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PRESENT STATUS OF THREE MONITOR LIZARDS (*VARANUS BENGALENSIS, V. FLAVESCENS* AND *V. SALVATOR*) IN THE SUNDERBANS

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INTRODUCTION

Sunderbans is one of the important biosphere reserve's and a world heritage site too. They cover of about 9630 sq/km, out of which 4264 sq/km holds mangrove forest and an area of 1330.1 sq/km is designated as core area. It has more than 106 Islands. It is one of the largest wetland ecosystems with number of rivers, rivulets and creeks. It is home for a rich and varied fauna and flora and also a feeding and breeding ground for the nesting water monitor and also is the ground for Olive Ridley Turtle.

The modern squamates evolved from a common ancestral Diapsid reptile stock which inhabited earth roughly about 155 million years ago in the middle of the Jurassic period of the Mesozoic era. The Order comprises nearly 3272 species under 357 Genera included in 12 Families from all over the world except Arctic, New Zealand and Ireland. The reptilian fauna of India comprises 500 species (Das, 2003) and they occur in varied habitats from plains to mountains, low to heavy rain fall area and even in deserts, occupying every ecological niche of the Republic of India.

The monitor lizards are the largest Saurians of the world and inhabit Africa, Arabian Peninsula, South and South-East Asia as well as Indo-Australian Archipelago including Australia and several Pacific Islands. One of the comprehensive listings of monitor lizards was published by Lisle (1998) who listed about 77 species and recently Bohme (2003) listed about 58 different species and 28 subspecies of monitor lizards. Very recently Koch et. al. (2010)who listed 73 extant species of monitor lizards in the world. There were 46 species of monitor lizards so for found on three continents namely Africa, Australia and Asia and only about 9 species of monitor lizards were reported from Asian Continent (Bennett, 1998). There are only four species of monitor lizards in India i.e. *Varanus bengalensis*, *V. flavescens*, *V. salvator* and *V. griseus*. Excepting the Desert monitor, the remaining three species are recorded from the study areas.

The populations of monitor lizards have severely shrink in number and the lizards are at risk throughout the range of their occurrence. The monitor lizards have been exploited commercially for their valuable skin and also captured for eating by fisher folk in the Sunderbans. Hence, all the four species of monitor lizards were protected under Schedule I of IWPA, 1972. The protection and preservation of the endangered species in the wild is one of the primary goals of wildlife conservation and management. The objectives of the present study were to accumulate information on diversity and distribution of monitor lizard Sin Sunderbans and (ii) to determine current status and threat faced by the monitor lizards in Sunderbans. Since, the information would be helpful for conservation and management of monitor lizards in its natural

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habitats. It is hoped that the results achieved during the study will help a better management of the valuable and endangered reptiles.

TAXONOMY

Systematic position of Indian Monitor Lizards are:

CLASS: REPTILIA
ORDER: SQUAMATA
FAMILY: VARANIDAE
Genus: *Varanus* Merrem
Varanus bengalensis (Daudin, 1758)
Common Monitor

Size: Adult, medium

Weight: 3.5 Kg

Length: From snout to vent=74 cm; Tail 100.0 cm.

Field notes: The Indian monitor is dorsally dark brownish or olive brown with blackish dots and ventrally yellowish, spotted with numerous black spots. Tail is quite long and compressed. It always preferring undisturbed places far from human settlements, the common monitor is active during the summer.

Varanus flavescens (Hardwicke & Gray, 1827)

Yellow Monitor

Size: Adult, medium

Weight: 3.0 Kg.

Length from Snout to vent: 31.5 cm; tail 38.4cm.

Field notes: The yellow monitor is dorsally light brown or yellow, with fused light transverse bars. The tail is very short. It is partial to wetlands where it can burrow easily and seek its food.

Varanus salvator (Laurent, 1768)

Water Monitor

Size: Grown up adult

Weight: More than 6.0 Kg.

Length: Total length including tail approximately 250 cm.

Field notes: The water monitors dorsally looks dark alive, snout light with transverse black bars. Ventrally yellow, head is tapering, long slender neck. It is the longest of all the monitor lizards.

KNOWN DISTRIBUTION

The Indian Monitor occurs throughout the Indian subcontinent including Western Ghats. In addition, the species is recorded in Sri Lanka, Myanmar, Bangladesh, South east Iran, Afghanistan, Pakistan and South eastern Uzbekistan.

The Yellow monitor is recorded from Northern and North eastern India from Punjab to Orissa, West Bengal and Assam. In Orissa, it inhabits the drainage system of Brahmani and Mahanadi rivers. In West Bengal, it is widely distributed and is found in Terai, Siliguri in Darjeeling District; Botanical gardens in Howrah District; Sagar Island, Pathar Protima and Kakdwip in 24 Parganas District; Krishnagar in Nadia District; Singur in Hooghly District; Goalbathan, Pakur, Kharagpur and Medinipur in Medinipur District. In Assam the yellow monitors reported from Guwahati and Goalpara in Dhubri District. In Bihar the monitor was reported from Patna. In Uttar Pradesh the monitor was recorded from Gorakhpur, Fatehgarh, Varanasi, Mirzapur and Agra District. Also reported the county's capital, New Delhi. Elsewhere known from Bangladesh, Nepal and also Pakistan.

The water monitor restricted to the mangrove swamps of Sunderbans in West Bengal, Bhitarkanika in Orissa and Andaman and Nicobar Islands. Very recently it has been recorded form Khasi Hills from Meghalaya. Outside India recorded from South east Asia, Bangladesh, Bhutan, Brunei, Burma, Southern China, Hong Kong, Indonesia, Kampuchea Laos, Malaysia, Nepal, Philippines, Singapore, Sri Lanka, Thailand and Vietnam.

STUDY AREA

The study was carried out throughout the Sunderbans selecting localities Gosaba, Sajnekhali, Pakhiralaya, Sajalya and Basanti; Bakkhali and Bhagbatpur; Kakdwip, Bishalakshipur, Namkhana, PatharProtima and Sagar Island (Chhayerghari, Sreedham, Chamagudi and Kali Bazar).

TOPOGRAPHY AND CLIMATE OF THE STUDY AREA

(i). Physical features: In Sunderbans tides influence the water quality and water movement caused by surface and bottom currents. The circulation of water is a major factor in maintaining the populations of sessile and benthic organisms. The salinity of the water is an important factor influencing the distribution and biology of organisms. The depth and width of estuary are also varied with season and depends upon influence of fresh water and distance from sea. Turbidity is high during monsoon and low during winter.

(ii). Climate: The weather of Sunderbans can be classified into three types as monsoon-it starts from July and continues upto October with occasional rains throughout the year. The post monsoon is characterised by cold weather with thunder storms, of which usually happen during March-June every year.

(iii). Vegetation: the Sunderbans is unique in nature and their tools for survival evolved over millions of years makes interesting scientifically. The mangrove forests are salinity resistant and hence they are called as halophytes where they developed extensive root system with a number of pneumatophores to draw oxygen. In all there are 26 species of mangrove plants are found in in Sunderbans. In terms of the faunal elements, there are more than 980 species of vertebrates and invertebrates. The fishes, birds among vertebrates and arthropods, mollusca and annelids among invertebrates constitute the dominant group of animals.

STUDY PERIOD

Totally four surveys were undertaken during different seasons to assess the population and status of these species in Sunderbans and the details are as given below :

First survey was undertaken from 20.10.2008 to 29.10.2008

Second survey was undertaken from 13.08.2009 to 22.08.2009

Third survey was undertaken from 26.03. 2010 to 04.04. 2010

Fourth and final survey was undertaken from 13.09.2010 to 22.09.2010

METHODOLOGY

The survey were undertaken throughout the Sunderbans in selected localities for the period from April, 2008 to march, 2011. The surveys were conducted at different habitat types including the protected areas.

The observations on monitor lizards were made using visual encounter surveys method (VEL) (Campbell and Christman, 1982; Com and Bury, 1990; Crump and Scott, 1994) to gather data on population of Varanus and general areas. Surveys were carried out in different aquatic and terrestrial habitats using a binocular. Thorough investigation were conducted in different habitat types including forest, grassland, human settlements, wetlands and agricultural lands the time of sighting, number of individuals, size and the habitat types were noted with GPS coordinates. Morphological measurements were taken using 1 m measuring tapes. After recording the measurements, the animals were released into their original habitats. The representative habitats were surveyed by foot between 1000 hr to 1600hr. The animals were identified and verified by the help of field guide of Daniel (2002).

ECOLOGY AND BEHAVIOUR

Indian Monitor

Habit and Habitat: The Indian monitor is diurnal in habits. It inhabits forest, desert, river banks, by the side of nullah, marshy land, and tidal creeks. It occupies burrows, dense vegetation, hollows of trees, creeks and cervices. It is a god climber, runner and also a good swimmer.

Food and Feeding habit: It is carnivorous and feeds mainly on terrestrial vertebrates like birds and their eggs, rats, frogs, fish and also feeds on crustaceans mainly crabs.

Breeding patterns: It is oviparous, laying around 10-20 eggs in holes or debries between February and March.

Yellow Monitor

Habit and Habitat: the Yellow monitor inhabits sandy areas, bordering large rivers, heavily forested tract dotted with marshes and canals. It is partial to wetland. It is a good swimmer and makes burrows on muddy bunds around ponds, lakes and marsh lands.

Food and Feeding Habit: A carnivore, mainly feeding on freshwater crabs and fishes. It also feeds on mice, frogs, toads, and eggs of reptiles, birds and also small mammals.

Breeding patterns: It lays 3 to 30 eggs in a single clutch and eggs are smooth, soft and leathery. Visser (1985) reported that incubation of captive monitor is 149-155 days period at temperature of 30° C and August is usually supposed to be suitable for laying eggs

Water Monitor

Habit and Habitat: The water monitor is more aquatic than all the monitor lizards. It inhabits wet, marshy, and humid forests, banks of rivers canals, sea coast, particularly in the estuarine forests.

Food and Feeding habit: It is carnivorous, feeding insects, crabs, fish, rats, birds, frogs and rotten flesh.

Breeding patterns: It mainly breeds during June to August and lays 15 to 30 eggs in holes on the river banks or in the hollows of trees close to water.

Basking of Indian Monitor

It was very interesting to observe the monitors at their favourite pastime-basking in the wild. We had sighted an Indian monitor basking at Sagar Island area. It was around 12:00hr. The monitor made its body vertically expanded with the head directed upwards. It remained motionless during basking nearly for about two to three hours. During basking it did not get upset even after repeated disturbance. It stayed calm and quiet near burrow. Almost the lizard was so much motionless that it appeared dead.

STRUCTURE OF BURROWS OF MONITORS

The burrows of Varanus are very interesting in nature and it is a notable feature of these species when compared to other burrow making animals. During our survey, we noticed many burrows very commonly one in every hundred or two hundred meters transects and it is more in area where no trees compared to area with trees. The number of openings used by monitor varies from two to six and opening size varies form minimum 10 cm to 25 cm. There has been clear distinction in the nature of burrows the monitor excavates compared to that of other burrowing animals. We have recorded many burrows even at less than 20 cm. However, these burrows were excavated by crustaceans, mainly crabs. The burrows of crabs have very small openings and not too deep inside the openings in comparison to the burrow excavated by monitor lizards. It is not surprising to see that sometime monitor lizards inhabit termetaria. I personally experienced presence of monitors in its burrows or nearby its burrows. One interesting observations made during our survey at Bakkhali where there more than six to eight burrows on all the four sides of paddy fields, fresh water ponds and bamboo trees. Each burrow had more than four to six openings and in burrows the monitors were also sighted. The monitor while entering its hole, it bends its body into U" shape with the head and tail facing the opening. The males are very active than females throughout the year.

The Indian monitor excavates its own burrows. It will dig into earthen mounds. It always prefers slopes, under exposed roots and also large stones. The burrows are oval in shape. Inside the burrow the lumen are more cylindrical, widest at its mouth and taper towards the extreme end to accommodate its head and body.

The remarkable behaviour of monitor lizards was the excavation of their burrows where they

Table. 1: Details of observations of monitor lizards in different habitat types in Sunderbans.

Habitat Types	Number of examples/species recorded		
	Varanusbengalensis	*Varanusflavescens*	*Varanussalvator*
A. Forested area			
1. Mangrove forest			2
2. Freshwater swamp area	2	4	
B. Agriculture area			
1. Paddy field	4		
2. Grassland	4		
C. Human habitation	2		

Table. 2 : Details of observations of monitor lizards at different localities of Sunderbans.

Serial No.	Locality	*Varanusbengalensis*	*Varanusflavescens*	*Varanussalvator*
1.	Bakkhali	04*		
2.	Bishalakshipur			01
3.	Kakdwip	02		
4.	Patharprotima	02		
5.	Sajnekhali			01
6.	Sagar island	04	02	
7.	Surjobindha**		02	

□: Number of examples sighted.

**: New locality of *Varanusflavescens* recorded

Table. 3 : Number of burrows of monitor lizards scored at different locality during the survey in Sunderbans.

Serial No.	Name of the area	Number of burrows scored
1.	Bakkhali	22
2.	Bhagabatpur	04
3.	PatharProtima	16
4.	Namkhana	06
5.	Sagar Island	34
6.	Kakdwip	24
7.	Bishalakshipur	18
8.	Gosaba	04
Total	**8 localities**	**128 burrows**

always prefer to make two openings, one meant for entry of the animal and opposite end for exit doors. In order to confuse the other (including man), the monitor lizards excavates a false burrow sometimes. When confronted, the monitor emits a loud hiss-like noise to warn its enemy.

RECENT OBSERAVTIONS AND RESULTS

The present study is an outcome of four surveys conducted to assess the status, diversity and distribution of monitor lizards in Sunderbans. First survey was undertaken to Sajnekhali area where Sunderban Tiger reserve is situated. We hired the launch after obtaining the permission from STR office to survey the areas. Survey was undertaken in and around the Sajnekhali, Nethidopani and Chamta areas by launch. Launch cruised along the river on both sides, using the binocular keep on watching movement of animals in the mangroves. Around 12:00hr one example of *Varanussalvator* was noticed in between the mangroves.

Second survey was undertaken to Bakkhali and Bhagabatpur area. It was a very interesting day of our survey as on the fourth day of our survey at Bakkhalinear a paddy field and fresh water ponds we noticed six to eight fresh muddy burrows slightly above the ground. The entire area was covered with grasses and herbs. The burrows sighted were found to have openings both for entry and exit. At 11:30 hrs in the survey morning, a monitor lizard emerged and found its way to an open burrow. In all four specimens of *Varanus bengalensis* were recorded I one locality at different burrows.

Third survey was undertaken to Kakdwip and Bishalakshipur area. There were many bamboo trees and muddy burrows. In addition, locals told us they have been regularly noticing the monitor in the pond. One example of *Varanus salvator* was observed in the area. At Kakdwip also two examples of *Varanus bengalensis* were sighted.

Fourth survey was undertaken to Sagarisland. Four examples *of Varanus bengalensis* and two examples of *Varanus flavescens* were recorded from the area. For the first time we recorded two examples of *Varanus flavescens* from Surjobindha area of Sunderbans.

During the whole survey we have sighted 12 examples of *Varanus bengalensis*, 4 examples of *Varanus flavescens* and 2 examples of *Varanus salvator*. In addition, there are more than 128 burrows of monitor lizards were sighted throughout the survey. Some were old burrows and some were very new burrows where fresh marks of finger scratches, tail drags were clearly visible at the entry openings. Even hole shape also indicates the feature of new burrows.

During the entire period of survey the highest number of sightings were occurred at Sagar Island and then Bakkhali with 6 and 4 individual respectively were observed (Table. 2). The maximum number were sighted at paddy field and freshwater ponds and highest during monsoon (breeding period) compared to pre and post monsoon period. Two individuals each were sighted at Kakdwip and Patharprotima and one individual each were sighted at Bishalakshipur and Sajnekhali areas of Sunderbans. It indicates the Bakkhali and Sagar Island provided suitable habitat types for these species.

TABULATION OF OBSERVATIONS AND RESULTS

PRESENT STATUS OF MONITOR LIZARDS IN SUNDERBANS

During our survey we could spot all the three monitor lizards at different localities but their population is declining. Though widely distributed, the monitor lizards are threatened animals, because of heavy exploitation for their valuable skin an edible meat and eggs. In order to maintain healthy populations, habitat conservation may be the best suggestive measure. Its habitat mainly the plains along rivers have already been using for agricultural purposes. During first rain s there were a good number of monitor lizards were seen and later it was difficult to notice the species in its habitat. It is the right time to initiate captive breeding programmes, so that the population of these species in the wild can be increased.

PRESENT THREATS TO THE SPECIES IN SUNDERBANS

The population of all the three species of monitor lizards has drastically declined throughout their range due to illegal and extensive exploitations and adults for their commercially valuable skin, food purposes by local fisherman community and traditional

medicinal values. The skin is used in manufacture of luxury items, which were traded in India and abroad. Locally the species were exploited for meat, eggs and traditional values. Habitat loss and human settlements nearby rivers and mangroves resulted in loss of virgin habitat of theses reptiles. Conversion of marshland into paddy filed also caused serious threat to the survival of these species in Sunderbans.

CONSERVATION MEASURES SO FOR TAKEN AND IMPORTANT SUGGESTIONS TO PROTECT THE SPECIES

All the three species of monitor lizards were considered endangered and declared as protected species under Schedule I of Indian Wildlife (Protection) Act, 1972. The International Union of Conservation of Nature and Natural Resources (IUCN) has also considered them as endangered and listed in Appendix I. The monitors also included in Appendix I of Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The establishment of National Parks, Wildlife Sanctuaries and Biosphere Reserves paved the way for protection of these species in the wild.

The most useful recommendations to protect the species are as follows (i) At present there is no special management of these species in respect of the population monitoring, habitat conservation and control measures. Introduction of strict legislation to conservation and protection and initiation of severe action against those violating wildlife laws and policies (ii) Formulation a legislation to protect the habitat, feeding and breeding sites and hibernating spots of these species (iii) Creation of awareness among the public to protect of these species in the wild (iv) Prevention of poaching, illegal killing and trading products of these species and (v) Initiation of captive breeding programmes to increase the populations of these species in the wild.

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