

SUMMARY 5

Amphibians form a connecting link between fishes and reptiles as they are the first group of vertebrate animals to emerge from an aquatic environment to live on land. Among the three orders of Amphibia, the order Anura is the largest, comprising the most diverse set of species.

Anurans are functionally important for nutrient cycling and energy flow in most freshwater and terrestrial ecosystems. Anurans are ecologically important as they are primary consumers during their larval stage and primary predators when they are at their adult stage. Further tadpoles and adults are eaten by other higher vertebrates. Thus anurans are known to occupy an indispensable position in the food chain. In addition to this they are also being exploited by humans for food and medicinal purposes all over the world.

Amphibian species are facing extinction and their populations are declining faster than that of mammals or birds. Worldwide focus was made on amphibians because of the specific concern that their populations are fast declining on a global basis.

To many amphibian species, loss and degradation of wetlands is a major threat as wetlands are the suitable habitats for their breeding, larval development and foraging. Frogs and toads are vulnerable to human exploitation and are sensitive to a number of environmental factors, both natural and anthropogenic.

Excessive exploitation of the economically important species, uncontrolled International trade and indiscriminate collection of specimen for academic purposes are known to threaten several species.

Chemical contaminants such as pesticides, heavy metals, acid rain, nitrogen based fertilisers and chemical run off can have lethal, sub lethal and endocrine effects on amphibians. Some of these include death, decreased growth rate, behavioural abnormalities, decreased reproductive function, and weakened immune systems, feminization of male frogs and hermaphroditism.

The decline in the number of frog species is a warning signal of an ecological disaster, as they are the living barometers of the health of the environment. The potential for getting natural medicines for many maladies will be affected due to the disappearance of anurans.

One of the aims of this study is to elucidate the factors (meteorological and physico chemical) influencing anuran community structure of Periyakulam Taluk.

Periyakulam Taluk lies at the foot hills of Kodaikanal between North Latitude $10^{\circ} 00'$ and $10^{\circ} 13'$ and East Longitude $77^{\circ} 27'$ and $77^{\circ} 44'$ having a total area of 37,500 ha. The terrain of the Periyakulam Taluk is predominantly undulating. The land use of this taluk was prepared with the help of remote sensing techniques. For the purpose of this investigation the habitats of anuran study in this taluk was demarcated into

- (i) Mixed crop land (rice, sugar-cane and banana)
- (ii) Coconut grove
- (iii) Mango grove
- (iv) Fallow lands and
- (v) Water bodies.

The anuran species survey was made in the five habitats mentioned above.

In Periyakulam Taluk, agricultural operations were not governed by any natural seasons. The capricious monsoon however had an influence on the cropping pattern, as water availability for farming activity depended on monsoon. The farming operation for a specific crop depended on agro climatic conditions. In Periyakulam Taluk, there was no pronounced season such as winter, spring etc but the speciality was that it received South West Monsoon (178 mm) during the first half of the year and North East Monsoon (384 mm) during the second half of the year. Therefore, anuran survey details were grouped under two equal split periods of the year *i.e.* January to June and July to December. The sampling was carried out during the year 2005 and 2006. Observations presented in this work are an average of two years. The preserved samples were used for subsequent analysis.

Soil samplings of the habitats such as Mixed crop land, Coconut grove, Mango grove and Fallow lands were made through quadrat sampling, once in six months for two years. The average of the analytical values was taken into consideration. The soil analyses included moisture, texture, pH, EC, total nitrogen, total phosphorous and potassium.

A total of ten water bodies were sampled once in a month. Parameters such as temperature, pH, EC, chloride, bicarbonate, Na, K, Ca, Mg, and DO were analysed for two years and the average values were presented. Under the meteorological observations air temperature measurements were taken using hygrometer half a meter above the ground level. Similarly humidity measurements were also made.

Regarding rainfall, the data received from the Meteorological Department of the Govt. of Tamil Nadu were utilised.

Enumerations of the anurans in the terrestrial habitat such as Mixed crop land, Coconut grove, Mango grove and Fallow lands were made once in a month as per *Visual Encounter Method (VES)* and *area constraint method*. The survey data obtained on anuran studies were subjected to specialised analysis such as *relative abundance*, *species richness*, *Shannon Weiner diversity index*, *evenness*, *community co-efficient*, *niche breadth* and *niche overlap*.

The extent of Mixed crop land, Coconut grove and Water bodies increased during July to December. However the differences were very marginal. Between January to June and July to December the soil temperature fluctuation was higher in Coconut grove and the fluctuation was low in Mixed crop land. The overall annual soil temperature of Periyakulam Taluk during the study period (average of all habitats) was 26.3 °C.

The moisture content of the soil samples of all the habitats were higher during the period July to December. The differences in moisture content between January to June and July to December was low both in Mixed crop land and Fallow lands. The difference was higher in Coconut grove and Mango grove.

Soil collected from the Mixed crop land had the highest level of moisture both during January to June (26.3 %) and during July to December (28.4 %).

The textural analysis of soil indicated that all the four habitats were more or less identical in nature. However the percentage of sand was higher in Coconut grove (70.38 %) when compared to that of other habitats.

The soils of Mixed crop land and Fallow lands exhibited change in pH between January to June and July to December. It is known that the pH values were always lower during July to December.

The EC of the soil during July to December in general was lower than that of January to June, but the amplitude of change was phenomenal in Coconut grove, Mango grove and Fallow lands. Fallow lands expressed greater deviation during January to June from the overall EC of the soils of Periyakulam Taluk.

The changes with respect to total nitrogen and total phosphorous and potassium of the soil were marginal between the two periods.

In the case of Water bodies, till September the temperature of water increased steadily and declined further. The lowest temperature was recorded during December.

Unlike that of soil, the pH of the water showed wide fluctuation ranging from 5 - 8. The lowest reading was reported during June to August. During the above period, the temperature observed also was very high. Thus the water temperature and pH showed inverse relationship. But the temperature and EC showed a clear positive relationship.

The chloride, Na, P, Ca and Mg ions followed the change in temperature of the water. When temperature of the water was high all the above parameters also were high. The water temperature and ionic content of the water showed direct relationship. The air temperature, humidity and water temperature also had close relationship.

As already indicated, Periyakulam Taluk had two monsoons. The first monsoon namely South West Monsoon was in peak during March and April

and the second monsoon (North East Monsoon) was during October and November. The intensity of North East Monsoon was relatively higher. The average rainy days were higher during the month of October.

The species survey data indicated that Periyakulam Taluk has a total of 12 species belonging to the family Bufonidae (*B. melanostictus*, *B. scaber*), Microhylidae (*K. taprobanica*, *M. ornata*, *U. systoma*), Ranidae (*E. cyanophlyctis*, *E. hexadactylus*, *L. limnocharis*, *H. crassus*, *H. tigerinus*, and *T. breviceps*) and Rhacophoridae (*P. maculatus*).

During this study a total of 4291 anurans were encountered. *L. limnocharis* was recorded in large numbers (1445). *K. taprobanica* and *T. breviceps* were observed to be low. The overall encounter rate in Periyakulam Taluk was 1.37 individuals per quadrat during the study, irrespective of the periods. The lowest encounter was observed in *K. taprobanica* and *T. breviceps* and the highest was in *L. limnocharis*.

Most of the Ranids preferred aquatic and semi aquatic habitat. Rhacophoridae and Bufonidae confined to arboreal habitat. All the species recorded in the present study belonged to the list of species of least concern by the International Union for Nature and Natural Resources (IUCN).

H. crassus, *H. tigerinus*, *L. limnocharis* and *B. melanostictus* were observed to be present in all the five habitats, but *E. hexadactylus* was recorded only in the Water bodies. Similarly *U. systoma* was recorded only in rice fields.

The cluster analysis indicated that Mixed crop land and Fallow lands formed a cluster. Coconut grove and Mango grove formed another cluster.

L. limnocharis was found to be the top ranker in all the five habitats. *B. melanostictus* was the second topper. *M. ornata* and *E. cyanophlyctis* were the third abundant species.

The *species diversity* (Shannon diversity indices) of anurans in the above habitats showed a range from 0.27 to 1.9. The maximum index value of 1.9 was observed in Water bodies and the minimum diversity index (0.27) was observed in Mango grove.

Four species (*B. melanostictus*, *B. scaber*, *E. hexadactylus* and *P. maculatus*) displayed uniform pattern of distribution during the period January to June. During the above period clumped distribution was observed in *E. cyanophlyctis*, *H. crassus*, *L. limnocharis* and *M. ornata*.

Random distribution pattern was observed only in two species *ie.*, *K. taprobanica* and *T. breviceps*.

Among the five habitats, maximum *evenness* was recorded in Mango grove (0.99) and minimum *evenness* was observed in Water bodies (0.71). Out of the two periods investigated, the maximum as well as minimum indices were observed during the first half of the year (January - June) only (0.85 and 0.51).

B. melanostictus and *L. limnocharis* were the two dominant species in all the habitats during the two periods (full year). *L. limnocharis* had the highest *niche breadth* value in Water bodies and also lowest *niche breadth* value in Mango grove. Almost all the aquatic frogs were having the highest *niche breadth* score in Water bodies.

The habitat preference of anurans showed that 22 percent of *B. melanostictus* was recorded in Mixed crop land. Similarly *L. limnocharis*

was observed mostly in Mixed crop lands. *E. cyanophlyctis* was observed mostly in Water bodies especially in floating condition. *E. hexadactylus* was observed (39 %) among floating vegetation. The preferred microhabitat of *P. maculatus* was green leaves (56 %). *K. taprobanica* preferred (61 %) wet soil. *H. crassus* and *H. tigerinus* had the highest *niche overlap* of 0.98 indicating that these two species co-existed more than any other species. Similarly *L. limnocharis* and *B. melanostictus* were observed to co-exist (*niche overlap* 0.79).

The coefficient of community value was highest in Coconut grove. It was observed that the ambient temperature negatively influenced the abundance of *E. cyanophlyctis* and *H. tigerinus*, *H. crassus*, *L. limnocharis* and *M. ornata*.

The regression analysis indicates that the soil temperature, air temperature, humidity and rainfall had a very decisive role on the abundance and density of anurans.

Abundance of all the species showed a strong linear positive relationship with rain fall.

Only selected habitats such as Mixed crop land, Coconut grove, Mango grove, Fallow lands and Water bodies (lentic) were studied in the present investigation. The total area covered in this work is 23422 ha against the total geographical area of 37500 ha of Periyakulam Taluk. This works out to 62 percent. The remaining area is formed of residential areas, roads, built up areas, canals and reservoir. This work did not concentrate on these left out areas since the main focus was made on the agrarian ecosystem, where the influence of monsoon and the man made irrigation are high. With reference to the canals, it is to be noted that during a short period only there used to be water in canals as they are ephemeral. Hence

canal was not covered in the present study. The Periyakulam Taluk has a major reservoir (Vaigai). Cursory survey gave a clue that reservoir did not have anurans apparently due to carnivorous fish species being cultivated by the State Fisheries Department. Therefore the anurans of the reservoir are not included in this study.

However the areas not covered in this work have to be pursued though the chances of anuran potential is found to be very minimum (based on preliminary survey made by the same investigator before commencing the present work).

It is hoped that the present work will add information to the existing knowledge on the anuran resources of Periyakulam Taluk, Theni district, India.

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