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Amniotic diversity of Taranga Hill-forest, Gujarat, India

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Abstract

Amniotes is the group of the animals' *viz*., reptiles, birds and mammals, in which extra-embryonic membranes are developed around the embryo for different functions. Amniotic diversity of Taranga Hill-forest (THf) has been studied. THf was represented by 147 species belonging to 116 genera and 62 families. Of these, 24 species were reptiles (belonging 21 genus and 11 families), 98 species were birds (belonging 73 genus and 35 families) and 25 species were mammals (belonging 22 genus and 16 families). It shows that THf has good amniotic diversity. The THf covers 21.21% amniotic diversity of Gujarat and 7.07% of India. The total amniotic diversity of THf was covered by 66.67% species of birds, 17.01% species of mammals and 16.33% species of reptiles. Of the total 62 families, 6 families have high diversity, 18 families have moderate diversity, 10 families have low diversity and 28 families have very low diversity. The high-diversified six families were Colubridae, Accipitridae, Corvidae, Muscicapidae, Sylviidae and Passeridae. Diversity in an area is dependent upon the availability of variable food sources, habitats for roosting, resting, breeding and sheltering; semi-arid climate and evolutionary history of the Aravalli ranges.

***Key words*:** Amniotes, diversity, Aravalli ranges, avifauna, reptiles, mammals, roosting, semi-arid climate, breeding

Introduction

Taranga is one of the famous pilgrim places of North Gujarat. The Taranga Hill-forest (THf) (24°00′N and 72°46′E, 365.76 msl) is located at starting point of the Aravalli ranges in the North Gujarat region, India. The THf is unclassified reserve forest (under section- IV) with total area of 18.12 km^2. According to Champion and Seth (1968), the THf falls in to forest type 5/E2 (*Boswellia* type of forest) of North Gujarat.

The climate of this area is semi-arid with irregular rainfall. It is strongly periodical and seasonal. There are three main seasons and their sub-categories are in this study area are defined as: winter (December-January), early summer (February-March), late summer (April-May), early monsoon (June-July), monsoon (August-September) and post monsoon (October-November). Winter is the period of cold weather. Early summer is the transitional period between the winter and summer, when the nights are cool and the days are worm. Late summer is the period of worm dry weather. Early monsoon is the starting period of rainy season, when the weather is generally hot and humid. Monsoon is the period of slow rainfall and form of slow and in fine drops. The dry season is characteristics by low and erratic

rain received primarily during the monsoon (months of July to September). During this period, the uneasiness is decrease and the coldness is spread in weather. Post monsoon is a transitional period between the monsoon and winter. The dry season is characteristics by low and erratic rain received primarily during the monsoon (months of July to September). It gets most of its rain from the south-west monsoon, which usually sets in by the middle of June or the beginning of July and continues until September and at times until the beginning of October. Heavy rain occurs during July and August but usually remains light during June and September. Average annual rainfall remains 663.60 mm with about 40 rainy days. The THf experiences a prolonged dry season. Average temperature remains 19.80 to 30.73°C.

The THf covers mainly tropical thorn-scrub type vegetation. It is characterized by low altitude hill vegetation. Scrubs are dominant species of this forest. Shrub species are mainly mixed thorny type, which is dominantly present in all parts of the forest. Xerophyte vegetation is dominant. Grassland occasionally present on small part of the plain areas. *Anogeissus latifolia, Acacia chundra, Bauhinia recemosa, Butea monosperma* and *Sterculia urens* are major trees; *Achyranthus aspera, Adhatoda vasica, Calotropis gigantea, Maytenus emarginata, Zizyphus mauritiana, Abrus precatorius, Asparagus racemosus, Cuscuta reflexa, Pedalium murex* are common shrubs and climbers; and *Andrographis paniculata, Bergia capensis, Cassia auriculata, Enicostemma hyssopifolium, Datura metel* are common herbs. Agro-ecosystems exist at the skirt areas of the forest. Crop calendar is fixed as an agropractice for local farmers.

During the course of evolution, higher vertebrates transformed from aquatic life to terrestrial life. Towards the end of the Devonian period, about 350 million years ago the vertebrates organization produced a population of amphibian creatures and from these fully terrestrial populations have been derived which do not breed in water. Gradually animals got adapted to face dryness and other environmental factors as their terrestrial habitat. Their body organization and structure of egg is changed owing to get adaptation. Moreover, to get rid of evaporation of water from the egg, extra-embryonic membranes were developed. Amniotes include most of the land-dwelling vertebrates alive today namely, Reptiles, Birds and Mammals.

Diversity is extensively used for environmental monitoring and testing of any region, and its conservation. As the objective of world conservation strategy is to maximize diversity of habitats, this diversity is extensively used to monitor and evaluate habitats. According to Usher (1986), diversity is the most frequently adopted criterion for evaluation of conservation schemes. There is no any published record of amniotes except various snake species (Bhavsar, 2008) and status of avifauna (Patel and Patel, 2010) at THf; occurrence, distribution and status of small and certain rare species of mammals in the North Gujarat region (Dharaiya, 2008); and evaluating habitat and human-bear conflicts in North Gujarat, to seek solutions for human-bear coexistence (Dharaiya, 2009). In an attempt to fill this information gap, this study was conducted to prepare a database of common amniotic fauna in and around THf. In this paper, it is given an overview of the amniotic diversity, based on ecological status of the various species at

THf. It is presumed that THf is a part of the Aravalli ranges which is very old in a natural history.

Methodology

The study was conducted from early December 2006 to late November 2008. Reptiles and mammals were observed whole day whereas birds were observed from early morning until noon 12 h. The study area was divided into four zones based on its ecological identity i.e., Agricultural and riverbed area, Rocky thorn-scrub forest area, Hillocks and foothill site, and Traffic zone (Road site) (Fig. 1). Each study zone was visited once per month to record the reptiles and their related parameters. A total 24 visits were done in each site (i.e., total 96 visits were done during study period).

Visual encounter surveys (Heyer *et al*., 1994; Rödel and Ernst, 2004) and visual encounter searches methods were used for reptilian study; in which each zone was randomly explored on the basis of habitat structure such as under the stones, crevices of rocks, holes of trees, among the shrubs and herbs, etc. Whenever come across the reptiles in the wild were caught with the help of net, bag or simple wooden stick. Rapid slippery movement of some lizards create trouble to catch in forested habitat. All catched specimens were examined carefully and identified by using the diagnostic characters as per Das (1985), Daniel (2002) and help of field guide (Whitaker and Captain, 2004). After taking down the necessary data it was again released safely in their habitat. No voucher specimen has been collected. Moreover, their habitat and food also noted whenever it is possible. For further detailed studies, information was collected from relevant literature. Secondary information on different species of reptiles was gathered by interviewing and showing colour pictures of the creatures to villagers, forest personnel and wildlife enthusiasts. Taxonomy and nomenclature of Chelonions and Lacertilians was according to Daniel (2002) whereas of Ophidians was according to Whitaker and Captain (2004).

Variable width line transects method described by Burnham *et al.* (1981) was adopted for avifaunal study. Whenever a bird was sighted, it was identified up to species and details like the number and habitat type were recorded. Birds were identified by using 8×40 binoculars and with the help of field guide (Grimmett *et al*., 1999; Ali, 2002). Bird taxonomy and names follows Grimmett *et al*. (1998).

Some direct and indirect methods were used for mammalian survey. They were as fallows.

1. Line transects method: In this method a predetermined transects were traversed either by foot. The different mammalian species encountered were recorded. These lines transects were used in different locations to determine the presence or absence of different species in the particular habitats.
2. Roadside surveys: These surveys were made both on foot and by vehicle. These were successful particularly in case of monkeys, which can tolerate the presence of humans and allow the observations to be made from close quarters.
3. Point transects method: This method was also tried, but did not prove as effective as the line transect method and roadside survey.
4. Water hole technique: This method was also used for the study of mammals. It was applied more efficiently during

pinch periods when water acts as limiting factor. All the methods were applied during early morning hours and late evening hours, except the water hole technique, which was applied during the noon and sometime at night hours in the summer season.

5. Indirect methods: Sometimes evidences such as burrows, quills, bones, defecation, signs of destruction of habitat were carefully observed and recorded. These evidences also indicate the presence of particular animals. The spot where such evidences were found is then marked and later surveyed intensively for the presence of the animal. Villagers and nomads were also contact and interviewed over wide areas regarding the presence or absence of mammals by providing them with the pictorial guides and photographs of different mammals for identification that are likely to be found in the area. For identification and classification purposes, colourful plates by Prater (1971) proved helpful. Binoculars (8×40 Olympus) were used to record the observations from a distance to avoid any disturbance to mammals.

Biological diversity of any area can be measured on the basis of number of genus-species present in that particular area. Biodiversity will be more in the area, having more number of genus-species. This concept leads to determination of reptilian diversity. Based on genus-species number, ranking was given to each family as below.

No. of genus	**Ranking**	**No. of species**	**Ranking**
5 or more than 5	+ + + +	7 or more than 7	+ + + +
3 to 4	+ + +	4 to 6	+ + +
2	+ +	2 to 3	+ +
1	+	1	+

At the last final judgment was made based on total score of each genus and species. Based on total score, following four groups are given.

Diversity	Total score (Out of 8)
High Diversity (HD)	7 or more than 7
Moderate Diversity (MD)	4 to 6
Low Diversity (LD)	3
Very Low Diversity (VLD)	2

Results

Amniotic diversity of THf was represented by 147 species belonging to 116 genera and 62 families (Append. 1). Of these, 24 species were reptiles (belonging 21 genus and 11 families), 98 species were birds (belonging 73 genus and 35 families) and 25 species were mammals (belonging 22 genus and 16 families) (Tab. 1). It indicates diversity of amniotes at THf. The THf covers 21.21% amniotic diversity of Gujarat and 7.07% of India (Tab. 2). The total amniotic diversity of THf was covered by 66.67% species of birds, 17.01% species of mammals and 16.33% species of reptiles.

There were total 62 families of amniotes at THf. Among these families, 6 families have high diversity (>87.50%), 18 families have moderate diversity (50 to 75%), 10 families have low diversity (37.50%) and 28 families have very low diversity (<25%). The high-diversified 6 families were Colubridae (7 species belonging 7 genera), Accipitridae (5 species belonging 5 genera), Corvidae (13 species belonging 9 genera), Muscicapidae (9 species belonging 6 genera), Sylviidae (8 species belonging 5 genera) and Passeridae (7 species belonging 6 genera). Of which, Colubridae is reptilian family and other are avian families. There was no any high-diversified mammalian family (Append. 2). Out of 18 moderately diversified families, 4

Table 1. Amniotic diversity of Taranga Hill-forest

Class	No. of Family	No. of Genus	No. of Species	Diversity of Family			
				HD	MD	LD	VLD
Reptiles	11	21	24	01	04	02	04
Aves	35	73	98	05	10	06	14
Mammals	16	22	25	00	04	02	10
Total	62	116	147	06	18	10	28

HD = High Diversity, MD = Moderate Diversity, LD = Low Diversity and VLD = Very Low Diversity

Table 2. Comparison of amniotic diversity of Taranga Hill-forest with World, India and Gujarat

Class	World	India	Gujarat	Taranga Hill-forest	% of India	% of Gujarat
Reptiles	5817	456	114	24	5.26	21.05
Aves	9026	1232	476	98	7.96	20.59
Mammal	4629	390	103	25	6.41	24.27
Total	19472	2078	693	147	7.07	21.21

were reptiles, 10 were birds and 4 were mammals. Of the total 62 families, 10 families possess low diversity they were Gekkonidae, Varanidae, Coraciidae, Meropidae, Psittacidae, Laniidae, Paridae, Pycnonotidae, Herpestidae and Leporidae. The remaining 28 families of amniotes possess very low diversity and each was represented by one species belonging one genus (Append. 2).

Among all amniotes, White-naped Tit (*Parus nuchalis*) a globally threatened and endemic resident has been found as local migrant, scarce in number, common in occurrence and breeder in the tropical thorn-scrub forest habitat of THf. Indian Chameleon (*Chamaeleon zeylanicus*) is a typical striking reptilian species at THf. Common Garden Lizard, Northern House Gecko, Fan-throated Lizard, Brahminy Skink and Common Rat Snake as reptiles; Red-vented Bulbul, Rock Pigeon, Rose-ringed Parakeet, House Swift, Red-rumped Swallow, Large Grey Babbler and Purple Sunbird as birds; and Common Langur, Wild Boar, Fivestriped Palm Squirrel, Indian Desert Gerbille, Nilgai and Indian Hare as mammals were abundant and sustain species at THf due to frequently available food sources, suitable habitat, maximum breeding chances and high population.

Discussion

Amniotic diversity of THf was represented by 147 species belonging to 116 genera and 62 families. It shows that THf has good amniotic diversity. Diversity in an area is dependent upon the availability of variable food sources, habitats for roosting, resting, breeding and sheltering; semi-arid climate and evolutionary history. This is a tropical thorn-scrub forest with pilgrimage place. Even different types of food are provided to amniotes regularly as a cultural heritage of the people. Another reason, to which the good amniotic diversity at THf can be attributed, is the availability of varied favourable microhabitat.

The amniotic diversity acts as an excellent bioindicator for the quality of the ecosystem and health of the environment. Moreover, they are important component of food chains of the ecosystem. According to

Iskandar (2004), some reptiles are good indicators for assessing forest condition because they are very sensitive to ecological and climatic change. They are abundant in the ecotones and easy to observe, so that a quantitative analysis can be performed. Terrestrial reptiles are excellent indicators of the relative amounts of microhabitats in ecosystems (Jones, 1986). Aquatic snakes are good indicators of the health of aquatic systems. These animals are especially sensitive to pollution and loss of aquatic habitat (Hall, 1980). Herpetofauna are important in food chains and they make up large proportions of vertebrates in certain ecosystems (Bury and Raphael, 1983). Information on reptile abundance and diversity helps determine the relative health of ecosystems. Abundance and diversity fluctuate directly with changes in the composition and amount of microhabitats.

According to Gill (1994) and Whitman *et al.* (1998), birds are widely recognised as good bioindicators of the quality of the ecosystems and health of the environment. They are being used as tools for conservation and environmental impact assessment. Because of their highly specific habitat requirements, birds become increasingly intolerant of even slight ecosystem disturbance (Schwartz and Schwartz, 1951) e.g., the White-naped Tit requires dry thorn-scrub forest. They also play a vital role in various agro-ecosystems; their diversity is an indication of congenial habitat for survival (Jayson and Mathew, 2002). Birds constitute one of the common fauna of all habitat types, and because they are responsive to change, their diversity and abundance can reflect ecological trends in other biodiversity (Furness and Greenwood, 1993).

Small mammals such as rodents are considered to be especially important components of the ecosystem as they serve as prey for small and medium sized carnivores (Shanker, 2003). The large sized carnivore mammalian species are essential for regulation of herbivores population in forest ecosystem. It is vital for stability of any ecosystem.

Considerable discussion is on about quantitative measurement of diversity, which is directly correlated with the stability of ecosystem, being higher in biologically controlled system, and lower in polluted ecosystems (Rosenberg, 1976). A number of hypotheses have been made to explain the characteristic diversity profiles of different habitats. Habitat heterogeneity, in addition to area, is an important determinant of species richness (diversity) (Boecklen and Simberloff, 1986). Habitat factors such as tree density, basal area, number of tree species, percent ground cover, percent canopy cover and canopy height, are also important in determining diversity. Habitat heterogeneity at THf may be one of the factors causing the higher diversity recorded. Diversity is directly correlated with the stability of the ecosystem and will be high in biologically controlled systems, as seen at THf. The evaluation of the area shows the rich and undisturbed species diversity of amniotes at THf.

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Appendix 1. Amniotic fauna of Taranga Hill-forest recorded during study period

Family/Common name	Scientific name	Status
REPTILIAN DIVERSITY		
Trionychidae		
1. Indian Flap-Shell Turtle	*Lissemys punctata*	F, C
Testudinidae		
2. Starred Tortoise	*Geochelone elegans*	S, O
Gekkonidae		
3. Northern House Gecko	*Hemidactylus flaviviridis*	F, C
4. Brook's Gecko	*Hemidactylus brookii*	S, r
Agamidae		
5. Common Garden Lizard	*Calotes versicolor*	VC, A
6. Fan-throated Lizard	*Sitana ponticeriana*	F, C
Chamaeleonidae		
7. Indian Chameleon	*Chamaeleon zeylanicus*	F, O
Scincidae		
8. Brahminy Skink	*Mabuya carinata*	F, C
9. Little Skink	*Mabuya macularia*	S, r
10. Snake Skink	*Lygosoma punctatus*	Lf, O
Varanidae		
11. Common Indian Monitor	*Varanus bengalensis*	Lf, C
12. Desert Monitor	*Varanus griseus*	S, r
Pythonidae		
13. Indian Python	*Python molurus molurus*	S, r
Boidae		
14. Common Sand Boa	*Gongylophis conicus*	Lf, O
15. Red Sand Boa	*Eryx johnii johnii*	Lf, O
Colubridae		
16. Common Trinket Snake	*Coelognathus helena helena*	S, r
17. Common Rat Snake	*Ptyas mucosa*	F, C
18. Blotched Royal Snake	*Spalerosophis diadema*	Lf, O
19. Russell's Kukri Snake	*Oligodon taeniolatus*	S, r
20. Indian Bronzeback Tree Snake	*Dendrelaphis tristis*	S, O
21. Checkered Keelback	*Xenochrophis piscator*	Lf, O
22. Common Cat Snake	*Boiga trigonata*	S, O
Elapidae		
23. Common Krait	*Bungarus caeruleus**	S, O
24. Common Cobra	*Naja naja**	S, O
AVIFAUNAL DIVERSITY		
Phasianidae		
25. Grey Francolin	*Francolinus pondicerianus*	R, F, FC, B, GR
26. Indian Peafowl	*Pavo cristatus*	R, Lf, FC, B, OM
Picidae		
27. Yellow-crowned Woodpecker	*Dendrocopos mahrattensis*	R, S, FC, BP, IN
28. Black-rumped Flameback	*Dinopium benghalense*	LM, S, FC, ?, IN

Megalaimidae		
29. Coppersmith Barbet	*Megalaima haemacephala*	LM, S, FC, BP, FR
Upupidae		
30. Common Hoopoe	*Upupa epops*	WM, LF, O, NB, IN
Coraciidae		
31. Indian Roller	*Coracias benghalensis*	R, LF, FC, B, IN
32. European Roller	*Coracias garrulous*	PM, S, r, NB, IN
Dacelonidae		
33. White-throated Kingfisher	*Halcyon smyrnensis*	R, S, FC, B, PI
Meropidae		
34. Green Bee-eater	*Merops orientalis*	R, F, FC, B, IN
35. Blue-cheeked Bee-eater	*Merops persicus*	WM, Lf, O, NB, IN
36. Blue-tailed Bee-eater	*Merops philippinus*	☺
Cuculidae		
37. Asian Koel	*Eudynamys scolopacea*	R, LF, FC, B, FR
38. Pied Cuckoo	*Clamator jacobinus*	MM, LF, O, NB, IN
Centropodidae		
39. Greater Coucal	*Centropus sinensis*	R, LF, FC, B, CR
Psittacidae		
40. Plum-headed Parakeet	*Psittacula cyanocephala*	R, F, FC, PB, FR
41. Rose-ringed Parakeet	*Psittacula krameri*	R, LA, FC, B, FR
Apodidae		
42. House Swift	*Apus affinis*	R, LA, FC, B, IN
Strigidae		
43. Spotted Owlet	*Athene brama*	R, LF, FC, B, CR
Columbidae		
44. Rock Pigeon	*Columba livia*	R, A, FC, B, GR
45. Eurasian Collared Dove	*Streptopelia decaocto*	R, F, FC, B, GR
46. Laughing Dove	*Streptopelia senegalensis*	R, F, FC, B, GR
47. Yellow-footed Green Pigeon	*Treron phoenicoptera*	R, F, FC, NB, FR
Scolopacidae		
48. Common Sandpiper	*Actitis hypoleucos*	☺
Burhinidae		
49. Eurasian Thick-knee	*Burhinus oedicnemus*	LM, S, FC, BP, CR
Charadriidae		
50. Red-wattled Lapwing	*Vanellus indicus*	R, LF, FC, B, IN
Accipitridae		
51. Shikra	*Accipiter badius*	R, LF, FC, B, CR
52. White-eyed Buzzard	*Butastur teesa*	LM, S, C, BP, CR
53. Black-shouldered Kite	*Elanus caeruleus*	R, Lf, FC, B, CR
54. Black Kite	*Milvus migrans*	LM, S, C, B, OM
55. Oriental Honey-buzzard	*Pernis ptilorhyncus*	R, Lf, FC, B, IN (?)
Podicipedidae		
56. Little Grebe	*Tachybaptus ruficollis*	LM, S, O, BP, IN (?)
Ardeidae		
57. Indian Pond Heron	*Ardeola grayii*	LM, S, O, BP, PI (?)
58. Cattle Egret	*Bubulcus ibis*	R, Lf, FC, B, IN
59. Great Egret	*Casmerodius albus*	LM, S, O, BP, PI
60. Intermediate Egret	*Mesophoyx intermedia*	LM, S, O, BP, PI
Threskiornithidae		
61. Black Ibis	*Pseudibis papillosa*	LM, S, C, B, IN
62. Black-Headed Ibis	*Threskiornis melanocephalus*	LM, S, O, B, IN (?)
Laniidae		
63. Bay-backed Shrike	*Lanius vittatus*	☺
64. Southern Grey Shrike	*Lanius meridionalis*	R, F, FC, B, IN (?)
65. Long-tailed Shrike	*Lanius schach*	R, Lf, FC, B, IN (?)
Corvidae		
66. Marshall's Iora	*Aegithina nigrolutea*	R, Lf, FC, B, IN
67. Common Iora	*Aegithina tiphia*	R, Lf, FC, ?, IN

68. Large-billed Crow	*Corvus macrorhynchos*	R, Lf, FC, NB, OM
69. House Crow	*Corvus splendens*	R, F, FC, B, OM
70. Rufous Treepie	*Dendrocitta vagabunda*	R, Lf, FC, B, OM
71. White-bellied Drongo	*Dicrurus caerulescens*	R, Lf, FC, NB, IN
72. Black Drongo	*Dicrurus macrocercus*	R, F, FC, B, IN
73. Eurasian Golden Oriole	*Oriolus oriolus*	LM, Lf, O, NB, FR(?)
74. Small Minivet	*Pericrocotus cinnamomeus*	R, F, FC, B, IN
75. White-throated Fantail	*Rhipidura albicollis*	R, Lf, FC, NB, IN
76. White-browed Fantail	*Rhipidura aureola*	R, Lf, FC, NB, IN
77. Asian Paradise-flycatcher	*Terpsiphone paradise*	V, S, r, NB, IN
78. Common Woodshrike	*Tephrodornis pondicerianus*	R, F, FC, NB, IN
Muscicapidae		
79. Brown Rockchat	*Cercomela fusca*	R, Lf, FC, NB, IN
80. Oriental Magpie Robin	*Copsychus saularis*	R, Lf, FC, NB, IN
81. Isabelline Wheatear	*Oenanthe isabellina*	WM, S, O, NB, IN
82. Finsch's Wheatear	*Oenanthe finschii*	☺
83. Black Redstart	*Phoenicurus ochruros*	WM, Lf, O, NB, IN
84. Common Redstart	*Phoenicurus phoenicurus*	WM, S, O, NB, IN
85. Jerdon's Bushchat	*Saxicola jerdoni*	R, S, FC, NB, IN
86. Common Stonechat	*Saxicola torquata*	WM, S, O, NB, IN
87. Indian Robin	*Saxicoloides fulicata*	R, F, FC, B, IN
Sturnidae		
88. Bank Myna	*Acridotheres ginginianus*	R, F, FC, B, OM
89. Common Myna	*Acridotheres tristis*	R, F, FC, B, OM
90. Brahminy Starling	*Sturnus pagodarum*	R, F, FC, B, OM
Paridae		
91. Great Tit	*Parus major*	R, Lf, FC, ?, IN
92. White-naped Tit	*Parus nuchalis*	LM, S, C, B, IN
Hirundinidae		
93. Red-rumped Swallow	*Hirundo daurica*	R, La, FC, B, IN
94. Wire-tailed Swallow	*Hirundo smithii*	R, Lf, FC, B, IN
95. Plain Martin	*Riparia paludicola*	R, Lf, FC,?, IN
Pycnonotidae		
96. Red-vented Bulbul	*Pycnonotus cafer*	R, A, FC, B, FR
97. White-eared Bulbul	*Pycnonotus leucotis*	R, Lf, FC, B, IN (?)
Hypocoliidae		
98. Grey Hypocolius	*Hypocolius ampelinus*	☺
Cisticolidae		
99. Rufous-fronted Prinia	*Prinia buchanani*	R, Lf, FC, B, IN
100. Grey-breasted Prinia	*Prinia hodgsonii*	R, F, FC, B, IN
101. Plain Prinia	*Prinia inornata*	R, F, FC, B, IN
102. Ashy Prinia	*Prinia socialis*	R, F, FC, B, IN
Zosteropidae		
103. Oriental White-eye	*Zosterops palpebrosus*	R, Lf, FC, ?, IN
Sylviidae		
104. Paddyfield Warbler	*Acrocephalus agricola*	WM, Lf, O, NB, IN
105. Common Tailorbird	*Orthotomus sutorius*	R, F, FC, B, IN
106. Sulphur-bellied Warbler	*Phylloscopus griseolus*	☺
107. Lesser Whitethroat	*Sylvia curruca*	WM, Lf, O, NB, IN
108. Yellow-billed Babbler	*Turdoides affinis*	R, Lf, FC, NB, IN
109. Common Babbler	*Turdoides caudatus*	R, F, FC, B, IN
110. Large Grey Babbler	*Turdoides malcolmi*	R, La, FC, B, IN
111. Jungle Babbler	*Turdoides striatus*	R, F, FC, B, IN
Alaudidae		
112. Ashy-crowned Sparrow Lark	*Eremopterix grisea*	R, F, FC, B, IN (?)
113. Indian Bushlark	*Mirafra erythroptera*	R, Lf, FC, BP, IN
Nectariniidae		
114. Purple Sunbird	*Nectarinia asiatica*	R, La, FC, B, NR
Passeridae		

115. Indian Silverbill	*Lonchura malabarica*	R, Lf, FC, B, GR
116. White Wagtail	*Motacilla alba*	WM, S, O, NB, IN
117. White-browed Wagtail	*Motacilla maderaspatensis*	R, Lf, FC, ?, IN
118. Tree Pipit	*Anthus trivialis*	☺
119. House Sparrow	*Passer domesticus*	R, F, FC, B, GR
120. Chestnut-shouldered Petronia	*Petronia xanthocollis*	R, F, FC, B, GR
121. Baya Weaver	*Ploceus philippinus*	R, F, FC, B, GR
Fringillidae		
122. Crested Bunting	*Melophus lathami*	V, S, r, NB, GR
MAMMALIAN DIVERSITY		
Cercopithecidae		
123. Common Langur	*Semnopithecus entellus*	A, VC
Felidae		
124. Leopard*	*Panthera pardus*	S, r
Canidae		
125. Jackal	*Canis aureus*	Lf, VC
126. Indian fox	*Vulpes bengalensis*	S, C
Hyaenidae		
127. Striped Hyena*	*Hyaena hyaena hyaena*	S, r
Herpestidae		
128. Common Mongoose	*Herpestes edwardsi*	Lf, VC
129. Ruddy Mongoose	*Herpestes smithi*	Lf, VC
130. Small Indian Mongoose	*Herpestes auropunctatus*	Lf, VC
Ursidae		
131. Sloth Bear*	*Melursus ursinus*	S, r
Bovidae		
132. Nilgai or Blue bull	*Boselaphus tragocamelus*	A, VC
Suidae		
133. Indian Wild Boar	*Sus scrofa*	A, VC
Manidae		
134. Indian Pangolin*	*Manis crassicaudata*	S, r
Erinaceidae		
135. Longeared Hedgehog	*Hemiechinus auritus collaris*	Lf, VC
136. Pale Hedgehog	*Paraechinus micropus micropus*	S, VC
Soricidae		
137. Grey Musk Shrew	*Suncus murinus*	S, O
Leporidae		
138. Indian Hare	*Lepus nigricollis ruficaudatus*	A, VC
139. Desert Hare	*Lepus nigricollis dayanus*	S, C
Hystricidae		
140. Indian Porcupine*	*Hystrix indica*	S, r
Sciuridae		
141. Fivestriped Palm Squirrel	*Funambulus pennanti*	A, VC
Muridae		
142. Indian Desert Gerbille	*Meriones hurrianae*	A, VC
143. Longtailed Tree Mouse	*Vandeleuria oleracea*	Lf, VC
144. Bandicoot Rat	*Bandicota indica*	S, r
Pteropodidae		
145. Indian Flying Fox	*Pteropus giganteus*	Lf, VC
146. Fulvous Fruit Bat	*Rousettus leschenaultia*	F, VC
147. Shortnosed Fruit Bat	*Cynopterus sphinx*	F, VC

Status of Reptiles

Abundance Status: A= Abundant (>75 AMP= Annual mean population) , F= Frequent (21 to 75 AMP), Lf= Less frequent (6 to 20 AMP), S= Scarce (1 to 5 AMP); Occurrence Status: VC= Very common (Recorded during 22 to 24 visits out of 24 visits), C= Common (Recorded during 14 to 21 visits out of 24 visits), O= Occasional (Recorded during 5 to 13 visits out of 24 visits) and r= Rare (Recorded during less than 5 visits out of 24 visits).

Status of Birds

Resident Status: Resident (R)= Resident throughout the year within area, Local Migrant (LM)= Resident with some local movement within area, WM= Winter migrant within area, MM= Monsoon migrant within area, PM = Passage migrant within

area and Vagrant (V)= Vagrant with only a single or couple of records within area, depending on its movement and seasonality of occurrence. Abundance Status: Abundant (A)= Mean population is more than 100, Less abundant (La)= Mean population is 50 to 100, Frequent (F)= Mean population is 25 to 50, Less frequent (Lf)= Mean population is 5 to 25 and Scarce (Sc)= Mean population is less than 5. Occurrence Status: Fairly Common (FC)= Sighted on 22 to 24 out of 24 visits, Common (C)= Sighted on 14 to 21 out of 24 visits, Occasional (O)= Sighted on 7 to 13 out of 24 visits and Rare (r)= Sighted on less than 7 out of 24 visits. Breeding Status: Breeder (B)= Birds who were observed to breed or showed evidence (nests or newly fledged chick(s) recorded) of breeding in THf, Non-breeder (NB)= Birds who showed no evidence of breeding within THf, Breeding Probable (BP)= Birds who were observed to breed throughout Gujarat yet no evidence of their breeding was observed in THf by us, Breeding Possible (PB)= According to authority bird who do not breed in THf but shows evidence of breeding according to us and (?)= Not confirmed. Feeding habit Status: Insectivores (IN)= Refers to animals that primarily eat insects, Frugivores (FR)= Animals that feed largely on fruit, Granivores (GR)= Animals that eat primarily seed, Nectarivores (NR)= Animals that feed primarily on nectar that they get from flowers, Piscivores (PI)= Animals that eat primarily fish, Omnivores (OM)= Refers to animals that eat everything, such as plant food, fish, mammals, birds, etc. and will scavenge food), and Carnivores (CR)= Animals whose diet consists primarily other animals. "☺"= We can't say about it's status.

Status of Mammals

Abundance Status: A= Abundant (More than 100 AMP), F= Frequent (AMP between 50 to 100), LF= Less frequent (between 20 to 50), S= Scarce (AMP less than 20); Occurrence status: VC=Very common (Recorded during 22-24 visits out of 24 visits), C= Common (Recorded during 14-21 visits out of 24 visits), O= Occasional (Recorded during 5-13 visits out of 24 visits) and r= Rare (Recorded during less than 5 visits out of 24 visits). * = Sign recorded.

Appendix 2. Diversity ranking of families based on genus-species numbers recorded at Taranga Hill-forest

Class/Family	No. of genus	No. of species	Ranking of genus	Ranking of species	Total score	Diversity remark
Trionychidae	1	1	+	+	2	VLD
Testudinidae	1	1	+	+	2	VDL
Gekkonidae	1	2	+	+ +	3	LD
Agamidae	2	2	+ +	+ +	4	MD
Chamaeleonidae	1	1	+	+	2	VLD
Scincidae	2	3	+ +	+ +	4	MD
Varanidae	1	2	+	+ +	3	LD
Pythonidae	1	1	+	+	2	VLD
Boidae	2	2	+ +	+ +	4	MD
Colubridae	7	7	+ + + +	+ + + +	8	HD
Elapidae	2	2	+ +	+ +	4	MD
Phasianidae	2	2	+ +	+ +	4	MD
Picidae	2	2	+ +	+ +	4	MD
Megalaimidae	1	1	+	+	2	VLD
Upupidae	1	1	+	+	2	VLD
Coraciidae	1	2	+	+ +	3	LD
Dacelonidae	1	1	+	+	2	VLD
Meropidae	1	3	+	+ +	3	LD
Cuculidae	2	2	+ +	+ +	4	MD
Centropodidae	1	1	+	+	2	VLD
Psittacidae	1	2	+	+ +	3	LD
Apodidae	1	1	+	+	2	VLD
Strigidae	1	1	+	+	2	VLD
Columbidae	3	4	+ + +	+ + +	6	MD
Scolopacidae	1	1	+	+	2	VLD
Burhinidae	1	1	+	+	2	VLD
Charadriidae	1	1	+	+	2	VLD
Accipitridae	5	5	+ + + +	+ + +	7	HD
Podicipedidae	1	1	+	+	2	VLD
Ardeidae	4	4	+ + +	+ + +	6	MD
Threskiornithidae	2	2	+ +	+ +	4	MD
Laniidae	1	3	+	+ +	3	LD
Corvidae	9	13	+ + + +	+ + + +	8	HD
Muscicapidae	6	9	+ + + +	+ + + +	8	HD
Sturnidae	2	3	++	+ +	4	MD

Paridae	1	2	+	+ +	3	LD
Hirundinidae	2	3	+ +	+ +	4	MD
Pycnonotidae	1	2	+	+ +	3	LD
Hypocoliidae	1	1	+	+	2	VLD
Cisticolidae	1	4	+	+ + +	4	MD
Zosteropidae	1	1	+	+	2	VLD
Sylviidae	5	8	+ + + +	+ + + +	8	HD
Alaudidae	2	2	+ +	+ +	4	MD
Nectariniidae	1	1	+	+	2	VLD
Passeridae	6	7	+ + + +	+ + + +	8	HD
Fringillidae	1	1	+	+	2	VLD
Cercopithecidae	1	1	+	+	2	VLD
Felidae	1	1	+	+	2	VLD
Canidae	2	2	+ +	+ +	4	MD
Hyaenidae	1	1	+	+	2	VLD
Herpestidae	1	3	+	+ +	3	LD
Ursidae	1	1	+	+	2	VLD
Bovidae	1	1	+	+	2	VLD
Suidae	1	1	+	+	2	VLD
Manidae	1	1	+	+	2	VLD
Erinaceidae	2	2	+ +	+ +	4	MD
Soricidae	1	1	+	+	2	VLD
Leporidae	1	2	+	+ +	3	LD
Hystricidae	1	1	+	+	2	VLD
Sciuridae	1	1	+	+	2	VLD
Muridae	3	3	+ + +	+ +	5	MD
Pteropodidae	3	3	+ + +	+ +	5	MD
Total: 62	116	147				