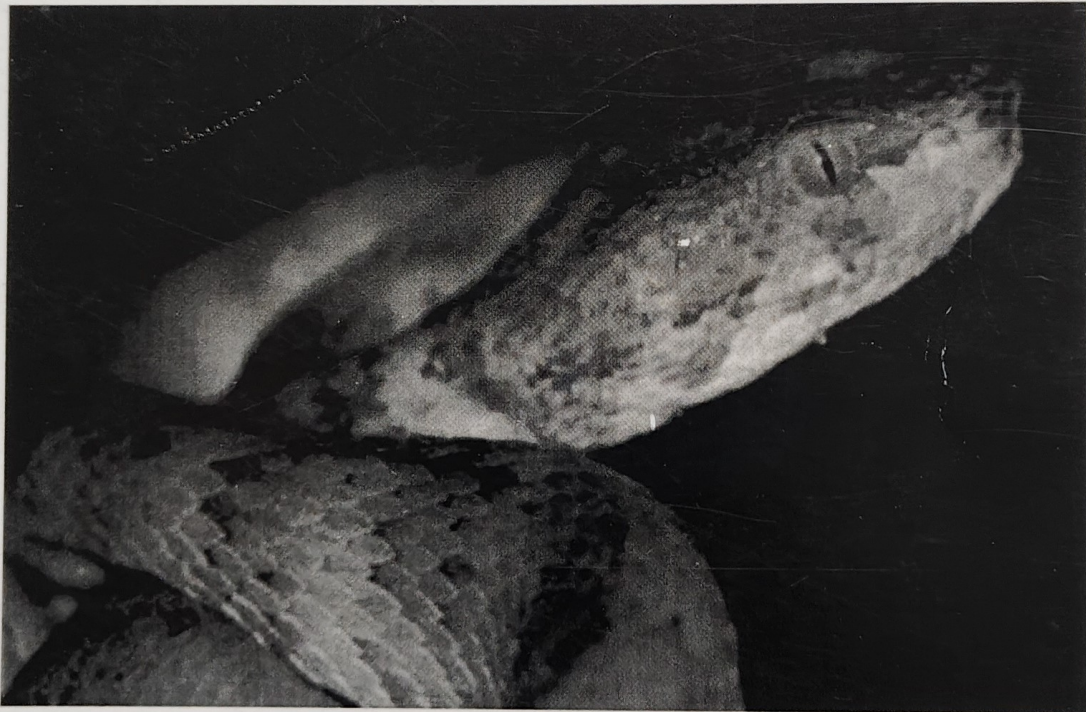


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Cover

Andaman pitviper (*Trimeresurus andersonii*)

A venomous pitviper species endemic to the Andaman Islands of India, in the Bay of Bengal. Also see article on this species in page 21.

Photo: Dinesh Meena & Kokila Meena

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THANK YOU TO NATURE LOVERS & PHILANTHROPISTS!

The Chennai Snake Park Trust sincerely acknowledges with gratitude the generous contributions from numerous individuals and organizations, who donated to our zoo during the Covid-19 lockdown in 2020-21. Your collective donations have now enabled us to tide over the financial crisis and recuperate from the delicate situation prevailing then. We are now gathering our strength so as to get back to normal.

We thankfully list our major donors in the following:

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ENRICHMENT TECHNIQUES FOR REPTILE ENCLOSURES

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Introduction

The basic objectives of Enrichment of an animal enclosure are: 1. to provide a simulated condition inside the enclosure which ideally suited to the animals' natural life, 2. to make the visitors observing the animals as if they are seen in their original habitat. Modern zoo management emphasizes the need for providing a sufficiently large enclosure along with simulated natural environmental conditions as a part of zoo management. Providing a spacious enclosure alone will not suffice meeting the natural needs of the animal. Here comes various enrichment techniques:

Why the zoo animals need a simulated wild condition?

1. Physical / psychological Needs: Many wild zoo animals possess some habits of their own while freely living in their respective habitat. When they are kept in a captive condition, they tend to modify their original habits / behavior as; the conditions in captivity are not suited to their life style. This results in some erratic behaviors including some stereotypic behaviors. Ex: constant stereotypic body movements of elephants / monkeys in captivity.
2. Physiological needs: Many zoo animals for better health and survival need some basic conditions that are easily available in their natural habitats. For example exposure to natural sunlight, ideal temperature, natural food items etc., are some basic needs for all captive wild animals in their enclosures.
3. Breeding Needs: Many wild animals breed only when a simulated natural environment is provided.

Why the visitors should observe the animals in the simulated conditions?

Visitors' point of view also there is a need for providing simulated conditions. Now days, zoos act as not only a recreation place but also as the place for learning and education. By seeing the animals in a simulated environment, the visitors will correctly understand the original habitat of the animal and also their natural behaviour.

Enrichment techniques:

Enrichment does not mean to provide a colourful and decorative settings inside the enclosure. It goes with what the animal requires and feels. For example, for a desert lizard, providing a sand bed with desert plants like cactus will do. Further, our enrichment plan should have some concepts before implementation. The following are some enrichment category:

1. Physical enrichment
2. Physiological enrichment
3. Psychological / behavioral enrichment
4. Environmental enrichment
5. Ecological enrichment
6. Ecosystem enrichment
7. Informational Enrichment

1. Physical enrichment: This refers to physical needs of the animal species. The physical needs deal with size of the animal and number of animals in the enclosure. In addition the physical activity patterns are to be considered. Bigger the animal bigger will be the enclosure size. Similarly, more the animal number more the space to be considered. In this respect the CZA has issued clear guidelines on the enclosure size for various animal species. This type of enrichment is essential for free moving active animals so as to enable them to move freely and active inside the enclosure. If their movement is restricted, they are likely to develop some abnormal / stereotypic activity. One can observe this behavior among the caged animals like, big cats, monkeys, elephants etc.

Physical enrichments for Reptiles:

Here reptiles include all snakes, lizards, crocodiles, turtles etc. Generally all reptiles are idle and less active. However, the size of the reptile species should be considered for fulfilling the physical needs. Among snakes, pythons need larger enclosure and among other reptiles, crocodiles need larger enclosure. Visitors' point of view, small animals like snakes if kept in large enclosures, it will be difficult for viewing. In such cases, the snakes may be provided with off-exhibit enclosure in addition to exhibit cage for closer and better viewing.

2. Physiological enrichment: This deals with physiological needs of the animals. Presence or absence of some factors inside the enclosure will affect the physiology of the animal. The physiology of the animal which likely to be affected are: Reproductive physiology, Feeding physiology, growth physiology, health physiology etc. For providing this enrichment, one has to understand all physiological needs of the animals concerned.

Physiological enrichment for Reptiles:

As far as reptiles are concerned, they are all cold blooded animals. Their activities mainly depend on natural sunlight and temperature. Many lizards require direct sunlight as their reproductive requirements. In the case of open enclosures, there will not be any problem for getting sunlight. The problem will be for closed cages / enclosures where there is no scope for sunlight entrance. Under such conditions, the animal may not breed although other factors are provided and therefore necessary structural arrangements may be made for the entrance of direct sunlight inside the enclosure. Under this arrangement, the animals prefer to use the sunlight by staying under it (picture 1). Similarly, providing optimum temperature inside the closed enclosures is a must during extreme summer and winter. Water spraying system may be provided during hot days in order to reduce the temperature. Similarly during cold seasons, heating system should be provided inside the covered enclosures (picture 2).

3. Psychological / behavioral enrichment: This refers to providing enrichment devises in order to meet the animal's behavioural requirements. For this purpose one must understand the normal wild behaviours of the animal and their activities in their wild habitat. For example, an arboreal animal may require trees or tree branches and a burrowing animal may require sand bed etc.

Behavioural enrichments for Reptiles:

Most of the snakes are kept in closed enclosures and hence, providing some tree branches may help the animal to climb on it and use them. In Chennai Snake Park, most of the enclosures for the snakes are small. However, some dead tree branches are effectively used by the snakes. Similarly, Sandboas like burrowing animals are provided with sand beds that are used for burying / hiding. Similarly, the Varanus lizard which is kept in an open enclosure is provided with a live tree to fulfill its tree climbing behavior. It likes to hide most of the times. Therefore a hollow dead wooden log is also provided which is used for hiding and also as a shelter. For green whip snakes, we provided tree branches which the snakes often used as its shelter (picture 3).

4. Environmental enrichment: This is a new concept in which the enclosure's enrichment represents most of the natural environment of the animals inside. The best example is the walk-through aviary / walk-through butterfly park etc. Here, all the environmental factors are provided including natural light, wind flow, rain, temperature variations are available. Apart from these, natural vegetation terrain, stream like water flow systems, etc are also supplemented. Here, the visitors feel as if they are walking inside the natural habitat of the animals exhibited. The whole area may be big enough that the birds may get their natural feeds from the ground as well as from the native vegetation.

Environmental enrichment in Reptile Enclosures:

Make use of the walk-through concept, the Chennai Snake Park made a walkthrough reptile enclosure for some exotic animals. Here we exhibited pet

wild animals like Iguanas, slider turtles, etc. Although the enclosure is small, we made artificial forest scenery. Being an open enclosure with mesh roofing, the enclosure is exposed to natural light and other weather conditions. Apart from the reptiles, we also introduced some exotic birds as biological enrichment. This makes the visitors to feel as if they are inside a mini forest (picture 4).

5. Ecological enrichment: This enrichment method slightly differs from the environmental enrichment. In the latter, the whole environmental factors are taken into account. Whereas, in the Ecological enrichment, only the essential ecological factors such as habit and habitat that are essential for the animal life. Burrowing habit, arboreal habit, nocturnal habit, Desert habitat, aquatic habitat, etc., are examples.

Ecological Enrichments for Reptiles:

Many animals like snakes have the habit of hiding themselves inside the enclosure. Here, the enrichments include, providing small bushes, small stone heaps, water troughs etc. Providing a warm condition during cold seasons is an essential ecological enrichment for small reptiles like snakes and lizards (picture 5).

6. Ecosystem enrichment: This is a new concept developed by me. This is more of Educative value. When we talk of any wild animal, one should aware of the ecosystem in which it lives. In that way, the animal has some role to play in its ecosystem. We created two types of Ecosystem for our Reptiles. One is for aquatic reptiles and another is for Terrestrial reptiles. In the wild no animal can live alone. In the aquatic ecosystem enclosure, we exhibited aquatic reptiles like water snakes, turtles, small crocodiles etc. Along with we also provided fishes, frogs and aquatic plants. Here, one can observe a small food chain. The frogs eat small insects inside the enclosure and the frogs in turn are consumed by water snakes. We also observed a symbiotic relationship between the turtles and the fishes. The fungus grown on the turtle shell are being eaten by the fishes and thus make the shell surface clean. There is a cycle of activities going on as in the case of natural aquatic ecosystem.

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Similarly, in the terrestrial Ecosystem, we are exhibiting, terrestrial reptiles like snakes, lizards and semiaquatic turtles and terrestrial tortoise. We provided artificial scenery of a terrestrial ecosystem inside the enclosure. A small water falls is also created.

Both the above Ecosystem enriched enclosures are of mode educational value. We provided also information boards depicting the functioning of both Ecosystems which will give a clear picture of the natural ecosystem to the public especially to the students (pictures 6 and 7).

7. Informational Enrichment: This is another new concept developed by me which emphasizes the need for providing necessary information about the animals exhibited in the respective enclosure. The latest and one on the major objectives for any zoo is Education and awareness creation about the wildlife. In that respect, there is a need for enriching the animal enclosures with suitable information. Providing information is an art itself. It starts with simple information boards in front of the enclosure stating the name and other vital information. But, one should see that the information provided reach the visitors. There are so many techniques to make our information to reach the visitors. Any information conveyed through in an interactive form will reach the visitors easily (picture 8). Apart from these information techniques, good interpreter adds more value to the information conveying techniques. All animal keepers must act as a good interpreter by knowing all vital information of the respective animal. This requires good training for the animal keepers. All animal keepers should have up to date knowledge about their animals. Thus it is imperative for enriching your animal enclosure by providing good and knowledgeable animal keepers.

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Picture 1



Picture 2



Picture 3



Picture 4



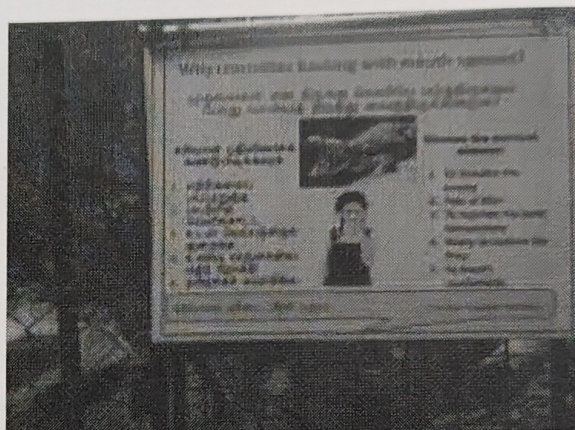
Picture 5



Picture 6



Picture 7



Picture 8

Legend for Pictures

Picture 1. Iguana enclosure provided with direct entry of overhead sunlight. Note that the animals prefer to stay under the sunlight.

Picture 2. Simple heating system inside a snake enclosure which will be used during cooler months.

Picture 3. A simple plant branch inside the arboreal snake enclosure, the green snake is effectively using these furnishings.

Picture 4. A walkthrough Iguana enclosure with a forest look. Here the visitors not only see the iguana but also other animals associated with the environment.

Picture 5. A mini natural habitat providing ecological needs of snakes is provided inside the snake enclosure.

Pictures 6 and 7. Typical Aquatic and Terrestrial Ecosystem scenes are created involving multiple species of aquatic (6) and terrestrial reptiles (7).

Picture 8. An interactive information board near Crocodile enclosure conveying the message on the behavior of the crocodiles.

COMPARATIVE ETHOLOGICAL STUDY ON INDIAN BLACK TURTLES *MELANOCHELYS TRIJUGA* IN TWO DIFFERENT CAPTIVE REGIMES AT THE CHENNAI SNAKE PARK

Lucky Razack*, S. Fahamitha Aproz, Farheen Kutharath, K.,
S. A. Nafeesa, S. Safrina Yasmin & E. Shamaa Anjum

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Abstract: We conducted an ethological study on captive Indian Black turtles (*Melanochelys trijuga*) in Chennai Snake Park during January–March 2020 for 30 days (60 hours) during the day time. This Zoological Park has 2 different captive regimes namely: Terrestrial enclosure and Underwater enclosure. In the Terrestrial enclosure, the most prominent activity was Basking [f – 31] with an average (2.5) and in the Terrestrial Water Enclosure, it was Surfacing Behaviour [f – 415], average (13). From the Underwater Enclosure, the most prominent activity was Surfacing behaviour [f – 32] with average (1). From the Interactions of the Terrestrial Enclosure, the prominent interaction was climbing by turtles [f – 4] with average (2) and in the Underwater enclosure, the prominent was climbing the juvenile crocodiles [f – 2] with average (0.5). From the above results it is found that basking, surface behaviour and climbing are the maximum activities done in the terrestrial enclosure. In the Underwater enclosure, surface behaviour and climbing were the maximum activities done. Thus these results provide basic information about the behaviour of the Indian Black Turtles.

Key Words: agonistic behaviour, basking, gaping, juvenile, surfacing behaviour, symbiosis.

Introduction

Many research works related to particular behavioural patterns were studied previously. Boyer and Brattstrom (1965) noted that Basking is common in turtles and the purpose is to regulate metabolism and dry off which may prevent disease. Froese and Burghardt (1974) studied the major behavioural pattern involved in food competition and aggressive behaviour in captive juvenile turtles. Descriptions for behavioural patterns in captive turtles were studied by Schineider et al. (2010). To know the differences in behaviour and interactions of this turtle species between themselves in the terrestrial regime and in the typical pond ecosystem (i.e.) underwater enclosure where the turtles were captivated along with the other aquatic animals.

Though this Indian black turtle is commonly found and is found throughout the Indian sub-continent, there is a lack of knowledge on its behavioural ecology. There are no recent statistics available on the increase or reduction of their population. At this stage of over exploitation of resources in the environment, it is very essential to provide basis of information. There are very few researches done on this turtle when compared to other turtle species, the result of this study may provide insight for the further researches on this species or other species of turtles.

Materials and Methods

The study consists of observing different behaviours of the Indian black turtle (*Melanochelys trijuga*) that were kept captive in the terrestrial and underwater regimes. This behavioural study of turtles followed Altmann (1974) sampling methods.

Study Animal: The Indian black turtle or pond terrapin (*Melanochelys trijuga*) is a species of turtle found in South Asia. It is a medium sized fresh water turtle. The size of the species may vary from 38 to 45 cm in length. The species occurs in India, Bangladesh, Myanmar, Sri Lanka, the Maldives, Nepal and Pakistan. Elevational distribution of the species ranges from sea level, in the Chennai region of South eastern India, up to ca. 800 m, North of

Discussion

Although the results of this study revealed that the overall number of activities of the turtles were found to be maximum in the Terrestrial enclosure when compared to Underwater enclosure. This might be because of the presence of land and water areas in the terrestrial enclosure. Despite the fact that the occurrence of this mechanism of observation in turtles might be in direct conflict with other theories previously published and it was difficult to interpret citing the work according to Altmann. Turtles are the species that are adapted to live in water so surface behaviour, resting, swimming and basking were the activities mostly done as per results. Results from the terrestrial and pond enclosure show that, surfacing behaviour was done at the highest rate. The turtles would stretch their head from inside the water pit and is an activity called surfacing behaviour that was done to breathe and to stay at the upper surface of water.

Works of Freitas et al. (2019) revealed that on an average, turtles spent one third of the time at the surface, spending 43% of the time at the surface during the day and 29% of the time during the night as a result of surfacing behaviour. Following the surfacing behaviour, resting behaviour was observed. Resting is a behaviour where the turtles were stationary inside water by relaxing themselves without moving and were stationary in the same place.

All the turtles performed dives where they remained at a fixed depth for a long period, surfaced briefly and then dived to the same depth again. It is generally believed these dive profiles are caused by the turtles resting on the sea bed according to Hays et al. (2000). Resting was followed by swimming. Swimming was quite often noticed in both the enclosures. Under the water, the turtles were seen moving from place to place by swimming. The studies revealed that monthly comparison of time spent by the turtles in the surface in the morning, in the afternoon and at night also revealed that they stayed longer at the surface during light hours than at night (Revelles et al., 2007).

The Underwater enclosure was typically a glass tank. The tank was layered with sand and pebbles at the bottom. The tank was filled with oxidised water and there were wooden logs floating at the top surface which helped the animals present in the tank to hold and to have balance while floating and water plants were also found inside the tank as in Figure 2. The Underwater Enclosure was a typical Pond Ecosystem in a tank that had 2 Indian black Turtles which were co-existing with 2 American red- eared slider turtles, 2 juvenile crocodiles, 3 water snakes, 2 adult fishes and 6 small fishes.

Results

Results of the observation sessions on captive *Melanochelys trijuga* maintained in the various regimes are tabulated below (see Tables 1 and 2).

Table 1. Activities of captive *Melanochelys trijuga* maintained in various enclosure regimes

Enclosure Type	Terrestrial Land Enclosure		Terrestrial Water Enclosure		Underwater Enclosure	
Activities	Frequency	Min-Max (Average)	Frequency	Min-Max (Average)	Frequency	Min-Max (Average)
Resting	10	1-14 [7]	282	1-29 [14.5]	12	1-2 [1]
Feeding	15	1-26 [13]	--	--	1	1-2 [1]
Crawling	13	1-18 [9]	--	--	--	--
Basking	31	1-5 [2.5]	--	--	--	--
Gaping	1	1-1 [0.5]	1	1-1 [0.5]	1	1-1 [0.5]
Surface Behaviour	--	--	415	1-26 [13]	32	1-2 [1]
Swimming	--	--	82	1-14 [7]	12	1-2 [1]

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Gaping	1	1-1 [0.5]	1	1-1 [0.5]	1	1-1 [0.5]
Surface Behaviour	--	--	415	1-26 [13]	32	1-2 [1]
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Table 2. Interactions among captive *Melanochelys trijuga* in enclosures of various regimes

Enclosure Type	Terrestrial Land Enclosure		Underwater Enclosure	
	Frequency	Min-Max (Average)	Frequency	Min-Max (Average)
Intra-specific Interactions				
Biting	--	--	1	1-2[1]
Agonistic behaviour	1	1-2 [1]	1	1-2[1]
Chasing	--	--	1	1-2[1]
Climbing	4	1-4 [2]	1	1-1[0.5]
Retreat (shell)	3	1-5 [2.5]	1	1-1[0.5]
Inter-specific Interactions				
	Frequency	Min-Max (Average)	Frequency	Min-Max (Average)
Climbing (crocodile)	--	--	1	1-1[0.5]
Support (snake)	--	--	2	1-1[0.5]
Climbing (turtles)	--	--	1	1-1[0.5]
Agonistic behaviour	--	--	1	1-2[1]
Symbiosis (fish)	--	--	1	1-2[1]

As regards the activity pattern (Table 1), in the Terrestrial Land enclosure, basking was the most predominantly done activity with frequency [f-31] with an average (2.5), followed by feeding activity [f-15] and average (13), followed by crawling with [f-13] and average (9), then by resting activity with [f-10] and average (7) and by gaping activity with [f-1] and average (0.5). In Terrestrial Water enclosure, the most dominant activity observed was surfacing behaviour with [f-415] with average (13), then by resting behaviour

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with [f-282] , average (14.5), followed by swimming [f-82] with average (7), then gaping activity with frequency [f-1] and average (0.5). In the Underwater enclosure, surfacing behaviour was done predominantly with frequency [f-32] and average (1), followed by the 2 activities such as resting and swimming both with frequency [f-12] and average (1), then by feeding activity with frequency [f-1] and average (1), followed by gaping with frequency [f-1] and average (0.5).

As regards the Interactions (Table 2), in the Terrestrial enclosure Intra-specific and Inter-specific interactions were seen. Among the Intra-specific interactions, climbing was mostly observed with frequency [f-4] with an average of (2) and then followed by agonistic behaviour with frequency [f-1], average of (1). From the Inter-specific interactions, retracting into shell was the activity done mostly with frequency [f-3] and average (2.5). Among the Intra-specific Interactions in Underwater enclosure, biting, agonistic behaviour, chasing were with the frequency of [f-1] and average (1) while climbing and retracting into shell activities were with the frequency [f-1] and average (0.5). Among Inter-specific Interactions in Underwater enclosure, snake support was with the frequency [f-2] and average (0.5), followed by the 2 interactions such as fish symbiosis and agonistic behaviour with frequency [f-1] and average (1) followed by climbing (crocodiles) and climbing (other species of turtles) was with the frequency [f-1] and average (0.5).

The most commonly observed activities in both the regimes were surfacing behaviour, resting, swimming and least performed activity was gaping. The interactions between the species from both the regimes were found to have climbing on other species as frequently done activity while agonistic behaviour was the least. The competition for food was higher in Terrestrial than in the Underwater enclosure. In the Underwater enclosure, turtles were found to take support from snakes and crocodiles to maintain their balance when inside water. Fishes were found living along with other aquatic animals in Underwater enclosure and so symbiosis was observed.

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Discussion

Although the results of this study revealed that the overall number of activities of the turtles were found to be maximum in the Terrestrial enclosure when compared to Underwater enclosure. This might be because of the presence of land and water areas in the terrestrial enclosure. Despite the fact that the occurrence of this mechanism of observation in turtles might be in direct conflict with other theories previously published and it was difficult to interpret citing the work according to Altmann. Turtles are the species that are adapted to live in water so surface behaviour, resting, swimming and basking were the activities mostly done as per results. Results from the terrestrial and pond enclosure show that, surfacing behaviour was done at the highest rate. The turtles would stretch their head from inside the water pit and is an activity called surfacing behaviour that was done to breathe and to stay at the upper surface of water.

Works of Freitas et al. (2019) revealed that on an average, turtles spent one third of the time at the surface, spending 43% of the time at the surface during the day and 29% of the time during the night as a result of surfacing behaviour. Following the surfacing behaviour, resting behaviour was observed. Resting is a behaviour where the turtles were stationary inside water by relaxing themselves without moving and were stationary in the same place.

All the turtles performed dives where they remained at a fixed depth for a long period, surfaced briefly and then dived to the same depth again. It is generally believed these dive profiles are caused by the turtles resting on the sea bed according to Hays et al. (2000). Resting was followed by swimming. Swimming was quite often noticed in both the enclosures. Under the water, the turtles were seen moving from place to place by swimming. The studies revealed that monthly comparison of time spent by the turtles in the surface in the morning, in the afternoon and at night also revealed that they stayed longer at the surface during light hours than at night (Revelles et al., 2007).



The observation made from the terrestrial enclosure, it was found that the turtles came out of the water pits and were basking on the circular rim surrounding the pits. Basking is an activity done to regulate the body temperature according to the environment. In the Underwater enclosure, the turtles basked themselves by emerging out of water and climbing the wooden logs or by climbing crocodiles that were already basking on the wooden logs.

Consequently, reptiles faced with important diurnal and seasonal temperature fluctuations, such as in temperate areas, rely largely upon behavioural thermoregulation to maintain their body temperature (T_b) within a specific range. Because T_b dictates the rate of most physiological processes, behavioural thermoregulation is expected to provide numerous physiological benefits that could ultimately increase fitness (Huey & Slatkin, 1976; Huey, 1991). Basking behaviour has important ramifications for the energy budget, and by extending the fitness, of temperate-zone turtles (Bulté & Blouin-Demers, 2010). Basking turtles avoided potentially aggressive encounters by averting faces while basking and moving away from approaching turtles. Directionality of behavioural interactions was strongly influenced by relative body size.

According to the results, the least performed activity was gaping in both the captive regimes. Gaping was the rarest observed activity from both the enclosures. Gaping is a behaviour where the turtle opens its mouth wide to inhale lot of air for heat liberation, almost similar to panting in mammals. Gaping is common in both land and in water. Basking turtles were occasionally observed to gape. This behaviour also is referred in the herpetological literature as gasping, panting or yawning and is characterized by opening the mouth briefly and then reclosing it without directing the gesture towards another turtle (Bury, 1979).

This behaviour differs from the open mouth gesture discussed by Bury & Wolfheim (1973) and Lovich (1988) since the latter is always directed at another turtle in an aggressive manner. Although basking behaviour has been the subject of numerous investigations (Boyer, 1965), the function of gaping remains unclear. Since most observations of gaping that have been published,

occurred when turtles were involuntary exposed in high temperatures, it was assumed to be primarily thermoregulatory and an attempt by the animal to lower body temperature (Legler, 1960; Pritchard & Greenwood, 1968). And Moll & Legler (1971) stated that gaping in turtles probably serves the same thermoregulatory functions as panting does in mammals. In spite of their conjecture, gaping is generally considered to be an inefficient cooling mechanism for turtles. Gaping has been described as a social behaviour (Bury & Wolfheim, 1973).

Turtles were seen interacting with themselves and also with the other animals. Climbing upon other turtles as an intra-specific interaction and also upon other species as inter-specific interaction were noted. As the turtles live with other animals, there prevails a mutual understanding that helps them to climb upon others. This climbing activity was mainly observed while performing basking behaviour. The least interaction was agonistic behaviour. Agonistic behaviour such as biting, snatching was found mainly when the food was provided.

All the turtles crawled towards the direction of food and tried to snatch the food from one other by biting and climbing. A comparative phylogenetic analysis indicates that turtles with carnivorous and durophagous diets are capable of biting (agonistic behaviour) harder than species with other diets. This pattern is consistent with the hypothesis that an evolutionary increase in bite performance has allowed certain turtles to consume harder or larger prey. Simple performance measures such as gape width (enabling animals with larger gapes to eat larger prey), (Wheelwright, 1985) are often correlated with diet. Aggressive behaviour was positively correlated with the number of turtles basking, the frequency of emergences and water temperature.

The possible reasons for deviation might be that the observation was recorded were only for certain months and during day time, so there could be some changes in their behaviour during the other seasons and night time. In our observation there might be no adequate empirical knowledge of the dependencies between relevant variables. This might also be a probable reason for deviation.

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We thank the Principal and Head, Zoology Dept. of Justice Basheer Ahmed Sayeed College for Women, for their support to all our academic endeavours. At the Chennai Snake Park, we thank the Executive Chairman, the Director and the Dy. Director & Scientist for their kind permission for this study and for logistic support during the work.

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SEASONAL DYNAMICS OF SIGHTINGS OF ANDAMAN PIT VIPER *TRIMERESURUS ANDERSONII* NEAR PORT BLAIR, ANDAMAN ISLANDS, INDIA

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Introduction

The Andaman pit viper *Trimeresurus andersonii* Theobald, 1868 is a species of venomous snake, a pit viper endemic to the Andaman Islands, India (Das, 2002; Whitaker & Captain, 2004). This species can be identified by the following characters: triangular-shaped, flat head, covered with small scales; vertically elliptical pupil; presence of loreal thermo-receptor pit; strong keeled temporal scales; supralabial 10-12; first partially or completely fused with nasal; 9-12 scales between eyes; dorsal scales are keeled, ventral: 170-182 (Male, 172-185 (Female)); anal usually undivided; subcaudal: 66-78 (males), 50-62 (females); paired; body length 665mm, tail 125 mm (male) 900mm, tail 140 mm (females); body is cream/brown wooden coloured (Das, 2002; Whitaker & Captain, 2004).

This species is reported to be endemic to the Andaman Islands, with preciserecords from the following sites: Ross Islands, Havelock, Chatham, Bambooflat, Minnibay, Prothrapur, Carbyn beach, Dollygunj, Pahargaon, Diglipur, Port Blair, Garacharma, Ograbaraj, Wandoor, Chidiyatapu. This species is nocturnal (active during nights) and is known to feed on small birds, rodents and sometimes on other small animals. Though considered a common and venomous snake in the region, no information exists in scientific literature on its abundance and seasonal dynamics, based on long-term field observations. We present our data to fill this lacuna.

Materials & Methods

The Andaman Islands are a part of the union territory of India, situated in Bay of Bengal, with the capital Port Blair ($11^{\circ}39'25.09''\text{N}$; $92^{\circ}44'43.47''\text{E}$; 206 ft elevation). Study area is regions surrounding Port Blair in South Andaman District. We photographed the snakes using Canon 1200D Camera, identified the species using field guide books (Das, 2002; Whitaker & Captain, 2004) and noted down our periodical observations in datasheets.

We used visual encounter survey method, as formalized by Campbell & Christman (1992). It can be used along transect, streams, ponds or large areas and should be conducted by observers walking through a designated area for a prescribed time visually searching in a systematic manner.

Results and Discussions

Table 1. Monthly breakup of sightings of *Trimeresurus andersonii* in 2016-17

Months	Sightings in 2016	Sightings in 2017
January	0	0
February	0	0
March	0	0
April	2	1
May	4	2
June	12	10
July	10	9
August	8	6
September	5	3
October	5	2
November	1	1
December	1	0

We here present our observation of records and sighting frequencies of the Andaman Pit Viper during 2016-2017, for two years from Port Blair. This species was observed several times during night hours. We frequently observed this pit viper in human habitations too, especially near the officers barrack Police line and other places. This indicates a good population of *Trimeresurus andersonii* even in inhabited areas surrounding Port Blair.

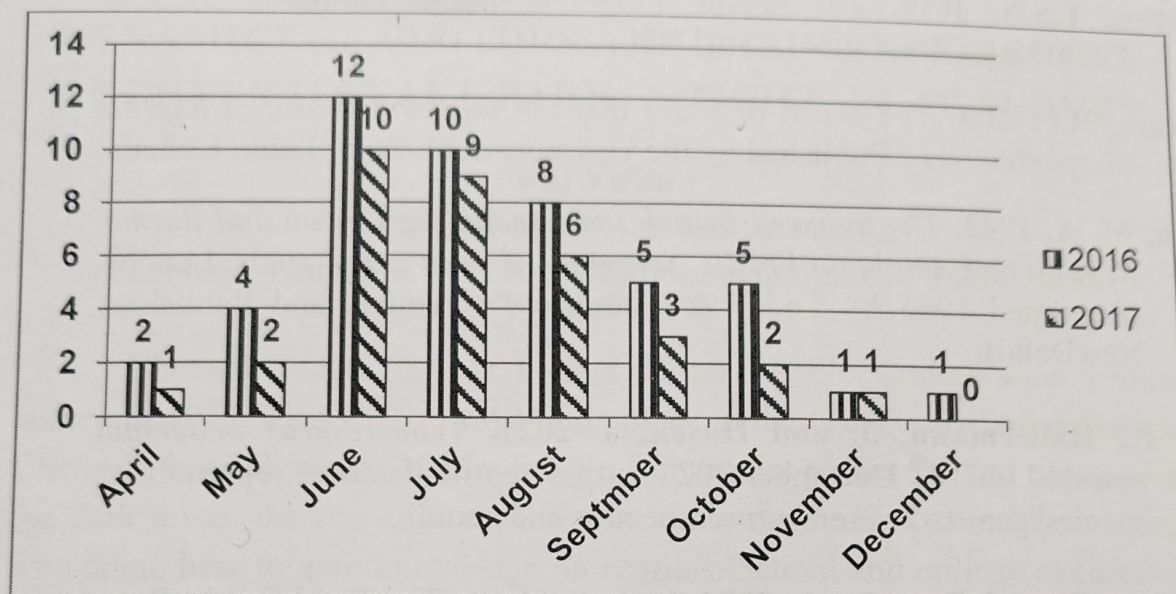


Figure 1. Seasonal breakup of *T. andersonii* sightings in Port Blair (2016-17)

In 2016 maximum sightings were seen during June i.e. 12 and minimum was during April, November and December. In 2017 maximum sightings were during June and minimum was during December (zero). None were seen in Jan.-Mar. 2016-17. Based on our long-term observations, we suspect a potential decline in the population of Andaman Pit Viper due to urbanization, deforestation, illegal hunting and anthropogenic activities.

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DYNAMICS OF VISITORS AND THEIR EXPERIENCES AT CHENNAI SNAKE PARK: A THREE-YEAR SURVEY

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Chennai Snake Park is India's oldest Reptile Conservation centre, started in 1972. This Park always finds place in the 'To-Do list' of visitors to Chennai, from all walks of life. People from many places far and close, visit the Park to see the zoo animals and pass time; there are also serious visitors who come here to gain knowledge on reptiles. School and college excursions regularly happen here. Chennai Snake Park has nearly 300 live reptiles, representing some 35 species, including native Indian species and a few foreign or exotic species. In Indian fauna, many threatened and protected species featured in the Schedules of the Indian Wildlife Protection Act, 1972 are also present here in the zoo. Captive breeding programmes of such species also happen here.

To understand the dynamics of visitor influx and their experiences in the Park, their levels of appreciations about the displays and other amenities present in the Park, a visitor survey was conducted aiming to address the aforesaid topics. Data sheets were accordingly charted by the Park authorities. I interviewed consenting visitors in the Park campus. I visited the Park almost once a month for two years 2018 and 2019. In 2020, post Covid-19 zoo reopening, I visited the Park almost every day during October, November to do a similar, visitor survey commissioned to the Park by the Central Zoo Authority, New Delhi. Here, I present my survey output in the following.

Regarding the provenance of visitors (Table 1), understandably, many come from in and around Chennai, followed by other-state visitors, then by those from other districts in Tamil Nadu. Foreign visitors were comparatively fewer, though regular.

Table 1. Break-up of city and various out-station visitors during 2018-19

Visitors	No. people	% values
Chennai	56	51.40%
Tamil Nadu	14	12.80%
India	27	24.80%
Foreign	12	11%
Total	109	100%

To understand the number of times a visitor has been to the Park (Table 2), we scored and found out that those who visit our zoo for this first time, were predominant, followed by re-visitors (visited long back when young), and then by those who had previously been here recently.

Table 2. Break-up of first time and revisiting population during 2018-19

Visitors times	No. people	% values
First timers	103	46.80%
Revisit (1st young)	88	40%
Visited before	29	13.20%
Total	220	100%

As to the interaction of visitors and the signage boards (Table 3), it is glad to note that most people read the boards, followed by those who open the closed boards for answers and then by more studious lot who photograph the board for information gaining.

Table 3. Break-up of visitor interaction with signage boards during 2018-19

Visitor Action	No. people	% value
Read	420	67.50%
Opened	194	31.20%
Photographed	8	1.30%
Total	622	100%

In the aftermath of the Covid-19 breakout, lockdown (in March 2020) and relaxation, the Chennai Snake Park was reopened to public by October 2020. Since then, for the next two months, using the SOP precautions I interacted with visitors to understand their feedbacks of Park's visit, using the CZA's questionnaire.

Visitors graded the Park's amenities (Table 4) like waiting area/time, landscaping, hygiene, approach, animal viewing and visitor facilities. Out of 100 participating visitors, the following data were obtained as feedback. Most visitors graded our Park's features as 'Good' (57-80%), followed by 'Excellent' (10-26%) and then 'Fair' (10-18%). One exception that was scored equally as 'Excellent' and 'Fair' was the animal viewing. I understand that this probably refers to the elaborate enclosure furnishings that render the in-door, closed-moat enclosure animals hard to spot, by the visitors.

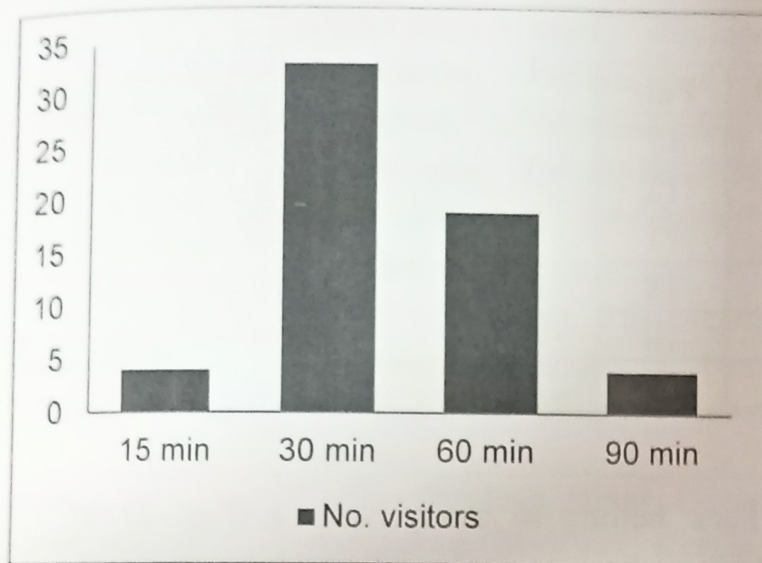


Fig. 1. Break-up of time spent by visitors at Chennai Snake Park in 2020

Visitors spend varying amount of time (Fig. 1) viewing the Park. Most visitors finish viewing the Park in 30 minutes, followed by those who complete it in 60 minutes. Some finish it in as early as 15 minutes, while others take up to 90 minutes, but these were scarce, outlier values.

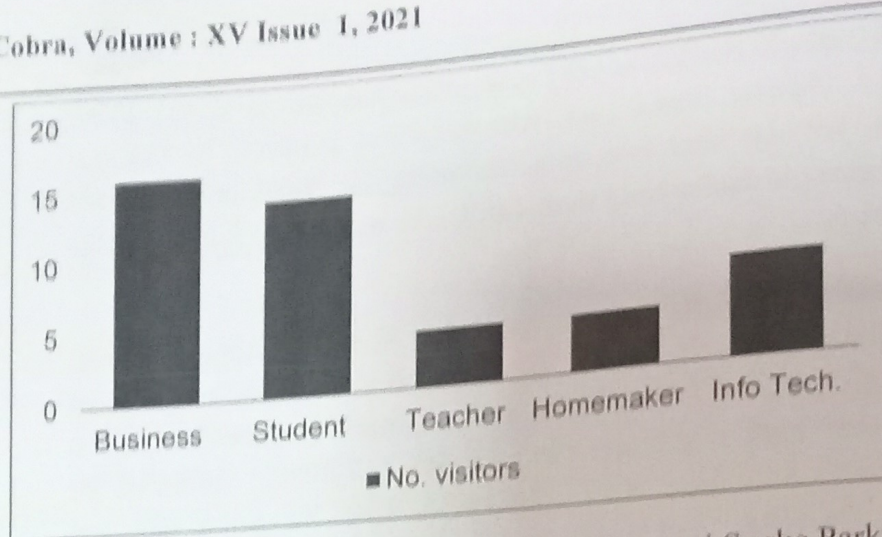


Fig. 2. Break-up of occupations of visitors at Chennai Snake Park in 2020

Table 4. Grades of visitors' feedback on the various aspects of Chennai Snake Park in 2020

Particulars	Excellent	Good	Fair
Waiting	26	57	17
Landscaping	18	70	12
Hygiene	20	69	11
Approach	11	71	18
Viewing	10	80	10
Facilities	11	72	17

Visitors coming to our Park belong to many sectors (Fig. 2) of occupation and profession. Most were businessmen, followed by students, information technology/software professional, and then teachers and homemakers.

It is hoped that this exercise of understanding and quantifying visitor feedbacks and dynamics will aid in the management of this Park and to the betterment of visitor services even more.

Acknowledgement

I thank the Executive Chairman, Director, Dy. Director and Education Officer of Chennai Snake Park for authorising and encouraging me to do this work and for all their advice. I thank my parents and brother who often accompanied me to the Park and encouraged me.

Appendix. Places from where visitors visited Chennai Snake Park in 2018-19

Visitor Category	Places
Greater Chennai	Agaram, Anna Nagar, Avadi, Ayanavaram, Chetpet, Chrompet, Gummidipoondi, KK. Nagar, Kodambakkam, Kolathur, Korattur, Kundratur, M.G.R Nagar, Madavaram, Manali, Mylapore, Nungabakkam, Padi, Pallavaram, Pallikaranai, Pammal, Parry's Corner, Perambur, Periyapalayam, Periyar Nagar, Porur, Pozhichalur, Purasawalakam, PuthuPettai, Putlur, Red hills, Saidapet, Sevvapet, Sholinganallur, Tambaram, Tondiarpet, Triplicane, TVK Nagar, Vadapalani, Velachery, Venus, Villivakam, Vysarpadi.
Tamil Nadu (other districts)	Coimbatore, Cuddalore, Hosur, Kumbakonam, Madurai, Nilgiri, Pondicherry, Salem, Thirunerveli, Thirupur, Tiruchy.
India (other states)	Andhra Pradesh, Bihar, Gujarat (Ahmedhabad), Karnataka (Bangalore, Mysore), Kerala, Madhya Pradesh (Bhopal), Maharashtra (Nagpur, Mumbai), New Delhi, Orissa, Panjab (Chandigarh), Telangana (Hyderabad), West Bengal (Kolkata).
Foreign visitors	Australia, Maldives, Saudi Arabia, United Kingdom (London), United States of America (Florida, New York).

UPDATED CATALOGUE OF HERPETOLOGICAL SPECIMENS IN THE CHENNAI SNAKE PARK

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Chennai Snake Park maintains a collection of wet-preserved, reptile and amphibian specimens in a museum to provide facilities for identification and classification of herpetofauna. Systematic zoological collections are of great scientific value since they are the sole resources for taxonomic studies (Das, 2003). To this end, this museum's collections have been widely used in many taxonomic studies (read below). Details on this collection have been already published as catalogues of the park's museum holdings (Anonymous, 1980; Kalaïarasan et al., 1994; 1995 a & b).

The latest one that was a decade old (Ganesh, 2010) presented a list of 111 species. But in the past decade, a lot of new species of herpetofauna have been described from India and a lot of species previously considered as synonyms have been resurrected and recognized as valid species. Additionally, a few new country records of species were also reported. So a sharp increase was seen in the number of Indian herpetofaunal species now recognized, especially in peninsular India (Ganesh, 2020).

For example, in amphibians Dinesh et al. (2009) reported a total of 284 species, while after a decade it is now 450 (Dinesh et al., 2020; Frost, 2021). Venugopal (2010) reported 200 Indian lizard species as occurring in India, but now it is 340 (Uetz et al., 2021). As for Indian reptiles, Aengals et al. (2011) reported 518 species, while Aengals et al. (2018) reported 572 species. But now, a few years later, the total figure is 720 (Uetz et al., 2021).

Such a drastic increase in this region's fauna doesn't indicate any new influx or addition per se. But, this inherently-necessary change only reflects our refined understanding of classification and naming of the herpetofauna. This exercise necessitated an update of our Park's museum catalogue which is presented below representing 17 amphibians, five chelonians, 45 lizards and 83 snakes, covering 150 species in all.

AMPHIBIA De Blainville, 1816

GYMNOPHIONA Rafinesque-Schmaltz, 1814

Beddome's caecilian *Ichthyophis beddomii* Peters, 1879

Material: CSPT/A-1, 2 e.g., adults from Gudalur, lower Nilgiris.

ANURA Duméril, 1806

BUFONIDAE Gray, 1825

Common Asian toad *Duttaphrynus melanostictus* (Schneider, 1799)

Material: CSPT/A-16, 3 e.g., adults from Madras.

Peninsular Indian toad *Duttaphrynus peninsularis* (Rao, 1920)

Material: CSPT/A-20, 7 e.g., adults from Tuticorin.

Dwarf toad *Duttaphrynus scaber* (Schneider, 1799)

Material: CSPT/A-19, 8 e.g., adults from Chengelpet.

MICROHYLIDAE Günther, 1858

Ornate small-mouthed frog *Microhyla ornata* (Duméril & Bibron, 1841)

CSPT/A-9, 4 e.g., adults from Madras.

Red small-mouthed frog *Microhyla rubra* (Jerdon, 1854)

CSPT/A-10, 4 e.g., adults from Madras.

Variegated balloon frog *Uperodon variegatus* (Stoliczka, 1872)

Material: CSPT/A-18, 4 e.g., adults from Madras.

Painted frog *Uperodon taprobanicus* (Parker, 1934)

Material: CSPT/A-11, 4 e.g., adults from Madras.

Marbled balloon frog *Uperodon systoma* (Schneider, 1799)

Material: CSPT/A-12, 2 e.g., adults from Madras.

RHACOPHORIDAE Hoffman, 1932

Indian tree frog *Polypedates maculatus* (Gray, 1834)

Material: CSPT/A-14, 4 e.g., adults from Madras.



DICROGLOSSIDAE Anderson, 1871

Cricket frog *Minervarya agricola* (Jerdon, 1853)

Material: CSPT/A-4, 4 e.g., adults from Narmada Valley and Madras.

Skipper frog *Euphlyctis cyanophlyctis* (Schneider, 1799)

Material: CSPT/A-5, 2 e.g., adults from Narmada Valley and Madras.

Green frog *Euphlyctis hexadactylus* (Lesson, 1834)

Material: CSPT/A-8, 1 e.g., adult from Narmada Valley.

Indian bull frog *Hoplobatrachus tigerinus* (Daudin, 1803)

Material: CSPT/A-7, 2 e.g., adults from Narmada valley.

Jerdon's bull frog *Hoplobatrachus crassus* (Jerdon, 1853)

Material: CSPT/A-6, 1 e.g., adult from Madras.

Indian burrowing frog *Sphaerotheca breviceps* (Schneider, 1799)

Material: CSPT/A-3, 3 e.g., adults from Madras.

Roland's burrowing frog *Spaerotheca rolandae* (Dubois, 1983)

Material: CSPT/A-17, 3 e.g., adults from Madras.

REPTILIA Laurenti, 1768

TESTUDINES Batsch, 1788

CHELONIIDAE Gray, 1825

Olive ridley sea turtle *Lepidochelys olivacea* (Eschscholtz, 1829)

Material: CSPT/T-3, 2 e.g., juveniles from Madras beach.

GEOEMYDIDAE Theobald, 1868

Black pond turtle *Melanochelys trijuga* (Schwigger, 1814)

Material: CSPT/T-2, 1 e.g., adult from Madras.

Hamilton's turtle *Geoclemys hamiltoni* (Gray, 1831)

Material: CSPT/T-6, 1 e.g., adult, captive born.

TESTUDINIDAE Gray, 1825

Starred tortoise *Geochelone elegans* (Schoepff, 1795)

Material: CSPT/T-1, 1 e.g., adult from Madras.

TRIONYCHIDAE Bell, 1828

Flapshell turtle *Lissemys punctata* (Lacépède, 1788)

Material: CSPT/T-4, 1 e.g., adult from Madras.

SQUAMATA Oppell, 1811

SAURIA Macartney, 1802

GEKKONIDAE Gray, 1825

Waynad day gecko *Cnemaspis waynaadensis* (Beddome, 1870)

Material: CSPT/L-21, 1 e.g., subadult from Gudalur, lower Nilgiris.

Nilgiri day gecko *Cnemaspis nilagirica* Manamendra-Arachchi, Batuwita & Pethiyagoda, 2007

Material: CSPT/L-22, 4 e.g., adults and subadult, from Ootacamund, Nilgiris.

Galaxy day gecko *Cnemaspis* cf. *galaxia* Pal, Mirza & Shanker, 2021

Material: CSPT/L-24, 1 e.g., adult from Madurai hills.

Bark gecko *Hemidactylus leshcenaultii* Duméril & Bibron, 1836

Material: CSPT/L-13, 4 e.g., adults from Madras and Narmada valley.

Asian house gecko *Hemidactylus frenatus* Schlegel, 1836

Material: CSPT/L-14, 4 e.g., adults from Madras and Narmada valley.

Spotted house gecko *Hemidactylus parvimaculatus* Deraniyagala, 1953

Material: CSPT/L-15, 3 e.g., adults from Madras.

Murray's gecko *Hemidactylus murrayi* Gleadon, 1887

Material: CSPT/L-31, 2 e.g., adults from Narmada valley.

Termite hill gecko *Hemidactylus triedrus* (Daudin, 1802)

Material: CSPT/L-16, 4 e.g., adults from Madras.

Spotted rock gecko *Hemidactylus maculatus* Duméril & Bibron, 1836

Material: CSPT/L-17, 1 e.g., adult from Narmada Valley.

Reticulated gecko *Hemidactylus reticulatus* Beddome, 1870

Material: CSPT/L-18, 5 e.g., adults from Chengelpet.

Giant gecko *Hemidactylus giganteus* Stoliczka, 1871
Material: CSPT/L-19, 1 e.g., adult from Narmada Valley.

Granite rock gecko *Hemidactylus graniticolus* Agarwal, Giri & Bauer, 2011
Material: CSPT/L-20, 1 e.g., adult from near Gingee.

Scaly gecko *Hemidactylus scabriceps* (Annandale, 1906)
Material: CSPT/L-40, 5 e.g., adults from Tuticorin.

Meghamalai Dravidian gecko *Dravidogecko* cf. *meghamalaiensis* Chaitanya, Giri, Deepak, Datta-Roy, Murthy & Karanth, 2019
Material: CSPT/L-41, 1 e.g., adult from near Madurai hills.

Tokay gecko *Gekko gekko* (Linnaeus, 1758)
Material: CSPT/L-23, 7 e.g., adults; from Calcutta, West Bengal.

Emerald gecko *Phelsuma andamanensis* Blyth, 1860
Material: CSPT/L-25, 1 e.g., adult from North Andaman Islands.

AGAMIDAE Gray, 1827

Pondicheri fan-throated lizard *Sitana ponticeriana* Cuiver, 1829
Material: CSPT/L-37, 3 e.g., adults from Madras.

Kanyakumari fan-throated lizard *Sitana marudhamneydhal* Deepak, Khandekar, Varma & Chaitanya, 2016
Material: CSPT/L- 43, 4 e.g., adults from Kanyakumari.

Western Ghats flying lizard *Draco dussumierii* Duméril & Bibron, 1837
Material: CSPT/L-12, 2 e.g., adults from Valparai.

Anaimalai spiny lizard *Salea anamallayana* (Beddome, 1878)
Material: CSPT/L-10, 1 e.g., adult from Valparai.

Nilgiri spiny lizard *Salea horsfieldii* Gray, 1845
Material: CSPT/L- 38, 1 e.g., adult from Ootacamund, Nilgiris.

Common garden lizard *Calotes versicolor* (Daudin, 1802)
Material: CSPT/L-2, 3 e.g., adults from Madras.



Green forest lizard *Calotes calotes* (Linnaeus, 1758)

Material: CSPT/L-3, 1 e.g., adult from Mayiladuthurai.

Large-scale forest lizard *Calotes grandisquamis* Günther, 1875

Material: CSPT/L-6, 1 e.g., adult from Valparai.

Elliott's forest lizard *Monilesaurus ellioti* (Günther, 1864)

Material: CSPT/L-4, 2 e.g., adults from Valparai.

Roux's forest lizard *Monilesaurus rouxii* (Duméril & Bibron, 1837)

Material: CSPT/L-5, 2 e.g., adult from lower Nilgiris.

Bay Island lizard *Coryphophylax subcristatus* (Blyth, 1861)

Material: CSPT/L-37, 1 e.g., adult from South Andaman.

Peninsular rock agama *Psammophilus dorsalis* (Gray, in Griffith, 1831)

Material: CSPT/L-7, 2 e.g., adult from Shevaroy and Yelagiri.

Indian rock agama *Psammophilus blanfordanus* (Stoliczka, 1871)

Material: CSPT/L-8, 4 e.g., adult; from Narmada valley and Gingee.

Himalayan rock agama *Laudakia himalayana* (Steindachner, 1867)

Material: CSPT/L-9, 1 e.g., adult from Pohur Pajan, Kashmir.

Indian spiny-tailed lizard *Saara hardwickii* (Gray, 1827)

Material: CSPT/L-11, 1 e.g., adult, captive born.

CHAMELEONIDAE Gray, 1825

South Asian Chameleon *Chamaeleo zeylanicus* Laurenti, 1768

Material: CSPT/L-1, 2 e.g., adult from Guindy, Madras.

SCINCIDAE Gray, 1825

Bibron's skink *Eutropis bibronii* (Gray, 1839)

Material: CSPT/L-29, 4 e.g., adult from Madras.

Beddome's skink *Eutropis beddomei* (Jerdon, 1870)

Material: CSPT/L-31, 2 e.g., adult and subadult from Gingee and Chengelpet.

Keeled skink *Eutropis carinata* (Schneider, 1801)

Material: CSPT/L-33, 2 e.g., adult and young one from Madras.

Tytler's skink *Eutropis tytleri* (Theobald, 1868)

Material: CSPT/L-32, 1 e.g., adult from South Andaman Islands.

Bronze skink *Eutropis cf. macularia* (Blyth, 1853)

Material: CSPT/L-28, 2 e.g., adult from Madras.

Spotted snake skink *Riopa punctata* (Linnaeus, 1758)

Material: CSPT/L-30, 4 e.g., adult from Madras.

White-dotted skink *Riopa albopunctata* (Gray, 1846)

Material: CSPT/L-26, 4 e.g., adults, from Madras.

Travancore litter skink *Sphenomorphus dussumieri* (Duméril & Bibron, 1839)

Material: CSPT/L-29, 1 e.g., adult from Kanyakumari hills.

Side-spotted ground skink *Kaestlea laterimaculata* (Boulenger, 1887)

Material: MAD/L-38, 1 e.g., adult from Kodaikanal, Palni hills.

LACERTIDAE Gray, 1825

Leschenault's snake-eye *Ophisops leschenaultii* Milne-Edwards, 1789

Material: CSPT/L-36, 1 e.g., adult from Gingee.

Blinking snake-eye *Ophisops nictans* Arnold, 1989

Material: CSPT/L-35, 1 e.g., adult from Narmada Valley.

VARANIDAE Gray, 1827

Indian monitor *Varanus bengalensis* (Linnaeus, 1758)

Material: CSPT/L-34, 1 e.g., adult from Madras.

Water monitor *Varanus salvator* (Laurenti, 1768)

Material: CSPT/L-39, 1 e.g., juvenile from Andaman Islands.

Yellow monitor *Varanus flavescens* (Gray, 1827)

Material: CSPT/L-41, 1 e.g., adult from Calcutta.

SERPENTES Linnaeus, 1758

TYPHLOPIDAE Merrem, 1820

Common worm snake *Indotyphlops braminus* (Daudin, 1803)

Material: CSPT/S-1, 2 e.g., adults from Madras.

Beaked worm snake *Grypotyphlops acutus* (Duméril & Bibron, 1844)

Material: CSPT/S-2, 2 e.g., adults from Madras and Madurai.

GERRHOPILIDAE

Beddome's worm snake *Gerrhopilus* cf. *beddomii* (Boulenger, 1890)

Material: CSPT/S-13, 1 e.g., adult from near Madras.

UROPELTIDAE Müller, 1832

Pied-belly shieldtail *Melanophidium punctatum* Beddome, 1871

Material: CSPT/S-9, 1 e.g., adult from near Courtallam, Tirunelveli.

Wynaad shieldtail *Melanophidium wynaudente* (Beddome, 1863)

Material: CSPT/S-8, 1 e.g., adult from Gudalur, lower Nilgiris.

Madurai shieldtail *Platyplectrurus madurensis* (Beddome, 1878)

Material: CSPT/S-2, 5 e.g., subadults from Kodaikanal, Palni hills.

Wall's shieldtail *Teretrurus rhodogaster* (Wall, 1921)

Material: CSPT/S-14, 2 e.g., subadults from Kodaikanal, Palni hills.

Anamallay shieldtail *Teretrurus sanguineus* (Beddome, 1867)

Material: CSPT/S-10, 1 e.g., adult from Valparai, Anaimalai.

Perrotet's shieldtail *Plectrurus perroteti* Duméril, Birbon & Duméril, 1854

Material: CSPT/S-15, 1 e.g., adult from Ootacamund, Nilgiris.

Red-bellied shieldtail *Rhinophis sanguineus* Beddome, 1863

Material: CSPT/S-5, 1 e.g., adult from Gudalur, lower Nilgiris.

Travancore shieldtail *Rhinophis travancoricus* Boulenger, 1892

Material: CSPT/S-11, 1 e.g., adult from Courtallam, Tirunelveli.

Elliot's shieldtail *Uropeltis ellioti* (Günther, 1858)
Material: CSPT/S-81, 1 e.g., adult from Yercaud, Shevaroyes.

Ashambu shieldtail *Uropeltis liura* (Günther, 1875)
Material: CSPT/S-3, 2 e.g., adults from Madurai hills.

Wood-mason's shieldtail *Uropeltis woodmasoni* (Theobald, 1876)
Material: CSPT/S-4, 1 e.g., adult from Anaimalai.

Madurai shieldtail *Uropeltis madurensis* (Beddome, 1878)
Material: CSPT/S-6, 1 e.g., adult from Madurai Hills.

Shortt's shieldtail *Uropeltis shorttii* (Beddome, 1863)
Material: CSPT/S-80, 2 e.g., adults from Yercaud, Shevaroyes.

Palni shieldtail *Uropeltis pulneyensis* (Beddome, 1863)
CSPT/S-4a, 1 e.g., adult from Kodaikanal, Palani hills.

Peter's shieldtail *Uropeltis petersi* (Beddome, 1878)
Material: CSPT/S-7a, 1 e.g. adult from Kodaikanal, Palani hills.

Mahendragiri shieldtail *Uropeltis myhendrae* (Beddome, 1886)
Material: CSPT/S-5, 1 e.g., adult from Kanyakumari hills.

Red-spotted shieldtail *Uropeltis rubromaculata* (Beddome, 1867)
Material: CSPT/S-7, 1 e.g., adult from Valparai, Anaimalai.

PYTHONIDAE Fitzinger, 1826

Indian rock python *Python molurus* (Linnaeus, 1758)
Material: CSPT/S-16, 1 e.g., juvenile, captive, still-born.

Reticulated python *Malayopython reticulatus* (Schneider, 1801)
Material: CSPT/S-17, 1 e.g., juvenile, captive, still-born.

ERYCIDAE Bonaparte, 1831

Common sand boa *Eryx conicus* (Schneider, 1801)
Material: CSPT/S-18, 1 e.g., adult from Madras.

Red sand boa *Eryx johnii* (Russell, 1801)
Material: CSPT/S-19, 1 e.g., adult from Madras.

Whitaker's boa *Eryx whitakeri* Das, 1991
Material: CSPT/S-20, 1 e.g., adult from Mangalore.

ACHROCHORDIDAE Bonaparte, 1831

File snake *Acrochordus granulatus* (Schneider, 1799)
Material: CSPT/S-75, 1 e.g., adult from Port Blair, South Andaman.

PAREIIDAE

Perrotet's wood snake *Xylophis perroteti* (Duméril, Bibron & Duméril, 1854)
Material: CSPT/S-37, 1 e.g., adult from Coonoor, Nilgiris.

Deepak's wood snake *Xylophis stenorhynchus* (Günther, 1875)
Material: CSPT/S-38, 3 e.g., adults from Valparai, Anaimalai.

Captain's wood snake *Xylophis deepaki* Narayanan, Mohapatra, Balan, Das & Gower, 2021
Material: CSPT/S-77, 4 e.g., adults and subadults from Kanyakumari hills.

VIPERIDAE Boie, 1827

Russell's viper *Daboia russelii* (Shaw & Nodder, 1799)
Material: CSPT/S-64, 1 e.g., adult from Madras.

Saw-scaled viper *Echis carinatus* (Schneider, 1801)
Material: CSPT/S-65, 1 e.g., adult from Madras.

Hump-nosed pitviper *Hypnale hypnale* (Merrem, 1820)
Material: CSPT/S-66, 5 e.g., adults and subadults from Gudalur, lower Nilgiris, Valparai, Madurai hills and Courtallam, Tirunelveli hills.

Himalayan pitviper *Gloydius himalayanus* (Günther, 1864)
Material: CSPT/S-71, 3 e.g., adult and subadults from Pohur Pajan, Kashmir.

Large-scaled pitviper *Trimeresurus macrolepis* Beddome, 1862
Material: CSPT/S-69, 1 e.g., adult from Valparai, Anaimalai.

Malabar pitviper *Trimeresurus malabaricus* (Jerdon, 1854)
Material: CSPT/S-76, 2 e.g., adults from Gudalur, lower Nilgiris.

Anaimalai pitviper *Trimeresurus anamallensis* (Günther, 1864)
Material: CSPT/S-72, 1 e.g., adult from Valparai, Anaimalai.

Bamboo pitviper *Trimeresurus gramineus* (Shaw, 1802)
Material: CSPT/S-68, 2 e.g., adults from Gingee hills.

Horse-shoe pitviper *Trimeresurus strigatus* Gray, 1842
Material: CSPT/S-67, 1 e.g., adult from near Ootacamund, Nilgiris.

Andaman pitviper *Trimeresurus andersoni* Theobald, 1868
Material: CSPT/S-70, 2 e.g., adults from Port Blair, South Andaman; and North Andaman.

Cantor's pitviper *Trimeresurus cantori* Blyth, 1846
Material: CSPT/S-79, 1 e.g., adult from Nicobar Islands.

HOMALOPSIDAE

Common smooth water snake *Enhydris enhydris* (Schneider, 1799)
Material: CSPT/S-42, 1 e.g., adult from Calcutta.

Dog faced water snake *Cerberus rhynchops* (Schneider, 1799)
Material: CSPT/S-41, 1 e.g., adult from South Andaman.

ELAPIDAE Boie, 1827

Banded krait *Bungarus fasciatus* (Schneider, 1801)
Material: CSPT/S-55, 1 e.g., adult from Calcutta.

Common krait *Bungarus caeruleus* (Schneider, 1801)
Material: CSPT/S-54, 1 e.g., subadult from Madras.

Slender coral snake *Calliophis melanurus* (Shaw, 1802)
Material: CSPT/S-52, 1 e.g., adult from Madras.

Striped coral snake *Calliophis nigrescens* Günther, 1862
Material: CSPT/S-78, 2 e.g., adults from Madurai hills and Kodaikanal.



Beddome's coral snake *Calliophis beddomei* Smith, 1943

Material: CSPT/S-82, 1 e.g. adult from Yercaud, Shevaroyoys.

Monocled cobra *Naja kaouthia* (Lesson, 1831)

Material: CSPT/S-57, 1 e.g., adult from Calcutta.

Indian cobra *Naja naja* (Linnaeus, 1758)

Material: CSPT/S-53, 1 e.g., adult from Madras.

King cobra *Ophiophagus hannah* (Cantor, 1839)

Material: CSPT/S-56, 1 e.g., young one from South Andaman.

Hook-nosed sea snake *Hydrophis schistosus* (Daudin, 1803)

Material: CSPT/S-61, 1 e.g., adult from Madras beach.

Yellow sea snake *Hydrophis spiralis* (Shaw, 1802)

Material: CSPT/S-58, 1 e.g., adult from Madras beach.

Annulated sea snake *Hydrophis cyanocinctus* Daudin, 1803

Material: CSPT/S-59, 1 e.g., adult from Madras beach.

Cochin banded sea snake *Hydrophis ornatus* (Gray, 1842)

Material: CSPT/S-30, 1 e.g., adult from Madras beach.

Banded sea snake *Hydrophis fasciatus* (Schneider, 1799)

Material: CSPT/S-60, 1 e.g., adult from Madras beach.

Short sea snake *Hydrophis curtus* (Shaw, 1802)

Material: CSPT/S-62, 1 e.g., adult from Madras beach.

Pelagic sea snake *Hydrophis platurus* (Linnaeus, 1766)

Material: CSPT/S-63, 1 e.g., adult from Madras beach.

Malacca sea snake *Hydrophis caeruleus* (Shaw, 1802)

Material: CSPT/S-73, 2 e.g., subadults from Madras beach.

Sea Krait *Laticauda colubrina* (Schneider, 1799)

Material: CSPT/S-74, 1 e.g., adult, from Andaman Coast.

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