Cobra

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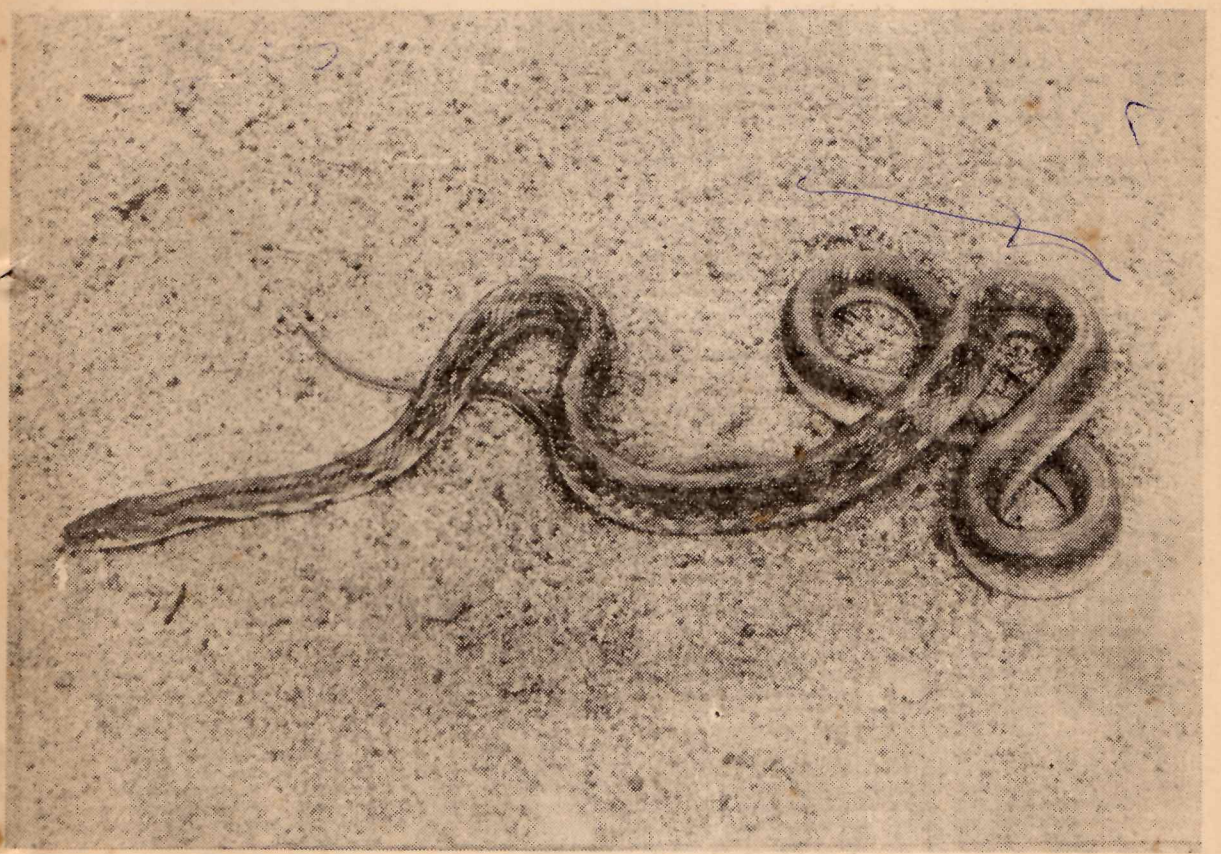

Madras Snake Park Trust
Guindy National Park – Guindy
Madras - 600 022. - India

THE MADRAS SNAKE PARK TRUST

Cover photo : Trinket Snake (*Elaphe helena*)

By : M. Krishnan

COBRA

Quarterly Newsletter of the Madras Snake Park Trust

CONTENTS

EDITORIAL

With the Biodivesity Convention coming into force—India being a partner in it, there is an urgent need to iventory our rich biodiversity. Whereas this has already got on all over the country in various ways, there has been little effort directed towards inventorying herpetofaunal diversity in India. The primary reason for this lacuna is the non-existence of appropriate, inexpensive methodology and the lack of easily accessible taxonomic keys. One of the real challenges to herpetologists is therefore to fill this gap and the Madras Snake Park Trust has taken a pioneering step in this concern.

Fourteen volumes of Cobra have already been made available to subscribers and readers both within and outside India. A wide range of topics have also been covered in these volumes. Volume 15 will therefore devote most of its space to discussing methodology for inventorying reptiles and amphibians. It is also hoped that in the subsequent issues, more methodology and simple taxonomic keys will be included. It is hence hoped that the readers of Cobra will find it not only informative but also enjoyable.

METHODOLOGY FOR INVENTORYING AMPHIBIANS AND REPTILES

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Introduction :

Biodiversity conservation can be complicated by a variety of factors and the lack of knowledge on how the multitude of life forms are distributed in space and time is probably the primary one. Despite the fact that India's biodiversity is the most well-documented amongst the tropical and third world countries we are still not in a position to confidently rank many parts of the country by their component species/ community richness. This is particularly felt when we attempt to evaluate zones and localities within the country based on the diversity of lower organisms, for instance the lower vertebrates viz., fishes, amphibians and reptiles.

Inventorying the lower vertebrates in India has never been easy for various reasons. Firstly, there are no simple guides to identifying species in the field. Secondly species are often quite elusive and seasonal that even where present, they are overlooked. Thirdly, these creatures have been historically treated either as food or harmful and thus the overall interest in them has been limited. And finally, the amount of conservation value placed upon organisms with 'greater' aesthetic appeal has unfortunately left the lower vertebrates down the ladder as 'loathsome'. Consequently during the past 100 years less than 200 papers/notes have been published on the geographical distribution of amphibians and reptiles as against the not less than 20 such communications that appear on Indian birds per year.

Amphibians and Reptiles :

Amphibians and reptiles are popularly considered as 'cold blooded' due to their poikilothermic nature—a physiological incapability to maintain constant body temperatures. These vertebrates are also collectively referred to as herpetiles (herps) and their assemblage, herpetofauna. Frequently, field studies/surveys have been carried out without separating the two classes of vertebrates (eg., Scott, Jr. 1982; Inger, *et al*, 1984; Daniels and Ishwar, 1993). Nevertheless, these classes are very different in their physiology and habits. For instance, amphibians lead a bimodal life (life in water as well as on land), have very distinct larval stages, exchange gases through their slimy skins (which in turn makes them sensitive creatures to both influences in water and land and restricts their ranges to cool and moist habitats) and most species are vocal. Reptiles on the contrary are without any distinct life history stages but for the eggs, young and adults, possess rough protecting skins and except geckos all are generally mute. Also amongst reptiles lizards, snakes, crocodiles and turtles are ecologically more distinct than the subgroups of amphibians viz., anurans (frogs/toads), caecilians and salamanders (a single species in India). These

fundamental differences are important factors that bias field studies of the two distinct classes. I therefore feel that inventorying of species diversity within these classes should adopt different strategies as will be discussed below.

A Practical Approach to Inventorying Herpetofaunal Diversity :

Before attempting to inventory herpetofaunal diversity one has to be clear about the following. Firstly, inventorying and monitoring are not one and the same. Inventorying is just documenting the number of species and/or individuals encountered within a specified geographical area at any given time. Monitoring is the next step where the present assemblage is periodically checked for noticeable changes against past inventories made from the same area. Secondly, diversity can be measured simply by recording the number of species within a well-defined area (species richness) or adding information on the relative abundances of each of the component species. Thirdly, the costs involved in inventorying biodiversity are often high. Therefore we must try and maximize the efficient utility of the available resources and time by choosing the most appropriate method.

Inventorying amphibians and reptiles is not as straight forward as that of birds and most mammals. There are nevertheless a number of standard survey methods recommended for the study of amphibians and reptiles worldwide (Campbell and Christman, 1982; Vogt and Hine, 1982; Bury and Corn, 1991; Heyer, *et al*, 1993). One of the most popular methods is trapping these animals using 'arrays' of pitfall and funnel traps. This method has been advocated, based on studies in North America, as the most appropriate for estimating both species richness and abundances within localities (Campbell and Christman, 1982). However, while working in the forests of Western Ghats collecting nocturnal ground insects using pitfall traps of 30 cm depth and 10 cm diameter (10 traps per hectare) over a 2 year period, I never came across a trapped amphibian or reptile. If 30 cm is to be considered as a much smaller depth than the 50 cm normally recommended for herpetiles, I must mention that the insect traps contained at the bottom an insecticidal solution which was strong enough to kill the small rats that occasionally fell in. Moreover the type and operation of traps recommended in literature are too expensive. Vogt and Hine (1982) have given the cost for sampling eight sites using such traps during a 'single' season in North America as US $ 1200.

While inventorying herpetofauna the primary emphasis should be on the species richness. Data on abundance will be the most useful while selecting sites of conservation value and for future monitoring of the population of selected species within a community or the community as such. Hence estimates of abundance can be kept as a 'second' priority as it will also be apparent from the discussion below that an investigator will frequently be forced to do without data on abundances of species.

The best method for inventorying herpetofauna, in my experience, is the 'time constrained search' (Vogt and Hine, 1982). This method involves the selection of a site/habitat and within predetermined limits thoroughly search for amphibians and reptiles over a fixed period of time. Between site, habitat or even larger landscape comparisons of herpetofaunal richness can be made if the following are kept constant : 1) the total area searched, 2) the number of hours spent, 3) the time of the day, 4) the season and 5) the expertise/manpower. Time constrained search is a form of sampling and is never as exhaustive as surveys. However, the results obtained

through such sampling (provided the samples are from representative and widely distributed sites) are often more reliable than that from less standardized large-scale surveys.

Amphibians and reptiles occupy a wide, variety of niches/microhabitats than the other terrestrial vertebrates. This makes locating species/individuals in the field difficult as compared to birds or mammals They may occur in arboreal, terrestrial, fossorial and aquatic microhabitats. Further, many species shift from one microhabitat to another depending on the life history stage, season and surrounding temperature. This characteristic emphasizes the need to standardize the sampling effort. A thorough search, for instance of a forest floor, would involve turning logs, rocks, litter and soil, searching between leaves under barks, within rotting wood, crevices, tree-holes, etc.

I have noticed during my study of amphibians and reptiles in the Western and Eastern Ghats that fossorial and aquatic forms dominate in open, drier habitats than within cool and moist forests. Fossorial forms such as uropeltid snakes are more common in the high elevations such as the hill-tops of Nilgiris where night temperature goes down considerably during most of the year. Terrestrial and arboreal niches are most frequently occupied within rainforests. A prior knowledge of these habitats would help considerably in inventorying herpetiles.

In general, except a few terrestrial lizards most amphibians and reptiles prefer to be active during the cooler hours of the day. Amphibians are definitely more active during the night (Fig. 1) and amongst reptiles, snakes are more often encountered during evening/night sampling than during the daytime. The first rains drive out a number of amphibians from their elusive hideouts. A sunny morning after a couple of rainy days are best suited to look for snakes.

Obtaining absolute densities of species is next to impossible following any sampling procedure. Estimating relative abundances is less difficult. However, the cost and effort involved will be often very high. For instance, while sampling snakes around Madras in the scrub jungles, in a day's effort with a team of 4-5 experienced snake-catching *Irulas* over an area of 30 ha, I have never been able to obtain more than 10 individuals including 2-3 species. Snakes are elusive and so are most species of burrowing reptiles and amphibians. On the contrary, a waterbody in summer will attract frogs and toads in such numbers that their local abundances are often exaggerated (Daniels, pers. observ). Interpretations of relative abundances thus requires a lot of caution and prior knowledge of the species and habitat.

Wherever estimates of relative abundance is necessary while inventorying herpetofauna, one might resort to some sort of commonness/rarity scale of assessment. This can be done by recording the frequency of encounter of species while sampling. Data on the number of records of any given species in a sample and the total number of samples where the species has occurred give us a clue as to whether the species is common or rare in any selected area. There has generally been agreement between field biologists that the most common species in any given area will also be the most frequently encountered.

Tadpoles definitely pose a lot of problems while inventorying amphibians species diversity. Firstly, they cannot be readily identified. Secondly, they frequently go unnoticed in muddy waters even where abundant. Sampling using nets has to be resorted to in these habitats. In a few species of ranid

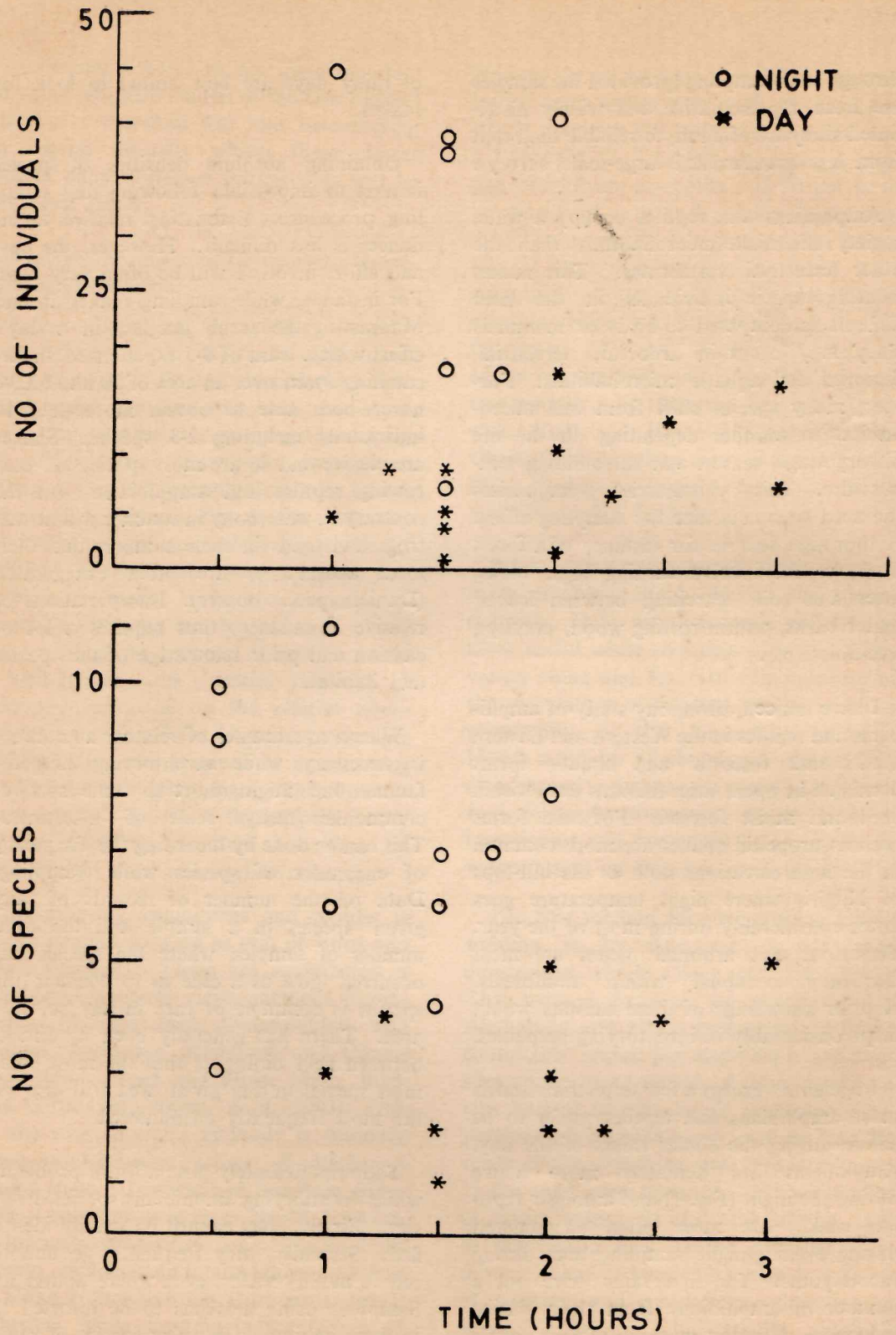

Figure 1 : Comparison of night and day sampling efficiencies based on data collected in and around the Barro Colorado Island, Panama between September and December 1989.

frogs the adults remain long enough or permanently in their breeding areas and often provide clues to identifying the tadpoles. However, adults of most amphibian species disperse after spawning. Most tadpoles can only be identified after they metamorphose. Tadpoles can be reared in shallow aquaria fed on hard boiled egg yolk and rice till they metmorphose. Maintenence of appropriate water temperature is nevertheless critical.

Discussion :

There are 205 species of amphibians and 400 species of reptiles currently known in India. These figures have emerged after the nearly 100 years of local and regional surveys of herpetiles starting with the early British naturalists to that periodically conducted by the Zoological Survey of India and other academic institutions. Some parts of India are better known for their herpetofauna than others. For instance, the Nilgiri Biosphere Reserve and the Western Ghats are amongst the best studied while the Eastern Himalayas and the Andaman and Nicobar islands are comparatively 'dark' (Inger and Dutta, 1986; Daniels, 1992; Daniels, 1993).

The above discussion of methods for inventorying amphibians and reptiles is in no way exhaustive. It nevertheless highlights the difficulties faced by investigators and some practical means of dealing with the limitations. As has been mentioned, each group of herpetiles tend to occupy different microhabitats and be active at different times limiting the scope of a general sampling strategy. Hence in order to help the researcher choose the right approach tables 1 & 2 have been included. These tables suggests that sampling during the day and night can yield varying results. These results are influenced by the beha-

Table 1 : A rough-and-ready guide for designing field study of amphibian and reptile diversity.

Type of Samples	Amphibians				Reptiles				
	Caec	Trefg	Frg/Td	Tad	Croc	Snak	Turt	Liz	Gec
Day Samples	*	*	*	**	**	*	**	**	*
Night Samples	**	**	**	—	*	**	*	*	**
Voice/Calls	—	**	**	—	—	—	—	—	**
Breeding site	—	**	**	**	*	—	**	—	—
Indirect clues	—	*	—	—	*	*	—	—	—
Oral Interviews	—	—	—	—	*	*	*	*	—
Opportunistic	*	*	*	*	*	*	*	*	*

* Useful; involves more effort

** Most appropriate

— Not recommended

Caec Caecilians; Trefg — Treefrogs; Frg/Td — Frogs/Toads

Tad — Tadpoles; Croc — Crocodiles; Snak — Snakes; Turt — Turtles

Liz — Lizards; Gec — Geckos

Table 2 : Appropriate microhabitats to be sampled for selected groups of elusive amphibians and reptiles.

Microhabitat	*Amphibians*		*Reptiles*			
	Caecilian	Treefrog	Burrowing Snake		Skink	Gecko
Fossorial :						
Moist soil/Humus	**	—	**		**	—
Wet stream bank	**	—	—		—	—
Rock crevices	—	**	—		**	**
Terrestrial :						
Under logs	**	—	**		**	**
Within logs	—	**	—		**	**
Leaf litter	—	**	—		**	**
Arboreal :						
Under bark	—	**	—		—	**
Ficus roots	—	**	—		—	**
Low bushes	—	**	—		—	—

** Appropriate

— Not recommended

viour of the concerned group of animals. For instance, crocodiles and freshwater turtles can be seen basking during the day. Crocodiles can also be counted at night using 'eye-shine' against lights. However, this involves a lot of risk-taking and confidence on the part of the investigator who visits crocodile habitats at night. Night sampling is absolutely essential for sea turtles in their breeding beaches and generally for all species of amphibians. Burrowing forms need to be unearthed.

Indirect sampling may often be of considerable help while inventorying herpetiles. The seasons and time of activity of amphibians and reptiles are well-known to native humans all over the country. It is best that an investigator makes full use of this wherever easily available. These natives would also be able to identify the presence of a number of species especially snakes by indirect clues such as sloughed skins and treefrogs by their arboreal foam nests. It is generally safe not to assess densities of species using these indirect clues.

Once familiar, amphibian and gecko calls are as good a bird calls in identifying species. Learning to recognise species (or groups viz., geckos, frogs, toads, treefrogs) by their calls is an important excercise while inventorying herpetofaunal richness.

Although there are not many field guides available to a researcher interested in herpetofauna, a few viz., Daniel, 1983 (reptiles in general), Whitaker, 1978 (common snakes), Das, 1985 (turtles), Murthy, 1990 (lizards) and for amphibians Daniel (1963 & 1975), Daniel and Sekar (1989) and Daniels (1991) should be of considerable

help. These are also readily available over much of the country.

Investigators interested in inventorying herpetofaunal diversity will have to start with compiling what is already known of the locality in literature. The next step is to identify species by name or codes (where identification is difficult in the field). The last process is to get more data on the species through any of the methods discussed above. Data collected opportunistically is of considerable value while dealing with large areas. Prior knowledge of the habitat is a great advantage while inventorying herpetofaunal diversity. Frequent sampling covering all seasons adds to the completeness of the herpetofaunal inventory.

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STUDIES ON COURTSHIP AND NESTING BEHAVIOUR OF STARRED TORTOISE *GEOCHELONE ELEGANS* IN CAPTIVITY AT MADRAS SNAKE PARK

P. TAMILARASAN, *Madras Snake Park.*

The starred tortoise *Geochelone elegans* is fairly common in India, Sri Lanka and Pakistan (Deraniyagala 1939, Smith 1931, Thulasi Rao and Subba Rao 1990). The tortoise is distributed throughout Central and southern India, extending west as far as Sind and south through greater part of the Madras Presidency to SriLanka (Smith, 1931). It is crepuscular, being most active in the early hours of the morning and in the late afternoons. During the day, it hides between plants and stones.

Adult tortoises were kept in captivity (3 males & 6 females) in the Madras Snake Park Trust (Temp. 27.5°C to 37.8°C, Humidity : 86%) and their breeding habits studied (27.8.90 to 26.9.90). Courtship and mating were observed between the last week of August and the first week of October with a peak period of activity in mid September.

MATING :

A single male & 2 females were observed during the study. Copulation was a prolonged and strenuous activity for the male. When the female was not interested, the male tried to lift the posterior part of the female by placing its head under the plastron. Once successful, the male mounted the female in a semi-upright i.e. inclined position. After gaining a strong grip, the process of copulation began.

The female in most cases opened its mouth, quietly chewed, or remained passive or during the copulation, she sometimes moved away dragging the male along with her. Copulation lasted between two and 15 minutes, in each act. The male was seen dipping its penis in water after retraction.

TABLE — 1 : Morphometric measurement of the tortoise studied.

S.No.	Sex	*Carapace* (*cm*) Length	Width	*Plastron* (*cm*) Length	Width	Total weight of each animal (gms)
1.	Male (M)	15	10	11.6	8.5	650
2.	Female (F1)	22	13	18.2	15.2	1500
3.	Female (F2)	18.5	15	12.5	9.5	1300

NESTING :

The mated female tortoises dug a hole in loose ground using hind legs, softening the earth by urinating. Both tortoises (F1 & F2) laid their eggs at different dates, 26.9.90 and 9.10.90 respectively.

The nest venue was selected near the brick wall or fence of the pit where the study was made. Nest excavation byfemale (1) started at 11.00 A.M. While excavating the nest fore limbs were used for support firmly fixed on the ground. It used the hind limbs alternatively while diggiing. The excavated mud was pushed out laterally. The carapace was also used for bringing out the excavated mud. While digging the nest the female starred tortoise looked around by simply turning its head. The nesting site was fully in shade but for slight penetration of sunlight.

The female tortoise raised its anterior region with the help of forelimbs to a height of 5 to 8 cm with an interval of 2 to 3 minutes and carefully observed around. It was reluctant to feed throughout the nesting process. During excavation the male tortoise came to the nesting site and watched the process for about 2 to 5 minutes then it went back.

The posterior end of carapace of the female tortoise was involved in preventing falling excavated mud by closing the entire opening of the nest. The mud was kept on sides of the nest in a semi-solid texture. It inserted its hind limb into the nest pit for measuring the depth (Table 2.)

EGG LAYING :

Egg laying started exactly at 2 P.M. After laying each egg, it correctly and properly arranged clutch by alternative use of hind limbs. It inserted and pressed the laid eggs in the lateral side of the nest pit using hind limbs. While adjusting and pressing the clutch, the head frequently protruded and retracted. The eggs laid were white in colour. The number of eggs laid is given in Table 3.

TABLE — 2 : Nest dimensions and clutch size

S.No.	Nest pit Diameter	Nest pit Depth
1.	9.0 cm	13.0 cm
2.	6.5 cm	9.5 cm

TABLE — 3 : Details of egg laying in starred tortoises

Marked Female tortoise	Date of Copulation	Date of egg laying	Eggs length range (cm)	Eggs Width range (cm)	Eggs Weight range (gm)	Number of Eggs
F1	24.8.90	26.9.90	3.8-4.1	3.0-3.2	21-23	5
F2	24.8.90	9.10.90	2.3-4.1	1.9-4.1	9-24	3

There was a 2 minute gap between each egg layed. Frequently it tried to bury the eggs deeply in the nest pit so as to make space for laying successive eggs. Thus it completed its egg laying process by 2.20 p.m. It took 20 minutes for egg laying and 5 minutes for adjusting the clutch for the tortoise. Then it started filling up nest pit at 2.25 p.m. with mud by using limbs alternately. While filling, the other tortoises came to the site and returned. It collected some soil by hind limbs and inserted it into the pit and pressed it to make it rigid. When soil was not available, it extended hind limb backward and laterally as far as possible and collected the soil and dumped it into the nest pit. Fore limbs were involved neither during excavating not for dumping but fixed in the same point. The tortoise never moved its fore limbs till completion of the process. Dumping was completed at 3.50 p.m. then the tortoise moved slowly with mud sticking on the back of carapace and hind limbs.

ACKNOWLEDGEMENTS :

The author expresses deep sense of gratitude to Dr. R.S. Pillai, Research Officer and Shri A.N. Jaganatha Rao.

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REPTILES IN GWALIOR ZOO (MADHYA PRADESH)

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Gwalior Zoo is the oldest in Madhya Pradesh. Gwalior Zoo has over 450 animals representing more than 70 species. Amongst reptiles, marsh crocodile and starred tortoise have always been in the Zoo. However they did not represent the reptiles found in North Madhya Pradesh and therefore, a small reptile house was built in the Zoo Following is the list of reptiles presently maintained in Gwalior Zoo.

1. Marsh Crocodile (*Crocodylus palustris*) — 6
2. Gharial (*Gavialis gangeticus*) - 7
3. Starred Tortoise (*Geochelone elegans*) — 9
4. Common Indian Monitor (*Varanus bengalensis*) — 2
5. Beaked Worm or Blind Snake (*Typhlina acutus*) — 5
6. Dhaman (*Ptyas mucosus*) — 3
7. Indian Python (*Python molurus*) — 3
8. Russell's Earth Boa (*Eryx conicus*) — 2
9. Indian Cobra (*Naja naja*) — 3
10. Russell's viper (*Vipera russelli*) — 1
11. Sawscaled viper (*Echis carinatus*) — 2

A few more species of snakes, seven turtle species found in Madhya Pradesh and two species of skinks along with small lizards are likely to be added to Gwalior Zoo reptilium in the next few months.

RANGE EXTENSION OF SOUTHERN GREEN LIZARD (*Calotes calotes* Linn, 1958)

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A short term project on herpetofaunal assemblage in the plains of N.Q. Milleth district, Tamilnadu, was undertaken from January '94—March '94. During the study, the southern green lizard (*Calotes calotes* Linn 1958) was recorded from two localities viz., Mannampandal and Maraiyur villages near Mayiladuthurai. Earlier this species has been recorded from Shevaroy hills, Travancore and Nicobar Islands in India and also Sri Lanka (Smith, 1935) This species also occurs in wooded areas of Coimbatore & Chingleput in Tamilnadu (Daniels, pers. commn). Daniel (1983) described this slender, long tailed arboreal species as preferring well wooded country and has collected from tall trees. We also recorded this species only in well wooded groves especially on *Acacia arabica* trees at above 4—5 mt. height.

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