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www.zoosprint.org/Newsletters/ReptileRap.htm
The conservation of Indian reptiles: an approach with molecular aspects

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Taxonomy and Conservation

India’s colossal biological diversity can be credited to the vast array of ecological habitats ranging from tropical, sub-tropical, temperate, alpine to desert. According to the World Biodiversity Classification, India represents two biodiversity hotspots (Western Ghats and northeastern India) and has the richest vertebrate fauna in Asia. According to Ramakrishana & Alfred (2006), the reptile fauna of India consists of about 460 species; with 244 snakes, 178 lizards, three crocodiles, and 35 turtles. Among these, 33 are considered threatened. Das (2003) reported 506 species within the political boundaries of the Republic of India. Aengals et al. (2011) accounted 518 species of reptiles which includes 3 species of crocodiles, 34 species of turtles and tortoises, 202 species of lizards and 279 species of snakes belonging to 28 families. Molur & Walker (1998) accounted about 95 endemic reptile taxa in the Western Ghats of which 62 are reported as vulnerable. However, the information on Indian reptiles is still introductory as alpha taxonomy with the conventional outlook is yet to absorb the modern molecular trends in systematics and conservation. A large number of Institutions and Museums in the country suffer from lack of funding resources to pursue various molecular researches and many of the species predicted to be taxonomically enigmatic, or similar to known species are still awaiting formal detection using modern techniques. The Zoological Survey of India, the premier institution, has played an important role in promoting animal systematics in the country. But the National Zoological Collection housed at the Zoological Survey of India which holds the largest reptile collections in the country dates back to the early part of the 19th century; has yet to be fully entered into electronic databases. The Indian Wildlife Protection Act (1972) that legally denies permission to export any biological sample materials outside India also hinders the research activities of other developed countries on Indian reptile groups. Moreover, most species are known from very few localities and from few adults; a situation that impedes both traditional taxonomic advancement and conservation efforts. In addition, the genetic information required for extensive systematic revisions for most genera is lacking.

The introduction of “New Systematics” by Huxley (1940) and Mayr (1942) made/helped zoologists realise the importance of other characters to supplement the morphological characters for precise identification. This is very significant for the identification of unknown biological material when using a combination of evidences (morphology, behaviour, molecules, etc.) instead of relying on one-dimensional taxonomy (Bond & Sierwald 2003; Seberg et al. 2003; Lee 2004; Will & Rubinoff 2004). Several recent studies have applied mitochondrial DNA (mtDNA) markers in phylogeographic studies to geographically widespread taxa to determine distinctive and unrecognized evolutionary lineages (e.g., Avise et al. 1992; Zamudio et al. 1997). Also, elucidation of phylogenetic relationships among closely-related taxa is critical to correctly infer a taxon (e.g. Arnold 1993; Harvey et al. 1996; Roderick & Gillespie 1998).

Taxonomic studies by means of molecular techniques have contributed significantly to our perceptive of lineages contained by species or species groups. They have endorsed for revisions of taxonomically difficult groups, often revealing unrecognized taxa and smoothened the
progress of recognition of isolated or distinctive lineages. Molecular systematics through PCR amplification and sequencing makes the use of various molecular techniques: such as allozyme, isozyme, mitochondrial DNA (mtDNA) to provide information on the genetics of wide-ranging species or species groups in isolated habitat. Therefore, molecular techniques are crucial for studies in phylogeography, because it is “the field of study concerned with the principles and processes of genealogical lineages, especially those within and among closely-related species” as stated by Avise (2000). Such studies can be carried out with Indian lizard families Gekkonidae and Lacertidae as its exact phylogeny has not fully been established yet. Also, with mtDNA sequence, data, we can investigate the systematic relationships within genera or species by using the rapidly evolving control region of the mitochondrial genome. Because it has proven reliable in resolving intraspecific variation in many vertebrates including turtles (Stewart & Baker 1994; Encalada et al. 1996; Shaffer & McKnight 1996), accurately identifies closely related emydid turtle species (Lamb et al. 1994). Besides, animal genome data with potentially endless supply of evolutionary and systematic information can obviously be used to infer species diagnosis, description and identification. Consequently, the taxonomy of most organisms is better worked out for taxa occurring in Europe and America than the tropics. Therefore, some of the current names for tropical taxa could be the first approximation to a complex biological reality. The sampling of subspecies within a species does not promise the sampling of significant variation. Phylogenetic studies of congeneric species should therefore be shared with phylogeographic surveys of haplotype dissimilarity, so that the monophyly of populations of a putative species with respect to others can be tested. As stated by Ball & Avise (1992), the discussion about the levels of intraspecific or interspecific variation necessary to distinguish species and subspecies limits has received considerable notice in the last several decades. Several current studies that have discussed the border line among inter and intraspecific variation have utilised molecular information, mostly to test existing hypotheses of species-level relationships and boundaries. At the same time, a number of formerly documented subspecies genetically match though morphologically they overlap, implying that they probably should not be recognized at any taxonomic level. Parallel work on the snake Pituophis melanoleucus points that the conventional outlook suggested by Conant (1956) for the single polytypic species is conflicting with the molecular evidence, and Painted Turtles Chrysemys picta present an additional outstanding prospect to explore the question of species boundaries within a widespread species complex. According to Bishop & Schmidt (1931), the genus Chrysemys as currently recognized contains a single extant species, C. picta. Four subspecies are generally recognized: Chrysemys picta bellii, C.p. dorsalis, C.p. marginata, and C.p. picta. Thus, decisions regarding species and subspecies boundaries can, and do have dramatic impacts on species conservation and management (Shaffer et al. 2000). After almost three centuries of herpetological work in India, a good number of research papers have been published. Though, the main comprehensive works would indisputably have been by Malcolm A. Smith, and there is no wonder that it took more than twelve years for him to produce these three separate volumes on Indian reptiles. Smith (1931) systematically placed the crocodiles and turtles in Volume I, the lizards in Volume II (1935), and the snakes in Volume III (1943). These precious classics have long been regarded as fundamental references in the library of any herpetologist interested in Indian regions. Further contributions were made by Tiwari & Biswas (1973), Sharma (1977, 1978, 1981, 1998, 2002, 2007), Murthy (1985, 1994, 2010), Das (1991, 1994, 1996, 1997
a&b, 2003), Tikedar & Sharma (1992), Das & Bauer (2000),
Das & Sengupta (2000), Daniel (2002), Whitaker &
Captain (2004), Gower & Winkler (2007), Manamendra-
Arachchi et al. (2007), Mukherjee and Bhupathy
(2007), Thorpe et. al. (2007), Giri
(2008), Giri & Bauer (2008),
Das & Vijayakumar (2009),
Giri et al. (2009a), Giri et
al. (2009b), Mahony (2009,
2010), Pook et al. (2009),
van Rooijen & Vogel (2009),
Zambre et al. (2009), Haralu
(2010) and Venugopal (2010).
Today, about 518 species of
reptiles which includes three
species of crocodiles, 34
species of turtles and tortoises,
202 species of lizards and 279
species of snakes belonging
to 28 families (Aengals et al.
2011) are found in India. The
poorly resolved taxonomies
among some families (e.g.
Uropeltidae, Agamidae) has
created some confusion in
Indian reptile taxonomy
than in other vertebrates of
the more complex groups
and numerous new species sit
in laboratories/collection
halls awaiting more detailed
studies based on genetic
data. The recent taxonomic
revisions have elevated the
number of endemic uropeltid
species to 47 (based on
morphology). For instance,
David (2003) stated that the
taxonomy of uropeltids is
unstable and is likely to be
substantially revised in future.
For such groups, interspecific
hybridisation could be
very common. Therefore,
according to biological species
concept, the whole group
is to be placed and treated
under a complex species.
Since many subspecies are
not distinct species, they are
reproductively compatible and
will periodically interbreed with
adjacent subspecies. These
breeds pose several problems
to the evolutionary zoologist
and could be misidentified as
a new species adding up to
more confusion. This could
be because the zoologists
confined their studies
mainly to the morphological
characters, ignoring the
detailed analysis of the
interspecific and intergeneric
breeds and most of their
descriptions were based on
single “type” specimens. Members of a subspecies
share a unique geographical
range or habitat, a group
of recognizable genetically
controlled characteristics,
morphological or molecular,
and a unique natural history
as compared to other
subspecies. Accordingly,
those who adhere to purely
morphological species concept
should also refer to the
 genetic characteristics before
assigning anytaxonomicstatus
to the sample. However, bear
in mind that all subspecies
have the potential to suitable
adaptations to their specific
ecological habitat and also
have the potential to evolve
in to a new species.

Principal threats
Habitat alteration is the
major threat. The impacts
on lizards and snakes are
very apparent as they are
terrestrial. Forest species are
more vulnerable due to their
lack of ability to resist the
high temperatures of open
formations. Most common
and widely distributed species
are more resistant, but many
will disappear when their
habitats are totally eliminated.
Moreover, people fear or
dislike snakes; they tend to
be killed whenever they are
seen.

Crocodiles and turtles
are hunted for their meat
and eggs. Construction of
hydroelectric dams alters the
entire habitat in the area of
the reservoir, thus should be
treated as a real local threat.
Even as animals run away,
large numbers are rescued
and dumped in nearby forests,
even though the impacts on
the ecology and biology of the
nearby populations are mostly
unknown as stated by Pavan
(2002). Dams are likely to
cause huge potential impacts
on the reproductive biology
of the turtle and crocodile
populations downstream and
on the population formation
of lizards and snakes even
though these impacts may
not be instantly evident.

The smaller forest reptiles
are very vulnerable to
microclimate changes. Agro-
chemicals are another major
threat and may be especially
serious in small protected
areas surrounded by agricul-
tural land. The long-term
effects of these threats need
to be understood in order to
delineate appropriate conserv-
ation strategies. Therefore,
monitoring of reptile populations is essential in situations such as these.

**Threatened species**

Indian reptiles are a poorly-studied group since information regarding distribution, population dynamics and most of the information available is from only a few well-studied locations. Owing to the widespread destruction of India’s natural vegetation and landscapes, Ramakrishan & Alfred (2006) reported 33 reptile species as threatened category. *Gavialis gangeticus* is critically endangered while the other two crocodile species; *Crocodylus porosus* and *Crocodylus palustris* are threatened. The turtles (*Dermochelys coriacea*, *Dermochelys imbricata*, *Chelonia mydas*, *Lepidochelys olivacea*, *Batagur baska*) are threatened from overexploitation and numerous other threats, such as habitat destruction, predation of its eggs and the slaughter of nesting adults or flesh by man. The monitor lizards are also listed as threatened and vulnerable.

**Conclusion**

Morphology when supplemented with more refined genetic data is essential for a better understanding of the dynamics of population in a highly fragmented habitat. Unfortunately, as of today there is no reported use of extensive genetic studies of Indian reptiles to uncover the divergence patterns of populations currently isolated are of great interest for setting priorities for taxa as well as protected areas.

Many publications claiming to address the conservation of Indian reptiles communicate little or nothing about the usage of molecular techniques with regard to reptile conservation; hence there is a broad lack of genetic data, which could lead to inadequate systematics ending up with taxonomic revision of many taxa. In some ways, the current level of knowledge of reptile population is very significant even though the causes of reptile declines have been made without clear evidence and few suggestions about how to progress. Therefore, the current situation of reptile conservation in India needs special attention with further advanced research. To overcome these problems, the application of molecular data is requisite to explore the accurate species limits. Nearly all known Indian reptiles probably occur in protected areas, even though the mere protection of a single population is obviously insufficient to maintain the genetic variability in the species’ component populations. To improve representation, we need a better understanding of their distributions – strategic field surveys and complete electronic databases with adequate genetic information are vital (Graham et al. 2004) for the conservation future of these animals. Researches should also include finding out the effects of geographic barriers, such as larger rivers, mountains or national highways which could restrict the movements of reptiles between populations, thus preventing any genetic exchange between them. The absence of data is not a firm basis for being indifferent to claims of reptilian declines. One simple response is to call for immediate monitoring programs, but this requires additional consideration of, for example, how monitoring should be undertaken and which species and habitats should be investigated. To begin to address these questions, more fundamental research in reptilian biology is needed. In particular, genetic-based research will improve the knowledge of reptilian biology and will dramatically increase the chances of identifying instances of possible decline that merit dedicated study. Species that have not been reported for many years, often since their initial description, should be the main concern for accurate and precise revisions of conservation-status data. The key in conservation assessment is to find out isolated or patchy populations in order to formulate conservation strategies. Therefore, gaining an understanding of diversity patterns, monitoring the genetic variability of populations in fragments, and comparing them to populations isolated at different times in the
past would be invaluable contributions to conservation of Indian reptiles. Although, it was stated by the great herpetologist Smith (1931) “the herpetological fauna of the country is now well known”, even after three quarters of a century we know little about the patterns and processes responsible for the evolution and differentiation of our reptile fauna. We are still in the exploratory phase in terms of our understanding of India’s reptile diversity, and no area and no taxa should be regarded as having low biological importance without exhaustive inventories and field surveys.

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43(3): 385–393


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The following record is completely accidental and no systemic survey technique or search method was utilized for the same.

The Indian Egg Eater Snake is the only snake of the genus *Elachistodon* recorded in the Indian subcontinent. As the name suggests, its diet primarily consists of eggs though not exclusively (known to eat geckos in captivity) (Gans & Williams 1954). Similar to its African counterpart, a snake belonging to genus *Dyspeltis*, it has elongated inferior processes of the anterior thoracic vertebrae. They are not only coated with enamel, but also penetrate the esophagus, which assists these snakes to break the egg shell inside the throat, and release the protein-rich yolk inside the gut (Boulenger 1890).

Indian Egg Eater Snake was thought to be extinct by Murthy et al. (1993). According to Malcolm Smith et al. about five specimens were recorded until late 1943 from the areas surrounding Jalpaiguri District in northern Bengal Smith (1943). Captain et al. (2005) recorded it for the first time in Wardha District of Maharashtra based on a dead specimen. Thirteen specimens (seven live, six dead) were recorded in and around Amravati District by Nande et al. (2007). Apart from this there have been several unpublished records the snake in certain localities of Vidharbha region of Maharashtra. Raju Vyas also published some photographic records in 2010 of this snake in Gujarat. Considered extremely rare, and from isolated locations (as detailed in Table 1) it was considered as one of the least found snake species on the Indian subcontinent (Khaire 2010). Its behavior and habits are relatively unknown (Dandge 2007), and only its diet and description is available in the existing literature (Khaire 2010).

A snake was rescued late night at around 1100hr in the garden of a house in the locality of Shivaji Nagar, Shegaon, Maharashtra (21°9′43″N & 79°4′47″E) by Karan Thakur of Snake Rescue Volunteers, a local NGO working in the area of study. Being unable to identify the snake on the first instance, it was decided to keep the snake for later identification provisionally being identified as an ‘Indian Egg Eater’ on the basis of descriptive photos given in the Handbook by Khaire (2010). Till then the snake was kept in a plastic translucent box with holes on the lid and adequate hiding was provided. The snake was measured, photographed and the scales counted. The snake was identified as Indian Egg Eater *Elachistodon westermanni* based on the holotype descriptions in the literature (Wall 1913; Gans & Williams 1954; Rosenberg & Gans 1976). For confirmation
the data was sent to Gerard Martin, Bangalore, Varad Giri, Mumbai, and Ashok Captain, Pune. The snake was released in the presence of forest officials as it is under Schedule I of the Wildlife Protection (Act) 1972, Traffic India (2010) in the forested areas close to the rescued location bearing similarities in the habitat.

The detailed description, scale counts and other measurements are tabulated (Table 2).

**Morphological characters**

The specimen has an overall coloration as brown/tan with darker gradient towards the cephalic (head) end (Image 1). The underbelly is white in appearance beginning from about two dorsal scales adjacent to the ventral scales. Dorsally zigzag white cross bands start from the neck becoming white specks from about mid-body (Image 2). There is a continuous vertebral yellow band which is prominent till anterior 1/3rd of the body becoming discontinuous towards the head. Tail is long and shows prehensile ability. The head portion is narrow and indistinct from the neck with small eyes and vertical pupils and a distinct oblique postocular streak. Frontal and parietal scales show black coloration over the brown ground color 95 and 75 % respectively and form a cross like pattern starting from the internasals to the nape of the neck. Horizontal black band starts post ocular and

### Table 1. Locality distribution of *Elachistodon westermanni*.

<table>
<thead>
<tr>
<th>Author</th>
<th>Period</th>
<th>Locality</th>
<th>Dorsal (Midbody)</th>
<th>Ventral</th>
<th>Subcaudal</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Reinhardt</td>
<td>1863</td>
<td>Rangpur, Bangladesh</td>
<td>15</td>
<td>217</td>
<td>59</td>
<td>1 (Holotype)</td>
</tr>
<tr>
<td>2. Blandford</td>
<td>1875</td>
<td>Purnea, Bihar, India</td>
<td>15</td>
<td>208</td>
<td>65 fide Blandford, 63 fide wall (1913)</td>
<td>1</td>
</tr>
<tr>
<td>3. Wall</td>
<td>1913</td>
<td>Near Mal, Jalpaiguri district, West Bengal, India</td>
<td>15</td>
<td>213</td>
<td>62</td>
<td>1</td>
</tr>
<tr>
<td>4. Rosenberg &amp; Gans</td>
<td>1976</td>
<td>Rapli Dun, Chitwan, Nepal</td>
<td>Not noted</td>
<td>210</td>
<td>58</td>
<td>1</td>
</tr>
<tr>
<td>5. Captain, A. et al.</td>
<td>2005</td>
<td>Wardha, Maharashtra, India</td>
<td>15</td>
<td>213</td>
<td>68</td>
<td>1</td>
</tr>
<tr>
<td>6. Nande et al.</td>
<td>2007</td>
<td>Amravati, Maharashtra, India</td>
<td>15</td>
<td>214</td>
<td>69</td>
<td>13 (7 live + 6 dead)</td>
</tr>
<tr>
<td>7. Raju Vyas (Photographic records)</td>
<td>2006-07</td>
<td>Gujarat</td>
<td>Not noted</td>
<td>Not noted</td>
<td>Not noted</td>
<td>4 (3 live + 1 dead)</td>
</tr>
<tr>
<td>8. Balu Deshmukh</td>
<td>Unpublished</td>
<td>Akola, Maharashtra</td>
<td>Not noted</td>
<td>Not noted</td>
<td>Not noted</td>
<td>2</td>
</tr>
<tr>
<td>9. Gajendra Surkar</td>
<td>Unpublished</td>
<td>Wardha</td>
<td>Not noted</td>
<td>Not noted</td>
<td>Not noted</td>
<td>2</td>
</tr>
<tr>
<td>10. Abhishek Narayanan (Current Work)</td>
<td>2010</td>
<td>Shegaon, Maharashtra, India</td>
<td>15</td>
<td>210</td>
<td>56</td>
<td>1</td>
</tr>
</tbody>
</table>
its neck and lift its upper body off the ground ready to strike (characteristic ‘S’ shaped position) (Image 4). (Like Trinket snakes and cat snakes). But became very calm when handled off ground.

Inference: The snake has been previously recorded from Man Khettra, Junagarh District; Sasan-Gir and Surat in Gujarat followed by Amravati and Wardha districts in Maharashtra. This current record thus fills in the gap in the distribution from the south-western borders of Gujarat to north-eastern borders of Maharashtra comprised of Saurashtra region, around Vadodara District in East Gujarat, South Gujarat and entire stretch of Vidharbha Region. This land is

<table>
<thead>
<tr>
<th>Number of ventrals</th>
<th>210</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of subcaudals</td>
<td>56 pairs</td>
</tr>
<tr>
<td>Number of dorsals 1 head-length behind the head</td>
<td>19</td>
</tr>
<tr>
<td>Number of dorsals at the position of the middle ventral</td>
<td>15</td>
</tr>
<tr>
<td>Number of dorsals 1 head-length before the tail</td>
<td>19</td>
</tr>
</tbody>
</table>

Behavior observations (in controlled environment)

The snake was rescued at night, when it was lying on wet mud motionless outside in the garden of a house. It acted aggressively when the rescuers approached it.

It was able to move on the ground slowly with a serpentine (S-Shaped) movement (Image 3). For an aggressive display it has the ability to flatten

Table 2. Scalation data of *Elachistodon westermanni*

<table>
<thead>
<tr>
<th>No. Characters</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mental</td>
<td>Single</td>
</tr>
<tr>
<td>Internasals</td>
<td>1 Pair</td>
</tr>
<tr>
<td>Prefrontals</td>
<td>1 Pair</td>
</tr>
<tr>
<td>Frontal</td>
<td>Single</td>
</tr>
<tr>
<td>Parietals</td>
<td>1 Pair</td>
</tr>
<tr>
<td>Anterior temporals</td>
<td>2 Pair</td>
</tr>
<tr>
<td>Posterior temporals</td>
<td>2 Pairs</td>
</tr>
<tr>
<td>Nasal / Supranasal-postnasal</td>
<td>1 Pair</td>
</tr>
<tr>
<td>Loreals</td>
<td>1 Pair</td>
</tr>
<tr>
<td>Preocular</td>
<td>1 Pair</td>
</tr>
<tr>
<td>Postocular</td>
<td>2 Pair</td>
</tr>
<tr>
<td>Supraocular</td>
<td>1 Pair</td>
</tr>
<tr>
<td>Supralabials</td>
<td>7 pairs</td>
</tr>
<tr>
<td>Infralabials</td>
<td>6 Pairs</td>
</tr>
</tbody>
</table>
a semi-arid zone and similar to the locality descriptions for the holotypes. With wide distribution pattern and habitat variability, this snake is important to be studied for adaptation capabilities and evolutionary changes and microhabitat preference.

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Acknowledgement

Heartiest gratitude to Gerry Martin and Varad Giri for the constant support and encouragement. Thanks to Ashok Captain for timely help and suggestions on the record. Karan Thakur and Deepak Sharma from Snake Rescue Volunteers, Shegaon for giving a once in a lifetime opportunity to see and record this enigmatic snake.
Ecological studies on python have showed that they feed on a variety of animals including frogs, rodents, wild cats, peafowl and ungulates like Barking Deer, Chinkara and Spotted Deer (Daniel 1983)

There have been several cases where python death occurred due to movement of the prey in the gut region due to suffocation or the body is pierced by horns and antlers (Sharma 2004)

We observed one such incidence in the Chilla range of Rajaji National Park, Uttarakhand in July 2011. I was working on a summer training project on monitoring of mammals in the mentioned study area under the supervision of Dr. Bivash Pandav (Wildlife Institute of India). On the morning of 02 July 2011 we were on our way to check the results of a camera trap device that we had placed in the Gara-Amgadi region of the park for monitoring leopards and tigers. There was some strange stench in the area and following the source of the smell, we observed a pair of antlers in the nearby bushes. On moving closer to the site we saw a dead python, with an approximate length of 3.5–4 m and a dead adult male Spotted Deer (Image 1). The male Spotted Deer had been killed by the python, but was swallowed partially till the neck region (Images 2–3). The antler and the jaw bones of the Spotted Deer could be seen as they had pierced the body (posterior oral region) of the python.

We suspect that the python must have tried to swallow its prey, but maybe as a result of...
a sudden sideways movement to facilitate swallowing or a sudden injury by the rock present beside the body of the python, the antlers and the jaws must have pierced through the body (Image 4). The oral cavity of the python was left wide open as the head region of the deer was found entangled in the oral region of the python (Image 5). The incident must be a day or two old as beetles and flies had already started scavenging and decay of several body parts was prominent.

References


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Herpetofauna of the Vidyanagari campus of the University of Mumbai, Maharashtra

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Mumbai (formerly known as Bombay), considered to be the economical capital of India, is a unique city where two kinds of jungles – a concrete jungle and a real forest co-exist with each other. Despite the increasing habitat destruction resulting from mounting population in the city of Mumbai, it still has rich biodiversity. Mumbai’s biodiversity is a product of confluence of Arabian Sea to the west and the Western Ghats to the east.

Vidyanagari campus of University of Mumbai (19°04’18.5”N & 72°51’21.5”E) is situated at Kalina, Santacruz which is a central suburb of Mumbai City having an area of 230 acres. In spite of the number of development and construction activities going on in the University campus, it still possesses a good vegetation cover providing habitat for a variety of fauna. Although a few attempts have been made by Jadhav et al. (2007) and Upadhye et al. (2008) to study floral and avifaunal diversity of the campus, respectively, there is absolutely no scientific report focusing exclusively on herpetofaunal diversity of the campus. Considering the ecological importance of herpetofauna, the present study was undertaken.

Methods
The study was carried out for a total duration of 24 months from May 2008 to April 2010. Amphibians and reptiles encountered during extensive field trips were captured, photographed (whenever possible) and carefully identified with the help of field guides (Daniel, 1983; Das 2002; Whitaker & Captain 2004) before release. Snakes were identified using scale count as described by Smith (1943) and Daniel (1983). Nomenclature adopted here is as given by Das (1994) and Dutta (1997) for reptiles and amphibians, respectively. Venomous snakes were released away from the human settlements at the outskirts of the campus where there is vast, unused land with thick vegetation. Record of specimens killed under vehicles and by humans was also made. The status of each species was observed in four categories on the basis of total number of each species encountered or sighted during the entire survey. The category values were: rare (1–4), uncommon (5–14), common (15–29) and abundant (greater than 29).

Results
Amphibians: Six species of amphibians were recorded at the campus during the study period. Only three specimens of Narrow-mouthed Frog were spotted during the study while the Common Indian Toad Duttaphrynus melanostictus and Skittering Frog Euphlyctis cyanophlyctis were abundantly seen and remaining three species of amphibians (one species of toad and two of frogs) were common (Table 1). The Common Indian Toads were frequently found hiding under the platforms in classrooms.

Reptiles: The status of the 21 species of reptiles belonging to 17 genera and

<table>
<thead>
<tr>
<th>Family</th>
<th>Common Name</th>
<th>Scientific name</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bufonidae</td>
<td>Common Indian Toad</td>
<td>Duttaphrynus melanostictus</td>
<td>Abundant</td>
</tr>
<tr>
<td></td>
<td>Marbled Toad</td>
<td>Duttaphrynus atomisticus</td>
<td>Common</td>
</tr>
<tr>
<td>Microhylidae</td>
<td>Narrow-mouthed Frog</td>
<td>Microhyla ornata</td>
<td>Rare</td>
</tr>
<tr>
<td>Dicroglossidae</td>
<td>Indian Cricket Frog</td>
<td>Fejervarva limnocharis</td>
<td>Common</td>
</tr>
<tr>
<td></td>
<td>Skittering Frog</td>
<td>Euphlyctis cyclophlyctis</td>
<td>Abundant</td>
</tr>
<tr>
<td></td>
<td>Indian Bull Frog</td>
<td>Hoplobatrachus tigrinus</td>
<td>Common</td>
</tr>
</tbody>
</table>

Table 1. Systematic List of amphibians of the Mumbai University campus
eight families recorded from Mumbai University campus is provided in Table 2.

Five species of the family Gekkonidae, two species of Agamidae and a species of Scincidae lizards were observed at the campus. Northern House, Northern Spotted Geckos and Southern House Geckos along with Indian Garden Lizard were observed in abundance at the campus while the Bark Gecko Hemidactylus leschenaulti was rarely spotted. Common skinks or Keeled Grass Skinks Eutropis carinata were observed in great numbers especially in early mornings under the rocks and leaf litter. A specimen was rescued from a classroom located on the third floor of the Department of Life Sciences.

Two gravid female specimens of Indian Flapshell Turtle Lissemys punctata were rescued from the road bordering the vast marshy wetlands in the monsoon, which may have come accidentally onto the road (on land) for laying eggs. They were released safely back into the adjacent riverine habitat.

Among the 12 species of snakes recorded on the campus, nine were found to belong to the family Colubridae, out of which only one was semi-venomous and the rest were non-venomous. Rat Snake, Checkered Keelback and Buff-striped Keelback were seen abundantly on the campus. Buff-striped Keelbacks were seen in great numbers in monsoon season as they gathered for mating. Checkered Keelbacks were sighted near the pond and in the canals of the campus, mainly near water resources. A number of non-venomous Rat Snakes were rescued from the academic buildings during the study and released. The longest specimen measured just over 2.4m. Rat Snakes were also found to be killed by grass cutters in the campus as these are commonly mistaken for the venomous Spectacled Cobra. Even though, two of the big fours in India—Russell’s Viper and Spectacled Cobra—were found to be quite common at the campus, fortunately no human bite cases have been recorded.

Table 2. Systematic List of reptiles of the Mumbai University campus

<table>
<thead>
<tr>
<th>Family</th>
<th>Common name</th>
<th>Scientific name</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trionychidae</td>
<td>Indian Flapshell Turtle</td>
<td>Lissemys punctata</td>
<td>Rare</td>
</tr>
<tr>
<td>Gekkonidae</td>
<td>Northern House Gecko</td>
<td>Hemidactylus flaviviridis</td>
<td>Abundant</td>
</tr>
<tr>
<td></td>
<td>Southern House Gecko</td>
<td>Hemidactylus frenatus</td>
<td>Abundant</td>
</tr>
<tr>
<td></td>
<td>Brook’s House Gecko</td>
<td>Hemidactylus brookii</td>
<td>Common</td>
</tr>
<tr>
<td></td>
<td>Rock or Northern Spotted</td>
<td>Hemidactylus maculates</td>
<td>Abundant</td>
</tr>
<tr>
<td></td>
<td>Bark Gecko</td>
<td>Hemidactylus leschenaulti</td>
<td>Rare</td>
</tr>
<tr>
<td>Agamidae</td>
<td>Indian Garden Lizard</td>
<td>Calotes versicolor</td>
<td>Abundant</td>
</tr>
<tr>
<td></td>
<td>Fan-throated Lizard</td>
<td>Sitana ponticeriana</td>
<td>Common</td>
</tr>
<tr>
<td>Scincidae</td>
<td>Common Skink</td>
<td>Eutropis carinata</td>
<td>Abundant</td>
</tr>
<tr>
<td>Boidae</td>
<td>Common Sand Boa</td>
<td>Gongylphis conicus*</td>
<td>Common</td>
</tr>
<tr>
<td>Colubridae</td>
<td>Common Vine Snake</td>
<td>Ahaetulla nasutus*</td>
<td>Rare</td>
</tr>
<tr>
<td></td>
<td>Buff-striped Keelback</td>
<td>Amphisema stolata*</td>
<td>Abundant</td>
</tr>
<tr>
<td></td>
<td>Checkered Keelback</td>
<td>Xenochropis piscator*</td>
<td>Abundant</td>
</tr>
<tr>
<td></td>
<td>Rat Snake</td>
<td>Ptyas mucosus*</td>
<td>Abundant</td>
</tr>
<tr>
<td></td>
<td>Green Keelback</td>
<td>Macropisthodon plumbicolor*</td>
<td>Uncommon</td>
</tr>
<tr>
<td></td>
<td>Common Wolf Snake</td>
<td>Lycodon aulicus*</td>
<td>Common</td>
</tr>
<tr>
<td></td>
<td>Banded Racer</td>
<td>Argyrogena fasicoliat*</td>
<td>Uncommon</td>
</tr>
<tr>
<td></td>
<td>Common Bronze-back Tree</td>
<td>Dendrelaphis tristis*</td>
<td>Rare</td>
</tr>
<tr>
<td></td>
<td>Snake</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Banded Kukri Snake</td>
<td>Oligodon armensis*</td>
<td>Common</td>
</tr>
<tr>
<td>Elapidae</td>
<td>Spectacled Cobra</td>
<td>Naja naja**</td>
<td>Common</td>
</tr>
<tr>
<td>Viperidae</td>
<td>Indian Russell’s Viper</td>
<td>Daboia russelli **</td>
<td>Common</td>
</tr>
</tbody>
</table>

* - Non-venomous; ** - Venomous
Discussion

The present results indicate that Vidyanagari campus of Mumbai University is considerably richer in terms of its herpetofaunal diversity when compared to observations made by Wadatkar (2004) in the campus of University of Amravati. The investigator reported 12 species of snakes, two species of geckos, three species of skinks and one species of Calotes in his study. These observations are significantly important when considering the fact that unlike that of Vidyanagari campus of Mumbai University the Amravati University campus is covered by hilly forested area and
therefore, ideally expected to be richer in herpetofauna. However, Bengal Monitor *Varanus bengalensis* which was reported to be common at Amravati campus was found to be totally absent at Mumbai University campus.

The significance of herpetofauna in ecology needs no emphasis. The insect populations are regulated by amphibians such as toads and frogs along with reptiles like lizards and skinks. Snakes are of tremendous importance in the food chain as they keep the population of rats and mice under check.

Nowadays, biodiversity in urban areas is threatened by urbanization, pollution, habitat destruction, climate change, introduction of alien species and extinction cascade where extinction of one species causes extinction of other (Jadhav et al. 2007). The rich herpetofaunal diversity observed in the present survey could be attributed to the suitable habitats such as gardens, marshy wetlands, grasslands, ponds, canals and to the presence of variety of plant types like herbs, shrubs, trees, bamboos etc. (over 292 plant species: Jadhav et al. 2007) in the University campus providing shelter and food for a vast array of species. The need for green spaces like Vidyanagari campus which provides a safe haven for various species cannot be overemphasized. The present study which is the first ever study of herpetofauna of the campus,
is hoped to be useful for the scientific community, students and to the teaching and non-teaching staff of the campus to add to the present knowledge. Awareness lectures are being arranged at the campus for a better consciousness about herpetofauna and for requesting people not to kill herpetofauna, especially snakes.

References

Daniel, J.C. (1983), The Book of Indian Reptiles. Bombay Natural History Society,


Acknowledgment
Authors would like to express their sincere thanks to Prof. S. V. Deshmukh, former Head, University Department of Life Sciences for his cooperation and encouragement. Thanks are also due to Varun Torsekar, Research Scholar, Indian Institute of Sciences, Bangalore for his support.
Herpetofaunal diversity in and around the selected man-made wetlands of central and northern Gujarat, India

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2 AINP on Agricultural Ornithology, 3 AICRP on Biological Control of Crop Pests and Weeds, Anand Agricultural University, Anand, Gujarat 388110, India
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Water is the fundamental need of all living organisms. Without water, life is impossible. Depending on the type of wetland, many species of life forms i.e. high biological diversity is found in and around them. Wetlands are classified on the basis of quality and quantity of the water. The lack of easy availability of this liquid gold i.e. water, either in terms of quality or the quantity or both parameters, has led us (human beings) to search other alternatives to fulfill our water requirements.

Presently, it has been noted that the species diversity of inland water ecosystems is most threatened and in many parts of the world, it is in continuous and accelerating decline (MEA 2006). In India, as elsewhere in the world, freshwater and freshwater-dependent ecosystems provide a range of ecological services for humans like drinking water, fish, flood protection and wildlife (Postel 1998; Revenga & Kura 2003). As population and associated water demands increase, balancing the requirement between the aquatic environment and developmental needs is becoming critical in many of the world’s river basins, India being no exception (WII 2010).

To fulfill our basic needs and requirements, we develop or construct a new water body, either as a dam on river systems, or as rainwater collected in artificial earthen depressions or by creating water reservoirs or by other alternatives like the use of ground water by constructing wells, hand pumps and other such extraction mechanisms. Such kind of man-made water bodies are the results of alteration of a large area of habitat; either the forestlands or scrublands getting submerged in water. These kinds of water bodies support many types of biodiversity. We know the irrigation and agricultural values, but are still ignorant about the types of biodiversity actually/directly supported by such kind of man-made water bodies.

Therefore, we explored five representative man-made water bodies in central and northern Gujarat, with a view to prepare an inventory of biodiversity, especially herpetofauna found in and around the man-made water bodies. We have also tried to assess the true significance of the water bodies other than the agricultural importance.

Objectives

The study was carried out with the following objectives, (i) To collect the base line information of reptiles and amphibians in and around the water bodies, (ii) To study the status of herpetofauna from these areas, (iii) To know the importance of such kind of water bodies from the viewpoint of biodiversity conservation, (iv) To suggest multipurpose management for versatile use without the violation of original objectives and purpose of the water bodies.

Study area

There are various sizes of man-made water bodies available in various biodiversity zones. It is also found that they are either surrounded with agricultural fields or share boundaries with protected areas of the state. Therefore, the study was conducted in five man-made water bodies, namely: (i) Hathmati dam, (ii) Dantiwada dam, (iii) Deo dam, (iv) Kanewal water tank and (v) Pariej water tank (Fig. 1).

The first three water bodies are “dam” type water bodies and are built on river systems, namely Hathmati...
River, Banas River and Dev-Dhadhar River, respectively and the remaining two water bodies; Kanewal and Pariej are “water tank” type water bodies and are filled by the waters of Mahi and Narmada irrigation canals of Vanakbori Dam and Sardar Sarovar (Narmada Dam). First three water bodies are for irrigation purpose, whereas the waters of Kanewal and Pariej water tanks are utilized for irrigational purpose and as drinking water by the surrounding towns and villages. The topographic, salient features and other relevant details of the water bodies are mentioned in Table 1.

Methods

All these five water bodies were surveyed in various seasons, during 2004 and 2005. A total of 30 field days were spent for the study, to find out the estimate of species of amphibian and reptiles surviving in and around these water bodies. This is considering the area around the water body as '500m area from the demarcation of high water marks of the particular water body'.

Each one of the identified water bodies was surveyed through a rapid survey and various potential areas were selected surrounding the water bodies for the aspect of availability of amphibians and reptilian species. These habitats were intensively explored (especially microhabitats) through repeated visits in various seasons.

During the study, all the important species have been documented through the colored photographs and as and when close examination was required, the animals were caught with various known methods of catching amphibians and reptiles. All caught animals were released in the same habitat after recording the necessary data.

All collected specimens were examined and carefully identified by using the diagnostic keys, given by Smith (1935, 1943) and Daniel (1963a, 1963b and 1975) & Daniels (1997) and nomenclatures adopted here are those of Das (1994 & 2003), Dutta (1997) and Frost et al. (2006) for reptiles and amphibians, respectively.

Field surveys: (a) visual encounter surveys, (b) watching aquatic reptilian species through the field binoculars (10x50), and (c) recording the species through indirect evidences like shell, molt/moult and sound. In addition, secondary information was
gathered from local people of surrounding villages, staff of forest department and irrigation department. Other wildlife enthusiasts were also inquired about the presence of different species of amphibians and reptiles by showing the colour pictures of the species.

Results and Discussion

During the study period, we were able to collect information about the availability of nine species of amphibians belonging to four families (Table 2) and 25 species of reptiles belonging to 14 families (Table 3) from in and around the earlier mentioned five water bodies of Gujarat State. Of which, nine species are toads and frogs, one species of crocodile, two species of turtles, twelve species of lizards and ten species of snakes. The record of availability of herpetofauna at each water body shows that the highest number of amphibians and reptilian species were recorded from Deo dam and the lowest number was recorded from Pariej water tank (Fig. 2).

Out of the total 34 species of amphibians and reptiles, 17 species were recorded from all five wetlands, including four species of anuran-amphibians (one species of toad and three species of frogs) and 13 species of reptiles (one species of turtle, seven species of lizards and five species of snakes).

The Common Indian Tree Frog *Polypedates maculatus*

<table>
<thead>
<tr>
<th>Common name (Scientific name)</th>
<th>Hathmati</th>
<th>Dantiwada</th>
<th>Deo</th>
<th>Pariej</th>
<th>Kanewal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bufonidae</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Common Asian Toad (<em>Duttaphrynus melanostictus</em>)</td>
<td><em>P</em></td>
<td><em>P</em></td>
<td><em>P</em></td>
<td><em>P</em></td>
<td><em>P</em></td>
</tr>
<tr>
<td>Marbled Toad (<em>Duttaphrynus stomaticus</em>)</td>
<td><em>P</em></td>
<td><em>P</em></td>
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<tr>
<td>Microhylidae</td>
<td></td>
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<tr>
<td>Ornate Narrow-mouthed Frog (<em>Microhyla ornata</em>)</td>
<td><em>P</em></td>
<td><em>P</em></td>
<td><em>P</em></td>
<td></td>
<td><em>P</em></td>
</tr>
<tr>
<td>Marbled Balloon Frog (<em>Uperodon systoma</em>)</td>
<td></td>
<td><em>P</em></td>
<td><em>P</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dicroglossidae</td>
<td></td>
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</tr>
<tr>
<td>Indian Skipping Frog (<em>Euphlyctis cyanophlyctis</em>)</td>
<td><em>P</em></td>
<td><em>P</em></td>
<td><em>P</em></td>
<td><em>P</em></td>
<td><em>P</em></td>
</tr>
<tr>
<td>Indian Bull Frog (<em>Hoplobatrachus tigrinus</em>)</td>
<td><em>P</em></td>
<td><em>P</em></td>
<td><em>P</em></td>
<td><em>P</em></td>
<td><em>P</em></td>
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<tr>
<td>Cricket Frog (<em>Fejervarya limnocheris</em>)</td>
<td><em>P</em></td>
<td><em>P</em></td>
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<td><em>P</em></td>
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<tr>
<td>Short-headed Burrowing Frog (<em>Sphaerotheca breviceps</em>)</td>
<td><em>P</em></td>
<td><em>P</em></td>
<td><em>P</em></td>
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<tr>
<td>Rhacophoridae</td>
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<tr>
<td>Indian Tree Frog (<em>Polypedates maculatus</em>)</td>
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</tr>
</tbody>
</table>

Table 2. Systematic list of amphibians species recorded in and around Hathmati dam, Dantiwad dam, Deo dam, Pariej water tank and Kanewal water tank, Gujarat State, India

Table 1. Salient features of the water bodies from study area at Gujarat State, India
and Crocodile Mugger *Crocodylus palustris* were recorded only at Deo dam, while Lacertidae lizards Snake-eyed Lacerta *Ophisops jerdonii* and Indian Fringe-toed Lizard *Acanthodactylus cantoris* were found only at Dantiwada dam. The Common Indian Wolf Snake *Lycodon aulicus* was recorded at Kanewal water tank only.

Present study indicates a good amphibian and reptilian diversity supported by man-made water bodies. The amphibian and reptilian diversity is dependant on the surrounding habitat of these water bodies. The highest diversity was recorded at Deo and Dantiwada dams because both the water bodies are situated very close to the protected areas and in river basin areas which included agricultural fields also. Whereas, lower diversity was recorded at Kanewal and Pariej water tanks because both the wetlands are situated on the plains with earthen bunds on their periphery and are surrounded by agricultural fields. These two wetlands are far away from the forests and protected areas.

Here, we come across a valuable suggestion after the present study that Gujarat State has over 300 man-made water bodies ranging from small to large sizes. The concerned criteria for further actions should not only be the utility of the water and the size of these reservoirs but also the overall biodiversity existent in and around the water body. Our experience with the department of irrigation suggests that they consider a solitary point of view and that point is the
Table 3. Systematic list of reptilian species recorded in and around five man-made water bodies of Gujarat State, India

<table>
<thead>
<tr>
<th>Common name (Scientific name)</th>
<th>Hathmati</th>
<th>Dantiwada</th>
<th>Deo</th>
<th>Pariej</th>
<th>Kanewal</th>
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<tbody>
<tr>
<td><strong>Crocodilidae</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>1 Mugger (Crocodylus palustris)</td>
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<td>P</td>
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</tr>
<tr>
<td><strong>Trinychidae</strong></td>
<td></td>
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<td></td>
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<tr>
<td>2 Indian Softshell Turtle (Nilssonia gangeticus)</td>
<td>-</td>
<td>P</td>
<td>P</td>
<td>-</td>
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</tr>
<tr>
<td>3 Indian Flapshell Turtle (Lissemys punctata)</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td><strong>Gekkonidae</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>4 Brook’s House Gecko (Hemidactylus brookii)</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>5 Yellow-green House Gecko (Hemidactylus flaviviridis)</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>6 Bark Gecko (Hemidactylus leschenulitii)</td>
<td>-</td>
<td>P</td>
<td>P</td>
<td>-</td>
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</tr>
<tr>
<td><strong>Agamidae</strong></td>
<td></td>
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<tr>
<td>7 Garden Lizard (Calotes versicolor)</td>
<td>P</td>
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<td>P</td>
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<td>P</td>
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<tr>
<td>8 Fan-throated Lizard (Sitana ponticeriana)</td>
<td>P</td>
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<tr>
<td><strong>Chamaeleonidae</strong></td>
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<tr>
<td>9 Indian Chamaeleon (Chamaeleo zeylanicus)</td>
<td>-</td>
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<tr>
<td><strong>Scincidae</strong></td>
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<tr>
<td>10 Spotted Supple Skink (Lygosoma puncatus)</td>
<td>P</td>
<td>P</td>
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</tr>
<tr>
<td>11 Common Keeled Grass Skink (Eutrophis carinata) (Image 1)</td>
<td>P</td>
<td>P</td>
<td>P</td>
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<td>P</td>
</tr>
<tr>
<td>12 Striped Grass Skink (Eutrophis macularius)</td>
<td>P</td>
<td>P</td>
<td>P</td>
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</tr>
<tr>
<td><strong>Lacertidae</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>13 Snake-eyed Lacerta (Ophisops jerdonii)</td>
<td>-</td>
<td>P</td>
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<td>-</td>
</tr>
<tr>
<td>14 Indian Fringe-toed Lizard (Acanthodactylus cantoris)</td>
<td>-</td>
<td>P</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Varanidae</strong></td>
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<tr>
<td>15 Bengal Monitor (Varanus bengalensis)</td>
<td>P</td>
<td>P</td>
<td>P</td>
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<tr>
<td><strong>Typhlopidae</strong></td>
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<tr>
<td>16 Brahminy Worm Snake (Ramphotyphlops braminus)</td>
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<td>P</td>
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<tr>
<td><strong>Boidae</strong></td>
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<tr>
<td>17 Common Sand Boa (Ganglyphphis conica)</td>
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<td>P</td>
<td>P</td>
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<tr>
<td>18 Common Red Sand Boa (Eryx johnii)</td>
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<td>P</td>
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<tr>
<td><strong>Pythonidae</strong></td>
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<tr>
<td>19 Indian Rock Python (Python molurus)</td>
<td>Report</td>
<td>P</td>
<td>P</td>
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<td><strong>Colubridae</strong></td>
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<tr>
<td>20 Common Wolf Snake (Lycodon aulicus)</td>
<td>P</td>
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<tr>
<td>21 Indian Rat Snake (Ptyas mucosus)</td>
<td>P</td>
<td>P</td>
<td>P</td>
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<tr>
<td>22 Checkered keel-back Water Snake ( Xenochrophis piscator)</td>
<td>P</td>
<td>P</td>
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<td><strong>Elapidae</strong></td>
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<td>23 Spectacled Cobra (Naja naja)</td>
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<td><strong>Viperidae</strong></td>
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<td>24 Saw-scaled Viper (Echis carinatus)</td>
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<tr>
<td>25 Russell’s Viper (Daboia russelli)</td>
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<td><strong>Total</strong></td>
<td>15</td>
<td>22</td>
<td>22</td>
<td>14</td>
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</table>

P - presence; * - past record
agricultural requirement for the management of man-made water bodies.

References


Acknowledgements

We are thankful to the Gujarat State Forest Department for financial support through an ad hoc project on the wetlands. We (BMP and JJJ) are also thankful to Officer-in-Charge, Biological Control Research Laboratory, Anand Agricultural University for encouragement.
A Malabar Pit Viper, *Trimeresurus malabaricus* (Jerdon, 1854) morph from the southern Western Ghats

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The Malabar Pit Viper, *Trimeresurus malabaricus* (Jerdon, 1854) is a medium-sized snake, endemic to the tropical rainforests of the Western Ghats occurring between 123m and 2134m above sea level on bushes, trees and rocks, often in close proximity to forest streams (Whitaker & Captain 2008; Sawant et al. 2010). Being polymorphic, the basic colour profile of a Malabar Pit Viper varies between green, olive, brown, yellow, blue, reddish-brown and maroon, speckled with black and brown spots which may form a zigzag pattern (Whitaker & Captain 2008). In this note we describe the sighting of a morph of *T. malabaricus* from the semi-evergreen forests of the Vazhachal Forest Division (10°19’48.5”N & 76°40’8.4”E) in the Kerala region of Western Ghats.

Our sighting was made at an elevation of 694m, and the viper was found resting on a dry twig, 9cm from the forest floor, with relatively little undergrowth, beside a forest path at 1650hr on 15th January 2011. The specimen was orange yellow in color and was without the typical brown or black spots on the body, characteristic of the other morphs (Whitaker & Captain 2008). In this specimen, the prominent spots were replaced by a darker orange tone forming a zigzag pattern identical to the other variations. The
coloration on the head was uniform and without the usual speckled appearance (Images 1 & 2). The individual was identified as *T. malabaricus* by its large and distinct triangular head, weak keels on dorsal scales, 19 dorsal scales at mid-body, nine supralabials and 11 infralabials.

Many vipers in India like the Saw-scaled Viper *Echis carinatus*, Hump-nosed Pit Viper *Hypnale hypnale*, Cantor’s Pit Viper *Trimeresurus cantor*, and Malabar Pit Viper exhibit polymorphism (Whitaker & Captain 2008). The reason for polymorphism, however, has not been investigated in any of these species. Pit vipers from the Goa region of the Western Ghats have been suggested to be habitat specific, their distribution being affected by seasonal changes in temperature and humidity (Sawant et al. 2010). If this distribution is unaffected by detectability of the species due to seasonal difference, polymorphism exhibited by the Malabar Pit Viper may not be due to thermoregulation but rather for camouflage. Additional factors such as locality (see Kark et al. 1997) and wider habitat use (Sawant et al. 2010) may also influence polymorphism.

**References**


**Acknowledgements**

The first author would like to thank Romulus Whitaker for confirming the identity of the specimen, the Zoological Society of London for financial support under the Erasmus Barlow Expedition Grant and the Department of Forest and Wildlife, Government of Kerala for the research permits (WL12-7326/2010).
The King Cobra *Ophiophagus hannah* Cantor, 1836, is the largest venomous snake in the world, reaching a length of up to 5.85m (Aagaard 1924). Although not a common snake, the species has a wide distribution (David & Vogel 1996). This monotypic genus of the family Elapidae is considered as a species complex by Das (2002), as the species varies in coloration, scalation and body proportion throughout its range.

In India, the distribution range of the species is recorded as Western Ghats, Uttar Pradesh (Terai), Bihar, Orissa, West Bengal, northeastern India and also the Andaman Islands (Whitaker & Captain 2004). In its distributional range, the species is recorded from various habitat types such as lowland, wet tropical forest, coastal rainforest, tropical and subtropical wet montane forest, dry forest, swamps and marshes, open scrubland, plantation and cultivated areas, alluvial and terai grassland, mangrove swamps, open country and disturbed areas, and near human habitations (Narayan & Rosalind 1989; David & Vogel 1996; Selich & Késtle 2002; Leviton et al. 2003). The King Cobra is listed under Schedule II of the Indian Wildlife (Protection) Act, 1972; Appendix II of CITES; and in the Vulnerable category by IUCN (2010) which also recommends research into, and monitoring of the population status of this species to gain a better understanding of how the population responds to threats and conservation.

In the present paper, we report the sightings of *Ophiophagus hannah* from different locations in the northern coastal Andhra Pradesh region (18°12’10.83” & 83°04’30.95” to 18°48’38.31”N & 83°48’52.44”N approximately) over the last few years (Image 1). Two large male King Cobras were even killed by locals on two separate occasions in this region which encompasses three districts of Srikakulam, Vizianagaram and Visakhapatnam respectively. A 4.26m long male King Cobra (Images 2 & 3) was spotted dead by volunteers of Green Mercy (an NGO working for wildlife conservation in the three districts) on 28th July 2009, at Sitampeta forest area 18°40’33.96”N & 83°48’27.11”E in Srikakulam (Murthy & Murthy 2010). The dead King Cobra weighed about 6.5kg and as the specimen was decomposing.
fast, it was carried to a nearby science college and preserved in 10% formalin solution. On enquiring, it was learnt that the snake was killed by people from surrounding villages. In another incident, a 3.84m long male King Cobra weighing 5.7kg was stoned to death by locals (Images 4 & 5) at Kapusompuram, a small village near S. Kota Town 18°06′57.67″N & 83°04′35.23″E. This incident took place on 30 October 2010. King Cobras have been sighted here by locals, forest department personnel and members of Green Mercy Organization in the recent past.

The geographic region of north Coastal Andhra has varied habitats ranging from coasts to dry, thorny, scrub to dry, deciduous forests and sal forests. Small pockets of semi-evergreen and moist deciduous forests do exist in Makkuvu, Duggeru and Salur forest blocks of Vizianagaram Division. This division occupies a very strategic position owing to the fact that many wild animals including elephants wander into this district from the adjacent state of Orissa on a regular basis. There are unconfirmed occasional sightings of King Cobras by locals from this region and also few other locations in Srikakulam and Visakhapatnam divisions as well. Direct evidence like actual sightings, killings by humans as well as indirect evidence in the form of shed skins, skeletal remains, tracks, and deserted leaf nests clearly suggests the occurrence of the species in this region. Furthermore, there have been reports in the local electronic and print media about sightings and killings of King Cobras with visuals. The species was also sighted by locals near Sunnapu Gedda Waterfalls in the adjoining Sitampet mandal of Srikakulam District which lies at Andhra-Orissa border (K.V. Ramana Murthy, Green Mercy, 25-08-2010 pers. comm.).

There is an apparent dearth of information regarding the exact distributional status of the species in northern coastal Andhra Pradesh due
to paucity of herpetological surveys. Invariably, it is a serious impediment for chalking out conservation management strategies. Lack of awareness and prevalent myths lead to unnecessary killing of these majestic serpents. Perhaps, habitat destruction, poaching and redundant killings by locals are taking a heavy toll on the resident King Cobra population. Developing inter-linking corridors between forest areas i.e., from S.Kota – Araku-Salur – Duggeru– Parvathipuram and Sitampeta regions could be useful for the long-term survival of King Cobra populations in Andhra Pradesh. Therefore, we recommend that immediate intensive surveys be carried out in all the three districts of northern Coastal Andhra Pradesh. Awareness programmes for local communities should be carried out to educate them about the ecological significance of the species and their conservation importance.

References


Leviton, A.E., G.O.U. Wogan, M.S. Koo, G.R. Zug, R.S.


Acknowledgements

This self-funded survey is an off-shoot of Green Mercy Organisation’s Conservation Programme to save snake fauna in Srikakulam and Vizianagaram districts. We are grateful to the field staff of Forest Department of all the three districts for their vital inputs and members of Green Mercy who have been very instrumental in data collection. We would like to express our heartfelt thanks to Mr. P. Gowri Shankar of Agumbe Rainforest Research Station for his valuable inputs on the manuscript.
The Kerala Agricultural University (KAU) main campus is located at Vellanikkara, Thrissur District, Kerala (Fig. 1 & Image 1). The campus has a total area of 391.44ha having garden lands, botanical garden, plantations of Coconut Cocos nucifera, Rubber Hevea braziliensis, Areca nut Areca catechu, Cocoa Theobroma cacao, Plantain Musa paradisiaca, and orchards of Mango Mangifera indica, Jack Artocarpus heterophyllus, Sapota Manilkara acharas and Guava Psidium guajava and Fodder Grasses Pennisetum pedicellatum. The KAU campus is very near to the Peechi-Vazhani Wildlife Sanctuary, Western Ghats, the aerial distance of which is not more than 4–5 km. KAU campus is located south of the Palghat Gap.

KAU campus enjoys a moderate climate. The main source of atmospheric precipitation is the south-west and north-east monsoons. The greater portion of the rain is from south-west monsoon between June and September. The 10-year mean minimum temperature is 23.3°C and 10-year mean maximum of 31.8°C. The mean annual rainfall is 2763mm. The mean number of rainy days per year is 110 days (KAU weather station, 2010).

Out of the 275 species of snakes of India (Whitaker & Captain 2004), Kerala has 102 species (Palot & Radhakrishnan 2011). Family Elapidae is represented by 17 species in six genera in India, out of which seven species in four genera are known from Kerala. Among the five species of coral snakes known to occur in India, four belong to the genus Calliophis and all these are found in peninsular India (Deepak et al. 2010) and all the four species are known from Kerala too. They are Calliophis beddomei, C. bibroni, C. nigrescens and C. melanurus (Palot & Radhakrishnan 2011).

**Present observation**

During the course of the ongoing herpetological survey in the KAU campus we discovered a Slender Coral Snake *Calliophis melanurus* on 16 June 2011. The specimen has a total length of 155mm, including the tail length of 15mm. This is much smaller than the total length measurements given in Smith (1943), indicating that it was probably a juvenile individual. The morphometric details of the snake including the scalation are given in Table 1. The scalation details of Slender Coral Snake obtained from KAU campus were compared with the scalation details for the Slender Coral Snake given in Smith (1943) and Whitaker & Captain (2004). The KAU
specimen has 38 subcaudal scales and based on this it can be concluded that it was a male individual. The GPS readings of the location from where the specimen was obtained are 76°16'45.4"E and 10°32'46.6"N, at an altitude of 43 m.

**Description**

Slender Coral Snake is an extremely slender bodied, mildly venomous snake with smooth scales (Images 2 & 3). The head and neck black, back light brown, tail brown with two black rings, one at the base and other near the tip of the tail, under side coral red. The snake when disturbed raised and coiled the tail.

**Distribution**

Smith (1943) gives the distribution range of Slender Coral Snake from Bengal, Nagpur, Bombay, Dharwar, Malabar, Coimbatore, Anamalais and Sri Lanka. Molur & Walker (1998), give the distribution range of *Calliophis melanurus* as Maharashtra, Karnataka, Tamil Nadu and West Bengal. Whitaker & Captain (2004) give the Slender Coral Snakes definite records from Gujarat, Maharashtra, Karnataka, Tamil Nadu and West Bengal. There is a single record from Dhar, Madhya Pradesh (Vyas & Vyas 1981) and Nallamala.

<table>
<thead>
<tr>
<th></th>
<th>KAU specimen</th>
<th>Smith, (1943); Whitaker &amp; Captain (2004)</th>
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<tbody>
<tr>
<td>total length</td>
<td>155mm</td>
<td>335mm</td>
</tr>
<tr>
<td>tail length</td>
<td>15mm</td>
<td>22mm</td>
</tr>
<tr>
<td>ventrals</td>
<td>251</td>
<td>249-277</td>
</tr>
<tr>
<td>subcaudal</td>
<td>38</td>
<td>33-37 (male); 24-27 (female)</td>
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<tr>
<td>preocular</td>
<td>touches nasal</td>
<td>touches nasal</td>
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<tr>
<td>postocular</td>
<td>two</td>
<td>two</td>
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<tr>
<td>supra labials</td>
<td>6 (3rd and 4th touching eye)</td>
<td>6 (3rd and 4th touching eye)</td>
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<tr>
<td>anal scale</td>
<td>divided</td>
<td>divided</td>
</tr>
<tr>
<td>subcaudals</td>
<td>paired</td>
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northern Andhra Pradesh (Sharma 1971; Sanyal et al. 1993). Recently Guptha & Rajasekhar (2011) reported Calliophis melanurus from the Eastern Ghats.

Thus the present record of the Calliophis melanurus from the Kerala Agricultural University campus, Vellanikkara, Thrissur District, in Kerala is of interest. As this is the first record of this species from south of the Palghat Gap, Western Ghats. All other published records of this species were from north of Palghat Gap.

References


Acknowledgements

We thank the Associate Dean, College of Forestry, KAU for encouragement. We also thank Mr. Sreehari VS for helping in preparing the map.
UGC Sponsored Major Research Project on Herpetofauna

Project Title: “Herpetofaunal Diversity of Sonitpur District, Assam and Adjacent Arunachal Pradesh India with Special Reference to Ecbiology and Breeding Behaviour of Certain Rare Species”

i. Principal Investigator: Dr. Mohini Mohan Borah

ii. Designation: Assistant Professor in Zoology

iii. Address:
   a. Office: Chaiduar College, Gohpur, Sonitpur, Assam 784168
   b. Residence: Ward No.-6, Madhya Chatrang, P.O- Gohpur, Sonitpur, Assam 784168


v. Duration of Project: 3 Years w. e. f. 01-02-2011.

vi. PI in brief: The proposer of the project did his PhD on the topic “A study on distribution of amphibian fauna of Arunachal Pradesh with special reference to habitat ecology of tadpoles”. He has published 48 papers in different journals and national and international seminars. He has completed a UGC sponsored MRP on the topic “Exploration of aquatic fauna of Sonitpur District, Assam with emphasis on conservation measures” the result of which would be additional value of the proposed project. He has constant touch with famous herpetologists of the country and abroad. As these, he achieved a significant milestone in organising a programme at his own college on 07 may 2008 on the occasion of International Year of Frog, 2008 by the gracious participation of Prof. Dr. Annemarie Ohler, Curator of reptiles and amphibians, Museum National d’Histoire Naturelle, Paris, France and Dr. Stephans Grosjean, Assistant Professor of the same institute. The proposer is one of the contributor of the book “ Threatened Amphibians of the World ” published by, LYNX, Spain in 2008.

vii. Executive summary of the ongoing Project:

   The northeastern region of India along with eastern Himalaya is recognized as one of the global bio-diversity hotspot region of the world. The eastern Himalayan region is unique in all aspects of bio-diversity, ecosystem, topography, climate and anthropological diversity. The region is a gateway to the Indian region for migration from Myanmar, China, Bangladesh, Nepal, Bhutan etc. Major portion of the region is still largely inaccessible and less degraded ecologically than the main land of India, but is rather extremely fragile, vulnerable and falls under the highly seismic zone. The National Conservation Strategy, 1992, outlines the policy action required to give greater attention to biodiversity conservation. The present study area i.e., Sonitpur District of Assam occupies 5,324km² bordered with state of Arunachal Pradesh in the north and river Brahmaputra in the south. Though the study area comprises a significant portion of eastern Himalayan hotspot of biodiversity, and yet it is one amongst the least known. Various wild life surveys in the last decade mention mainly on mammals and birds. The reptilian species diversity in the present study site is still not fully understood except very few sporadic survey reports.

   Many of the checklist of amphibian and reptilian species of northeastern India need further authentication and many new species of Indo-Chinese elements are likely to occur. The aim of this ongoing project is to make a detailed investigation on amphibian and reptilian habitat of Sonitpur District of Assam and adjacent Arunachal Pradesh. A few physico-chemical parameter will be analysed in the diversified habitats of amphibians and reptilians of study site.

   The inhabitants over the years acquired unique knowledge about the use of amphibian and reptilian species as food, medicine and ornaments. A detailed ethnomedicozoological study may highlight various applications of animal species and could provide a scope of knowledge for developing indigenous economy and environmental security.

   The year 2008 has been declared as International Year of Frog because of their key role in ecological communities. They are considered as important bioindicatros of global climatic chang. Significant declines and apparent extinctions among numerous species were noted by researchers all over the world since 1980. The pressure on amphibian and reptilian habitat can be recorded only when detailed investigations on ecology, food habit, biology and taxonomic study is available. Study of distributional pattern or zoogeography of a species provides information on ranges of their natural distribution and boundaries that help to find out the endemic status of a species. The use of different species of frogs, lizards, tortoises, snake etc. by a indigenous people as food and medicine indicate its potential for economic and academic importance.

viii. Significance of the study:

   Initially any research and developmental programme survey and demarcation are basic necessities to be carried out in the beginning. Scientific knowledge on biodiversity in general and herpeto fauna in particular of the Sonitpur District is surprisingly deficient. Most of the area in the district is unique ecologically and faunistically. Another important consideration is a great variation in relationship of people to biodiversity and ecosystem which are social, economic, cultural and scientific importance. This project will help in bringing out first hand information and resources data base on the various aspects of biological studies on the lesser known herpetofauna of Sonitpur district of Assam and adjacent Arunachal Pradesh.

   The results of the project may provide useful information to the researchers, various state government departments, NGO’s, Indian Council of Medical Research, IUCN, Species Survival Group (SSG), Zoological Survey of India (ZSI), Indian Council of Agricultural Research (ICAR), Declining Amphibian Population Task Force (DAPTF), Bombay Natural History Society (BNHS), Zoo Outreach Organization (ZOO), Forest Research Institutes, Universities, Local entrepreneurs, etc.