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Research Paper

The highways to dead ends: Case studies on road kill mortality of Indian Rat Snake, *Ptyas mucosus*, Linnaeus 1758 (Reptilia: Squamata: Colubridae)

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Abstract: This study deals with the documentation of two road killed Indian Rat Snakes (*Ptyas mucosus*) from different territories. Snakes, like other organisms, play an important role in our ecosystem by balancing the food web. Snakes are both predator and prey. They naturally control the population of mice, other small rodents and other snakes by devouring them. Indian Rat Snake, a widespread species belonging to family colubridae, order squamata and class reptilia, is ecologically important non-venomous snake species and are often referred to as the friends of farmers because they control a large percentage of rodents, who in turn are responsible for destroying our standing and stored crops and spreading diseases. Urban roads, state and national highways, while facilitating human transportation, pose a significant threat to wild fauna. The speeding motorized vehicles on urban roads, state highways (SH) and national highways (NH) traversing through cities and towns are proving themselves as graveyards for ecologically important urban wildlife especially snakes, other reptiles and mammals. Through two case studies, the frequency, location and circumstances of road kill of Indian Rat Snakes has been discussed.

Keywords: Indian rat snake, colubridae, snake mortality, road kill, Motihari, WPA 1972, schedule II, linear infrastructure, habitat fragmentation, wildlife, conservation.

Introduction:

Indian rat snake (*Ptyas mucosus*) is very fast, an alert, active, diurnal and crepuscular non-venomous species and inhibits a wide range of habitats – coastal, arid, wet, mountainous, open fields as well as forests (Whitaker and Captain 2015) and is found throughout Indian subcontinent including Nepal, Sri Lanka, Myanmar, Afghanistan, Turkmenistan and China (Daniel 2002). The Rat Snakes lives in close proximity to humans. Currently, its population is decreasing rapidly due to anthropogenic threats, use of pesticides and chemical fertilizers, hunting, habitat fragmentation, road kill etc. It is traded for food, skins, and medicinal purposes in Indonesia (Auliya 2010). In India, Indian

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rat snake (*Ptyas mucosus*) has been listed in schedule II of the Wildlife (Protection) Act, 1972 and Indian population is listed in Appendix III of CITIES. This snake species is a least concerned species under IUCN red list category (Wogan et al. 2021).

In this anthropocene era, man-made activities such as rapid urbanization, deforestation, encroachments, railway, highway & dam construction has adversely affected the ecosystem and wildlife. Social and economic growth imperatives have been the driving force behind the large-scale and rapid spurt in linear infrastructure projects in India, particularly roads and railway lines. (Habib & Saxena 2024). However, while these projects aim to improve the transportation connectivity of the country, their ecological impacts on the natural ecosystems of the country are becoming increasingly evident (Habib and Saxena 2024). The intricate network of state and national highways which traverses through cities and towns are proving themselves as one of the major hotspots for road mortalities of urban wildlife especially small mammals, avian species, reptiles and amphibians. Each day several precious urban wild fauna mowed down on these concrete roads by speeding motorized vehicles. Roads negatively affect animal populations by presenting barriers to movement and gene flow by causing mortality (Jeffrey et al. 2007). Roads also affect animal survivorship and behaviour and thereby can act as a barrier to movement, which exacerbates habitat fragmentation and disrupts landscape permeability (Andrews and Gibbons 2005), Roads play major role in killing animals by collision with vehicles (Frissell and Trumbulak 2000). Terrestrial animals are vulnerable to road mortality or habitat fragmentation by roads (Rytwinski and Fahrig 2015; Hatti and Mubeen 2019; Allain and Goodman 2020). Reptilian species especially snakes are more vulnerable to road mortality. Freitas et al. (2013) also found high reptile mortality on roads. Highway and adjacent vegetation cover exhibit different structure patterns of the snake faunas (Aranguri et al. 2019). Ophidian road mortality is well documented (Klauber 1939; Fitch 1949; Bernardino and Dalrymple 1992; Rosen 1994; Gokula 1997; Bonnet 1999; Vijaykumar 2001; Smith and Dodd 2003; Ciesiolkiwicz 2006; Jochimsen 2006; DeGregorio 2010). In case of snakes, the effect of vehicular traffic has been related to their relatively slow rates of locomotion, their tendencies to thermo-regulate on road surfaces and their reactions to passing vehicles (Andrews and Gibbons 2005). Snakes may be intentionally targeted by motorists (Langley et al. 1989; Ashley et al. 2007). Reptilian females often travel long distances in search of appropriate sites for egg laying (Andrews et al. 2015; Deb and Sengupta 2020) which also makes them vulnerable to mowed down by vehicles.

Materials and Methods:

Both observations of Indian Rat Snake road kill incidents were recorded during field visits. Photographs of dead snakes were taken by mobile phone and Nikon D5300 Camera for documentation purpose while geo-coordinates were recorded by Garmin etrex GPS. The dead snakes were examined and identified upto the species level using standard field guides (Daniel 2002; Whitaker and Captain 2015; Das and Das 2017).

Observation and Discussion:

The studies from across the globe have been highlighting the adverse impacts of the road networks on wild animals, and the consequent mortality across invertebrates and higher vertebrates (Fahrig et al. 1995; Clarke et al. 1998; Mackenzie et al. 2001; Erritzoe et al. 2003; Yadav et al. 2022).

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Here, I am presenting two different cases of rat snake mortality observed in two different locations respectively from Nepal and India. At 1807 h on 26 July 2017, I encountered an adult Indian Rat Snake (approximately 5.5 ft. in length) which died due to road kill by an unknown two-wheeler on Surajpura main road (27.425783°N & 83.792992°E) in Nawal Parasi district Nepal during a field visit (fig. 1). The snake was found in good condition, except its head was brutally damaged which strongly indicates intentional killing in this case. In another case, at 1712 h on 30 June 2020, I observed an adult Indian Rat Snake, *Ptyas mucosus* (approximately 5.2 ft. in length) which became the victim of road mortality by an unknown vehicle on Motihari-Areraj main road (State Highway 54) near Raghunathpur (Geo-coordinates: 26.63512°N & 84.89024°E; Elevation 66 m ASL) in Motihari, Bihar, India. The snake was road killed while passing the road from left (fruit orchard with rich vegetation) to right side (dense human settlement). The body of this rat snake was badly damaged (fig. 2). The findings of this study suggests that Indian Rat Snakes are vulnerable to road mortality, particularly in areas with high vehicular traffic and inadequate or no wildlife crossings. Moreover, this study also suggests that roads can act as population sinks, declining snake populations and altering ecosystem dynamics. Rat snake and krait mortality on railway track were also reported from Simdega forest division in Jharkhand, India (Kumar and Prasad 2020). Patterns in snake road mortality can vary spatially and are dependent upon community composition (Andrews et al. 2008).

Conclusion:

Road kill is a significant anthropogenic threat to snakes, other reptiles, birds & mammals. Studies indicate that snakes, including Indian Rat Snakes, are among the most frequently affected reptiles in roadkill incidents. The present study indicates that both snake mortalities were reported during the evening time of rainy months (July and June respectively) and seems intentional run-over. The present study suggests the peak mortality occurs during monsoon (rainy season) when snakes are most active. The study also investigates the negative impact of roads (national and state highways) on Indian Rat Snakes in these localities. Reducing roadkill incidents for snakes requires a combination of thoughtful infrastructure design, public awareness, and conservation efforts. To mitigate the impact of vehicle mortality on wild animals, these road lanes should be monitored prudently, along with strict guidelines to protect wild animals (Karthik et al. 2018 and Yadav et al. 2022). This study contributes to our understanding of the impact of road mortality on Indian Rat Snake populations and informs conservation strategies for protecting these ecologically important species.

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Figure 1: First case of Indian Rat Snake (*Ptyas mucosus*) mortality on road in Surajpura, Nawal Parasi district of Nepal.

Figure 2: Second case of Indian Rat Snake (*Ptyas mucosus*) mortality on road in Raghunathpur, Motihari, Bihar, India.