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Abundance and diversity of herpetofauna population of Korapuzha Estuary, India: A transitioning shoreline ecosystem

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Abstract

A comprehensive assessment of the Korapuzha Estuary's herpetofauna species diversity was done from September 2018 to September 2019. Amphibians and reptiles were spotted along a terrestrial stretch using active searching; call survey; road-kill analysis and direct observation (opportunistic spotting). The findings reveal 16 species of reptiles from 11 families and 1 amphibian. The Indian Skipper Frog is the sole amphibian that has been identified. 4 species of the order Testudines and 12 species of the order Squamata were identified among all the reptiles. The Common Indian Monitor, garden lizard, Indian Cobra, Oriental Ratsnake, and Indian Black Turtle, were the most frequently seen reptiles. The banded Krait (*Bungarus fasciatus*) was recorded for the first time in Kerala's marshes. *Pelochelys cantorii* (Cantor's Giant Softshell), a species of reptile fauna, is listed on IUCN redlist as a critically endangered species. The frequency of herpetofauna is significantly limited owing to the region's close vicinity to the ocean, which prevents taxa from dispersing despite the fact that these organisms are difficult to locate due to their paradoxical activities.

Keywords: Korapuzha estuary, herpetofaunal, banded krait, Indian skipper frog, mangrove

Introduction

Mangroves are a diverse variety of halophytic trees, shrubs, and other plants that inhabit brackish waterways and tidal beaches in tropical and subtropical regions. The open networks of mangrove wetlands allow for the free interchange of materials and energy between both terrestrial and aquatic ecosystems (Padmakumar and Murugan, 2022) ^[15]. The mangrove ecosystem exhibits a variety of habitats, including microhabitats that are typical of terrestrial, intertidal, and aquatic environments. It performs biologically as a complex ecotone or border region between both marine and terrestrial ecosystems. Mangroves are characterized by the existence of foliage in the intertidal, amid shorelines, in the semi-arid tropics. Temperature, sedimentation, and tidal currents are all extremely changing environmental conditions in the intertidal zone. Mangrove aerial roots help to stabilize the environment and offer a substratum for many plant and animal species. The mangrove forests and canopy above the waters provide critical habitats for a diverse range of creatures (Nagelkerken *et al.*, 2008) ^[11]. Mangroves are only intermittently scattered throughout the shoreline of Kerala, usually restricted to the windward embayments of intertidal backwaters. Small or extensive mangrove strips can be found along riverbanks in coastal plains where the tidal inflow of mangrove swamps is a frequent occurrence. In contrast to the very complex and dendritic mangrove systems created on the bigger floodplain of the primary eastward running river basins on the eastern seaboard, Kerala's mangroves are less intricate in terms of tidal creek networks (Naskar and Mandal, 1999) ^[14]. Little over 4200 hectares (42 km²) of Kerala's coastline length, which is roughly 590 km long, is covered with mangrove forests. This amount represents lower than 1% of the entire mangrove zones in India, which covers 4, 87,100 hectares (Radakrishnan *et al.*, 2006) ^[19]. The fact that mangrove ecosystems are important and have a variety of distinctive characteristics may have sparked a great deal of interest in them. Animal-mangrove associations and interactions have not yet been the subject of faunistic research with the same fervor and passion as floral investigations.

Herpetofauna serves a crucial ecological role in biodiversity. They are a crucial element of a biosphere because they are the intermediate consumers at the midway level in a food web. They are also thought to be reliable biological controls and environmental health markers (Hammond *et al.*, 2016) [6]. Due to several anthropogenic pressures, including development and the modification of the forest landscape, the population of herpetofauna species is falling. The destruction of habitat, illnesses, deforestation and pollution are all contributing factors to this population reduction (Doherty-Bone, 2008) [2]. Additionally, the habitat disruption for amphibians and reptiles has been made worse by the increased rate of construction, particularly near the estuary (Gillespie *et al.*, 2005) [5]. Numerous unique land and aquatic fauna species can be found in the mangrove swamps (Nagelkerken *et al.*, 2008) [11]. They support the local wildlife by providing habitat, sustenance, and breeding sites for a variety of species such as crustaceans, fishes, frogs, reptiles, and mammals. Several advantageous elements have been added to the environment as a result of the mangrove ecosystem's unique qualities (Padmakumar and Joseph, 2022) [16]. A total of 14 species, including 13 species of reptile fauna and one species of amphibia, make up the herpetofauna of the northern Kerala mangrove ecosystem (Radakrishnan *et al.*, 2006) [19].

Materials and Methods

The Kozhikode District of Kerala is located in the basins of

three significant river basins: the Chaliyar, Korapuzha and Kuttiadi Rivers. The Elathur River, which enters the Korapuzha lagoon system (Image 2) close to the estuarine mouth, almost 1 km from the coastline, and another channel extending from the base of the elevated mountainous region encompassing the Kodiyanadumalai (700 m), which also flushes into the creeks near Kaniangode, about 16 km from the river mouth, make up the 52 km-long Korapuzha, a short and shallow river. The wetland never dries out. The ebbtide is almost entirely suppressed by the massive flow of silt-filled fresh waters that pour down the river during the monsoons. The river's shores are bereft of townships, industries, or major settlements (Rao and George, 1959) [20], but there are tiny localities and extensive, biodiversity-rich mangrove forests. Large backwaters that mimic lagoons and connect the brackish waters of the Korapuzha and Kuttiadi Rivers have the potential to be important biological areas for a variety of species, particularly herpetofauna (Padmakumar and Murugan, 2022) [17].

The study area is the Korapuzha Estuary (Image 1) located at 11°35'N, 75°73'E. Herpetofaunal observations were done from June 2018 to June 2019 at 12 distinct locations along the estuarine expanse. Given that a substantial proportion of herpetofauna is nocturnal, routine diurnal surveys were conducted monthly over the observation period. Comprehensive searching in recognized microhabitats; call surveys; road-kill studies; and opportunistic sightings were all utilized to identify and describe numerous herpetofauna.

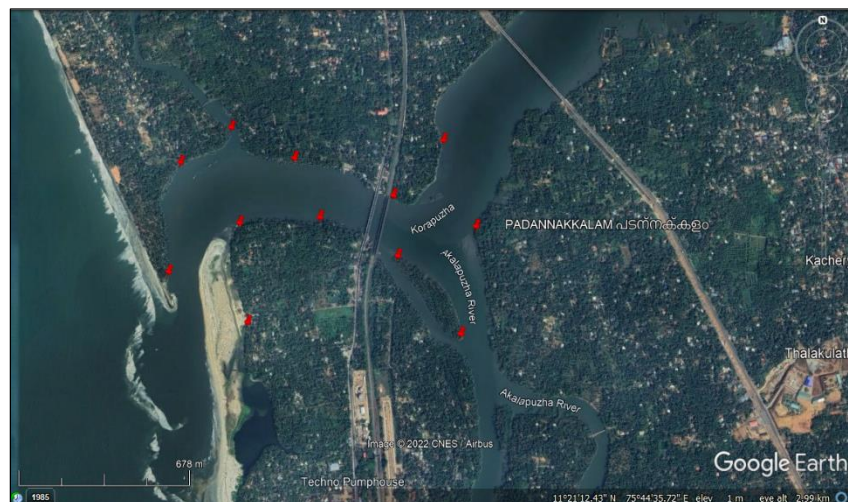


Image 1: Map showing Korapuzha/Elathur estuary, Kozhikode Dt., India



Image 2: A view of the Korapuzha estuary

Results

A total of 17 reptile species from 11 families and 1 amphibian were recorded in the current study (Table 1). The only amphibian that has been identified is the Indian Skipper Frog-*Euphlyctis cyanophlyctis*. Among the reptiles, 4 species of the order Testudines and 12 species of the order Squamata were recognized. The most commonly encountered reptiles were the Indian Cobra (*Naja naja*), Oriental Ratsnake (*Ptyas mucosa*), Indian Black Turtle (*Melanochelys trijuga*), Common Indian Monitor (*Varanus bengalensis*), and garden lizard (*Calotes versicolor*). It was intriguing to notice that their frequency was greater during the monsoon rains than during the summer months. The banded Krait (*Bungarus fasciatus*) (Image 3) is reported for the first time in Kerala's swamps (Padmakumar and Murugan, 2022) ^[18]. The krait was spotted while plunging through the lagoon into a commune with very few dwellers and only once during the entire study.



Image 3: Banded Krait (*Bungarus fasciatus*)

The Oriental Ratsnake was spotted regularly all through the year, unlike the other reptiles. Among the reptile fauna identified, the vulnerable species include *Lepidochelys olivacea* (Eschscholtz), *Dermochelys coriacea* (Vandelli), and *Ophiophagus hannah* (Cantor), which are listed on the IUCN Red List of Threatened Species. *Pelochelys cantorii* (Gray) (Image 4) is listed as Critically Endangered and *Varanus bengalensis* (Daudin) (Image 5) is listed Near Threatened. The lizard and snake varieties documented are unscrupulous land-based vegetation foragers that can be observed in the vicinities of the agrarian biome in the surroundings close to or away from the Wetlands.



Image 4: *Pelochelys cantorii*



Image 5: *Varanus bengalensis*

The Indian skipper frog (Image 6), the only amphibian prevalent in the study area was recorded every month, with the highest number of sightings occurring in May, June, July and August, indicating their ubiquity during the rainfalls. The solitary species is peculiarly the only anuran species that can sustain the frail salt concentrations component in wetlands, and thus known to be the only salt adaptable organisms that are encountered in the climes of murky water with mild salt concentrations.



Image 6: *Euphlyctis cyanophlyctis*

Table 1: Checklist of herpetofauna identified in the study area

Family	Common name	Scientific Name	Conservation Status
Chelonidae	Olive Ridley Sea Turtle	<i>Lepidochelys olivacea</i>	VU
Dermochelyidae	Leatherback Sea Turtle	<i>Dermochelys coriacea</i>	VU
Geoemydidae	Indian Black Turtle	<i>Melanochelys trijuga</i>	LC
Trionychidae	Cantor's Giant Softshell	<i>Pelochelys cantorii</i>	CR
Gekkonidae	Giant Spotted Gecko	<i>Hemidactylus maculatus</i>	LC
Agamidae	Oriental Garden Lizard	<i>Calotes versicolor</i>	LC
Scincidae	Keeled Indian Mabuya	<i>Eutropis carinata</i>	LC
Varanidae	Common Indian Monitor	<i>Varanus bengalensis</i>	NT
Colubridae	Oriental Ratsnake	<i>Ptyas mucosa</i>	LC
	Checkered Keelback	<i>Xenochrophis piscator</i>	LC
	Sri Lankan Green Vine Snake	<i>Ahaetulla nasuta</i>	LC
	South Asian Bockadam	<i>Cerberus rynchops</i>	LC
Elapidae	King Cobra	<i>Ophiophagus hannah</i>	VU
	Indian Cobra	<i>Naja naja</i>	LC
	Banded Krait	<i>Bungarus fasciatus</i>	LC
Viperidae	Russell's Viper	<i>Daboia russelii</i>	LC
Dicroglossidae	Indian Skipper Frog	<i>Euphlyctis cyanophlyctis</i>	LC

Discussion

Herpetofauna is spread far and wide across land and aquatic environments throughout the world's tropical and subtropical regions. In contrast, just a few species of amphibians and reptiles dwell or use coastal settings (McCoy, 2006) ^[9], owing to the harsh physical conditions that characterize the biota.

The herpetofauna in the wetland ecosystem of northern Kerala is diverse, with roughly 14 species, including 13 species of reptile fauna and one species of Amphibia (Radakrishnan *et al.*, 2006) ^[19]. Certain beachfront cum wetland ecosystem zones in northern Kerala, such as the Korapuzha estuary, have been observed to be primary turtle breeding sites especially, *Lepidochelys olivacea*, and are also listed in CITES Appendix I (Radakrishnan *et al.*, 2006) ^[19].

The studies revealed that the area's tidal-connected microhabitats are desirable for several amphibians and reptiles. The endurance of the amphibians and reptiles in the study to the saline water setting will expand the variety of habitats these species can occupy (Solania *et al.*, 2020) ^[22]. According to Catenazzi *et al.*, (2016) ^[23], evidence on population demographics gleaned through fast ecological assessments at the species level could be useful for restoration, particularly for isolated, endangered, and range-restricted taxa. There have been extensive reports on herpetofaunal richness in wetlands, particularly on the Indo-Pacific coast. Kadafi *et al.* (2020) ^[8] reported 38 herpetofauna taxa in the Kondang Merak forest, one of Java's last remnant low-lying woodlands. Rao (1998) ^[21] analyzed the ecological balance of *Barkudia melanosticta* (as *B. insularis*) in Vellore. The only amphibian reported was recorded to inhabit foliage litters in substantial numbers, possibly because leaf litters include a greater diversity of habitat types, allowing more organisms and taxa to cohabit in the littered ecological niche (Fauth *et al.*, 1989) ^[3]. Peninsular India, with its biomes, has great potential to host a wide range of reptiles, particularly snakes (Daniels, 2001) ^[1]. The snakes seen in the study were within and around human occupation, which might lead to human-snake conflict rather frequently. *Xenochrophis piscator* is one of India's most frequent snakes (Nath *et al.*, 2011) ^[12]; it was also noticed to be the estuary's most frequent snake. Because of the potential significance of amphibians as markers of ecological decline, amphibian research attracts

a lot of interest (Naresh *et al.*, 2012) ^[13]. Retrospective investigation on solitary marshes indicates that terrestrial habitats next to the marshland are critical for a considerable majority of the animal population (Gibbons, 2003) ^[4].

Conclusion

A swamp biome, regardless of how micro or inaccessible it is, contains biological and non-living factors that interplay to support richness at broader spatial dimensions. Mangroves, in particular, provide a substantial fraction of the regional fauna and are frequently crucial sites for sustaining herpetofaunal richness in the regions. As a result, extra efforts must be made to uncover unique and emblematic herpetological fauna of nature reserves or exceptional environments to strengthen and emphasize their ecological significance. These significant taxa can function as bioindicators for forecasting management needs and priorities in these ecosystems. Although such recommendations are dependent on the findings of the current study, further work in the current study area can be undertaken. A substantial number of species are still being described, highlighting the need for more coordinated scientific research in estuarine environments, as well as increased protection of the remaining habitat.

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