



A Study to Evaluate Diversity, Species Richness & Evenness of Ophio-fauna and their IUCN status in Ramnagar Area in Purba Medinipur, West Bengal

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Abstract: Ophio-faunal diversity and composition in the Ramnagar area of Purba Medinipur District in West Bengal were studied through a survey from 1.4.2022 to 31.3.2023. 4887 snakes (19 species) had been reported to have been observed by local people and staff of the forest department. Rat snakes were mostly observed, and king cobras were the least observed snakes. The diversity index of snake fauna was 2.6, species richness was 2.12, and species evenness was 0.88.

Keywords: Ophio-fauna Diversity, Species richness, Evenness, IUCN

I. INTRODUCTION

Ramnagar area is situated in Purba Medinipur District of West Bengal. Its geographical co-ordinates are 21⁰41'0" N and 87⁰33'0"E. It includes variety of habitats. Some part of it is in coastal area (Bay of Bengal). Agricultural lands, forest area, sand dunes, water channels, swamps etc. also represent various habitats. Most part of Ramnagar contains rural villages but some urban areas are also there. Due to developmental works and increasing urbanization process, natural habitats of other fauna is being destroyed day by day. Like others, ophio-fauna is also being affected by the modernization. Loss of habitat, habitat fragmentation, decrease in prey population etc. are putting pressure on their survival rate.

Snakes belong to sub order Ophidia and order Squamata. Around the globe 26 snake families and 3619 snake species had been reported [1]. 279 species of snakes are present in India [2]. Although majority of people suffer from ophiophobia but this fauna has important role in environment also. They maintain ecological balance and they are key component of food web [3]. Rodent pests are controlled by snake populations [4, 5]. Snakes are highest predator in reptile world, so continuity of their population is important for ecosystem to function smoothly [6]. They are chief source for preparation of life saving antivenom. So, evaluation of their diversity, composition etc. occasionally is very necessary.

II. OBJECTIVES

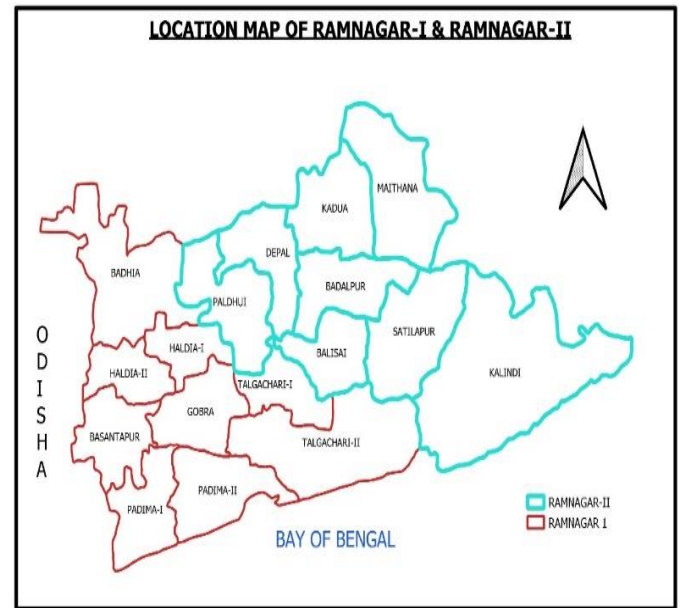
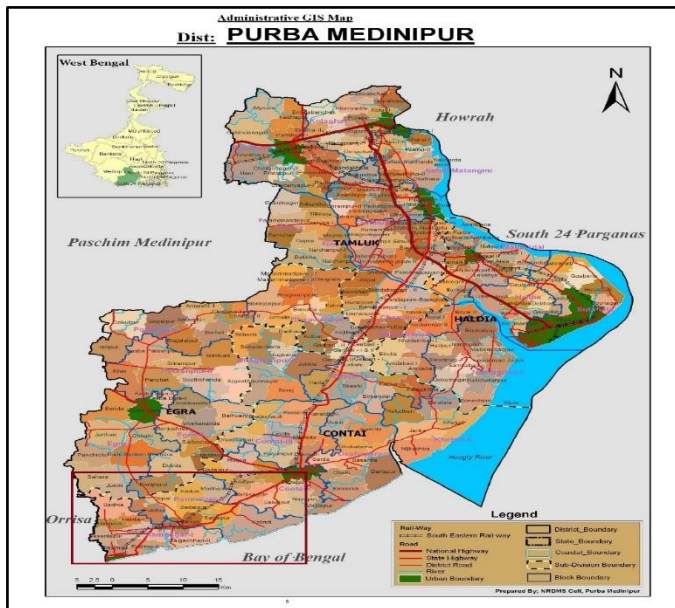
The objectives of this particular study includes-

- Estimation of ophio-faunal diversity.
- Evaluation of species richness.
- Evaluation of evenness of species.

III. MATERIALS AND METHODS

A. Study Area: -Ramnagar includes Ramnagar -1 & 2 blocks with a total 302.7 Km² area and 323384 population (according to Census,2011).It has a total 17 Gram panchayets (GPs). It harbours both urban and rural (maximum) areas. It is about 180 km from Kolkata, West Bengal's capital city.

1. Location map of study area:



B. Study Period: -The survey was carried out between 1st April, 2022 to 31st March, 2023.

C. Data Collection: - Interview mode of data collection was employed. A questionnaire was prepared to gather information from respondents about the types of snake they observed during the study period. Coloured photographs of various snakes were shown to them which helped them recognize the snake properly. Thousand respondents from various parts of the study area were selected randomly. Respondents included both local people and staffs of Forest Department.

D. Data Analysis: - Key to Indian Snakes [7, 8, 9, 10] had been used for better identification. MS-Words and MS-Excel used for data analysis and preparation of pie, bar diagrams etc.

3.1 Diversity measurement: For measurement of diversity, Shannon index and Simpson index are calculated here.

$$\text{Shannon Index or } H = - \sum P_i \ln P_i$$

P_i equals to n/N , where-

n denotes number of individuals of a species

N denotes number of all individuals of all the species

$$\text{Simpson Index or } D = 1 / \left\{ \sum \left(\frac{n(n-1)}{N(N-1)} \right) \right\}$$

3.2 Species Richness measurement: For calculating species richness, Margalef's index is used here.

$$\text{Margalef Index} = (S-1) / \ln(N)$$

S denotes total number of species

3.3 Species Evenness measurement: For estimating species, evenness in the area Shannon Equitability Index (E_H) is calculated.

$$E_H = H / \ln(K)$$

K denotes number of species

IV. RESULT & DISCUSSION

4.1 Result:

Table 4.1: The Calculation of Shannon & Simpson Index

Serial No.	Name of snakes	Number/frequency of observation(n)	Pi	InPi	Pi InPi	n(n-1)
1.	<i>Lycodon aulicus</i>	501	0.10	-2.30	-0.23	250500
2.	<i>Bungarus caeruleus</i>	399	0.08	-2.53	-0.20	158802
3.	<i>Daboia russelii</i>	530	0.11	-2.21	-0.24	280370
4.	<i>Naja naja</i>	101	0.02	-3.91	-0.08	10100
5.	<i>Ahaetulla nasuta</i>	401	0.08	-2.53	-0.20	160400
6.	<i>Amphiesma stolatum</i>	391	0.08	-2.53	-0.20	152490
7.	<i>Enhydris enhydris</i>	512	0.10	-2.30	-0.23	261632
8.	<i>Xenochrophis piscator</i>	440	0.09	-2.41	-0.22	193160
9.	<i>Ptyas mucosa</i>	702	0.14	-1.97	-0.28	492102
10.	<i>Indotyphlops braminus</i>	75	0.02	-3.91	-0.08	5550
11.	<i>Naja kaouthia</i>	320	0.07	-2.66	-0.19	102080
12.	<i>Coelognathus flavolineatus</i>	223	0.05	-2.99	-0.15	49506
13.	<i>Ophiophagus hannah</i>	13	0.003	-5.81	-0.02	156
14.	<i>Bungarus fasciatus</i>	14	0.003	-5.81	-0.02	182
15.	<i>Dendrelaphis tristis</i>	85	0.02	-3.91	-0.08	7140
16.	<i>Eryx johnii</i>	23	0.005	-5.30	-0.03	506
17.	<i>Cerberus rhynchops</i>	16	0.003	-5.81	-0.02	240
18.	<i>Chrysopelea ornate</i>	76	0.02	-3.91	-0.08	5700
19.	<i>Oligodon arnensis</i>	65	0.01	-4.61	-0.05	4160

Total frequency of observation(n)	H(Shannon Index)	D (Simpson Index)
4887	0.88	0.911

$$H \text{ (Shannon Index)} = -\sum P_i \times \ln P_i = -(-2.6) = 2.6$$

$$\text{Shannon equitability index or } E_H = H / \ln(K)$$

$$= 2.6 / \ln(19)$$

$$= 2.6 / 2.94$$

$$= 0.88$$

As the calculated value of E_H is close to 1, so it indicates that all the species are almost evenly distributed. High value of H also suggests high species diversity of poisonous and non poisonous snakes within the study area.

D (Simpson Index)

$$= 1 - \frac{1}{\sum n(n-1)/N(N-1)}$$

$$= 1 - 0.089$$

$$= 0.911$$

As the D value is close to 1, it is an indication of diversity of species in high number in Ramnagar -1 and 2 block.

Graph 4.1: Species composition and relative abundance of snake species in Ramnagar surrounding

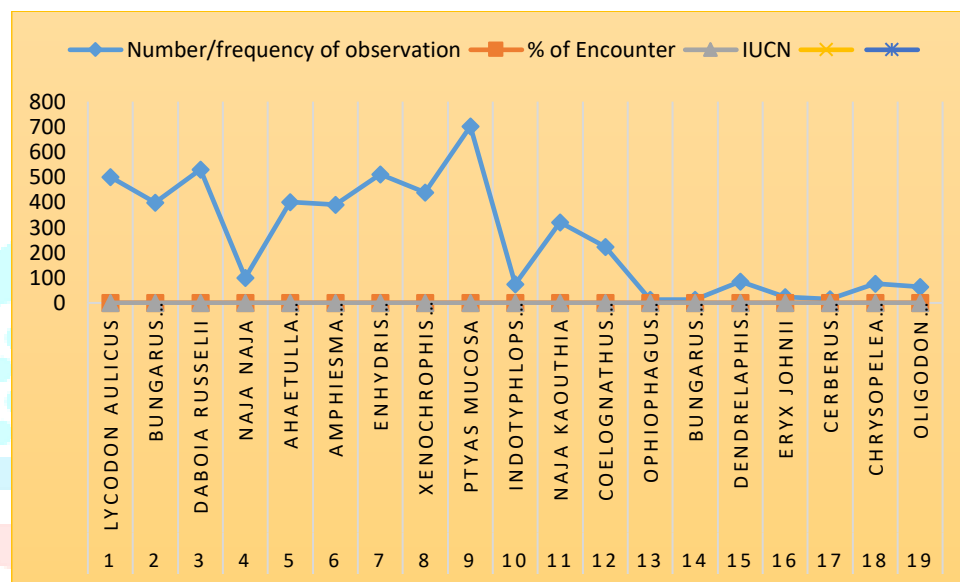


Table 4.2: Total number of Snake and IUCN CATEGORY observed during the study

Serial No.	Name of snakes	Number/frequency of observation	% of Encounter	IUCN	
1.	<i>Lycodon aulicus</i>	501	50.1%	LC	↑
2.	<i>Bungarus caeruleus</i>	399	39.9%	LC	↑
3.	<i>Daboia russelii</i>	530	53%	LC	↑
4.	<i>Naja naja</i>	101	10.1%	LC	↓
5.	<i>Ahaetulla nasuta</i>	401	40.1%	LC	↑
6.	<i>Amphiesma stolatum</i>	391	39.1%	LC	↑
7.	<i>Enhydris enhydris</i>	512	51.2%	LC	↑
8.	<i>Xenochrophis piscator</i>	440	44.0%	LC	↑
9.	<i>Ptyas mucosa</i>	702	70.2%	LC	↑
10.	<i>Indotyphlops braminus</i>	75	7.5%	LC	↓
11.	<i>Naja kaouthia</i>	320	32.0%	LC	↑
12.	<i>Coelognathus flavolineatus</i>	223	22.3%	LC	↑
13.	<i>Ophiophagus hannah</i>	13	1.3%	VU	↓

14.	<i>Bungarus fasciatus</i>	14	1.4%	LC	↓
15.	<i>Dendrelaphis tristis</i>	85	8.5%	LC	↓
16.	<i>Eryx johnii</i>	23	2.3%	NT	↓
17.	<i>Cerberus rhynchops</i>	16	1.6%	LC	↓
18.	<i>Chrysopelea ornata</i>	76	7.6%	LC	↓
19.	<i>Oligodon arnensis</i>	65	6.5%	LC	↓

[IUCN Category according to <https://www.iucnredlist.org> (2023); indicate decrease ↓ , increase of snake species ↑] [VU- Vulnerable, LC - Least Concern, NT- Near Threatened]

Graph 4.2: IUCN CATAGORY present status In Ramnagar surrounding

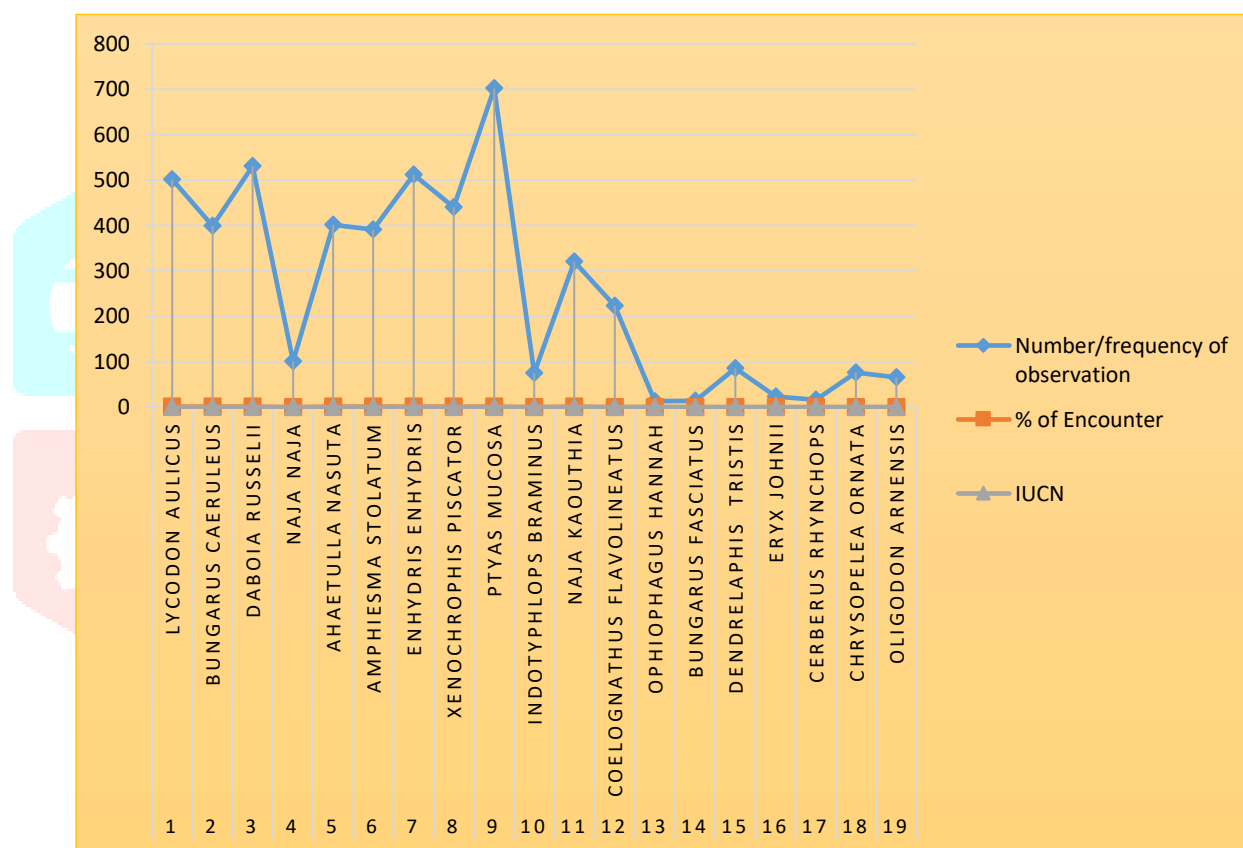


Fig 4.3: During Survey some snake species observed



A



B



C



D



E



F



G



H



I

[A: *Ahaetulla nasuta*; B: *Bungarus caeruleus*; C: *Coelognathus*; D: *Enhydryis enhydryis*; E: *Amphiesma stolatum*; F: *Indotyphlops braminus*; G: *Naja kaouthia*, H: *Vipera russelli*, I: *Ptyas mucosa*]

4.2 Discussion

During the study period, a total of 4887 snakes belonging to 19 different species were reported. Among 19 species, 6 were venomous, 2 were mildly venomous, and 11 were non-venomous. *Daboia russelii* was the most abundant (53%) venomous snake, and *Ophiophagus hannah* was the least observed (1.3%) venomous snake. But in the case of non-venomous species, *Ptyas mucosa* and *Eryx johnii* were the most abundant (70.2%) and least abundant (2.3%) species, respectively. The Shannon index ($H = 2.6$) and Simpson index ($D = 0.911$) for ophio-faunal diversity in the Ramnagar region give an indication of high species diversity. EH value (0.88 in this region) also suggests even distribution of various species. Margalef's index (for species richness) value is 2.12, which also supports the presence of various species within the study area. The presence of high diversity of ophio-fauna in Ramnagar region may be attributed to its rich floral diversity, presence of small water channels and swamps, appropriate temperature and rainfall, etc., which govern the growth and survival of their prey populations. Humidity, leaf litter, soil, debris, etc. are vital factors that may influence ophio-faunal diversity [11]. Due to the conservation of forest cover, the faunal diversity has increased in the Nilgiri Biosphere Reserve [12]. For the existence of endemic species within an area, monitoring of ecological processes from time to time and suitable conservation methods should be adopted to protect its rich genetic diversity [13].

The research data suggests majority of species present within study site are in LC category according to IUCN. But two species like *Ophiophagus hannah* and *Eryx johnii* remain in VU & NT category respectively. A species in VU category is one which may become extinct from that area very soon. King cobras mainly

found to be inhabited in bamboo thickets, dry leaf litters, swamps, near ponds or river embankments etc. From this research, it has been seen that various anthropogenic activities remain a threat for maintenance of natural habitat for various species of this area. Therefore, this species is no exception. Deforestation, cutting of bamboo trees, filling up of small ponds etc. are disturbing their habitat, natural growth & reproduction which in turn causing their decline in this area. If this trend continues, then this species will surely be elevated to the extinct category.

Although *Eryx johnii* is currently in NT category i.e. may become threatened in near future & requires immediate conservation measures to be taken in this area. It is a burrowing species living preferentially in loose sandy region. But its natural habitat is getting excavated enormously for using sand for filling up low land areas in other places. This kind of man made disturbances should be prevented for survival & healthy growth of this species.

Species like *Oligodon arnensis*, *Chrysopelea ornata*, *Cerberus rhynchops*, *Dendralaphis tristis*, *Bungarus fasciatus*, *Indotyphlops braminus* are in the LC category but data suggests their population decline in this area. Loss of habitat, habitat fragmentation, road-killing, lack of prey population, new construction works, indiscriminate killing by humans etc. are the factors that are hurting them more than others and causing decrease in their population. That's why various conservation strategies should be implemented in this region straightaway.

V. CONCLUSION

Although data suggests rich ophiofaunal diversity within the study area but some causes of concern are also there. Increasing anthropogenic activities are the major worries for survival and growth of snake population and also their prey population. Overgrazing by cattles, habitat fragmentation, expansion of agricultural lands, widening of previous roads & establishment of new ones, sand mining, urbanization etc. are decreasing the natural habitats of snakes. As a result human-snake encounter incidences are increasing which may increase mortality of both the populations [14]. Road killing is also a chief cause of possible decline in snake population.

So, it may be concluded that, to maintain healthy ophiofaunal diversity, time to time monitoring of different parameters for survival and conservation management strategies should be taken. Awareness programs and education of common people also have a vital role in preventing diversity loss.

REFERENCES

1. Uetz, P. & J. Hosek. eds. The Reptile Database, 2016. <http://www.reptiledatabase.org/db-info/SpeciesStat.html>.
2. Aengals, RV, Satish, M. and Palot, M.J. Updated checklist of Indian reptiles. Zoological Survey of India, 2011.
3. Manhas, A., Raina, R. and Wanganeo, A. Current status and Diversity of Ophidians (Reptilia: Squamata: Serpents) in Bhopal, Madhya Pradesh, central India. Int.J.Curr.Microbiol.App.Sci.6(5): 1384-1390, 2017.
4. Fitch, H. Study of Snake Populations in Central California, American Midland Naturalist, 41: 513-579, 1949.
5. Gibbons, J., The management of reptiles, amphibians and small mammals in North America: the need for an environmental attitude adjustment, U.S. Department of Agriculture, Forest Service, GTRRM-166, 1988.
6. Reading, C.J., Luiselli, L.M., Akani, G.C., Bonnet, X., Amori, G., Ballouard, J.M., Filippi, E., Naulleau, G., Pearson, D. and Rugiero, L. Are Snake Populations in widespread Decline? Biol. Lett., 1-4, 2010.
7. Whitaker, R. and Captain, A., Snakes of India, The Field Guide.p. 385. 1st Ed., Draco Books, Chengalpet, 2008.
8. Dutta, S.K., Nair, M.V., Mohapatra, P.P., and Mohapatra, A.K. Amphibians and Reptiles of Similipal Biosphere Reserve, Pp.7-8. Regional Plant Resource Center, Bhubaneswar, Orissa, 2009.
9. Whitaker, R. Common Indian Snakes, A Field Guide. pp. 138. Revised Ed. Macmillan India Ltd., New Delhi, 2006.
10. Dutta, S.K. and Acharjyo, L.N. Herpetofaunal resources and their conservation in Orissa, India. Zoos' Print 10(7): 5-8, 1995.
11. Faccio, S. Biological inventory of amphibians and reptiles at the Marsh- Billing- Rockfeller, National Historical Park and adjacent lands. Technical Report NPS/NER/NRTR-2005/008, National Park Service, Wood Stock, VT, 2001.

12. Larsen, T. B., 1987. The butterflies of the Nilgiri mountains of south India (Lepidoptera: biological diversity). US Government Printing Office, Washington DC.
13. Mathew, G. and V. K. Rahamathulla, 1993. Bio-diversity in the Western Ghats- a study with reference to Moths (Lepidoptera: Heterocera) in the Silent Valley National Park, India. Entomon.,20(2): 25-33.
14. Das, A. 2008. Diversity and Distribution of Herpetofauna and Evaluation Conservation Status in Barail Hill Range (Including Barail Wildlife Sanctuary), Assam, Northeast India. Final Report.Aaranyak. Guwahati. 94 pp.

