Conservation status of Reptilia in Agasthyamalai Biosphere Reserve, Western Ghats, India and its environment

Abstract

The Agasthyamalai Biosphere Reserve is an important biogeographical hot spot and hosts diverse ecosystem in its habitat. The objectives of the present study are to assess conservation status of Reptilia in Agasthyamalai Biosphere Reserve and to know the role of habitat in harbouring and conserving/protecting wild fauna. Day time opportunistic visual encounter survey method was employed to study and site different species of Reptiles. There are about 78 species of reptiles inhabited in the reserve, out of which 15 species are threatened as per IUCN, 2023 The reserve harbors three species of turtle and tortoises, 31 species of lizards under five families and 44 species of snakes under six families. There are about 37 species of reptiles which are endemic in the region comprises one species of *Geoemydidae*, six species of *Gekkonidae*, eight species of *Agamidae*, two species of *Scincidae*, seven species of *Uropeltidae*, eight species of *Colubridae*, one species of *Pareidae*, one species of *Elapidae* and three species of *Viperidae*.

Keywords: Agasthyamalai, Conservation, Endangered, Reptilia, Species.

Introduction

Agasthyamalai Biosphere Reserve is one of the rich faunal and floral assemblage in India covering an area of 3,500 km^2 of which 1,672.36 km^2 is in Tamil Nadu and the rest (1,827.64 km^2) in Kerala.. Pathanamthitta, Kollam and Thiruvananthapuram Districts in Kerala and Tirunelveli and Kanyakumari Districts in Tamil Nadu are the overall boundary of the reserve . The reserve lies Between 8° 8' to 9° 10' North Latitude and 76° 52' to 77° 34' East Longitude. Central location is 8°39′N 77°13′E . It comprises many wildlife sanctuaries namely Neyyar, Peppara and Shendurney and their adjoining areas are Achencoil, Thenmala, Konni, Punalur, in addition Thiruvananthapuram and Agasthyavanam are some special division in Kerala Henry et al.[7], Dutta et al.[5]. The famous tiger reserve Kalakkad Mundnthurai Tiger Reserve in Tamil Nadu is also part of the reserve Henry et al.[7], Dutta et al.[5].

The reserve comprises of tropical wet evergreen forests, moist deciduous forests and montane rain forests and shoal Henry et al.[7], Dutta et al.[5].. It is home to about 79 species of mammals (out of which 20 species are endemic), 45 species of amphibians (out of which 30 species are endemic), 46 species of fishes (out of which 10 species are endemic) and 337 species of birds (out of which 20 species are endemic) Narasimhan[18]. The seasons are also vary in the reserve where summer is very warm and humid with showers due to southwest monsoon and winters are generally cool and dry Henry et al.[7], Dutta et al.[5].. Summer starts in April and continue up to July and temperatures rises up to 35° C.

In the present study , we presented here 78 species of reptiles inhabited in the reserve, out of which 15 species are threatened as per IUCN (four species are listed as endangered, six species are listed as vulnerable and five species are listed as near threatened.

Methodology

The survey was conducted using day time opportunistic visual encounter method to site and locate active geckos, agamids, skinks, snakes and they were searched under boulders, tree holes, under leaf litters, and decomposed wooden logs. Nocturnal opportunistic visual encounter methods were used to search night snakes, geckos with the help of bright beam lights and head lamps. Collected samples were photographed, on site euthanized, fixed in alcohol for 24 hours and preserved in 70% alcohol.

Study Area

The present study is an outcome of surveys conducted by the author and other survey team from the centre in various forest ranges of Agasthyamalai Biosphere reserve namely Kalakkad, Mundanthurai, Ambasamudram, Pabanasam, Thirukurungudi, Alagiyapandiapuram, Boothapandi, Kalial, Kulasekaram and Vellimalai spread across Kanyakumari, Tenkasi and Tirunelveli Districts of Tamil Nadu and also based on published literature.

Survey methods

The survey teams spent 15-20 days on an average during each survey for the period from April, 2018 to March, 2022.We employed day time opportunistic visual encounter method to site and locate active geckos, agamids, skinks, snakes and they were searched under boulders, tree holes, under leaf litters, and decomposed wooden logs. Nocturnal opportunistic visual encounter methods were used to search night snakes, geckos with the help of bright beam lights and head lamps. Collected samples were photographed, on site euthanized, fixed in alcohol for 24 hours and preserved in 70% alcohol.

The data during day time was confined to number of individuals, other species in the same habitat etc were also studied. The animals were photographed using a NIKON Camera, geographical coordinates and altitudes were recorded using Garmin-16. The different species of reptiles were identified using field book Daniel[4,, Murthy [16]

Results and Discussion

The complete list of Reptilian fauna in Agasthyamalai Biosphere reserve along with their habitat and conservation status as per IUCN, 2023 and IWPA, 2022 are given in Table 1. The reptilian fauna in the ecosystems are represented by turtle and tortoises, lizards and snakes. Majority of the species were found in terrestrial/forest habitat except few species occur in aquatic condition namely fresh water pond turtle and common keel back snakes, few species are arboreal in nature like *Hemidactylus leschenaultii* observed always rest on tree branches, flying snake, C*hrysopeleaornata* and Malabar pit viper, *Craspedocephalus malabaricus* observed on tree branches at different localities during the survey.

Table.1. Checklist of Reptiles in Agasthyamalai Biosphere Reserve and conservation status

S. No.	Class/family	Species	Common name	Habitat	Conservation status as per	
					IWPA, 2022	IUCN, 2023

1	Order: Testudines Suborder: Cryptodira Family: Geoemydidae	Melanochelys trijuga (Schweigger, 1812)	Indian black turtle	Aquatic	Sch.II (Pt.c)	LC
2		Vijayachelys sylvatica (Henderson, 1912)	Cochin forest cane turtle	Terrestrial/ Forest	Sch.I (Pt.c)	EN
3	Family: Testudinidae	Geochelone elegans (Schoepff, 1795)	Indian star tortoise	Terrestrial/ Forest	Sch.I (Pt.c)	VU
4	Order: Squamata Suborder: Sauria Family:Gekkonidae	Hemidactylus leschenaultii Dumeril & Bibron, 1836	Bark gecko	Arboreal		LC
5		Hemidactylus triedrus (Daudin, 1802)	Dakota's leaf toad gecko	Terrestrial		LC
6		Dravidogecko anamallensis (Gunther, 1875)	Anamalai gecko	Forest		NT
7		Hemidactylus frenatus Dumeril&Bibron, 1836	Common house gecko	Terrestrial		LC
8		Hemidactylus parvimaculatus Deraniyagala, 1953	Spotted house gecko	Terrestrial		LC
9		Cnemaspis indica Gray, 1846	Indian day gecko	Forest		VU
10		*Cnemaspis ornata* (Beddome, 1870)	Ornate day gecko	Forest		NT
11		Cnemaspis beddomei (Theobald, 1876)	Beddome's day gecko	Forest		DD
12		Cnemaspis mysoriensis (Jerdon, 1854)	Mysore day gecko	Forest		LC
13		Hemidactylus maculatus Dumeril&Bibron, 1836	Spotted leaf rock gecko	Forest.		LC

14	Family: Chamaeleonidae	Chamaeleo zeylanicus Laurenti, 1768	Indian chamaeleon	Terrestrial	Sch.I (Pt.C)	LC
15	Family: Agamidae	Calotes calotes (Linnaeus, 1758)	Green forest lizard	Terrestrial		LC
16		Calotes grandisquamis Gunther, 1875	Large scaled forest lizard	Forest		LC
17		Monilesaurus ellioti Gunther, 1864	Elliot's forest lizard	Terrestrial		LC
18		Agasthyagama beddomii (Boulenger, 1885)	Indian kangaroo lizard	Terrestrial		EN
19		Sitana ponticeriana Cuvier, 1829	Pondicherry Fan throated lizard	Terrestrial		LC
20		Calotes versicolor (Daudin, 1802)	Common garden lizard	Terrestrial		LC
21		Calotes nemoricola Jerdon, 1853	Nilgiri forest lizard	Terrestrial		LC
22		Monilasaurus rouxii Dumeril&Bibron, 1837	Roux;s forest lizard	Forest		LC
23		Psammophilus blanfordanus (Stoliczka, 1871)	Blanford's rock agama	Terrestrial		LC
24		*Psammophilus dorsalis* (Griffith & Pidgeon, 1831)	South Indian rock agama	Terrestrial		LC
25		*Draco dussumieri* Dumeril&Bibron, 1837	Southern flying lizard	Terrestrial	Sch.II (Pt.c)	LC
26		Pseudocalotes andamanensis (Boulenger, 1891)	Green crestless forest lizard	Forest		VU
27	Family: Scincidae	Kaestlea travanocorica (Beddome, 1870)	Travancore ground skink	Forest		LC
28		Sphenomorphus dussumierie	Dussumier's litter skink	Terrestrial		LC

		(Dumeril&Bibron, 1839)				
29		*Riopa punctata* (Linnaeus, 1758)	Dotted garden skink	Terrestrial		LC
30		Eutropis carinata (Schneider, 1801)	Common skink	Terrestrial		LC
31		Eutropis macularia (Blyth, 1853)	Bronze skink	Terrestrial		LC
32		Eutropis beddomei (Jerdon, 1870)	Beddome's mabuya	Terrestrial		LC
33	Family: Lacertidae	Ophisops leschenaultii (Milne-Edwards, 1829)	Leschenault'sla certa	Forest		LC
34	Family: Varanidae	Varanus bengalensis (Daudin, 1802)	Indian monitor	Terrestrial	Sch.I (Pt.c)	NT
35	Suborder: Ophidia Family: Typhlopidae	Indotyphlops braminus (Daudin, 1803)	Brahminy blind snake	Terrestrial	Sch.II (Pt.c)	LC
36	Family: Uropeltidae	Melanophidium punctatum (Beddome, 1871)	Beddome's black earth snake	Terrestrial	Sch.II (Pt.c)	VU
37		Teretrurus rhodogaster (Wall, 1921)	Palni mountain burrowing snake	Terrestrial	Sch.II (Pt.c)	LC
38		Rhinophis sanguineus Beddome, 1863	Salty earth snake	Forest	Sch.II (Pt.c)	LC
39		Uropeltis ellioti (Gray, 1858)	Elliot's earth snake	Forest	Sch.II (Pt.c)	LC
40		*Uropeltis liura* (Gunther, 1875)	Gunther's earth snake	Forest	Sch.II (Pt.c)	DD
41		Uropeltis articeps (Gunther, 1875)	Tirunelveli earth snake	Forest	Sch.II (Pt.c)	NE
42		Uropeltis ocellata	Ocellated earth	Forest	Sch.II	LC

		(Beddome, 1863)	snake		(Pt.c)	
43	Family: Pareidae	*Xylophis deepaki* Narayanan, Mohapatra, Balan, Das & Gower, 2021	Deepak's wood snake	Terrestrial		NE
44	Family: Colubridae	*Ahaetulla dispar* (Gunther, 1864)	Gunther's vine snake	Forest	Sch.II (Pt.c)	NT
45		Ahaetulla nasuta (Lacepede, 1789)	Green vine snake	Terrestrial	Sch.II (Pt.c)	LC
46		*Ahaetulla perroteti* (Dumeril, Bibron&Dumeril, 1854)	Western Ghats bronze back	Grassland	Sch.II (Pt.c)	EN
47		*Ahaetulla pulverulenta* (Dumeril, Bibron&Dumeril, 1854)	Brown speckled whipsnake	Terrestrial	Sch.II (Pt.c)	LC
48		Amphiesma stolatum (Linnaeus, 1758)	Buff striped keelback	Terrestrial	Sch.II (Pt.c)	LC
49		Hebius beddomei (Gunther, 1864)	Beddome's keelback	Terrestrial	Sch.II (Pt.c)	LC
50		Dendrelaphis grandoculis (Boulenger, 1890)	Large eyed bronze back	Terrestrial	Sch.II (Pt.c)	LC
51		Dendrelaphis tristis (Daudin, 1803)	Common bronze back tree snake	Terrestrial	Sch.II (Pt.c)	LC
52		Lycodon travancoricus (Beddome, 1870)	Travancore wolf snake	Forest	Sch.II (Pt.c)	LC
53		*Lycodon aulicus* (Linnaeus, 1754)	Common wolf snake	Terrestrial	Sch.II (Pt.c)	LC
54		*Ptyas mocosa* (Linnaeus, 1758)	Oriental rat snake	Terrestrial	Sch.I (Pt.c)	LC
55		Coelognathus helenamonticollaris	Trinket snake	Terrestrial	Sch.II	LC

		Ganesh et al, 2018			(Pt.c)	
56		*Boiga forstenii (*Dumeril, Bibron&Dumeril, 1854)	Forsten' cat snake	Terrestrial	Sch.II (Pt.c)	LC
57		Boiga trigonata (Bechstein, 1802)	Common cat snake	Terrestrial	Sch.II (Pt.c)	LC
58		Chrysopelea ornata (Shaw, 1802)	Golden flying snake	Arboreal	Sch.II (Pt.c)	LC
59		Liopeltis calamaria (Gunther, 1858)	Calamaria reed snake	Forest	Sch.II (Pt.c)	LC
60		Rhabdophis plumbicolor (Cantor, 1839)	Green keelback	Terrestrial	Sch.II (Pt.c)	LC
61		Oligodon arnensis (Shaw, 1802)	Common kukri snake	Terrestrial	Sch.II (Pt.c)	LC
62		Oligodon brevicauda Gunther, 1862	Shorthead kukri snake	Forest	Sch.II (Pt.c)	VU
63		Oligodon taeniolatus (Jerdon, 1853)	Streaked kukri snake	Terrestrial	Sch.II (Pt.c)	LC
64		*Fowlea piscator* (Schneider, 1799)	Checkered keelback	Aquatic	Sch.I (Pt.c)	LC
65		*Proahaetulla antiqua* Mallik, Achyuthan, ganesh, Pal, Vijayakumar and Shanker, 2019	_	Forest	Sch.II (Pt.c)	EN
66		*Ahaetulla travancorica* Mallik, Srikanthan,Pal, D'Souza, Shanker and Ganesh, 2020	_	Terrestrial	Sch.II (Pt.c)	NE
67	Family: Elapidae	Calliophis nigrescens (Gunther, 1862)	Black coral snake	Terrestrial	Sch.II (Pt.c)	LC
68		*Naja naja* (Linnaeus, 1758*)*	Spectacled	Terrestrial	Sch.I	LC

			cobra		(Pt.c)	
69		Bungarus caeruleus (Schneider, 1801)	Indian krait	Terrestrial	Sch.II (Pt.c)	LC
70		Ophiophagus hannah (Cantor, 1836)	King cobra	Terrestrial	Sch.I (Pt.c)	VU
71	Family: Viperidae	Craspedocephalus macrolepis Beddome, 1862	Large scaled pit viper	Arboreal	Sch.II (Pt.c)	NT
72		Craspedocephalus malabaricus (Jerdon, 1854)	Malabarian pit viper	Arboreal	Sch.II (Pt.c)	LC
73		Craspedocephalus gramineus (Shaw, 1802)	Common bamboo viper	Arboreal	Sch.II (Pt.c)	LC
74		*Hypnale hypnale* (Merrem, 1820)	Hump nosed pit viper	Terrestrial	Sch.II (Pt.c)	LC
75		Craspedocephalus strigatus Gray, 1842	Horseshoe pit viper	Terrestrial	Sch.II (Pt.c)	LC
76		*Craspedocephalus peltopelor* Mallik, Srikanthan, Ganesh, Vijayakumar, Campbell, Malhotra and Shanker, 2021	_	Arboreal	Sch.II (Pt.c)	NE
77		*Craspedocephalus travancoricus* Mallik, Srikanthan, Ganesh, Vijayakumar, Campbell, Malhotra and Shanker, 2021	-		Sch.II (Pt.c)	NE
78		Echis carinatus (Schneider, 1801)	Saw scaled viper	Forest	Sch.II (Pt.c)	LC

Western ghats are known to rich assemblage of faunal wealth. Previous studies by many researchers reported occurrence of reptiles in different habitats. Ishwar et al. [8] in their study from KMTR recorded 17 species of forest floor reptiles by primary and secondary quadrats and overall reported 55 species of forest floor reptiles from the reserve.Ishwar et al. [9] reported 8 species of Agamid lizards from KMTR. Narayanan et al. [19] in their study on

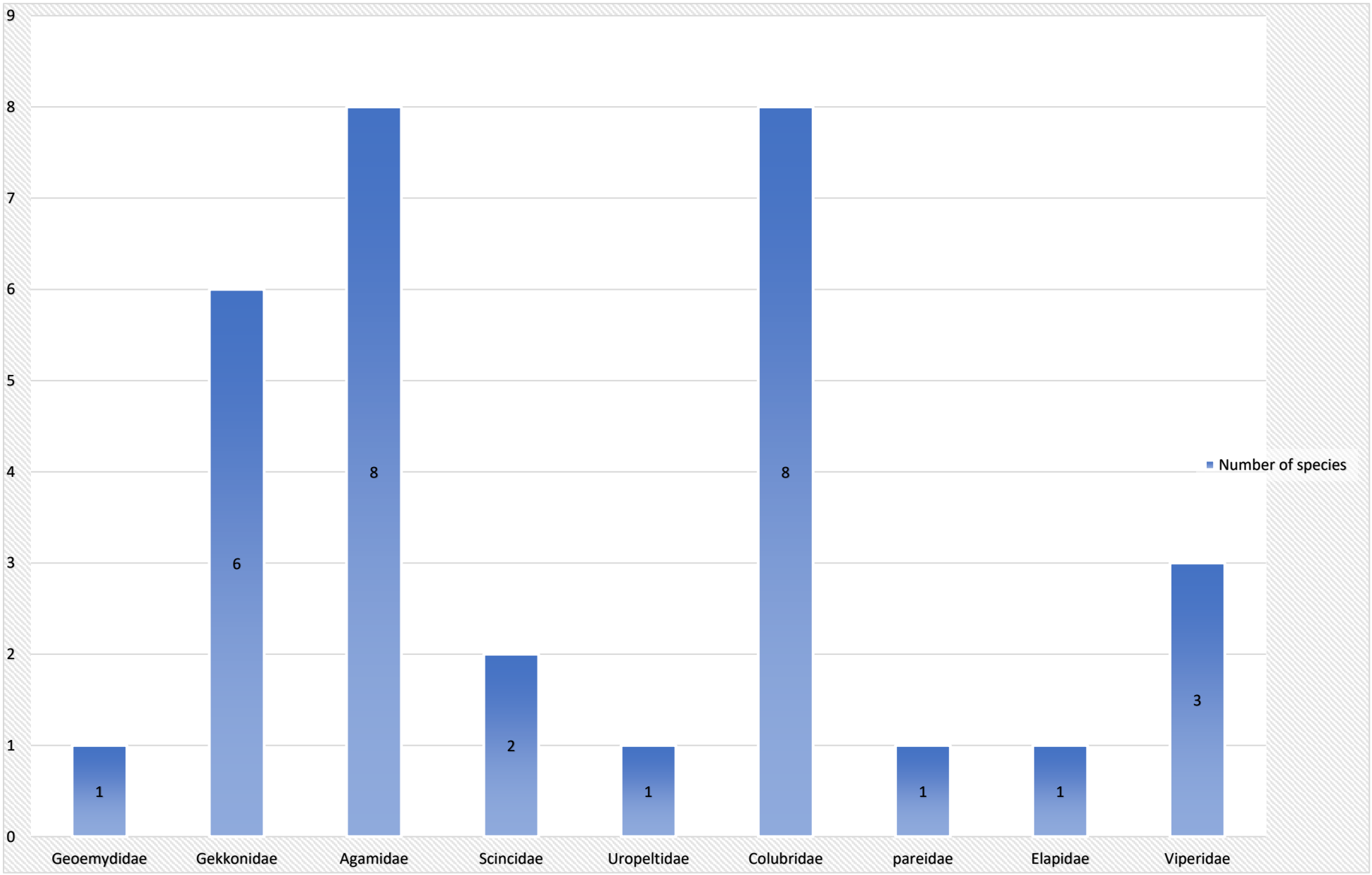
effect of road kills on wildlife population in KMTR reported 1450 incidences of road kills belonging to 29 species during different seasons. Venugopal [21] studied population density of agamid lizards in human modified habitats where the encounter rate of *Monilesaurus elliot*is higher in Vanilla plant than rainforest fragments, on the contrary *Draco dussumieri* density is identical in vanilla and rubber plantation. Sawant et al.[20] reported influence of season on population of three species of pit vipers where high encounter in monsoon compare to summer and winter due to low temperature, high humidity and rich prey base influences distribution of these species. Naniwadekar and Deepak [17] reported new distribution locality for *Calotes nemoricola* from Kudremukh hills of Western Ghats.

Previously Bhupathy and Nixon [2] recorded 10 species of reptiles from upper Nilgiri Biosphere reserve. Krishnan [14], Murthy [15] reported 26 species of reptiles from Kalakkad Sanctuary. Similarly Cherian et al.[3] reported 30 species of reptiles from Kalakkad sanctuary. Johnson [12] reported flying lizard in Mundanthurai sanctuary. Karthikeyan [13] reported arboreal skink *Dasia haliana* from Mundanathurai sanctuary. Ganesh et al.[6] reported 21 species of reptiles from Agumbeforest, Western ghats. Aengals and Ganesh [1] studied reptiles from Kanyakumari wildflife sanctuary.

There are 16 species of reptiles which are protected under different categories of IUCN [10]. Out of which four species are included under endangered category, six species are listed as vulnerable and five species are included under near threatened category. In addition, two species are listed as data deficient, five species are listed as not evaluated and 56 six species are listed under least concern. This indicates the reserve is very suitable and provide safe habitat for reptiles in its environment. Compared to Eastern ghats western ghats are more protected and composed of virgin forest this leads richness of fauna. During survey we come across thick forest, less disturbance and good habitat. This indicates free movement of animals from one place to another in search of food and other requirements. In addition, the temperature and humidity are also play an important role in the reserve.

There are seven species of reptiles which are protected under schedule I and 41 species under Schedule II of IWPA [11] as shown in Table 1. Among these forest cane turtle, *Vijayachelys sylvatica*, star tortoise, *Geochelone elegans*, Indian Chamealeon, *Chamaeleozeylanicus*, Indian monitor, *Varanus bengalensis*, Oriental rat snake, *Ptyas mucosa*, checkered keel back *Fowleapisctor*, spectacled cobra, *Naja naja* and king cobra, *Ophiophagus hannah* are protected under Schedule I of IWPA and one species of Geoemydidae, one species of Agamidae, one species of Typhlophidae, seven species of Uropeltidae, 21 species of Colubridae, two species of Elapidae and eight species of Viperidae are protected under Schedule II of IWPA, 2022. It reveals that different species of reptiles occur in different habitat conditions and are protected under different schedules of IWPA.

There are about 37 species of reptiles which are endemic in this unique ecosystem and are represented by one species of turtle, 18 species of lizard of which five species of Gekkonidae, six species of Agamidae, two species of Scincidae and 15 species of snakes of which seven species of Uropeltidae, eight species of Colubridae, three species of Viperidae, one species of Elapidae and one species of Pareidae.as shown in plate 1. Where lizards are represented by 54% , snakes 44 % and turtles 3% respectively in the reserve. This indicates highest representation of endemicity in the reserve.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Geoemydidae
Gekkonidae
Agamidae
Scincidae
Uropeltidae
Colubridae
pareidae
Elapidae
Viperidae
Number of species

Fig1 . Percentage of endemism of different families of Reptiles in Western ghats.

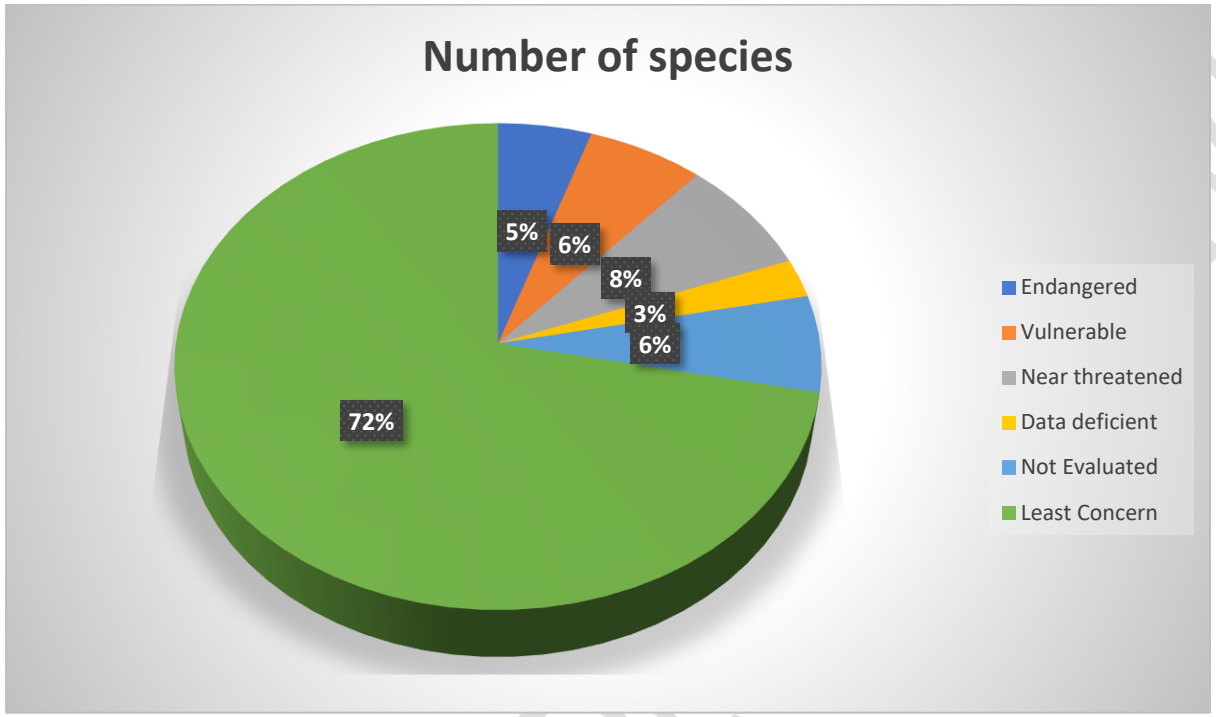

Fig.2. Percentage of threatened species of Reptiles in Agashyamaial Biosphere reserve as per IUCN, 2023.

Conservation implications

The Reptilian fauna occur in different niches i.e different species of reptiles occur from low altitude to high altitude unlike other groups. This distributional pattern in different altitudinal gradient has played an important role in conservation of reptiles in protected areas like Agasthyamalai Biosphre reserve.

Conclusion

The present study provided data on distribution of Reptilian fauna in Agasthyamalai biosphere reserve. During survey noticed at many places virgin forest has been replaced by rubber plantation and extraction of rubber is going on inside the forest. This led to loss of natural habitat and affect the population of wild fauna. Habitat loss and human interference are the major factors affecting the wild fauna and flora. Further research is necessary in the study area to improve habitat and conservation of Reptilian fauna. It is need to promote coordination among forest authorities and locals to improve wild fauna and flora in this unique environment.

Abbreviations: EN- Endangered, VU- Vulnerable, NT- Near Threatened, LC- Least Concern, NE- Not Evaluated, DD- Data Deficient, KMTR: KalakkadMundanthurai Tiger Reserve, IWPA: Indian Wildlife Protection ACT, Sch: Schedule, Pt: Part.

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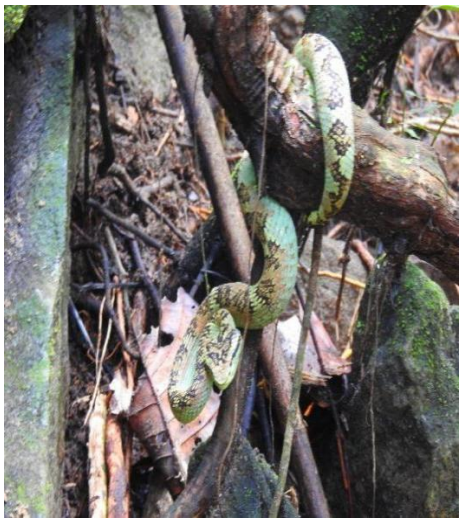
SUPPLEMENTARY MATERIALS

Plate . 1. Different species of Reptiles sighted during survey in Agasthyamalai Biosphere Reserve.



Craspedocephalus malabaricus

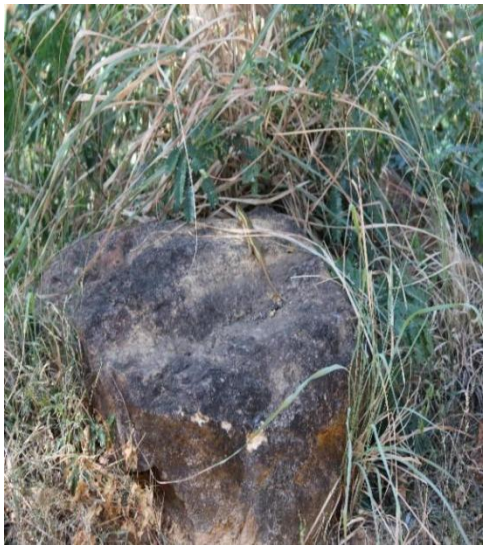
Amphiesma stolatum

Calotes versicolor

Monilesaurus elliotii

Calotes calotes

Sitana visiri



Eutropis carinata

Hemidactylus leschenaultii

Psammophilus dorsalis

Sphenomorphus dussumieri