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Anurans And Its Status In The Forest, Agricultural And Urban Ecosystemsin And Around Tumkur District, Karnataka

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Abstract: ***Lack of scientific data of Anuran populations in the Tumkur district, Karnataka, India, hampers in understanding the species richness. The present study of the assessment of Anuran population in the forest, agricultural and urban habitats of Tumkur district, from the year 2012 -13 revealed gradual differences in the distribution and size of these species. Adult frogs and toads were documented using Capture–Recapture and by Call survey methods. The larvae were counted using dip nets from the breeding sites. Seven Anuran species were recorded during the above period Duttaphrynus, Polypedates, Fejervarya, Hylo malabarica, Rana, Rachophorus and Kaloula taprobanica. The population size in the forest habitat was large compared to agricultural and urban habitats. The presence of anurans and habitat variables were subjected to ANOVA, Duncan Multiple regression and Karl Pearson correlation co-efficient test. Data analysis showed that anuran species in these habitats declined due to the consequences of anthropogenic activities. Hence there is an urgent need to develop conservation strategy for pool breeding and forest dwelling anurans.***

Keywords: Anurans, Tumkur district, Capture–Recapture, Decline, Conservation

I. INTRODUCTION

Anurans are popularly recognized for their bimodal life that generally includes an aquatic larval and terrestrial adult. They are pokilothermic organisms and the body temperature is strongly correlated with that of the environmental temperature. The most serious cause of amphibian and reptile decline in Europe is the loss of habitats (Ivelin 2011).The processes of habitat fragmentation and changes to the quality of habitat influenced the frog population across Melbourne (Kirsten 2006). Some local and regional factors influence the decline of frogs and toads in Michigan (Earl Werner et al. 2007).The Western Ghats is one of the 25 biodiversity hot spots in the world. Anurans are the integral components of many ecosystems and constitute the highest fraction of vertebrate biomass. They play an important role in acting as both predator and prey species and perform a key role in tropic dynamics (Odum 1956). Urban habitats are expanding throughout the world, and the processes of urbanization threaten the persistence of many plant and animal species. Amphibians, especially anurans, can inhabit many environments, from thick forest to small ponds. They adopt different physiological and behavioural traits. The decline in anuran population indicates ecosystem deterioration that might affect a wider spectrum of earth biological diversity. The anuran species richness is always correlated with the water body. The magnitude and direction of urban impacts on each species depends on that species life history attributes, sensitiveness to environmental disturbances, interspecies interactions and dispersal ability (Dickman 1987). The urbanization increases the density of human population and other infrastructures, which result in the displacement of flora and fauna. The diversity of fauna species exhibits varying responses to urbanization. The development rate and time to metamorphosis in *Rhinella spinulosa* is associated with pond duration (Marquez 2009). Concern about anuran declines has increased and it is now widely recognised that many species became extinct or decreased (Blaustein et al .1994). Conservation measures influenced the increase of the population size of *Bufo calamita* in Britain (John Buckley and

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Trevor 2004).Since the investigation regarding the decline of Anurans are paucity, the present study aim to know the status and distribution of the pool breeding anurans in the urban habitats in the city of Tumakuru(new name of Tumkur), Karnataka, India.

II. MATERIAL AND METHODS

STUDY AREA

Tumakuru is the one of the developing city in Karnataka, India (Figure 1) lies between 12º 45' N and14º 22' N latitude and between76º 24´ and 77º 30´ E longitude. Elevation is 822 m a.s.l. Tumakuru has a semi-arid climate with an annual mean temperature of 31^0C and rainfall 250 mm.(India Meteorological Department, Bangalore). The diversity and distribution of anurans in this city is not reported, but frogs and toads, inhabits in the lentic aquatic habitats such as ponds, ditches, stagnant pools and also in the water logged forest. (author observation).In the present study four water bodies were selected,1. Ammanikere (Loc: altitude: 803 ma.s.l,latitude: N$13^0$20' 41. 8andE 77^0 06' 33.4),largest pond in the city surrounded by dense human population, pond receives moderate rain water during monsoon. This pond is threatened by the entry of the domestic waste water, industrial effluents and habitat fragmentation due to the construction of park. 2. MydalaTank (Loc: altitude: 789 m a.s.l, latitude: N13^0 19' 24. 30 E $77^0$10' 22.40).It is a Fresh water tank located in the outskirt of the city, surrounded by forest and less human population. 3. Gubbigate pond (Loc**:** altitude: 812 m a.s.l, N13^0 19' 14. 20 E 77^0 08' 16.70).It is a stagnant water body located in the north of the City surrounded by paddy fields and less human population. This pond receives domestic and industrial effluents through the municipal drainage system.4. Shettihalli pond, (Loc: altitude: 844 m a.s.l, latitude: N13^0 19' 04. 30 E 77^0 11' 24.20).It is surrounded by buildings and roads tank receives rain water and in summer it will be dried. (We used geographic information system (GIS) to generate the pool and land gradient data.)

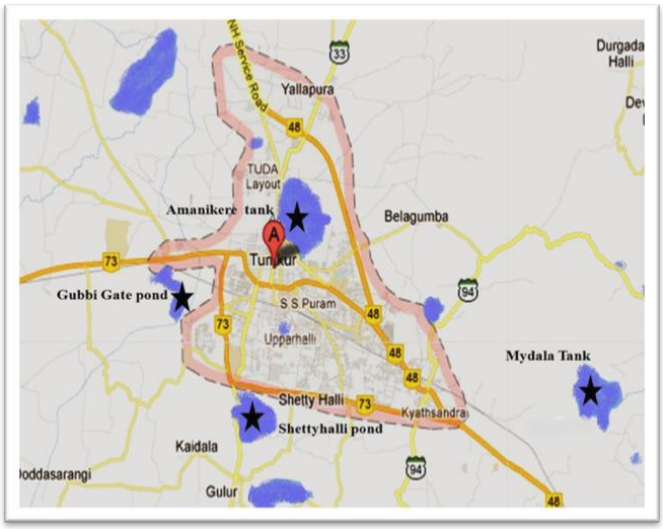

Figure 1: Pools surveyed for Anurans in the city of Tumakuru, Karnataka, India, in the year 2012 -13(marked in asterisk)

SURVEY METHODS

Four urban habitats in the city of Tumkur were surveyed for the presence of adult and tadpoles of anurans in the period from February 2012 to January 2013.Several field trips were made and each study site was visited twice in a month. Most anurans breed between June and September in this area .We visually searched for larval and adult anurans in each habitat. We also used dip nets to capture and count the frogs and tadpoles. The population of the adult anurans was estimated using Schnabel method of mark- recapture. (Sutherland 2000) using knee tagging as described by (Heyer and McDiarmid 1994).The number of marked and unmarked frogs and toads were recorded from 25x25 m^2 quadrate area. The tadpoles were collected from 1x1 m^2 quadrate in each site. Searches were performed through-out the day and night. We documented each frog and tadpole using Sony Handy cam (make: Japan).

III. DATA ANALYSIS

Several studies have identified that characteristics of habitat variables may affect the population of pool breeding anurans (Dickman 1987). In each survey, on reaching the site we measured air temperature, soil temperature, pH. We analysed the other water variables like dissolved oxygen, carbon dioxide, conductivity, free ammonia, phosphate, sulphate and nitrate levels in the laboratory. A mercury bulb thermometer (make, Japan, precision 0.1^0C) was used for the air temperature. The soil temperature was recorded using a mercury soil thermometer (make: Japan, precision 0.1^0C). The pH of the water was recorded using the pH papers. Dissolved Oxygen in water was measured using Winkler's method. Carbon dioxide and sulphate in water was analysed using the titrimetric method. Conductivity of water was recorded by electrometric method. Ammonia, phosphate and nitrate in the water were analyzed using spectrophotometric method. The presence of adult and tadpoles of anurans and habitat variables in the four sites of Tumakuru were subjected to analysis of variance (ANOVA) and Duncan Multiple regression test to find out the significant difference between the sites**.** Karl-Pearson correlation coefficient was used to check the relationship between the distribution of tadpoles, adults and habitat variables. The regression analysis was carried out to find the linearity between the proportion of marked frogs and toads in each catch and number of anurans previously marked. All the statistics were made using the SPSS 16 for windows.

IV. RESULTS AND DISCUSSION

During the study period from 2012 to 2013, we came across seven species of anurans (Table 1) in the Tumkur Urban ecosystem. The population distribution of adults anurans in the four habitats of the Tumakuru city is given in the (Table 2 and 3).A total of 45 frogs from Ammanikere, 105 frogs from Mydala, 60 frogs from Gubbigate and 62 anurans from Shettihalli pond were recorded. Out of these, 41%, 76%, 51% and 52% frogs were recaptured from the above sites

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respectively. The Schnabel method of anuran population estimate shown that Mydalakere (n=21.68) have more frogs and toads compared to other three sites Ammanikere (n=8.34), Gubbigate (n=17.41) and Shettihalli (n=16.68).The proportion of marked individuals of anurans in each catch was increased linearly in Mydala (Graph 1) y=0.0285x+0.2924, R^2= 0.7465) clearly indicating the population of anurans were constant, when compared to other three sites, Ammanikere (Graph2) y=0.0314x+0.4416, R^2=0. Gubbigate (Graph 3)y=0.0096x+0.4791, R^2= 0.1112.Shettihalli (Graph 4) y= 0.0029x+0.5479, R^2= 0.0082) The non-linearity of mark–recapture curve (Graph 2, 3&4) shows the violation of Schnabel method of mark recapture principle. The non-linearity slope indicates that some of the marked anurans were disappeared from the respective sites over the time of study. Pool breeding amphibians are highly sensitive to changes in hydrology, habitat fragmentation and chemical contamination (Peter et al. 2008). Similar studies shows that a vast majority of amphibian species declined due to the destruction of forested upland habitat adjacent to vernal pool in Massachusetts, USA (Bryan et al. 2008) The main threats of urbanisation to amphibian populations are habitat loss, habitat fragmentation, isolation and degradation of habitat quality (Andrew and Mark 2008). Urbanization threatens natural ecosystems through habitat conversion and fragmentation (Robert et al. 2007). Previous studies have shown negative effects of various indices of urbanization on amphibians (Gibbs 1998). Anthropogenic activities causes biodiversity decline, because it destroys species and disrupts community interactions and interrupts evolutionary processes resulting in irreversible loss of diversity (Joao Filipe et al. 2011). Amphibian decline in Western Ghats is related to several man-made activities (Krishnamurthy 2008). Similar studies on anurans in this area highlighted that agricultural intensification have a negative impact on the distribution of anurans (Ranjit Daniels 2003). Tadpoles of anurans are highly plastic and also depend upon various factors for survival (Saidapur 2001).

Anuran species	Family	Breeding month
Duttaphrynus melanostictus	Bufonidae	July -November
Polypedates maculatus	Rhacophoridae	July - September
Fejervarya granosa	Dicroglossidae	July - September
Hylarana malabarica	Ranidae	August -September
Kaloula taprobanica	Microhylidae	July - September
Rana limnocharis	Ranidae	July - October
Rhacophorus malabaricus	Rhacophoridae	August -September

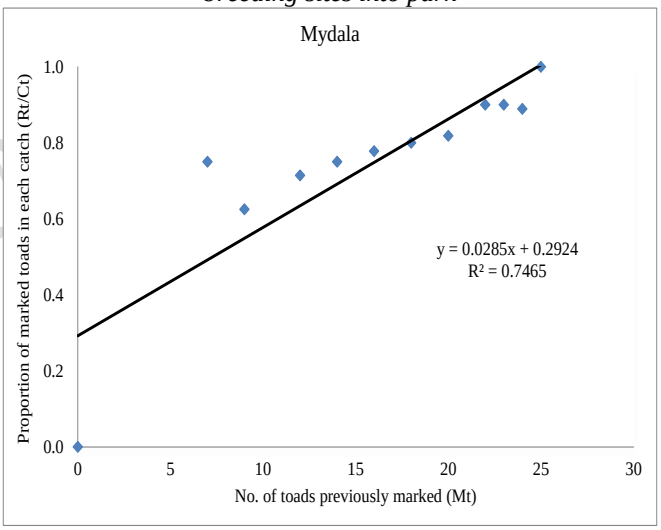
Table 1: Anurans recorded in the Tumakuru city 2012-13

Duration	Habitats				F-value	p-value
	Ammanikere	Mydala	Gubbi Gate	Shettyhally		
February 2012	1.25 ± 0.50	3.00 ± 0.82	1.50 ± 0.58	1.25 ± 0.50	7.56	0.004
March 2012	1.50 ± 0.58	3.25 ± 0.50	2.25 ± 0.50	1.25 ± 0.50	11.92	0.001
April 2012	1.50 ± 0.58	3.00 ± 0.82	2.25 ± 0.50	1.00 ± 0.00	9.80	0.002
May 2012	1.50 ± 0.58	2.75 ± 0.50	2.25 ± 0.50	1.25 ± 0.50	7.00	0.006
June 2012	1.25 ± 0.50	3.25 ± 0.50	2.00 ± 0.82	1.25 ± 0.50	10.06	0.001
July 2012	1.25 ± 0.50	5.00 ± 0.82	2.25 ± 0.50	1.75 ± 0.96	21.56	0.0001
August 2012	1.25 ± 0.50	4.75 ± 1.26	1.75 ± 0.50	1.50 ± 0.58	17.76	0.0001
September 2012	1.50 ± 0.58	3.00 ± 0.82	1.75 ± 0.50	1.25 ± 0.50	6.44	0.008
October 2012	1.00 ± 0.00	2.50 ± 0.58	2.00 ± 0.82	1.25 ± 0.50	6.07	0.009
November 2012	1.25 ± 0.50	2.25 ± 0.50	1.75 ± 0.50	1.25 ± 0.50	3.67	0.044
December 2012	1.00 ± 0.00	2.50 ± 0.58	2.00 ± 0.82	1.00 ± 0.00	9.00	0.002
January 2013	1.25 ± 0.50	2.50 ± 0.58	1.75 ± 0.50	1.00 ± 0.00	8.40	0.003

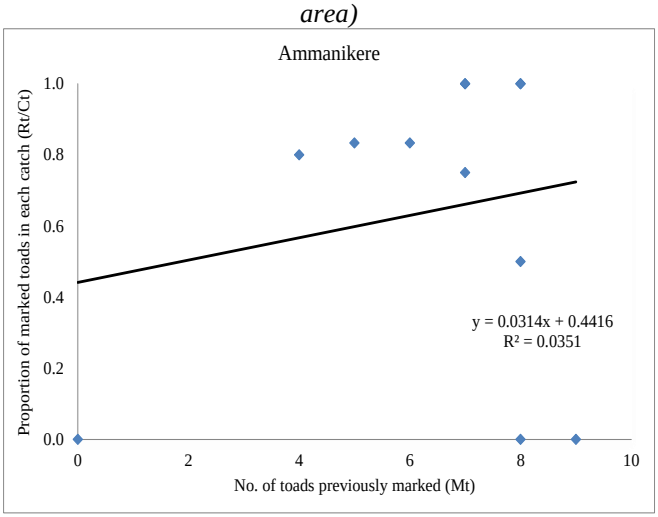
Table 2: Distribution of adult frogs and toads in the four different habitats of Tumakuru city (2012-13)

	Habitat				*F*	*p*
	Ammanikere	Mydala	Gubbigate	Shettyhalli		
Adult Toads (mean n/25m^2± SD)	3.75±1.54 (2-6)	8.75± 1.28 (7-12)	5.0 ±1.53 (2-7)	5.1±1.46 (3-8)	25.93	0.0001
Tadpoles (n/1m^2± SD)	-*-	104.50 ± 87.41 (10-250)	39.19 ± 31.42 (8-90)	24.06 ± 11.74 (8-42)	10.00	0.0001

*Table 3: Distribution of adult and tadpole in the four different habitats of Tumkur city (Values in parenthesis denote the range). *Tadpoles were not observed due to conversion of breeding sites into park*



Graph 1: Proportion of marked anurans in Mydala (forest area)



Graph 2: Proportion of marked anurans in Ammanikere (city area)

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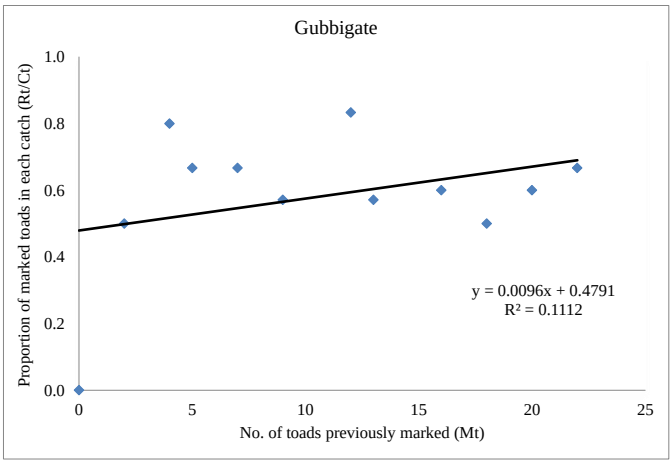
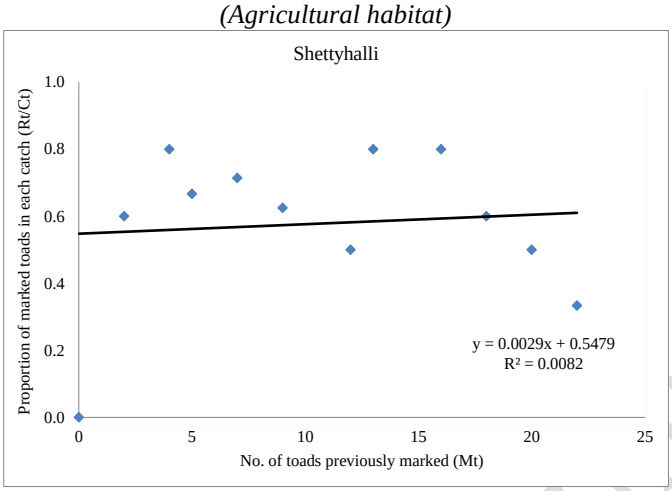


Graph 3: Proportion of marked anurans in Gubbigate Pond (Agricultural habitat)



Graph 4: Proportion of marked anurans in Shettihalli pond (Semi Urban area)

V. CONCLUSION

There is a significant negative correlation between urbanization and Species richness. Protecting the wetland breeding habitats on which these species depend is critical (Semlitsch 2002). In conclusion, urbanisation, fragmentation and modern agricultural practices have been shown to adversely impact anuran populations. We still do not fully understand how they operate at the population level. More problematic are the consequences of climate change, pollutants and diseases. Overall, our results support a gradual decline in the anuran population. Hence there is an urgent need to develop conservation strategy for pool breeding and forest dwelling anurans in the Tumakuru Urban ecosystems.

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