IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

A Study To Assess Road Killing Of Snakes And Its Relationship With Traffic Load

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Abstract: Roads always hurt surrounding flora and fauna. The amount of traffic load and mortality of snakes and their relationship were evaluated on three selected roads in Purba Medinipur District of West Bengal. During the study period (May 2021 – April 2022), 623 snakes had been killed by vehicles.9 species and 4 families had been recorded. Non-poisonous snakes were more abundant. A peak was noticed between June – August. Identification of 43 snakes was impossible due to severe disintegration of the body. Dec- Feb showed the lowest mortality due to the brumation behavior in snakes when they rarely come out into open areas like roads. A positive correlation was found between traffic load on each road and the mortality rate of snakes which seemed to be increased with increasing traffic load. To prevent biodiversity decline through loss of serpent lives, measures like speed restrictions, speed breakers, creating awareness among drivers about the role of snakes in the ecosystem, etc. may be adopted.

Keywords: Snakes, road killing, traffic load, relationship, biodiversity depletion.

I. INTRODUCTION

Roads are important for communication between people living in various regions of a landscape. Snakes also use roads to cross between different habitats or migrate from one area of the ecosystem to another area. Snakes use roads for thermoregulation and their slow movement accounts for their high mortality as vehicles run over them **[1]**. Slow-moving animals like reptiles have limited dispersal ability **[2]**. With increasing urbanization, more and more roads have been constructed or widening or modifications of the previous roads have been done to connect various regions. The number of vehicles on road has also increased. Thus, it becomes a major factor for mortality in vertebrates including reptiles.

In India, few attempts had been made to assess the road killing of the animal issue **[3, 4, 5]**. No study was carried out previously in Purba Medinipur District of West Bengal regarding the issue. In the current study, it was attempted to assess road mortality of snakes and its relationship with traffic load on three selected roads of Ramnagar-I, II, and Contai-I block of Purba Medinipur District of West Bengal.

II. OBJECTIVES

The objectives of the current study are-

- To measure the average number and types of vehicles on selected roads.
- To assess the number of snakes killed by vehicles on selected roads.
- To assess the effect of these incidents on biodiversity.
- To find out the relationship between traffic load and snake mortality rate.

III. MATERIALS AND METHODS

A. Study area: - Three roads had been selected for the study purpose. The first one was between Contai central bus stand ($21^0$46 '35.3" N $87^0$44'03.4" E) and Depal Hat ($21^0$43'57" N $87^0$32'56" E) via Mazna and was considered as Road –A. The second one was between Ramnagar bus stand ($21^0$40 '41" N $87^0$33'49" E) and Depal Hat ($21^0$43'57" N 87^0 32'56" E) and was considered as Road –B. The third one was between Giri More ($21^0$43'35.1" N $87^0$33'02.4" E) and Mirgoda Ganza ($21^0$43'02.3" N $87^0$29'10.5" E) and was considered Road-C. Some part of Road –A is in Contai-I block and others in Ramnagar-II whereas Road –B & C were situated in both Ramnagar –I &II blocks in Purba Medinipur District of West Bengal.

Both sides of Road-A were occupied mainly by cashew plants, Eucalyptus plants, and Acacia plants, and some agricultural fields were also there. Some part of it was in the semi-urban area and some in the rural area. Road –B was in the semi-urban area. Some agricultural lands, culverts, water channels, water bodies, houses, shops, etc. were there on both sides of the road. Road –C was completely in the rural area and mainly forest area and sand dunes covered both sides of the road.

1. ***Location map of study area:***

Fig: Road - A, B, C

Fig: Road - A

Fig: Road - B & C

B. Study Period: - The study was conducted from 1st May 2021 to 30th April 2022.
C. Study Design: - An observational study approach had been taken.
D. Data Collection: - Road –A was visited on Monday, Wednesday, and Friday whereas Roads –B &C were on Tuesday, Thursday and Saturday every week. Road –A was 21 Km long and 20ft wide, Road –B was 6.2 Km long, 22 ft wide and Road- C was 8.1 Km long,12.5 ft wide. A motorbike was used for observing dead specimens. The roads were visited once between 5:30 am -7:30 am (7:30 am- 9:30 am on winter days) and a second time between 4-6 pm (3-5 pm on winter days). For better observation of road-killed snake specimens, the speed of the bike was restricted to between 20-25 Km/hour. Android mobile phone was used to take photos of the specimens. Information such as TL of the snake, name of the place where the specimen was observed, the habitation of the nearest place, sex of the specimen, etc. was enlisted **[6]**. Most of the run-over specimens were identified but some remained unidentified for their bad body conditions. Observed specimens were removed as soon as possible to avoid repeated counting. By observing the body and blood condition etc. the specimens had been categorized as fresh and old. The information regarding the approximate time (whether day or night) of killing was also enlisted. Information regarding types and number of vehicles on each selected road had also been gathered.
E. Data Analysis: - Statistical analysis to obtain frequencies, percentages, one-way ANOVA, pie or bar diagram, etc. was done by MS Excel.

IV. RESULTS & DISCUSSION

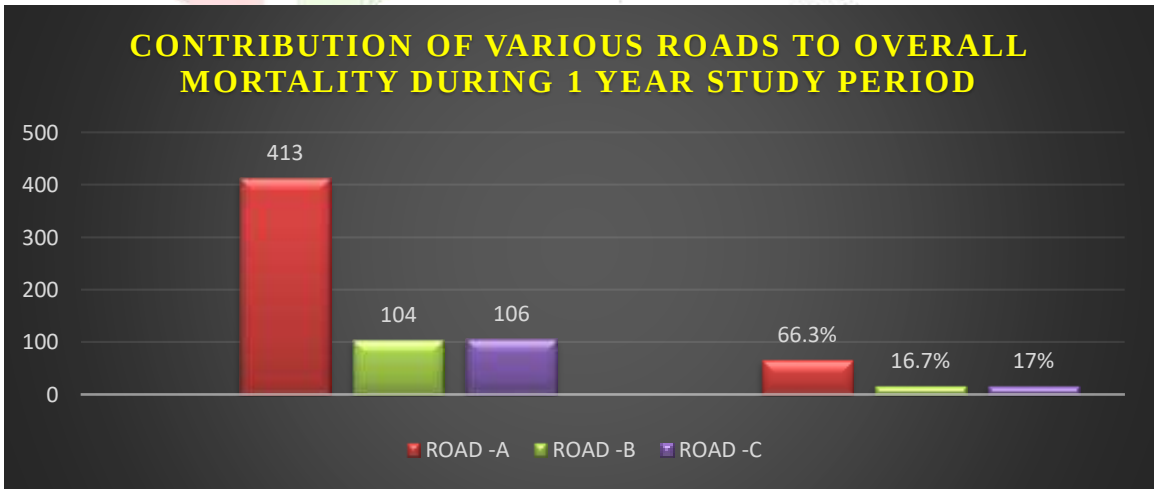
4.1 Result:

During the study period, 623 snakes had been killed, i.e., every month about 52 snakes had been smashed by vehicles. Road –A contributed 66.3%, Road –B 16.7%, and Road -C 17% of the total road-killed snakes during the study.

Table 4.1: Mortality number on various roads

NAME OF ROAD	NUMBER OF MORTALITY	% OF MORTALITY
ROAD -A	413	66.3
ROAD -B	104	16.7
ROAD -C	106	17

Graph 4.1: Contribution of various roads to overall mortality during study period



On Road-A, 9 species of snakes, on Road-B 7 species, and on Road-C 8 species of snakes were found to be dead. On Road-A, Amphiesma stolatum was the species with the highest mortality(n=124). On Road-B, Xenochrophis

piscator was found more frequently as a dead specimen (n=45) whereas Daboia russelii was most dominant (n=25) among observed killed specimens on Road –C.

Table 4.2: Number of road killed snakes observed on road -A

NUMBER OF OBSERVATIONS ON ROAD -A													
NAME OF SNAKE	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	TOTAL
Xenochrophis piscator	5	4	5	3	3	4	1	0	0	0	2	4	31
Enhydris enhydris	6	6	8	7	5	5	2	3	1	2	3	6	54
Amphiesma stolatum	10	13	16	15	14	11	11	7	5	4	8	10	124
Bungarus caeruleus	4	4	5	4	3	3	2	1	1	0	1	3	31
Ahaetulla nasuta	6	7	10	7	7	6	5	2	2	1	4	6	63
Daboia russelii	3	2	3	4	3	3	2	0	0	0	2	2	24
Lycodon aulicus	4	6	7	4	4	4	5	1	1	1	3	5	45
Oligodon arnensis	3	2	4	3	3	2	2	1	1	1	2	3	27
Naja kaouthia	1	1	2	3	2	3	0	0	0	0	1	1	14
TOTAL	42	45	60	50	44	41	30	15	11	09	26	40	413

Graph 4.2: Road – A month wise mortality number

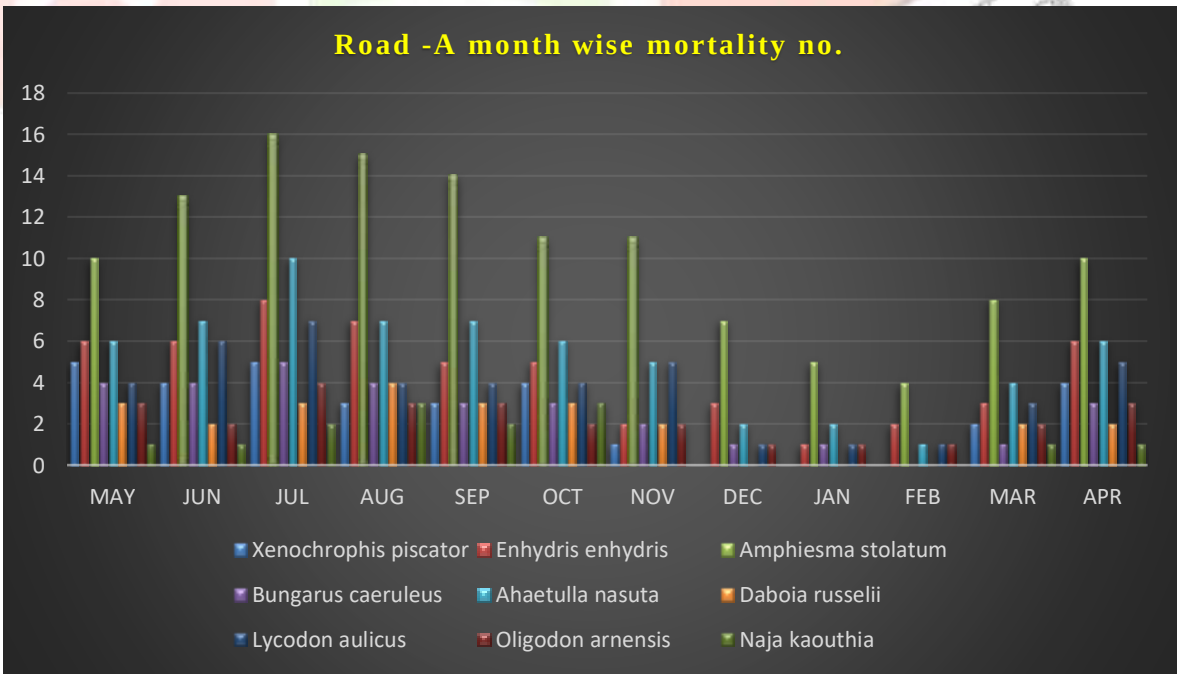


Table 4.3: Number of road killed snakes observed on road -B

NUMBER OF OBSERVATIONS ON ROAD -B													
NAME OF SNAKE	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	TOTAL
Xenochrophis piscator	4	6	9	8	3	4	4	1	1	0	2	3	45
Enhydris enhydris	1	2	2	3	3	0	1	0	0	0	1	1	14
Amphiesma stolatum	2	1	2	2	1	2	1	1	0	1	0	1	14
Bungarus caeruleus	0	2	2	0	1	1	0	0	0	0	0	0	06
Daboia russelii	1	0	1	0	2	0	0	0	0	0	0	1	05
Lycodon aulicus	1	2	3	2	2	2	2	1	0	0	1	1	17
Naja kaouthia	0	1	1	0	1	0	0	0	0	0	0	0	03
TOTAL	9	14	20	15	13	09	08	3	1	1	4	7	104

Graph 4.3: Road – B month wise mortality number

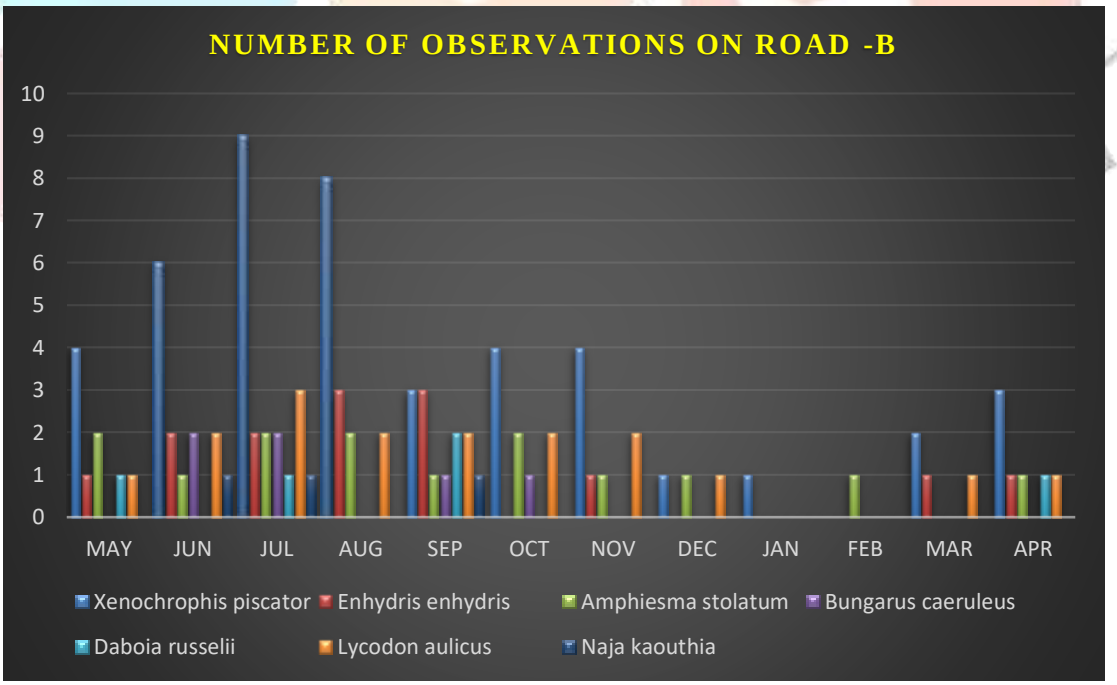
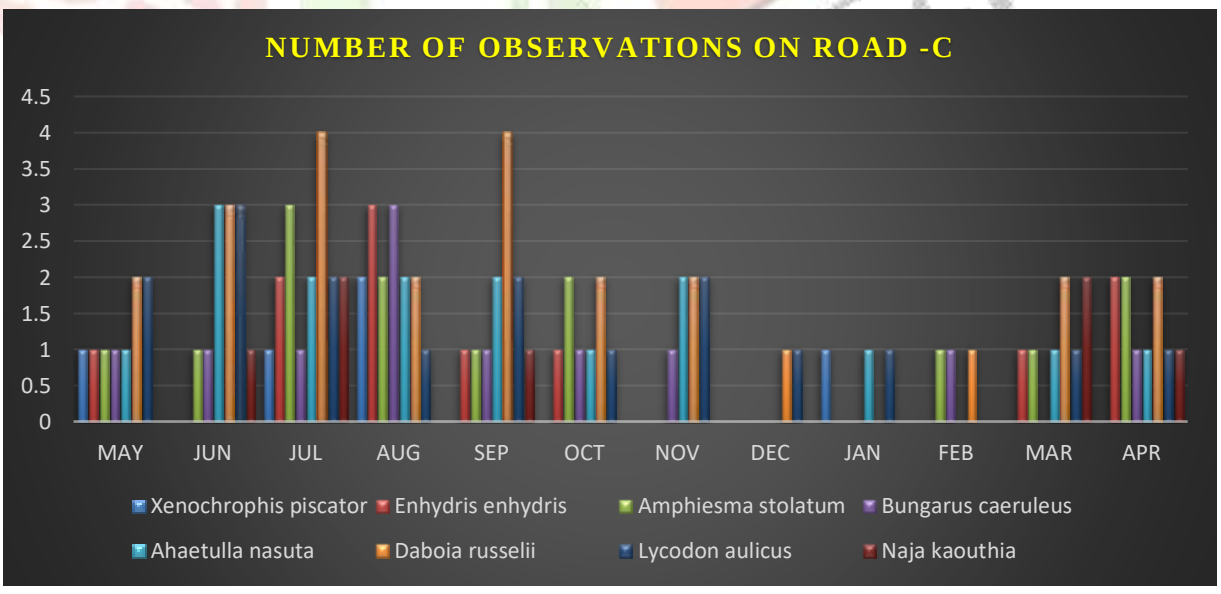


Table 4.4: Number of road killed snakes observed on road - C

NUMBER OF OBSERVATIONS ON ROAD -C													
NAME OF SNAKE	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	TOTAL
Xenochrophis piscator	1	0	1	2	0	0	0	0	1	0	0	0	5
Enhydris enhydris	1	0	2	3	1	1	0	0	0	0	1	2	11
Amphiesma stolatum	1	1	3	2	1	2	0	0	0	1	1	2	14
Bungarus caeruleus	1	1	1	3	1	1	1	0	0	1	0	1	11
Ahaetulla nasuta	1	3	2	2	2	1	2	0	1	0	1	1	16
Daboia russelii	2	3	4	2	4	2	2	1	0	1	2	2	25
Lycodon aulicus	2	3	2	1	2	1	2	1	1	0	1	1	17
Naja kaouthia	0	1	2	0	1	0	0	0	0	0	2	1	7
TOTAL	9	12	17	15	12	8	7	2	3	3	8	10	106

Graph 4.4: Road – C month wise mortality number

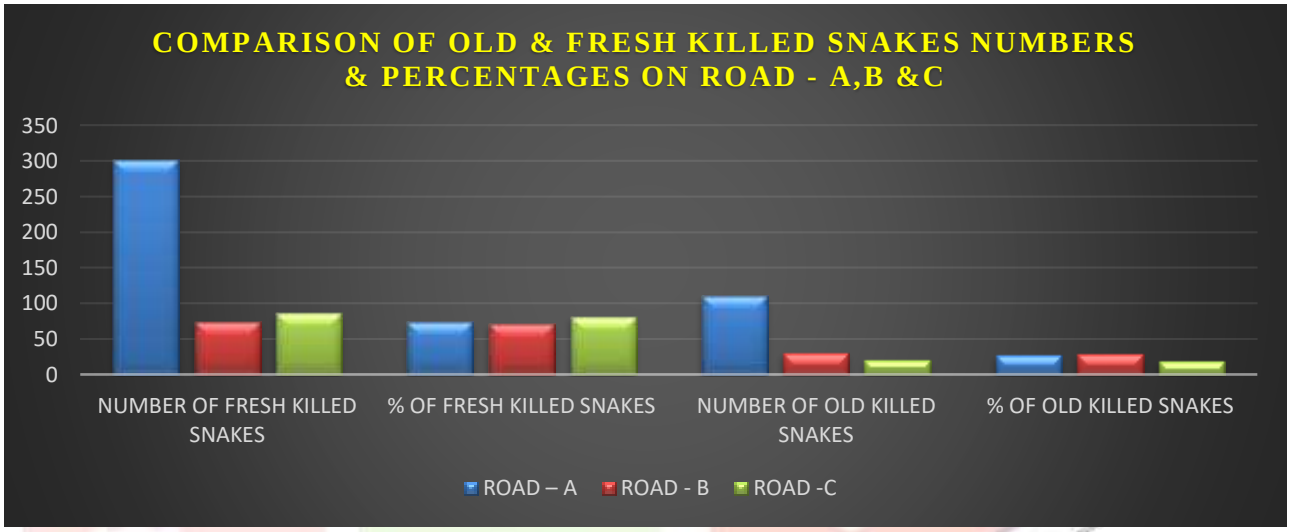


Number of freshly killed specimens was 302, 74, and 86 for Roads – A, B & C respectively whereas the number of old specimens was 111, 30 & 20 respectively.

Table 4.5: Showing Numbers & Percentages of Old & Fresh Killed Specimens on Road – A, B & C

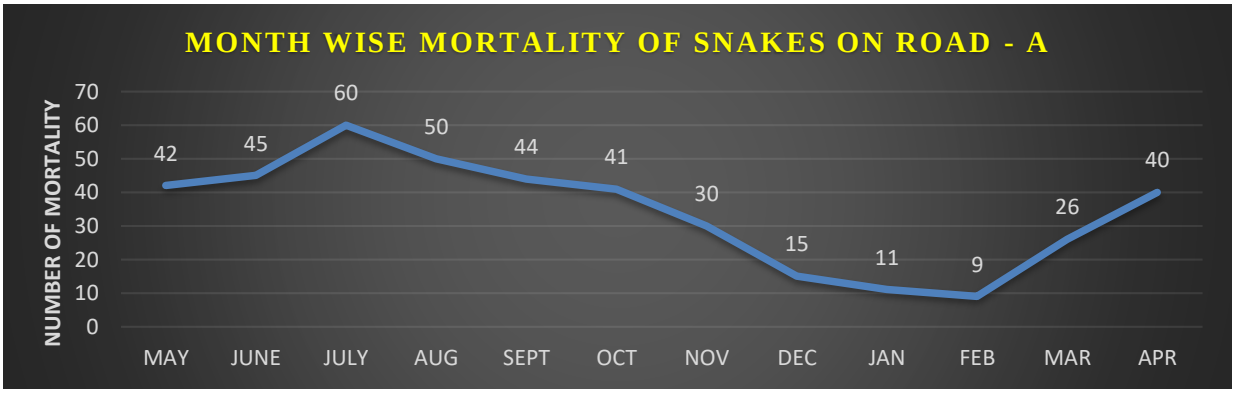
	ROAD – A	ROAD - B	ROAD -C
Number of fresh killed snakes	302	74	86
% of fresh killed snakes	73.1 %	71.2 %	81.1 %
number of old killed snakes	111	30	20
% of old killed snakes	26.9 %	28.8 %	18.9 %

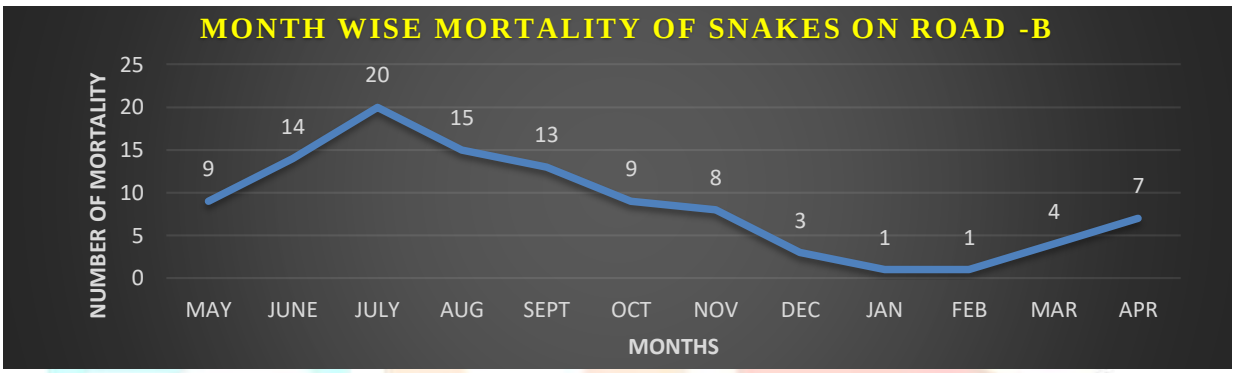
Graph 4.5: Fresh killed vs. old killed snake numbers

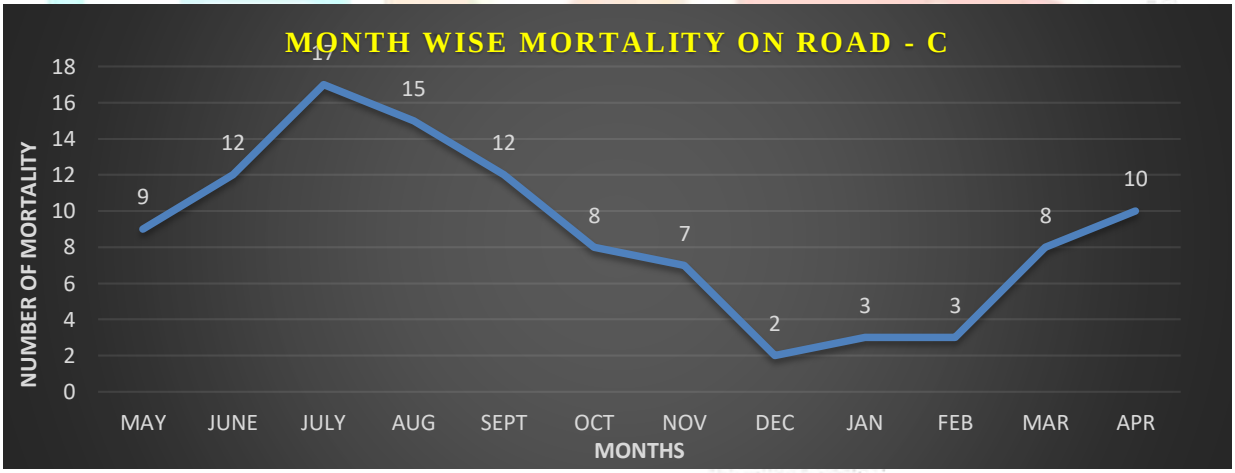


In all three selected roads, the maximum number of mortalities was observed in the month of June, July, and August.

Graph 4.6: Month wise killed snake numbers







Among the three roads, the mortality rate was higher on Road – A (MR =0.14) & lowest on Road –C (MR=0.09). Of all observed snakes only in 38% of cases, the sex of the specimen had been identified. There were 43 dead snakes where identification was not possible. The average number of vehicles /day on Road-A, B & C were 5439, 5197 & 3122 respectively.

With the use of one-way ANOVA, the F value had been calculated to find out if there was any significant difference between the group means of road-killed snakes mortality number in 3 selected roads.

Table 4.6: Snake Morphology, habitation relation with probable killing time

SL. No.	Name of snakes		Family	Mean Total Length (TL) in mm	Adjacent Habitation of the Killing spot	Probable killing time
	Scientific name	Local name				
1.	*Xenochrophis piscator*	Joldhora	Colubridae	1620	AB, FA	D
2.	*Amphiesma stolatum*	Hele or halhale sanp	Colubridae	550	GA, FA	D
3.	*Ahaetulla nasuta*	Laudoga	Colubridae	1524	FA	D
4.	*Lycodon aulicus*	Chiti	Colubridae	480	UA, FA, SA	D, N
5.	*Oligodon arnensis*	Udoykal	Colubridae	572	SA, FA	D, N
6.	*Enhydris enhydris*	Metuli	Homalopsidae	495	GA, AB	D
7.	*Bungarus caeruleus*	Kalach or Kalchiti	Elapidae	1310	SA, FA	N
8.	*Naja kaouthia*	Keute	Elapidae	1670	AA, GA, FA	D, N
9.	*Daboia russelii*	Chandrobora	Viperidae	432	SA, AA, FA	D, N

AB=Aquatic Body, FA=Forest Area, GA= Grassland Area, UA= Urban Area, SA= Sandy Area, AA= Agriculture Area. D= Day time, N= Night time.

During road survey some photos of dead snakes

A

B

C

D

E

F

Some of the road-killed snakes observed during study period: *A) Ahaetulla nasuta,B) Amphiesma stolatum, C) Lycodon aulicus, D) Enhydris enhydris, E) Daboia russelii, F) Unidentified species*

4.2 Discussion: A total of 623 road-killed snakes belonging to four families and nine species, were observed during the study period. Colubridae was the dominant family with five species, Elapidae with two, and Homalopsidae & Viperidae with one species each.

More number and species of dead snakes were observed on Road-A (n=413, species=9) than Road-B (n=104, species=7) & Road-C (n=106, species=8). The mortality rate (MR) was calculated **[7]** as (number of dead specimens observed)/ (total Km per survey)/ (number of the survey during the total study period). For Road-A, it was 0.14 [413/21/(12x12)], for Road-B 0.12 [104/6.2/(12x12)] & for Road-C, it was 0.09 [106/8.1/(12x12)]. The highest MR in Road –A, may be attributed to the diverse habitat on both sides of the road, high traffic load (5439 vehicles/day), wide road (20ft), and ignorance among drivers. The lowest MR in Road-C may be due to the very low traffic load (3122 vehicles/ day), narrow road(12.5ft) & its position in totally rural areas where only small vehicles with low speed were observed.
In 62% of cases, the sex of the specimens was not possible to detect because the lower body parts were badly damaged by vehicles. During the study period, 43 dead snakes were observed but identification was not possible as their bodies were disintegrated very poorly.

June, July and August constituted the highest % of mortalities (Road-A: 10.9% ,14.5% ,12.1%; Road-B: 13.5%, 19.2%, 14.4%; Road-C: 11.3% ,16% ,14.2%), as these months corresponds to rainy season. There was greater mortality in reptiles during the rainy season than in summer due to their slow movement **[8]**. The current study

also supported that. The mortality in snakes caused by moving vehicles might be due to their thermoregulating behavior **[1,4]**.

Lowest mortalities observed during December, January and February (Road-A: 3.6% ,2.7% ,2.2%; Road-B: 2.9% ,1% ,1%; Road-C: 1.9%, 2.8%, 2.8%), may be co related with the fact that snakes enter brumation period during these months.

From the study, it had been found that motorbikes, machine vans, private cars, auto-rickshaws, pickup vans, tractors, dumpers, and trucks were the vehicles operated on Road-A. On Road- B, motorbikes, private cars, trackers, pickup vans, machine vans, auto-rickshaws, buses, dumpers, and trucks were seen. But on Road-C, only small vehicles like motorbikes, auto-rickshaws, machine vans, private cars, etc. were observed. The number of vehicles observed per day was 5439, 5197 &3122 for Road-A, and B&C respectively. The high traffic load on Road –A contributed to its high MR (0.14) & Road- C with the lowest traffic load had the lowest MR (0.09).

High percentages of fresh-killed specimens were observed (Road-A: 73.1%, Road-B: 71.2%, Road-C: 81.1%) which might be due to observation every alternate day.

As the computed F (5.860744) exceeds the critical F value (3.4668), there is a statistically significant difference between the group means of road-killed snake mortality number on Road -A, Road-B & Road-C.

V. CONCLUSION

Undoubtedly, the observed number of snakes killed by vehicles is lower than the actual number because scavengers, greater traffic load & other forces eliminate or demolish run-over organisms within a day **[9,10,11]**. The study revealed that 623 snakes had been killed by vehicles during the study period among which the number & variety of non-poisonous snakes were much higher than poisonous snakes. It's a huge number& the biodiversity of the area is declining day by day. It will have a detrimental effect on the food chain & the balance of the ecosystem will be disturbed. Various measures like creating speed breakers, restricting speed limits below 40Km/hour, using signposts, spreading awareness among drivers about the importance & role of snakes in the ecosystem, taking legal actions against rash driving, etc. should be taken to avoid further loss of snake lives as well as biodiversity.

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