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# PRELIMINARY DATA ON SPECIES DIVERSITY OF AMPHIBIANS AND REPTILES (EXCLUDING SNAKES) FROM PANVEL, NAVI MUMBAI, INDIA

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**AUTHORS' CONTRIBUTIONS**

This work was carried out in collaboration among all authors. Authors PRP, AGR, SPS and LNM designed the study, carried out all the work, wrote the protocol and managed the literature searches. Author NBP wrote the first draft of the manuscript. All authors read and approved the final manuscript.

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## ABSTRACT

In this study, the impact of over-exploitation of natural resources on diversity of amphibians and reptiles in adjoining areas of Panvel, Navi Mumbai was assessed. The present work was carried out for one year (from June 2019 to May 2020). The results showed that a total of 26 species of amphibians and reptiles belonging to 16 genera and 12 families were recorded. Varied diversity of amphibians with 8 species representing 6 genera and 4 families were observed. Species diversity of reptile reveals 18 species representing 10 genera and 8 families. Turtles and tortoises were represented by 7 species belonging to 4 genera and 3 families. Study results indicates that coastal ecosystem of area adjoining Panvel is dominated by species of Polypedates maculatus, P. occidentalis and Pseudophilautus amboli followed by Duttaphrynus melanostictus, Ghatophryne rubigina, Hoplobatrachus crassus and H. tigerinus. High diversity of tree frogs and bullfrogs is correlated to the few landscapes with thick vegetation, suitable habitat and optimum rainfall in the study area. It can be concluded that over-exploitation of natural resources in Panvel region due to ongoing construction of Navi Mumbai International Airport (NMIA) are the key factors affecting the diversity of amphibians and reptiles. Mortality of amphibians and reptiles is due to lack of awareness regarding ecological role of amphibians and reptiles and fear of snake bite is noted. It is recommended to create awareness among general public about role of amphibians and reptiles and sustainable utilization of natural resources. Since no earlier reports are available, data presented here can be taken as a baseline data.

**Keywords:** Amphibians; diversity; natural resources; Navi Mumbai International Airport; panvel; reptiles.

## 1. INTRODUCTION

Biological diversity encompasses the intrinsic and anthropocentric values associated with it, particularly in terms of the ecosystem services. Biological diversity intrinsically pedals the functioning and stabilization of an ecosystem [1]. Species are the backbone of biology [2]. Monitoring species diversity can be used as a tool to reduce human mismanagement and pollution in urbanized, industrial, rural, and other managed areas. Studies on species diversity in any ecosystems are necessary to understand the effect of anthropocentric

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development on the integrity and sustenance of an ecosystem [3].

Amphibian and reptilian fauna show a relatively more limited agility and in particular amphibians with their glandular and sensitive skin serve as significant bio-indicators for the quality of the habitat and environmental changes. Amphibians are important prey for numerous arthropod taxa, including ground beetles and Epomis larvae [4]. Amphibians and reptiles are more easily accessible during fieldwork, which makes them a suitable target group [5].

World species diversity of amphibians consists of 6639 species and includes frogs, toads, caecilians and salamanders [6,7]. The comprehensive checklist of amphibians of India brought out by Dinesh et al. [8] enlists 432 species of amphibians from India. Amphibian fauna of Maharashtra State include 43 species distributed in six families like Icthyophiidae, Caecilidae, Bufonidae, Microhylidae, Ranidae and Rhacophoridae [9]. Amphibians play major role in ecosystem functioning, as indication of a healthy environment, prey and predator, consumers of pest insects and food for snakes, birds and small mammals [10].

Reptiles represent a major component of vertebrate species and are the predominant group in many rainforest, arid and mountain habitats with a species richness pattern mainly influenced by temperature on a global scale. Except turtles and crocodilians, reptiles have traditionally received much less attention from conservationists on full species sampling [11,12]. Exploitation of reptiles, for food, ornaments, clothing, accessories and as live exhibits and pets is also a threat, especially when harvests are illegal and uncontrolled [13].

Reptiles (lizards, snakes, turtles, tortoises and crocodilians) are still poorly known and are highly threatened. Decline in population of reptiles is a major concern and causes of catastrophic decline are habitat loss, environmental pollution, lethal diseases, unsustainable use of natural resources and global climate change [14-17].

Species diversity of amphibians and reptiles has been reported by various authors viz., amphibians [18-25] and reptiles [1,24,26-30].

Coastal environment of Navi Mumbai (Panvel, Uran, Vashi) has been under considerable stress since the ongoing construction of Navi-Mumbai International Airport (NMIA) by the City and Industrial Development Corporation (CIDCO). Construction of NMIA has resulted in deforestation, encroachment, reclamation and urbanization in the study area. It has affected the livelihood of local fishermen and coastal community along with the ecology of fauna from Panvel, Navi Mumbai [31-33].

Although many studies have been undertaken to evaluate the species diversity of amphibians and reptiles in India, no scientific studies have been carried out on the species composition of amphibians and reptiles of Mumbai and Navi Mumbai; hence, the present study is undertaken. In the present study, an attempt has been made to document the diversity of amphibians and reptiles in areas adjoining Panvel, Navi Mumbai to assess the impact of anthropogenic activities.

## 2. MATERIALS AND METHODS

### 2.1 Study Area

Navi Mumbai is basically a satellite township on the west shore of Maharashtra. It was made in 1971 to be another urban township of Mumbai by Government of Maharashtra. As per Census India 2011, it had a population of 1,119,477. Panvel (Lat 18° 59' 26.5668" N & 73° 7' 0.6384" E) is located in Raigad district of Maharashtra in Konkan region and is a node of the Navi Mumbai city. Geographically, Panvel is near Panvel creek which opens up in Thane creek. Kalundre river flows across the city in the south-west region and opens up into Panvel creek. Panvel with a population of 180,464 (Census India 2011) is a highly populated city due to its closeness to Mumbai. It is located in the Mumbai Metropolitan Region. Panvel is situated on the banks of Panvel Creek. It is also surrounded by mountains on 2 sides (Fig. 1).

### 2.2 Study Location

The present study of diversity and distribution of amphibians and reptiles was carried out for the period of one year, from June 2019 to May 2020. The area adjoining to Panvel was visited during dawn and dusk hours, one day of each month and 4 hours were spent at each site at both times (total day time was 8 hours). Also, data were collected from local NGOs as well as from the reports of accidental road kills. All amphibians and reptiles were photographed using Cannon 1100 D Zoom camera. For correct identification of amphibians and reptiles, field guides and books of Das [23] and Daniel [34] were presented in Fig. 1.

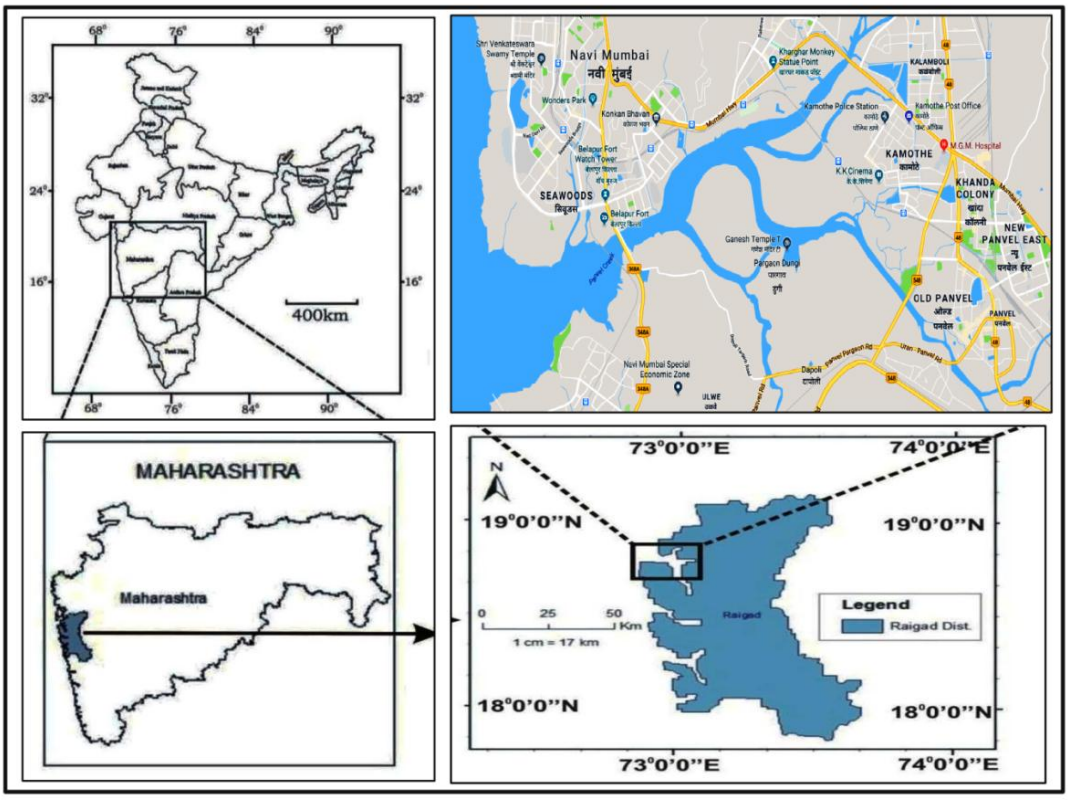


**Fig. 1. Location map of study area representing Panvel creek**

## 3. RESULTS AND DISCUSSION

A total of 26 species of amphibians and reptiles belonging to 16 genera and 12 families were recorded. Varied diversity of amphibians with 8 species representing 6 genera and 4 families was observed. Number of species of amphibians distributed in each family reveals that 3 species belong to family Rhacophoridae, 2 species, each to Bufonidae & Dicroglossidae and 1 species to Ranidae (Tables 1 & 4, Fig. 2).

Species diversity of reptile reveals 18 species representing 10 genera and 8 families. Among reptiles, lizards were represented by 11 species belonging to 6 genera and 5 families. Number of species of lizards distributed to each family reveals that 6 species belong to family Gekkonidae, 2 species to Mabuyidae and 1 species, each to Agamidae, Chamaeleonidae & Varanidae (Tables 2 & 5, Fig. 3). Turtles and tortoises were represented by 7 species belonging to 4 genera and 3 families. Number of species of turtles and tortoises distributed in each family reveals that 5 species belongs to family Trionychidae and 1 species each to Emydidae & Testudinidae (Tables 3 & 6, Fig. 4).

The present study indicates that coastal ecosystem of area adjoining Panvel is dominated by species of *Polypedates maculatus*, *P. occidentalis* and *Pseudophilautus amboli* followed by *Duttaphrynus melanostictus*, *Ghatophryne rubigina*, *Hoplobatrachus crassus* and *H. tigerinus*. High diversity of tree frogs and bullfrogs is correlated to the few landscapes with thick vegetation, suitable habitat and optimum rainfall in the study area. Rare occurrence of fungoid frog (*Hylarana malabarica*) was attributed to the over-exploitation of natural resources from the study area leading to loss of habitat for this species.

Diversity of lizards dominated by species belonging to the family Gekkonidae (geckos) and Mabuyidae (skink) denotes that at present ecosystem supports the habitat requirements of these reptiles. Similarly, more abundance of *Chamaeleo zeylanicus* indicates the resourcefulness of the ecosystem. High species diversity of turtles of the family Trionychidae (Indian Flapshell Turtle) at few undisturbed habitats and vegetations (Fig. 2) focuses highlight on productivity of the study area.


**Fig. 2. Undisturbed landscapes of habitats and vegetations in area adjoining to Panvel**

**Table 1. Preliminary checklist of Amphibians (frogs & toads) recorded in & around Panvel**

| No. | Family | Scientific name | Common name |
|---|---|---|---|
| 1 | Bufonidae | *Duttaphrynus melanostictus* (Schneider, 1799) | Asian Common Toad, Asian Black-spined Toad, Asian Toad, Black-spectacled Toad, Common Sunda Toad, Javanese Toad |
| 2 | Bufonidae | *Ghatophryne rubigina* (Pillai & Pattabiraman, 1981) | Kerala Stream Toad, Silent Valley Torrent Toad, Red Torrent Toad |
| 3 | Dicroglossidae | *Hoplobatrachus crassus* (Jerdon, 1854) | Jerdon's Bullfrog, South Indian Bullfrog |
| 4 | Dicroglossidae | *Hoplobatrachus tigerinus* (Daudin, 1803) | Indian Bullfrog, Indus Valley Bullfrog, Asian Bullfrog, Asia Bullfrog |
| 5 | Ranidae | *Hylarana malabarica* (Tschudi, 1838) | Fungoid Frog, Malabar Hills Frog |
| 6 | Rhacophoridae | *Polypedates maculatus* (J.E.Gray, 1830) | Common Indian Tree Frog Himalayan Tree Frog, Indian Tree Frog, Chunam Tree Frog |
| 7 | Rhacophoridae | *Polypedates occidentalis* (Das & Dutta, 2006) | Western Tree Frog, Charpa Tree Frog |
| 8 | Rhacophoridae | *Pseudophilautus amboli* (Biju & Bossuyt, 2009) | Amboli Bush Frog |

**Table 2. Preliminary checklist of Lizards (Squamata) recorded in & around Panvel**

| No. | Family | Scientific name | Common name |
|---|---|---|---|
| 1 | Agamidae | *Calotes versicolor* (Daudin, 1802) | Oriental Garden Lizard, Eastern Garden Lizard, Bloodsucker or Changeable Lizard |
| 2 | Chamaeleonidae | *Chamaeleo zeylanicus* (Laurenti, 1768) | Indian Chameleon |
| 3 | Gekkonidae | *Cyrtodactylus collegalensis* (Beddome, 1870) | Forest Spotted Gecko, Kollegal Ground Gecko |
| 4 | | *Hemidactylus aaronbaueri* (Giri, 2008) | Aaron Bauer's House Gecko |
| 5 | | *Hemidactylus brookii* (Gray, 1845) | Brooke's House Gecko, Brook's Gecko, Spotted House Gecko |
| 6 | | *Hemidactylus frenatus* (Schlegel, 1836) | Common House Gecko, Wall Gecko, Pacific House Gecko, Asian House Gecko, House Lizard, Moon Lizard |
| 7 | | *Hemidactylus maculatus* (Duméril & Bibron, 1836) | Spotted Leaf-toed Gecko, Giant Spotted Gecko |
| 8 | | *Hemidactylus paaragowli* (Srikanthan, Swamy, Mohan, & Pal, 2018) | Travancore Rock Gecko |
| 9 | Mabuyidae | *Eutropis carinata* (Schneider, 1801) | Common Skink, Brahminy Skink, Common Keeled Grass Skink, Golden Skink, Keeled Indian Mabuya, Many-keeled Grass skink |
| 10 | | *Eutropis macularia* (Blyth, 1853) | Little Skink, Bronze Mabuya, Bronze Grass Skink |
| 11 | Varanidae | *Varanus bengalensis* (Daudin,1802) | Common Indian Monitor, Bengal Monitor |

**Table 3. Preliminary checklist of turtles & tortoises (Testudines) recorded from Panvel**

| No. | Family | Scientific name | Common name |
|---|---|---|---|
| 1 | Emydidae | *Trachemys scripta elegans* (Wied-Neuwied, 1839) | Red-eared Slider Turtle, Red-eared Slider, Slider turtle, Red-eared terrapin, Red-eared turtle, Water slider turtle |
| 2 | Testudinidae | *Geochelone elegans* (Schoepff, 1795) | Indian Star Tortoise |
| 3 | Trionychidae | *Lissemys punctata andersoni* (Webb, 1980) | Spotted Northern Indian Flapshell Turtle |
| 4 | | *Lissemys punctata punctata* (Bonnaterre, 1789) | Southern Indian Flapshell Turtle |
| 5 | | *Lissemys punctata vittata* (Peters, 1854) | Central Indian Flapshell Turtle |
| 6 | | *Nilssonia gangetica* (Cuvier, 1825) | Ganges Softshell Turtle, Indian Softshell Turtle |
| 7 | | *Nilssonia hurum* (Gray, 1831) | Indian Peacock Softshell Turtle |

**Table 4. List of families with number of genera and species of frogs and toads recorded from Panvel**

| Sr. no. | Order | Family | Genera | Species |
|---|---|---|---|---|
| 1 | Anura | Bufonidae | 02 | 02 |
| 2 | | Dicroglossidae | 01 | 02 |
| 3 | | Ranidae | 01 | 01 |
| 4 | | Rhacophoridae | 02 | 03 |
| Total | 01 | 04 | 06 | 08 |

**Table 5. List of families with number of genera and species of lizards recorded from Panvel**

| Sr. no. | Order | Family | Genera | Species |
|---|---|---|---|---|
| 1 | Squamata | Agamidae | 01 | 01 |
| 2 | | Chamaeleonidae | 01 | 01 |
| 3 | | Gekkonidae | 02 | 06 |
| 4 | | Mabuyidae | 01 | 02 |
| 5 | | Varanidae | 01 | 01 |
| Total | 01 | 05 | 06 | 11 |

**Table 6. List of families with number of genera and species of turtles and tortoises recorded from Panvel**

| Sr. no. | Order | Family | Genera | Species |
|---|---|---|---|---|
| 1 | Testudines | Emydidae | 01 | 01 |
| 2 | | Testudinidae | 01 | 01 |
| 3 | | Trionychidae | 02 | 05 |
| Total | 01 | 03 | 04 | 07 |

Koirala et al [35] noted that protection of forest habitats is significantly important for conservation of herpetofauna diversity. Vignoli et al [16] recorded that the distribution and diversity of reptiles in a species-rich protected area of central Italy, natural land use supports the whole reptile community whereas urban and agricultural environments hosted about half of the species.

Pawar et al [32,33] correlated the depletion of coastal marine diversity from Panvel creek to the loss of habitat due to deforestation, overexploitation of natural resources for ongoing construction of Navi-Mumbai International Airport (NMIA), habitat fragmentation due to construction and widening of roads and rampant urbanization and industrialization of the area adjoining Panvel.

*Duttaphrynus melanostictus*

*Ghatophryne rubigina*

*Hoplobatrachus crassus*

*Hoplobatrachus tigerinus*

*Hylarana malabarica*

*Polypedates maculatus*

*Polypedates occidentalis*

*Pseudophilautus amboli*

**Fig. 3. Frogs and toads recorded in areas adjoining Panvel, Navi Mumbai**

*Calotes versicolor*

*Chamaeleo zeylanicus*

*Cyrtodactylus collegalensis*

*Hemidactylus aaronbaueri*

*H. brookii*

*H. frenatus*

*Hemidactylus maculatus*

*Hemidactylus paaragowli*

*Eutropis carinata*

*Eutropis macularia*

*Varanus bengalensis*

**Fig. 4. Lizards recorded in areas adjoining Panvel, Navi Mumbai**

**Trachemys scripta elegans**

**Geochelone elegans**

**Lissemys punctata andersoni**

**Lissemys punctata punctate**

**Lissemys punctata vittata**

**Nilssonia gangetica**

**Nilssonia hurum**

**Fig. 5. Turtles & tortoises (Testudines) recorded in areas adjoining Panvel, Navi Mumbai**

**Indian Bullfrog**

**Brooke's House Gecko**

**Indian Chameleon**

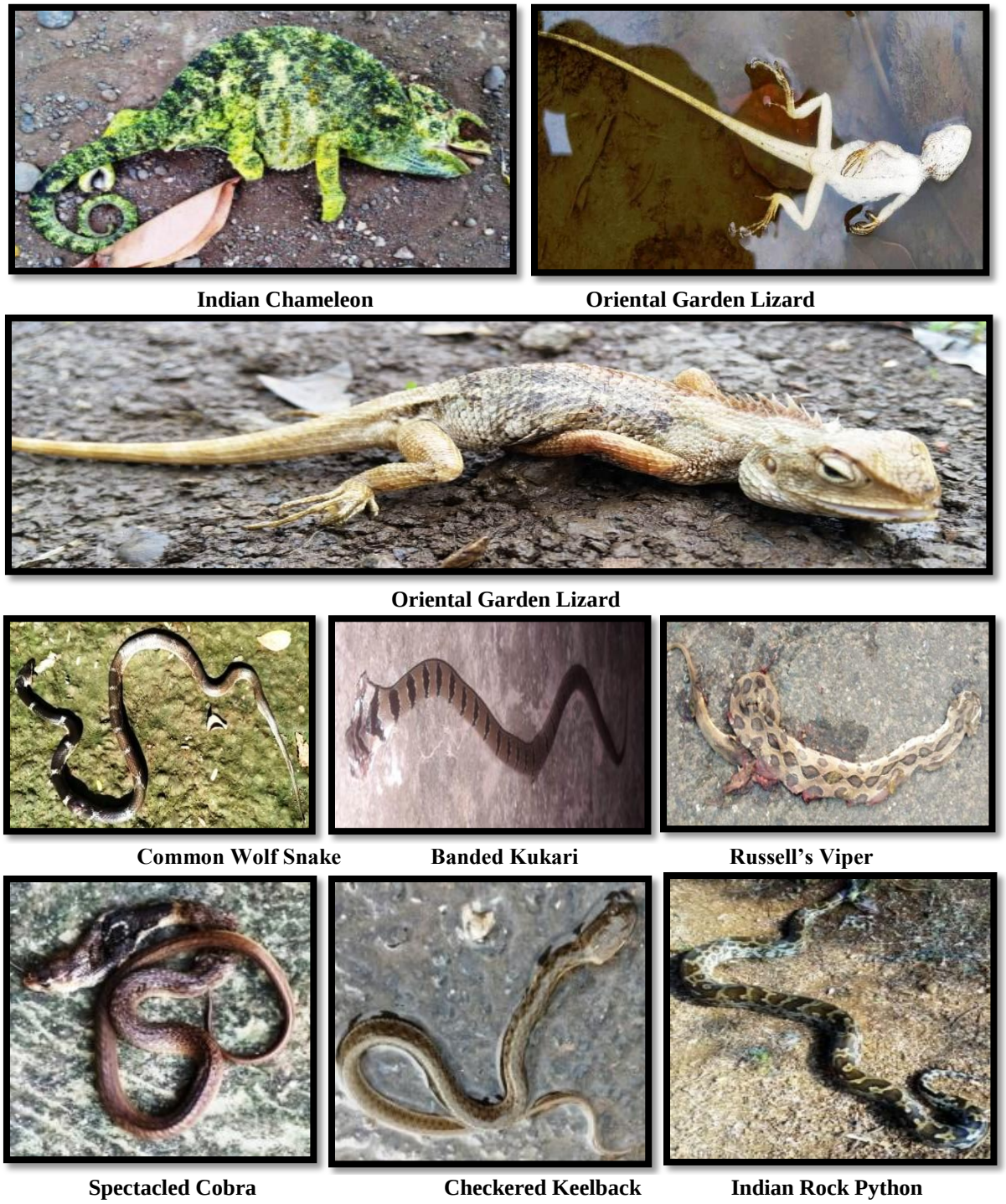


**Fig. 6. Anthropogenic impact and accidental road kills of amphibians and reptiles from Panvel**

Ongoing construction of NMIA covers an area of 1,160 hectares (4.5 Sq miles) in the vicinity of Panvel creek. The airport project has relocated 2,786 households located across 10 villages. Villages like Chinchpada, Kopar, Kolhi, Ulve, Upper Owale, Waghivalipada, Vaghivali, Ganeshpuri, Targhar & Kombadbhunje relocate in the nearby area of the creek. The airport area has to be filled with an average of 14 feet. For filling the airport area, nearby mountain resources were excavated at an alarming rate, without considering its impact on biodiversity. As a result, the amphibian and reptilian fauna from the study area is facing stress & are victimized to accidental road kills [32,33].

The present study reveals the mortality of Indian Bullfrog, Brooke's House Gecko, Indian Chameleon, Oriental Garden Lizard, Russell's Viper, Common Wolf Snake, Banded Kukari, Spectacled Cobra, Checkered Keelback and Indian Rock Python is of serious concern noted in this study (Fig. 6). The highest rate of mortality recorded for reptiles is attributed to the attraction of the reptiles on the roads for thermoregulation and warmth during early morning when the air temperature is cool. It is also correlated to the sluggish nature of many reptiles like pythons and sand boas to make them more susceptible to mortality [36].

Mortality of amphibian and reptiles noted in this study is also correlated to the loss of habitat due to deforestation, overexploitation of natural resources for ongoing construction of Navi-Mumbai International Airport (NMIA), habitat fragmentation due to construction and widening of roads and rampant urbanization and industrialization of the area adjoining Panvel [37]. The results of the study are in agreement with the findings on anthropogenic impact on diversity of amphibians and reptiles by Pradhan et al [3,38-41].

At present, ecological conditions in area adjoining Panvel, Navi Mumbai supports moderate diversity of amphibians and reptiles but due to over-exploitation of natural resources for ongoing construction of Navi Mumbai International Airport, deforestation, intense industrialization and urbanization, coastal pollution will affect the diversity of amphibians and reptiles in future. Therefore, data presented in this paper can be taken as a baseline data for future study.

## 4. CONCLUSION

The study shows that, at present, ecological conditions in area adjoining Panvel, Navi Mumbai supports moderate amphibian and reptile density. It can be concluded that over-exploitation of natural resources and deforestation in Panvel region due to ongoing construction of Navi Mumbai International Airport (NMIA) are the key factors affecting the diversity of amphibians and reptiles. Also, mortality of amphibians and reptiles in residential complexes is due to lack of awareness regarding ecological role of amphibians and reptiles and fear of snake bite. It is recommended to create awareness among general public about role of amphibians and reptiles in ecological food chain and also sustainable utilization of natural resources. Since no earlier reports are available, data presented here can be taken as a baseline data in knowing the status of amphibians and reptiles from adjoining area of Panvel, Navi Mumbai and effect of industrial development on it.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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