

DIVERSITY AND DISTRIBUTION OF AMPHIBIANS AND REPTILES IN THE RITCHIE'S ARCHIPELAGO, ANDAMAN AND NICOBAR ISLANDS

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Abstract

This study was carried out in the Ritchie's archipelago of Andaman and Nicobar Islands during 2008 through 2011. Quadrat method was used for estimating the species abundance and diversity of amphibians and reptiles. Total of 26 species of amphibians and reptiles, belonging to 21 genera and 12 families were recorded. Highest number of reptiles were recorded from Havelock Island (15 species), followed by John Lawrence (14), Neil (13), Inglis (11), Outram and Henry Lawrence (10), North Button (8). Of the recorded species of amphibians, Havelock and Henry Lawrence Islands showed high species richness.

Keywords: Amphibians Andaman, Reptiles, Ritchie's archipelago, Species abundance, Species diversity

INTRODUCTION

The Andaman and Nicobar archipelago comprises of 572 islands and extending over 800 km. These islands were once a part of the Asian mainland but got detached some 100 million years ago during the Upper Mesozoic period due to geological upheaval. The chains of these islands are in fact the camel back of the submerged mountain ranges projecting above the sea level running north to south between 6° 45' N and 13° 30' N Latitudes and 90° 20' E and 93° 56' E Longitudes with an extent of 8249 km². The Andaman and Nicobar Islands have tropical evergreen rain forests and tropical semi-evergreen rainforests as well as tropical moist monsoon forests. This tropical evergreen rain forest is only slightly less grand in stature and rich in species than on the mainland. The dominant species is *Dipterocarpus grandiflorus* in hilly areas, while *Dipterocarpus kerrii* is dominant on some islands in the southern parts of the archipelago. The monsoon forests of the Andamans are dominated by *Pterocarpus dalbergioides* and *Terminalia* sp.

Several studies have been carried out on reptiles and amphibians of Andaman and Nicobar Islands, and most of the work on listing the species or described new species. Few important studies are reviewed here, the studies reptiles and amphibian of Andaman and Nicobar Islands

has been initiated by Blyth (1846), followed by Tytler (1865), Stoliczka (1873). Smith (1940) made a detailed study on reptiles and reported 60 species from Andaman and Nicobar Islands. Biswas and Sanyal (1965 and 1978) described many new species of snakes. Whitaker (1978) reported 35 species of snakes, 28 species of lizards and nine species of amphibians from this region. Sarkar (1990) made a taxonomic and ecological study on the amphibians of Andaman and Nicobar Islands. Das (1994) published a list of 17 species of amphibians, 31 species of lizards and 39 species of snakes. Das (1995) described a new tree frog, *Polypedates insularis* from Great Nicobar. Daniels and David (1996) reported eight species of frogs, six species of lizards and six species of snakes from Great Nicobar. Das (1999) reported 40 species of reptiles and 12 species of amphibians from Andaman Islands and 37 species of reptiles and 11 species of amphibians from Nicobar Islands. Vijayakumar and David (2006) recorded 24 species of lizards, 14 species of snakes and 10 species of amphibians, including several suspected new species. Recently, Harikrishnan *et al.* (2012) reported a new species of *Coryphophylax* from Andaman Islands.

Study area

Ritchie's Archipelago is a cluster of smaller islands which lie some 25-30 km east of Great Andaman, the main

island group of the Andaman Islands. The archipelago consists of 4 larger islands, 7 smaller islands and several islets, extending in a roughly north-south chain, parallel to the main Great Andaman group. Baratang Island and South Andaman Island lie to the west across Diligent Strait. The active volcano of Barren Island is about 75 km further to the east.

The climate is wet tropical. It is warm and humid for the most of the year. The seasons can be divided into dry and rainy seasons. The extreme winter and summer are practically unknown, but there is a general nip in the air

during the months of December, January and February. During the months of March, April, and May can be uncomfortable due to high humidity although the temperature is not high. The average annual temperature ranged from 26.85 - 33.5°C. The humidity varies from 65 to 91 percent. The highest humidity is experienced from the month of May to November during the southwest monsoon. The rainfall ranges from 2020 to 3774 mm per year. The southwest monsoon which brings most of the precipitation normally begins in the month of May and ends in October. The northeast monsoon starts during November and ends in December.

Coordinates of survey locations in different islands

Fig. 1: Ritchie's Archipelago, Andaman & Nicobar Islands

Location	Coordinates	
	Latitude	Longitude
Havelock Island		
Kalapathar	11° 58.769'	93°00.980'
Radha Nagar	11° 59.050'	92°57.253'
Kalapathar	11° 58.511'	93°00.344'
Henry Lawrence Island	12° 05.137'	92°04.386'
John Lawrence Island	12° 04.276'	93°03.063'
Outram Island	12° 13.761'	93°06.055'
Middle Button Island	12° 16.473'	93°01.334'
South Button Island	12° 13.467'	93°01.244'
North Button Island	12° 18.974'	93°03.826'
Englis Island	12° 08.586'	93°06.651'
Neil Island		
Sitatpur	11° 49.168'	93°03.382'
Rampur	11° 49.229'	93°02.296'
Lakshmanpur	11° 50.057'	93°01.407'



METHODOLOGY

The study was carried out during 2008 through 2011 in the Ritchie's archipelago of Andaman and Nicobar Islands. Random surveys were conducted in almost all parts of the study area to document the amphibian and reptile fauna. The streams and marshy areas were specially surveyed for amphibians. The calls during the night time helped to locate and collect amphibian species. Diurnal data

were collected between dawn and mid day. Usually hand picking was employed for the collection of specimens. Night observations were made wherever possible. Collected specimens were preserved in 10 per cent formaldehyde solution. The specimens were identified based on field guides and systematic references (Boulenger, 1890; Smith, 1933, 1935 and 1943; Daniel, 1963a and b, 1975; Daniel and Sekar, 1989; Tikader and Sharma, 1992).

Quadrat sampling method was used for estimating abundance and diversity indices. Plots of 8 x 8m size were laid at random, ensuring adequate representations of all habitat types and altitudes. These plots were thoroughly searched by a team of three persons (Heyer, *et al.*, 1984). Adequate time was spent in each plot to search the area completely. Amphibians and reptiles in the plot were identified in the field itself as far as possible.

Species richness, diversity indices: The data were analyzed for richness and diversity indices using the computer program SPIDIVERS of STATECOL (Ludwig and Reynolds, 1988). Two diversity indices namely Shannon-Weiner's and Simpson's and two Richness indices like Margalef (R1) and Menhenick's (R2) were estimated. The most commonly used two evenness indices E1 and E2 were also computed.

Similarity measures: Jaccard similarity index between the different islands were calculated using the formula of Magurran (1988).

RESULTS AND DISCUSSION

Occurrence of species

A total of 26 species of reptiles and amphibians belonging to 21 genera and 12 families were recorded during the period of study (Table 1 and 2). Highest number of reptiles were recorded from Havelock (15 species), followed by John Lawrence (14), Neil (13), Inglis (11), Outram and Henry Lawrence (10), North Button (8). Of the recorded species of amphibians, Havelock and Henry Lawrence Islands showed high species richness.

Table 1: List of reptiles recorded in different in Islands of Ritchie's archipelago

Sl. No.	Species name	1	2	3	4	5	6	7
	Crocodylidae							
1.	<i>Crocodylus porosus</i> Schneider 1801	✓	✓		✓	✓	✓	
	Gekkonidae							
2.	<i>Cnemaspiskandianus</i> (Kelaart, 1852)	✓				✓	✓	
3.	<i>Cosymbotus platyurus</i> (Schneider, 1792)				✓		✓	
4.	<i>Gecko gecko</i> (Linnaeus, 1758)	✓	✓		✓		✓	✓
5.	<i>Gecko verreauxi</i> (Tytler, 1865)	✓			✓		✓	
6.	<i>Hemidactylus frenatus</i> (Dumeril & Bibron, 1836)	✓	✓	✓	✓	✓	✓	✓
7.	<i>Phelsuma andamanense</i> (Blyth, 1860)	✓	✓	✓		✓	✓	
	Agamidae							
8.	<i>Calotes andamanensis</i> (Boulenger, 1891)	✓	✓	✓				
9.	<i>Calotes emmaalticristatus</i> (Schmidt, 1845)		✓			✓		
10.	<i>Calotes mystaceus</i> (Dumeril & Bibron, 1837)		✓	✓		✓		
11.	<i>Coryphophylax subcristatus</i> (Blyth, 1860)	✓	✓	✓	✓	✓		✓
12.	<i>Calotes versicolor</i> (Daudin, 1802)	✓	✓	✓	✓	✓	✓	✓
	Scincidae							
13.	<i>Dasia olivacea</i> (Gray, 1838)		✓					✓
14.	<i>Eutropis andamanensis</i> (Smith, 1935)	✓	✓	✓	✓	✓	✓	✓
15.	<i>Eutropis tyleri</i> (Theobald, 1868)	✓		✓		✓		
	Varanidae							
16.	<i>Varanus salvator</i> (Laurenti, 1768)					✓		
	Typhlopidae							
17.	<i>Ramphotyphlops braminus</i> (Daudin, 1803)		✓	✓				
18.	<i>Typhlops andamanensis</i> (Laurenti, 1768)		✓		✓	✓		✓
	Colubridae							
19.	<i>Dendrelaphis pictus andamanensis</i> (Anderson, 1871)		✓			✓		

Elapidae								
20.	<i>Bungarusandamanensis</i> (Biswas&Sanyal, 1978)		✓				✓	
21.	<i>Ophiophagushannah</i> (Cantor, 1836)	✓					✓	
22.	<i>Najasagittifera</i> (Wall, 1913)	✓		✓	✓		✓	
Viperidae								
23.	<i>Trimeresuruspurpureomaculatesandersoni</i> (Theobald, 1868)	✓	✓	✓	✓		✓	✓

(1 - Neil; 2 - Havelock; 3 - Inglis; 4 - Outram; 5 - John Lawrence; 6 - Henry Lawrence; 7 - North Button)

Table2: List of amphibians recorded in different in Islands of Ritchie’s archipelago

Sl. No.	Species name	1	2	3	4	5	6	7
Dicroglossidae								
1.	<i>Fejervaryaandamanensis</i> (Stolicka, 1870)	✓	✓	-	✓	-	✓	✓
Ranidae								
2.	<i>Limnonectuslimnocharis</i> (Boie, 1994)	-	✓	✓	-	✓	✓	✓
Bufo								
3.	<i>Duttaphrynusmelanostictus</i> (Schneider, 1799)	✓	✓	✓	✓	✓	✓	✓

(1 - Neil; 2 - Havelock; 3 - Inglis; 4 - Outram; 5 - John Lawrence; 6 - Henry Lawrence; 7 - North Button)

Diversity indices

Reptiles

Highest diversity (H') of reptiles was observed in Havelock Island (2.63), followed by John Lawrence Island

(2.56) and lowest from South Button Island (2.04). Similarly, the richness index (R1) was also recorded highest in Havelock Island (4.16) and R2 (2.79) and lowest in South Button island R1 (2.24), R2 (1.79) (Table 3).

Table 3: Diversity indices of reptiles in different islands of Ritchie’s archipelago

Islands	Richness index		Diversity index		Hill’s Number		Evenness index	
	R1	R2	λ	H'	N1	N2	E1	E2
Neil	3.38	2.20	0.05	2.53	12.55	18.55	0.99	0.97
Havelock	4.16	2.79	0.04	2.63	13.82	23.33	0.97	0.92
Inglis	3.00	2.08	0.08	2.26	9.54	12.63	0.94	0.87
Outram	2.91	2.13	0.06	2.29	9.85	17.25	0.99	0.98
John Lawrence	3.46	2.13	0.06	2.56	12.89	16.80	0.97	0.92
Henry Lawrence	2.76	1.96	0.07	2.27	9.69	14.67	0.99	0.97
South Button	2.34	1.79	0.09	2.04	7.71	11.74	0.98	0.96

Amphibians

The diversity (H') of amphibian showed that highest in Henry Lawrence Island (1.08) and lowest in John

Lawrence Island (0.69). Similarly, the richness index (R1 and R2) also varied in different islands in the Ritchie's archipelago (Table 4)

Table 4: Diversity indices of Amphibians in different islands of Ritchie's archipelago

Location	Richness indices		Diversity indices		Hill's Number		Evenness indices	
	R1	R2	Lambda	H'	N1	N2	E1	E2
Neil	1.12	1.22	0.23	1.01	2.75	4.38	0.92	0.92
Havelock	1.24	1.34	0.17	1.05	2.87	6.00	0.96	0.96
Inglis	0.72	1.00	0.27	0.69	2.00	3.75	1.00	1.00
Outram	1.12	1.22	0.23	1.01	2.75	4.38	0.92	0.92
John Lawrence	0.56	0.82	0.40	0.64	1.89	2.50	0.92	0.94
Henry Lawrence	1.03	1.13	0.21	1.08	2.94	4.80	0.98	0.98
South Button	1.44	1.50	0.13	1.04	2.83	7.50	0.95	0.94

Similarity index

An alternative approach to measure the similarity of different sites is using similarity index, using the proportional similarity measures. Similarity index between

the different islands were computed using qualitative data (Table 5.5). The similarity index, which is influenced by the most abundance species, depicted the high similarity of community between Havelock and Outram, followed by Havelock and John Lawrence Islands.

Table 5: Similarity index of Reptiles and amphibians of Ritchie's archipelago

Islands	Neil	Havelock	Inglis	Outram	John Lawrence	Henry Lawrence	South Button
Neil	0	0.64	0.88	0.63	0.72	0.72	0.85
Havelock		0	0.82	0.96	0.93	0.83	0.75
Inglis			0	0.79	0.58	0.74	0.60
Outram				0	0.64	0.77	0.78
John Lawrence					0	0.68	0.54
Henry Lawrence						0	0.82
South Button							0

Our results show that the diversity and distribution of reptiles and amphibians in particular, and the herpetofauna in general, followed similar trends at different Islands. Of the recorded species, only four species were observed from all locations namely *Hemidactylus frenatus*, *Calotes versicolor*, *Eutropis andamanensis* and *Duttaphrynus*

melanostictus. The species like *Copsymbotus platyurus*, *Calotes emmaalticristatus*, *Dasiaolivacea*, *Varanus salvator*, *Ramphotyphlops braminus*, *Dendrelaphis pictus andamanensis*, *Bungarus andamanensis* and *Ophiophagus hannah* were recorded only in one or two more sites.

The difference in species richness and probably reflects differences in sampling effort. Their sampling efforts allowed them to search more localities and more habitats. The reason for significantly greater species diversity and higher species richness of reptiles in Havelock and John Lawrence Islands is that the both areas are covered with evergreen forest and presence of different microhabitats. Most of the animals were found on the low vegetation, below 1 m and under debris of the forest floor. Few animals were found on high vegetation, which is comparable with the study of Minh (2005).

The road networks in Havelock and Neil Islands were major disturbance factors for the herpetofauna. Accidental killings of reptiles and amphibians along the road were observed and annual clearings of road edges were also noticed. The herpetofauna of the Ritchie's archipelago is subject to the anthropogenic pressures similar to other parts of the world (Tompson, 2001; Wilson and McCranie, 2004a,b). The reptiles and amphibian fauna of Ritchie's archipelago suggest that the Andaman and Nicobar Islands fauna has closer biogeographic affinities with the south-east Asian one than to the Indian fauna. The herpetofauna of Ritchie's archipelago still faces considerable pressures due to increasing population pressure and other developmental activities.

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