

RESEARCH ARTICLE

Studies on the Influence of Temperature in Aquatic Anuran Population in Cauvery Delta Region of Tranquebar Taluk of Nagapattinam District, Tamil Nadu, India

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ABSTRACT

Amphibian is one of the important ecosystem component, both the ecologically and economically. In the present study, we intended to analyze the population density based on the temperature in different months during the year 2016–2017. The data were collected by visual encounter survey method, and amphibians were recorded in all 12 months from the study area for 2 years. The monthly variation habitat temperature was recorded in 2016–2017 using analysis of variance. In different habitat (cultivable, non-cultivable, pond, and grassland) temperature, the population was maximum at pond followed by grassland, agriculture, and non-cultivable. The maximum temperature was found in July with 74 numbers of species which were identified during 2016. Were recorded high number (1600) frog were recorded in pond 28°C during samba season followed by Thaladi and Kuruvai. Based on this study, we conclude that the population density may increase and decrease based on the temperature in all the three seasons with four microhabitats.

Keywords: Anuran, population agroecosystem Cauvery delta region, tranquebar

INTRODUCTION

The physiology of amphibian has received much attention than that of other vertebrates. The first investigations of the influence of temperature during activity have been made only recently.^[1,2] 1965 further, amphibians are active even at low body temperatures.^[3] To investigate the patterns of anaerobiosis in amphibians, lactate production was measured during maximal enforced activity at different temperatures an ecologically and phylogenetically diverse assemblage of urodeles and anurans was examined. In South India, agricultural lands are a complex mixture of different habitats, namely cultivated, non-cultivated, pond, grassland, agriculture fields, and paddy fields, comprising many small pieces of land owned by different farmers and with each piece subjected to different methods of cultivation. As a result, when farmer uses different agrochemicals, the total habitat gets contaminated with a mixture of agrochemicals.^[4-7] Agrochemical contaminants can affect amphibians either by

destroying biodiversity at lower trophic levels followed by effect at higher trophic levels.^[8,9] Hope to understand further the behavioral and neuromuscular changes that have accompanied the evolution of a highly protrusible tongue. In addition, if frog modulates its feeding behavior in response to differences in prey type, this study will be the first to document this ability among amphibians and the feeding behavior of anurans also has been considered to be highly stereotyped.^[10,11] The stereotype of feeding behavior found in anurans has been attributed to a limited range of fixed action patterns and to the animal's behavioral simplicity.^[10] In Western Ghats, many amphibians are living and breeding in shallow waters of rice paddy fields. In general, their breeding period coincides with the application of agrochemicals, including pesticides and fertilizers,^[12,13] Earlier studies have revealed elevated frequencies of morphological abnormalities (3.97%) in *Fejervarya limnocharis* from rice paddy fields.^[14] Although the Western Ghats has a diverse amphibian fauna,^[15] few toxicological studies are available,^[16,7] focusing on effects of individual or combinations of agrochemicals on larvae of amphibians.^[17] Recorded 12 species of amphibian in and around

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Agarakeerangudi village, Mayiladuthurai taluk of Nagapattinam district. Freshwater mussels play a number of important roles in aquatic ecosystems. As sedentary suspension feeders, unionoids remove a variety of materials from the water column, including sediment, organic matter, bacteria, and phytoplankton.^[18] However, the effects of agrochemicals on amphibian health status at field conditions are largely unknown. Hence, for the 1st time, we evaluated the anuran population.

Tropical and monsoonal climates are characteristics of the study region. The monthly average temperature is generally low at the beginning of the year. In the study area, the temperature reaches 38°C and the minimum touches even 19.30°C, in January and February months which are very pleasant with warm days and cool nights. Heat becomes intense in April and increases in May-June and comes down gradually in June-July when the southwest monsoon sets on. Very mild winter falls in December and January. Data on soil temperature are lacking and are computed by deducting 50°C from atmospheric temperature. Plant growth as well as chemical and various biological activities in the soil is greatly influenced by temperature.

Temperature is an important parameter, determining the climatic condition of any region. The climatic condition determines the agricultural pattern, lifestyle of people, and the socioeconomic conditions. The Cauvery delta region of Tranquebar taluk, Nagapattinam district, falls under the tropical region, so the temperature here is normally high. Monthly mean temperature is calculated from the daily temperature observed from 2016 to 2017 which varies seasonally. Temperature is very high during the summer season, low in the winter season, and moderate during other months.

MATERIALS AND METHODS

Study area

The present study was carried out at 12 places in Tranquebar taluk, Nagapattinam district, Tamil Nadu. The study was carried out for 2 years from January 2016 to December 2017. The study area is comprised of dry deciduous, grassland rocky scrub jungle, and agricultural landscapes.

Geographical landscape of tranquebar

The study area [Figure 1] is located in the Tranquebar taluk, Nagapattinam district, which lies on the middle of the coromandel coast. The district lies between 10°25' and 11°40' North Longitude and 76°49' and 80°01' East latitude of Tamil Nadu, India. The Nagapattinam district lies on the shores of the Bay of Bengal between latitude 10.7906°N and Longitude 79.8428°E an area of 2715 sq. km (1048 sq. mi.). The district capital, Nagapattinam, lies on the eastern coast, 350 km down south of the state capital Chennai.

The amphibians in all the habitats, such as cultivable, non-cultivable, pond, dry pond, and grassland, were studied, and the data collections were done during morning hours (6.00 am to 12.30 pm). During the survey periods, parameters such as population, microhabitat, and water distance from each species sightings, vegetation type, and soil types have also been recorded. The four habitats were classified into two categories, namely agricultural and non-agricultural areas. The species were identified using pictorial guides.

Visual encounter survey (VES) method

The selected village ponds were regularly monitored for diversity and density of amphibian population, activity, and temperature of the study area. The area was walked thoroughly for amphibians. Time-constrained VES method involves a systematic search of an area or habitat for a prescribed time.^[19] VES was used as formalized by Crump and Scott.^[20] The aim of this study was to maximize the species inventory.

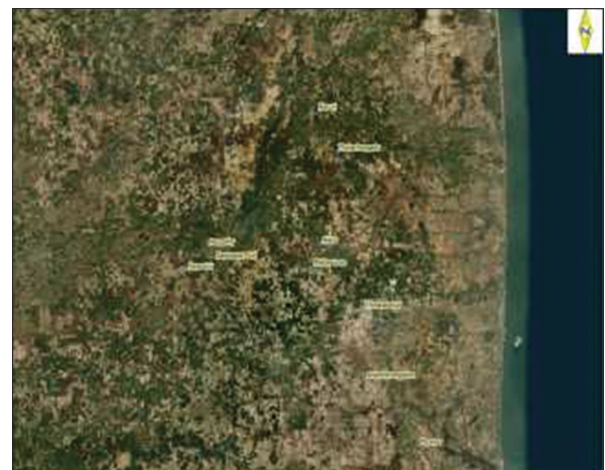


Figure 1: The study area

RESULTS AND DISCUSSION

Amphibian activity observed during this study revealed the response of the amphibians to their environmental climate. A total of 9 species of anurans were recorded [Table 1] during the year 2016. The temperature was found to be higher in the month of July (temp 0C±) that is minimum 27°C and maximum temperature 31°C (mean value = 29.03, N = 74, Standard Deviation = 0.875). Similarly, December month the minimum temperature 26°C and maximum temperature 28°C was observed (mean value = 27.57, N = 114, Standard Deviation = 0.764). Table.2 showed the month variation of anuran population based on the temperature in 2017. Here, we observed that August month minimum temperature 29°C was recorded and followed by maximum temperature 31°C,

(mean value = 12.42, N = 62, Standard Deviation = 14.74). Similarly, 2017 December month minimum temperature 28°C, and maximum temperature 31°C, were recorded (mean value = 29, N = 200, Standard Deviation = 2.25). From the above two table clearly indicated that, the population were decreased during maximum temperature of both 2016 and 2017. This is clearly indicated that the temperature influencing the anuran population in all the four habitat during three seasons.

In both the years the lower population was found to be in the month of august only the population temperature of amphibian was observed. The microhabitat environment temperature should be 28°C is optimum for more active for amphibian. Figure 2 clearly showed the population density during three seasons at four habitats with

Table 1: The monthly variation of anuran population based on the temperature in 2016

Months	Minimum temperature (°C)	Maximum temperature (°C)	Total number of population	Mean±SD
January	27	33	173	29.32±1.653
February	27	31	167	29.69±1.379
March	27	31	127	27.5±4.458
April	27	29	111	26.05±6.286
May	25	33	114	29.03±2.329
June	19	33	120	26.92±4.116
July	27	34	74	29.03±1.26
August	27	30	134	28.04±0.875
September	27	30	96	27.97±4.211
October	26	31	121	27.52±2.835
November	26	29	104	27.41±3.886
December	26	28	114	27.57±0.764
		Total	1455	28.15 ± 3.384

SD: Standard deviation

Table 2: The monthly variation of anuran population based on the temperature in 2017

Months	Minimum (°C)	Maximum (°C)	Total number of population	Mean±SD
January	27	30	132	26.74±6.881
February	27	30	140	25.58±7.925
March	27	31	129	28.04±5.757
April	27	30	117	25.53±8.695
May	27	29	141	28.3±0.744
June	28	31	147	27.81±6.761
July	28	30	111	25.68±9.831
August	29	31	62	12.42±14.74
September	29	31	86	17.45±14.551
October	27	30	196	28.53±3.047
November	27	30	146	28.62±1.051
December	28	31	200	29.23±2.250
		Total	1607	26.44±8.005

SD: Standard deviation

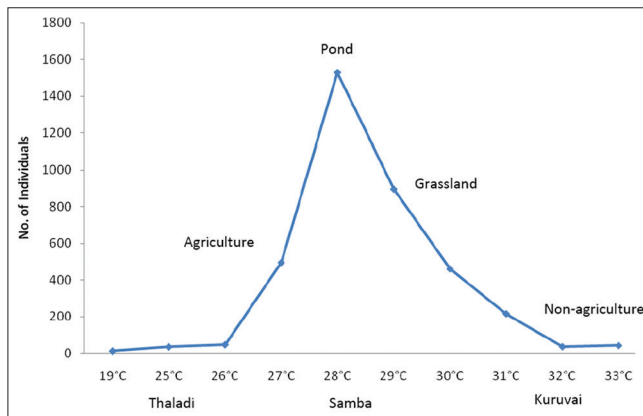


Figure 2: The influence of temperature on the population density in different habitats

temperature basis. As per the result, we observed maximum anuran population was observed (1600 numbers) in samba season with 27-30°C. The grass land occupied the second place of highest population density during samba followed by agriculture (600 numbers) and non agriculture (200 numbers) respectively kuruvai (32°C) and Thaladi (25°C). Aquatic ecosystem monitoring has been carried out in India based on either chemical or biological analysis. The chemical approach is useful to determine the levels of nutrients, metals, pesticides,^[21] as per the result present study was focused in the season of cultivation paddy field amphibians are temperature changed in these cultivation periods of Thalady, Samaba, and Kuruvai seasons. In the non-cultivated season on field, amphibian observation was very less due to their indolent temperature. This may be lack of water and moisture demand on the field. The rest of the other three season's water flow was regular in the cultivation field. Even though the use of fertilizers is also influenced in the temperature and in turn the amphibian population during this study. Hence, it is revealed that various factors such as microhabitat temperature, availability of water, and time also to determine the activity behavior of amphibians in the above-mentioned study area. Further detailed studies are warranted to delineate the population density variation during different temperatures in microhabitat.

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