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Studies on Organization of Anuran Communities In Nagpur District of Maharashtra, India

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ABSTRACT
Frogs and Toads make up an important part of wetland biodiversity and are a major component of wetland food chains as they play essential roles, both as predators and prey, in the ecosystems of the world. During present investigation 7 species belonged to family Dicroglossidaeidae, 3 species from family Ranidae, 2 species from Microhylidae and Rhacophoridae and 1 species from each Ranixalidae and Bufonidae. Relative diversity composition of each family revealed Dicroglossidaeidae (46.28%) was the most dominant while family Bufonidae (24.42%) ranked second, followed by family Ranidae (16.99), Microhylidae (9.13%), Rhacophoridae (2.87%) and the least dominant was Ranixalidae (0.32%). Species diversity, evenness and species richness at the different localities of Nagpur district was calculated by Shannon-Weiner index, Evenness index and Margalef's index. Shannon-Wiener Index (H') ranged from 1.753 (Koradi lake site) to 2.430 (Veena Dam site), the calculated values of Margalef's Index ranged from 1.325 (Telenkhedi Lake, Nagpur) to 2.519 (Veena Dam), the calculated values of Simpson's index (1/D) ranged from 4.028 (Koradi lake) to 9.617 (Veena Dam) and Pielou's Evenness Index ranged from 0.798 (Koradi lake site) to 0.909 (Godhni Lake). Thus the present investigation is the first attempt to study Anuran diversity and distribution from the selected study area.

Keywords: Anuran, Shannon-Weiner index, Pielou's Evenness index, Simpson's index and Margalef's index

Introduction

Frogs and Toads make up an important part of wetland biodiversity and are a major component of wetland food chains as they play essential roles, both as predators and prey, in the ecosystems of the world. They comes under order Anura of class Amphibia and are characterized by stout body, protruding eyes, limbs folded underneath and the absence of tail in adults. They have been studied systematically since the early 18th century and 5532 species of anurans had been documented worldwide (GAA-2004). Within the last decade, amphibians have the dubious distinction of being in the global spotlight owing to worldwide declines (Barinaga 1990, Wyman 1990, Wake 1991, Griffiths and Beebee, 1992, IUCN 2009). Anthropogenic habitat loss and degradation, disease, introduced species, and pollution or combinations of these factors are at the root of most declines (Laurance & Bierregaard 1997; Schelhas & Greenberg 1996).

In India various worker like Jerdon (1870), Anderson (1871), Stoliczka (1870), Boulenger (1888), Annandale (1924), Chanda (1994) and Ao *et.al,* (2003) studied Indian Herpetology and documented amphibian distribution in India. About 30 % - 57% of the Anurans in India are threatened and disappeared due to lose of natural habitats (Vasudevan *et al.,* 2001). As awareness of declines has increased, conservation groups, governments, and land managers have become more interested in protecting amphibian diversity.

However, the lack of accurate data on amphibian distributions, particularly for tropical regions where diversity and declines are concentrated (IUCN 2006), is often a roadblock to effective conservation and management. It is essential that we document the amphibian fauna of certain regions so that steps may be taken to ensure the survival of these fascinating creatures for future generations. Keeping this in view the present study was conducted to study the diversity distribution of Anuran fauna from Nagpur District of Maharashtra.

Material and Methods

Study sites

Anuran diversity survey was carried in Nagpur District of Maharashtra from January 2016 to December 2016 on a monthly basis covering a complete wet season (rainy season) and dry season (summer). Four sites were selected for observation *viz*., Telenkhedi Lake, Veena Dam, Godhni Lake and Koradi Lake. Specimens were collected manually and/or with the help of nets using Torch lights during Dusk time. Species were photographed and identified in their natural habitats, but in few cases when assessment was difficult, they were collected for

further identification. The species were identified with the help of Standard keys provided by Smith (1943), Chanda (2002), Daniel (2002) and Daniels (2005).

Statistical Analyses

Diversity Index:

Shannon-Wiener diversity Index

The species diversity will be calculated following Shannon Wiener diversity Index (H) (Shannon and Wiener, 1949).

$H = - \Sigma (Ni/N) \ln (Ni/N)$

Where Ni = Number of individuals of species i and N= Total number of individuals of all the species.

Pieoul's Index

Evenness Index was calculated as per Hill (1973).

$E = H / \ln S$

Where S= Total number of species, N= Total number of individuals of all the species, H = Index of diversity.

Margalef's Index

Margalef's index was used as a simple measure of species richness Margalef (1970).

Margalef's index = $(S-1) / \ln N$

S = Total number of species N = Total number of individual in sample ln = Natural logarithm

Simpson's Index

Simpson Index (D) = $\Sigma n(n - 1)/ N(N - 1)$

The relative diversity (RDi) of families was calculated by using following formula (Koli, 2014):

RDi = (No. of Anuran species in the family /Total no. of species)*100

Results and Discussion

A total of 942 anurans from 16 species were recorded from selected sites in Nagpur district of Maharashtra during the study period. The species belong to 9 genera and 5 families. Out of 16 species recorded 7species belonged to family Dicroglossidaeidae, 3species from family Ranidae, 2 species from Microhylidae and Rhacophoridae and 1 species each from Ranixalidae and Bufonidae (Table 1). As far as relative diversity is concerned family Dicroglossidaeidae (46.28%) was the most dominant while family Bufonidae (24.42%) ranked second, followed by family Ranidae (16.99), Microhylidae (9.13%), Rhacophoridae (2.87%) and the least dominant was Ranixalidae (0.32%) (Fig. 1). The present study agreed with the observation of Neog (2016).

Duttaphrynus melanostictus (Common Asian Toad) was the most dominant species and was widely distributed in all the sites owing to its wide range of habitats. The individual were recorded maximum from the Koradi lake site (39.36%). The second predominant species was *Euphlyctis cyanophlyctis* being found in all sites and maximum was documented at Koradi Lake (19.11%). The other important species obtained were *Hoplobatrachus tigerinus, Fejervaroya pierrei, Fejervaroya limocharis* and were documented from all sites. The least abundant was the *Rhacophorus malabaricus* (0.77%) and were recorded from Veena dam and *Indirana beddomii* was found only in the Godhni Lake site (1.58%) (Table-1). The number of individuals that represents each species in community may vary from place to place depending on the amount of rainfall, available habitats and human interference as the structure and diversity of an amphibian community is determined by the availability of food, moisture and micro habitat Daniels (1992).

Shannon-Wiener Index (H') ranged from 1.753 (Koradi Lake site) to 2.430 (Veena Dam), indicating that the lowest equitability was calculated from Koradi Lake and the highest diversity was calculated from Veena Dam. Both the values indicate that the Anuran fauna is more or less evenly distributed at all the localities of Nagpur district of Maharashtra (Table-2). The calculated values of Margalef's Index at the different localities of Nagpur district ranged from 1.325 (Telenkhedi Lake, Nagpur) to 2.519 (Veena Dam), indicating that Anuran's are more abundant at Veena Dam and less Abundant at Telenkhedi Lake area of Nagpur, remaining all the habitats show more or less the same abundance (Table-2). Simpson's index gives the species abundance and diversity by D. As D increase diversity decrease and the Simpson's index is usually express as 1-D or 1/d. This index is heavily weighted towards the most abundant species and being less sensitive to species richness. The calculated values of Simpson's index (1/D) ranged from 4.028 (Koradi Lake) to 9.617 (Veena Dam). This index showed that the lowest abundance was obtained from Koradi Lake and the highest abundance was obtained from Veena Dam (Table-2). Pielou's Evenness Index quantifies how equal community is numerically. It is ranged from 0.798 (Koradi Lake site) to 0.909 (Godhni Lake), indicating that the least variation at Koradi Lake site and maximum evenness at Godhni Lake (Table-2).

The above mentioned variations in the faunal makeup might be due the differences in ecological conditions. Some species were wide spread occurring regularly in different studied sites, they could tolerate wide variety of habitats and were aptly "ecologically generalized groups", on the other hand some forms were localized i.e. restricted to ecological specialized group.

Several workers have previously recorded Anuran species from India, *viz.*, Murthy (1968) reported 6 species from Telangana state; Daniels (1995), Padhye and Ghate (2002) and Dahnukar *et al.*, (2013) from Western Ghat in Maharastra state; Chanda (2002) recorded 14 species and Sen (2004) compiled 17 species from Manipur state. Choudhary (2004) recorded 10 species from Dibru Saikhowa National park. Bortamuli (2010) recorded 19 species from Charaideo subdivision (at present Choraideo District) of Sivasagar District whereas Bortamuli and Bordoloi (2008) recorded 25 species from various wetlands of Sivasagar District of Assam.

Table 1. Systematic List frequency percentage of Anuran's Population at the study sites in Nagpur district of Maharashtra (January, 2016 to December2016)

Family	Scientific name	IUCN status	Frequency % of Anuran's Population Bardhwan District			
			Telenkhedi Lake, Nagpur	Veena Dam	Godhni Lake	Koradi Lake
Dicroglossidae (Anderson)	*Euphlyctis cyanophlyctis* (Schneider,1799)	LC	15.71	6.56	6.84	19.11
	Hoplobatrachus tigerinus (Daudin,1803)	LC	6.28	3.09	3.16	4.89
	Fejervaroya pierrei (Dubois,1975)	LC	17.28	13.90	11.05	6.67
	Fejervrya teraiensis (Dubois, 1984).	LC	N.D.	1.54	3.16	N.D.
	Fejervaroya limocharis (Gravenhorst,1829)	LC	3.66	4.63	4.74	4.89
	Fejervrya syhadrensis (Annandale, 1919)	LC	N.D.	4.63	4.74	N.D.
	Fejervrya sp.	LC	21.99	14.29	12.11	8.44
Ranidae (Rafinesque)	*Hylarana aurantiacacaca* (Boulenger,1904)	LC	1.05	3.09	N.D.	5.78
	Rana taipehensis (Van Denburgh,1909)	LC	N.D.	8.88	10	4
	Rana curtipes (Jerdon, 1854)	LC	N.D.	2.32	4.74	N.D.
Ranixalidae	*Indirana beddomii (Günther, 1876)*	LC	N.D.	N.D.	1.58	N.D.
Microhylidae (Gunther)	*Microhyla ornate* (Dumeril & Bibron, 1841)	LC	7.85	12.74	14.21	2.67
	Kaloula taprobanica (Parker, 1934)	LC	N.D.	1.93	N.D.	N.D.
Rhacophoridae (Hoffman)	*Polypedates maculates* (J.E.Gray, 1830)	LC	N.D.	5.79	4.21	N.D.
	Rhacophorus malabaricus (Jerdon, 1870)	LC	N.D.	0.77	1.05	N.D.
Bufonidae (Gray)	*Duttaphrynus melanostictus* (Schneider,1799)	LC	29.32	15.83	18.42	43.56

Table 2. Calculated values of Diversity indices different Habitats of Anuran's Population at the study sites in Burdwan district of West Bengal (January, 2014 to December2014)

Sr. No.	Name of Site	Shannon-Weiner Index (H')	Pielou's Index (J)	Margalef's Index (M)	Simpson's Index (1/D)
1.	Telenkhedi Lake	1.805	0.868	1.325	5.308
2.	Veena Dam	2.43	0.897	2.519	9.617
3.	Godhni Lake	2.4	0.909	2.478	9.386
4.	Koradi lake	1.753	0.798	1.477	4.028

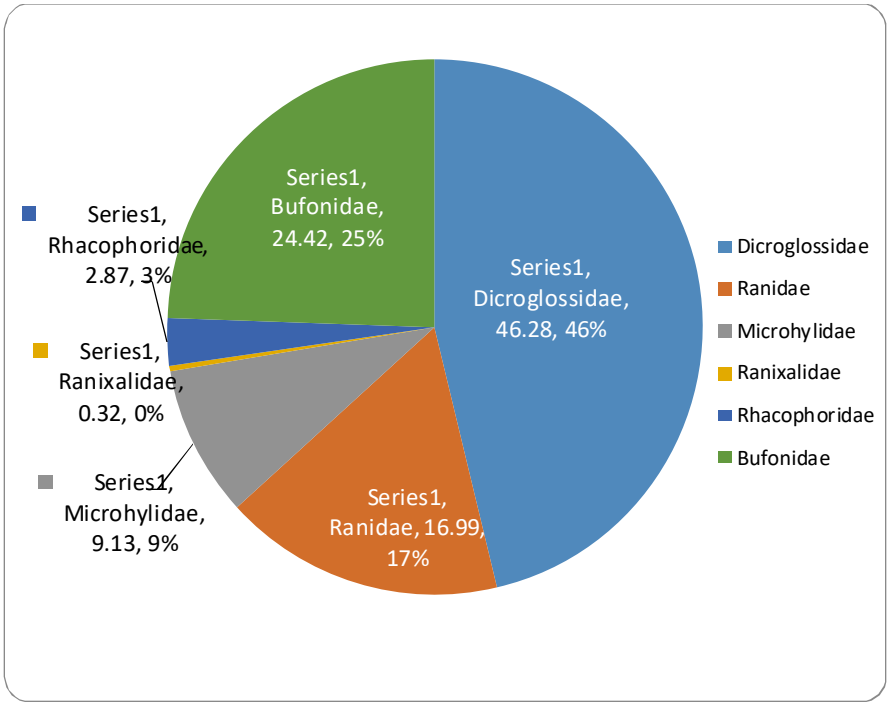

Figure 1: Relative diversity (RDi) of various families at study sites in Nagpur district of Maharashtra from January 2016 to December 2016.

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