Chapai Nawabganj district. Its confluence of water joined with the Meghna River near Chandpur prior to the discharge of water into the Bay of Bengal. According to the laws of nature, the direction of the channel of rivers changes which eventually makes islands. Likewise, in our studied area the Padma River islands have been created and it is a harbor of many wild animals for a long time in Rajshahi districts due to less access by humans. The islands of Padma River are now a safe place for various species such as birds, snakes, wild and domestic animals, etc. Although a few drawbacks still exist, however many herpetologists denominate the Padma River islands as a biodiversity hotspot. In connecting this, the Padma River islands could be considered good resources for herpetological study. Recently, Haidar et al. 2020 documented a new record of *P. condanarus* from these islands. In addition, the evidence of the hotspot (birds) of these islands is also revealed by Reza et al. (2014, 2016) and Rahman et al. (2012a, 2012b) who reported 141 birds and 50 herpeto-mammalian fauna here, respectively.

In general, biodiversity is important to measure the general health and aid to develop the conservation plan for a better ecosystem and ecological niche of various wild animals. Therefore, it is imperative to take action for the restoration of the fragile ecosystem for the greater benefit of the communities who depend on them (Mohanty et al., 2015). Likewise, the wildlife biodiversity of several scattered islands immerged in the belly of the river Padma needs to evaluate and quantify the diversity for proper conservation and sustainable use of them for the well-being of human civilization, particularly for the people of the Rajshahi region.

However, our targeted islands and/or area (Fig. 1) were not quantified previously exclusively. The diversity of fauna and flora of these islands needs to assess accurately. In addition, the isolation of liver tissue from the lives sand snake is a bit risky; and this kind of operation did not occur previously in Bangladesh, so far. In connecting this, the present study is a remarkable attempt to review the overall wild species richness in the Rajshahi district and show the procedure how to prepare liver tissue samples from live snakes for further DNA research work and analyses.

Materials and methods

Study area

We have studied some isolated islands and social forests of Rajshahi Upazila Sadar and Godagari Upazila under the Rajshahi district. The explored area is located inside and/or just the bank of the Padma River which is altogether situated between the Rajshahi district, Bangladesh, and Murshidabad district, West Bengal of India. We surveyed a vast area (about 40km) of islands of the Padma River on the Bangladesh-India border from December 2020 to December 2021 (Figure 1). The survey was done monthly and the direct observation FGD (Focus Group Discussion) method.

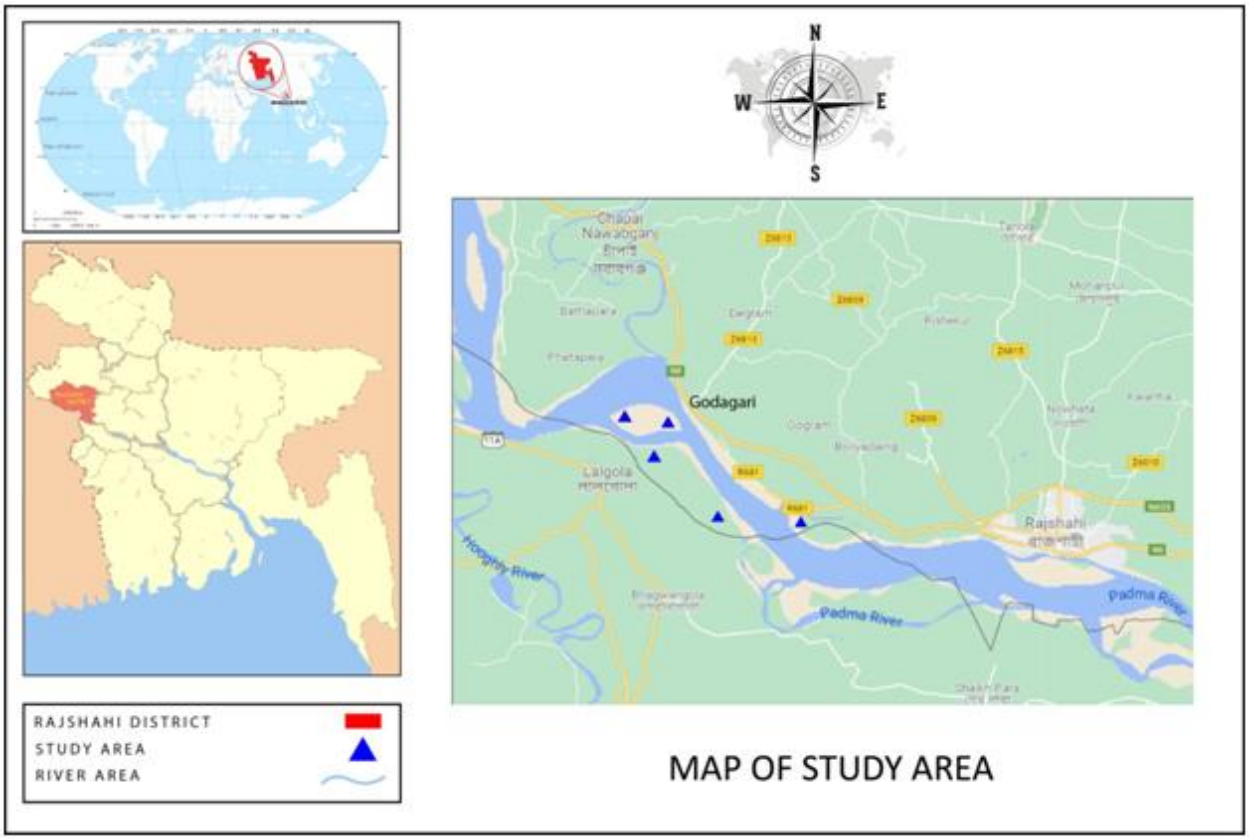

Figure 1. Map showing some isolated islands and social forests of Rajshahi Upazila Sadar and Godagari Upazila under Rajshahi district.

We completed the data collection from all our desired places by FGD and/or individual interview. For collecting the data, we also took help from the local herpetologists. The identification of these wildlife animals was done based on related available literature (Red List of Bangladesh, Volume

2: Mammals (2015); Red List of Bangladesh, Volume 3: Birds (2015); Red list of Bangladesh, Volume 4: Reptiles and Amphibians (2015) and Wildlife of Bangladesh, (checklist and guide) and online portal bases (eg., AmphibiaWeb, the Reptile database, etc.). Prior to using available literature, local expert taxonomist/herpetologist also preliminary identified the taxa. We also used various journals and references to prepare the checklist. After collecting all the information, we made a checklist according to the family. The list has been confirmed by the experts with repeated checks, sorting, and verification.

Operation of Sand Snake (*Psammophis condanarus*)

After collecting the sand snake, it was brought to Paba (Snake Rescue and Conservation Centre) Rajshahi as a live condition for further molecular study. Then, Ketamine Hydrochloride bp was injected into the snake's body by using 3 cc syringes for anesthetizing purposes. Later, we collected 5×5×5 mm size tissue samples from the caught snake specimens. This is the first time to anesthetize a live snake and perform the operation to collect the desired DNA samples in Bangladesh.

Snake details (Voucher no. BSFMSTUMHS-02)

Weight: 19gm

Body Length: 21.2 inch

Head to Anus Length: 19.2 inch

Anesthesia details

Medicine: Ketamine Hydrochloride bp

Dose: 7.5 mg/kg

Anesthesia Time: Time-dependent on temperature (August 31, 2021)

Dissecting Equipment

1. Artery forceps, 2. Forceps, 3. Surgical gloves, 4. Surgical hook, 5. Surgical scissor, 6. Surgical blade, 7. Vacuum Tube, 8. Thermometer, 9. Vernier scale, 10. Petri dish, 11. Weight machine, 12. Ethanol (99.92%), 13. Measurement tape and 14. Injection (3cc syringe)

Details of anesthetization and operation

First, we measured the total length of the snake by using measurement tape and weight using a digital weight machine. The temperature was recorded at 32˚C. Prior to injection, we wore surgical gloves and then injected the medicine into the snake's body. Around 3-4 minutes later, the snake was movement less. We kept the snake's mouth open with forceps. Because saliva accumulated in the snake's mouth due to anesthesia. If the snake's mouth was not kept open, the trachea may close

and ultimately the snake may die. The operation started from the ventral part of the snake, particularly the second quarter of the abdomen with the help of surgical blade. The liver is located just below the heart. Then the liver was separated by forceps and cut with a surgical blade and scissors. The liver was then placed in the petri dish. The length of the liver was 30 mm. The size of the liver was 5×5×5 mm. Then, this separated portion of the liver (5×5×5 mm) was put into 100% ethanol in a tube. At the end of the operation, the abdomen portion of the snake was sewed using a surgical needle and thread. The whole live snake was also preserved in 100% ethanol in a bottle (Fig. 2).

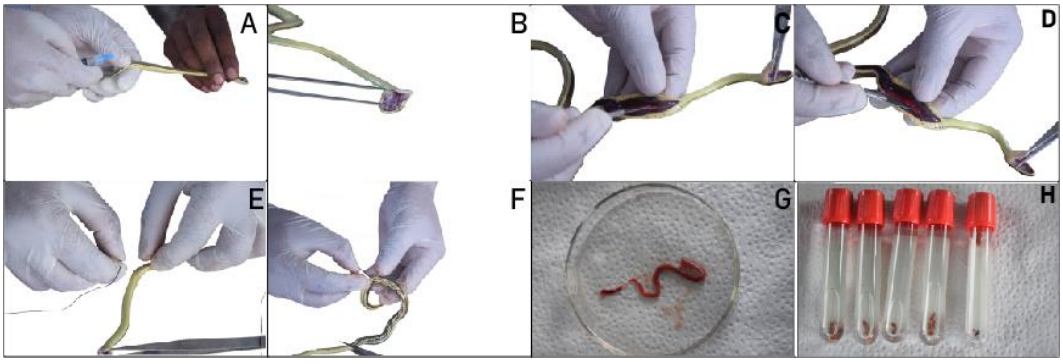

Figure 2. (A) Straight the snake, (B) Open the snake mouth by using forceps, (C) Examine the liver using needle, (D) Remove the snake liver, (E) Sewing the snake, (F) End moment of sewing, (G) The whole liver on the petri dish and (H) 5×5×5 mm size liver tissue inside the tube.

Results

General overview

Wildlife plays an important role in balancing nature and its surrounding environment. It provides the cohesion of different components of nature. Wildlife and nature have largely been associated with humans. Ecological balance, gene bank, plant propagation, cleaning of the environment, soil erosion, etc. can be maintained by wildlife diversity (Meena, 2019). Therefore, it is our responsibility to know and explore the distinctive species in the ecosystem and make a further recommendation for sustainable use of it. The Padma River is an important spawning and feeding ground for many riverine fish species of Bangladesh (Akther et al., 2017). We found a large number of fishermen in our study area. They were busy for fishing with different kinds of fishing gear such as – bair, jakijal, fasjal, current jal, china bair, etc. The current net and china bair is a major threat to the environment and fish biodiversity because the mesh size is too small to escape. During flood

season, fishing is only their profession (Galib et al., 2013). Further, farmers and herdsmen also involve in fishing during the offseason, because they have no other option to earn and survive. The fishermen, farmers, and herdsmen here are often injured by yock and snakes while going to work (Appendix 1).

On some islands, we found the distressed persons who have no property in the mainland of Bangladesh and settled here over the decades. On the contrary, another category of people also come here only in the dry season for cultivating the land. In addition, some other islands have been declared as social forests under the forest department and trees have been planted there (Appendix 2). For example, “Nirmala Char” (24˚22'59.0"N, 88˚25'01.2"E) is a kind of social forest where many kinds of trees were planted and taken care of for the purpose of protection and preservation of wild biodiversity. We have seen a huge abundance of snakes, birds, and wildlife here.

Domestic animals of the Padma River Island people

The settlers of the isolated islands are often having poor or no communication with the Rajshahi city or any other part of the mainland of Bangladesh. Therefore, they rear cows, goats, ducks, swans, buffaloes, and other domestic animals all the year round (Fig. 3). By taking care of these animals, they try to earn money and buy their necessary commodities. Excessive flooding in the monsoon and drought in the dry season pursues them to live in a measurable condition. Their lives run from hand to mouth. Their socio-economic condition is very critical and they live under the poverty line.

Figure 3. (A) Goats are grazing on the transitional area between wetland and land, (B) Swans are resting, (C) Ducks and swans are walking and (D) Buffaloes are resting inside the water.

Plants

The Padma islands are full of different species of trees. The abundance of babul trees (*Vachellia nilotica*) is the highest in number. Akashi trees (*Acacia auriculiformis)* have been planted in the social forests by the forest department of Bangladesh. The presence of different species of cashew trees (*Saccharum spontaneum*) also can be found here. These trees act as a host of different species of birds during the monsoon season. Besides, different types of reptiles take shelter in the branches of these trees. For example, the sand snake (*P. condanarus*) comes from India through the Farakka barrage and takes shelter in these trees. The local people also use these trees as fuel purposes (Fig. 4).

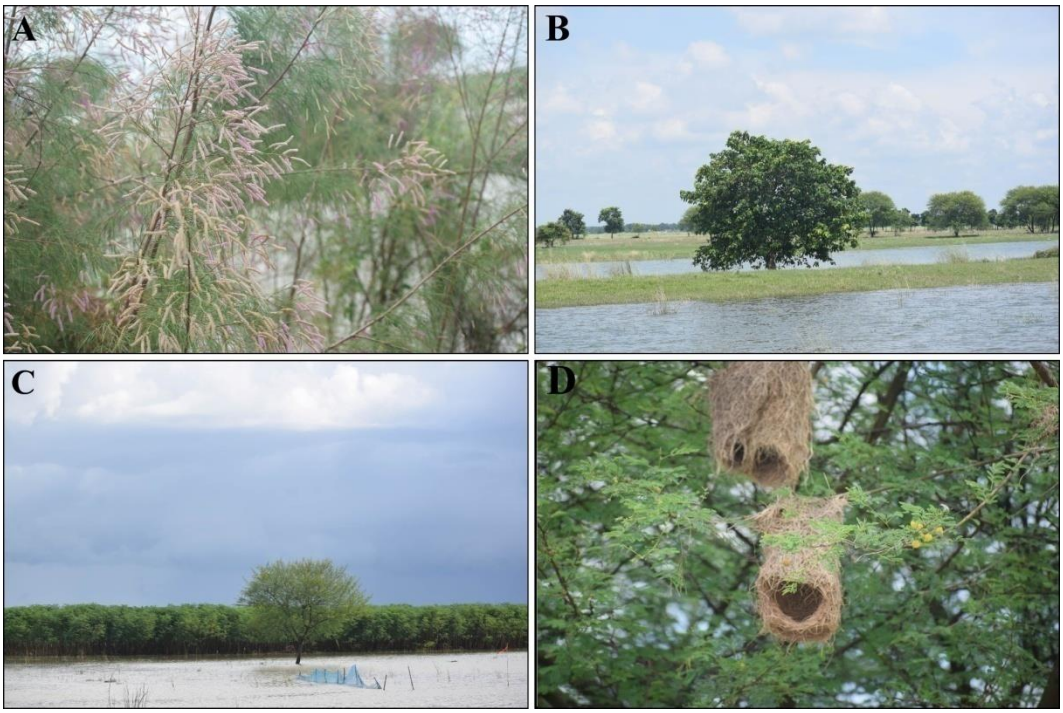

Figure 4. (A) Bamboo tress, (B) Overview of a wetland inside the islands, (C) Flooded area and (D) Birds nest is hanging from the branches of trees.

Reptiles

Snakes

We found a total of 6 species of snakes in our study area. All wild animals which we documented and shot for the picture were listed below.

Table 1. List of wild animals which are found in this study.

Sl No	Local name	English Name	Location	Family	Genus	Species	IUCN Status (Bangladesh) 2015
1	Not Available	Sand Snake	24˚27'35.0"N 88˚17'23.6"E	Lamprophiidae	*Psammophis*	*P. condanarus*	(LC)
2	Dagi Dora Sap	Buff Striped Keelback	24˚22'50.2"N 88˚24'28.3"E	Colubridae	*Amphiesma*	*A. stolatum*	(LC)
3	Dorakata Racer Shap, Bandkata Racer Shap	Banded Racer	24˚27'30.0"N 88˚18'17.5"E		*Argyrogena*	*A. fasciolata*	(LC)
4	Chandra Bora, Ulu Bora	Russell's Viper, Indian Russell's Viper, Common Russell's Viper	24˚22'05.4"N 88˚28'44.6"E	Viperidae	*Daboia*	*D. russelii*	(NT)
5	DarashShap	Indian Rat Snake, Dhaman, Oriental Rat Snake	24˚27'00.2"N 88˚18'59.3"E	Colubridae	*Ptyas*	*P. mucosa*	(LC)
6	KhoiaGokhra, GokhraShap, Goma Shap, GahamaShap, KharampaiaShap	Binocellate Cobra, Spectacled Cobra, Asian Cobra, Indian Cobra	24˚27'49.8"N 88˚17'38.7"E	Elapidae	*Naja*	*N. naja*	(NT)
7	Uudbiral, Uud, Vodor, Dhaira	Eurasian Otter, European Otter,	24˚22'58.3"N 88˚24'56.5"E	Mustelidae	*Lutra*	*L. lutra*	Least Concern (LC)

		European River Otter, Old World Otter, Common Otter					
8	Anura	Reptilia	24°22'58.3"N 88°24'56.5"E	Dicroglossidae	*Fejervarya* sp.	*Fejervarya*	Unknown
9	Gobok	Cattle egret	24°23'01.0"N 88°24'31.3"E	Mustelidae	*Bubulcus*	*B. ibis*	Least Concern (LC)
10	ShamukKhol	Asian Openbill	24°23'33.6"N 88°24'58.8"E	Ciconiidae	*Anastomus*	*A. oscitans*	
11	Indian Pond Heron	Kani Bok	24°23'40.5"N 88°23'54.2"E	Ardeidae	*Ardeola*	*A. grayii*	
12	Asian Pied Starling, Pied Myna	PakraShalik, GobreyShalik	24°22'16.8"N 88°27'38.4"E	Sturnidae	*Sturnus*	*S. contra*	
13	Gang Shalik	Bank myna			*Acridotheres*	*A. ginginianus*	
14	BronjeFinge	Bronzed drongo		Dicruridae	*Dicrurus*	*D. aeneus*	
15	ChotoPankouri	Little cormorant	24°22'41.9"N 88°24'11.8"E	Phalacrocoracidae	*Microcarbo*	*M. niger*	
16	Lal Lotika	Red-Wattled Lapwing	24°23'41.0"N 88°23'53.4"E	Charadriidae	*Vanellus*	*V. indicus*	

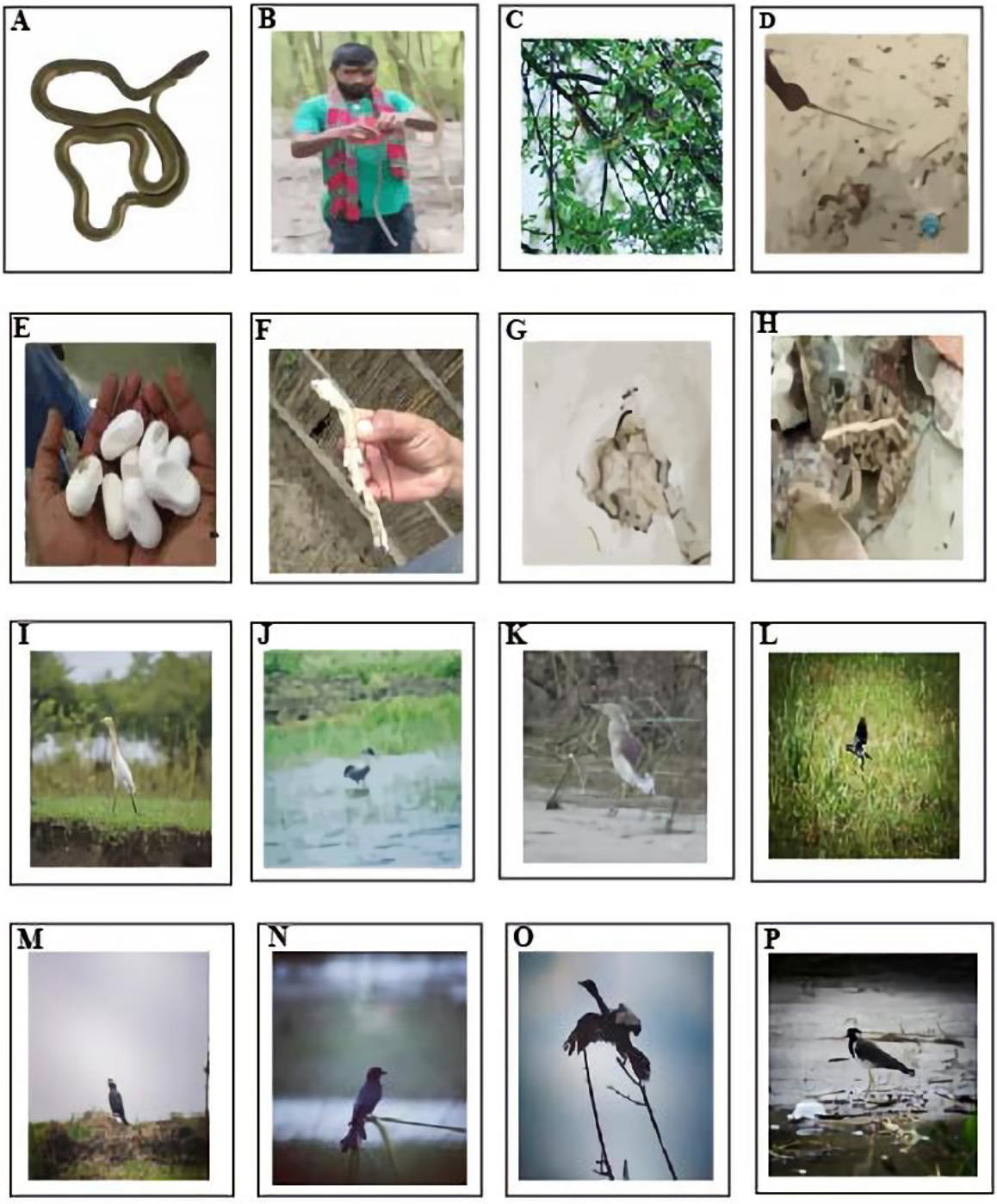

Figure 5. (A) *P. condanarus,* (B) *A. stolatum,* (C) *A. fasciolata*at rest time in babul tree, (D) *D. russelii,* (E) Unfertile egg of *P. mucosa,* (F)Shells of *N. naja,* (G)Footprint of *L. lutra,* (H) *Fejervarya* sp., (I) *B. ibis,* (J) *A. oscitans,* (K) *A. grayii,* (L) *S. contra,* (M) *A. ginginianus,* (N) *D. aeneus,* (O) *M. niger* and (P) *V. indicus.*

Wild animals

We have found footprints of various wild animals. However, we could not identify those animals because they were not clear for the soft and wet soil. We have been able to identify only one footprint i.e., otter (*L. lutra)*.

Otter

Based on footprint, we were able to identify one Eurasian Otter (*L. lutra)*. Our FGD meeting with the local people pursues us to believe that the breeding and feeding ground of Otter is remarkably declining day by day.

Frog

We have found many frogs in our study area. However, we documented only one frog which is morphologically difficult to identify. Because, *Fejervarya* species complex is a major concern to annotate the amphibian diversity in Asia, particularly in Bangladesh (Hasan et al., 2012).

Fox

We also found a few native foxes, but unfortunately unable to take any picture due to their fast running.

Birds

We have seen innumerable birds in the Padma Char but it was not possible to shoot the all birds with cameras. Only, a few of them was captured and recorded in our Nikon D5300 DSLR camera (with 70-300mm zoom lens) (Table 1 and Figure 5).

Discussion

Our study sketched a rough overview of the livelihood of the distressed people of the Padma islands whose daily life is strongly connected with the wild animals of this area. Based on the flood and erosion of land, they need to relocate their shelter from one place to another. Similar kinds of results were reported by Islam et al. (2011). Therefore, the concerned authority needs to take proper steps to enhance the socio-economic condition of these depressed dwellers. For example, establishing the social forest in this area is a positive indication to improve the wildlife biodiversity as well as the fate of these disdained people.

Bangladesh is a land of rivers. However, due to high sedimentation, the flow and direction of the river have changed significantly in recent days, particularly in the river Padma. Eventually, many small islands have been emerged inside the river and become the host of many natural vertebrates like frogs, snakes, birds, and other mammals. Due to incessant river erosion and the emergence of

new islands, the biodiversity of wildlife on the Padma islands is constantly changing. Our study provides little information about the current status of wildlife biodiversity of the Padma islands and contributes to the current understanding of the biodiversity situation. Based on IUCN (2015), *L. lutra*is critically endangered in this area and needs to conserve immediately. The footprint of otters is an indicator that the number of individuals is rapidly decreasing and they are now in threat. Therefore, government and non-government organizations need to take proper conservation plans to save this valuable carnivorous mammal that completely depends on catching fish inside the water.

Notwithstanding, no snake has been completely anesthetized in Bangladesh previously. Therefore, this operation might be the first record in Bangladesh so far. These baseline data might be useful to future researchers who might be interested to do the research on biodiversity of wild animals. Some species seem to be very rare and near to extinct. Therefore, we need to identify these critical animals and preserve them immediately. Hasan et al., 2012 revealed the cryptic anuran biodiversity of Bangladesh and revealed several unnamed species which might warrant full species status. Most importantly, it is difficult to identify the *Fejervarya* species complex by our naked eye alone. Therefore, the small *Fejervarya* species which was found in the Padma islands kept as *Fejervarya* sp. needs further examination to identify the specimen as species level. There is a need for increased action on the islands. Immediate and exclusive faunal surveys, ecological and life-history studies, and studies on the effects of habitat fragmentation on population are warranted in order to evaluate the conservation status most especially of rare and endemic wild animals. Human environment conflict destroys the desired ecological niche for the wild animals here. In spite of these drawbacks, the current study might open the door for researchers to design, plan and take action for the well-being of this overlooked wildlife biodiversity.

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