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J. Sci. Trans. Environ. Technov. 2019, 13(2) :54-58

Scientific Transactions i Environment and Technovation

Assessment of Anuran Diversity in the Freshwater Ponds of Thiruvarur District, Tamil Nadu, India

https://doi.org/10.56343/STET.116.013.002.004

http://stetjournals.com

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Abstract

The present study was carried out during August 2013 to March 2014 in different fresh water ponds of Thiruvarur district, Tamil Nadu, Southern India. Seven species of Amphibians viz, *Duttaphrynus melanostictus, Polypedates maculates, Hoplobatrachus tigerinus, Euphlyctis hexadactylus, Euphlyctiscyanophlyctis, Fejervarya limnocharis, and Ramanella variegat ata* were recorded. Among the seven species, the *Hoplobatrachus tigerinus* (305) *Euphlyctis hexadactylus* (301) were encountered frequently. *Fejervarya limnocharis*(30) and *Ramanella variegatata* (46) were the amphibian species with the lowest record in the study area. The density and diversity of amphibians varied significantly due to the type of micro habitat and season.

Key words: Amphibian, Anura, Diversity, Fresh water ponds. Micro habitat

Received : March 2018 Revised and Accepted : January 2019

INTRODUCTION

The recognized species of Amphibians which have been recorded throughout the world include 7301 (Amphibian Ark, 2014). Out of the 342 species of known Amphibians from India (Frost, 2013), 75 species are yet to be evaluated and 81 species are still under the data deficient category(Dinesh *et al.,* 2013). Amphibians are affected by the pollution of surface waters with fertilizers and pesticides (Richard, 2010). Amphibians are integral components of many ecosystems and serve as excellent bio-indicators of the environment (*Katie Finlinsonet al*., 2002).

The decline and disappearance of amphibian population in ponds are influenced by several factors such as climatic changes, indiscriminate use of fertilizers and pesticides, invasion of exotic plants and degradation of microhabitats. Invasive species are widely accepted as one of the leading causes of biodiversity loss and can have significant effects on resource availability and can suppress or enhance the relative abundance of native species, without necessarily being the driving force behind community change (Didham*et al.* 2005). Various factors, including both biotic and abiotic, influence the population dynamics of amphibian species in aquatic environments. Land alterations like converting agriculture land to human habitation, uses of pesticides in agriculture field, water contamination in village ponds by using pesticide and chemical fertilizers around the water bodies are some of the causes for decline of amphibian population in them. Invasion of exotic species (such as water hyacinth) is a threat to these ecosystem and could directly modify them, causing a cascading effect for resident biota e.g. space (Crooks, 2002).

Fig.1. Map showing the various study sites of the study area of Thiruvarur District, Tamil Nadu.

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

Table1. Mean (± S.D.) number of Amphibian species encountered in different months during August 2013 to March 2014 in the ponds studied at Thiruvarur District, Tamilnadu, India

S. No.	Months	AMPHIBIAN SPECIES						
		DM	*EH*	*EC*	*FL*	*HT*	*RV*	*PM*
1	August	2.42±1.09	1.65±0.52	1.60±0.68	2.00±1.04	3.18±3.57	1.00±0.00	1.73±0.47
2	September	2.91±1.28	1.85±0.63	1.82±0.87	1.13±0.35	3.10±1.52	1.00±0.00	1.71±0.49
3	October	3.37±1.78	2.03±0.67	1.50±0.58	1.00±0.00	3.96±2.08	1.50±0.55	2.00±0.88
4	November	2.43±0.82	2.22±0.72	1.72±0.54	0.00±0.00	2.98±1.45	0.00±0.00	2.35±2.04
5	December	2.79±1.11	1.91±0.80	1.75±0.68	2.00±0.00	3.47±1.74	1.43±0.53	2.10±0.86
6	January	2.32±0.94	1.98±0.58	1.69±0.48	0.00±0.00	3.40±1.46	1.50±0.52	2.28±0.80
7	February	2.59±0.94	2.18±0.40	1.75±0.71	1.50±0.71	3.25±1.58	1.00±0.00	1.00±0.00
8	March	2.19±1.17	1.85±0.99	2.00±0.00	1.80±0.45	2.77±1.42	1.00±0.00	1.50±0.71

DM=*D. melanostictus;* EH= *E. hexadactylus;* EC= *E.cyanophlyctis;* FL= *F. limnocharis;* HT=*H.tigerinus;* RV=*R. varigata;* PM= *P. maculatus*

Table 2. Diversity indices for amphibian species in different ponds of Thiruvarur district during the study period from August 2013 to March 2014.

Village Ponds	Shanon –H	Variance H	Simson-D
Edaiyankulam	1.7489	0.0031808	5.3372
Kuttai kulam	1.6299	0.0063163	4.2869
Nangali kulam	1.6768	0.0046345	4.5546
Pillayar koil kulam	1.6426	0.0044283	4.8905
Poundadi kulam	1.7334	0.0045374	4.8615
Sathiram Kulam	1.6976	0.0056883	4.6874
Vadugan Kulam	1.8107	0.0015535	5.5589
Vannan kulam	1.6222	0.0032377	4.7582
Vettukulam	1.7766	0.0047468	5.2811

Table 3. Abundance of amphibians' population in relation to aquatic plants during August 2013 to March 2014.

S. No	Vegetation type	*AMPHIBIAN SPECIES*							Grand Total
		EH	*EC*	*HT*	*RV*	*FL*	*DM*	*PM*	
1	Eichhornia sp.	76	31	66	23	7	0	0	203
2	Lily (Lilium sp.)	58	16	59	3	4	0	0	140
3	MixedVegetation	58	17	60	8	5	0	0	148
4	Open	52	21	53	6	4	0	0	136
5	Pistia sp.	57	17	67	6	10	0	0	157
	Grand Total	301	102	305	46	30	0	0	784

EH= E. hexadactylus; EC= E.cyanophlyctis; FL= F. limnocharis; HT=H.tigerinus; RV=R. varigata; DM= D. melanostictus; PM= P. maculatus

In India, Amphibian research is much neglected especially with reference to agriculture and semi-urban area. Small size ponds have more species and has a higher conservation value than a single large ponds of the same total area (Beat *et al*., 2002). The use of microhabitat, besides varying between different species, may also vary between individuals of the same species, for example, ontogenetically (Alford and Crump, 1982; Eterovick*et al*., 2010).

Table 4. Effects of different factors on the amphibian populations of village ponds studied.

S. No.	Factors	ANOVA				
		SS	*Df*	MS	F	p-value
1	Microhabitat	129734.8	9	14414.98	3.41336	0.001792*
2	Vegetation	42.3305	7	6.047214	0.301085	0.90324
3	Season	57888.8	18	57888.8	6.92482	0.016938*
4	Chemical Parameters	3427241	69	49670.15	1.306135	0.061736

Aquatic ecosystem is one of the most productive ecosystems in the world. This ecosystem consists of numerous plants and animals including species belonging to invertebrates and vertebrates. Ponds are the important freshwater habitats and play a vital role in maintaining biodiversity at the landscape level. However, they are vulnerable to environmental degradation and there is evidence that, at a national level, pond quality is declining in India. The microhabitats used by the forest-dwelling amphibians have been frequently studied, but very few reports are available with reference to amphibians of fresh water ponds in India(Sivakumar,2004; Thenmozhi and Thangapandian, 2013). The present article deals with population characteristics of amphibians in the selected ponds of Thiruvarur district, Tamilnadu, India and also the preference of microhabitats to the amphibians in them.

STUDY AREA

The present survey of amphibians was carried out in the village ponds of Thiruvarur District, Tamil Nadu, India. Thiruvarur district is bounded in northby Nagapattinam district, South by Thanjavur district.

The district lies between 10° 20'N and 11° 12'N and 78° 48'E and 79° 38'E. Thiruvarur district is spread in 2097.97 Km^2 areas between Thanjavur and Nagapattinam Districts. The present study was carried out for a period of eight months from August 2013 to March 2014.

The study sites were selected near Thiruthuraipoondi and its surrounding villages (Fig.1). The samplings were from 10 village ponds viz.,Aranmanai Kulam, Pillayar Kulam, Edaiyan Kulam, Nangali Kulam, Kuttai Kulam,.Vettu Kulam, Poundadi Kulam, Vannan Kulam, Sathiram Kulam and Vadugan Kulam. Aranmanai Kulam and Pillayar Kulam ponds were free from vegetations, Edaiyan Kulam and Nangali Kulam ponds were inhabited with the vegetations of *Pistia sp*., Kuttai Kulam and Vettu Kulam ponds were filled with the vegetations of *Lilium sp*., Poundadi Kulam and Vannan Kulam ponds were filled with the vegetations of mixed plants, and Sathiram Kulam and Vadugan Kulam ponds were filled with the weeds of *Eichhornia sp*.

RESULTS

A total of 1149 amphibians belonging to 7 species and 4 families were recorded. The seven species of amphibians were *Duttaphrynus melanostictus*, *Polypedates maculatus*, *Euphlyctis cyanophlyctis*, *Hoplobatrachus tigerinus*, *Euphlyctis hexadactylus*, *Ramanella variegata* and *Fejervarya limnocharis.* More number of amphibians (218) were recorded from Vadugan kulam followed by Aranmanai Kulam (124) and Nangali Kulam (121). In the remaining four ponds, 98 individuals of amphibians were encountered in Sathiram Kulam and Vettu kulam, 89 and 79 individuals of amphibians were encountered in Vannan Kulam and Pillayar Kulam, respectively. The minimum number of amphibian sightings were recorded in the open area pond of Pillayar Kovil Kulam (79). Among the seven species of amphibians *H. tigerinus* was encountered more in number (305) when compared to the other species. The sightings of *F. limnocharis* (30) was very less during the study period and was absent in VannanKulam.

Month wise variations in amphibian species in the study ponds are given in Table 1. *H.tigerinus* was the most abundant species of amphibian in all the months of the study period. *R.variegata* was observed in very low number and was not recorded in November 2013 in any one of the ponds.(Table 1)

Diversity indices of anurans ranged from 1.6222 to 1.810 (Table 2).The results of Shannon Weiner and Simpson index clearly showed significant variations in different village ponds studied. Maximum Shannon Wiener diversity was in Vadugan kulam (H = 1.810) and least in Vannan kulam (H=1.622) whereas the Simpson'sindex D= 5.5589 was maximum in Vadugan kulam and least in Kuttai kulam(4.286). Both the diversity indices for the amphibians diversities were the highest in the Vadugan kulam pond(Table 2).

The total sightings of various species of amphibians in the study ponds during the study period are given in Table 3. The amphibian sightings were the highest in *Eichhornia sp.*ponds and the least in ponds with Lily *(Lilium sp.)*.

There was significant variation in the amphibian populations due to microhabitats ($p<0.005$) and season ($p<0.05$) in the ponds of the present study (ANOVA;Table 4).

DISCUSSION

This main objective of the study was to understand the influence of various types of vegetations such as water hyacinth, *Pistia,* Lily and Mixed type of vegetations on the density and diversity of amphibians in selected pond ecosystems of Thiruvarur District. A total of 1149 amphibians belong to 7 species and 4 families were recorded. The maximum population was observed in *Eichhornia* pond and the minimum in the open area pond during the study period. The least number of amphibians in open pond might have been due the absence of hiding place to protect themselves from the predators. In addition that availability of prey items might also have been less. Similar type of results were also reported by Michael (2001). The abundance of *Hoplobatrachus tigerinus* (305) and *Euphlyctis hexadactylus* (301) were higher when compared to other anurans because the ponds hadbeen the original habitat of these anurans. *D. melanostictus* was the third highest number of anuran because of its cosmopolitan character. This was also in agreement with studies of Dutta (1997). He also reported that the *D.melanostictus*is to be cosmopolitan in distribution. Daniels (1992) stated that the number of individuals that represent each species in a community could vary from place to place depending on the amount of rainfall, availability of habitats and human interferences as the structure and diversity of an amphibian community are determined by the availability of food, moisture and micro habitat.

The results obtained from the present investigation showed that the microhabitat in the ponds had an impact on amphibian abundance and diversity. Most of the amphibians were recorded in water, water edges and on land only when compared to other microhabitats. This might have been due to the availability of prey items such as various insects, Phyto and Zoo planktons in the pond. This is also in accordance with the findings reported by McVea and

Boyd (1975). In the present study, the anuran population got suddenly decreased during February and March 2014. This might have happened due to aestivation of anurans because of the unfavorable conditions.

Micro habitat and sighting time also play a major role in influencing the density and diversity of amphibian population (Table 4), as there was a significant variation of amphibian populations due to microhabitats ($p<0.005$) and season ($p<0.05$). The relationship between habitat complexity and species richness has also been reported earlier for many species of amphibians (Purrenhage and Bone, 2009; Silva *et al*., 2011)

CONCLUSION

Amphibians are important for impending scientific studies regarding environmental health. As noteworthy bio-indicators, amphibians can reflect the condition of their habitat. Their semi-permeable skin makes amphibians respond sensitively to the environmental alterations and their populations might show decline due to agricultural fertilizers, water quality, aquatic plants and poor water level in summer especially in the months of March and April, resulting in low amphibian population in many studied ponds. However, other determining factors of amphibian populations were not studied. Since amphibians are considered prophetic organisms, studies of amphibians are necessary to understand the environmental issues that could potentially impact more organisms, primarily humans. Hence studies on diversity and habitats of amphibians are the need of the hour in order to make conservation priorities. This study generates baseline data on the amphibian fauna of this region, which could help the future studies. It is concluded that most of the physico-chemical and biological parameters in the pond under study showed a monthly pattern of variation due to their local factors like release of sewage, dumping of organic debris, release of inorganic nutrients, detergents etc, which could have potentially influenced the population status of the amphibians.

REFERENCES

Alford. R.A., and M.L. Crump. 1982. Habitat partitioning among size classes of larval southern Leopard frogs, *Rana utricularia. Copeia*. 367-373. https://doi.org/10.2307/1444617

Amphibian Ark. News letter. 2014.27,18 https://doi.org/10.1097/01.EEM.0000459015.21354.1c

Beat Oertli, Dominique Auderset Joye, Emmanuel Castella, Raphae¨ lle Juge, Diana Cambin, Jean- Bernard Lachavanne. 2002. Does size matter? The relationship between pond area and biodiversity. *Biol.Conserv.*, 104:59–70. https://doi.org/10.1016/S0006-3207(01)00154-9

Crooks, J. A. 2002. Characterizing ecosystem-level consequences of biological invasions: the role of ecosystem engineers. *Oikos*, 97:153–166. https://doi.org/10.1034/j.1600-0706.2002.970201.x

Daniels, R. J. R., Geographical distribution patterns of amphibians in the Western Ghats, India. *J. Biogeogr.*, 1992, 19, 521– 529. https://doi.org/10.2307/2845771

Didham, R.K., Tylianakis, J.M., Hutchison, M.A., Ewers, R.M. and Gemmell, N.J. 2005.Are invasive species the drivers of ecological change? *Trends in Ecology and Evolution* 20. https://doi.org/10.1016/j.tree.2005.07.006 PMid:16701420

Dinesh, K.P., C. Radhakrishnan, K.V. Gururaja, K. Deuti & G. Bhatta (2013). *A Checklist of Amphibia of India with IUCN Red list Status. Zoological Survey of India*. http://zsi.gov.in/checklist/Amphibia_ final.pdf

Dutta, S. K. 1997. *Amphibians of India and Sri Lanka* (checklist and bibliography). Odyssey Publishing House, Bhubaneswar, India.

Eterovick, P.C., C.R. Rivers, K. Kopp, M. wachlevski, B.P. Franco, C.J. Dias, I.M. Barata, A.D.M. Ferreira and L.G. Afonso. 2010. Lack of phylogenetic signal in the variation in anuran microhabitat use in southeastern Brazil. *Evol. Ecol.* 24:1-24. https://doi.org/10.1007/s10682-008-9286-9

Fauth, J.E., Crother, B.I. & Slowinski, J.B. (1989) Elevational patterns of species richness, evenness and abundance of the Costa Rican leaf litter herpetofauna. *Biotropica*, 21, 178–185. https://doi.org/10.2307/2388708

Frost, D. R. (2013). *Amphibian Species of the World: an Online Reference*. Version 5.6 Electronic Database accessible at http://research.amnh.org/herpetology/amphibia/index.html. American Museum of Natural History, New York, USA.

Inger, R.F., Shaffer, B., Koshy, M. & Bakde, R. (1984a) A report on a collection of amphibians and reptiles from the Ponmudi, Kerala, South India. *J. Bombay Nat Hist Soc.*, 81: 406–427.

Katie Finlinson, Heather Anderson, Matthew Bol, Noberto Coc, Robert Forbes, and James. 2002. Humble Project Anuran: *An ecological research project concerned with theassessment and monitoring of anuran populations in the region around Las Cuevas, Chiquibul Forest Reserve, Belize.* Priliminary report submitted to Institute of Ecology and Resource Management University of Edinburgh.

McVea, C. & Boyd, C.E. (1975). Effects of water hyacinth cover on water chemistry, phytoplankton, and fish in ponds. *Journal of Environ. Qual.*, 4(3): 375-378. https://doi.org/10.2134/jeq1975.00472425000400030020x

Michael. F.S. 2001.Habitat Loss, Fragmentation and Predator Impact: Spatial Implications for Prey Conservation. *J. Appl. Ecol*. 38(4): 720-735. https://doi.org/10.1046/j.1365-2664.2001.00642.x

Purrenhage, J.L. and M.D. Bone. 2009. Amphibian community response to variation in habitat structure and competition density. *Herpetologia*. 14-30. https://doi.org/10.1655/08-017R1.1

Richard Isenring. 2010.Pesticides reduce biodiversity. Pesticides News. 88,4-7.

Silva. K. A., I. A. Martins and D.C. Rossa-Feres. 2011. Environment heterogeneity anurans diversity in homogenous environment. *Zoologia*., 28:610-618. https://doi.org/10.1590/S1984-46702011000500009

Thenmozhi. K. and Thangapandian, S. 2013. Amphibian community and microhabitat Association in Agarakeeragudi Agro ecosystem. Mayiladuthurai Tamil nadu. Cobra Volume;V11 Issue 2.2013.