



Diversity of Freshwater Turtles *Melanochelys trijuga* in and Around Sankarapuram Wetland Complex on Kallakurichi District, Tamil Nadu, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.56557/UPJOZ/2024/v45i114077

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://prh.mbimph.com/review-history/3053>

Original Research Article

Received: 26/11/2023

Accepted: 29/01/2024

Published: 08/05/2024

ABSTRACT

India is one of the most species-rich regions of freshwater turtles in the world, also, they are being collected, for slaughter, eaten, and traded in huge numbers. The scope of this study on *Melanochelys trijuga*, also known as the Indian Black Turtle, focuses on collecting comprehensive information about the species in India, specifically in Tamil Nadu, with a special emphasis on Sankarapuram. The study aims to address the lack of current data about this turtle species and contribute to the understanding of its taxonomy, distribution, habitat, behavior, and conservation status. Various methods are employed in this study such as visual sighting of habitat to encounter the target animal, and, indirectly through interview-based survey information from local communities. Visual survey was conducted on 20 locations of the sankarapuram study area. On the surveyed 20 locations the tortoise was observed in five locations viz. two Coconut farm, two ordinary well which used for irrigation purpose and a lake side muddy shallow area. Totally 10

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individuals were observed in this study period. We had an opportunity to examine the specimens very closely once it comes out behind the open well. The captured specimens were later examined by comparison with the standard key characteristics and manuals in order to identify the specimen and found as *Melanochelys trijuga* species. In this study we observed both male and female individuals. The individuals are found as adults. The characteristics and ecology information were compared with the existing data in previous record and publications and manuals. Obtained *Melanochelys trijuga* species was found as Nearly Threatened status in the International Union for Conservation of Nature (IUCN) category.

Keywords: Coconut farm; Indian black turtle; *Melanochelys trijuga*; ordinary well; turtle.

1. INTRODUCTION

Freshwater turtles are conspicuous reptiles, contributing to effective environmental biodiversity with diverse forest organisms. In India, 24 species of freshwater turtles are available in various habitats such as rivers, lakes, forests, deserts, wetlands, and swamps are the diversity hotspot for aquatic turtles. India is one of the most species-rich regions of freshwater turtles in the world, also, they are being collected, for slaughter, eaten, and traded in huge numbers. Further, these critical turtle habitats are under significant anthropogenic threats of habitat degradation and modification, increase in pollution, climate change and invasion of exotic species. In consequence, recently in 2019, over 60% of tortoises are listed as threatened in IUCN Red List.

Sankarapuram is one of the six blocks in Tirukoilur talk, Kallakurichi district. The Tamil Nadu district's groundwater development board was announced and predicted sankarapuram block is one of the groundwater overexploited categories area. The panchayat has 5319 ordinary wells and most of them are for irrigation purpose. These adjacent areas are highly productive for agriculture. Unfortunately, these wetlands are facing a range of anthropogenic pressure, in terms of rapid urbanization, alteration of the natural regime due to hydrological development, overexploitation, landfill deposition, and drainage.

Hence, freshwater turtles can have commensurate impacts on the ecosystem processes and are a good indicator of the health of wetland and waterbodies, however, very few scientific contributions exist in terms of species-wise occurrence or abundance in different habitats [1,2,3]. Hence, conducted studies along sankarapuram waterbodies and documenting the *Melanochelys* sp. diversity and habitats is a potential addition to further surveys by future and may contribute new information on the ecology of

certain turtle species in various waterbodies. The scope of this study on *Melanochelys trijuga*, also known as the Indian Black Turtle, focuses on collecting comprehensive information about the species in India, specifically in Tamil Nadu, with a special emphasis on Sankarapuram (kallakurichi, TamilNadu – 606 401). The study aims to address the lack of current data about this turtle species and contribute to the understanding of its taxonomy, distribution, habitat, behavior, and conservation status. The study intends to achieve the following objectives and utilize the available resources to study this turtle. To collect the details of freshwater turtle in freshwater ecosystem around Sankarapuram. To examine the locations of freshwater bodies on selected study area based on interview survey. To collect the Taxonomic classification of collected *Melanochelys trijuga* freshwater turtle species in India. To collect habitat information of the recorded freshwater Turtle species in Sankarapuram (kallakurichi, TamilNadu – 606 401). To understand the status of *Melanochelys trijuga*, its threats and conservations.

2. METHODOLOGY

For every effective conservation activity, collecting baseline information on species occurrences, biogeography, and their conservation status are the first step to be undertaken. They are essential tools for developing our knowledge and understanding of species diversity and distribution, identify threats to the populations and, identify species conservation strategies. Various methods are employed in this study such as visual sighting of habitat to encounter the target animal, and, indirectly through interview-based survey information from local communities.

Based on the talks about tortoise sightings in rainy seasons, first, we conducted the Questionnaire survey in adjacent area peoples such as farmers, elderly natives, and people who live close to wetlands and water bodies to better

grasp their knowledge of freshwater turtles, past sighting details, and general specimen appearance, to confirm the presence of tortoise species through recent sightings information at the study area, Sankarapuram (Fig. 1). The questions were asked in the local language and a colored turtle identification guide was used while interviewing people on the study area about the occurrence and abundance of various turtle species. The questions asked for the ecological knowledge of local people about freshwater turtles (feeding areas/basking areas/nesting areas) and attitudes towards turtles' presence in the wetland/waterbody. The study was carried out from August 2022 to March 2023 with an aim to determine the diversity, distribution, and present status of freshwater turtles in the selected Sankarapuram study area.

Visual Encounter Survey is another effective method to determine the presence and absence of species in the survey area. Sighting were conducted with local experienced observers using a HQ image facilitated camera mobile during day time (08:00AM – 04:00PM) carefully walking around the periphery of lakes, open well, vegetation-dense wet area, recent urbanized low-lying places, especially on the trails leading to open well. Whenever a turtle was encountered, location was recorded using Mobile phone GPS, all observed activities like basking, surfacing, and burrowing was also noted as evidence to record.

3. RESULTS AND DISCUSSION

The questionnaire survey was done by the interactions with 60 individuals in the selected study area. The local people said that the tortoise are present in the Sankarapuram and they were seen in rainy season. They told us the tortoise was seen on the shrubs and bushes grown road the sides while passing on vehicles. Others told the tortoise was seen at dawn or morning time at the floats or rocks of the pond, while they basking on the sun. The others told the turtle can be seen always in the open well in some places. The images are shown to the people for identification aid to confirm species by their appearance. However, they were often unconfident to show one species image by seeing all species images (Fig. 1).

Visual survey was conducted on 20 locations of the sankarapuram study area. On the surveyed

20 locations the tortoise was observed in five locations viz. two Coconut farm, two ordinary wells which used for irrigation purpose and a lake side muddy shallow area. Totally 10 individuals were observed in this study period. We had an opportunity to examine the specimens very closely once it comes out behind the open well. The captured specimens were later examined by comparison with the standard key characteristics and manuals in order to identify the specimen and found as *Melanochelys trijuga* species. In this study we observed both male and female individuals, all of them adults. The characteristics and ecology information were compared with the existing data in previous record, publications and manuals. Obtained *Melanochelys trijuga* species has been categorized as Nearly Threatened status by the International Union for Conservation of Nature (IUCN).

Melanochelys trijuga is a turtle, which is also commonly known as Indian Black Turtle [4] and Indian Pond Terrapin or the three-striped roofed turtle is a fascinating species of freshwater turtle found in various parts of South Asia. It is an aquatic species that live in lentic water bodies. It is a freshwater turtle with a medium-sized carapace that extends up to 383 mm. So far, around 6 subspecies have been reported worldwide out of which, 4 subspecies are described to be present in India.

The Indian black turtle possesses a shell that is predominantly black, with three yellowish stripes running vertically along its carapace, giving it its common name. It is categorized as a member of the genus *Melanochelys* and a member of the Geoemydidae family [5]. Adults of this species average a carapace length of 25 to 30 centimeters, which is medium in size. They are exceptional swimmers thanks to their sleek and smooth shells and webbed feet.

Melanochelys trijuga is omnivorous, it feeds on both aquatic plants and small invertebrates. Though it lives in standing water bodies, sometimes it also lives in running water bodies, such as rivers and streams. The species is nocturnal and spends its nights at the banks of the water bodies. Due to continued urbanization and infrastructure, its habitat and wetlands have shrunken. In Kerala, its population is exploited and traded for consumption, pet trade [6].



1. Three-striped roofed turtle



2. Red crowned roofed turtle



3. Gemels leaf turtle



4. Asian leaf turtle



5. Southeast Asian box turtle



6. Keeled box turtle



7. Spotted pond turtle



8. Growned River turtle

Fig .1. List of species image used as an aid at questionnaire survey

Table 1. List of visual survey locations on selected study area Sankarapuram

Sl.No	Environment	Latitude (°N)	Long (°E)	Sighting	Count
1.	Pond	11.88331	78.91311	No	0
2.	Coconut farm	11.88354	78.91373	Yes	1
3.	Ordinary well	11.88442	78.91256	Yes	2
4.	Urbanized land	11.884961	78.912942	No	0
5.	Dense plant area	11.88338	78.91495	No	0
6.	Lake	11.878741	78.912059	Yes	4
7.	Ordinary well	11.881041	78.910176	No	0
8.	Ordinary well	11.879574	78.909314	No	0
9.	Ordinary well	11.877900	78.912695	No	0
10.	Ordinary well	11.877643	78.913139	No	0
11.	Coconut farm	11.877208	78.913467	Yes	1
12.	Ordinary well	11.877552	78.913725	No	0
13.	Ordinary well	11.878113	78.913933	No	0
14.	Ordinary well	11.878855	78.914595	No	0
15.	Ordinary well	11.879834	78.914713	No	0
16.	Ordinary well	11.879942	78.913668	Yes	2
17.	Ordinary well	11.878738	78.915819	No	0
18.	Ordinary well	11.878801°	78.916377°	No	0
19.	Ordinary well	11.876302°	78.915521°	No	0
20.	Ordinary well	11.877308°	78.915438°	No	0

Freshwater turtles are distinctive animals of riverine and wetland ecosystem and are differ from sea turtles and have special adaptation for freshwater habitat. Altering the natural habitat makes the habitat vulnerability to theses reptiles. Freshwater turtles are a key component of biodiversity in aquatic ecosystems. Without turtles, aquatic ecosystems would progressively degrade in ways yet to be understood, and would

undergo loss of biodiversity [7,8]. The present rate of anthropogenic activity and climate change shifts their major drives of habitat loss, habitat fragmentation and cause major decline of turtles. On the other hand, many freshwater turtle species are exploited for food and pet trade. The people with less or no knowledge of turtle habitat result in the death of the pet specimen.



Fig. 2. Specimens of Male and Female *Melanochelys trijuga* species observed on visual survey

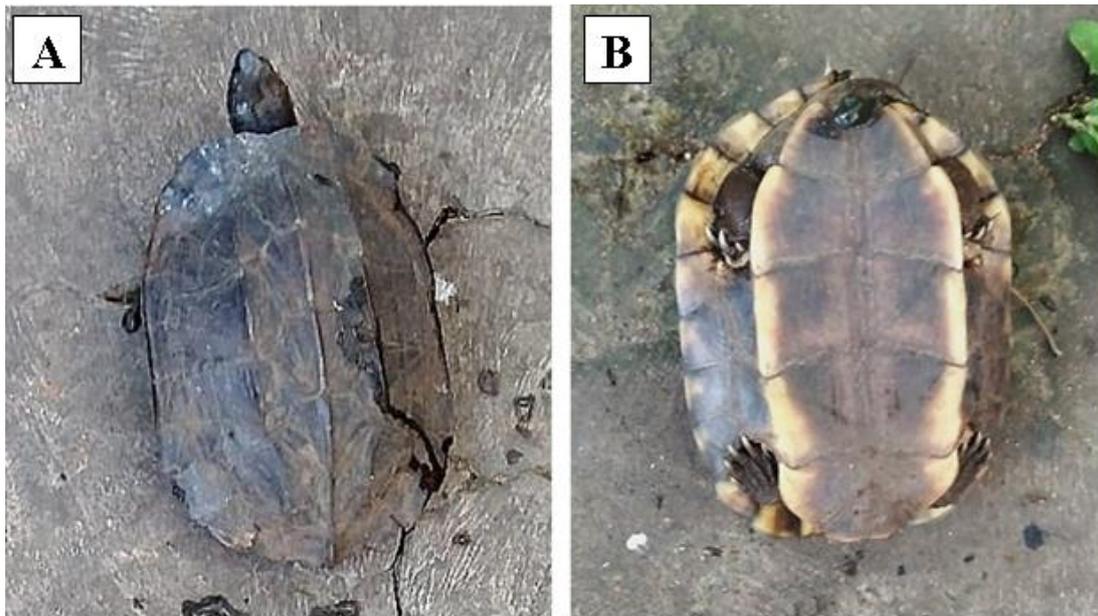


Fig. 3. Carapace and Plastral view of adult *Melanochelys trijuga* species

3.1 Life Cycle

The life cycle of *Melanochelys trijuga*, commonly known as the Indian Black Turtle [9] or the Indian Pond Terrapin, encompasses various stages and processes that contribute to the overall survival and reproduction of this remarkable species. Understanding the life cycle of *M. trijuga* is crucial for conservation efforts and the preservation of its habitat.

3.2 Reproductive Behavior

Melanochelys trijuga exhibits sexual dimorphism, with males typically smaller in size compared to females. The highest level of gonad activity occurred in both sexes during the reproductive season, which lasts from July to August. These are the monsoon months, when the days are longer. Only during July and August did the male reach its maximum size before rapidly regressing. During these months, there was mating. Once mating occurs, females undergo a gestation period of approximately 90-120 days [10].

3.3 Nesting Habits

The oviducts of the females reveal the existence of eggs much earlier than July. By the end of August, they started laying eggs in clutches, and they continued until October. Female *M. trijuga* display strong nesting site fidelity, often returning to the same location year after year to lay their eggs. Preferred nesting habitats include sandy

riverbanks, sandbars, and open areas adjacent to water bodies. Nesting occurs during the monsoon season, when water levels are typically higher, providing suitable conditions for egg incubation. The females dig deep nests with their hind limbs, depositing a clutch of 10-30 eggs on average [11]. After carefully covering the eggs, the females return to their aquatic habitat, leaving the eggs to incubate.

3.4 Egg Incubation and Hatching

The incubation period of *M. trijuga* eggs lasts for approximately 60-90 days [12], depending on environmental factors such as temperature and humidity. The sex determination of the hatchlings is temperature-dependent, with cooler temperatures typically resulting in male hatchlings, while warmer temperatures favor female hatchlings [13]. This phenomenon, known as temperature-dependent sex determination (TSD), adds another layer of complexity to the species' life cycle. The developing embryos derive nourishment from the egg yolk, gradually growing and developing within the protected environment of the egg [14].

3.5 Survival Strategies

Upon hatching, in order to reach the surface during the day, hatchlings dig upward from the nest chamber [15,16], but if they do so, they will wait until twilight to leave the nest. The hatchlings face numerous challenges as they

make their way to water bodies such as artificial light [17]. The hatchlings employ various survival strategies, including rapid movement, camouflage, and group behavior, to increase their chances of reaching the safety of water [18,19]. Once in the aquatic environment, the hatchlings find refuge among aquatic vegetation, where they continue their growth and development.

3.6 Conservation Implications

Understanding the life cycle of *Melanochelys trijuga* is crucial for effective conservation strategies. The destruction of nesting habitats, pollution of water bodies, and illegal wildlife trade pose significant threats to this species. Conservation efforts should focus on preserving and restoring suitable nesting sites, controlling pollution, and enforcing regulations against the illegal trade of *M. trijuga* [20]. Additionally, educating local communities about the importance of this species and its role in maintaining ecosystem balance can foster a positive attitude towards conservation.

4. CONCLUSION

In this preliminary study ten individuals of *Melanochelys trijuga* was observed. Hence complete dedicated survey this required to assess the freshwater turtle diversity status in sankarapuram, Kallakurichi district.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:

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