Green cover may predict persistence of garden lizards in city parks of Chennai Metropolis, India: insights from a preliminary study

Chennai (12.90–13.22°N 80.05–80.32°E) in southeastern India is a megacity where peripheral natural greenery has rapidly depleted over the decades (Amirtham et al. 2009; Sundaram 2011, 2020; Padmanabhan et al. 2017). Here, intentionally created recreational greenery or 'city parks' that still target human beneficiaries alone escape the cement. Chennai is reported to have 525 parks, the earliest of which was founded in 1769 (Sudhakar 2020, 2023). Among the most common and widespread reptiles of this city, is the garden lizard *Calotes versicolor* (Daudin, 1803) (Subramanean 2017), a synanthropic, diurnal, insectivorous, arboreal lizard (Asana 1931; McCann, 1937; read with Gowande et al. 2021). On account of its habitat use and diet, its presence indicates the well-being of live vegetation cover with insect pollinators (Kar 1987; Kalaiarasan & Rajarathinam 2005). In this study, we use *C. versicolor* as a model to examine the status of green covers within the urban sprawl of Chennai.

One of us (SG) visited these parks to scan the surroundings and note down every garden lizard seen. A total of 26 city parks in Chennai were selected such that they cover the spatial spread of the city and also represent many types of spatial extents. They were categorized as small (<1 ha), medium (1–2 ha), and large (>2 ha) parks based on land area. The smallest park was only 0.02 ha (Anbazhahan Park) whereas the largest park was 11.2 ha (Pallikaranai Park), over 500 times larger. So the field visit duration to a park differed as per the land area sizes. One particular site – the Egmore Museum is not a park although an urban green space and was visited on ticketed basis within the stipulated areas, days, and timings.

Periodical visits were made to the selected 26 parks, during mornings (7:30–10:30 am) and evenings (3:30–5:30 pm) and were as per park timings. As *C. versicolor* is the only arboreal agamid in the area (Subramanean 2017), no action was necessary after detection for data collection. Movements inside the park were

Map of Greater Chennai with the 26 city parks pin-marked and numbered, as follows (alphabetically): 1—Anbazhagan Park | 2—Anna Nagar Park | 3—Anna Robinson Park | 4—Ashok Nagar 5E Park | 5—Bougenvilla Park | 6—Egmore Museum | 7—Gill Nagar Park | 8—Jai Nagar Park | 9—Jeeva Park | 10—Kittu Park | 11—Kodambakkam Park | 12—Korattur Park | 13—May Day Park | 14—Mayor Sundar Rao Park | 15—Muthulakshmi Park | 16—Nageshwar Rao Park | 17—Natesan Park | 18—Padi Millenium Park | 19—Pallikaranai Park | 20—Panagal Park | 21—Semozhi Poonga | 22—Shenoy Nagar Park | 23—Shivan Park | 24—Tower Park | 25—Tree Park | 26—Valluvar Kottam Park | Map rendered from Google Earth.

always done honouring the prevailing etiquettes. Visits done in a park ranged from 1–3 times, especially for the larger parks. Time duration spent visiting a park ranged from 2.5–6.0 h. Overall 100 h were spent in these 26 parks. Time-honoured surveys (Ribeiro-Júnior et al. 2008) were chosen over distance-honoured methods as it was not practical for observer to lay line-transects inside the park or use existing (random, cursive) pathways for such purposes owing to the nature of this sampling method (Buckland & Turnrock 1992). Time-constrained surveys were also stated to be better choice than line-transects (Attiwilli et al. 2024). Visits were carried out over five months from October 2023 to February 2024 and were temporarily suspended during peak monsoon (December 2023), when most parks were closed to the public and when data collection was either impossible or incomparable.

From a 100-hour fieldwork done in 26 parks, a total of 237 sightings of the garden lizard (*Calotes versicolor*) were obtained. Among the 26 parks surveyed, no sightings were obtained in four parks. The number of lizard sightings obtained in one park overall, ranged between 1 and 31. Classified as per park area, it was 7–31 sightings within large parks, 9–17 within medium parks, and 1–25 within small parks. Lizards were sighted in all (6/6) the large parks, most (4/5) of the medium parks and many (3/15) of the small parks.

Our results (Table 1) show that there are minor mismatches in the survey input (survey duration honouring the park's area). Pallikaranai Park was the largest in area but had 5.6 h field visit duration. The maximum time of 6 h was spent in the somewhat smaller Semmozhi Poonga,

Table 1. Quantifications of survey inputs and outputs concerning garden lizards in city parks. Highest values within a column are in bold; while the lowest values appear in bold italics.

Name of the park	Area size category	Duration (in hours)	No. of sightings	Relative Abundance %	Encounter Rate	Hour / sighting
Egmore Museum	Large	4.6	17	7.1	3.70	0.27
Pallikaranai Park	Large	5.6	**31**	**12.9**	**5.54**	**0.18**
Semmozhi Poonga	Large	**6.0**	7	2.9	2.80	0.36
Shenoy Nagar Park	Large	4.0	8	3.3	2.00	0.50
Tower Park	Large	5.0	21	8.7	4.20	0.24
Valluvar Kottam Park	Large	3.3	15	6.2	4.55	0.22
Bougenvilla Park	Medium	3.0	10	4.1	3.33	0.30
Nageshwar Rao Park	Medium	3.3	0	0.0	0.00	0.00
Natesan Park	Medium	3.5	12	5.0	3.43	0.30
Shivan Park	Medium	5.0	17	7.1	3.40	0.29
Padi Millenium Park	Medium	4.0	9	3.7	2.25	0.44
Anna Nagar Park	Small	3.0	2	0.8	0.67	1.50
Anna Robinson Park	Small	4.0	12	5.0	3.00	0.33
Ashok Nagar 5E Park	Small	4.0	2	0.8	0.50	2.00
Jeeva Park	Small	2.5	11	4.6	4.40	0.23
Korattur Park	Small	3.0	4	1.6	1.33	0.75
May Day Park	Small	5.9	25	10.4	4.24	0.24
Panagal Park	Small	2.5	11	4.6	4.40	0.23
Tree Park	Small	3.0	11	4.6	3.67	0.27
Anbazhagan Park	Small	3.5	2	0.8	0.57	1.75
Gill Nagar Park	Small	5.6	2	0.8	0.36	2.83
Jai Nagar Park	Small	3.0	0	0.0	0.00	0.00
Kittu Park	Small	4.0	***1***	***0.4***	***0.25***	***4.00***
Kodambakkam Park	Small	***2.5***	0	0.0	0.00	0.00
Mayor Sundarao Park	Small	2.8	9	3.7	3.21	0.31
Muthulakshmi Park	Small	3.4	0	0.0	0.00	0.00

that is anyway a 'large' category site. Likewise the smallest of all, the Anbazhahan Park had a duration of 3.5 h, while the least duration was spent in a somewhat larger Kodambakkam Park, that is anyway a 'small' category site.

Semmozhi Poonga where survey duration was the highest yielded only seven sightings, far fewer than the highest frequency (31). Likewise, short duration of 2.5 h was spent in Panagal Pak and Jeeva Park (small parks), but they yielded 11 lizard sightings each. Also, Muthulakshmi Park and Jai Nagar Park where no sightings were obtained were surveyed for 3–3.4h. This highlights the role played by intrinsic floral and other features of the park that impacts and changes the default view that more time spent in visiting a park will fetch greater lizard sightings. Revealing such patterns was one of the most fundamental aims of this study.

Pallikaranai Park yielded the highest sighting frequency (31) and hence relative abundance (12.9%), had the highest encounter rate (5.54) and conversely the least time needed for a lizard sighting (0.18). Taken together, these features project the Pallikaranai park as perhaps the most important site to ensure continued survival of garden lizards in Chennai. On the other hand, Kittu Park, a small-sized park had the lowest sighting frequency (1), relative abundance (0.4), encounter rate (0.25), and conversely the highest time required (4.00) for a sighting. So among all the parks visited where the garden lizard was seen, it performed the lowest.

It is to be noted here that Pallikaranai Park, appraised as the best for the garden lizards is a large-sized park, whereas Kittu Park, appraised as the poorest park for the lizards is a small-sized park. This indicates the intrinsic value of size of the green cover area as a predominant factor in harbouring garden lizards. Another support to this hypothesis is that despite spending the same 5.6 h duration, Pallikaranai a large-sized park, fared far better (31 vs. 2 sightings) compared to the small-sized Gill Nagar Park. Secondly, despite spending almost equal time duration (5.9 vs. 6 h), the 0.4 ha May Day Park fared far better (25 vs. 0 sightings), compared to the tiny 0.03 ha Kodambakkam Park.

On the contrary we also observed that at least one medium-sized park (Nageshwar Rao Park) did not fetch any detections of the garden lizard despite surveys. Whereas, all the large-sized parks had sightings of the garden lizards. Revisiting the importance of survey input, average survey time spent in a park ranged 3–4 hours sometimes depending on the park's area. The average sighting frequency of garden lizards in a park was around 9–10 sightings. This implies that apart from land area alone, other confounding factors like green cover density and human dominance may play a role in determining the lizard numbers present.

Several studies attest that *C. versicolor* is a rather dominant and resilient species (McCann 1937), at least in Chennai (e.g., Preston 2014; Subramanean 2017). In a taxonomic context, those few studies that apparently report on the population ecology of native Indian *C. versicolor* complex, actually do not refer to *C. versicolor* any more (Gowande et al. 2021). The study in Karachi of Pakistan by Khan & Mehmood (2004) now pertains to *C. farooqi* Auffenberg & Rehman, 1995. The study from Vadodara, Gujarat, western India by Adhikari et al. (2006) refers to *C. vultuosus* (Harlan, 1825). Chennai, parks have been considered as biodiversity refuges in urban spaces (Sudhakar 2020, 2023). In a regional context, such studies in Chennai parks have focussed only on 'appealing' and 'human-friendly' taxa like butterflies (Thangapandian et al. 2014) and birds (Gandy 2023). Against this backdrop, in both the contexts, our preliminary study on the lizard *C. versicolor* becomes noteworthy.

References

Adhikari, R., B. Suresh & B. Pilo (2006). Population structure of *Calotes versicolor* (Daudin) in an industrial area in Vadodara district of Gujarat State, India. pp. 294–297. In: Singh, A.K. & L. Kumar (eds.). *Advanced Ecology*. Daya Publishing House, New Delhi, 306 pp.

Amirtham, L.R., M.D. Devadas & M. Perumal (2009). Mapping of micro-urban heat islands and land cover changes: a case in Chennai City, India. *The International Journal of Climate Change: Impacts and Responses* 1(2): 71.

Asana, J.J. (1931). The natural history of *Calotes versicolor*, the common blood-sucker. *Journal of the Bombay Natural History Society* 34: 1041–1047.

Attiwilli, S., N. Ravikanthachari & K. Kunte (2024). A comparison between time- constrained counts and line transects as methods to estimate butterfly diversity and monitor populations in tropical habitats. *Insect Conservation & Diversity* 17(1): 88– 101.

Buckland, S.T. & B.J. Turnock (1992). A robust line transect method. *Biometrics* 901–909.

Gandy, M. (2023). Chennai flyways: Birds, biodiversity, and ecological decay. *Environment and Planning E: Nature and Space*. 6(4): 2678–2699.

Gowande, G., S. Pal, D. Jablonski, R. Masroor, P.U. Phansalkar, P. Dsouza, A. Jayarajan & K. Shanker (2021). Molecular phylogenetics and taxonomic reassessment of the widespread agamid lizard *Calotes versicolor* (Daudin, 1802) (Squamata, Agamidae) across South Asia. *Vertebrate Zoology*, 71: 669–696.

Kalaiarasan, V. & R. Rajarathinam (2005). Dietary habits of Indian garden lizard *Calotes versicolor* (Daudin). *Cobra*, 61: 16–20.

Kar, A. (1987). Relative importance of temperature and photoperiod in the physiology of Indian garden lizard, *Calotes versicolor*. *Current Science*, 56(10): 497–499.

Khan, M.Z. & N. Mahmood (2004). Study of population status and natural history of agamid lizards of Karachi. *Pakistan Journal of Biological Sciences*, 7(11): 1942–1945.

McCann, C. (1937). Notes on *Calotes versicolor* (Daudin). *Journal of the Bombay Natural History Society*, 39: 843–848.

Padmanaban, R., A.K. Bhowmik, P. Cabral, A. Zamyatin, O. Almegdadi & S. Wang (2017). Modelling urban sprawl using remotely sensed data: A case study of Chennai city, Tamilnadu. *Entropy*, 19(4): 163.

Ribeiro-Júnior, M.A., T.A. Gardner & T.C. Ávila-Pires (2008). Evaluating the effectiveness of herpetofaunal sampling techniques across a gradient of habitat change in a tropical forest landscape. *Journal of Herpetology* 42(4): 733–749.

Subramanean, J. (2017). Lizards of Chennai and its Environs, Tamil Nadu. *Cobra*, 11(2): 27–30.

Sudhakar, P. (2020). Ornamental gardening and parks in Chennai – a review. *Indian Journal of Environmental Education*, 20: 30–40.

Sudhakar, P. (2023). A Study of the Floristic Diversity of Selected Corporation Parks in Chennai. *Indian Journal of Environmental Education*, 22 & 23: 91–102.

Sundaram, A.M. (2011). Urban green-cover and the environmental performance of Chennai city. *Environment, development and sustainability*, 13(1): 107–119.

Sundaram, A.M. (2022). Restoring Urban Green Cover of Chennai City: An Ecological Approach. In Environmental Concerns and Remediation: Proceedings of F-EIR Conference 2021 (pp. 145–171). Cham: Springer International Publishing.

Thangapandian, M., A. Ganesh, P. Ramaraj, C. Selvakumar & S. Janarthanan (2014). Diversity and status of butterflies in the city of Chennai, Tamil Nadu. *Hexapoda* (Insecta Indica), 21(1): 1–9.

Acknowledgements
We thank our respective institutions for encouraging our collaborative research activities. At the Gurunanak College, thanks are due to the principal and at the Kalinga Foundation, the founder director. We sincerely thank the custodians of the respective parks. We thank Dr. Sanjay Molur for his insightful review comments on this manuscript.

S. Ganesh[1], S. Bhuvaneshwari[2] & S.R. Ganesh[3]
[1&2] Department of Zoology, Gurunanak College, Velachery, Chennai, Tamil Nadu 600042, India.
[3] Kalinga Foundation, Guddekeri, Agumbe, Shivamogha District, Karnataka 577411, India.
Email: [3]snakeranglerr@gmail.com (corresponding author)

Citation: Ganesh, S., S. Bhuvaneshwari & S.R. Ganesh (2024). Green cover may predict persistence of garden lizards in city parks of Chennai Metropolis, India: insights from a preliminary study. Reptile Rap #254, In: *Zoo's Print* 39(7): 05–09.