ZOO'S PRINT

Communicating Science for Conservation

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Contents

Cover photo (Fan Throated Lizard) design by Latha G Ravikumar, Zoo Outreach Organization, Coimbatore

Fantastic Facts

Part 3

Indian Freshwater Turtles

Conservation / Threat Status of Turtles

Many turtles, terrapins and tortoises are threatened with extinction, that is, dying out completely. Listed below are the turtles discussed in this article (from Part 1 to 3), with their status, or prospects of survival.

Name	Status (Global)
Assam Roofed Turtle	Endangered
Cochin Forest Cane Turtle	Endangered
Crowned River Turtle	Vulnerable
Rock Terrapin	Near Threatened
Indian Flapshell Turtle	Least Concern
Indian Softshell Turtle	Vulnerable
Indian Narrow-headed Softshell Turtle	Endangered
Red-crowned Roofed Turtle	Critically Endangered
Northern River Terrapin	Critically Endangered

THE CATEGORIES

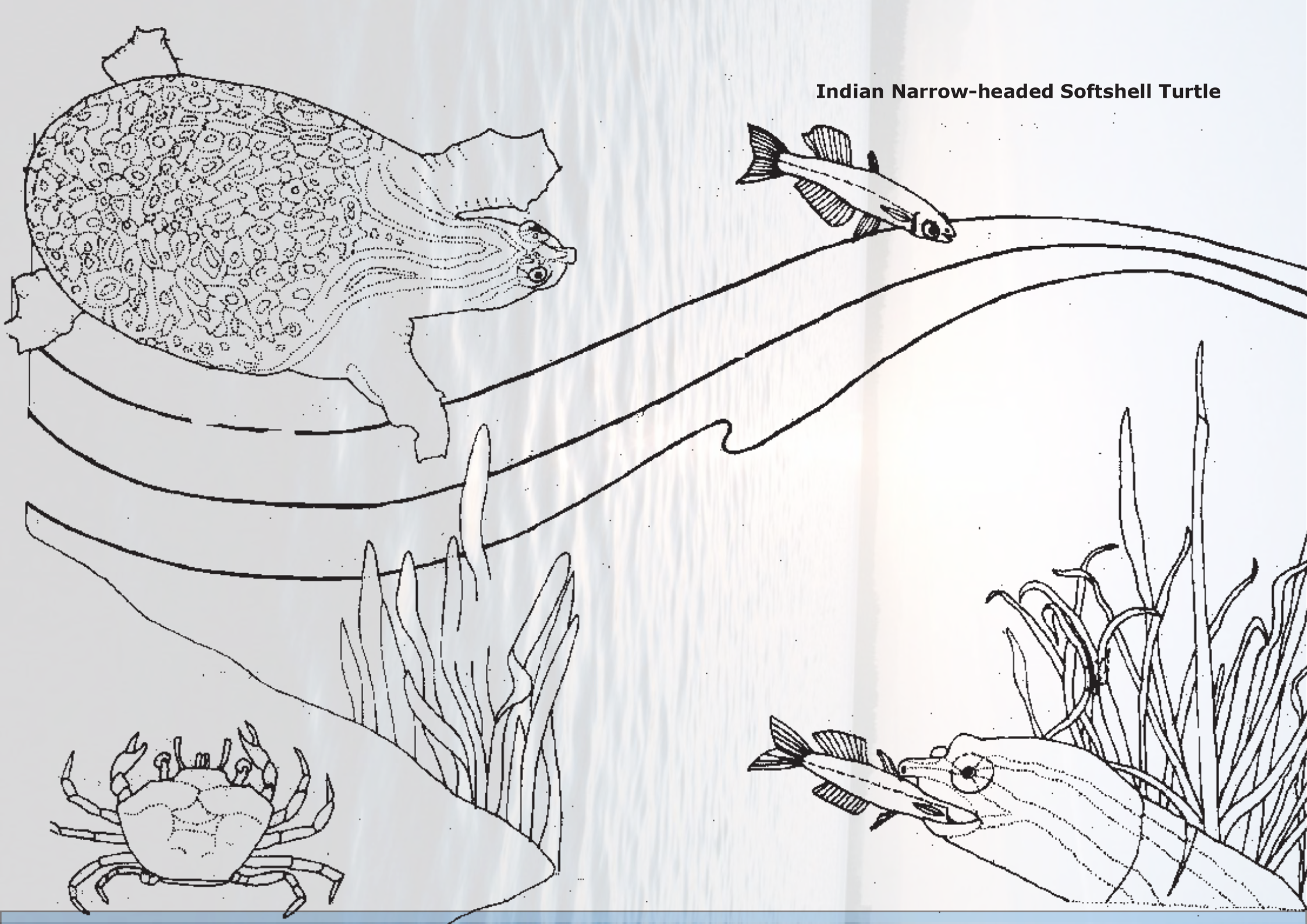
Critically Endangered -- This is the highest category that a species can be assigned before "extinction". It represents a "last ditch" effort to provide a warning to wildlife agencies and governments to activate management measures to protect the species before it disappears from the face of the earth. When a species is Critically Endangered, usually its chances of living for the next 100 years are very low. Often, its chances of surviving even for 10 years are not good at all !

Endangered -- This is the second highest threat category that a species can be assigned before it becomes further threatened e.g. Critically Endangered or Extinct. When a species is Endangered, its chances of survival as a species for the next 100 years are low.

Vulnerable -- The IUCN Red List defines Vulnerable as when a species is not Critically Endangered or Endangered, but is still facing a high risk of extinction in the wild. This is the first threat category for ranking a species when it has some serious problems from human-related threats. When a species is Vulnerable, it means that precautionary measures have to be taken to keep the species from becoming more threatened.

Non-threatened categories -- There are several non-threatened categories in the IUCN Red List. They include species that are already Extinct, or species that are not yet threatened. If a species is widely distributed in large numbers and has no threats, then it is ranked "Least Concern".

Information and Illustrations by Dr. Indraneil Das, Chair (former), IUCN SSC South Asian Reptile Specialist Group. Designed and compiled by Sally Walker with help from Sanjay Molur, Latha Ravikumar & B.A. Daniel Zoo Outreach Organization.


Indian Narrow-headed Softshell Turtle

Indian Narrow-headed Softshell Turtle

Chitra indica (Gray, 1830)

Endangered globally

Narrow-headed Softshell Turtle is found in many rivers, including the Ganga, Godavari, Indus, Mahanadi, Padma and even Coleroon in southern India. It prefers sandy sections of rivers.

This turtle has i) eyes so close to the tip of the head that it looks funny ii) a shell covered with skin, and a pig-like nose iii) a shell that is over 1 meter long iv) may lay 65-187 eggs at a time, close to the river bank.

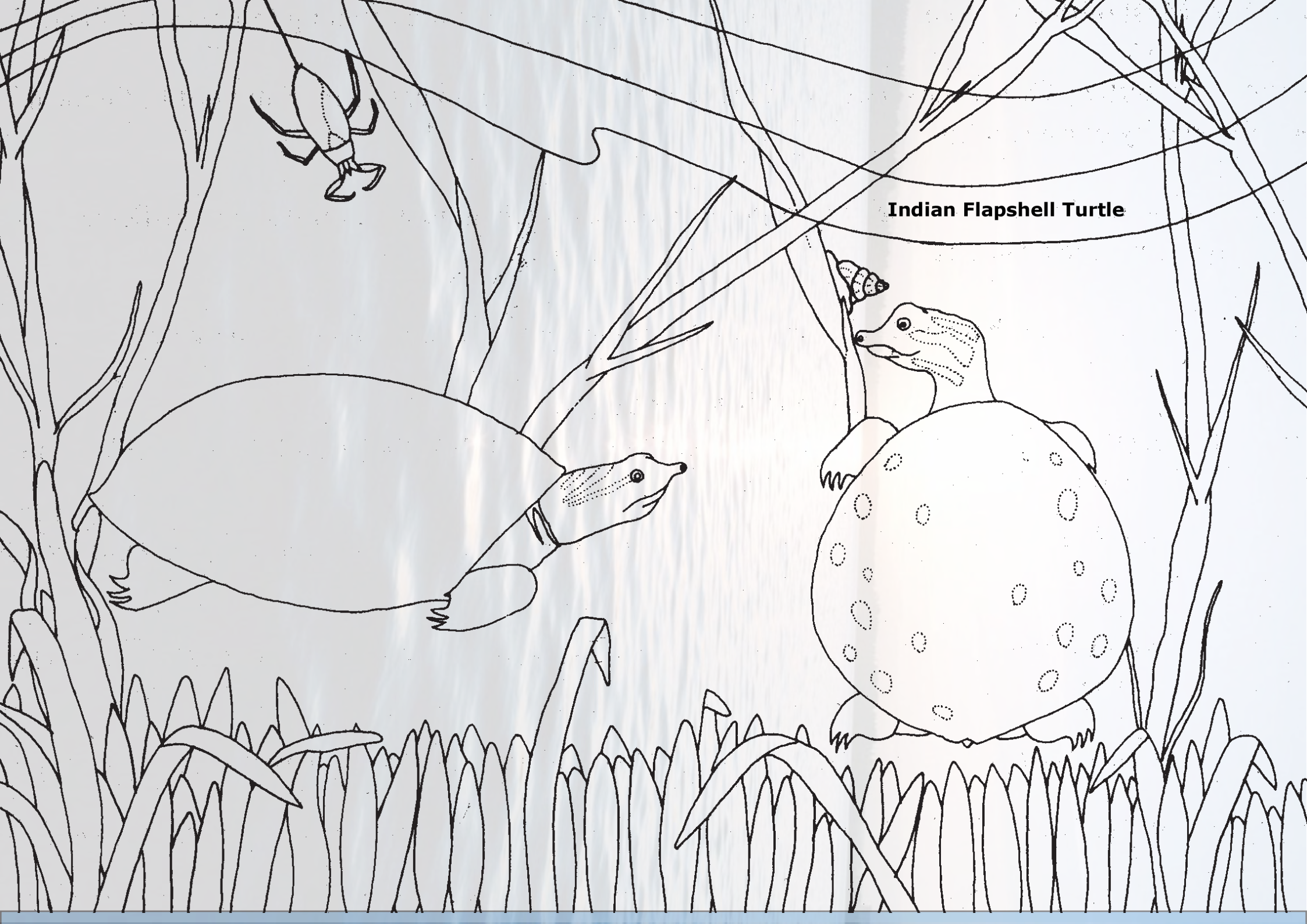
Narrow-headed Softshell Turtle hunts in ambush, burying itself in the sand and striking fishes as they approach, as shown by the adult turtle on the right that has just caught a fish. Small fishes are sucked in whole!.

DANGER: It is caught for food using hooks and nests. Pollution of rivers and dams are other reasons why this turtle is getting rare.

Colouring Instruction: The head of the turtle on the right grey, leaving yellow lines along the face. The baby turtle has large areas of grey, with smaller areas of yellow, on the shell, while the head and legs are grey.

Local names:

Bengali: *Chitra/Chhim*; Hindi: *Chitra/Seem*; Oriya: *Balera katchha*


Indian Flapshell Turtle

Indian Flapshell Turtle
Lissemys punctata (Lacépède, 1788)

Least Concern globally

Indian Flapshell Turtle is found all over India and some countries of South Asia - Pakistan, Nepal, Bangladesh and Sri Lanka - as well as in Myanmar (Burma) in rice fields, forest ponds, rivers and reservoirs.

This turtle has i) a skin flap under which the legs can be tucked in ii) a shell covered with skin iii) a pig-like nose iv) may lays 2-14 eggs v) small turtle, only 37cm in shell length vi) northern Indian variety tends to have yellow spots on its shell and face, unlike that from the south.

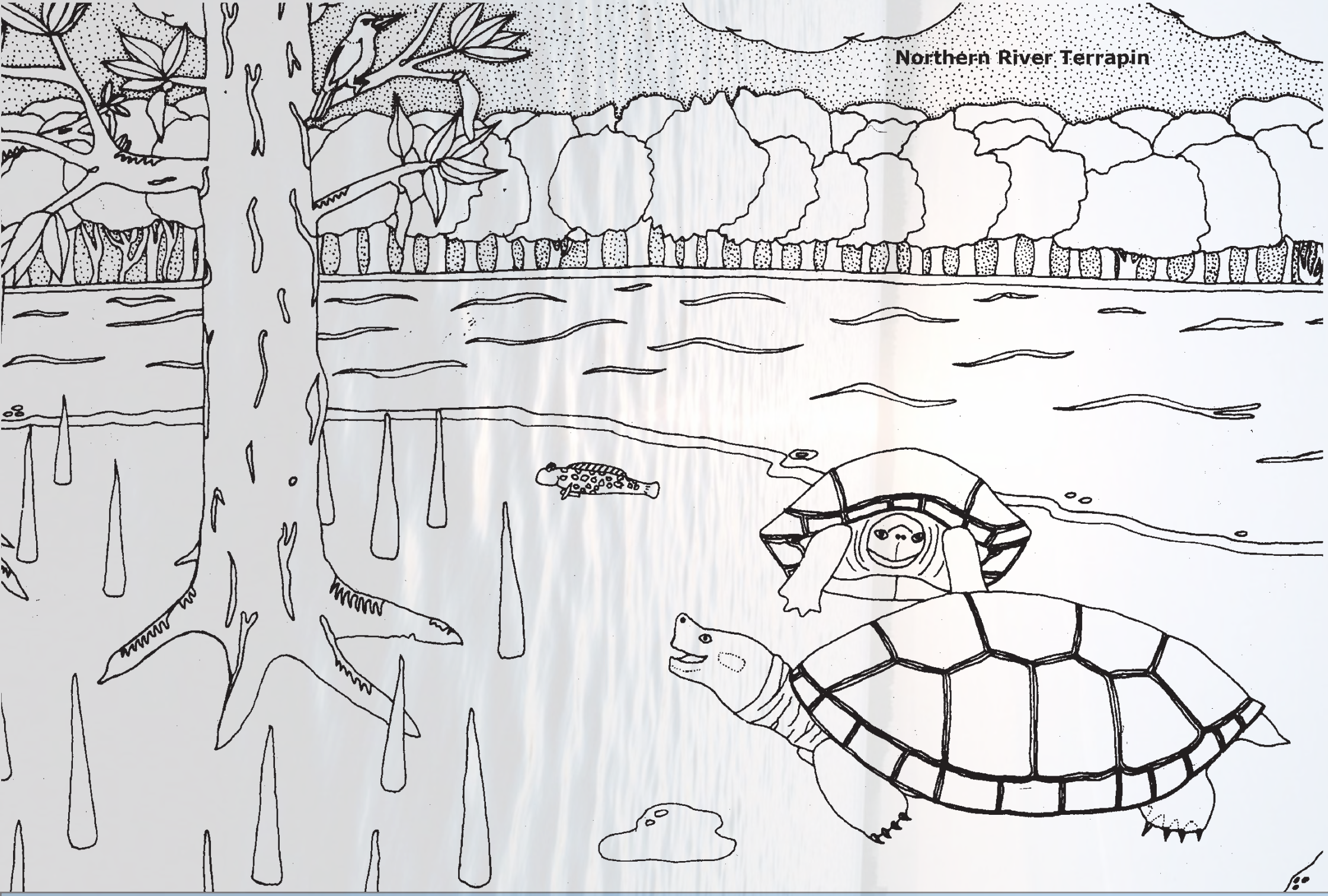
Indian Flapshell Turtle survives in many areas because it can live in human habitations. Eats plants as well as insects, snails and fishes.

DANGER: Too many are now being caught for food, for making medicine and even for cleaning wells having insects.

Colouring Instruction: Left turtle is from southern India with green shelf, head and legs green and black stripes on head. Right turtle is from northern India with green shell and yellow spots on the dotted areas. Head and legs are green as well; lines on face are yellow.

Local names:

Assamese: *Bagh dura/Baminy kasso*; Bengali: *Chiti kachim/Sundhi*; Gujarati: *Pani no kachbo*; Hindi: *Matia/Sundri*; Kannada: *Bili aame*; Oriya: *Panka kaichha*; Tamil: *Pal aamai*; Telugu: *Neeti tabelu*


Northern River Terrapin

Northern River Terrapin
Batagur baska (Gray, 1830)

Critically Endangered globally

Northern River Terrapin is found in India and Bangladesh, in mangrove forests, where the river meets the sea.

This turtle has i) an upturned nose ii) very smooth shell iii) 4 claws instead of 5 iv) a 60 cm long shell v) lays between 5-60 eggs each.

Northern River Terrapin comes on land only to lay eggs. The adults feeds only on fruits and leaves of certain plants. Some baby turtles also eat a prawn or a fish. Nesting is often with other turtles. The upturned nose probably allows River Terrapin to be underwater with very little of its body showing outside as it sticks it nose out to breathe. This keeps it safe from its enemies.

DANGER: Destruction of mangrove forests and removal of sands from sea beaches. Many turtles were caught for making turtle soup in Kolkata earlier.

Colouring Instruction: Colour the shell brown or greengrey. Males and females have different coloured heads. The female (in front) has a brown head, the male (at the back) has a red head.

Local names:

Bengali: *Bala Katha/Boro Ketho/Ram Kachim/Pora Katha/Bali Katha/Sono Katha/Sundhi*

Fantastic Facts

Questions

(All answers are in this article - read all the parts from 1 to 3)

1. Which turtle has a "pug" nose and 4 claws instead of 5 ?
_____

2. Which is the most ferocious turtle that you should never pick up ?
_____

3. Of most of the Indian freshwater turtles, which are usually bigger ... males or females ? _____

4. Which turtle is found ONLY in the river Ganga ?
_____

5. Which turtle uses its bad smell as a defense ?
_____

6. What is the largest Indian freshwater turtle ?
_____

7. Which turtle back is like a roof, or pyramid ?
_____

8. Which turtle's shell is covered with skin and eyes are very close together
_____

9. What is the smallest turtle ? _____

10. Which 3 turtles have pig-like noses ?
_____

Math lesson ... if you put all the turtles together, adding only their average shell length as described in this booklet, how long would your line of turtles be ?

Fantastic Facts

Further Reading

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The World of the turtles and Crocodiles by Romulus, Zai Whitaker and Indraneil Das. National Book Trust, New Delhi, India. 1993.

Turtles and Tortoises of India by Indraneil Das. Oxford University Press, Bombay, India, 1995.

Encyclopedia of Turtles by Peter Pritchard.T.F.H. Publications, Neptune, New Jersey, USA. 1979.

Answers for the questions

1. Northern River Terrapin, *Batagur baska*
2. Indian Softshell turtle, *Nilssonia gangetica*
3. Females
4. Red-crowned Roofed Turtle, *Batagur kachuga*
5. Rock Terrapin, *Melanochelys trijuga*
6. Crowned River Turtle, *Hardella thurjii*
7. Assam Roofed Turtle, *Pangshura sylhetensis*
8. Narrow-headed Softshell Turtle, *Chitra indica*
9. Cochin Forest Cane Turtle, *Vijayachelys silvatica*
10. Narrow-headed Softshell Turtle, *Chitra indica*; Indian Flapshell Turtle, *Lissemys punctata*, Indian Softshell Turtle, *Nilssonia gangetica*

Math: if we put all the turtles together, adding only their average shell length as described in this booklet, then your line of turles would be 501 cms (197 inches)

Print this mask on a card and cut it

Pangshura sylhetensis
(Assam Roofed Turtle)

Collect these masks for exciting games

ISSN 2230-7052
168
21 December 2018
BUGS R AL
Newsletter of the
Invertebrate Conservation & Information Network of South Asia (ICINSA)

COMMON BANDED PEACOCK

Record of new larval host plant of *Papilio crino* from Bankura, West Bengal

Introduction

Papilio crino Fabricius, 1793 belongs to the Papilionidae family and commonly known as Common Banded Peacock (Evans 1927). Papilionidae is the family of long tailed butterfly; most members of this family have tailed hind wing (Kehimkar 2008). *Papilio crino* is not common in Bankura District of West Bengal as well as in India. In Bankura, it is generally found both in the moist and dry forests, though population density is quite higher in the moist scrub jungles and plantations. This butterfly is found throughout the year but more common in July (Kehimkar 2008). The larval host plant of *Papilio crino* is known to be *Chloroxylon swietenia* (Roxb.) DC. of the plant family Rutaceae (Bell 1912; Robinson et al. 2010; Theivaprakasham et al. 2018), which is completely absent in the region. Yet presence of the butterfly in this region of India indicates a long migration from Deccan plateau or presence of some another unknown host plant in the Chhotanagpur Plateau and Gangetic Plains (Ravikanthachari et al. 2018.

Moreover, no extensive survey work has been carried out so far to find out the diversity of butterfly species in relation to the associated plants in Bankura as well as records of larval host plants of butterflies are not so well documented (Das 2014).

IUCN Red List:
Not Assessed

Insecta
[Class of Insects]

Lepidoptera
[Order of insect including butterflies and moths]

Papilionidae
[Family of swallowtail butterflies]

Papilio crino
[Common Banded Peacock]

Species described by Fabricius in 1793

Methodology

A survey had been carried out at Raibaghini (23^{0}01’29.0”N and 87^{0}33’32.6”E), near Kotulpur town in Bankura District of West Bengal. The area is in the connection zone of Chhotanagpur Plateau and Gangetic Plains. The average elevation is about 41.148 meters above sea level. The average annual rainfall of this area is 1236 mm and average temperature throughout the year is 26.6^{0}C.

The study was done following the opportunistic method (Williams 2015). During the survey period (between 6 March

ISSN 2230-7052
168
21 December 2018
Bugs R All
Newsletter of the
Invertebrate Conservation & Information Network of South Asia (ICINSA)

2018 and 26 April 2018), the egg laying behaviour of female butterflies on host plants and their immature stages were observed. Eggs were collected and reared indoors in plastic containers under a controlled environment. The boxes were covered with a thin cloth to allow for air movement and to protect the larvae from parasitoids. The larvae were supplied with fresh young leaves and the containers were cleaned daily to avoid fungal or bacterial infection. No food supplement was added. The eggs and larvae were reared till pupation and to adulthood. Additionally, immature stages were also observed in the natural environment.

Global distribution:
India, Sri Lanka
(Kehimkar 2016)

A site map of the study area

Result and Discussion

A single egg was laid by a female on 6 March 2018 at about 13:30 hrs on the underside of a leaf of *Citrus limon* (L.) Osbeck, which was about 1.5 m tall shrub of Rutaceae. At first the egg was yellowish in colour and round-shaped; gradually it turned more grayish. After 4 days (on 10 March 2018), the egg hatched and the first instar caterpillar emerged. It remained as larva for 41 days.

The freshly emerged larva was of blackish colour with a white dorsal stripe. After 4 days and 9 hours, i.e., on 15 March 2018, first molting took place. It turned greenish and the black parts reduced. Second molting occurred on 25 March 2018, i.e., after 9 days and 13 hours. On 30 March 2018 the size was recorded and that was 1.3 cm. The larva turned more deep green colour after third moulting on 6 April 2018. The larva became large, bluish green in colour and a white stripe was seen on the dorsal side in between the thorax and abdominal segment. The ocelli became more prominent. After 42 days from hatching, the larva successfully pupated on 16 April 2018. The pupa was green in colour, like other pupa of the *Papilio* genus. Just after 10 days 9 hours and 35 minutes from the date of pupa, ultimately an adult emerged on 26 April 2018. Newly emerged adult *Papilio crino* was healthy and normal in size. In the total larval development phase it was given only leaves of *Citrus limon*.

ISSN 2230-7052
168
21 December 2018
Bugs R All
Newsletter of the
Invertebrate Conservation & Information Network of South Asia (ICINSA)

Images

Fresh egg of *Papilio crino*

Portion of the new larval host (*Citrus limon*) plant with flower and fruits (Inset)

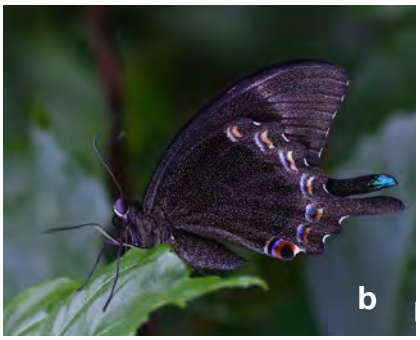
The egg just before hatching

Freshly emerged larva

Caterpillar after second molting

Last instar caterpillar of *Papilio crino*

Pupal stage



Adult *Papilio crino*. a. Dorsal view b. Side view

Conclusion

Swallowtail females are very choosy about where they lay their eggs. Common Banded Peacock (*Papilio crino*) butterfly lays eggs on *Citrus* leaf in absence of *Chloroxylon swietenia*, the previously reported larval host plant. Hence, *Citrus limon* (L.) Osbeck is a host plant of *Papilio crino*.

ISSN 2230-7052
168
21 December 2018
Bugs R All
Newsletter of the
Invertebrate Conservation & Information Network of South Asia (ICINSA)

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BAYA WEAVER BIRD

Nest colonies and abnormal nests of *Ploceus philippinus* in Tindivanam Taluk, Villupuram District, Tamil Nadu

Nests of *Ploceus philippinus on B. flabellifer*: (a) Normal nest (scale bar—3.6cm), (b) Two-storeyed abnormal nest (scale bar—11.5cm).

IUCN Red List: Least Concern (BirdLife International, 2016)

Aves
[Class of Birds]

Passeriformes
[Order of Passerine]

Ploceidae
[Family of small passerine birds]

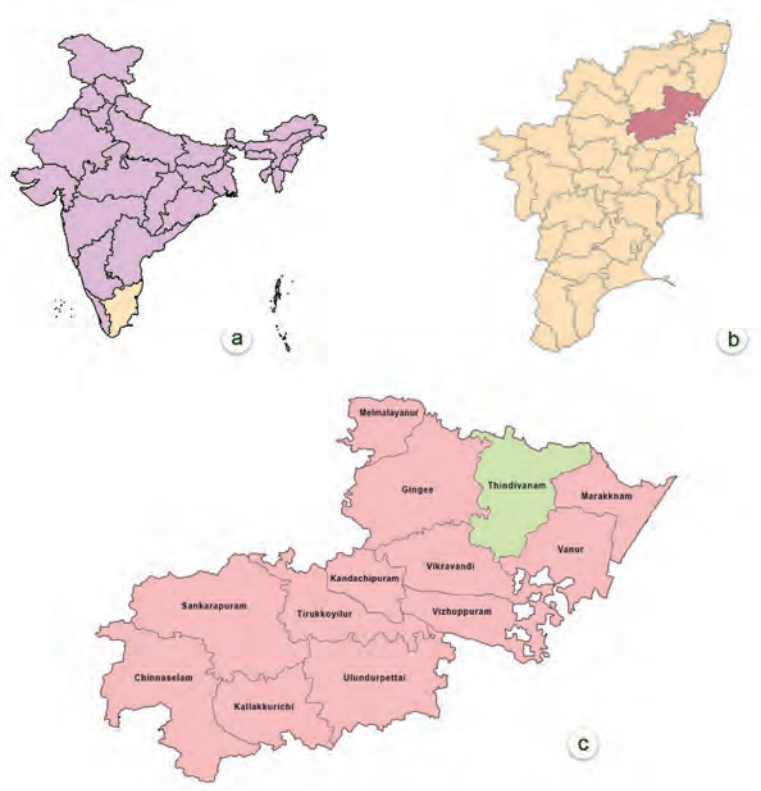
Ploceus philippinus
[Baya Weaver bird]

Species described by Linnaeus in 1766

Ploceus philippinus are social, gregarious, polygamous, and colonial-nesting birds that occur throughout the Indian subcontinent (Ali et al. 1956). These are also known in Java and Sumatra (Indonesia) (Wood 1926), Pakistan, Bangladesh, Thailand, Malaysia, and Sri Lanka (Ali & Ripley 1999). These are common in agricultural and open grassy landscapes (Quader 2005). These birds breed during monsoon months, June—November (Rasmussen & Anderton 2005). *Ploceus philippinus* generally prefer tall, linear trees with dense canopies, more often preferring the taxa of Arecaceae. Davis (1974) has identified 40 nest-supporting plants in India including four species, such as a species of Vachellia (= Acacia), *Borassus flabellifer*, *Cocos nucifera* (Arecaceae), and *Tamarindus indica* (Fabaceae) in Tamil Nadu. Davis (1985) explains *P. philippinus* preference for the Arecaceae as the availability of unbranched trunks and long, swaying foliage, which prevent predators and provide suitable leaf strips for nest

construction. Within the Arecaceae, *P. philippinus* mostly build nests on *Cocos nucifera* (Arecaeae) along the western coast and on *Borassus flabellifer* (Arecaceae) along the eastern coast of the peninsula. These birds are also known to build nests on *Vachellia nilotica* (= *Acacia nilotica*, Fabaceae) in the arid regions of north-western India (Sharma 1989). Sharma (1987) has identified 47 nest-supporting plants including *Calotropis procera* (Asclepiadaceae), *Cordia gharaf* (Boraginaceae), *Adhatoda vasica* (Acanthaceae), and *Cynodon dactylon* (Poaceae) in Alwar and Bharatpur Districts of Rajasthan. *Ploceus philippinus* prefer the exotic Eucalyptus trees than any Arecaceae in Chorao Island in the Mandovi estuary of Goa (Borges et al. 2002). Trees such as *B. flabellifer*, *Phoenix sylvestris* (Arecaceae), *Pithecellobium dulce*, *Albizia lebbeck* (Fabaceae) are the preferred plants for nest building by *P. philippinus* in West Bengal (Biswas et al. 2010) and, the introduced species of *Callistemon* (Myrtaceae) in Rajasthan (Kumar & Kumar 2015). *Ploceus philippinus* build nests on *Areca catechu* (Arecaceae) planted in rows in traditional home garden agroforestry system in Assam (Yashmita-Ulman et al. 2017).

Global Distribution: Native: Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Pakistan, Singapore, Sri Lanka, Thailand, Viet Nam (BirdLife International, 2016)



Survey area. (a) India map showing Tamil Nadu (yellow); (b) Tamil Nadu map showing Villupuram District (brown); (c) Villupuram District map showing Tindivanam Taluk (pale-green)

Nests of *P. philippinus* predominantly occur as colonies, but isolated nests are not uncommon (Pandey 1991). *Ploceus philippinus* built nests in colonies and the number of nests in each colony varies from 2-250 (Davis 1974). Each colony consists of 5-24 nests and the birds opt for trees standing amidst grasslands, crop fields as well as damp and water-inundated localities (Borkar & Komarpant 2003). However, these birds prefer building nests on plants that overhang a

waterbody (Khan 1799). Nests constructed on branches overhanging waterbodies are believed to be protected from rats and similar terrestrial animals (Ali 1931). In Parbati Hills, Pune, *P. philippinus* built 82.8% of nest colonies over waterbodies and of these, 65.7% were hanging either within wells (Crook 1960). Similar records from Tamil Nadu exist (Davis 1974).

Nests of *P. philippinus* vary from 40 to 100 cm in length (Wood 1926), each with clearly discernible parts, viz., stalk, body, and an entrance tube (Sharma 1995). However, deviations from the above design occur, which could be referred as 'abnormal'. For instance, such nests include either repetition or elaboration of one or more of parts, or lack of one or more of parts, formation of additional sections such as stalk and entrance tube, and even abnormality in the position of the nest on the supporting tree or its parts. These variations include multistoreyed nests, which include more than one egg chamber in a vertical order, and more than one storey built in the same fashion. Ali et al. (1956) have reported on different abnormalities in *P. philippinus* nests in Pune, Maharashtra. Ambedkar (1958, 1980) has described abnormal nests in Parbati Hills ($26^0$20'-$77^0$08'N; $78^0$16'-$78^0$16'E), Pune, and multistoreyed and composite nests in Kumaon Terai ($28^0$44'-$30^0$49'N; $78^0$45'-$81^0$5'E). Sharma (1985) and Borkar & Komarpant (2003) provide detailed notes on abnormal nests in Rajasthan and in southern Goa, respectively. Sixteen types of abnormal nests under the broad categories of structural abnormality, orientational abnormality and mixed abnormality have been noted in Alwar and Bharatpur, Jaipur, and Udaipur districts of Rajasthan (Sharma 1995).

Tindivanam taluk in Villupuram district is largely an agricultural area, where *P. philippinus* populations build nests and breed successfully. Large numbers of nest colonies occur in the farm and fallow lands and in spaces around irrigation wells. A study of the abnormal nests of *P. philippinus* were carried out by Sharma (1995) in Rajasthan, Borkar & Komarpant (2003) in Southern Goa and Ali et al. (1956) and Ambedkar (1958, 1980) in Pune. Other than these no systematic study has been done so far on the qualitative and qualitative aspects of abnormal nests in Tamil Nadu.

Hence by surveying and analyzing nest colonies and abnormal nests on 13 nest-supporting plant species and power cables in 55 villages in Tindivanam Taluk, we sought answers to the following questions: What are the maximum and minimum number of nests in nest colonies? How many of these are preferentially constructed overhanging irrigation wells? How many different types occur among the abnormal nests?

MATERIALS AND METHODS

Survey area

The survey was conducted in 55 villages (Table 1) in Tindivanam Taluk, Villupuram District ($11^0$12'-$11^0$93'N; $78^0$65'-$79^0$48'E), Tamil Nadu, covering 80 km^2 overall. Human population in the survey area is *c.* 5,00,000 with agriculture being the principal occupation. Soil is made of red-sandy loam and black-cotton soil. The major crops of this area are *Oryza sativa*, *Sorghum bicolor*, *Pennisetum glaucum*, *Eleusine coracana*, *Setaria italica*, *Saccharum officinarum* (Poaceae), *Vigna radiata* and *Arachis hypogaea* (Fabaceae). Monoculture of *Casuarina equisetifolia* (Casuarinaceae) and *Manihot esculenta* (Euphorbiaceae) is common in the water-scarce parts of Tindivanam. The maximum and minimum temperatures in the district are 36^0C and 20^0C, respectively. The average annual rainfall of the district is 1000 mm. About 95% of the normal rainfall occurs because of north-east monsoon in October-December and south-west monsoon in June-August (Annon, 2017).

Table 1. List of villages surveyed for *Ploceus philippinus* nests in Tindivanam Taluk (Villupuram District)

	Name of the village
1.	Alagiramam
2.	Andipalayam
3.	Anganikuppam
4.	Annamputhur
5.	Athikuppam
6.	Avvaiyarkuppam
7.	Chendur
8.	Chendur Chettipalayam
9.	Chinnanerkunam
10.	Chinnavalavanur
11.	Deevanur
12.	Edapalaiyam
13.	Ellai
14.	Erayanur
15.	Ganapathypattu
16.	Gopalapuram
17.	Kannigapuram
18.	Kanniyam
19.	Keel Edaiyalam

	Name of the village
20.	Kenipattu
21.	Kenipattu Colony
22.	Kodima
23.	Konamangalam
24.	Koralur
25.	Kothamankalam
26.	Kovadi
27.	Kutteripattu
28.	Madurapakkam
29.	Mailam
30.	Melperadikuppam
31.	Molachur
32.	Muppuli
33.	Nallamur
34.	Nallamur Colony
35.	Padirappuliyur
36.	Palapattu
37.	Panjaalam
38.	Panthamangalam

	Name of the village
39.	Pearani
40.	Peramandur
41.	Periyathachoor
42.	Rettanai
43.	Sendiyam Pakkam
44.	Sithani
45.	Sozhiyasorkulam
46.	Thenkalavai
47.	Thenkolapakam
48.	Thennalapakkam
49.	Thenpasiyar
50.	Veedur
51.	Vengai
52.	Venkanthur
53.	Vikravandi Nallalam
54.	Vilagambadi
55.	V. Panchalam

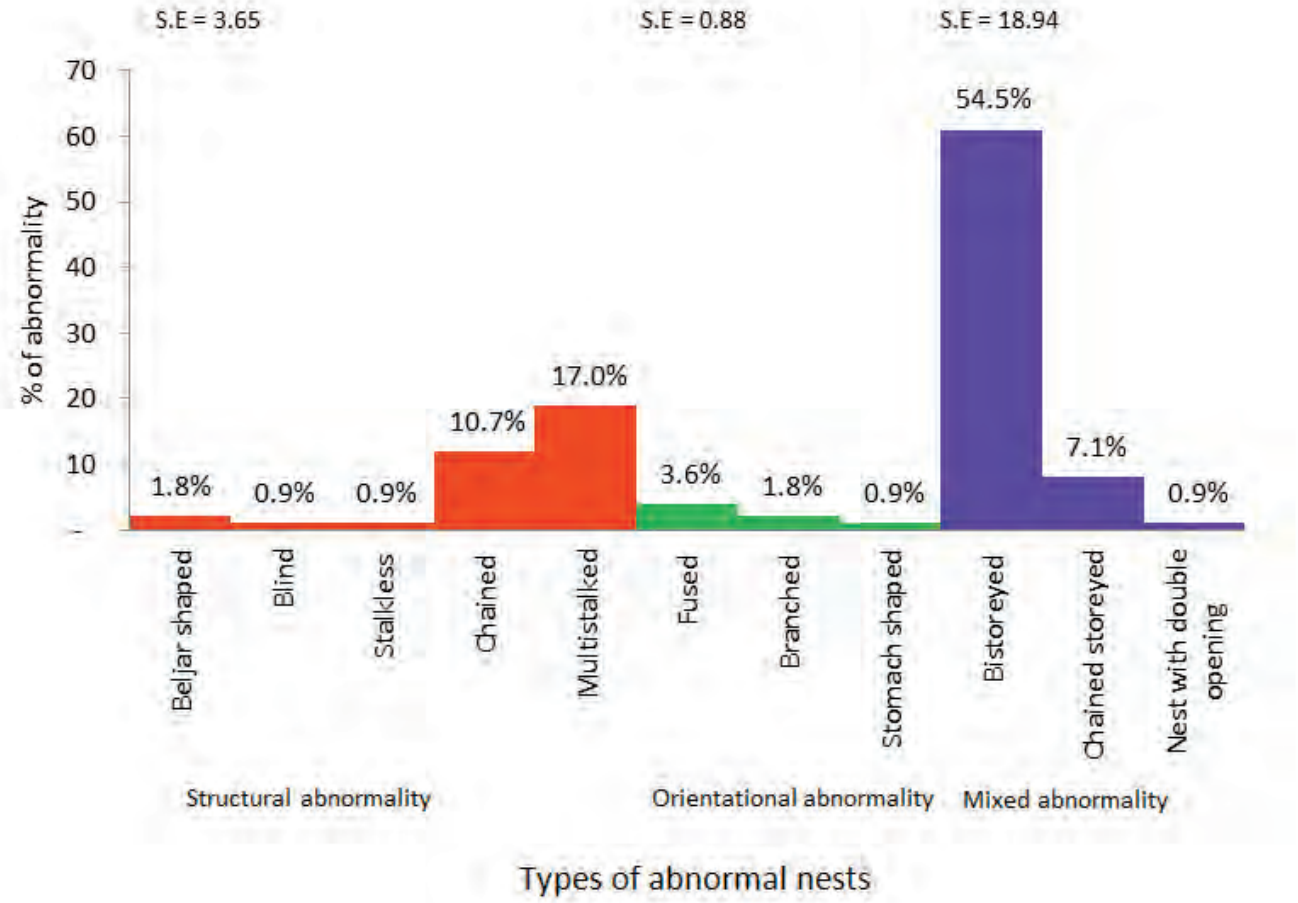
Methods

A total of 4408 nests of *P. philippinus* were examined in and around cultivating fields. The total numbers of nest-supporting plants, nests on power cables, nests, nest colonies, abnormal nests, and nests hanging over irrigation wells were considered. Because *P. philippinus* populations are active between 0600 and 1100 h and 1500 and 1800 h, the survey sites were visited between 0600 and 1100 h and 1500 and 1800 h every day in May-November 2017. Normal and abnormal nests were censused visually when they occurred proximally. When they were at a distance, census notes were made using a pair of Super Zenith field binoculars (Model No. 20x50 Field 3^0, Jack Berg, El Paso, Texas,

Nest colonies drooping into irrigation wells in crop fields: (a) Normal nests on *Cissampelos pareira* and *Phyllanthus reticulatus* (scale bar-80cm), (b) on *Prosopis juliflora* (scale bar—80cm), and (c) on *Morinda tinctoria* (scale bar—80cm), (d) Abnormal nests on *Ficus benghalensis* (scale bar—66cm).

USA), not disturbing nests and inhabiting birds. Locations of the nest-supporting plants and power lines were determined using a standard GPS (Garmin Etrex 20X). Photographs and videographs of nest colonies and abnormal nests were made on the spot using a digital camera (HDR—CX13, Sony). Nest-supporting plants were identified using Nair & Henry (1989). Abnormal nests were classified following Sharma (1995).

Types and percentages of abnormal nests of *Ploceus philippinus*



Collected data were tabulated, analyzed and shown as graphical representations. Pearson's χ^2 test was used to verify differences in means of variance between various habits of nesting plants with normal and abnormal nests using SPSS (Statistical Packages for Social Sciences). The level of significance was assessed at 0.05%.

RESULTS

The censused nest-supporting plants (n=270) belonged to 13 species and 10 families. Nine of them were trees, two shrubs, one herb, and one twiner. In total, 4408 nests were counted on nest-bearing plants and power cables in 55 villages. Abnormal nests constituted 2.5% (n=112) of total number of nests (4408).

The numbers of nests in each nest colony varied: 55.5% of nest-supporting plants (n=150) bore nests between one and 10, whereas 17% of nest-supporting plants (n=46) bore 11—20 nests, 11% (n=30) bore 21—30 nests, 6.3% (n=17) bore 31—40 nests. A total of 93 nests occurred on one well-grown tree of *B. flabellifer* in Anganikuppam ($12^0$4'N-$79^0$35'E). Solitary nests occurred on 18 plants. Pearson's χ^2 test was applied to

Table 2. Association between habits of nest-supporting plants / power cables and nests (Chi-Square tests) of *Ploceus philippinus*

Habits of nest-supporting plants/ power cables	Nest-supporting plants	Total no. of plants/ power cables bore nests	Total no. of normal nests	% of total of normal nests	Total no. of abnormal nests	% of total of abnormal nests	Total nests	% of total of nests
Unbranched Trees	*Borassus flabellifer*	247	3984	90.38%	87	1.97%	4071	92.35%
	Cocos nucifera							
	Phoenix sylvestris							
Branched trees	*Casuarina equisetifolia*	12	94	2.13%	6	0.14%	100	2.27%
	Ficus benghalensis							
	Azadirachta indica							
	Morinda tinctoria							
	Prosopis juliflora							
	Pithecellobium dulce							
Shrubs	*Phyllanthus reticulatus*	7	47	1.07%	1	0.02%	48	1.09%
	Securinega leucopyrus							
Twiner	*Cissampelos pareira*	3	51	1.16%	2	0.05%	53	1.20%
Herb	*Ruellia prostrata*	1	1	0.02%	0	0%	1	0.02%
Power cables		4	119	2.70%	16	0.36%	135	3.06%
Total		**274**	**4296**	**97.46%**	**112**	**2.54%**	**4408**	**100%**

***Statistically significant value 1.205E-10 ($p<0.05$) is arrived in χ^2 test**

determine preferences of *P. philippinus*, such as unbranched or branched trees, shrubs, twiners, herbs, and power cables. A significant difference among the various habits of nest-supporting plants, such as unbranched trees, branched trees, shrubs, herbs, twiner, and power cables with respect to the normal and abnormal nests was noticed. The level of significance was found at less than 0.05% (Table 2).

Frequency of nests overhanging waterbodies

Of the total nests surveyed (n=4408), 3.2% (n=144) of them, including nine abnormal nests, were hanging over waterbodies, i.e., irrigation wells occurring within crop fields in seven villages, viz., Thenkolapakkam, Gopalapuram, Kizhedayalam, Edapalayam, Sendiambakkam, Koothamangalam, and Vikravandi Nallalam. The overhanging nests were attached to five species of plants, viz., *Ficus benghalensis* (Moraceae), *Morinda*

Table 3: Percentage of abnormal nests of *Ploceus philippinus*

	Type of nest abnormalities	Total number of abnormal nests counted	% of abnormal nests
1	Structural abnormalities	35	31.3%
2	Orientational abnormalities	7	6.2%
3	Mixed abnormalities	70	62.5%

tinctoria (Rubiaceae), *Cissampelos pareira* (Menispermaceae), *Phyllanthus reticulatus* (Phyllanthaceae), and *Prosopis juliflora* (Fabaceae), which were growing around the walls of irrigation wells.

Variations among abnormal nests

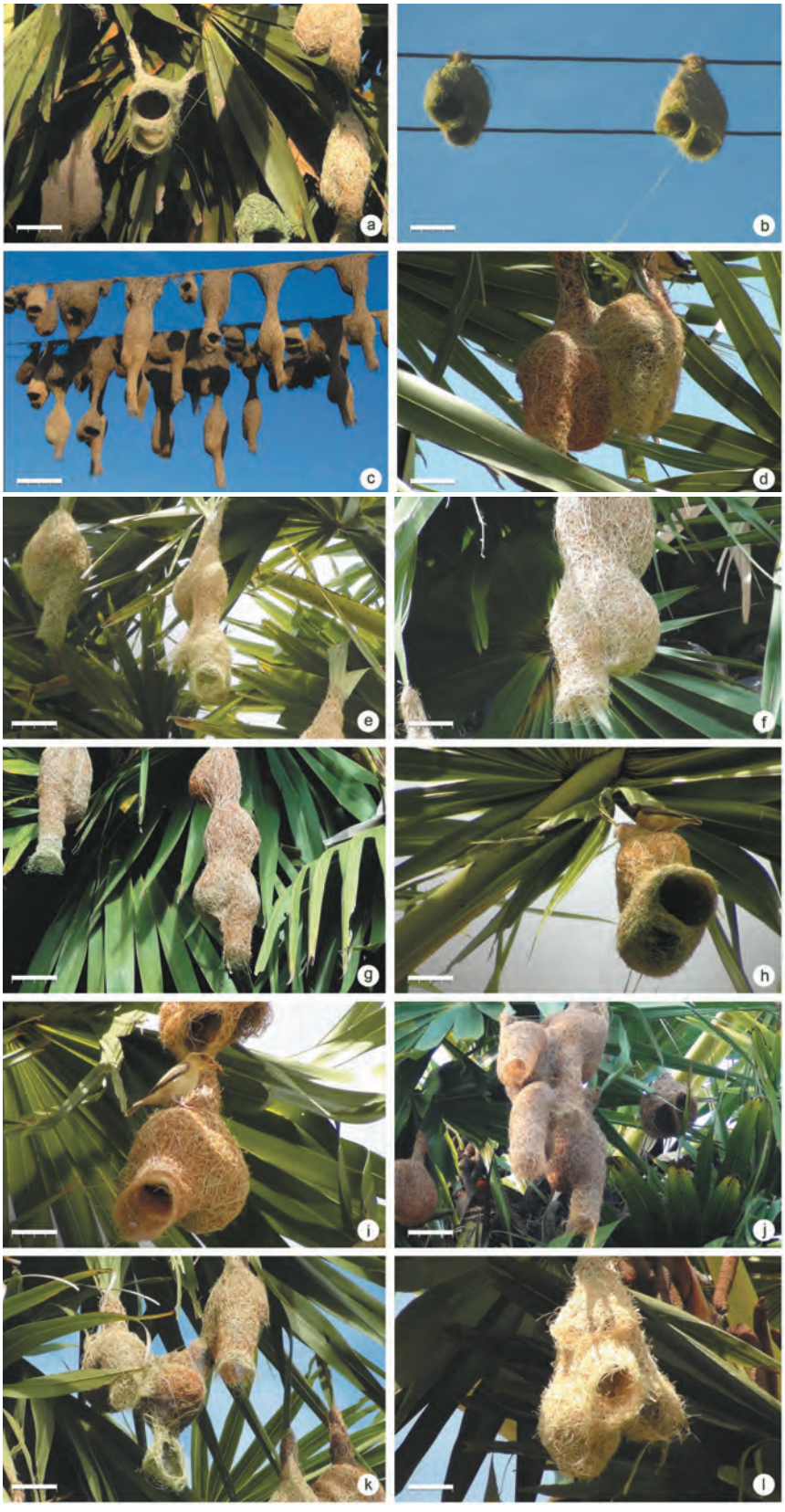
Of the total of 112 abnormal nests, 77% (n=86) occurred on *B. flabellifer*, 14% (n=16) on electric power lines, 3% (n=3) on *M. tinctoria*, and the remainder (n=7) on five plants viz., *Phoenix sylvestris*, *F. benghalensis*, *P. reticulatus*, *C. pareira*, and *P. juliflora*. Fifteen types of abnormal nests were observed and all of them belonged to three major categories: those with structural abnormalities (31.3%; n=35), those with orientational abnormalities (6.2%;n=7), and nests had mixed abnormalities (62.5% n=70) (Table 3). Thirty-five structurally abnormal nests were censused and the same consisted of bell-jar shaped-2, blind-1, stalkless-1, multistalked-19, and chained-12 types. The orientational abnormal nest type includes fused nests-4, branching nests-2, and stomach shaped nest-1. Third category mixed-abnormal nests consisted of bistoreyed-61, and chained nests-9. Among the two-storeyed nests 54.4% (n=61), complete two-storeyed were 16.9% (n=16), 1+1 type—9.8% (n=11); 1+1/2 type—26.7% (n=30); ½+1 type—2.6 % (n=3), and ½+1/2 type—0.9% (n=1). One nest was found with two openings. Pictures of abnormal nests are given. All the multistalked nests (n=19) were found on *B. flabellifer* trees. Chained nests occurred only on power cables.

DISCUSSION

Maximum and minimum numbers of nests in nest colonies

Ploceus philippinus populations build nests in colonies. The numbers of nests in one colony could vary from 5 to 24 (Borkar & Komarpant 2003) and occasionally more than 200 in some. But solitary nests also occur (www.weavers.adu.org). The present survey revealed that 55.5% of nest colonies include nests from 1 to 10. Another 17% plants bore nests from 11 to 20. A majority of the nest colonies included nests less than

Pictures of abnormal nests of *Ploceus philippinus*. (a) Multistalked nest on *B. flabellifer* crown, (b) Stalkless nests on power line, (c) Chained and wide stalked nests on power lines, (d) Fused nests, (e) Fused branching nest, (f) Two storeyed nest, (g) Chain storeyed nest, (h) 1+½ nest type, (i) ½+1 nest type (j & k) Mixed abnormal nests, (k) Nest with double openings.



20. A rare observation was that 93 nests were found on a single *Borassus flabellifer* in Anganikuppam Village. This reveals that *P. philippinus* live and build nests in colonies. Solitary nests were observed on 18 nest-supporting plants belonging to five species, such as *B. flabellifer*, *M. tinctoria*, *P. reticulatus*, *P. sylvestris* and *R. prostrata*. The existence of less than 10 nests in 55.5% nest colonies including solitary nests on 18 nest-supporting plants reveals that the nest colonies of these colonial birds in the study area indicate that continuous monitoring is necessary to know whether the number of nests in every colony increase or not in future.

Nests overhanging waterbodies

Borkar & Komarpant (2003) observed that *P. philippinus* populations built nests hanging over water bodies in South Goa. In Assam, nest-supporting trees occur around water

sources and agricultural fields (Yashmita-Ulman et al. 2017). The present study has revealed that 144 nests including nine abnormal nests attached to nest-supporting plants were drooping into irrigation wells matching with the observations of Khan (1799), Ali (1931), Crook (1960), Davis (1974), Sharma (1987) and Borkar and Komarpant (2003). Sharma (1987) has identified four nest-supporting plants viz., *C. procera*, *C. gharaf*, *Adhatoda vasica*, and *Cynodon dactylon* which bore nests found overhanging on wells and water bodies in Rajasthan. But in the present study five plants such as *F. benghalensis*, *M. tinctoria*, *C. pareira*, *P. reticulatus*, and *P. juliflora* growing adjacent to irrigation wells supporting *P. philippinus* nests, bore nests and found overhanging on water. Apart from the cultivating areas, irrigation wells in cultivable lands also provide habitats for these birds. *Ploceus philippinus* select nest-supporting trees close to waterbodies for safety; safety of nests and broods (Davis 1974).

Abnormal nests

Of the total abnormal nests (n=112) enumerated, 76.7% nests (n=86) were found on *B. flabellifer* trees. Borkar & Komarpant (2003) had listed 13 distinct types of anomalous nests in South Goa. The abnormal nests (n=112) have been categorised in to 15 types based on the classifications proposed by Sharma (1995) and the different types of abnormal nests are given. Out of 13 nest-supporting plants, abnormal nests were found on seven plant species and on power lines. Among the total (n=112) abnormal nests, 62.5% were mixed abnormal types, 31.3% nests had structural abnormalities and 6.2% nests had mixed abnormalities.

The present study reveals that 92.3% of nests (n=4071) occurred on unbranched trees viz., *B. flabellifer*, *C. nucifera* and *P. sylvestris*, 3.06% nests (n=135) on power cables, 2.3% nests (n=100) on branched trees, such as *C. equisetifolia*, *F. benghalensis*, *A. indica*, *M. tinctoria*, *P. juliflora* and *P. dulce*, 1.2% nests (n=53) on twiner *C. pareira*, 1.09% nests (n=48) on shrubs like *P. reticulatus* and *S. leucopyrus*.

Out of all abnormal nests (n=112), 77.6% (n=87) of abnormal nests occurred on unbranched trees, such as *B. flabellifer* and *P. sylvestris*, followed by power cables 14.2% (n=16), and intensely branched trees, such as *F. benghalensis*, *M. tinctoria*, *P. juliflora* and *C. pareira* 5.4% (n=6). It attributes that the birds preferred to construct both normal as well as abnormal nests on unbranched nest-supporting plants. Next to the unbranched trees, birds preferred power cables in the crop fields for building nests. All the noted multistalked nests 16.9% (n=19) were found attached to the fronds of *B. flabellifer* trees. To reinforce swaying nests, the birds connect a portion of nest with the leaf terminals nearby, possibly

to minimize the swing. Multistalked nests were not found on any other plants and power cables. In normal instances, *P. philippinus* maintain a distance between two successive nests hanging on the same branch. Since the surface of power cables are smooth in texture and slippery, the *P. philippinus* might have connect adjacent nests by mesh of woven fibres fabricating along the wire and makes the nests as chains. Twelve such chained nests (10.7%) existed on power cables.

In India the abnormal nests of *P. philippinus* were studied by a few in Pune, Maharashtra (Ali et al. 1956; Ambedkar 1958, 1980), Southern Goa (Borkar & Komarpant 2003), and Rajasthan (Sharma 1985, 1988, 1995). Other than these no systematic study was carried out on abnormal nests of *P. philippinus*.

Apart from *P. philippinus*, abnormal nests also occur in other species of *Ploceus*. For example *Ploceus benghalensis* builds a nest bearing an unusually long entrance tube of 1 m length (Mishra 2004) and *P. ocularis* constructs nests with entrance tubes of 2 m length in southern Africa (Maclean 1985). The African weaver bird *P. cucullatus* usually constructs kidney-shaped nests, but abnormal supernumerary antechambers are also built by these. Sometimes the males of *P. cucullatus* build either bottomless or canopied nests (Collias & Collias 1962) with variations in either the presence or the absence of a tube (Crook 1963). In South Africa, Angola, Zambia, and Mozambique, the Southern-Masked Weaver *P. velatus* constructs significantly abnormal nests among the weaver birds of the world. Intraspecific variations in the length of entrance tubes also occur in the nest-building behaviour of *Ploceus*. *Ploceus manyar* build nests with short entrance tubes in reed stands (species of *Phragmites*, Poaceae) in India and with long entrance tubes in trees in Java, Indonesia (Delacour 1947). In Madagascar, *P. sakalava* constructs nest with shorter entrance tubes in the arid habitats than in the non-arid habitats. (Moureau 1960)

Other genera of Ploceidae also build abnormal nests. Sociable weaver *Philetairus socius* (Aves: Passeriformes: Ploceidae) endemic to South Africa, Namibia, and Botswana build the largest, compound community nests in the Savannah regions. Grey-capped social weaver *Pseudonigrita arnaudi* (Aves: Passeriformes: Ploceidae) constructs nest with two entrance tubes on the ventral side of the nest (Collias & Collias 1977).

CONCLUSION

This is perhaps the first systematic study on nesting status and abnormal nests of *P. philippinus* in agrarian landscapes of Tindivanam taluk, Tamil Nadu. Survey found that *P. philippinus* preferred non-branching palm trees and power cables over branching trees for nesting. I further found that the irrigation wells also serve as potential nesting

habitats for these birds. But increasing conversion of cultivated lands into housing areas and subsequent urbanization along with the loss of Arecaceae, such as *Borassus flabellifer*, *Phoenix sylvestris*, and *Cocos nucifera* that are vital nest supporting plants for *P. philippinus* is a conservation issue in this landscape. Increasing practices of monoculture of *Casuarina equisetifolia* and *Saccharum officinarum*, abandoning cultivation of cereals and millets, also causes shortage of grains to these birds. It is pertinent to involve common people in monitoring of weaver populations and to garner their support in the preservation of nesting sites. The fact that survey was restricted only to a small geographical area that included 55 villages could locate and count over 4000 nests means that this region has an enormous potential to support significantly high nesting populations of these *P. philippinus*. I feel compelled to say that a detailed systematic survey covering the entire region, involving local communities, will help in drafting an action plan to conserve the declining *P. philppinus* populations, which are widely recognized as the indicators of the health of agroecosystem.

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FOUR-HORNED ANTELOPE

Hand raising of orphaned wild *Tetracerus quadricornis* in captivity - a field report

Three days old fawn at bask

IUCN Red List: Vulnerable (IUCN SSC Antelope Specialist Group, 2017)

Mammalia
[Class of Mammals]

Cetartiodactyla
[Order of Even-toed ungulates and cetaceans]

Bovidae
[Family of Cloven-hoofed ruminants]

Tetracerus quadricornis
[Four-horned Antelope]

Species described by de Blainville in 1816

No large Indian ungulate, other than deer has adapted itself to a wider variety of forest types and environmental conditions. Major threats for Four-horned Antelope *Tetracerus quadricornis* and its habitat are mainly due to feral dogs, encroachment, extension of road network, poaching, overgrazing and water scarcity. Deers were hunted in India for meat and other purposes using snares, nets, dogs, and guns. Injured and orphaned fawns are often picked up for hand rearing, an attempt to nurse and thus save them (Putman 1990). Hand rearing is a time-consuming process that requires extensive knowledge of the animal biology.

Hand rearing of twenty days old fawn

Global Distribution: Native: India, Nepal (IUCN SSC Antelope Specialist Group, 2017)

Using a milk substitute that is similar to the milk composition of the hand-reared species is especially important. The success rate of hand rearing of newly born fawns that have not yet consumed milk is close to zero and that of a 1 week-old fawn is 50% (Wolfel 1993). Rao & Acharjyo (1996) addressed several health issues throughout the hand-rearing period and were overcome with veterinary assistance. The present field report describes the details of hand-raising of orphaned wild fawn.

Results and Discussion

On arrival to the Karuna wildlife rescue centre, rescued by villagers from the agriculture field near by Bukkapatnam Forest Range, Anantapur, Andhra Pradesh on the evening (around 16.00hr) of 11 December 2016 was found to be healthy and the fawn allowed to suckle lukewarm fresh cow's milk four times (06:00hr, 10:00hr, 14:00hr, 18:00hr) forcefully for three days and adopted well. Later multivitamins supplemented along with milk and after a month suckling of lukewarm fresh cow's milk was reduced to three times depending on need. Feeding milk was gradually reduced and completely stopped at the end of 5th month. In order to prevent malnutrition the only way to increase the frequency of meals, which often resulted in indigestion and diarrhea which must be taken care. Thus regular veterinary examinations must be continued on daily basis.

Grown up fawn with an adult

During the hand-rearing period, the fawn was kept in a separate enclosure with access to a fenced garden. It was rarely left

Two months old hand reared fawn

alone for more than three hours at a time. From the age of one month, the antelope was encouraged to follow by routine calling and was allowed to walk freely (Gehlot 2010).

At the age of 4-6 months, the deer was gradually introduced to a group. It was necessary to restrict the deer to a fenced site to prevent the risk of predation, illegal hunting and accidents. The keeper maintained contact with the deer on a daily basis to retain the relationship that was required to be able to work with them under free-ranging conditions (Pinter 1963).

The fawn began foraging at the age of 6th week and gradually consumed a variety of locally available plants and sliced fresh vegetables and fruits. The fawn had very little contact with people besides its keeper and would not accept milk from people they did not know well. In order to ensure that they would accept milk from more than just one keeper, an additional person fed the fawn on a daily. Feeding attempts by an unfamiliar person would face active resistance and the fawn would appear to be frightened were strictly avoided.

Faeces were soft and yellowish during the first week and they gradually became harder and darker. Within 2–3 weeks, the faeces became dark-brown pellets. They began defecating independently and started practicing communal defecation and urination as a part of territorial demarcation or might be for communication purposes (David & Sharma 2009).

Introduced to other deer

The experiences indicated that hand-rearing of four horned antelope is potentially useful

tool in physiological and ecological studies. When setting up a research programme with hand-reared Four-horned Antelope, it is advisable to take into consideration the limiting factors and potential biases. This documented case can be used as a tool for carrying out a feasibility study for a conservation of endangered species by hand-raising with minimal risks. We conclude that it is possible to study hand-reared Four-horned Antelope in large habitats and to maintain a close relationship with them in their adulthood.

After six months

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HIMALAYAN SEROW

Photographic evidence of *Capricornis thar* in Lansdowne Forest Division, Uttarakhand, India

Camera trap image of Himalayan Serow in Kotdwar Range, Lansdowne Forest Division, Uttarakhand (WWF-India camera traps)

IUCN Red List:
Near Threatened
(Duckworth &
MacKinnon 2008)

Mammalia
[Class of Mammals]

Cetartiodactyla
[Order of even-toed ungulates and cetaceans]

Bovidae
[Family of cloven-hoofed ruminants]

Capricornis thar
[Himalayan Serow]

Species described by Hodgson in 1831

Himalayan Serow *Capricornis thar* is a Near Threatened species under IUCN Red List of Threatened Species and listed as a Schedule-I species under the Wildlife (Protection) Act (1972) of India. Though protected, its population is declining due to decrease in its habitat, hunting for its meat and loss of forest cover due to clearing for agriculture and collection of fuelwood (Green 1987a; Duckworth & MacKinnon 2008). Like other mountain ungulates, Himalayan Serow also forms a part of the prey base for carnivores especially leopards. Limited work has been done on the distribution, status and ecology of the Himalayan Serow but, its presence has been recorded in east and southeast Bangladesh; in Himalayas (Bhutan, northwestern & northeastern India including Sikkim

and Nepal), in China (Tibet only), and probably in western Myanmar (Grubb 2005). In India, Himalayan Serow is sparsely distributed throughout the forest covered southern slopes of the Himalaya starting from Jammu and Kashmir in northwest to the hill states of northeastern India (Prater 1965). There are no accurate estimates of the population size of the species available in India, but their density in Kedarnath Wildlife Sanctuary (Uttarakhand) has been estimated at 1.6 Serow/km² (Green 1987a). It is also listed as an Endangered species in Nepal by WWF-Nepal and Department of National Parks and Wildlife Conservation, Nepal (Chapagai and Dhakal, 2002) and thus, its hunting is prohibited throughout Nepal since 1992 (Wegge & Oli 1997). In China, Himalayan Serow is a Class II protected species (Duckworth & MacKinnon 2008), while in Bhutan, it is listed in Schedule I of Bhutan's Forest and Nature Conservation Act, 1995 which provides licensed hunting permits for adult male Himalayan Serow, but not for females or young (Green 1987b). In Bangladesh, the Himalayan Serow is protected under the Wildlife (Preservation) Act, 1973. It is listed under Schedule III, and cannot be hunted, killed or captured (Green 1987b).

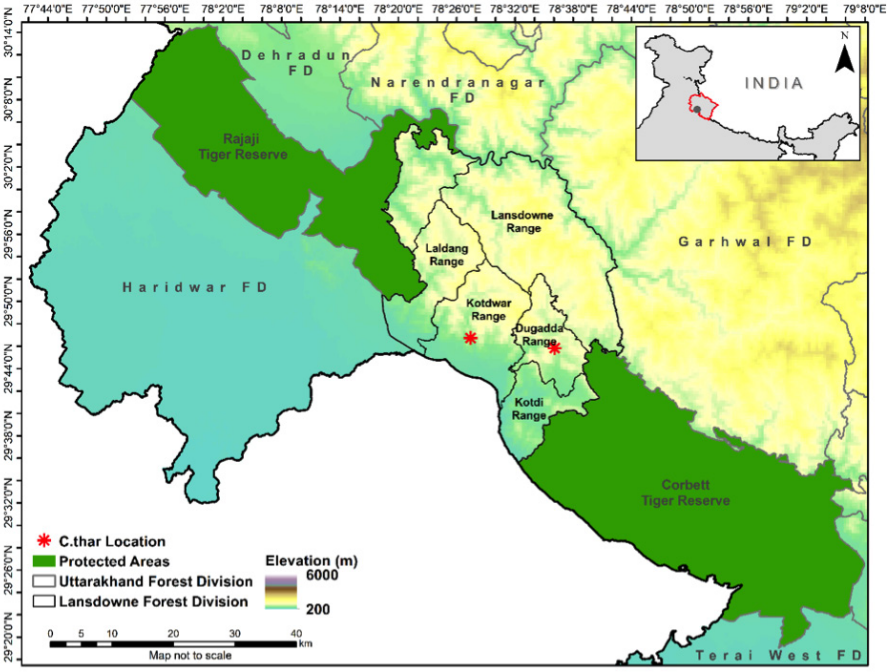
Global Distribution :
Native: Bhutan, India, Bangladesh, China and Nepal (Duckworth & MacKinnon 2008)

Trap image of Himalayan Serow in Dugadda range, Lansdowne Forest Division, Uttarakhand 2018. (WWF-India camera traps)

Himalayan Serow has a large head, thick neck, short limbs, long mule-like ears, and a coarse coat of dark hair (Schaller 1977). It is solitary, although there have been few occasions when as many as seven have been seen together (Prater 1965). Anecdotal information provided by the local villagers to our team during the camera trapping exercise also suggest that they are mainly active during the night and early morning hours. Both sexes are grossly similar in appearance and are about equal size (Schaller 1977; Aryal 2008). The species is oriental in origin (Schaller 1977), and is known to be locally present between 300m and 3,000m elevation in all Himalayan states (Green 1987b), there have been accounts throughout the species range that it inhabits rugged steep hills and rocky places, especially the limestone regions, and also in hill and mountain forest areas (Duckworth & MacKinnon 2008). Aryal (2008) found that the Himalayan Serow prefers gentle to steep slopes, while avoiding the plains to stay away from the predators. They use steeper areas as resting places and

gentler slopes for grazing (Aryal 2008). In the Terai Arc landscape, Himalayan Serow have been recorded at elevations of 413m in Nandhaur Wildlife Sanctuary, Uttarakhand and at 172m in Bihar's Valmiki Tiger Reserve (WWF-India unpublished report).

Lansdowne Forest Division, where the Himalayan Serow was photo-captured, is a biodiverse habitat tract in the Shivalik - Lower Himalayan ecoregion within India's Terai Arc Landscape. This division also serves as a crucial wildlife corridor for tigers, elephants and other animals and facilitates their movement between Corbett Tiger Reserve and Rajaji Tiger Reserve (Johnsingh & Williams 1999; Harihar et al. 2009). The division is located on 29^{0}37'–30^{0}2'N and 78^{0}19'–78^{0}43'E, longitudinally in the south western portion of district Pauri Garhwal (Kukreti & Bhatt 2014). It is one of the first forest divisions in India to be registered (4 September 2015) and approved or accredited (25 May 2017) as Conservation Assured Tiger Standards (CA|TS) site, which is an accreditation scheme that encourages protected areas where tigers are found to meet a set of standards and criteria, created by an international group of experts and protected area managers, that assures effective and long term tiger conservation (http://www.conservationassured.org). The division spans an area of 433km^2 and encompasses five ranges: Kotdi, Dugadda, Lansdowne, Kotdwar, and Laldhang. The terrain is undulating (elevation range 300–1000 m), and has diverse habitats including sal forests, small grasslands (*chaurs*) mixed forests (dominated by *Mallotus philippensis*), and Himalayan forests (characterized by *Pinus roxburghii*) (Kukreti & Bhatt 2014; Jhala et al. 2015). There are steep hills, deep valleys, multiple rocky streams (raus) and some perennial rivers. The hill slopes which are both densely wooded, and have patches of grass provide suitable habitat for Serow and goral (*Naemorhedus goral*) whose habitat include steep slopes, ridges, and gentle slants (Aryal 2008). Major rivers and streams include Kohlu, Saneh, Koh, Sigaddi, Rawasan and Malan all of which feed into the Ganga river. These rivers and other forest streams, provide ample amount of water for the wildlife in the forest, including in the dry season, when water accumulates in small pools



Map of Lansdowne Forest Division showing the 2 locations where the Himalayan Serow was captured on the camera traps. (Saloni Salaria/ WWF-India)

Habitat of Lansdowne Forest Division (Photos by: Dr. Pranav Chanchani (A) & Siddhant Umariya (B, C, & D) /WWF-India)

along drainage features.

The photographic evidence of the Himalayan Serow was recorded during the All India Tiger Estimation (AITE) surveys of the National Tiger Conservation Authority of India and Wildlife Institute of India, jointly implemented in Lansdowne Forest Division by World Wide Fund for Nature (WWF-India) and the Uttarakhand Forest Department. Between May and August 2018, pairs of camera traps were deployed within 191-2 km^2 grids. The Himalayan Serow was only photo-captured at two camera trap-stations. One adult male individual was recorded in Nauri beat of Dugadda range (29^{0}47'08"N & 78^{0}36'53"E) at the elevation 1,011m in June 2018 and other adult male in Malan beat of Kotdwar Range (29^{0}47'51"E & 78^{0}28'15"E) at the elevation of 934m in July 2018. Both records were from moist deciduous hill forests dominated by *Shorea robusta*, *Haldina cordifolia*, *Acacia catechu*, *Lantana camara*, and *Murraya koeingii*.

Previously, Himalayan Serow has never been captured on the camera traps in Lansdowne Forest Division. However, there is one photographic record of the Himalayan Serow from Duggada range clicked by a photographer - Mr Rajiv Bisht in the year 2016. Other anecdotal evidence gathered from the locals living within and around the Lansdowne Forest Division and the forest staff also suggests that this shy animal occurs in the area. Himalayan Serow has also been included in the management plan of Lansdowne Forest

Division. Being an understudied species, the photographic evidence for the continuing presence of the Himalayan Serow's in Lansdowne Forest Division opens up scope for further studies and highlights the need for comprehensive conservation efforts to ensure the persistence of small populations of endangered species and their habitats.

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