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ECOLOGY, FAUNAL DIVERSITY AND HABITAT MANAGEMENT STRATEGIES OF AMPHIBIANS AND REPTILES OF SUNDERBAN

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INTRODUCTION

Sunderban is one of the largest mangrove ecosystem characterized by a group of islands facing the sea. It starts from mouth of river Hughly in the west to the river Meghna in the east and covers four districts viz., North and South 24 Parganas (Hughly to Raimangal river) of India, Khulna (Raimangal to Madhumati river), Backergunje and Barishal District (Madhumati river to Meghna river) of Bangladesh. It lies between 87° 51´-92° 30´ east longitudes and 21° 31´-22° 30´ north latitudes. Of the total forest area, we are fortunate to have 4264 sq.km. within the Indian limits. In recent estimate by forest department, it has been stated that 4,264 sq/km of forest persist within Indian territory and the rest 4109 sq/km is in Bangladesh. It is one of the largest wetland ecosystem with rieverie areas, encompasses number of rivers, rivulets and creeks. It is a home for variety of fauna and flora and a feeding and breeding site for estuarine crocodile, water monitor and also a landing site for olive ridley turtle.

At present there are about 265 species of amphibians are known from India (Das and Dutta, 2007), and there are about 450 species of reptiles reported from India, though the comprehensive study on amphibians and reptiles from sunderban is very limited. However, Mukherjee (1975) and Chanda (1995) have reported on a few species of amphibians in their study on sunderban biota. Similarly Acharji and Mukherjee (1964); Talukdar (1982) and Saha (1983); Mandal and Nandi (1989); Agarwal and Ghosh (1995) and Sanyal *et al.* (1995) have reported occurrence of reptiles from sunderban. Recently Chowdhury and Vyas (2005) have reported 9 species of turtles, tortoises and terrapins, 9 species of lizards and crocodiles and 23 species of snakes from sunderban. No detailed work has been done on the ecology, faunal diversity of amphibians and reptiles of sunderban and management strategies of its habitat. Hence the present work was undertaken to study the distribution of amphibian and reptilian fauna in various habitat of sunderban and to report the conditions of its habitat and its maintenance.

This work is based on the intensive survey by the author for the last three years from April, 2005 to March, 2008. Totally seven surveys have been undertaken and visited many areas from all

the regions such as in the east Hem Nagar and Kultali; in the west Bakkhali and Bhagwatpur; in the north Hasnabad, Hingal ganj and Nebukhali; in the south Sagar Island, Kakdwip and Patharprotima and in the central Jharkhali and Sandesh khali area of sunderban.

MATERIAL AND METHODS

To obtain first tentative impression of amphibian and reptilian occurrence in the sunderban, distributional data and list of species reported was compiled based on the earlier studies.

Collection Methods : Forest area including mangroves, fresh water ponds, paddy fields, small bushes and old tree trunk, etc in the study area are observed for faunal components. Surveys were undertaken during day time for covering herpetofaunal diversity including heliothermic (basking) reptiles. In the evenings nocturnal species such as frogs, toads and snakes were also covered by using torch.

The amphibians and reptiles sampled by searching through their suitable hiding places in deeply shaded forest, inside the soil nearby ponds. The call of frogs were also taken as guiding tools for their easy collection. Some species were identified based on the physical features (external featuers/ body scales) with the help of field guide and reference books in the field and noted in the field note book. Boats were hired where ever necessary and assistance of fisherman was also rendered for the collection of reptilian species. Generally lizards, snakes, frogs and toads were collected by using long forceps.

The habit and habitat was recorded based on the field observations.

SYSTEMATIC ACCOUNT

Class AMPHIBIA

Order ANURA FISCHER

Family BUFONIDAE

Genus ***Duttaphrynus*** Frost *et al.*, 2006

1. ***Duttaphrynus melanostictus*** (Schneider, 1799)

Common Indian Toad

Material examined : 1ex., Kalithala, xi.11.2006, Coll. VAR, KN-1373; 1ex., Kakdwip, xxvi.10.2007, Coll. VAR, KN-1384; 2exs., Patharprotima, ii.11.2007, Coll. VAR, KN-1385.

Habit and Habitat : It is nocturnal in habit, occur at damp places, under logs, etc. It hides under bark of the tree trunk and its holes, under stones, etc. during day time.

Food habit : It feeds mainly on insects. It has a sticky extensive tongue and the prey is crammed into mouth, small particles of food are swept into mouth by fanning action of the front feet.

Breeding : It breeds mainly in monsoon, but under favorable conditions it may breeds throughout the year. There is a considerable competition among males for getting females. The females lays the eggs in running water, pool and tanks in the form of a strings which is composed of gelatinous material to protect the eggs from washed away water current. The development is very short.

Distribution : India; They have been recorded in Meghalaya, Arunachal Pradesh, Sikkim.

Elsewhere : Burma; Sri Lanka; China; Malaysia; Indonesia; Philippines.

Status : Least concern.

Family MICROHYLIDAE

Subfamily MICROHYLINAE

Genus ***Microhyla*** Tschudi,1838

2. ***Microhyla ornata*** (Dumeril and Bibron, 1841)

Ornate Microhylid

Material examined : 4exs., xxvii.10.2007, Paschim Gangadharpur, Coll. VAR, KN-1389.

Habit and Habitat : It occurs in forest vegetation and grassy, water pools and dry litter.

Food habit : It is insectivorous and feeds mainly on ants and insects.

Breeding : It breeds with the onset of monsoon specially from May to August. During monsoon the male and female sits in pairs close to water and the female lays the eggs which are attached to submerged grasses in shallow water.

Distribution : They have been recorded all over India.

Elsewhere : Myanmar; Sri Lanka; Southern China; Indo-China.

Status : Least concern.

Family DICROGLOSSIDAE

Subfamily DICROGLOSSINAE

Genus ***Euphlyctis*** Fitzinger, 1843

3. ***Euphlyctis cyanophlyctis*** (Schneider, 1799)

Indian skipper frog

Material examined : 4exs., v.11.2007, Sagar Island, Coll. VAR, KN-1388.

Habit and Habitat : It inhabits in all biotopes and in all seasons of the year. It is aquatic in nature and active during day and night. It has an interesting habit of skipping on the water surface.

Food habit : It is a voracious feeder and feeds mainly on insects, tadpoles and insect larvae.

Breeding : It breeds during monsoon. Tadpoles were found in the month of July.

Distribution : They have been recorded all over India.

Elsewhere : Pakistan; Afghanistan; South Arabia; Sri Lanka.

Status : Least concern.

4. ***Euphlyctis hexadactylus*** (Lesson, 1834)

Indian green frog

Material examined : 6exs., xxi.7.2006, Sandeshkhali, Coll. VAR, KN-1370.

Habit and Habitat : It is aquatic in nature and found abundantly along bank of river and also in tanks. The adult frog occur along the green weeds and it looks bright green and resembles green vegetation, so that we cannot recognize its presence easily, only when it starts crocking we can come to know its presence along grassy green vegetation in ponds.

Food habit : The adult are carnivorous and feeds on worms, fishes, etc.

Breeding : With the onset of monsoon the male and female are appears and swims together in the water, the males starts croaking and attracting the female by making in-cessant calling. After reaching the female the male and female pairs and swims in the water and female lays the eggs in the water. The eggs have seen attached to submerged vegetation in the form of string.

Distribution : India : They have been recorded in West Bengal; Tripura; Maharashtra; Tamil Nadu; Kerala.

Elsewhere : Sri Lanka.

Status : Least concern.

Genus ***Fejervarya*** Bolkay, 1915

5. ***Fejervarya limnocharis*** (Gravenhorst, 1829)

Paddy Field frog

Material examined : 2exs., x.11.2006, Hemnagar, Coll. VAR, KN-1374; 3exs., xx.07.2006, Bangatush khali, Coll. VAR, KN-1372; 1ex., xix.04.2006, Hingalganj, Coll. VAR, KN- 1390.

Habit and Habitat : It is found in the vicinity of tanks and water streams and also in paddy field throughout the year. It does not float on the water surface but rests on the surface of water. During dry season they found in damp places or under logs.

Food habit : It feeds on insects and worms.

Breeding : Juveniles were found in the month of February.

Distribution : They have been recorded all over India.

Elsewhere : Sri Lanka; China; Malaysia; Indonesia; Philippines.

Status : Least concern.

Genus ***Hoplobatrachus*** Peters, 1863

6. ***Hoplobatrachus tigerinus*** (Daudin, 1803)

Indian Bull frog

Material examined : 2exs., xxiii.06.2005, Jharkhali, Coll. VAR, KN-1368; 4exs., xxi.07.2006, Sandeshkhali, Coll.VAR, KN-1371.

Habit and Habitat : It is aquatic and occurring in wells, tanks and ponds throughout the year. During hibernation and aestivation it is found deep in the soil. With the onset of monsoon plenty of were seen in the field.

Food habit : It feeds mainly on insects, fishes and its liver, etc.

Breeding : It breeds during rainy season. The male has an vocal sac which is bright cobalt blue color. With the onset of monsoon rain the male frog starts to croak loudly and incessantly. Male

and females were swim together in the water. After breeding male lose its yellow color. Eggs are laid in small puddles, the eggs are surrounded by a transparent jelly substance. After hatching the tadpoles are swept into pools.

Distribution : They have been recorded all over India.

Elsewhere : Nepal; Burma; China; Indonesia.

Status : Least concern.

Class REPTILIA

Order CROCODYLIA

Family CROCODILIDAE

Genus ***Crocodylus*** Gronovius, 1763

1. ***Crocodylus porosus*** (Schneider, 1801)

Estuarine crocodile

Material examined : Observed in the field.

Habit and Habitat : It is a sluggish and lethargic creature typically associated with brackish water, such as coastal mangrove swamp forests, but also visits fresh water river. It is semi-aquatic and enters sea to long journeys and inhabits estuaries. It lives in saline water but drinks fresh water.

Food habit : It is an opportunistic feeder and feed during both day and night and ebb and flood tide. It is a shallow water or edge feeder. Juvenile and sub adults feeds on crustacean, insects and small fish, whereas adults feeds on sharks, monkeys, even men and larger ones are cannibalistic.

Breeding : The male attains the sexual maturity at the age of 16 years and female at 10 years. The female makes mound nest in the wet season and lays 25-120 eggs and the incubation period is between 80-100 days and the parental care takes place by females.

Locality : Bakkhali and Bhagwatpur area of sunderban.

Distribution : India; They have been recorded in East coast of India; Andaman and Nicobar Island.

Elsewhere : Sri Lanka; Bangladesh; Philippines; Malaysia; Indonesia; Australia.

Status : Protected species under Schedule I, Wild life Protection Act ,1972. The total populations in India may be around 170-330. Several breeding centres across the country at Andhra Pradesh, Tamil Nadu and West Bengal are successfully rearing the species. The species breeds readily in captivity.

Order CHELONIA

Family CHELONIDAE

Genus ***Lepidochelys*** Fitzinger,1843

2. ***Lepidochelys olivacea*** (Eschscholtz, 1829)

Olive ridley turtle

Material examined : Observed in the field.

Habit and Habitat : It is a marine turtle.

Food habit : It feeds on crustacean such as crabs, shrimps; molluscs, jellyfish, tunicates, small in-vertebrate, fishes and their eggs, large planktons and marine algae. It swims over long distance and float calmly over deep sea water, waiting for certain crustaceans which emerge to the surface of water only during night.

Breeding : It forages at great depth in tropical neritic water, nest takes place at night, egg laying occurs for 15-20 minutes in a shallow nest cavity and refill and cover the nest after egg laying. The females rough up the surface of nest site by compact the soil by thumping with its shell. Incubation occurs for 49 to 62 days and females nest 2 to 3 times in a season. The females migrate to the nest after two years.

Locality : Bhagwatpur and Bakkhali area of sunderban.

Distribution : India : They have been recorded in West Bengal; Orissa; Andaman and Nicobar Islands.

Elsewhere : Pacific; Indian; South Atlantic oceans.

Status : Protected species under Schedule I, Wildlife (Protection) Act, 1972. New Delhi CITES convention prohibited its collection and Since July, 1981. Appendix I, CITES.

Family EMYDIDAE

Genus ***Batagur*** Gray, 1855

3. ***Batagur baska*** (Gray, 1831)

River Terrapin

Material examined : Observed in the field.

Habit and Habitat : It is found at fresh, brackish or salt water and also in fresh water lakes, canals and water bodies and shallow muddy tidal region at the wide river mouth lined with mangrove.

Food habit : It is an omnivorous and prefers vegetation diet consists stem, leaves and fruits of river side plants. It also feeds on mollusca, crustaceans and fishes.

Breeding : The mating occurs during September and November and males assumes bright *breeding* color during mating. It nests in colony on the sandy banks of with slopes and river islands. Nesting females are site specific and there is a definite period for egg deposition. The females dig the pit for nest and creating deep egg chamber and deposits the eggs in three clutches and the whole egg laying may occur for 15 to 20 days. It covers the nesting spot and surrounding area with sand and females dig a false nest to confuse the predator.

Locality : Jinga Khali area of sunderban.

Distribution : India : They have been recorded in West Bengal.

Elsewhere : Bangladesh; Burma; Thailand; Vietnam; Malay Peninsula; Sumatra.

Status : Protected species under:-Scheduel I, Wildlife (Protection) Act, 1972. The species is endangered all along the range and is protected by legislation throughout its range. Many hatcheries have been established for incubation of its eggs at Malaysia. It Appendix I, CITES.

Order SQUAMATA

Suborder LACERTILIA

Family GEKKONIDAE

Genus ***Gekko,*** Linnaeus, 1758

4. ***Gekko gecko*** (Linnaeus)

House gecko

Material examined : 4exs., xx.04.2006, Hasnabad, Coll. VAR, KN-1391; 5exs.,xxx.10.2007, Sagar Island, Coll. VAR, KN-1392.

Habit and Habitat : It inhabits in houses, holes in walls, trees, on the ground, etc.

Food habit : It is mainly insectivorous and feeds on moths, spiders, beetles, cockroaches, flies, etc. It has a thick tongue and food subjected to chewing to enable it to swallow.

Breeding : It is oviparous and the female lays two eggs with shells as hard and brittle and produce a pair of eggs on the time adhesive to walls. I have found young and eggs on the coconut palm . Each are round and white eggs and measured about 3/8 inches in diameter.

Distribution : They have been recorded all over India.

Status : Least concern.

Genus ***Hemidactylus,*** Oken

5. ***Hemidactylus brooki*** (Gray, 1845)

Spotted Indian House gecko

Material examined : Observed in the field.

Habit and Habitat : It is terrestrial and inhabits in open forests, bark of tree trunks and old deserted buildings.

Food habit : It is insectivorous and feeds on insects, spiders, etc.

Breeding : It is viviparous. It breeds during summer and the female lays two small spherical eggs in a single clutch which hatch out in subsequent days.

Locality : Many localities throughout Sunderban such as Sagar Island and Sandesh Khali area.

Distribution : India : They have been recorded all over India.

Elsewhere : Sri Lanka.

Status : Least concern.

Family AGAMIDAE

Genus ***Calotes,*** Merrem

6. ***Calotes versicolor*** (Daudin,1802)

Indian Garden lizard

Material examined : Observed in the field.

Habit and Habitat : It is an arboreal lizard , living in bushes, shrubs and also in plain area.

Food habit : It is insectivorous and particularly feeds on ants, spiders, centipedes, etc.

Breeding : It breeds during summer and extends upto rainy season. It may lays 6-25 eggs in a clutches in the hole in the soft soil.

Locality : Gazi khali area of sunderban.

Distribution : India : They have been recorded all over India.

Elsewhere : Sumatra to South China; Sri Lanka; Pakistan; Afghanistan.

Status : Least concern.

Genus ***Sitana,*** Cuvier

7. ***Sitana ponticeriana*** (Cuvier, 1829)

Fan Throated lizard

Material examined : Observed in the field.

Habit and Habitat : It is a fast runner, it occurs in shrub vegetation and sandy area.

Food habit : It is insectivorous and feeds on ants and other insects.

Breeding : It breeds during summer. The female lays around 6-14 eggs in a clutch which buried in the soil.

Locality : Sandesh khali and Sagar Island areas of sunderban.

Distribution : India : They have been recorded all over India.

Elsewhere : Sri Lanka.

Status : Least concern.

Family Chamaeleonidae

Genus ***Chamaeleon*** Laurenti, 1768

8. ***Chamaeleo zeylanicus*** (Laurenti, 1768)

Indian Chaemaeleon

Materials examined : Observed in the field.

Habit and Habitat : It is an arboreal lizard.

Food habit : It is an insectivorous and feeds on insects, spiders, etc.

Breeding : These are oviparous, females eggs are laid in, deposited in the ground , rocks, it may breed during May.

Locality : Many localities of sunderban such as Sagar Island, Gazikhali, etc.

Distribution : They have been recorded all over India.

Elsewhere : Sri Lanka; Pakistan.

Status : Least concern.

Family SCINCIDAE

Genus ***Mabuya,*** Fitzinger

9. ***Mabuya carinata*** (Schneider, 1801)

Common Skink

Material examined : Observed in the field.

Habit and Habitat : It is a terrestrial, diurnal lizard and lives under bushy area.

Food habit : It is insectivorous.

Breeding : It is oviparous and laying around 6-10 eggs.

Locality: Pakhiralaya area of sunderban.

Distribution : India : They have been recorded in Peninsular India; Assam; West Bengal.

Elsewhere : Sri Lanka; Nepal.

Status : Least concern.

Family VARANIDAE

Genus ***Varanus*** Merrem, 1820

10. ***Varanus salvator*** (Daudin, 1802)

Water monitor

Material examined : Observed in the field.

Habit and Habitat : It is an aquatic, inhabit wet, marshy and humid forests, banks of rivers and also estuarine forests.

Food habit : It is omnivorous and swims for long distance in sea in search of food and feeds on bird eggs and fishes.

Breeding : It breeds from June to August. It lays nearly 15 -30 eggs in holes on the river banks or on the trees besides water.

Locality : Sajne khali area of sunderban.

Distribution : India : They have been recorded all over India.

Elsewhere : Sri Lanka; Bangladesh; Northern Burma; Southeast Asia; Northern Australia.

Status : Protected species under :-Schedule I, Wild life (Protection) Act, 1972 and is at risk throughout its range.

Family TYPHLOPIDAE

Genus ***Typhlops*** Oppel, 1811

11. ***Typhlops porrectus*** (Stoliczka, 1871)

Slender Blind snake

Materials examined : Observed in the field.

Habit and Habitat : It is a nocturnal worm snake, hiding under stones, wooden logs, etc.

Food habit : It feeds on worms and fishes.

Breeding : It is not known.

Locality : Rangabelia area of sunderban.

Distribution : They have been recorded all over India.

Status : Least concern.

Family COLUBRIDAE

Genus ***Ptyas*** Fitzinger, 1843

12. ***Ptyas mucosus*** (Linnaeus, 1758)

Rat snake

Material examined : 2exs., x.11.2006, Hemnagar, Coll. VAR, KN-1379.

Habit and Habitat : It is an aquatic and diurnal snake. Occur at varied habitat like plain, agriculture fields, grass lands, trees and hollows under wooden logs, crevices of rocks, etc.

Food habit : It feeds on small mammals, birds, reptiles, eggs of birds and amphibians.

Breeding : The *breeding* season starts from April which extends up to September.

Distribution : They have been Recorded in Meghalaya; Assam; Sikkim; West Bengal.

Elsewhere : Throughout south and southeastern Asia.

Status : Protected species under :-Appendix II, CITES.

Genus ***Elaphe*** Fitzinger, 1833

13. ***Elaphe helena*** (Daudin, 1803)

Trinket snake

Material examined : Observed in the field.

Habit and Habitat : It is a nocturnal in habit and inhabits crevices in rocks, hollows in trees, dense bushes, etc.

Food habit : It feeds on small mammals, birds, lizards and amphibians.

Breeding : The female lays around 6-8 eggs and the hatchlings are very much similar to parents.

Locality : It was observed at Paschim Gangadharpur and Rangabelia area of sunderban.

Distribution : They have been recorded in Gujarat; Himalayas; Assam: Nagaland.

Elsewhere : Sri Lanka; Pakistan.

Status : Least concern.

Genus ***Oligodon*** Boie, 1827

14. ***Oligodon arnesis*** (Shaw, 1802)

Common Kukri snake

Material examined : Observed in the field.

Habit and Habitat : It is a diurnal snake and inhabits masonry work building, rocky area and also in plain area.

Food habit : It feeds on insects, spiders, small reptiles and their eggs, amphibians, birds and their eggs, small rodents or mice.

Breeding : It is oviparous.

Locality : Ranga belia area of sunderban.

Distribution : They have been recorded in Gujarat; Penninsular India; Western Himalaya; West Bengal.

Elsewhere : Pakistan; Nepal; Bangladesh; Sri Lanka.

Status : Least Concern.

Genus ***Lycodon*** Boie, 1826

15. ***Lycodon aulicus*** (Linnaeus, 1758)

Common Wolf snake

Material examined : 2exs., v.06.2007, Canning, Coll. VAR, KN-1382.

Habit and Habitat : It is nocturnal and good climber. It is commonly found in and around the human habitation.

Food habit : It feeds on small lizards, frogs and also mice.

Breeding : It is oviparous in nature and during *breeding* season it may lays 3 to 11 eggs in a single clutch.

Distribution : They have been recorded all over India.

Elsewhere : Pakistan; Nepal; Sri Lanka; Bangladesh; Myanamar.

Status : Least concern.

Genus ***Amphiesma*** Dumeril & Bibron, 1854

16. ***Amphiesma stolatum*** *(*Linnaeus, 1758*)*

Striped snake

Material examined : 1ex., ix.11.2006, Hemnagar, Coll. VAR, KN-1378; 1ex., xxx.10.2007, Namkhana, Coll. VAR, KN-1386.

Habit and Habitat : It is found in moist grassy areas, under stones, wooden logs, under leaves of tree and also in gardens.

Food habit : It feeds on frogs, toads, lizards and also small mammals.

Breeding : During *breeding* season i.e. in May it may lays about 10 eggs in a single clutch and it incubate the eggs for about 20 days.

Distribution : They have been recorded all over India.

Elsewhere : Pakistan; Nepal; Bhutan; Bangladesh; Sri Lanka.

Status : Least concern.

Genus ***Xenochrophis*** Gunther, 1864

17. ***Xenochrophis piscator*** (Schneider, 1799*)*

Checkered Keelback

Material examined : 1ex., x.11.2007, Hemnagar, Coll. VAR, KN-1375.

Habit and Habitat : It inhabits marshy areas, pools of water, ditches, canals and shallow edge of rivers contains vegetation.

Food habit : It feeds mainly on small fishes and frogs.

Breeding : Courtship and mating occurs in around September and October. It lays eggs in late November to the end of May. Egg clutches are varies from 80 to 90 eggs. The incubation period ranges from 35 to 55 days.

Distribution : They have been recorded all over India.

Elsewhere : Rest of South Asia.

Status : Protected species under :-Appendix III, CITES.

Genus ***Atretium*** Cope, 1861

18. ***Atretium schistosum*** (Daudin, 1803)

Olivaceous Keelback

Material examined : Observed in the field.

Habit and Habitat : It occurs in the vegetation near fresh water.

Food habit : It feeds mainly on fishes and also frogs.

Breeding : It is oviparous in nature and during *breeding* period it lays 12 to 30 eggs at a time.

Locality : Rangabelia and its surrounding of area of sunderban.

Distribution : They have been recorded in Anaimalais; Wynaad; Mysore; Uttar Pradesh; Orissa.

Elsewhere : Sri Lanka; Bangladeh; Nepal.

Status : Least concern.

Genus ***Ahaetulla*** Link, 1807

19. ***Ahaetulla nasuta*** (Lacepede, 1789)

Green Whip snake

Materials examined : Observed in the field.

Habit and Habitat : It is a diurnal, arboreal snake and inhabits dense cluster and branches of vegetation.

Food habit : It feeds mainly on lizards, birds, amphibians and also small mammals.

Breeding : It is viviparous and give birth to 3-22 young ones at a time and breeds during March and extends up to December.

Locality : Gosaba and Rangabelia area of sunderban.

Distribution : They have been recorded in Gujarat; Penninsular India; West Bengal.

Status : Endangered (Rare).

Genus ***Enhydris*** Sonn & Latr, 1802

20. ***Enhydris enhydris*** (Schneider, 1799)

Smooth Water snake

Material examined : 1ex., xx.09.2005, Bakkhali, Coll. VAR, KN-1369; 1ex., xii.11.2006, Hemnagar, Coll. VAR, KN-1376.

Habit and Habitat : It is a gentle snake, inhabits ponds, irrigation fields, water bodies and also in slow running canals.

Food habit : It feeds on fishes, lizards and also frogs.

Breeding : It is viviparous in nature and produces 6 to 18 young ones at a time.

Distribution : They have been recorded in Madhya Pradesh; Uttar Pradesh; Andhra Pradesh; Bihar; Orisaa; West Bengal; Assam.

Elsewhere : Bangladesh; Nepal; Myanamar.

Status : Least concern.

Genus ***Cerberus*** Cuvier, 1829

21. ***Cerberus rhynchops*** (Schneider, 1799)

Dog-faced water snake

Material examined : 2exs., viii.11.2006, Hemnagar, Coll. VAR, KN-1377.

Habit and Habitat : It is nocturnal in habit and inhabiting the holes and crevices in the estuaries of tidal rivers. It is a good swimmer.

Food habit : It feeds on fishes, frogs and also toads.

Breeding : It is viviparous and gives birth to 6 to 28 young ones at a time.

Distribution : They have been recorded in Gujarat; Coastal and tidal rivers of India from Bomaby to Cochin-China; Andaman and Nicobar Islands.

Elsewhere : Pakistan; Bangladesh; Sri Lanka upto Australia.

Status : Common.

Genus ***Bungarus*** Daudin, 1803

22. ***Bungarus caeruleus*** (Schneider, 1801)

Common Indian krait

Material examined : Observed in the field.

Habit and Habitat : It is nocturnal in habit and inhabits grassland, rocky area, marshy and also in gardens.

Food habit : It feeds on small mammals, frogs, toads, lizards and also fishes.

Breeding : It breeds during April to July. During *breeding* period it lays about 6 to 10 eggs in the holes of ground.

Locality : Kakdwip and its surrounding area of sunderban.

Distribution : They hve been recorded in Gujarat; West Bengal; Peninsular India; Rajasthan; Punjab; Haryana; Uttar Pradesh; Madhya Pradesh; Orissa; Maharashtra; Andhra Pradesh; Karnataka; Tamil Nadu; Kerala.

Elsewhere : Pakistan; Nepal; Bangladesh; Sri Lanka.

Status : Least Concern.

Genus ***Naja*** Laurenti, 1768

23. ***Naja naja Kaouthia*** (Lesson, 1831)

Monoocelate cobra

Material examined : 1ex., Kakdwip, xxvi.10.2007, Coll. VAR, KN-1383.

Habit and Habitat : It is a diurnal snake and inhabits in agriculture field, grassy vegetation and in rodent caves.

Food habit : It feeds on frogs, lizards, rodents, etc.

Breeding : It breeds during April to July. During *breeding* period it lays around 9 to 45 eggs and the incubation period lasts for about 62 to 90 days.

Distribution : They have been recorded in Assam; West Bengal; Bihar; Eastern Uttar Pradesh; Eastern Himalayas.

Elsewhere : Bangladesh; Nepal; China; Most of the South- east Asia; Peninsular Malaysia.

Status : Least Concern.

Genus ***Enhydrina*** Gray, 1849

24. ***Enhydrina schistosum*** (Daudin, 1803)

Beaked sea snake

Materials examined : Observed in the field.

Habit and Habitat : It is a marine poisonous snake inhabits shallow coastal water.

Food habit : The main food of the species are fishes, crustaceans and prawns.

Breeding : It is ovo-viviparous and gives birth to 4-9 juveniles.

Locality : Sagar Island area of sunderban.

Distribution : They have been recorded in Gujarat; Coastal water of Goa; Tamil Nadu; Orissa; West Bengal.

Elsewhere : Pakistan; Bangladesh; Sri Lanka; Indo-pacific water (Thailand, Malaysia and Singapore).

Status : Least concern.

Genus ***Hydrophis*** Latreille, 1802

25. ***Hydrophis caerulescens*** (Shaw , 1802*)*

Many Toothed sea snake

Material examined : Observed in the field.

Habit and Habitat : It inhabits swampy area and also in mangrove ecosystem.

Food habit : It feeds on fishes and crustaceans.

Breeding : It is not known.

Locality : Hem nagar and Dulduli area of sunderban.

Distribution : They have been recorded in Coasts of Goa; Maharashtra; Karnataka; Tamil Nadu; West Bengal; Gujarat.

Elsewhere : Pakistan; Bangladesh; China; Myanamar; Malaysia; Thailand to Australia.

Status : Least concern.

26. ***Hydrophis nigrocinctus*** *(*Daudin, 1803)

Banded sea snake

Materials examined : Observed in the field.

Habit and Habitat : It inhabits in the brackish water.

Food habit : It feeds on fishes, frogs, etc.

Breeding : It is not known.

Locality : Observed in the field at Hemanagar area of sunderban.

Distribution : They have been recorded in Bay of Bengal (Sunderban).

Elsewhere : Japan; Tasmania.

Status : Rare.

HABITAT MANAGEMENT

There is an ongoing global biodiversity crisis due to unprecedented loss of natural habitat (ecosystem). In order to conserve and enhance the animal population, it is essential to monitor its natural habitat. Habitat loss is one of the reason that many species were disappeared in the wild, some were facing extinction and some are in danger in near future. The most recent publication of IUCN red list of threatened species has reported that 39% of listed species are threatened with extinction (IUCN, 2007). The major threat for the loss of natural habitat is the human modification of nature/interference and his settlements in the nearby forests by removing the forests/ rivers, etc. This led to the loss of habitat of many species and it ultimately leads to complete disappearance/ elimination of many species in the wild. Therefore, there is an urgent need to develop the strategies to protect natural habitat.

Despite ecological and evolutionary roles played by the amphibians and reptiles, the studies on strategies of habitat of these groups have been ignored or given little consideration. Hence in the present study an attempt was made to know the present conditions of different habitat of these important groups and necessary measures to improve its habitat, so that we can protect and enhance its population.

(i) **Present conditions of different habitats :** The forceful human settlements by removing mangrove vegetation and virgin forest land has caused the loss or complete destruction of natural habitat of many evolutionarily important fauna of amphibian and reptiles. The construction of roads, dams, etc, by removing the natural habitat hinders the movement of animals in the nature and number of animals have been dying due to road accident. The clearance of original habitat for agriculture purpose has led to the depletion of many species in the nature. Discharge of domestic waste, pesticides and fertilizers to the river have affected on the larval development of amphibians. The loss of terrestrial and aquatic habitat have resulted in the reduction of primary productivity and primitive communities, this led to decreased availability of food and declined in the number of animal communities. The affect on primary productivity imbalances the whole ecosystem and ultimately the whole population will be under danger. At present both aquatic and terrestrial habitat of many species of amphibians and reptiles in sunderban are under deteriorated condition due to continuous human interference for every day needs. Therefore there is an urgent need to protect these population in sunderban.

(ii) **Important measures to protect the habitat**: In sunderban already the population of *Lepidochelys olivacea*, *Batagur baska* have declined in their number due to habitat loss. The *Crocodylus porosus* and Monitor lizard are very rare to see in sunderban. Many species of frogs and snakes have declined in their number due to loss of habitat. The important measures to protect these species are :

(a) *Proper maintenance of fresh water ponds all along/ nearby river bank* : The fresh water ponds of aquatic frogs, snakes, etc. should have proper length, width and depth, so that the frogs and snakes moves/swims throughout the pond and bred easily. The proper depth will helps in sitting of insects and for its multiplication and also for fishes to breed and multiply. This will serve as food for frogs and in turn frogs will serve as food for snakes. In the ponds proper water level has to be maintained throughout the year depends upon the season and time of the year. The decreased water level leads to moves out of many species. Special attention has to be given to control temperature, nutrients, oxygen, turbidity, salinity, etc. in the ponds. Growing of dense masses of algae, submerged angiosperm, control of plankton, growing of green grasses will helps in sitting of insects and also its multiplication. As amphibians and reptiles are ectothermic, the body temperature of these animals may vary with environmental conditions and the rise in temperature may affecting its metabolic activity. Thermal conditions in natural water played major role in ecology of amphibians and reptiles. Temperature serves as a cue for variety of life process and distribution of these

species. Consequently altered temperature may have serious consequences for aquatic species. Development of natural vegetation in the ponds will minimize alternation in temperature. Salinity is fatal to amphibians. The eggs and larvae are killed even by one percent of salinity, therefore care has to be taken to prevent mixing of saline water in the ponds and regular checking of saline concentration in the water has to be undertaken.

(b) *Protection of terrestrial habitat from grazing* : Particularly for terrestrial toads, snakes, lizards, etc. protection of terrestrial habitat from cattle grazing will preserve its natural habitat. For example the terrestrial toads prefers moisture land and bushy vegetation where many number of insects can settle and it will serve as a food for frogs. In turn, the bushes are serves as shelter ground for many land snakes where it can catch frogs, toads, etc. Therefore, protection of natural habitat from grazing will protect the terrestrial species and conserve its population.

(c) *Shifting of human settlement nearby forests/rivers* : Human settlements nearby forest/river have destroyed the natural habitat of many species in the wild and caused disappearance of many species in the environment. Therefore shifting human settlement nearby forest/river will protect the natural habitat of many species in the wild and its population.

DISCUSSION

The present study deals with 32 species of amphibians and reptiles for studying the habitat, food habit, distribution and present conditions of different habitat in sunderban. The available literature from the previous works has revealed that the work was limited to the occurrence of different species in the area. In the present study it was observed that the amphibians and reptiles have been occur in a wide variety of habitat such as terrestrial, aquatic, arboreal, burrowing etc.

The majority of amphibians live only on land or in fresh water and usually they were confined to stagnant and slowly running water and the fauna represented by the terrestrial *Duttaphrynus melanostictus*. The anurans are almost entirely aquatic in their habitat such as *Hoplobatrachus tigerinus* which enters water chiefly during *breeding*. The reptilian fauna in the estuaries are represented by the number of sea snakes, turtles, crocodiles. The sea snakes namely *Hydrophis nigrocinctus* quite common and highly poisonous. The dog faced water snake (*Cerberus rhynchops*) is very common along the estuarine rivers of sunderban. Turtles namely *Batagur baska*, olive ridley turtle, estuarine crocodile *Crocodylus porosus* were found in the river. Biswas (1983) has reported on the food and feeding habit of estuarine crocodile where it also invades muddy areas in the mangrove ecosystem.

Most of the mangrove amphibians and reptiles do not show any anatomical modifications to meet the environmental conditions. However, they show some behavioral adaptations such as burrowing is the common behavior to hidden from the predators and enters the period of hibernation and aestivation during un-favorable conditions.

SUMMARY

In the present study a total of 32 species of which 6 species of amphibians belonging to 1 order 3 families, 3 genera and 26 species of reptiles belonging to 3 orders, 10 families and 3 genera respectively are reported. As per the study frogs, toads and snakes are quite plentiful in sundernban, whereas crocodiles, turtles and monitor lizard are less in number. This paper based on the collections and observations made by the author for a brief period of three years survey in the area. In the present study the author come across rare and endangered species in the sunderban namely, dog-faced water snake *Cerebrus rhynchops*, water monitor, *Varanus salvator* estuarine crocodile, *Crocodylus porosus*, and turtles *Lepidochelys olivacea* and *Batagur baska.*

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REFERENCES

Acharjii, M.N. and Mukherjee, A.K. 1964. Report on a collection of snakes from lower Bengal (Reptilia : Ophidia). *Zool. Soc. India*, **16 (**1-2) : 76-81.

Agarwal, V.C. and Ghose, R.K. 1995. Fauan of Tiger Reserve (Sunderbans, Palamau, Simlipal and Manas). *Fauna of Sunderban Tiger Reserve. Fauna of Conservation Areas*, **8** : 1-46.

Biswas, S. 1983. Food of Indian crocodile. *J. Hamadryad*. Madras Snake Park Trust, **8**(3) : 20-23.

Chanda, S.K. 1995. Anura : Amphibia : *Est. Ecos. Ser. Hugli-matla Estuary. Zool. Surv. India.* Part : **2** : 389-480.

Chowdhury, B.R. and Vyas, P. 2005. The Sunderbans. *A pictorial Field Guide. Reptilia* : 72-79. Rupa and Co. New Delhi.

Das, I. and Dutta, S.K. 2007. Sources of larval identities for amphibians of India. *J. Hamadryad*, **31**(2) : 330-358.

Mandal, A.K. and Nandi, N.C. 1989 Fauna of Sundrban mangrove ecosystem, West Bengal. *Fauna of Conservation Series*, **3** : 43-45.

Mukherjee, A.K. 1975a. The Sunderbans of India and its biota. *J Bombay. nat. Hist. Soc*., **72**(1) : 1-20.

Saha, S. G. 1983. Annual bites and deaths from snake bite at Harendra Nagar subsidiary Health Cemtre, District 24 Pargansa. West Bengal. *J. Hamadryad*, **8**(1) : 15-17.

Sanyal, D.P. Dattagupta, B and Sur, S. 1995. Reptilia. *Est. Ecos. Ser. Hughly-Matla Estuar. Zool. Surv. India*, Part **2** : 401-416.

Talukdar, S.K. 1982. On a small collection of reptiles from the Sunderbans, West Bengal. *Indian J. Zool*., **20**(4) : 184-186.