

Diversity of amphibians in the micro habitats of the agroecosystems of Nagapattinam District, Tamil Nadu, India

<https://doi.org/10.56343/STET.116.010.004.004>
<http://stetjournals.com>

Thenmozhi Jagaveerapandian*, Karunakaran Kasinathan and Karthik Thamizharasu

PG and Research Department of Zoology and Wildlife Biology, A.V.C. College, Mannampandal, , Mayiladuthurai - 609 305, Tamil Nadu, India

Abstract

Amphibians play an important role in the ecological cycle of the agroecosystem. The declining trend and disappearance of amphibian population in ponds are influenced by several factors such as climatic changes, fertilizers, pesticides and invasion of exotic plants. Time constrained VES (Visual Encounter Survey) method involves systematic search of an area. A total of 9 species of anurans were recorded in the present study in Nagapattinam district. They belonged to seven genera and four families of amphibians. Studies on the microhabitats revealed that most of the amphibians preferred the water bodies and edge of the water as the micro habitat. In the present study *Hoplobatrachus crassus*, *Fejervarya limnocharis* and *Microhyla ornata* were encountered in all types of microhabitats when compared to other species of amphibians.

Keywords: Amphibians, GPS, Micro habitats, VES Method and Nagai District.

Received : August 2015

Revised and Accepted :April 2017

INTRODUCTION

Amphibians are habitat specific and highly sensitive animals. So, these are called indicator species of environment and also, they play an important role in ecological cycle around the agricultural field (Blaustein and Wake, 1990; Vitt *et al.*, 1990; Wyman, 1990; Wake, 1991; Cushman, 2006). Among the amphibians, the order Anuran constitute the vast majority (88%) of living species of amphibians and the bulk of their genetic, physiological, ecological and morphological diversity. Amphibians currently include more than 7301 recognized species in the world and 342 species in India (Frost, 2013). Out of the 342 species of known amphibians from India, 75 species are yet to be evaluated and 81 species are still under the data deficient category (Dinesh *et al.*, 2013). The 342 species of Indian amphibians include 306 species of anurans, 35 species of Gymnophiona and 1 species of Salamander (Dinesh *et al.*, 2013). The amphibians of the Western Ghats are diverse and unique, with more than 80% of the 181 amphibian species are endemic to the region. About 77 species are reported from the state of Tamil Nadu, India (Dinesh and Radhakrishnan, 2009). Also, many new species have been recently discovered from India, especially in Western Ghats

(Vasudevan and Dutta, 2000; Dutta and Ray, 2000; Biju and Bossyut, 2003; Gururaja *et al.*, 2007; Dinesh *et al.*, 2009; Biju *et al.*, 2009, 2010; Joshy *et al.*, 2009; Dinesh *et al.*, 2013). Amphibians are more threatened and declining in population than birds and mammals (Stuart *et al.*, 2004).

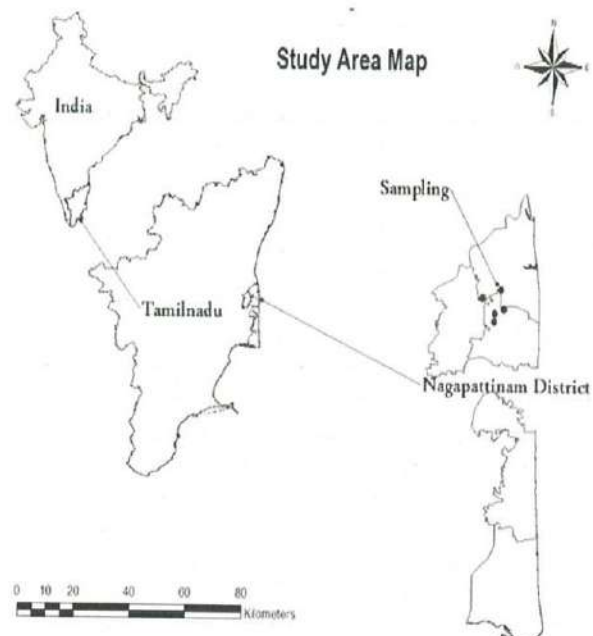


Fig. 1. Study area map showing the sampling points of different habitats of Nagapattinam District during the study period from May 2014 to September 2014.

*Corresponding Author :
 email: jvtamphibia@gmail.com

Table 1. List of Anuran species recorded from Arupathy and its surrounding habitats of Nagapattinam District during the study period from May 2014 to September 2014.

S.No.	Family	Species Name	IUCN Status
1	Bufonidae	<i>Duttaphrynus melanostictus</i>	LC
2	Dicroglossidae	<i>Euphlyctis cyanophlyctis</i>	LC
3	Dicroglossidae	<i>Euphlyctis hexadactylus</i>	LC
4	Dicroglossidae	<i>Hoplobatrachus tigerinus</i>	LC
5	Dicroglossidae	<i>Hoplobatrachus crassus</i>	LC
6	Dicroglossidae	<i>Fejervarya limnocharis</i>	LC
7	Microhylidae	<i>Microhyla ornate</i>	LC
8	Microhylidae	<i>Ramanella varigata</i>	LC
9	Rhacophoridae	<i>Polypedates maculatus</i>	LC

Table 2. Mean values of microhabitat usage by Anurans in Nagapattinam District during the study period from May 2014 to September 2014.

Sl. No	Species	Banana Tree	Ground	Grass land	Leaf Litter	Leaf on water	Stone	Tree branches	Water	Water Edge
1	<i>Duttaphrynus melanostictus</i>	0	1.1±0.3	1.0±0.0	0	0	0	0	0	0
2	<i>Euphlyctis cyanophlyctis</i>	1.0±0.0	1.2±0.5	0	1.0±0.0	1.0±0.0	0	0	1.7±1.3	5.5±0.5
3	<i>Euphlyctis hexadactylus</i>	0	1.1±0.5	0	1.1±0.4	1.0±0.0	0	0	1.4±0.8	2.3±1.8
4	<i>Hoplobatrachus crassus</i>	0	1.6±0.8	1.0±0.0	1.0±0.0	1.0±0.0	1.0±0.0	0	1.3±0.8	1.0±0.0
5	<i>Hoplobatrachus tigerinus</i>	0	1.2±0.5	1.0±0.0	1.0±0.0	0	0	0	1.2±0.4	0
6	<i>Fejervarya limnocharis</i>	0	1.3±0.6	1.3±0.4	1.8±0.9	1.0±0.0	0	0	1.3±0.7	0
7	<i>Microhyla ornate</i>	1.0±0.0	1.0±0.1	0	0	1.0±0.0	0	2.0±0.0	1.0±0.0	0
8	<i>Polypedates maculatus</i>	0	1.0±0.0	0	0	0	0	1.0±0.0	1.0±0.0	0
9	<i>Ramanella varigata</i>	1.0±0.0	1.0±0.0	1.0±0.0	0	0	0	1.0±0.0	1.0±0.0	0
	Grand Total	1.0±0.0	1.1±0.5	0.9±0.5	1.3±0.6	1.0±0.0	1.0±0.0	1.1±0.4	1.4±0.9	3.2±2.2

Table 3. Amphibian species presence and absence in different microhabitats of the study area of Nagapattinam District during the study period from May 2014 to September 2014.

Species Name	Banana Tree	Ground	Grass land	Leaf Litter	Leaf on water	Stone	Tree branches	Water	Water Edge	Total %
<i>Duttaphrynus melanostictus</i>	-	*	*	-	-	-	-	-	-	6
<i>Euphlyctis cyanophlyctis</i>	*	-	-	-	*	-	-	*	*	13
<i>Euphlyctis hexadactylus</i>	-	-	-	-	*	-	-	*	*	6
<i>Hoplobatrachus crassus</i>	-	-	*	-	*	*	-	*	*	16
<i>Hoplobatrachus tigerinus</i>	-	-	*	*	-	-	-	*	-	9
<i>Fejervarya limnocharis</i>	-	*	*	*	*	-	-	*	-	16
<i>Microhyla ornate</i>	*	*	-	-	*	-	*	*	-	16
<i>Polypedates maculatus</i>	-	*	-	-	-	-	*	-	-	6
<i>Ramanella varigata</i>	*	*	*	-	-	-	*	-	-	13
Total	3	5	5	3	5	1	3	6	3	100

animal species have their main pattern of distribution in this kind of habitat and frog diversity is typically much lower in agricultural areas than the surrounding habitats (Bonin *et al.*, 1997). In human habitation and semi-urban area non practiced or non domestic animals are facing every risk in their life cycle. The major problem of living habitat, even they are prepared as small place, is that the habitat is either changed or altered for the purpose of cultivation or for human settlement. Habitat alteration is a major factor in the global trend of declining populations of amphibians

The declining and disappearance of amphibian population in ponds are influenced by several factors such as climatic changes, fertilizers, pesticides, invasion of exotic plants and degradation of microhabitats. Pond ecosystems may provide the framework for metapopulation structure and dynamics in many amphibian species (Stephen and Closkey, 1996). Current agricultural systems have become not suitable habitat for Anuran species, which has been attributed to pesticides contamination, habitat degradation, cultivation changes and deficiency of irrigational facility in the Cauvery deltaic region. Agricultural landscapes containing arable land in many regions are the dominating habitats, having little resemblance to natural habitats. Few

(Collins and Storfer, 2003; Stuart *et al.*, 2004). Amphibians are more threatened and attained the declining status as per the IUCN red list than the other animals (Stuart *et al.*, 2004). They are sensitive to environmental changes both in terrestrial and aquatic habitats because they have highly semi-permeable skins and different stages of life cycle (Alford and Richards, 1999). There are many studies on the microhabitat use by forest-dwelling amphibians, but very few such works on amphibians of grassland and agricultural areas. This study examines habitat use of

the Anurans, which inhabit grasslands and agricultural areas.

Totally 90 endemic amphibian species of Western Ghats require habitat and habitat-quality protection. Several other restricted species occurring in other biogeographic zones with high human impact include the Eastern Ghats, north-eastern India, Himalayas, the Terai and the islands of Andaman and Nicobar, which need urgent and immediate attention for conservation. In this context the present article deals with the diversity of amphibians and the microhabitats in the agro ecosystem of Nagappattinam district, Tamil Nadu, India.

DESCRIPTION OF THE STUDY AREA

The Nagapattinam district lies on the east coast of the south Cuddalore district and another part of the Nagapattinam district lies on the south of Karaikkal and Thiruvarur district. It is bordered by the Bay of Bengal. The district lies between 10°25' and 11°40' North Longitude and 76°49' and 80°01' East latitude. The general geological formation of the district is plain and coastal. The district is also known as "The District of Ponds". The district has a varied topography with sea on one sides and the other parts of Thiruvarur, Karaikal (Territory Union), Thanjavur and Cuddalur Districts on the other side. Field work was carried out in Arupathi, EaswaranKoil, East Meaterupu, Parasalur, Kezapparasarur of Nagappattinam district, Tamil Nadu, India. Paddy and Banana were cultivated in these areas. Anuran survey was intensively carried out in five different habitats including the fields of banana, paddy and nut grass, and ponds and canals. All the coordinates were pointed using the Global Positioning System (GPS).

MATERIALS AND METHODS

Visual Encounter Survey method (VES) was carried out for 246 hours by involving two persons. The headlights and torch lights were used to find out the presence or absence. All the areas were walked thoroughly for the survey of amphibians. Sighting of an individual species was recorded with notes on ecological parameters. Time constrained VES involves systematic search of an area or habitat for a prescribed time (Heyar *et al.*, 1994; Campbell and Christman, 1982).

The field work was carried out from May 2014 to September 2014. Overall, data were collected regularly during morning and evening of the study period. The list of species encountered and co-variables such as temperature, microhabitat, and water distance from each species sightings, vegetation type and soil types were also recorded during the study period. Photographs of the amphibians and various pictorial field guides were used to identify the species in the field itself. Unidentified species was identified with published keys of Daniels (2005).

P - ISSN 0973 - 9157
E - ISSN 2393 - 9249

April to June 2017

RESULTS AND DISCUSSION

Totally 9 species of amphibians were recorded during the present study. They included five species of Dicroglossidae, two species of Microhylidae and a single species of Rhacophoridae and Bufonidae each. The nine species of amphibians include *Duttaphrynus melanostictus*, *Euphlyctis cyanophlyctis*, *Euphlyctis hexadactylus*, *Hoplobatrachus tigerinus*, *Hoplobatrachus crassus*, *Fejervarya limnocharis*, *Microhyla ornata*, *Ramanella varigata*, and *Polypedatus maculatus*. (Table 1).

According to the usage of habitat and characteristics the amphibians are categorized into aquatic, terrestrial and arboreal. Among the nine species four species were belonged to aquatic, four species were terrestrial and the remaining one was arboreal. In the present study both aquatic and terrestrial amphibians were reported and analyzed for microhabitat usage by the species. Microhabitat usages of amphibians were less in grassland habitats (0.9±0.5) and maximum was in water (3.2±2.2) (Table 2). Three amphibians, *Hoplobatrachus crassus*, *Fejervarya limnocharis* and *Microhyla ornate* were used all types of habitats (16 %) *Euphlyctis cyanophlyctis* was found recorded from banana plant, leaf surfaces in water and in water, whereas *Ramanella varigata* (13%) was found mostly on the plant surfaces. *Hoplobatrachus tigerinus* used plant surfaces and water (9%) and the three species namely *Duttaphrynus melanostictus*, *Euphlyctis hexadactylus* and *Polypedates maculatus* used either water or plant surfaces (6%) (Table 3). Amphibian species were most sited in four main microhabitats of the study area. Totally 6 species from water, and 5 species from ground, floor, grassland and plant leaves on water were recorded. The other four microhabitats included banana plant, leaf litter, tree, tree branches and water edges. Three species were present in all habitats (Table 3). Only one species was sighted under stone. Dennis *et al.* (2013) described agricultural area was more suited habitat than the secondary forest area which could be due to the hydrological conditions and food availability in the area. All the agriculture areas of Cauvery delta regions are converted into human habitation due to urbanization and lack of water for irrigation and less rainfall. Many wet lands of these districts have been converted into residential places. Seshadri *et al.* (2012) discussed the impact of urbanization on the population status of amphibians in Puducherry state. It has been reported that about 33% of amphibians were eliminated from the city. The present study area of Nagapattinam had undergone urbanization and rapid conversion of agricultural lands into residential places in the recent years. Seshadri *et al.* (2012) reported 14 species of amphibians from the wetlands of Puducherry, India. GrazyKutty (2007) recorded 12 species of amphibians from agricultural areas of Periyakulam Taluk. 10 species of

184 Karunakaran Kasinathan *et al.*,
amphibians have been reported from agricultural area
of Kanyakumary District. But in the present study only
9 species of amphibians were encountered

CONCLUSION

Amphibians are habitat specific and highly sensitive
animal. The habitat degradation leads to decline in
the amphibian population and density. Hence, to
protect the environment and the balanced ecosystem,
the amphibians need urgent and immediate
conservation.

ACKNOWLEDGEMENTS

The authors thank the Principal and the Management
for the necessary permission and encouragement,
and Dr. R. Saravanamuthu, Former Head of the
Department of Botany, AVC College (Autonomous),
Mannampandal, Mayiladuthurai for his critical
comments and this manuscript preparation.

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