



Tamil Nadu Forest Department
Advanced Institute For Wildlife Conservation
(Research, Training & Education)
Vandalur, Chennai 600 048



**Distribution Status and threat assessment of the endemic
Madras Hedgehog (*Paraechinus nudiventris*) and associated
species in selected districts of Tamil Nadu**

***Annual Plan of Operations (APO)
2023-2024***





Report on

**‘DISTRIBUTION STATUS AND THREAT ASSESSMENT OF
THE ENDEMIC MADRAS HEDGEHOG (*PARAECHINUS
NUDIVENTRIS*) AND ASSOCIATED SPECIES IN SELECTED
DISTRICTS OF TAMIL NADU’**



Annual Plan of Operations (APO (2023-24))

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TABLE OF CONTENTS

	Page
1 Abstract	1
2 Introduction	2
3 Objectives	4
4 Study area	4
5 Study species	7
6 Methodology	8
6.1 Questionnaire survey	8
6.1.1 Simple Random Sampling	9
6.1.2 Purposive Random Sampling	9
6.1.3 Snowball Sampling	9
6.2 Nocturnal survey	10
6.2.1 Spotlighting	10
6.2.2 Infrared Thermal Imagery	11
6.2.3 Camera trap	13
7 Result	15
7.1 Questionnaire Result: District-wise	18
7.1.1 Tiruvallur	18
7.1.2 Kanchipuram	21
7.1.3 Villupuram	24
7.1.4 Chennai	27
7.1.5 Erode	28
7.1.6 Tirunelveli	31

7.2	Nocturnal Survey Result	33
7.2.1	Spotlight Survey	33
7.2.2	Infrared Thermal Imagery	37
7.2.3	Behavioural observation	39
7.2.4	Camera Trap Survey: Area-wise	40
7.2.4.1	Guindy National Park	40
7.2.4.2	Infected Golden Jackal in the Guindy National Park	44
7.2.4.3	Nanmangalam Reserved Forest	45
7.2.4.4	Vandalur Reserved Forest	46
7.2.4.5	Feral animals in the Guindy National Park, Vandalur, and Nanmangalam Reserved Forests	47
7.2.4.6	Kurumbaram Reserved Forest	48
8	Threats	49
8.1	Habitat Destruction	49
8.2	Road Kills	51
8.3	Poaching	52
8.4	Stray Dog Interaction	53
8.5	Use for Medicinal Purposes	53
9	Outreach Activity	54
10	Discussion	55
11	Recommendations	56
12	References	57
13	Annexures	60

LIST OF FIGURES

Fig. No.	Title	Page
1	Map of the study area district in Tamil Nadu state	5
2	Photos of the habitat in the study area	6
3	Photos of a questionnaire survey	10
4	Photos of the spotlighting survey	11
5	Photos of the Infrared Thermal Imagery Camera	12
6	Photos of the camera trap survey	14
7	District-wise graph showing the total number of Positive and Negative responses	16
8	Map showing the previous sightings of Madras Hedgehogs (Secondary) in the Northern districts of Tamil Nadu	17
9	Map of questionnaire survey locations in the Tiruvallur district	18
10	Map of positive response locations (Secondary) in the Tiruvallur district	19
11	Map of associated species distribution (Indian Fox, Golden Jackal, Jungle Cat) in the Tiruvallur district (Secondary data)	20
12	Map of questionnaire survey locations in the Kanchipuram district	21
13	Map of positive response locations (Secondary) in the Kanchipuram district	22
14	Map of associated species distribution (Indian Fox, Golden Jackal, Jungle Cat) in the Kanchipuram district (Secondary data)	23
15	Map of questionnaire survey locations in the Villupuram district	24
16	Map of positive response locations (Secondary) in the Villupuram district	25

17	Map of associated species distribution (Indian Fox, Golden Jackal, Jungle Cat) in the Villupuram district (Secondary data)	26
18	Map of locations in Chennai district where pet markets were visited	27
19	Map of questionnaire survey locations in the Erode district	28
20	Map of positive response locations (Secondary) in the Erode district	29
21	Map of associated species distribution (Indian Fox, Golden Jackal, Jungle Cat) in the Erode district (Secondary data)	30
22	Map of questionnaire survey locations in the Tirunelveli district	31
23	Map of positive response locations in the Tirunelveli district (Secondary data)	32
24	Map of associated species distribution (Indian Fox, Golden Jackal) in the Tirunelveli district (Secondary data)	33
25	Map of direct sighting locations of Madras Hedgehog in Tirunelveli district	35
26	Photo plate of Madras Hedgehog	36
27	Photo plate of Madras Hedgehog recorded with the Infrared Thermal Imagery camera	37
28	Photo plate of Madras Hedgehog in different types of habitats recorded with the Infrared Thermal Imagery camera	38
29	Photos of the other fauna captured in the camera trap at Guindy National Park, Chennai	41-43
30	Photo plate of the infected Golden jackal in the Guindy National Park	44
31	Photos of the other fauna captured in the camera trap at Nanmangalam Reserved forest, Tambaram	45
32	Photos of the other fauna captured by the camera trap at Vandalur Reserved Forest	46

33	Photo plate of Feral animals in the Guindy National Park, Vandalur, and Nanmangalam Reserved Forests	48
34	Photos of the other fauna captured by the camera trap at Mango Grove near Kurumbaram Reserved Forest, Villupuram	49
35	Palm leaves used as a fence and a house	50
36	Photos of Live fence and artificial fence in the study area	50
37	Photos of Madras Hedgehog roadkill in the Tirunelveli District	51
38	Map of road construction near Koonthankulam, Tirunelveli District	52
39	Photos taken during the outreach activity in the schools	54

LIST OF ANNEXURES

Annexure No.	Title	Page Number
1	Questionnaire datasheet	60-61
2	List of other fauna sighted by the questionnaire respondents	62
3	List of other fauna captured by the camera traps	63
3.1	Guindy National Park	63
3.2	Nanmangalam Reserved Forest	63
3.3	Vandalur Reserved Forest	64
3.4	Villupuram	64
3.5	Tiruvallur	64

1. ABSTRACT

There are 6,646 mammalian species in the world, with 420 of these occurring in India. Although small species are categorised as those that can weigh up to 5 kg, small mammals like rats and insectivores usually weigh less than 120 grams. Most of these small animals rely on seeds or insects for survival, and they are essential to maintaining healthy ecosystems. There are 19 species of hedgehogs in the subfamily Erinaceinae, which can be found in Africa, Europe, and Asia. Three of the five hedgehog species known to exist in South Asia are exclusively found in India: The Madras Hedgehog is native to southern India and can be found in areas of Tamil Nadu, Kerala, Karnataka, Andhra Pradesh, and Telangana. Madras Hedgehog is listed as a 'Least Concern' species by the IUCN. This semi-fossorial, nocturnal animal is protected under Schedule II of the Wildlife (Protection) Act, 1972. The goal of this study was to fill in knowledge gaps about the status and Distribution of the Madras Hedgehog (*Paraechinus nudiventris*) in the Northern districts of Tamil Nadu namely Chennai, Kanchipuram, Tiruvallur, and Villupuram and examine the factors influencing its Distribution in the dry regions of southern and western Tamil Nadu, particularly in Tirunelveli and Erode districts.

There were 554 survey participants (338 men and 206 women), and 154 of them confirmed sighting the Madras Hedgehog. With 89 confirmations, Tirunelveli had the most observations, followed by Erode with 53, Tiruvallur with 9, Villupuram with 2, and Kanchipuram with one. These findings reveal significant differences in the species' distribution in selected districts of Tamil Nadu. Questionnaires were sent to the field staff of the Tamil Nadu Forest Department and TANII (Tamil Nadu Innovation Initiatives) incubation centres. A total of 167 responses were received from 14 districts, including the study area. Of these, 25 were positive responses for Madras Hedgehog sightings from Kanniyakumari, Erode, Theni, and Virudhunagar.

Furthermore, this study is the first to use infrared thermal imagery cameras to document the Madras Hedgehog in India. This was beneficial for doing night surveys to examine the behaviour of the animal. The study species possesses a keen sense of smell and hearing, which are essential for detecting prey, and was discovered through observations. Several threat factors were observed during the study including habitat loss, road kills, hunting for meat and medicine, and killing by stray dogs. In areas and habitats supporting the hedgehog, it is necessary to raise awareness about the species among the local human community. Further research is also needed to understand its ecological significance, habitat preferences, population dynamics, and behaviour.

2. INTRODUCTION

Globally, 6,759 mammal species have been identified, of which 96 species are recently extinct, leaving 6,646 extant species (Mammal Diversity Database, 2025). In India, 420 mammal species have been identified, categorized into 14 orders and 48 families (Pradhan & Talmale, 2012). The term "small mammal" is used differently by various researchers. According to Delany (1974), it refers to insectivores and rodent species weighing less than 120 grams. Bourliere (1975), however, classified small mammals as those weighing up to 5 kilograms. Meanwhile, Chew and Robert (1978) defines small mammals based on their size range, noting that most of these species have diets partially reliant on seeds or insects. Additionally, they often require burrows as shelter to survive extreme environmental conditions and avoid predators.

Small mammals play a critical role in maintaining the balance of the food chain, as they serve as prey for many predator species (Aschwanden *et al.*, 2007). Some small mammal species also act as unique prey that help stabilize the food chain.

Hedgehogs are members of the subfamily Erinaceinae and include 19 species distributed across Africa, Europe, and Asia. These species are classified into five genera: *Atelerix* (4 species), *Erinaceus* (4 species), *Hemiechinus* (2 species), *Mesechinus* (5 species), and *Paraechinus* (4 species) (Mammal Diversity Database, 2024; Gazzard *et al.*, 2025). Hedgehogs are typically characterized by spines covering their bodies, except for the face and underbody, and a distinct pig-like snout (Sayyed *et al.*, 2015).

In South Asia, there are five species of hedgehogs, three of which are found exclusively in India. These are the Indian Hedgehog (*Paraechinus micropus*), the Indian Long-eared Hedgehog (*Hemiechinus collaris*), and the Madras Hedgehog or Bare-bellied Hedgehog (*Paraechinus nudiventris*) (Marimuthu & Asokan, 2014; Kumar & Nijman, 2016). The Madras Hedgehog, primarily found in Tamil Nadu and Kerala, is classified as 'Least Concern' by the IUCN and listed under Schedule II of the Wildlife Protection Act, 1972 (Venkataraman *et al.*, 2013). It is a nocturnal, insect-eating, semi-fossorial mammal endemic to Southern India, with distribution across Tamil Nadu, Kerala, Karnataka, Andhra Pradesh, and Telangana (Molur, 2005; Kumar, 2019).

The Madras Hedgehog has been recorded in various districts of Tamil Nadu, including Salem and Arcot, and is considered common in the Southern Western Ghats (Srinivas *et al.*, 2013; Molur, 2005). Its presence has also been reported in Nallamalai Hills and other areas in Andhra Pradesh and Kerala (Srinivasulu & Nagulu, 2002; Molur, 2005).

Sankaranarayanan *et al.* (2024) reported that grasses such as *Chrysopogon* spp., *Heteropogon* spp., and *Panicum* spp. form the primary vegetation in areas where the Bare-bellied hedgehog was recorded. They also noted the presence of shrubs typical of South Indian scrublands, including *Avarampoo* (*Senna auriculata*) and *Acacia* spp., along with trees like the Toddy Palm (*Borassus flabellifer*) and the invasive Mesquite (*Prosopis juliflora*).

Disturbances in their natural habitat including habitat destruction caused by small-scale tree logging, firewood collection, agricultural activities, and pesticide use are threats to this species (Molur, 2005). Although its use in trade is limited, hedgehog-derived medicines and the consumption of hedgehogs have been noted (Kumar & Nijman, 2016). The Madras Hedgehog plays a key role in maintaining ecological balance by feeding on a variety of insects and small animals, effectively controlling their populations and supporting the overall health of the ecosystem. Being nocturnal, it is highly active at night, matching the activity patterns of many insects it feeds on.

At the same time, the hedgehog serves as prey for predators such as golden jackals, small Indian foxes, jungle cats, and Indian grey mongoose (Jiang & Hoffmann, 2013). The Madras Hedgehog plays an important role in the food chain both as a predator and as prey for other animals.

While the distribution of Madras Hedgehogs has been documented in 19 districts of Tamil Nadu (Kumar *et al.*, 2024), information on their presence in the northeastern districts of the state remains limited (Kumar *et al.*, 2018). Reports include dried skins kept by natural healers and sightings near Marakkanam in Villupuram district and Keelakarai near the Gulf of Mannar (Ramanujam & Anbarasan, 2007; Kumar *et al.*, 2018).

Kumar *et al.* (2018) state that these previously reported (Marakkanam, Keelakarai) sites are primarily situated within fallow lands and nearby grassland areas,

indicating a high possibility of the hedgehog's presence in these regions. The species prefers dry deciduous scrub habitats near villages, grasslands, shrubs around urban landscapes, edges of cultivated fields, and dried ponds (Molur, 2005; Kumar & Nijman, 2016).

This study was proposed to address the significant gap in knowledge regarding the status and distribution of the Madras Hedgehog (*Paraechinus nudiventris*) in the northern districts of Tamil Nadu (Chennai, Kanchipuram, Tiruvallur, and Villupuram). In addition to assessing its presence and distribution in this region, the study also aims to compare the factors influencing the species distribution in the arid zones of southern and western Tamil Nadu (Tirunelveli and Erode districts). By examining the variations in environmental conditions, human impact, and habitat availability across these diverse areas, we employed a comprehensive approach of questionnaire surveys, direct field surveys, and camera trap surveys. The surveys were designed to collect both qualitative and quantitative data on the distribution of Madras Hedgehogs, their habitat preferences, and any significant threats they may face in these regions. Data collection on the associated species in the habitat was also planned. By combining direct field observations, interviews with local communities, and analysis of nocturnal activity patterns, we aim to provide a more comprehensive understanding of the species' presence and conservation needs in the selected districts.

3. OBJECTIVES

1. To assess the distribution status of the Madras Hedgehog (*Paraechinus nudiventris*) and associated species in selected districts of Tamil Nadu.
2. To identify and assess the threats to the conservation of the Madras Hedgehog (*Paraechinus nudiventris*).
3. Suggest specific conservation measures.

4. STUDY AREA

The study was conducted in the state of Tamil Nadu. Of the 38 districts in the state, six were selected for detailed study: Chennai, Erode, Kanchipuram, Tiruvallur, Tirunelveli, and Villupuram districts were selected based on Madras Hedgehog sighting reports found in literature (Fig. 1).

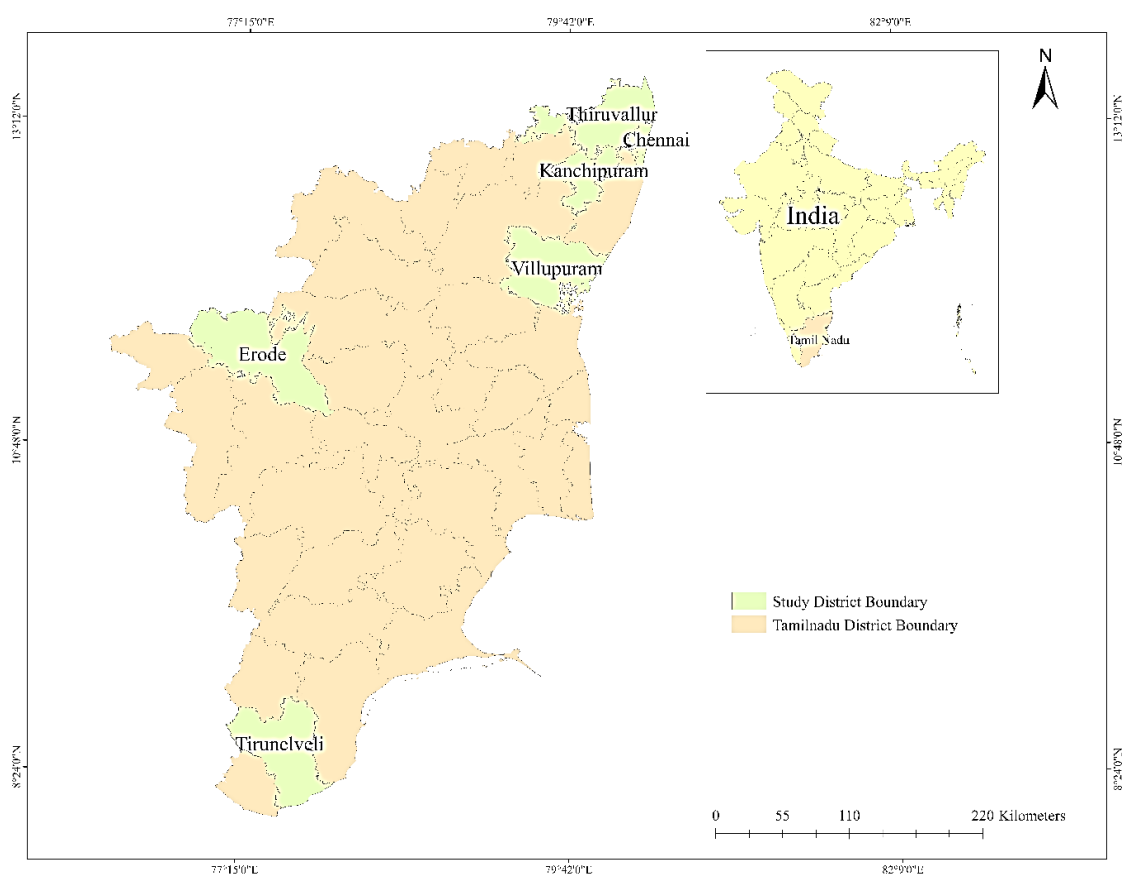


Figure 1. Map of the study area districts in Tamil Nadu state.

Chennai is located in the northeastern region of Tamil Nadu, along India's southeast coast. This area is home to a variety of mammals. Erode is close to the Cauvery River, which helps support its agriculture and wildlife. Its proximity to the biodiverse Western Ghats adds to the ecological importance of the region. It supports agriculture and is home to a variety of bird species and mammals. Kanchipuram has farms and wetlands that support animals like jackals, civets, and black-naped hares, adding to the natural diversity of the area.

Tiruvallur is known for its large agricultural areas and water resources, such as the Poondi Reservoir. These water bodies not only help with irrigation but also attract birds and mammals including porcupines and jungle cats exist in this area. Tirunelveli is primarily being sustained by the Tamirabarani River flowing from its forested hills. This region also attracts both resident and migratory bird species to the Koonthankulam Bird Sanctuary and sustains species like golden jackals and Indian pangolins. Villupuram is home to a variety of fauna, including wild boars and civets, in addition to the abundant birdlife around the Kazhuveli Bird Sanctuary.



Figure 2: Photos of the habitat in the study area. a) Grasslands with a Palm grove, b) Agricultural field, c) Paddy field edges with palm trees, d) Scrub with grassland habitat, e) Grasslands near the Reserved Forest, f) Open grasslands, g) Scrub Forest, h) Rocky habitat near Eucalyptus plantation.

During the research, a variety of habitat types were found across the study area, indicating the ecosystem's diversity (Fig. 2). In the Chennai district the fewer agricultural practices are noted because of urbanization, and it also has some remaining reserved forest itself with a variety of floral and faunal diversity. Other than those areas that have tall trees and damp areas, paddy fields surrounded by palm trees attracted species from a variety of environments. Animals might be grazing on open areas with grasslands close to agricultural land. A wide range of species was supported by the grasslands located near to restricted forests, which created a combination of open space and forest boundaries.

Some grasslands were dominated by *Prosopis juliflora*, an invasive plant species that local communities commonly harvested for firewood. Additionally, Mango groves within farmlands, with dense trees and seasonal fruits, attracted animals, especially fruit-eaters like Bonnet macaques. Wild animals were also attracted to areas close to the protected forest. The Tirunelveli district's wide-open grasslands with palm trees are a particularly unique ecosystem that serves as a habitat for numerous dryland species. Areas adjacent to reserved forests were also hotspots for wildlife activity, further highlighting the ecological importance of these diverse habitats.

5. STUDY SPECIES

Madras Hedgehog (*Paraechinus nudiventris*, Horsfield, 1851) is a small terrestrial, insectivorous, and fossorial mammal with a spiny integument on the dorsal side of its body (Molur *et al.*, 2005; Menon, 2023). These species are characterized by short, grooved spines that are white and brown in colour (Marimuthu & Asokan, 2014).

Hedgehogs are born with spines that are soft at birth but harden as they grow older. These spines are different from quills, as they maintain a uniform length across the body, while quills can vary in length. Hedgehog spines are stout, slightly curved, and lack barbs. Additionally, due to the bulbous shape of the base, these spines don't fall easily (IFAW, 2024).

The face and abdomen of these animals are covered with soft, light-coloured fur. Hedgehogs have the unique ability to curl into a tight ball as a defence mechanism. They are primarily nocturnal, spending most of the day sleeping and becoming active at dusk to search for food. They also possess a strong sense of smell and hearing, which aid them in locating prey. Typically, European hedgehog species hibernate during the winter, while African species tend to enter a state of aestivation during the summer (Marimuthu & Asokan, 2014).

The ecology and behaviour of the Madras Hedgehog remain largely unexplored, with limited knowledge about its habitat preferences, movement patterns, feeding behaviour, and social interactions. This lack of comprehensive research creates critical gaps in understanding the species' unique life pattern and ability to adapt to environmental changes.

6. METHODOLOGY

The fieldwork was carried out from September 2024 to March 2025. A combined approach of questionnaire surveys, field surveys, and camera trap surveys was used to detect the distribution of the study species. A questionnaire survey was carried out in the morning hours, and at places where people gather in groups.

6.1. Questionnaire survey

As part of the study, a questionnaire consisting of 20 questions was designed to gather information from local respondents. The research team conducted the survey from September 2024 to March 2025, primarily between 9:00 AM and 6:00 PM. After completing the daytime surveys, the team also conducted nocturnal surveys to gather additional data from individuals in the study area.

In addition to field surveys, questionnaires were also distributed to staff members of the Tamil Nadu Forest Department between August 2024 and February 2025 using Google Forms and email communications. These methods ensured the collection of responses through both direct field interactions (Fig. 3) and online submissions. This combined approach provided valuable insights from multiple sources, contributing to a comprehensive understanding of the data.

6.1.1. Simple random sampling

Simple random sampling is a probability sampling method in which respondents are selected randomly from a complete list of all members of the population (Tubbs *et al.*, 2024). In this study, we applied this method by conducting random surveys among local people within the study area. The respondents included people from various backgrounds, such as daily wage workers, drivers, and students. This approach ensured that every individual in the population had an equal chance of being selected, minimizing bias and enhancing the reliability of the data collected.

6.1.2. Purposive sampling

Purposive sampling is a non-probability sampling method in which the investigator deliberately selects respondents considered crucial to the research objectives (Haque, 2010). In this study, we identified and involved respondents who had significant exposure to the natural habitat and in-depth local knowledge. These included members of the local indigenous communities, cattle herders, agricultural workers, farmers, garden keepers, and workers associated with the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS). Their regular interaction with the natural habitat made them key informants, providing valuable insights essential to the objectives of the research.

6.1.3. Snowball sampling

Snowball sampling is a non-probability sampling method where the first respondent was identified by any other sampling method, which helps identify additional participants, creating a chain of referrals (Tubbs *et al.*, 2024). While surveying the local people, several individuals shared their friends and relatives who have more knowledge of the target species and have had frequent sightings. Some people shared about the indigenous tribes who are more connected to the habitats and have the best knowledge of the animals.

Hence, questionnaires are helpful in detecting the presence of hedgehogs in a given area. However, a lack of detection by respondents cannot guarantee their absence. Therefore, using multiple detection methods can provide a more reliable way to study the presence of hedgehogs (Haigh, 2011). After gaining insights from the

questionnaire survey, we used a combined approach of field surveys (Nocturnal and Diurnal) and Camera trap surveys to detect the animal presence.



Figure 3. Photos of a questionnaire survey. a & b: The Research team and the Forest department staff are conducting a questionnaire survey of the villagers.

6.2. Nocturnal survey

6.2.1. Spotlighting

Spotlighting is a nocturnal survey technique that involves searching the ground with a powerful torch to scan the animal presence. This method requires the survey area to be organised using predefined transects or routes (Thomass & Wilson, 2018).

The spotlight surveys were conducted during the evening hours (Fig. 4). The team comprised two to seven members who worked together to detect the presence of the study species in the selected areas. These areas were chosen based on suggestions from local residents who had reported previous sightings of the species. In addition, information gathered from questionnaires helped identify regions with a higher likelihood of hedgehog presence. The team also explored several locations deemed suitable for the species' habitat, as recommended by the locals, further increasing the chances of successful detection.

During the survey, team members systematically walked through the selected areas multiple times by using the Fenix LR40R V2.0 Torch, Fenix TK20R V2.0 Torch, Britelite Impact EVO Torch, Mr. Light Mr.2800 Torch, and Life Systems head torches from 5:30 PM to 00:45 (IST). The Garmin eTrex 30x GPS device was used to collect geographical coordinates. Visual searches were conducted using spotlighting techniques to detect the study species. While focusing on the target species,

observations were also made of other faunal species inhabiting the area. This thorough approach aimed to maximize the chances of detecting the hedgehog and gaining insights into the overall biodiversity of the study area.

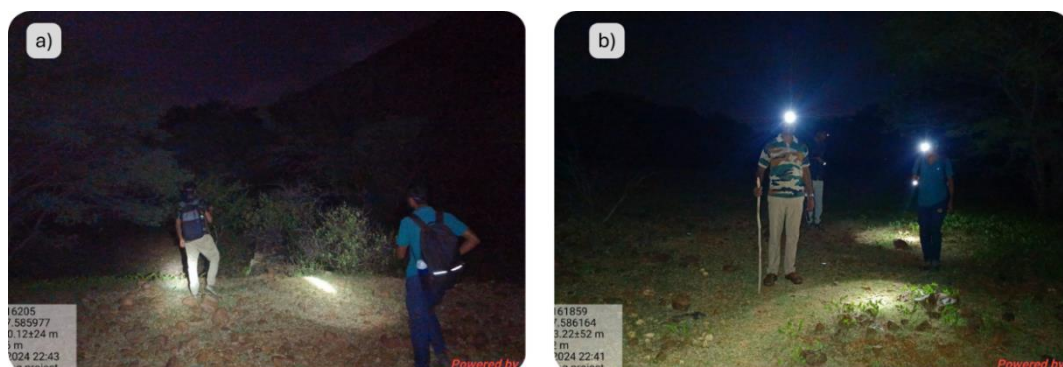


Figure 4. Photos of the spotlighting survey. a & b: The Research team consists of the Forest Department field staff during the Nocturnal survey.

6.2.2. Infrared Thermal imagery

Thermal infrared imaging systems, which capture heat-based images, are highly effective tools for detecting warm-blooded animals. These systems work by identifying the heat emitted by animals and highlighting them against a cooler background (Sabot & Hudson, 1995). Unlike other detection methods that rely on visible light, thermal imaging operates efficiently in all lighting conditions, including complete darkness. This capability makes it particularly useful for nocturnal surveys and studies conducted in low-light environments, where traditional methods may not be as effective.

Haigh *et al.* (2012) tested a handheld Infrared Thermal Imagery Camera (Testo 880 range) to detect hedgehogs that were already radio-tagged. Their study found that the infrared camera was unable to detect hedgehogs in gardens, pastures, or arable land. The detection range was less than 1 meter, and even when the exact location of the hedgehog was known, the device needed to be positioned very close (within 1 meter) for successful detection.

Bowen *et al.* (2020) used the FLIR E60 Thermal Infrared Camera (TIC) to detect hedgehogs in grassland habitats. They reported successful detection of hedgehogs at

distances up to 60 meters, particularly in areas with very short grass. However, the detection range was shorter if the hedgehogs were partly hidden by vegetation.

Bearman-Brown *et al.* (2020) utilized the FLIR E53 infrared thermal Camera alongside detection dogs to locate hedgehogs. Their study found that, on average, these two methods detected nearly twice as many hedgehogs as spotlighting in both amenity grasslands and pastures. Additionally, the infrared camera had a greater minimum detection distance compared to detection dogs and spotlighting. However, none of these methods were successful in detecting hedgehogs in woodland habitats, highlighting the limitations of thermal technology in dense vegetated environments.

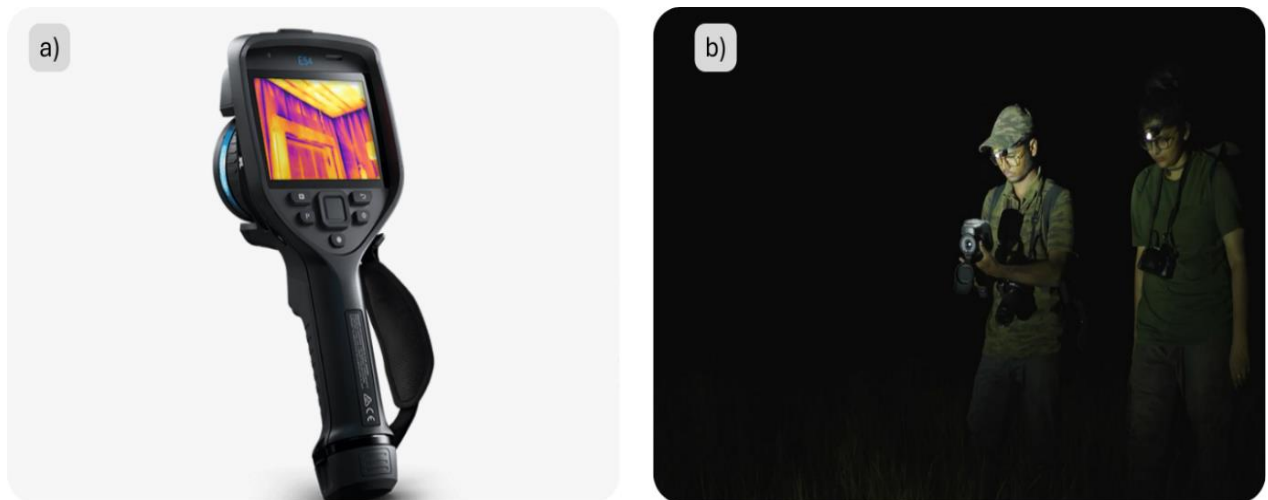


Figure 5. Photos of the Infrared Thermal Imagery Camera. a) Infrared Thermal Imagery Camera, b) Researchers using an Infrared Thermal Imagery Camera in the nocturnal survey.

In this research study, we used the FLIR E54 Advanced Thermal Imaging Camera (Teledyne FLIR, USA), a sophisticated device designed for precision thermal imaging (Fig. 5). The camera features an infrared (IR) resolution of 320×240 pixels, ensuring high-quality thermal images. It is also equipped with a 4-inch LCD touchscreen, offering a display resolution of 640×480 pixels for clear visuals. The camera is capable of detecting temperature ranges from -20°C to 120°C with a high degree of accuracy, resolving temperatures within $\pm 2^{\circ}\text{C}$. Additionally, it includes a built-in 5-megapixel digital camera and an LED lamp, which allows for the simultaneous capture of standard digital images, even in low-light or challenging conditions.

6.2.3. Camera trap

Camera traps were deployed to monitor the presence of the Madras Hedgehog and other species that share similar ecological niches within the study area. These traps were strategically positioned close to the ground level, ensuring optimal detection of the target species. The locations for deploying the camera traps were chosen based on their suitability for observing the animals while minimizing any disturbance to their natural behaviour (Fig. 6).

Camera traps are an effective tool for monitoring elusive or rare species, enabling the collection of substantial data in a shorter timeframe compared to traditional survey techniques (Burton *et al.*, 2015).

Camera traps can collect important information on small mammals, though studies are necessary to evaluate their effectiveness (Cutler & Swann, 1999). Kelly (2008) suggested that the utility of camera trapping methods for systematic surveys of small mammals should be thoroughly assessed prior to widespread adoption.

Glen *et al.* (2013) observed that the camera traps often exhibited delays in detecting hedgehogs, occasionally taking several minutes to trigger, even when hedgehogs were moving at a slow pace. It was observed that hedgehogs were not detected while feeding directly in front of the camera traps, but were captured once they began to move. However, camera traps do have limitations. Kelly and Holub (2008) suggest that clearing dense vegetation from the camera's field of view can reduce false triggers and ensure unobstructed photographs.

Carbone and Cates (2018) recorded the hedgehog and others, along with several other species, namely foxes, muntjac, rabbits, squirrels, cats, rats, and mice. By using the camera traps in the Hampstead Heath habitat.

For this study, the equipment included Cuddeback digital camera traps (Silver and Blue models) and Browning Trail Cameras Model BTC-7E-HP5. Photographs taken during the study period were captured using the Nikon D5600 Camera with a 75-300mm lens, as well as the Canon EOS R10 Camera with an 18-150mm lens.

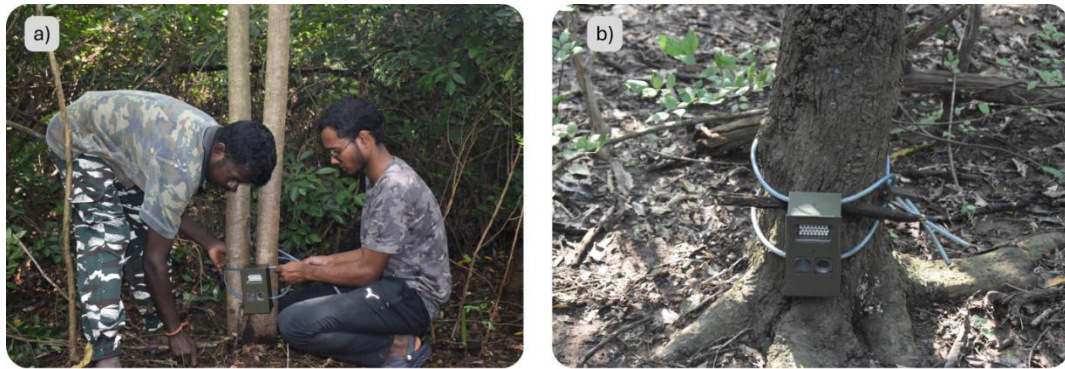


Figure 6. Photos of the camera trap survey. a) Researcher and Forest department field staff deploying the camera trap, b) Deployed camera trap.

One of the key advantages of using camera traps is their effectiveness in capturing wildlife activity during night-time. This feature was invaluable for documenting the nocturnal activities of the Madras Hedgehogs and other nocturnal animals, providing critical insights into their behaviour and movement patterns. By operating silently and without human presence, the camera traps allowed researchers to observe natural behaviours and movement patterns without disturbing the animals or altering their environment.

7. RESULTS

The questionnaire survey gathered responses from local people within the study area aged between 10 and 90 years from various occupational backgrounds, including school and college students. A total of 544 responses were recorded, of which 338 were male and 206 were female respondents (Fig. 7).

Out of the 544 responses collected from the study area, the highest number of respondents was recorded in the Tiruvallur district with 197 respondents. This was followed by Tirunelveli with 123 respondents, Villupuram with 79 respondents, Erode with 73 respondents, Kanchipuram with 66 respondents, and Chennai with the lowest count of 6 respondents.

The lower number of responses from Chennai is primarily due to the limited presence of wild landscapes in the district, as urbanization has significantly diminished rural and semi-natural habitats where species like Madras Hedgehog are commonly found. To overcome this limitation, camera traps were deployed in key protected areas within Chennai, including Guindy National Park (GNP), Nanmangalam Reserved Forest, and Vandalur Reserved Forest, to gather additional data.

A total of 154 respondents sighted the study animal in the survey across five districts. Tirunelveli recorded the highest number of sightings, with 89 confirmations. Erode followed with 53 confirmed sightings, while Tiruvallur had 9 reports. Villupuram and Kanchipuram reported significantly fewer sightings, with 2 and 1 respondents, respectively. This suggests a notable variation in the species' presence across the districts, likely influenced by habitat quality, availability, and human disturbances.

The questionnaire survey results have revealed previously undocumented locations within these districts, offering new insights into the Distribution of the study species. These newly identified areas are crucial in expanding our understanding of the species' habitat preferences and range. This information is vital for assessing current distribution patterns and can serve as a foundation for future research. It may also be pivotal in guiding conservation efforts to protect the species. Such findings highlight the importance of comprehensive surveys in uncovering hidden aspects of species distribution.

In addition to the direct questionnaire survey, we distributed a questionnaire to TANII (Tamil Nadu Innovation Initiatives) innovation cum incubation centres around Tamil Nadu, as well as the field staff of the Tamil Nadu Forest Department. The responses were received from the districts of Chengalpattu, Chennai, Erode, Hosur, Kanchipuram, Kanyakumari, Madurai, Thanjavur, Theni, Thoothukudi, Tirunelveli, Nilgiris, Virudhunagar, and Villupuram. From the questionnaire, 167 respondents were covered, among them, twenty-five were sighting reports: two from Theni, five from Erode, two from Virudhunagar, and sixteen from Kanyakumari.

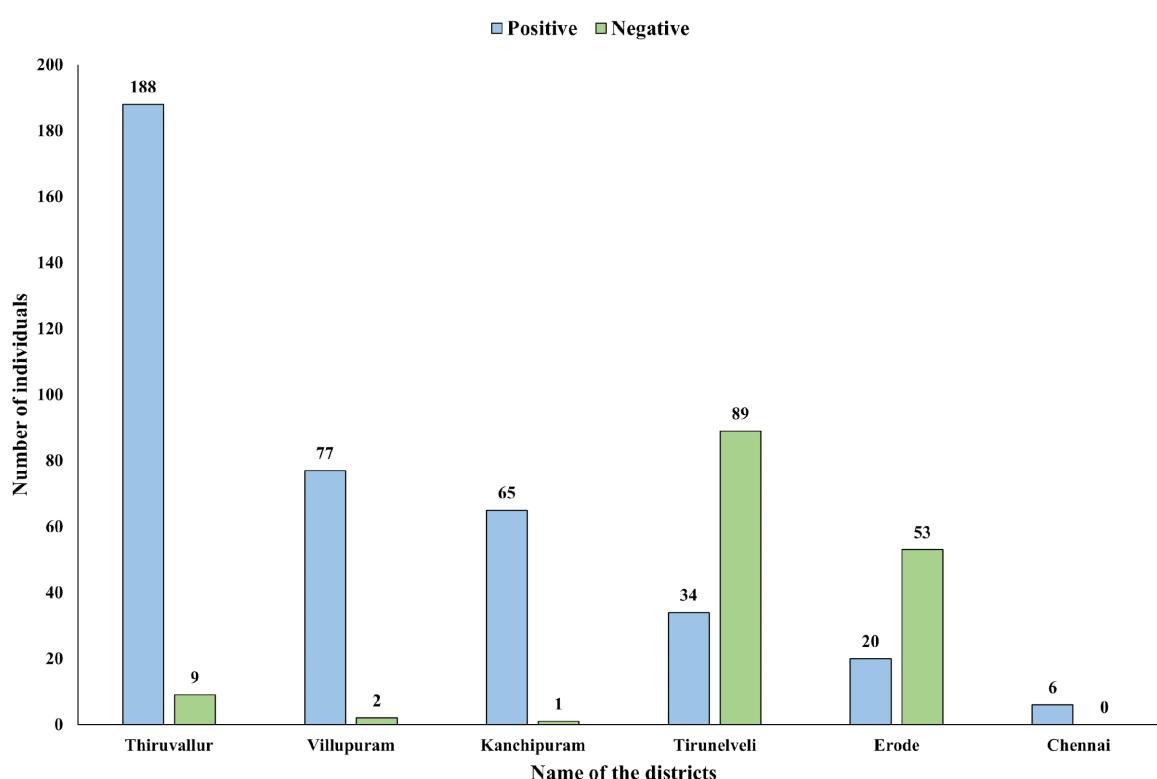


Figure 7. District-wise graph showing the total number of Positive and Negative responses.

The questionnaire survey was conducted in six districts within the study area. Among these, Tirunelveli and Erode districts had the highest number of direct sightings of the Madras Hedgehog, with a greater proportion of respondents confirming sightings, compared to neagative responses. In contrast, the districts such as Chennai, Kanchipuram, Tiruvallur, and Villupuram recorded fewer sightings, but provided valuable new information (Fig. 8).

The observation indicates that Erode and Tirunelveli districts provide more favourable habitats for the species. Earlier research also confirmed the presence of hedgehogs in these areas, providing further support for this finding. Additionally, traditional knowledge shared by local communities in these districts highlights that the species prefers particular types of habitats commonly found in these regions.

The integration of contemporary data collection with the ecological knowledge shared by local communities highlights the importance of Erode and Tirunelveli as key regions for supporting and sustaining wildlife populations and the study animal. Protecting and maintaining these habitats is crucial to ensuring the continued presence of hedgehogs in these districts.

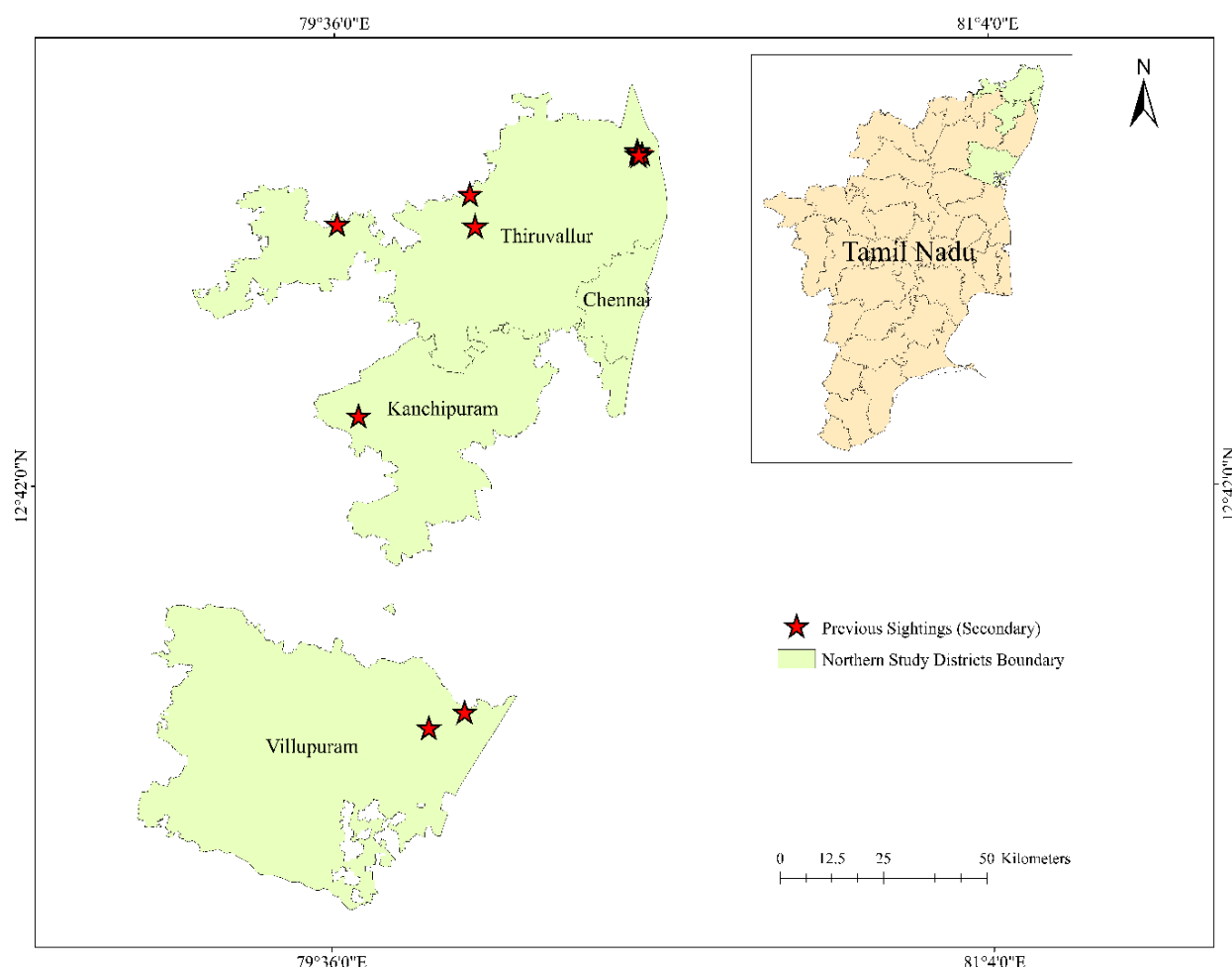


Figure 8. Map showing the previous sightings of Madras Hedgehogs (Secondary data) in the Northern districts of Tamil Nadu.

New sighting reports have been documented from the northern districts of Tamil Nadu; all the sightings from these districts represent previously undocumented locations for the species. This discovery expands our understanding of the species' distribution and highlights the importance of these areas for conservation. These findings underscore the role of community-based surveys in uncovering critical data about species' habitats and their geographical spread. This information could contribute to further studies and conservation planning.

7.1. Questionnaire Results: District-wise

7.1.1. Tiruvallur

A questionnaire survey was carried out in the Tiruvallur district to collect information from areas recognized for their ecological and environmental importance. The selected locations included the surroundings of Pazhaverkadu Bird Sanctuary, known for its rich bird diversity and significance as a habitat for various avian species; Gudiyam, located near the Seethanjeri Reserved Forest, which is valued for its archaeological relevance and wildlife habitats; and areas near Thiruthani, which are noted for their unique environmental characteristics. Additionally, these locations are near Andhra Pradesh, where districts have previously recorded the distribution of the Madras Hedgehog in earlier studies (Fig. 9).

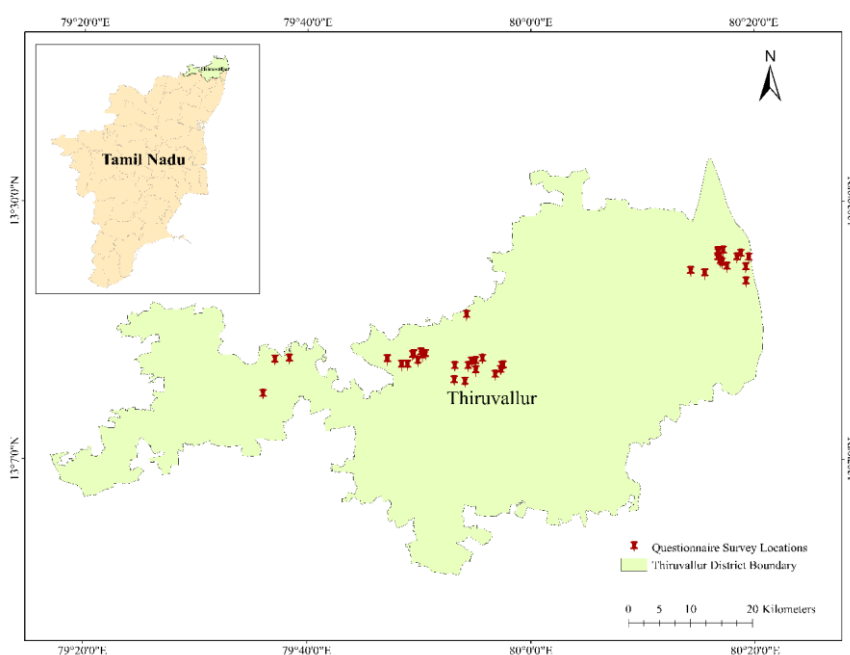


Figure 9. Map of questionnaire survey locations in the Tiruvallur district.

The survey was designed to gather detailed data from these regions, aiming to gain better understanding of the local ecological conditions and the presence of wildlife. By focusing on these key sites, the study sought to obtain insights into habitat features, species distribution, and interactions of wildlife with their environment.

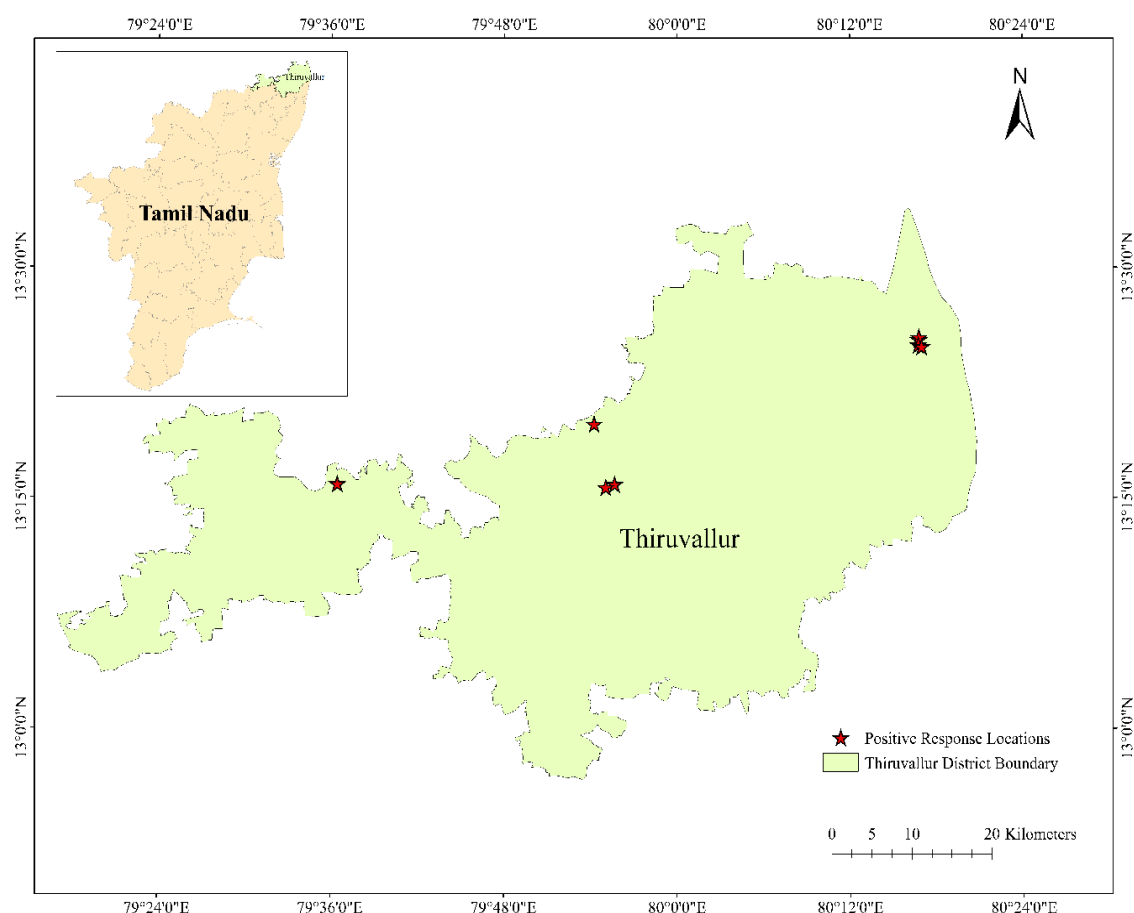


Figure 10. Map of positive response locations (Secondary data) in the Tiruvallur district.

The questionnaire survey identified nine locations within the Tiruvallur district that showed positive responses (Fig. 10), indicating the possible presence of the species. However, these findings represent only preliminary observations and require further confirmation. To confirm the presence of the species in these areas, a detailed field survey is necessary. Conducting extensive field investigations will help confirm the suitability of habitats, distribution of the species, and ecological conditions in these locations. This step is crucial for verifying the accuracy of the initial reports, planning effective conservation actions, and protecting these habitats.

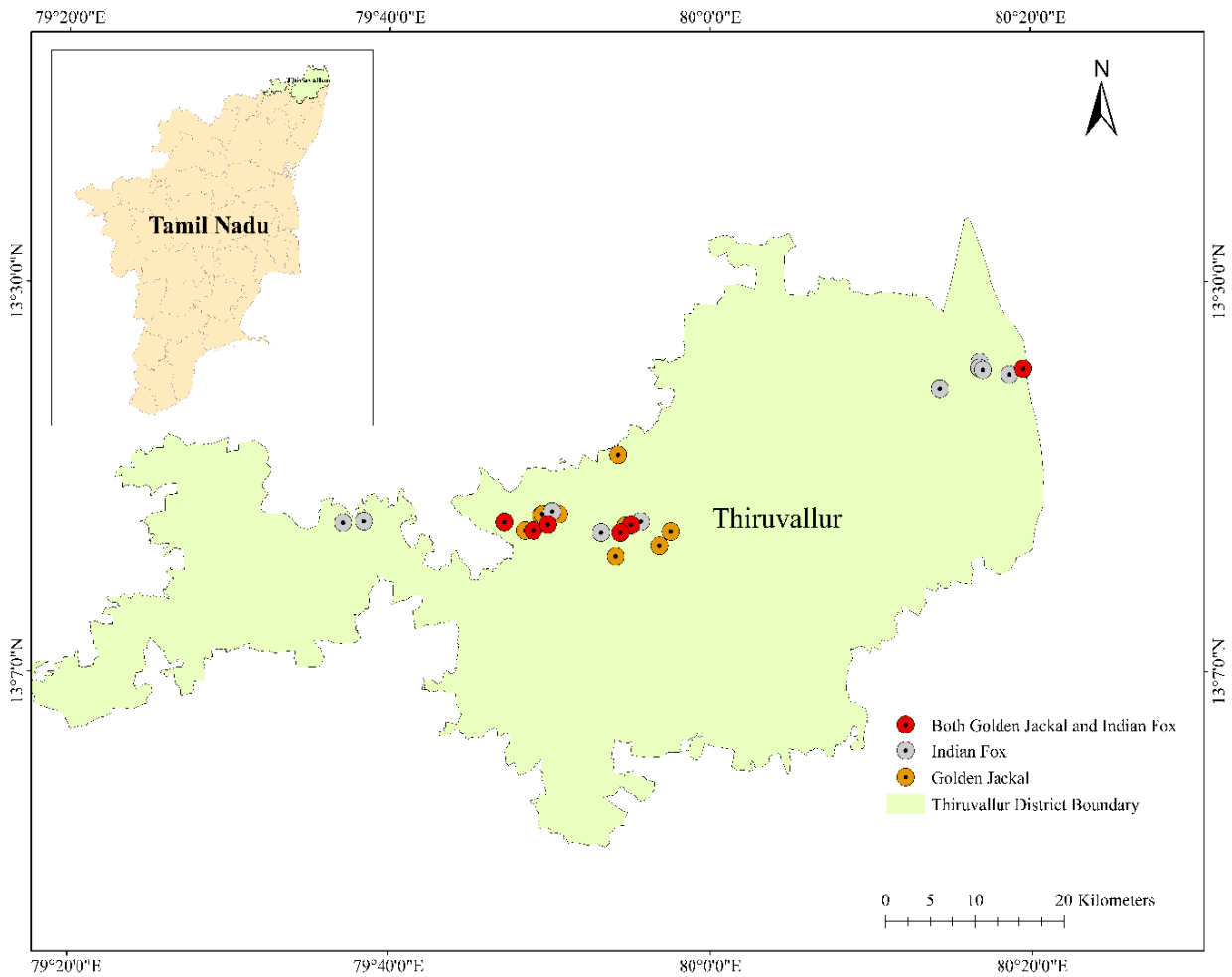


Figure 11. Map of associated species distribution (Indian Fox, Golden Jackal, Jungle Cat) in the Tiruvallur district (Secondary data)

The questionnaire survey also provided valuable data on the distribution of two predator species, such as the Golden Jackal and the Indian Fox. Several areas within the Tiruvallur district were reported the presence of both species, indicating the overlapping territories and shared habitats (Fig. 11). Residents have reported sightings of these animals not only near protected areas but also in non-protected regions, including grazing lands and human settlements. This highlights the significant role that non-protected areas play in supporting wildlife populations, acting as essential habitats for various species. A higher frequency of sightings was recorded in locations such as Seethanjeri, Pazhaverkadu, and Poonimaangadu. These observations emphasize the need to recognize and prioritize the conservation value of non-protected areas to ensure the continued survival of diverse wildlife outside formally designated protected zones.

7.1.2. Kanchipuram

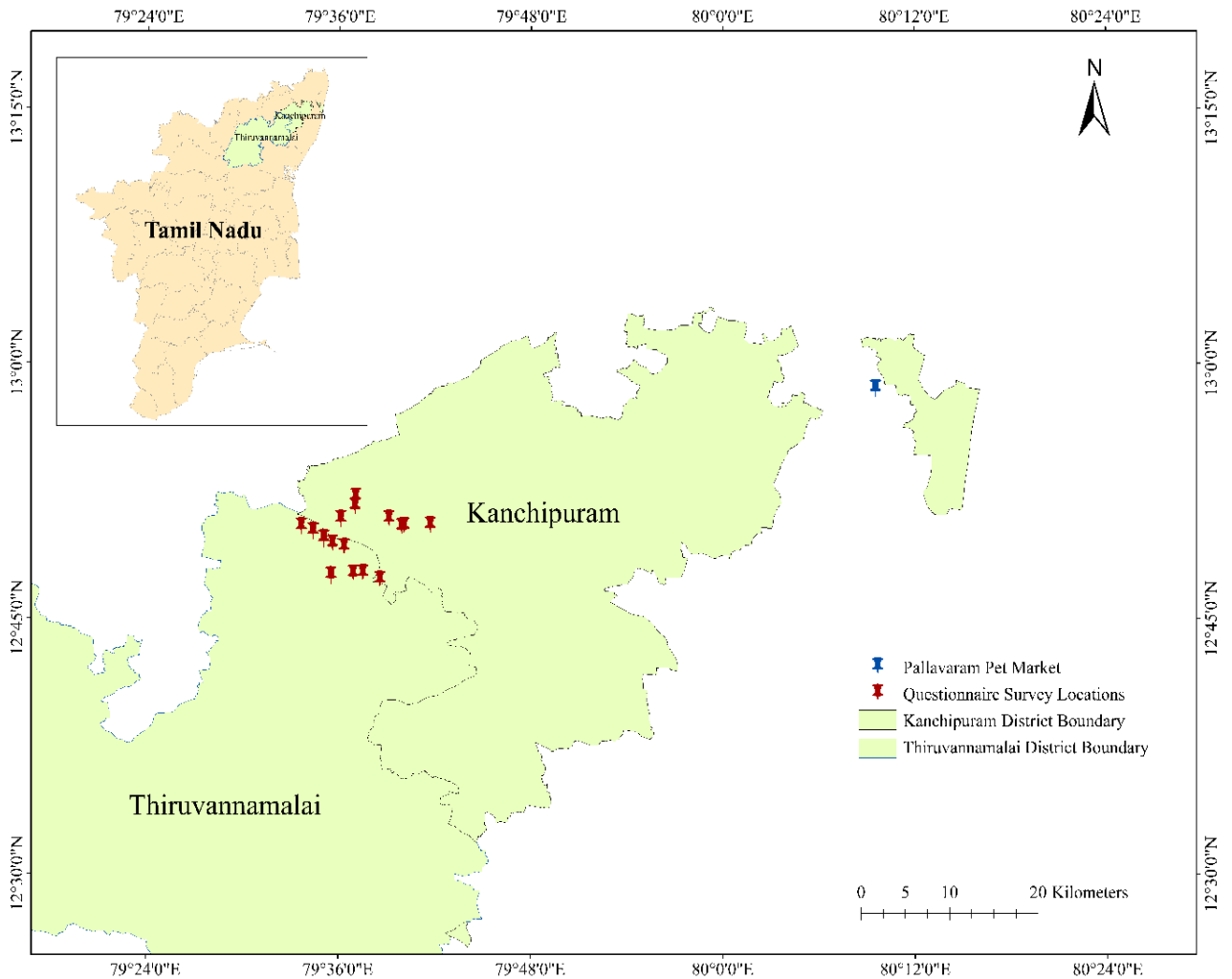


Figure 12. Map of questionnaire survey locations in the Kanchipuram district

A questionnaire survey was conducted in the Kanchipuram district, focusing on locations near Thiruppanangadu and Vembakkam (Fig. 12). These areas are predominantly composed of agricultural lands and grazing lands, which play an important role in supporting local wildlife. These areas also contain brick kilns, where workers are more likely to encounter the animal due to their frequent presence in and around these habitats. The survey aimed to gather information about the ecological conditions and the presence of species in these regions.

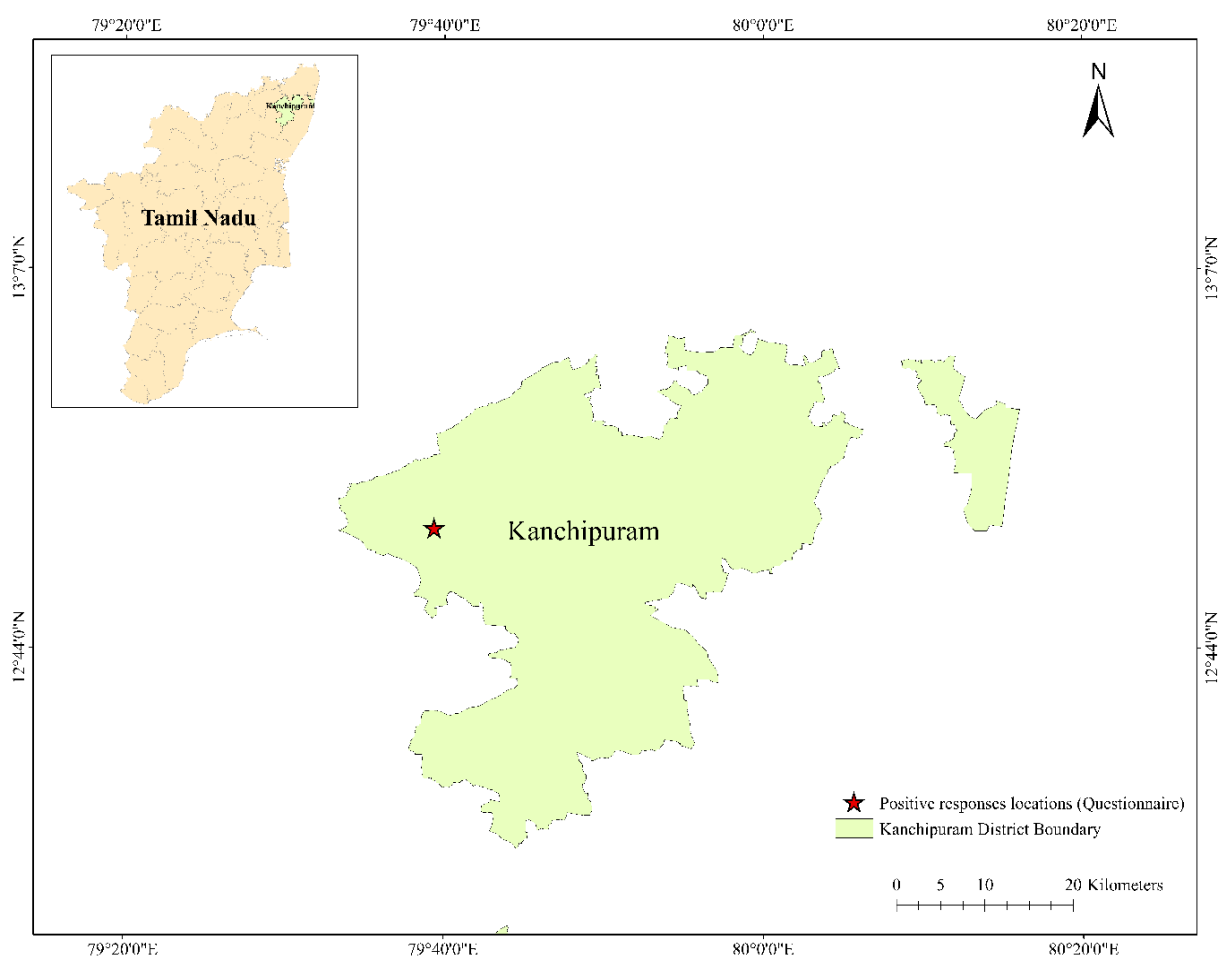


Figure 13. Map of positive response locations (Secondary data) in the Kanchipuram district.

Based on the questionnaire survey conducted in the Kanchipuram district, a single sighting of Madras Hedgehog was reported by a local resident in the Musaravakkam area (Fig. 13). This sighting was shared during an interaction, where the local mentioned that the hedgehog had been captured by the Nakkalae community and kept in a small cage, but he was not sure about where they captured the animal. The area surrounding Musaravakkam is primarily made up of agricultural and grazing lands, as highlighted in the previous survey findings. The findings from this survey contribute to a broader understanding of how human-modified landscapes, such as farmlands, grazing lands, can still play a crucial role in the conservation of this elusive species.

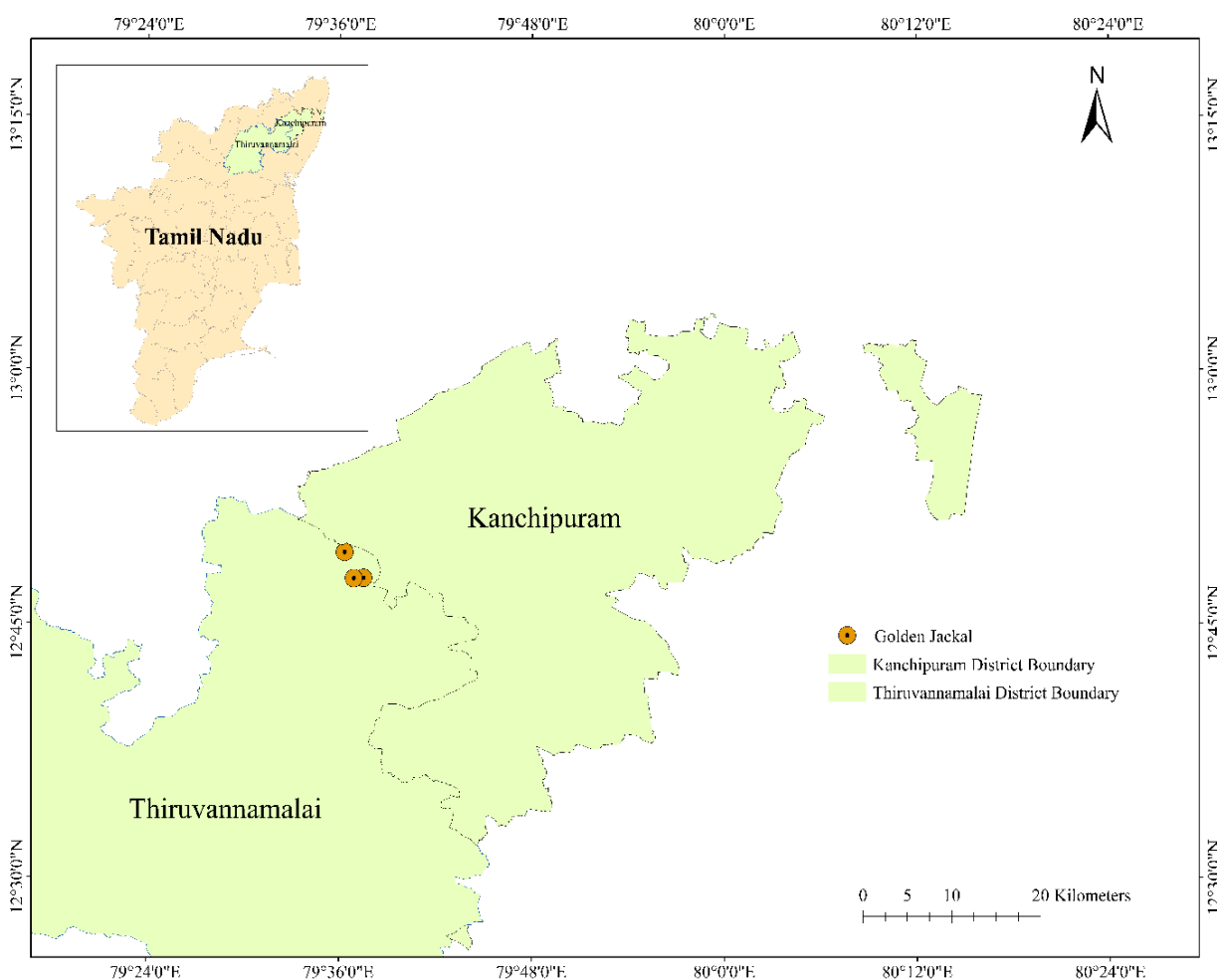


Figure 14. Map of associated species distribution (Indian Fox, Golden Jackal, Jungle Cat) in the Kanchipuram district (Secondary data).

In several locations across Kanchipuram, residents have reported sightings of Golden jackals, particularly observed in grazing lands and non-protected areas adjacent to agricultural fields (Fig. 14). Such observations indicate that these non-protected regions play a significant role in supporting the survival of Golden jackals by providing essential foraging and habitat spaces. The occurrence of these sightings near human-dominated landscapes also highlights the species' remarkable adaptability and resilience, demonstrating their ability to coexist and thrive outside traditional protected zones.

7.1.3. Villupuram

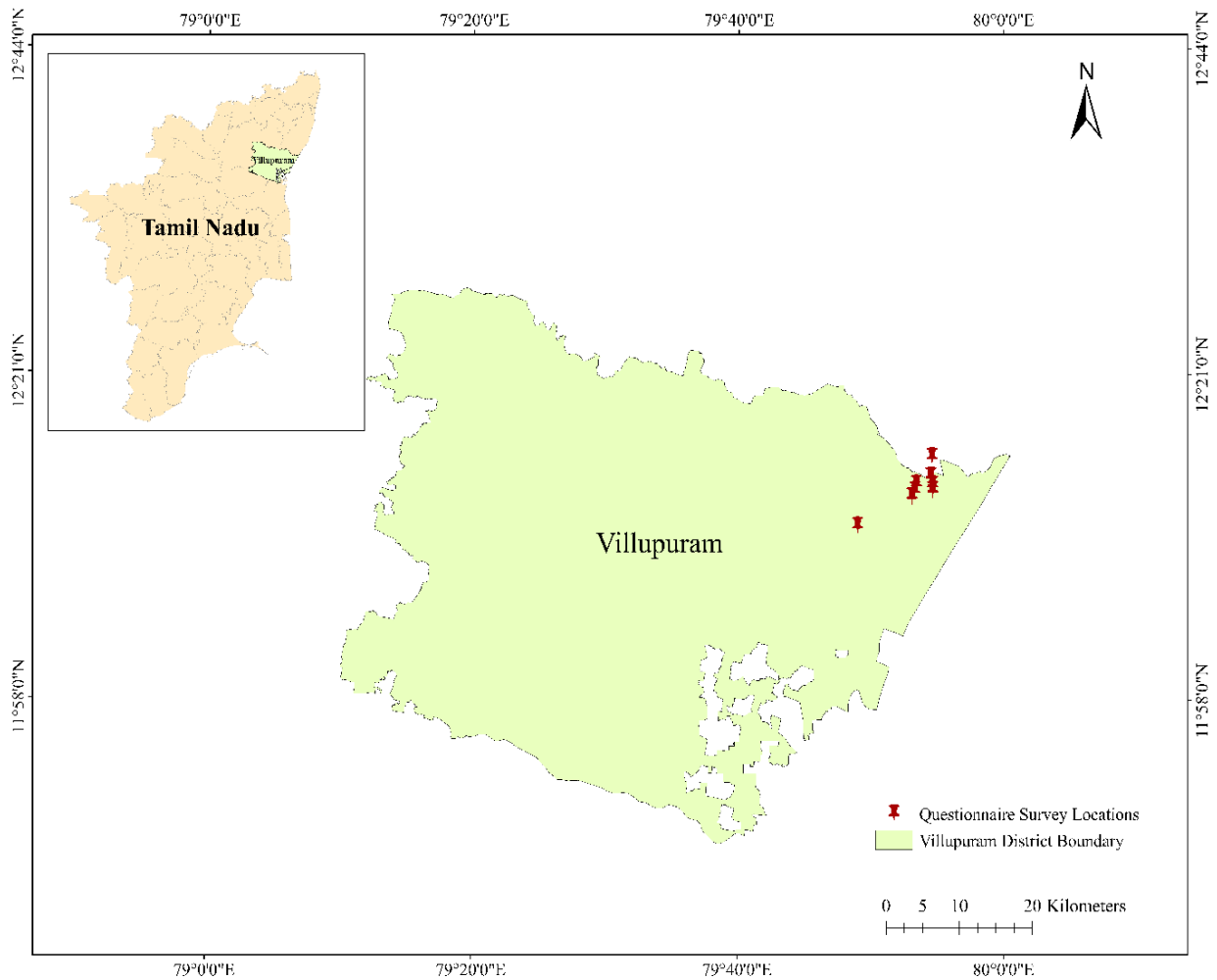


Figure 15. Map of questionnaire survey locations in the Villupuram district.

A questionnaire survey was conducted in and around the Kurumbaram Reserved Forest, focusing on areas of ecological importance (Fig. 15). This location was chosen based on a previous record of the dried skin of a Madras Hedgehog, which was found in possession of a natural healer near Marakkanam. The survey aimed to gather information about the presence of the species and the environmental conditions in the region.

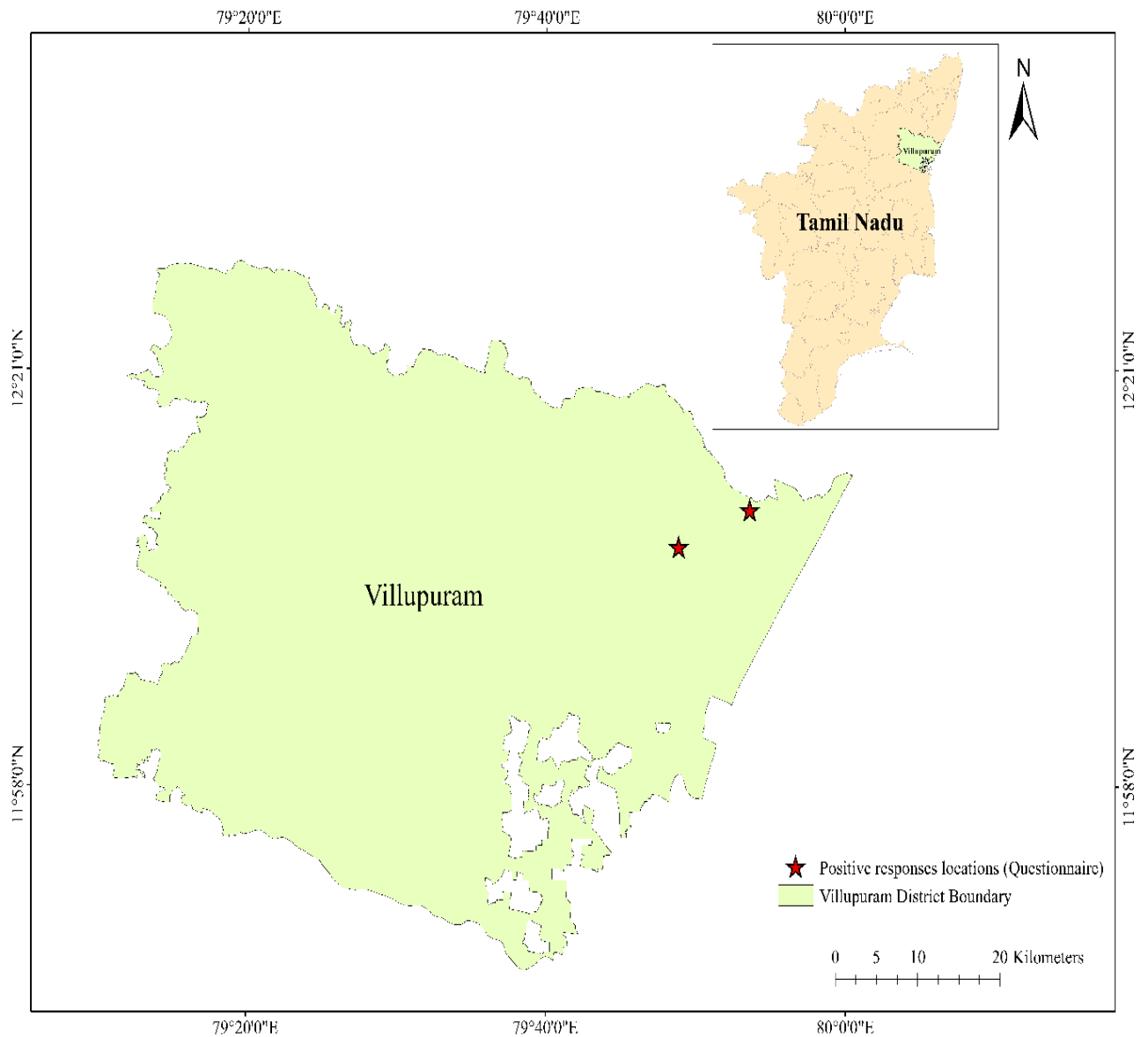


Figure 16. Map of positive response locations (Secondary data) in the Villupuram district.

During the questionnaire survey in the Villupuram district, researchers recorded a single sighting of the Madras Hedgehog (Fig. 16). This finding highlights Villupuram as a potential habitat for the species. Further research in Villupuram district could contribute valuable data to broaden the understanding of the species range and support conservation planning efforts aimed to protect this unexplored mammal.

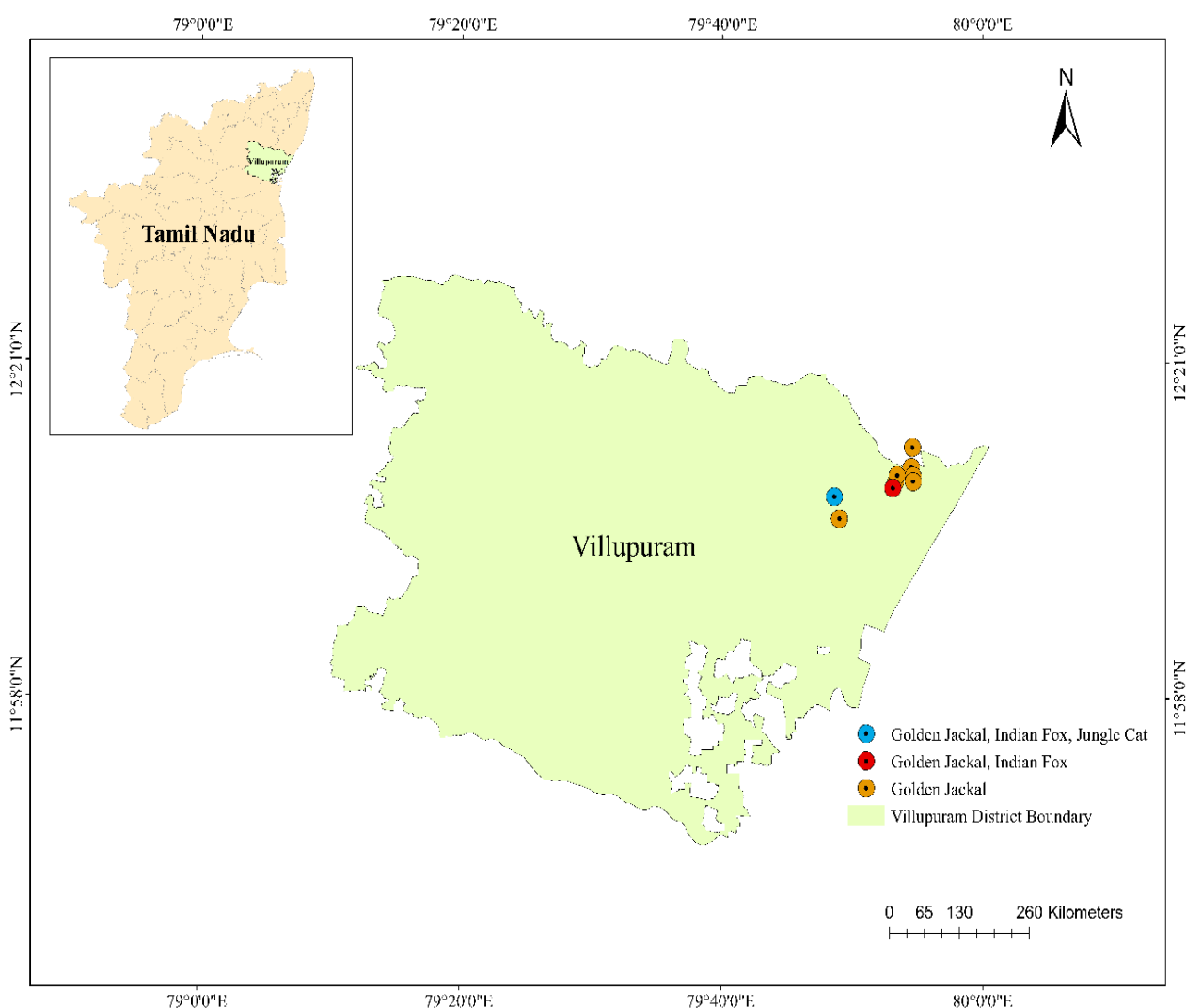


Figure 17. Map of associated species distribution (Indian Fox, Golden Jackal & Jungle Cat) in the Villupuram district (Secondary data).

In the Villupuram district, sightings of Golden jackals, Indian foxes, and Jungle cats have been reported from Alankuppam. Several locations near Kurumbaram have reported higher occurrences of Golden jackal sightings (Fig. 17). Additionally, the area near Kurumbaram is the only location where both Golden jackal and Indian foxes have been reported. The Kurumbaram Reserved Forest, characterised by shrubland and plantations, serves as a habitat for these species. When these animals venture beyond the protected area, the adjacent villages offer opportunities for local communities to encounter them, emphasizing the ecological connectivity between the forest and surrounding human settlements.

7.1.4. Chennai

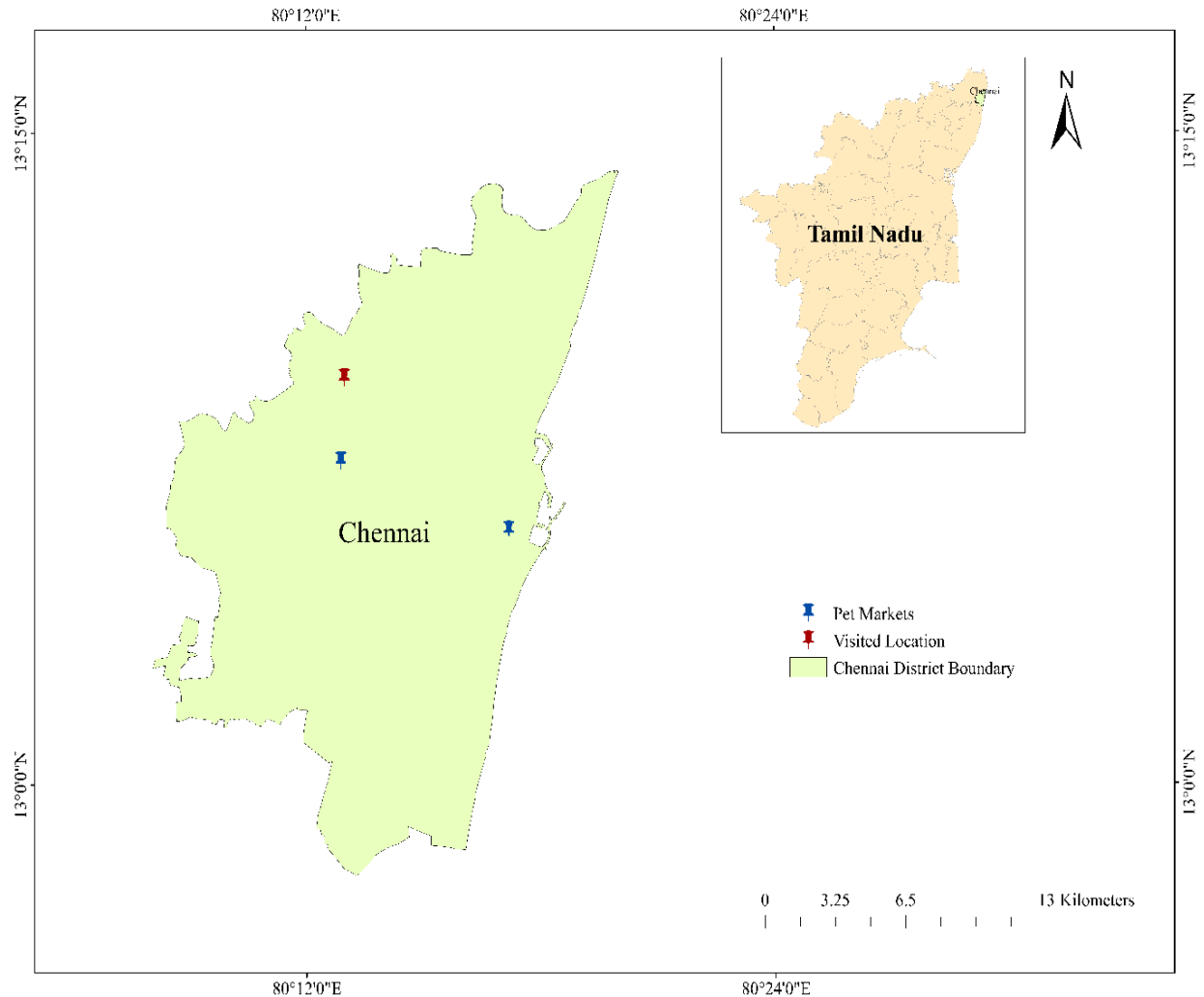


Figure 18. Map of locations in Chennai district where pet markets were visited.

Due to the limited availability of rural landscapes in Chennai for field surveys, alternative approaches were adopted. A questionnaire survey was conducted in Retteri, an area located near Retteri Lake (Fig. 18). Furthermore, visits were made to the Kolathur Pet Market and the Parrys Pet Market (Broadway) to gather information from pet shopkeepers' perceptions of the study animal and its potential involvement in trade. These observations provided valuable information to complement the ecological findings.

7.1.5. Erode

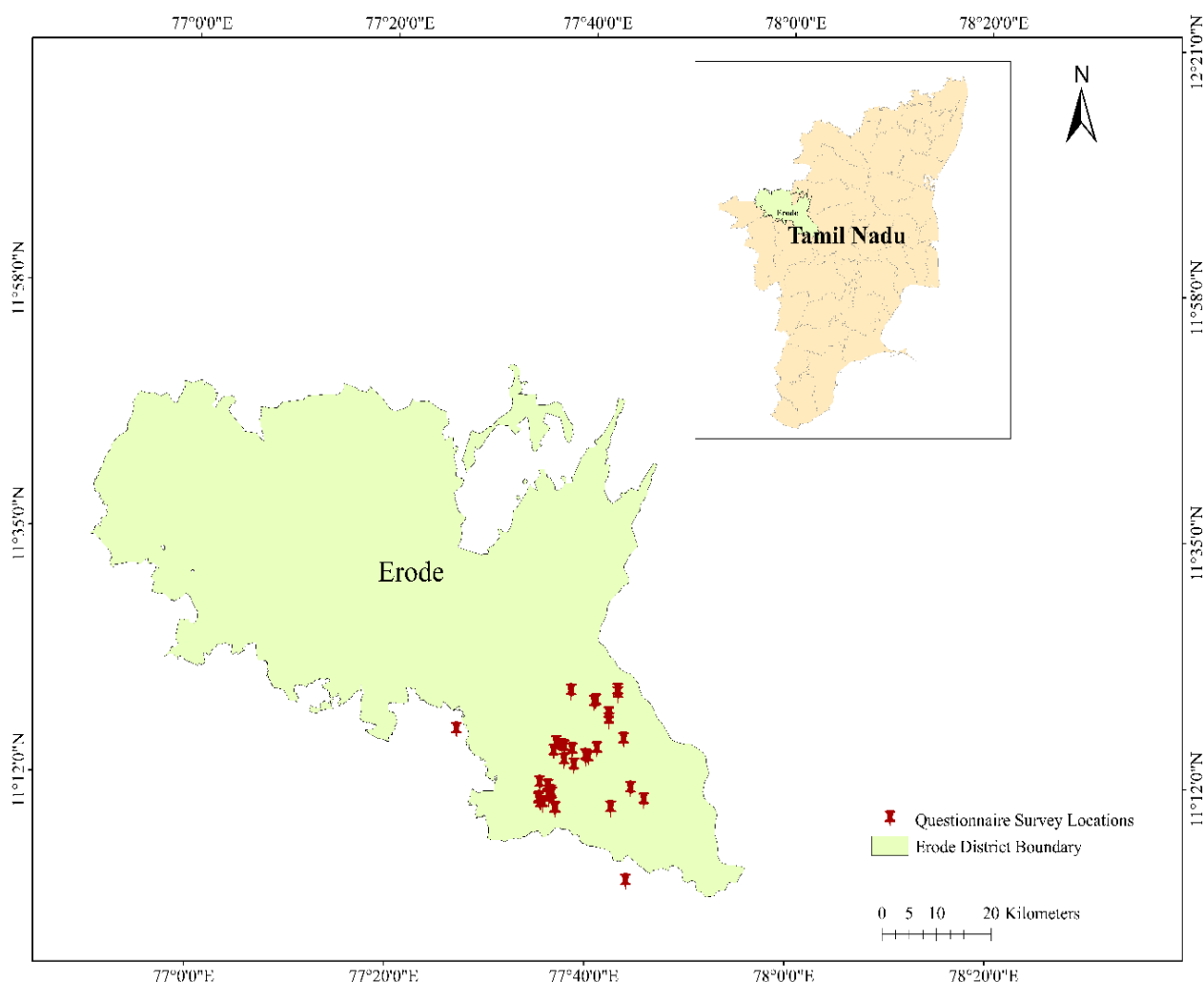


Figure 19. Map of questionnaire survey locations in the Erode district.

A questionnaire survey was carried out in the Erode district, focusing on areas surrounding the Vellode Bird Sanctuary and Chennimalai Reserved Forest (Fig. 19). These locations were selected based on the previous records of sightings of the Madras Hedgehog in these regions. In Erode, there are vast agricultural fields that were observed and open areas that are used as grazing land by the local people. The survey aimed to collect information about the current presence of the species and its habitat in these areas. Further studies are necessary to confirm the species' presence and better understand its distribution in these areas.

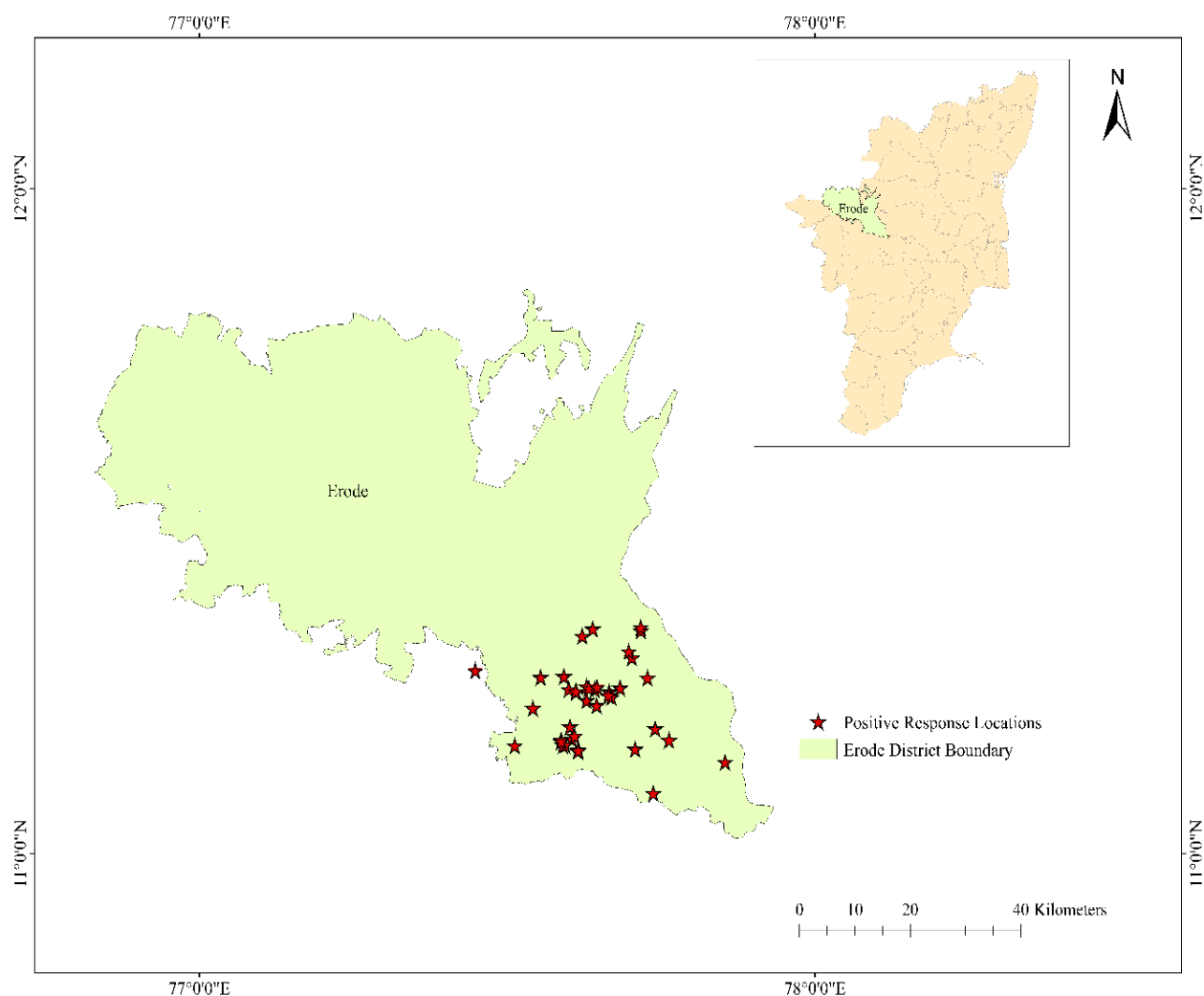


Figure 20. Map of positive response locations in the Erode district (Secondary data).

The research team was unable to directly observe the Madras Hedgehog during the surveys. However, local respondents provided several direct sighting records through the questionnaire responses (Fig. 20). They mostly sight the animal near the agricultural land while going to agricultural work or while grazing their cattle. These community-sourced accounts serve as key indicators of the presence of the species in the area. This information highlights the need for further field investigations to validate these findings and assess the habitat suitability. These insights can help us guiding future research and conservation planning, especially in regions where the detection of elusive or nocturnal species proves challenging.

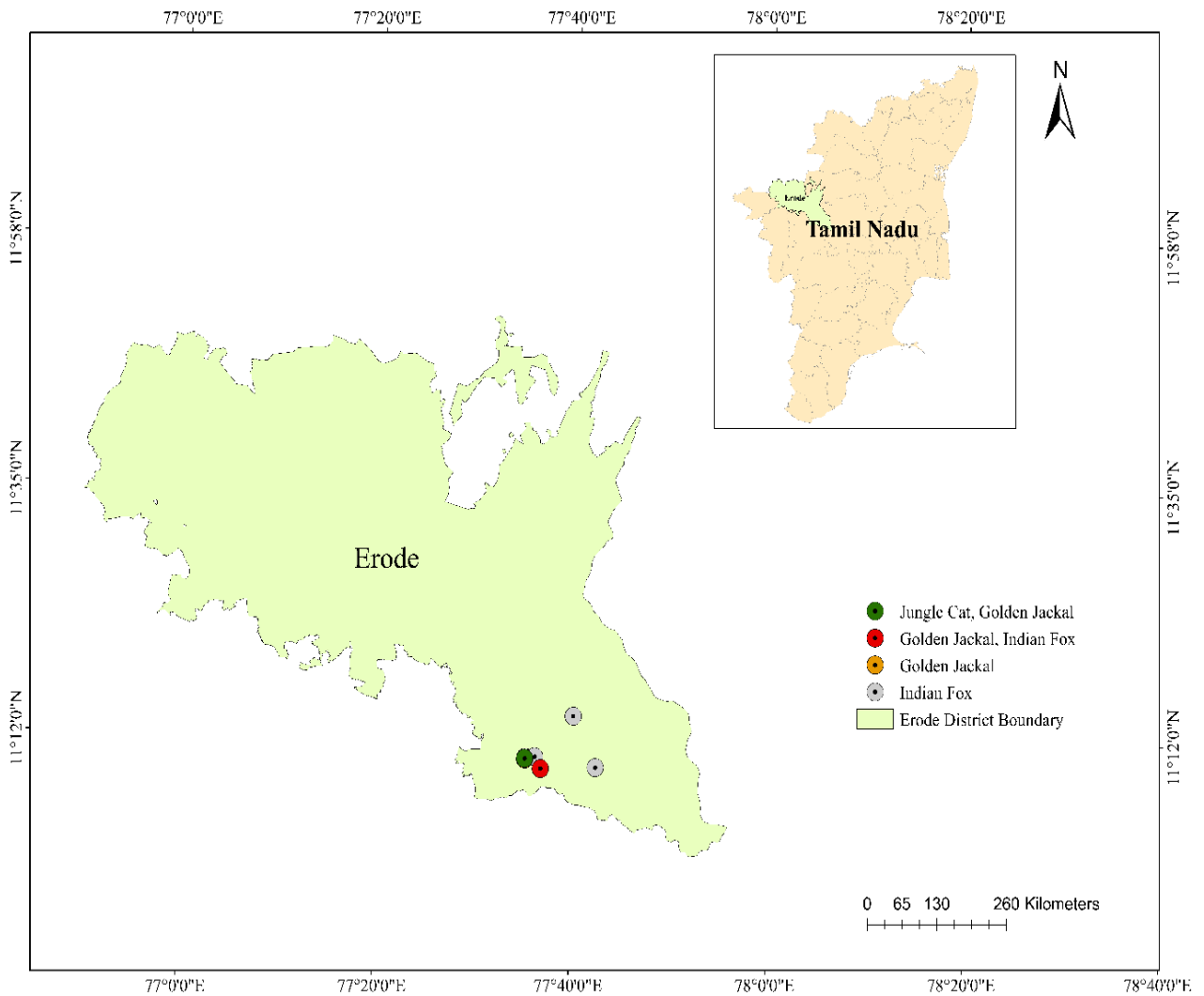


Figure 21. Map of associated species distribution (Indian Fox, Golden Jackal & Jungle Cat) in the Erode district (Secondary data)

In the Erode district, sightings of Golden jackals and Jungle cats have been reported from the same location, indicating possible habitat overlap. Additionally, another location in the Erode district has sightings of both Golden jackals and Indian foxes (Fig. 21). Furthermore, multiple locations across the district have similarly reported co-occurrences of Golden Jackals and Indian foxes, suggesting that these species share common habitats and possibly similar ecological requirements in the region.

7.1.6. Tirunelveli

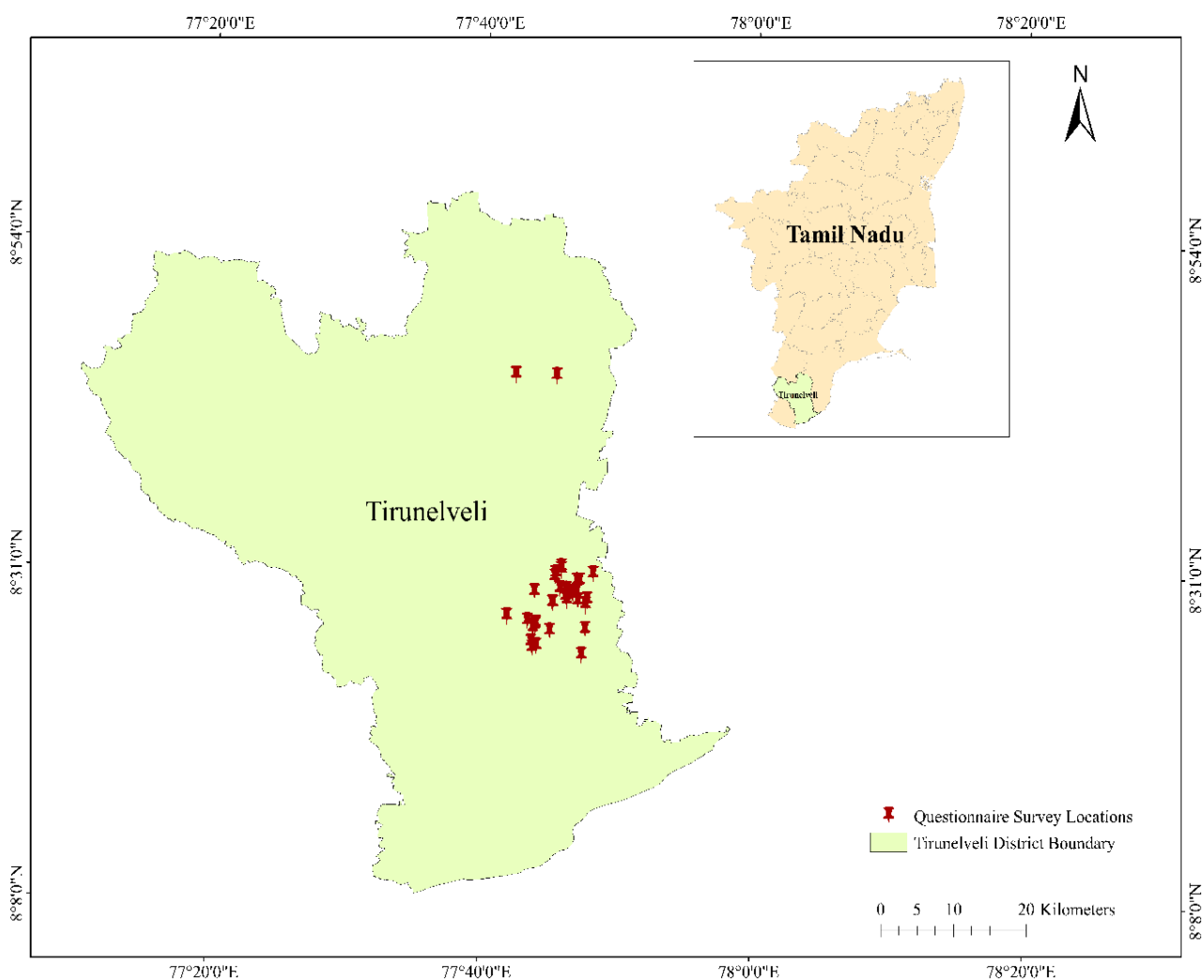


Figure 22. Map of questionnaire survey locations in the Tirunelveli district.

In Tirunelveli district, a questionnaire survey was carried out in the areas surrounding the Koonthankulam Bird Sanctuary (Fig. 22). This region is known for its abundant lakes, open grasslands, and palm groves, which provide a suitable habitat for the Madras Hedgehog. The survey aimed to gather local ecological knowledge from residents familiar with the landscape, identify the potential presence of the species, and assess the habitat suitability. Protecting and managing these environments is important for the long-term conservation of the Madras Hedgehog and maintaining the ecological integrity of the region.

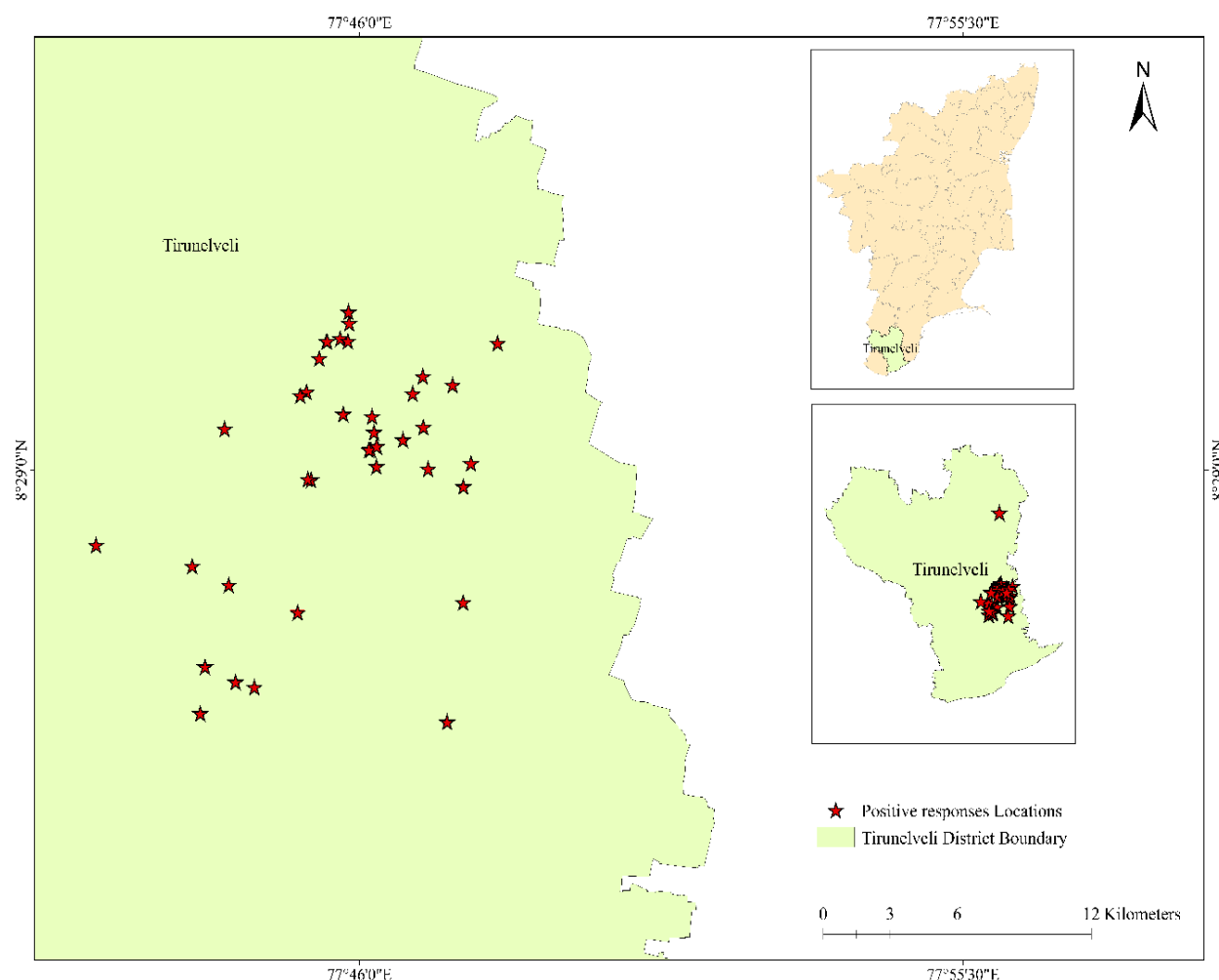


Figure 23. Map of positive response locations in the Tirunelveli district (Secondary data)

The questionnaire survey conducted around the Koonthankulam Bird Sanctuary yielded encouraging results, with many local respondents reporting sightings of the Madras Hedgehog (Fig. 23). These community-based reports were further validated by confirmed sightings by the researchers during their fieldwork. The area, with its lakes, open grasslands, and palm groves, provides ideal ecological conditions for the hedgehog. These findings not only confirm the presence of the species in the Tirunelveli district but also underscore the ecological value of the Koonthankulam region. This research study highlights the importance of continued monitoring and in-depth studies for a better understanding of the behaviour, distribution, and habitat preferences.

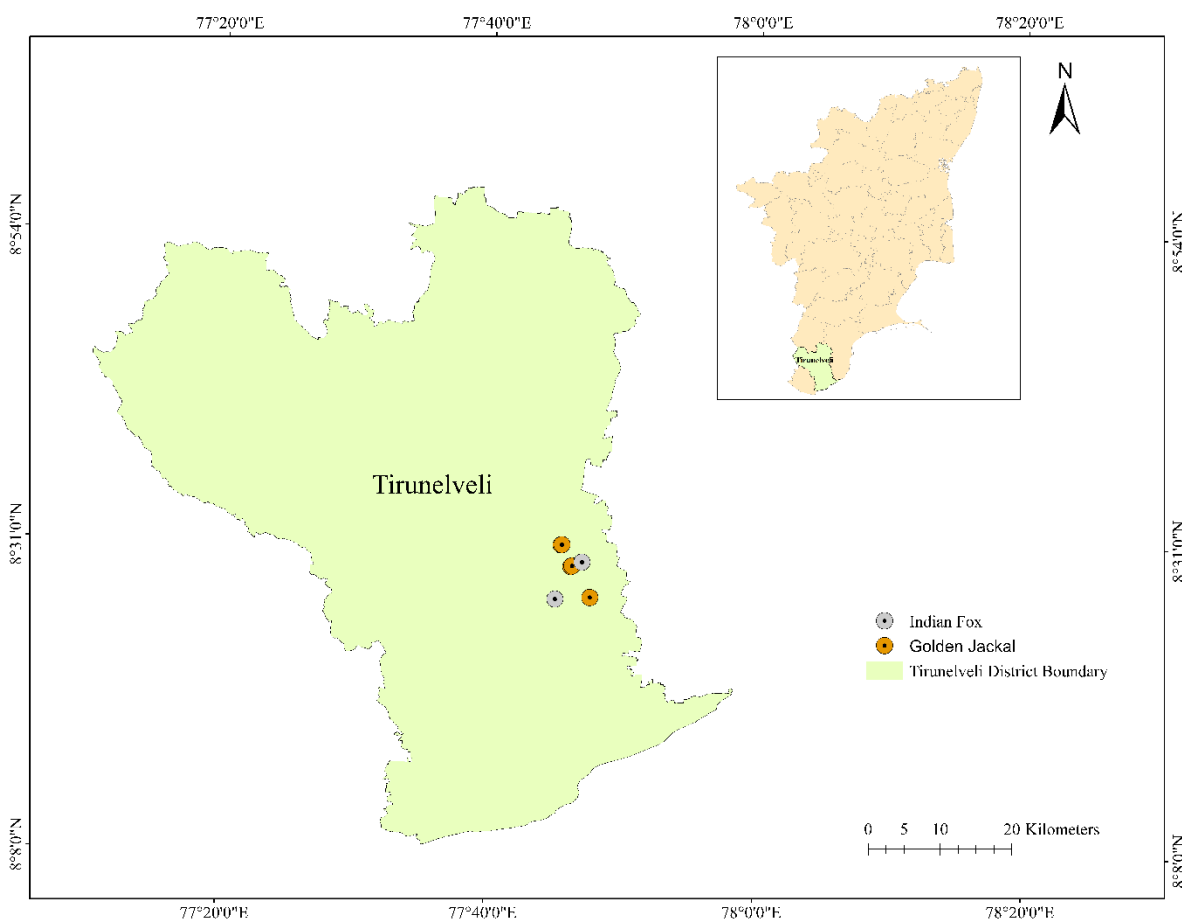


Figure 24. Map of associated species distribution (Indian Fox & Golden Jackal) in the Tirunelveli district (Secondary data).

In Tirunelveli, residents from multiple locations reported sightings of Golden jackals and Indian foxes, particularly near agricultural fields and grazing lands (Fig. 24). These sightings often occurred during cattle herding activities, suggesting that these animals may be attracted to such areas in search of food or shelter. Their presence in these human-influenced landscapes highlights the importance of understanding the interaction between wildlife and agricultural practices, as these areas may serve as important supplementary habitats for these species.

7.2. Nocturnal survey result

7.2.1. Spotlight survey

During the study period, nocturnal spotlight surveys were conducted over 30 nights, with volunteers spending an average of 4 hours per night in the field, typically between 5.30 PM and 12.45 AM (IST). This night-time only method was chosen

especially to maximise the chances of detecting nocturnal species. Despite multiple efforts across districts, the target species was only sighted in Tirunelveli. However, responses from local participants through the questionnaire revealed more sightings in other districts, such as Erode, which could indicate variations in species distribution patterns or habitat preferences.

The survey coincided with the monsoon season, which posed several challenges like intense rainfall, high humidity, and occasional flooding in some places, which hindered fieldwork by limiting visibility and making certain locations difficult to access. These weather-related constraints, combined with the brief duration of the fieldwork, reduced the overall scope of the survey and influenced the quantity and quality of data collected. To improve future studies, surveys could be planned during drier seasons or conducted with contingency strategies in place to mitigate the impact of adverse weather.

During the surveys, several other nocturnal animals were observed in addition to the target species. These incidental sightings contribute valuable data on the overall biodiversity of the surveyed areas and help build a more comprehensive picture of the local nocturnal fauna.

The Madras Hedgehog was directly observed in a variety of habitat types during the nocturnal survey conducted in the Tirunelveli area, showing its adaptability and habitat acceptance. Most sightings occurred in fields dominated by *Prosopis juliflora*, an invasive plant species that appears to provide sufficient cover and microhabitat conditions for the hedgehogs.

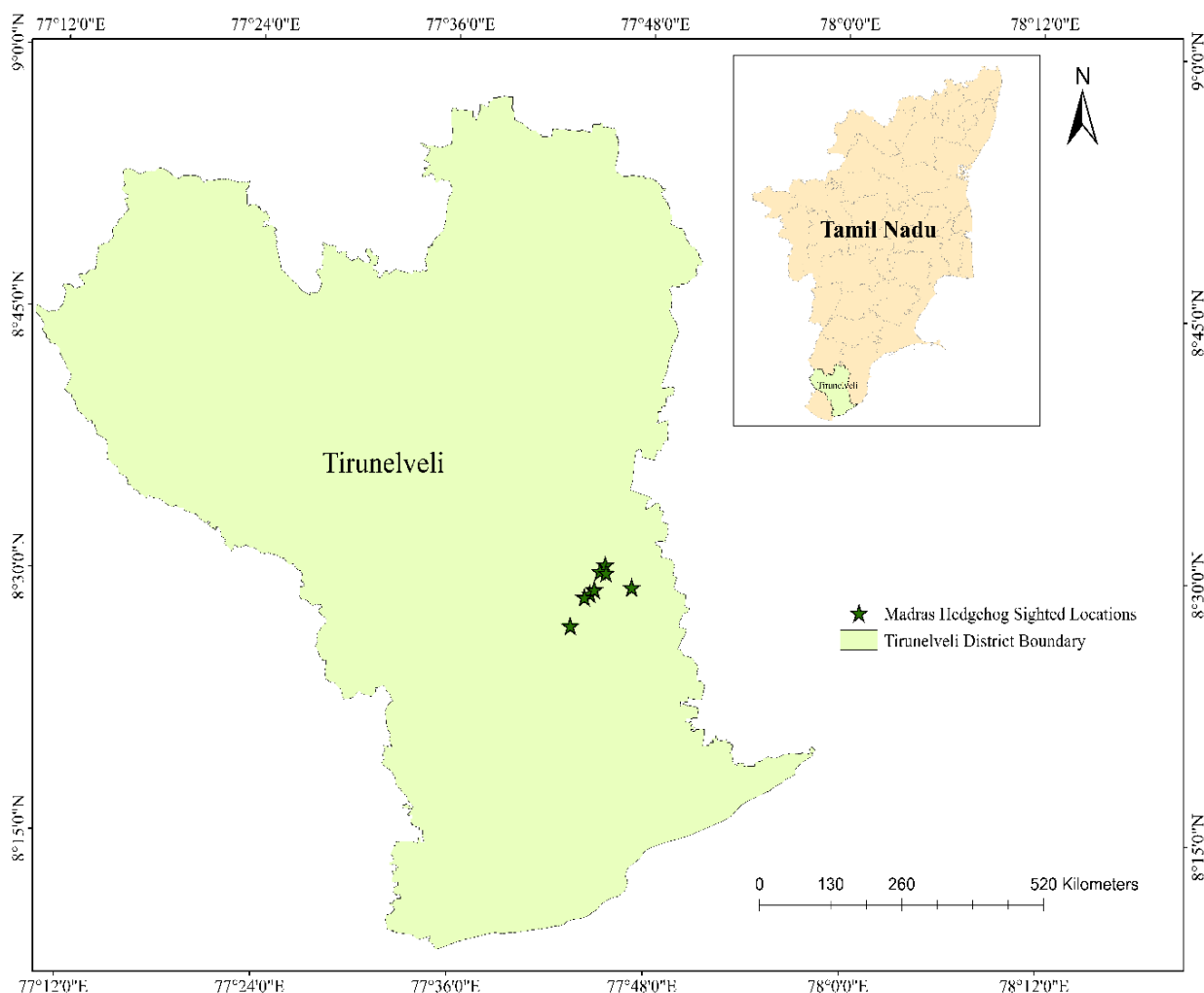


Figure 25. Map of direct sighting locations of Madras Hedgehog in Tirunelveli district.

Furthermore, the hedgehog was also observed near rocky patches formed during the construction of Tirunelveli main canal, which is an essential irrigation source in the districts of Tirunelveli and Thoothukudi (Fig. 25 & 26). These man-made rocky areas likely offer important shelter and protection from predators, serving as refuge sites in otherwise open landscapes. The Madras Hedgehogs were also spotted near naturally formed small rocky hillocks, which provide essential hiding spots and enhance habitat complexity. The Madras Hedgehog's existence in the Tirunelveli district depends on a variety of habitat types, including both natural and man-made landscapes, which should be preserved even in non-protected areas.

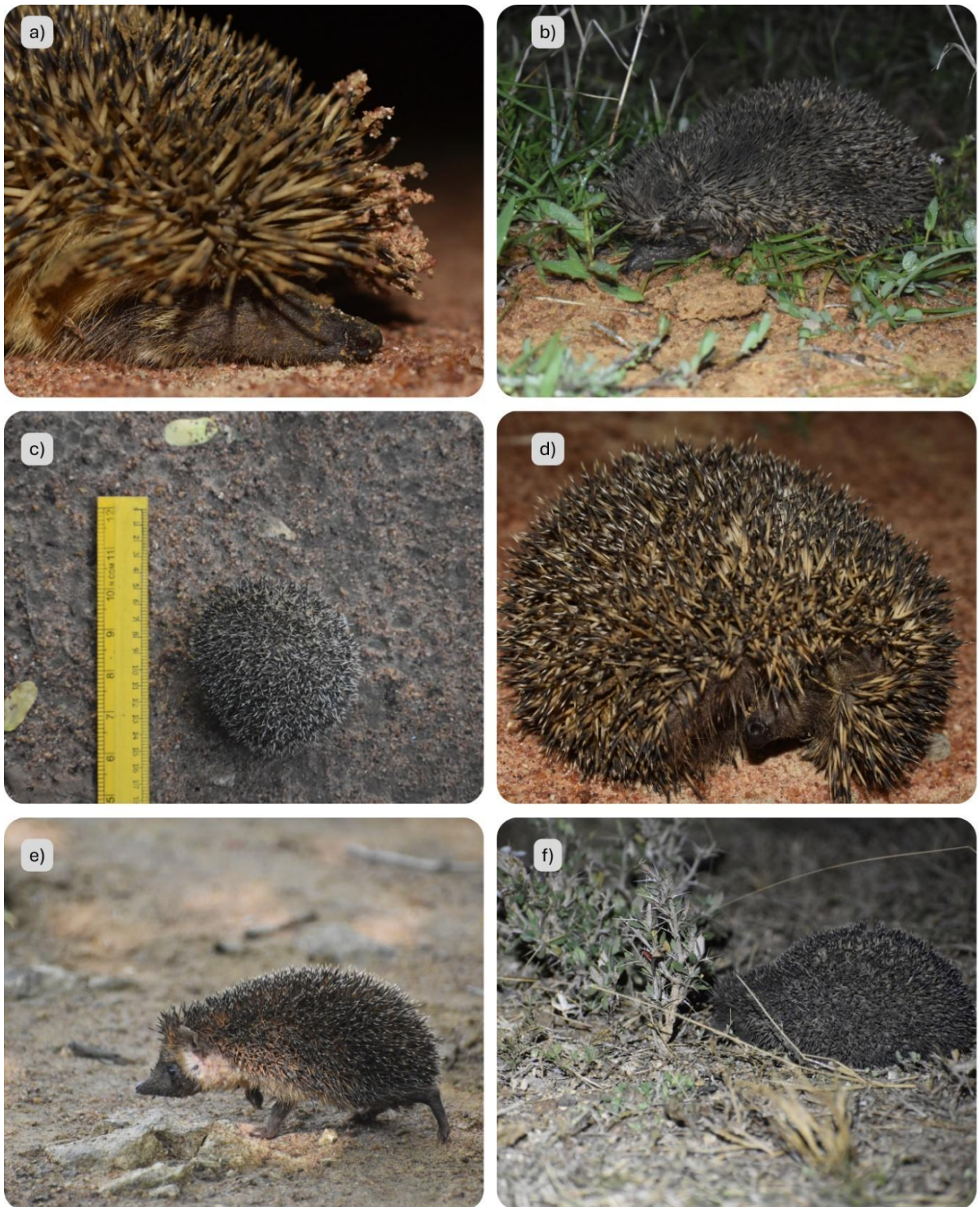


Figure 26. Photo plate of Madras Hedgehog. a) Close view of the face of a Madras Hedgehog, b) An adult Madras Hedgehog feeding the termites, c) Madras Hedgehog in the volvation position (Defence behaviour), d) Madras Hedgehog in the becoming volvation position, e) Madras Hedgehog walking, f) Madras Hedgehog in an alert position.

7.2.2. Infrared thermal imagery

During the nocturnal surveys (30 nights), the research team employed the FLIR E54 Advanced Thermal Imaging Camera, which was used to detect the presence of warm-blooded animals, including the study species (Fig. 27). To improve the effectiveness of the survey, one of the team members carried the thermal imaging camera in addition to the spotlighting survey. Although the presence of the trees and shrubs could block the view and influence the probability of spotting the target species, the Infrared thermal imagery camera worked most effectively in open grassland regions. Considering the camera's value and sensitivity, as well as the challenging weather during the survey time, this camera usage was carefully planned and limited to appropriate locations to ensure the safety of the equipment and the survey's efficiency.

Overall, the use of the FLIR E54 significantly contributed to the study, providing precise thermal imaging and valuable insights. Despite its limitations in specific habitats, the device remains a powerful tool for wildlife studies, especially when combined with other survey techniques, as an integrated approach encourages the accuracy of detecting warm-blooded animals in diverse environments without disturbing the animal.

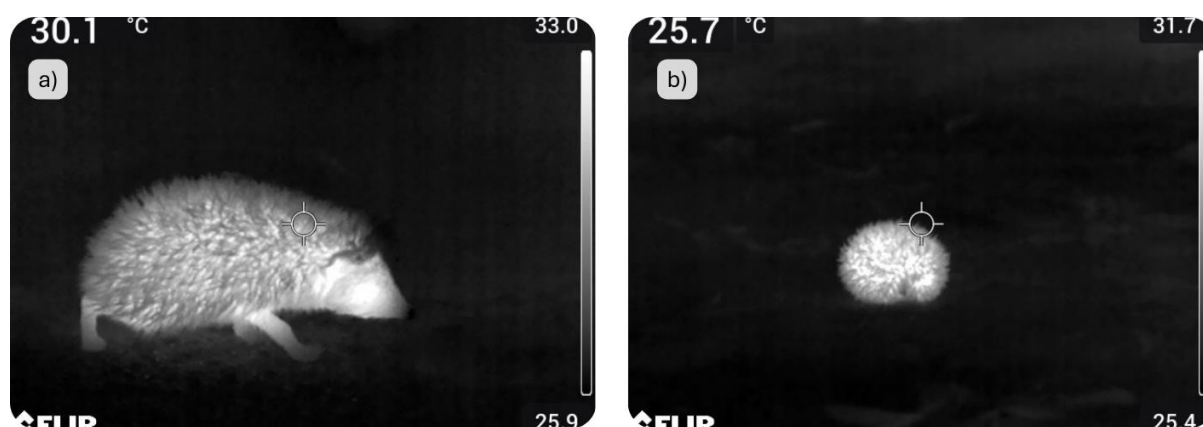


Figure 27. Photo plate of a Madras Hedgehog recorded with an Infrared Thermal Imagery camera. a) Close view of Madras Hedgehog, b) Madras Hedgehog in volvation position.

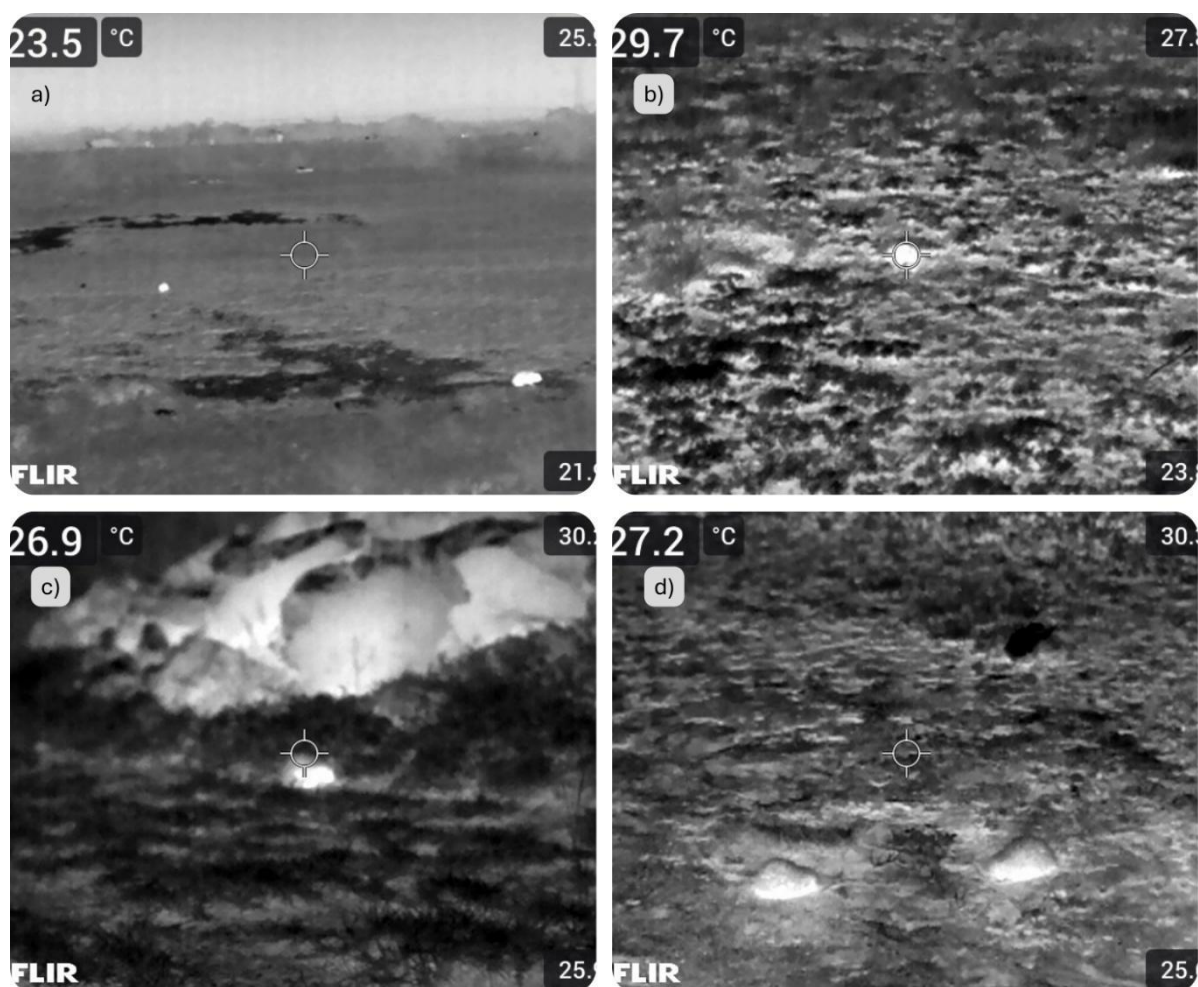


Figure 28. Photo plate of Madras Hedgehog in different types of habitats recorded with the Infrared Thermal Imagery camera. a) Two Madras Hedgehogs captured in the open low grassland habitat, b) Madras Hedgehog in the grassland area with sand patches, c) Madras Hedgehog in the rocky habitat, d) Madras Hedgehog in the grassland habitat without sand patches.

During the fieldwork, Madras Hedgehogs were easier to locate in open low grassland habitats compared to other habitats by the Infrared Thermal Imagery (Fig. 28). These grasslands had sparse vegetation, allowing better visibility of the animals using Infrared Thermal Imagery. However, in areas where the grass was denser, visibility significantly declined. The thicker vegetation offered more cover for the hedgehogs, making them harder to locate. In grasslands with sand patches, identifying hedgehogs was also challenging. At night, heat emitted from the sand interfered with observations, as it was often mistaken for the presence of animals.

Madras Hedgehogs were also seen in rocky habitats, but identifying them in such areas proved difficult. The rocks often resembled the hedgehogs in their curled-

up (volvation) position, which caused misidentifications. Even with Infrared Thermal Imagery, it was hard to differentiate rocks from hedgehogs under these conditions.

In cattle-grazed grasslands, small hoof marks left by the animals exposed patches of sand, which further complicated observations. These sand patches were often mistaken for the presence of Madras Hedgehog. The ground-nesting avifauna like Pipits, Larks, Quails, and Nightjars, which were sighted also caused similar confusion during the study. These birds commonly use open habitats, and their presence further added to the challenge of distinguishing between signs of birds and other wildlife, like hedgehogs, during the study.

In India, this study marks the first documentation of the Madras Hedgehog using the Infrared Thermal Imagery Camera, offering valuable insights into the species and its preferred habitats. This non-invasive method allowed researchers to track the animal without disturbing its natural behaviour, ensuring accurate observations. This study marks an important step in understanding the Madras Hedgehog and encourages future research to explore its behaviour, habitat, and conservation needs.

However, the thermal imaging camera had limitations in certain habitats. In scrublands with dense tree cover, the vegetation blocked visibility and hindered the detection of animals using the thermal imaging camera. Similarly, in rocky areas and grazing lands with sandy patches, the emitted heat from rocks and sand often led to false detections, misinterpreting non-living elements as potential animals. These challenges highlighted the importance of selecting appropriate habitats for surveys and integrating multiple detection methods to overcome such limitations.

7.2.3. Behavioural observation

During the research study, the Madras Hedgehogs were observed feeding on termites, confirming their insectivorous diet. During the nocturnal survey, these hedgehogs were seen climbing a 6-foot-tall man-made water trench, dry at the time, with ease. Additionally, the hedgehogs were observed climbing a pile of rocks, around 6 feet in height. After climbing, they were seen hiding in the small gaps between the rocks.

These observations highlight the hedgehogs' ability to adapt to their surroundings. Their climbing skills allow them to explore different terrains, such as trenches and rocks. Such behaviours demonstrate how the Madras Hedgehog has effectively adjusted to human-modified environments and utilises various structures in its habitat for survival.

During the nocturnal survey, it was observed that the Madras Hedgehog is highly sensitive to sound and noted that they are sensitive to smell, which appears to play a crucial role in detecting and locating prey.

7.2.4. Camera trap survey

The camera trap survey was conducted in two significant study locations over two distinct periods. The first phase took place in Guindy National Park, beginning in the last week of September 2024 and continuing until the second week of March 2025. The second phase was carried out in the Nanmangalam Reserved Forest, Tambaram, from the second week of December 2024 to the second week of March 2025. This survey aimed to track and record wildlife activities in both protected regions.

Due to the significant number of unprotected areas in these primary locations, additional camera traps were deployed on a limited number of survey nights in other study locations.

This method not only provided valuable insights into the distribution and behaviour of the study species but also enabled the identification of associated species sharing the same habitat. It is a non-invasive and efficient tool that helps researchers monitor wildlife without disrupting the ecosystem.

7.2.4.1. Guindy National Park

In Guindy National Park, a total of 7 camera traps were deployed to capture animal movements, with a particular focus on small mammals. To optimise detection, the traps were positioned at a suitable height (low to the ground level) suitable for capturing images of ground dwelling species. The camera traps were deployed in various habitats like the shrub area adjacent to grasslands, the grassland with woody trees, and the mud roads bordering dense vegetation.







Figure 29. Photos of the other fauna captured in the camera trap at Guindy National Park, Chennai. a) Indian Monitor Lizard, b) Indian palm squirrel, c) Bonnet macaque, d) Spotted deer, e) Golden jackal with the fish, f) A group of Indian Grey Mongoose, g) Indian Pangolin, h) Common Palm Civet, i) Malayan Night heron, j) Indian Crested Porcupine, k) Jungle Cat, l) Golden Jackal, m) Indian Black Turtle, n) Rat sp., o) Blackbuck, p) Barn Owl, q) Jungle Cat with rat kill, r) Jungle cat with kill

The Guindy National Park has an area coverage of 270.57 hectares, features tropical dry evergreen forest vegetation that supports a diverse array of wildlife species across its varied habitats. Spotted deer and Blackbuck were mostly recorded in the grassland habitat. Golden jackal and Jungle cat were documented near the mud road and grasslands while they are searching for prey. Malayan Night Heron, Common Palm Civet, and rat species are sighted in the dense vegetation. Barn owls and Indian Black turtle were recorded in the open grassland. Indian pangolin and Indian Crested Porcupine were captured on camera in both dense vegetation and along mud road paths (Fig. 29).

7.2.4.2. Infected Golden Jackal in the Guindy National Park



Figure 30. Photo plate of the infected Golden jackal in the Guindy National Park. a & b) infected Golden jackal captured during the daytime, c & d) infected Golden jackal captured during the night-time.

During the camera trap survey in Guindy National Park, two Golden jackals were observed with unhealthy skin conditions, exhibiting bare tails and bald patches on their bodies (Fig. 30). These symptoms are consistent with mange infection, a condition caused by parasitic mites, such as *Sarcoptes scabiei*, which burrow into the epidermis, forming tunnels in the outer skin layers (Spratt and Singleton, 2008). Golden Jackals that inhabit or live near human settlements often come into close contact domestic animals like dogs, increasing the risk of disease transmission

particularly mange and particularly vulnerable to such infections due to increased exposure to parasites like fleas and ticks and limited genetic diversity in small, isolated populations (Negi, 2014). There is chance of these limited population of Golden jackal in Guindy National Park may infected as it is also surrounded by the human settlement areas.

Spratt and Singleton (2008) emphasize the importance of early detection and diagnosis, including the examination of even minor skin lesions and Sero seroepidemiological surveys to understand the prevalence of mange. Infected individuals, if untreated, can become vectors for further spread, particularly in densely populated wildlife zones.

7.2.4.3. Nanmangalam Reserved Forest

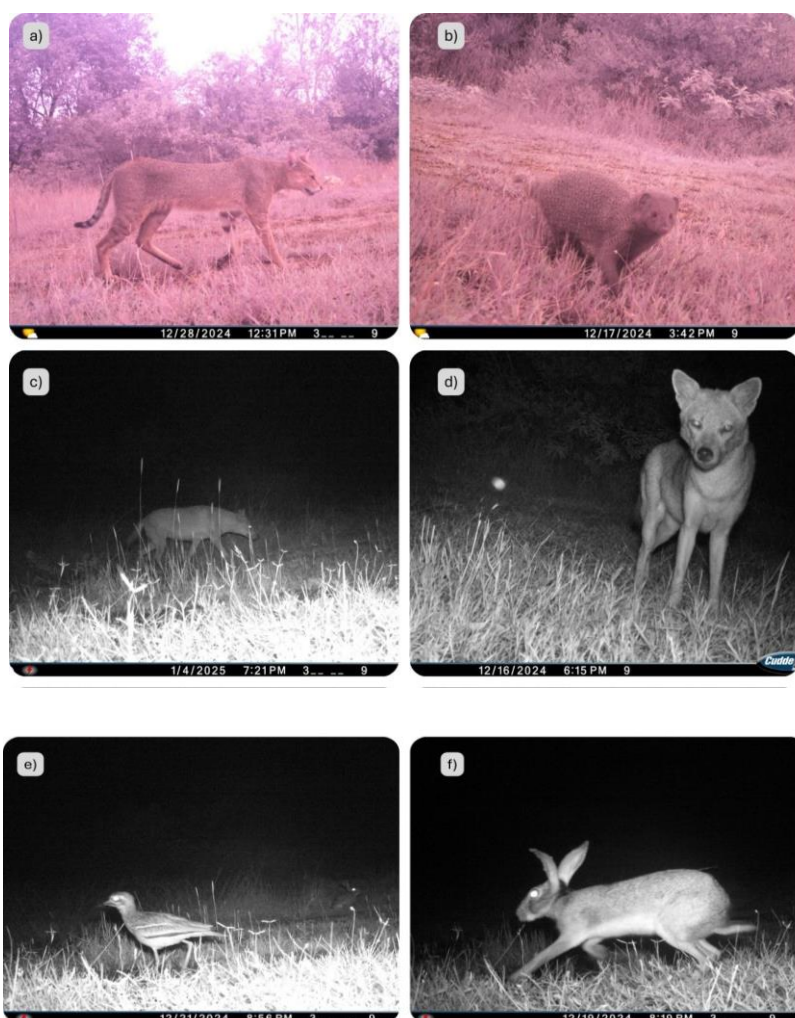


Figure 31. Photos of the other fauna captured in the camera trap at Nanmangalam reserved forest, Tambaram. a) Jungle Cat, b) Indian Grey Mongoose, c) Golden Jackal, d) Golden Jackal, e) Indian Thick-knee, f) Black-naped Hare.

Nanmangalam Reserved Forest features a diverse landscape comprising scrub forest, abandoned quarries and Eucalyptus plantation, which together support a variety of wild flora and fauna (Fig. 31). As a part of camera trap survey, two camera traps were strategically deployed along the scrub forest path that reveals a variety of fauna using the same habitat for survival.

7.2.4.4. Vandalur Reserved Forest

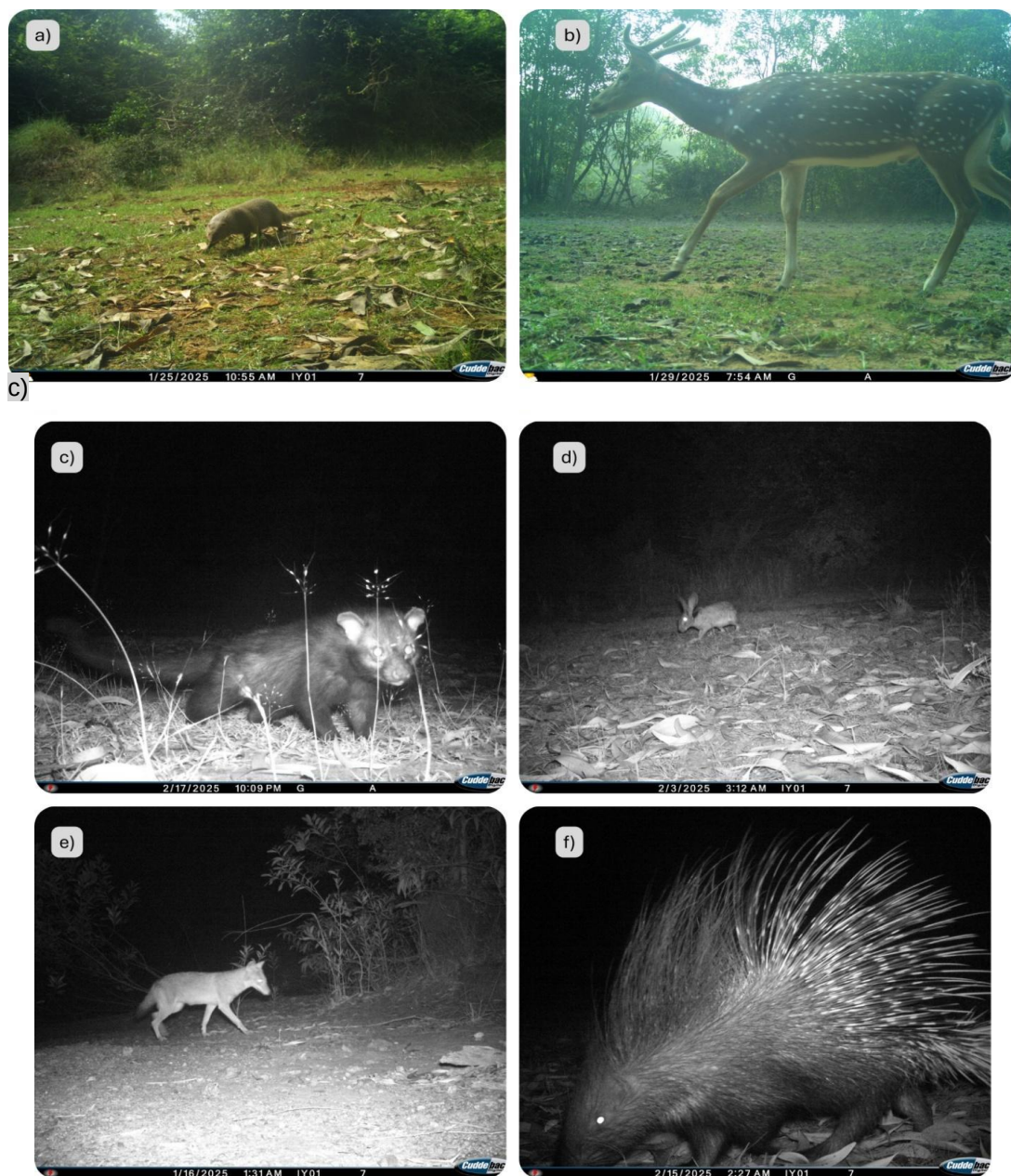


Figure 32. Photos of the other fauna captured by the camera trap at Vandalur Reserved Forest. a) Indian Grey Mongoose, b) Spotted Deer, c) Common Palm Civet, d) Black-naped hare, e) Golden Jackal, f) Indian Crested Porcupine.

Vandalur Reserved Forest has a diverse habitat consisting of scrublands, plantations, and ponds, providing essential shelter and resources for a range of wild species (Fig. 32). As a part of the camera trap survey, a total of 2 camera traps were deployed in Vandalur Reserved Forest. The findings highlighted the nocturnal activity of several species, with camera traps capturing animals that are primarily active at night, including the Indian Crested Porcupine, the Black-naped hare, and the Common Palm Civet.

7.2.4.5. Feral animals in the Guindy National Park, Vandalur, and Nanmangalam Reserved Forests

During the camera trap survey, camera traps recorded footage of domestic cattle, feral cats, and feral dogs along with other wildlife species. These human-associated animals were observed within and around protected areas, raising several conservation concerns. In Nanmangalam Reserved Forest, both domestic cattle and feral dogs were documented (Fig. 33), indicating grazing pressure and disturbance within the reserve. In Vandalur Reserved Forest, only feral dogs were observed, suggesting that free-ranging dog populations may pose a threat to wildlife in that area. Feral cats were exclusively recorded in Guindy National Park, highlighting the intrusion of urban-adapted species into core conservation zones. This invasion could influence wildlife's natural behaviour, raise competition for limited resources, and increase the risk of disease transmission. There are significant concerns about the existence of feral and domesticated animals in these protected areas since diseases can spread from wildlife to domestic animals or vice versa

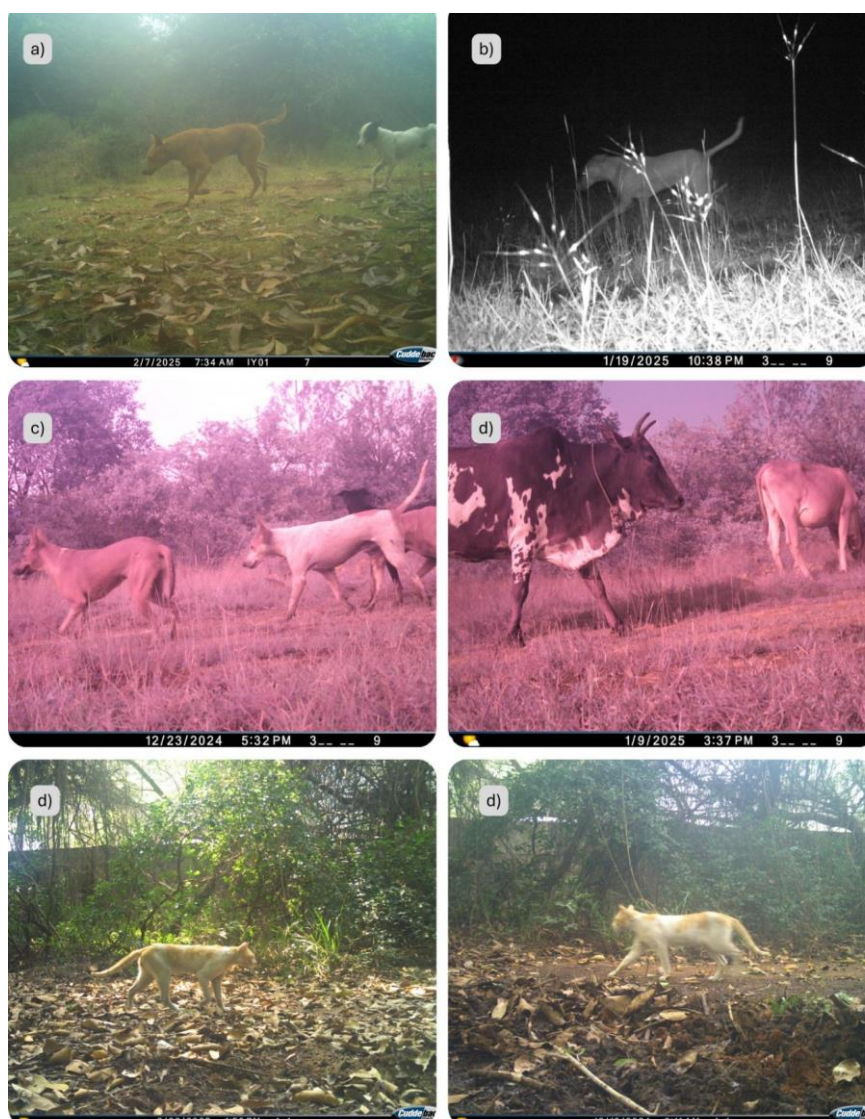


Figure 33. Photo plate of feral animals in the Guindy National Park, Vandalur, and Nanmangalam Reserved Forests. a) Feral dogs in the Vandalur Reserved Forest, b) Feral dog during night in Nanmangalam Reserved Forest, c) Feral dogs in Nanmangalam Reserved Forest, d) Domestic cattle in Nanmangalam Reserved Forest, e & f) Feral cat in the Guindy National Park.

7.2.4.6. Kurumbaram Reserved Forest

A total of two camera traps were deployed in the Kurumbaram Reserved Forest during the survey and animals are shown in Figure 34.

A camera-deployed area in a neighbouring mango grove, situated near the Reserved Forest boundary. This location was selected to assess the movement of wildlife between the forest and nearby agricultural lands.

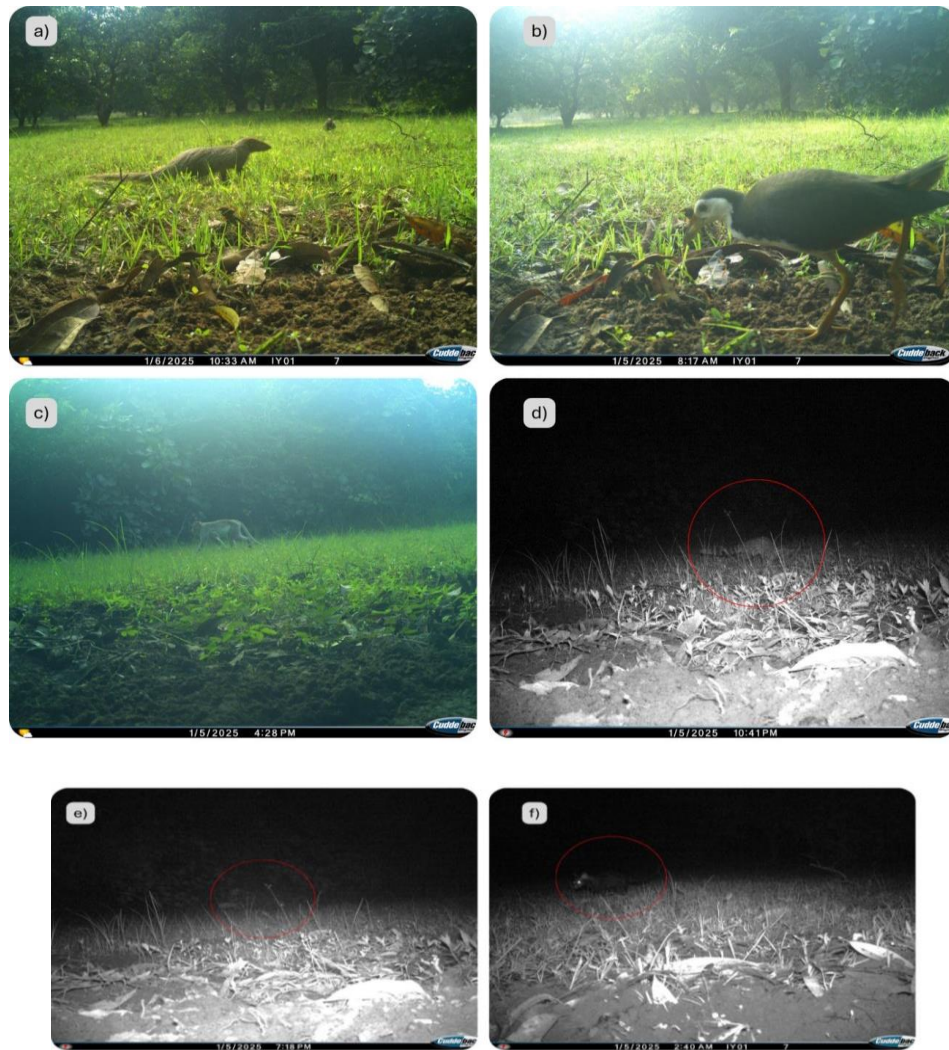


Figure 34. Photos of the other fauna captured by the camera trap at Mango Grove near Kurumbaram Reserved Forest, Villupuram. a) Indian Grey Mongoose, b) White-breasted Waterhen, c) Bonnet Macaque, d) Small Indian Civet, e) Indian Crested Porcupine, f) Common Palm Civet.

8. THREATS

8.1. Habitat Destruction

In the northern study districts, particularly in places like Chennai, urbanization has significantly transformed the natural landscape. Agricultural fields have become scarce and open grasslands have almost entirely disappeared. The remaining unprotected areas are heavily influenced by human activity, which contributes to further disturbance of native ecosystems.

Habitat destruction poses a significant threat to the Madras Hedgehog. During the study period, local communities frequently gathered these fallen branches into piles for use as firewood. In doing so, they unknowingly disturb the animals that take shelter under these branches. Sometimes, the unused firewood piles are burned in the fields, and could result in the accidental deaths of these animals.



Figure 35. Palm leaves used as a fence and a house. a) Palm leaves used as a fence, b) Palm leaves used to build a house.

The practice of burning palm fronds has significantly impacted this species, as they often use these leaves as shelter. In the past, local residents used palm tree leaves to make fences, build houses, and construct cattle sheds (Fig. 35). However, this traditional practice has declined over time, leading to an increase in the burning of these leaves. This probably result in the accidental deaths of the species that rest under them. Tree logging was also observed as a common activity, which caused the loss of their natural shelters, such as dead branches from trees and palm tree leaves.



Figure 36. Photos of Live fence and artificial fence in the study area. a) Live fence (Kiluvai chedi or Mulkiluvai in Tamil), b) Artificial fencing.

Artificial fencing can significantly influence animal movement, often restricting their natural migration and foraging routes. In contrast, live fencing allows for more permeability, enabling wildlife to move more freely between fragmented habitats (Fig. 36).

Urbanization has played a major role in reducing the natural spaces where this species can survive. As agricultural and undeveloped lands are converted for human infrastructure, the species is left with fewer areas to forage and rest, dramatically shrinking their viable range.

Additionally, the widespread use of pesticides in agricultural areas poses both direct and indirect threats. Pesticides reduce the insect availability, a primary food source for hedgehogs and other insectivores, thereby disrupting the food chain. Pesticides may also pose direct risks to hedgehogs if they come into contact with contaminated soil or water.

These combined factors, habitat destruction, traditional practices turning harmful, urban expansion, and chemical exposure the urgent need for targeted conservation measures.

8.2. Roadkill

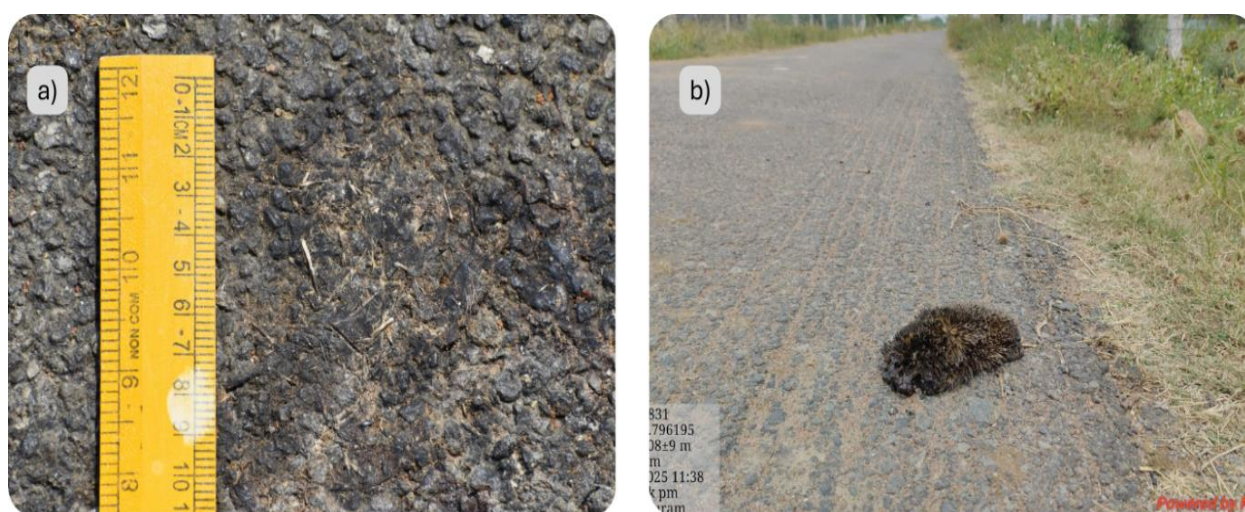


Figure 37. Photos of Madras Hedgehog roadkill in the Tirunelveli District. a) Recent roadkill of the Madras Hedgehog, b) Roadkill happened location with spines.

The construction and expansion of road networks through their natural habitats have caused significant disturbances to hedgehog populations. While foraging,

hedgehogs often need to cross roads, exposing them to the risk of being run over by vehicles (Fig. 37). When they sense danger, these animals curl into a ball as a defence mechanism, a behaviour known as volvation.

This makes them resemble a stone on the road, leading drivers to overlook them, resulting in fatal accidents. In the past, these habitats were untouched by roads, but the increasing development of road networks has intensified the risk of road kills. These changes have made survival increasingly difficult for hedgehogs, as the road construction not only fragments their habitat but also directly impacts their ability to move safely within their environment.



Figure 38. Map of road construction near Koonthankulam, Tirunelveli. a) Satellite map taken in 2010, b) Satellite map taken in 2024.

Four road kills were recorded in two weeks near Koonthankulam Bird Sanctuary, which covers 72.04 hectares. This wetland, located near Koonthankulam village in Nanguneri Taluk, Tirunelveli district (Tamil Nadu Wetland Mission, 2025), has a distribution of Madras Hedgehogs. In 2010, there was only one main road in the

area, but now new roads have been built nearby, as per the 2024 satellite image, as shown in the above (Figure 38), where the Madras Hedgehog roadkill was noted.

This shows that building new roads near unprotected areas leads to more deaths of wild animals. Protecting the areas around Koonthankulam Bird Sanctuary can help save the Madras Hedgehog and other wildlife in the region.

8.3. Poaching

Poaching has also emerged as a threat. Based on the questionnaire, the local residents reported that while they go hunting, they occasionally kill Madras Hedgehogs when encountered. This is largely driven by the traditional belief that hedgehog's meat has medicinal properties, leading to its consumption. In many areas, we noticed that locals use their native breed of dogs to hunt hares, which sometimes also results in catching hedgehogs.

8.4. Stray dog interaction

When a hedgehog senses danger, it instinctively curls into a tight ball, a defensive behaviour known as the volvation position. This position helps to protect the hedgehog by exposing only its spiny outer covering. However, when local dogs encounter a hedgehog in this curled-up state, they often see it as a play object. The dogs interact with the hedgehog by nudging or rolling it, eventually managing to capture it despite its defensive posture. Once caught, the dog usually delivers the hedgehog to its owner. This interaction highlights how hedgehogs, despite their protective mechanisms, can still be vulnerable to predation by domesticated animals.

8.5. Use for medicinal purposes

As per the questionnaire, this species is frequently used in traditional remedies, especially for treating lung-related problems such as wheezing, whooping cough, cold, and general coughing, particularly in children. The process involves burning the hedgehog's spines, wiping the leftover ash with a white cloth, and mixing it with natural honey to prepare a remedy. Additionally, it is believed that consuming the meat of this species can cure various health issues, further adding to the pressure on their populations.

9. OUTREACH ACTIVITY



Figure 39. Photos taken during the outreach activity in the schools. a) Outreach activity in Kasturibai Primary School, Uppilipalayam, Erode, b) Outreach activity in Jagathambal Subramaniyam Government Higher Secondary School, Pazhaverkadu, Tiruvallur.

The objective of an outreach program is to educate students about the study species and its ecological importance. Through this initiative, young learners gain insight into the species' crucial role in maintaining ecosystem balance, as well as the threats it faces (Fig. 39). By fostering awareness at an early age, the program aims to instil a sense of responsibility and appreciation for biodiversity.

10. DISCUSSION

The study provides secondary data on the occurrence of the Madras Hedgehog in six districts of Tamil Nadu: Chennai, Tiruvallur, Kanchipuram, Villupuram, Erode, and Tirunelveli. Several locations in these districts were identified where the species has been observed, highlighting the necessity for further research to better understand its habitat preferences, behavioural ecology, and population distribution.

Two sightings were reported by local people near Marakkanam in Villupuram district, which aligns with earlier observations by Ramanujam and Anbarasan (2007), who documented the use of dried Madras Hedgehog skin by traditional healers in this region. This reaffirms the importance of examining the species' cultural and traditional significance, as such practices may directly influence conservation efforts and local perceptions of the species.

The study also showed differences in awareness among local people about the Madras Hedgehog across various districts. In Erode and Tirunelveli, people were more familiar with the species, likely due to its higher sighting probability in these areas. On the other hand, people in Chennai, Tiruvallur and Kanchipuram had limited knowledge. Efforts to increase awareness and education in these areas could play a crucial role in encouraging community participation in conservation initiatives to learn about this species.

Roadkill was found to be a serious hazard, especially in Tirunelveli, to the Madras Hedgehog in this study. This is comparable with a previous study by Kumar and Nijman (2016). Construction of new roads has increased automobile traffic and put wildlife in danger. The risk might be reduced, and the species could be protected with the implementation of practical measures, including building wildlife bridges, enforcing speed limits by placing signage boards.

Earlier studies also reported habitat destruction, like firewood collection, pesticide use, and agricultural practices (Molur, 2005). Urbanization, excessive pesticide use that impacts this species' prey base, and land clearing for agricultural purposes were identified as significant risks in the current study. A thorough analysis of a variety of issues, including ecology, factors that determine the species' presence

in a particular habitat, and threats, should be conducted to frame conservation action plans for the species in the future.

11. RECOMMENDATIONS

Non-protected lands, such as open grasslands and barren areas with scrub, are often used by local people as grazing lands for their livestock. However, these lands also provide essential habitats for various wildlife, including the Madras Hedgehog. These habitats serve as necessary resources for shelter, feeding, and movement for many species. Despite their ecological importance, they are frequently excluded from conservation planning and remain highly vulnerable to degradation. Incorporation of these habitats into conservation frameworks is essential for maintaining ecosystem balance and safeguarding local wildlife populations.

Wildlife corridors can facilitate the safe movement of the Madras Hedgehog across fragmented habitats and lower the chances of road accidents. These corridors should link different parts of their habitat and have as little human disturbance as possible. Infrastructure improvements, such as warning signage boards to alert drivers and speed restrictions in known wildlife crossing areas, can also help prevent road accidents involving animals.

A comprehensive field investigation across all districts could not be completed due to constraints, including lack of time for field data collection and survey activities. As a result, only selected regions within the study districts were surveyed, leaving several areas exposed. This limitation emphasizes the need for additional time and manpower in subsequent research for greater coverage of all districts and comprehensive data gathering. In these districts, extensive field surveys might reveal the presence of animals.

More research is required on the ecology, behaviour, and population dynamics of the Madras Hedgehog to understand its habitat preference, movement patterns, and interactions with other species which will provide valuable insights into its behaviour. Studies on human-wildlife interactions and the impact of anthropogenic pressures can further guide policymaking and conservation efforts.

Creating awareness among local communities about the ecological importance of this species can help reduce hunting and poaching. Conservation programs can be

designed in such a way to educate people on the benefits of biodiversity and the need to protect wildlife. Habitat restoration through replanting native plants and controlling deforestation, are critical steps for the conservation of the Madras hedgehog.

12. REFERENCES

- Aschwanden, J., Holzgang, O., & Jenni, L. (2007). Importance of ecological compensation areas for small mammals in intensively farmed areas. *Wildlife Biology*, 13(2), 150-158.
- Bearman-Brown, L. E., Wilson, L. E., Evans, L. C., & Baker, P. J. (2020). Comparing non-invasive surveying techniques for elusive, nocturnal mammals: a case study of the West European hedgehog (*Erinaceus europaeus*). *Journal of Vertebrate Biology*, 69(3), 20075-1.
- Bourliere, F. 1975. Mammals, small and large: the ecological implication of size. In *Small mammals: their productivity and population dynamics* (No. 5). (Eds. Golley, F. B., Petruszewicz, K., & Ryszowski, L). Cambridge University Press (Book). pp. 1-8.
- Bowen, C., Reeve, N., Pettinger, T., & Gurnell, J. (2020). An evaluation of thermal infrared cameras for surveying hedgehogs in parkland habitats. *Mammalia*, 84(4), 354-356.
- Burton, A. C., Neilson, E., Moreira, D., Ladle, A., Steenweg, R., Fisher, J. T., ... & Boutin, S. (2015). Wildlife camera trapping: a review and recommendations for linking surveys to ecological processes. *Journal of applied ecology*, 52(3), 675-685.
- Carbone, C., & Cates, R. (2018). London Hogwatch, Hampstead Heath camera-trap survey, April-July 2018. *ZSL Institute of Biology*.
- Chew and Robert, M. 1978. The impact of small mammals on ecosystem structure and function. In *population of small mammals under natural conditions*. (Eds. Golley, F. B., Petruszewicz, K., & Ryszowski, L). Cambridge University Press (Book). London. pp. 167-180.
- Cutler, T. L., & Swann, D. E. (1999). Using remote photography in wildlife ecology: a review. *Wildlife Society Bulletin*, 571-581.
- Delany, M.J. 1974. The ecology of small mammals. Edward Arnold Ltd, London, Book, p.478.
- Gazzard, A., Macdonald, D. W., & Rasmussen, S. L. (2025). Conservation concern for Europe's hedgehog species (Erinaceidae): Current statuses, issues and needs. *Biological Conservation*, 304, 111033.
- Glen, A. S., Cockburn, S., Nichols, M., Ekanayake, J., & Warburton, B. (2013). Optimising camera traps for monitoring small mammals. *PloS one*, 8(6), e67940.
- Haigh, A. J. 2011. The ecology of the European hedgehog (*Erinaceus europaeus*) in rural Ireland. PhD Thesis, University College Cork.
- Haigh, A., Butler, F. and O'Riordan, R. M. (2012) 'An investigation into the techniques for detecting hedgehogs in a rural landscape', *Journal of Negative Results*, 9(1), pp. 15-26.

- Haque, M. (2010). Sampling methods in social research. *Global Research Methodology*, 8(5), 1-6.
- IFAW-International Fund for Animal Welfare (2024). Animals with spines and quills. <https://www.ifaw.org/international/journal/animals-spines-quills>.
- Jiang, X., and Hoffmann, R. 2013. Insectivores. In A. J. T. Johnsingh & N. Manjrekar (Eds.), *Mammals of South Asia*. University Press (India) Private Limited, Book.
- Kelly, M. J. (2008). Design, evaluate, refine: camera trap studies for elusive species. *Animal Conservation*, 11(3).
- Kelly, M. J., & Holub, E. L. (2008). Camera trapping of carnivores: trap success among camera types and across species, and habitat selection by species, on Salt Pond Mountain, Giles County, Virginia. *Northeastern naturalist*, 15(2), 249-262.
- Kumar, B., Babu, S., & Kumara, H. N. (2019). Predicting the potential Distribution of the lesser-known endemic Madras hedgehog *Paraechinus nudiventris* (Order: Eulipotyphla, Family: Erinaceidae) in southern India. *Mammalia*, 83(5), 470-478.
- Kumar, B., Rasmussen, S. L., Thanvir, M., & Shahidh, M. (2024). Mapping the distribution of the Endemic Madras Hedgehog *Paraechinus nudiventris* in Tamil Nadu, India. *Conservation*, 4(4), 812-829.
- Kumar, B., & Nijman, V. (2016). Medicinal uses and trade of Madras hedgehogs *Paraechinus nudiventris* in Tamil Nadu, India. *Traffic Bulletin*. 28. 7-10.
- Kumar, B., Togo, J., & Singh, Ranjit. (2018). The South Indian hedgehog *Paraechinus nudiventris* (Horsfield, 1851): Review of distribution data, additional localities, and comments on habitat and conservation. *Mammalia*. 83. 10.1515/mammalia-2018-0128.
- Mammal Diversity Database. (2024). Mammal Diversity Database (1.13) [Data set]. Zenodo. <https://doi.org/10.5281/zenodo.12738010>.
- Mammal Diversity Database. (2025). Mammal Diversity Database (Version 2.0) [Data set]. Zenodo. <https://doi.org/10.5281/zenodo.15007505>.
- Marimuthu, R., & Asokan, K. (2014). Bare-bellied or Madras Hedgehog, *Paraechinus nudiventris*, (Horsfield 1851) in Coimbatore, Tamil Nadu. *Zoo's Print Journal*, 29(1), 33-34.
- Menon, V. (2023). *Indian mammals: a field guide*. Hachette India.
- Molur, S., Srinivasulu, C., Srinivasulu, B., Walker, S., Nameer, P. O., & Ravikumar, L. (2005). Status of South Asian non-volant small mammals: conservation assessment and management plan (CAMP) workshop report. *Zoo Outreach Organization/CBSG-South Asia*, Coimbatore, India, 618.
- Negi, T. (2014). Review on current worldwide status, Distribution, ecology, and dietary habits of golden jackal, *Canis aureus*. *Octa Journal of Environmental Research*, 2(4).
- Pradesh, U. (2016). Medicinal uses and trade of Madras Hedgehogs *Paraechinus nudiventris* in Tamil Nadu, India. *Traffic Bulletin*, 28(1), 7.
- Pradhan, M. S., & Talmale, S. S. (2012). *Indian Mammals: Checklist with Comments on Type Locality, Distribution, Conservation Status, and Taxonomy*. Nature Books India.
- Ramanujam, M. E., & Anbarasan, R. (2007). A preliminary report on the vertebrate diversity of the Kaliveli watershed region. *Zoo's Print Journal*, 22(3), 2608-2616.
- Sankaranarayanan, R., Ganesh, A., Selvakumar, S., & Thalavaipandi, S. (2024). New locality records of the Bare-bellied Hedgehog, *Paraechinus nudiventris*

- (Horsfield, 1851) from Tirunelveli, Tamil Nadu, India. *Records of the Zoological Survey of India*, 321-323.
- Sayyed, A., Talmale, S. S., & Mahabal, A. (2015). First photographic evidence and second record of Indian Hedgehog *Paraechinus micropus* (Blyth, 1846) from Maharashtra, India. *Zoo's Print Journal*, 30(8), 5-6.
- Spratt, David & Singleton, Grant. (2008). Hepatic Capillariasis. 10.1002/9780470377000.ch14.
- Srinivas, G., Babu, S., Kumara, H. N., & Molur, S. (2013). Assessing the status and Distribution of large mammals in Highwavy and its environs, Southern Western Ghats. Technical report submitted to CEPF-ATREE Small Grants and Rufford Small Grants, Coimbatore, India.
- Srinivasulu, C., & Nagulu, V. (2002). Mammalian and avian diversity of the Nallamala Hills, Andhra Pradesh. *Zoo's Print Journal*, 17(1), 675-684.
- Tamil Nadu Wetland Mission, 2025, <https://www.tnswa.org/koonthakulam-bird-sanctuary>.
- The Wildlife Protection Act, 1972 (53 of 1972) as amended by The Wild Life (Protection) Amendment Act, 2002 (18 of 2002) (w.e.f. 1-4-2023), 96.
- Thomas, E., & Wilson, E. (2018). Guidance for surveying hedgehogs. *Hedgehog Street*. Available online: <https://www.hedgehogstreet.org/wp>.
- Tubbs, Sarah & Berggren, Per. (2024). Questionnaire surveys to investigate marine mammal fisheries bycatch: systematic review and best practice. *Frontiers in Marine Science*. 11. 10.3389/fmars.2024.1481840.
- Venkataraman, K., Chattopadhyay, A., & Subramanian, K. A. (2013). *Endemic animals of India (Vertebrates)* (pp. 238-pp).
- Wroughton, R.C. 1907. Notes on the fauna of a desert tract in Southern India. Part III – A list of a small collection of mammals from Ramnad. *Mem. Asia. Soci. Beng.* 1: 221 222.

13. ANNEXURES

1. Questionnaire datasheet



Advanced Institute for Wildlife Conservation
Research, Training and Education



1. QUESTIONNAIRE FOR MADRAS HEDGEHOG

District/Division Name:	Date:
Range Name:	Researcher Name:

Respondent Details:

Person Name:	Occupation:
Gender:	Age:
Native/Migrant	Phone number:

Village Details:

Village Name:	Co-ordinates:
Primary Landscape:	Nearby natural habitat type:

General Questions

1. Have you ever sighted Madras Hedgehog in your region or any other adjacent landscape?

If yes, additional details

2. Have you noted any indirect signs of Madras Hedgehog presence (burrows, tracks, feces)?

If yes, additional details?

3. Have you sighted any other wild animals in your region? If yes, additional details

4. If Hedgehogs are present in your area, do you visualize any threats to it or its habitat?

5. Are there any poaching activities of wild animals in your region?

6. Any other information relevant to the conservation of the Madras Hedgehog?

7. Any local beliefs, stories, or traditional knowledge about Madras Hedgehog in your community or region

If Madras Hedgehog has been sighted/observed by the respondent (tick the appropriate items):

Sighting type:	Direct		Indirect			
Time of sighting:	Day		Night			
Sighting point	GPS coordinates for the exact point or the nearest point					
Date last sighted						
Season	Summer		Monsoon		Winter	
Habitat	Waterbody	Forest	Barren land	Build-up area	Agricultural land	Others
Distance at which animal was sighted (in metres)						

Index:

- ❖ Sighting type – Direct sighting / Indirect sighting
- ❖ Time of sighting – Day time/Night time
- ❖ Sighting point – The exact point or the nearest point where the villager saw the Madras Hedgehog along with GPS coordinates
- ❖ Date last sighted – date or rough month and year
- ❖ Season - Summer season / Monsoon Season / Winter season
- ❖ Habitat – Waterbody/Forest/Barren land/Build up area/ Agricultural land
- ❖ Distance at which animal was sighted – By the respondent when animal was sighted.

2. List of other fauna sighted by the Questionnaire respondents

S. No.	Common Name	Scientific Name	IUCN Status
Mammalia			
1	Barking Deer	<i>Muntiacus muntjak</i> (Zimmermann, 1780)	LC
2	Black-naped Hare	<i>Lepus nigricollis</i> (F. Cuvier, 1823)	LC
3	Bonnet Macaque	<i>Macaca radiata</i> (É. Geoffroy Saint-Hilaire, 1812)	VU
4	Common Palm Civet	<i>Paradoxurus hermaphroditus</i> (Pallas, 1777)	LC
5	Golden Jackal	<i>Canis aureus</i> (Linnaeus, 1758)	LC
6	Indian Crested Porcupine	<i>Hystrix indica</i> (Kerr, 1792)	LC
7	Indian Fox	<i>Vulpes bengalensis</i> (Shaw, 1800)	LC
8	Indian Gerbil	<i>Tatera indica</i> (Hardwicke, 1807)	LC
9	Indian Grey mongoose	<i>Urva edwardsii</i> (É. Geoffroy Saint-Hilaire, 1818)	LC
10	Indian Leopard	<i>Panthera pardus fusca</i> (Meyer, 1794)	VU
11	Indian Monitor	<i>Varanus bengalensis</i> (Daudin, 1802)	NT
12	Indian Palm Squirrel	<i>Funambulus palmarum</i> (Linnaeus, 1766)	LC
13	Indian Pangolin	<i>Manis crassicaudata</i> (E. Geoffroy, 1803)	EN
14	Jungle Cat	<i>Felis chaus</i> (Schreber, 1777)	LC
15	Large Bandicoot Rat	<i>Bandicota indica</i> (Bechstein, 1800)	LC
16	Little Indian Field Mouse	<i>Mus booduga</i> (Gray, 1837)	LC
17	Nilgiri Langur	<i>Semnopithecus johnii</i> (J. Fischer, 1829)	VU
18	Sloth Bear	<i>Melursus ursinus</i> (Shaw, 1791)	VU
19	Spotted Deer	<i>Axis axis</i> (Erxleben, 1777)	LC
20	Wild boar	<i>Sus scrofa</i> (Linnaeus, 1758)	LC
Reptilia			
1	Common Krait	<i>Bungarus caeruleus</i> (Schneider, 1801)	LC
2	Indian Black turtle	<i>Melanochelys trijuga</i> (Schweigger, 1812)	LC
3	Indian Chameleon	<i>Chamaeleo zeylanicus</i> (Laurenti, 1768)	LC
4	Indian Cobra	<i>Naja naja</i> (Linnaeus, 1758)	LC
5	Indian Rat Snake	<i>Ptyas mucosa</i> (Linnaeus, 1758)	LC
6	Indian Rock Python	<i>Python molurus</i> (Linnaeus, 1758)	NT
7	Red Sand Boa	<i>Eryx johnii</i> (Russell, 1801)	NT
8	Russell's Viper	<i>Daboia russelii</i> (Shaw & Nodder, 1797)	LC
Aves			
1	Barn Owl	<i>Tyto alba</i> (Scopoli, 1769)	LC
2	Grey Junglefowl	<i>Gallus sonneratii</i> (Temminck, 1813)	LC
3	Indian Peafowl	<i>Pavo cristatus</i> (Linnaeus, 1758)	LC
4	Little Cormorant	<i>Microcarbo niger</i> (Vieillot, 1817)	LC
5	Spotted Owlet	<i>Athene brama</i> (Temminck, 1821)	LC
Arachnida			
1	Indian Red Scorpion	<i>Hottentotta tamulus</i> (Fabricius, 1798)	NE

3. List of other fauna captured by the camera traps

3.1. Guindy National Park

S. No	Common name	Scientific name	* IUCN status
Mammalia			
1	Blackbuck	<i>Antelope cervicapra</i> (Linnaeus, 1758)	LC
2	Common Palm Civet	<i>Paradoxurus hermaphroditus</i> (Pallas, 1777)	LC
3	Domestic cat (feral)	-	-
4	Golden Jackal	<i>Canis aureus</i> (Linnaeus, 1758)	LC
5	Indian Crested Porcupine	<i>Hystrix indica</i> (Kerr, 1792)	LC
6	Indian Grey mongoose	<i>Urva edwardsii</i> (É. Geoffroy Saint-Hilaire, 1818)	LC
7	Indian Palm Squirrel	<i>Funambulus palmarum</i> (Linnaeus, 1766)	LC
8	Indian Pangolin	<i>Manis crassicaudata</i> (E. Geoffroy, 1803)	EN
9	Jungle Cat	<i>Felis chaus</i> (Schreber, 1777)	LC
10	Pig (feral)	-	-
11	Spotted Deer	<i>Axis axis</i> (Erxleben, 1777)	LC
Aves			
1	Cattle egret	<i>Ardea ibis</i> (Linnaeus, 1758)	LC
2	Common Myna	<i>Acridotheres tristis</i> (Linnaeus, 1766)	LC
3	Greater Coucal	<i>Centropus sinensis</i> (Stephens, 1815)	LC
4	Indian Peafowl	<i>Pavo cristatus</i> (Linnaeus, 1758)	LC
5	Indian pond heron	<i>Ardeola grayii</i> (Sykes, 1832)	LC
6	Malayan Night Heron	<i>Gorsachius melanolophus</i> (Raffles, 1822)	LC
7	Red-wattled Lapwing	<i>Vanellus indicus</i> (Boddaert, 1783)	LC
8	White-breasted waterhen	<i>Amaurornis phoenicurus</i> (Pennant, 1769)	LC
Reptilia			
1	Indian black turtle	<i>Melanocheilus trijuga</i> (Schweigger, 1812)	-
2	Indian Monitor	<i>Varanus bengalensis</i> (Daudin, 1802)	NT

3.2. Nanmangalam Reserved Forest

S. No	Common name	Scientific name	*IUCN status
Mammalia			
1	Black-naped hare	<i>Lepus nigricollis</i> (F. Cuvier, 1823)	LC
2	Dog (feral)	-	-
3	Domestic cattle	-	-
4	Golden Jackal	<i>Canis aureus</i> (Linnaeus, 1758)	LC
5	Indian Grey mongoose	<i>Urva edwardsii</i> (É. Geoffroy Saint-Hilaire, 1818)	LC
6	Indian Peafowl	<i>Pavo cristatus</i> (Linnaeus, 1758)	LC
7	Jungle Cat	<i>Felis chaus</i> (Schreber, 1777)	LC
Aves			
1	Cattle egret	<i>Ardea ibis</i> (Linnaeus, 1758)	LC

2	Common Myna	<i>Acridotheres tristis</i> (Linnaeus, 1766)	LC
3	Gray Francolin	<i>Ortygornis pondicerianus</i> (Gmelin, 1789)	LC
4	Indian Thick-knee	<i>Burhinus indicus</i> (Salvadori, 1866)	LC
5	Quail sp.	-	-
6	Snipe sp.	-	-
7	White-breasted waterhen	<i>Amaurornis phoenicurus</i> (Pennant, 1769)	LC

3.3. Vandalur Reserved Forest

S.No	Common name	Scientific name	*IUCN Status
Mammalia			
1	Black-naped Hare	<i>Lepus nigricollis</i> (F. Cuvier, 1823)	LC
2	Common Palm Civet	<i>Paradoxurus hermaphroditus</i> (Pallas, 1777)	LC
3	Dog (feral)	-	-
4	Golden Jackal	<i>Canis aureus</i> (Linnaeus, 1758)	LC
5	Indian Crested Porcupine	<i>Hystrix indica</i> (Kerr, 1792)	LC
6	Indian Grey mongoose	<i>Urva edwardsii</i> (É. Geoffroy Saint-Hilaire, 1818)	LC
7	Small Indian Civet	<i>Nectogale elegans</i> (Milne-Edwards, 1870)	LC
8	Spotted Deer	<i>Axis axis</i> (Erxleben, 1777)	LC
Aves			
1	Gray Francolin	<i>Ortygornis pondicerianus</i> (Gmelin, 1789)	LC
2	Indian Peafowl	<i>Pavo cristatus</i> (Linnaeus, 1758)	LC
3	Red-wattled Lapwing	<i>Vanellus indicus</i> (Boddaert, 1783)	LC

3.4. Villupuram

S.No	Common name	Scientific name	*IUCN Status
Mammalia			
1	Bonnet Macaque	<i>Macaca radiata</i> (É. Geoffroy Saint-Hilaire, 1812)	VU
2	Common Palm Civet	<i>Paradoxurus hermaphroditus</i> (Pallas, 1777)	LC
3	Indian Crested Porcupine	<i>Hystrix indica</i> (Kerr, 1792)	LC
4	Small Indian Civet	<i>Nectogale elegans</i> (Milne-Edwards, 1870)	LC
Aves			
1	White-breasted waterhen	<i>Amaurornis phoenicurus</i> (Pennant, 1769)	LC

3.5. Tiruvallur

S. No.	Common Name	Scientific Name	IUCN Status
Mammalia			
1	Wild boar	<i>Sus scrofa</i> (Linnaeus, 1758)	LC

***List of IUCN Status:** DD - Data Deficient, LC – Least Concern, NT – Near Threatened, VU – Vulnerable, EN – Endangered, CR – Critically Endangered, EW – Extinct in the Wild, EX – Extinct, NE – Not Evaluated

Report: 'Distribution status and threat assessment of the endemic Madras hedgehog (*Paraechinus nudiventris*) and associated species in selected Districts of Tamil Nadu'. Annual Plan of Operations 2023-24, AIWC (R, T & E), TNFD, Vandalur, Tamil Nadu.



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