

Studies on anuran development :
An Experimental Analysis Of Larval Growth and
Metamorphosis of *Rana limnocharis* Wiegmann,
in Relation to Certain Environmental Factors

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CERTIFICATE

I, the undersigned, certify that this thesis entitled "STUDIES ON ANURAN DEVELOPMENT : AN EXPERIMENTAL ANALYSIS OF LARVAL GROWTH AND METAMORPHOSIS OF *Rana Limnocharis* Weigmann, IN RELATION TO CERTAIN ENVIRONMENTAL FACTORS", submitted by Mr. ASHISH GUPTA for the degree of Doctor of Philosophy of the North-Eastern Hill University ^{has been compiled} under my supervision during the period 1984-87. He has been duly registered for the award of Ph.D. degree and the thesis presented is worthy of being considered for the award of the Ph.D. degree. This work has not been submitted for any degree to any other university.

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INTRODUCTION

The utility of frogs and toads is known since times immemorial. They have been used from the dawn of the scientific era for a number of discoveries ranging from the discovery of Galvanic currents by Galvani in 1780 (quoted in Ronan, 1983) to pregnancy diagnosis tests in this century (Cochran, 1961). They are used world over for imparting fundamental zoological knowledge as well as for research in the field of vertebrate anatomy, physiology, genetics and development (see Cochran, 1961; Nace, 1968; Heusser, 1974 among others). Among vertebrates they are first animals used for investigation on the phenomenon of differentiation, and also they are the first vertebrates in which cloning was first investigated and its use was demonstrated. Economically, the use of frogs as food and for medicinal purposes, such as, for heart ailments, wounds and for food poisoning has been known in certain countries for example China and South East Asia from Prehistoric days (Henderson, 1864). In recent years they are also used as gourmet food items in many western countries.

The frogs and toads belong to Order Anura, which is the largest living Order of Class Amphibia. They are widely distributed all over the world except snow clad mountains and waterless deserts. They inhabit fresh water systems and their surroundings. One species *Bufo marinus* has been reported from marine waters in South America (Bradoo, 1986). Some species are completely aquatic

such as *Rana cyanophlyctis* and *Xenopus laevis* and some prefer to live mostly on land such as *Bufo melanostictus*, but great majority of anurans are amphibious in habit; but all of them breed in water.

In North-Eastern India, which is endowed with tropical and subtropical ecosystems, has varieties of streams, rivers, lakes, hills, mountains and humid climatic conditions ranging from hot plains to cold weather at higher altitudes. The region is gifted with varied types of forest systems and a huge assemblage of rich and diverse flora as well as fauna. According to recent reports more than 124 species of Anura grouped in 25 genera and 8 families have been described from the Indian subcontinent (see Pillai and Murthy, 1986; Kiyasetuo, 1986 unpublished, among others). Pillai and Chanda (1976) compiled information that as many as 40 anuran species have been reported from North-Eastern region alone. And out of these, the state of Meghalaya itself has 30 anuran species, belonging to 6 families. These numbers are ever increasing as more and more reports are flowing in.

✓ The frogs and toads have always been used as models for various types of morphological, physiological, developmental as well as ecological investigations. Though we have in this country so many types of anuran species, we do not have information on biology, development, genetics and ecology of even most common species. In the first world conference on the export of frozen

frog legs vis-a-vis environmental considerations organised by Marine Products Export Development Authority (MPEDA) and Central Inland Fisheries Research Institute (CIFRI), Barrackpore at Calcutta in 1986, deep concern was expressed on the indiscriminate exploitation of anuran fauna of this country. The frogs and toads are used for educational purposes in schools, colleges and a number of research institutions all over the country. Millions of tons of frozen frog legs are exported from this country through MPEDA to Western countries (Table 1.1). It is estimated that in 1980 alone about 18 million tons of frogs were used for educational purpose where as about 60 million tons of frogs were used for export purpose. A comparison of the trends on their utilization since 1956 (Fig. 1.1) reflects that educational sector utilizes 1/3 of that exported by MPEDA. As a result of it their population is reaching a low ebb raising an alarming concern. It was felt though the practices to exploit anuran fauna cannot be completely stopped, it is possible to raise more anurans by culture. Before undertaking such programme, it is necessary to have basic informations on various aspects of biology, physiology as well as ecology of these animals.

The frogs and toads (from an important component of our ecosystem. They play a vital role as intermediate trophic members as well as predators in the following food chain.

Plants > Invertebrates > Frogs/toads > Birds and Reptiles > Mammals

Besides being an important unit in ecological cycles and food chains it has been estimated that they protect our crops from innumerable pests and predators. Increasing trends of weights of undestroyed pests in relation to weights of frogs killed since 1963 have been shown in Table 1.2. Their indiscriminate capture badly affects the agro-ecosystem as the crops are damaged by many pests and predators, which are otherwise removed in a natural way by frogs and toads.

Though the adult frogs have their ^{own} role, their larval stages are nevertheless very important in the ecosystem. Their presence in large numbers in the fresh water ecosystems during monsoon periods provides an excellent opportunity to examine the impact of transient consumers on the dynamics of unmanipulated aquatic ecosystems (Seale, 1980). They form an an important link in the food chains of natural fresh water ecosystems feeding on algae and plankton and being preyed upon by naids and larvae of other aquatic insects, fishes etc. (Heyer, 1973; Heyer and Muedeking, 1976). They also have a great biological significance as the larvae exploit food sources which otherwise could have been completely inaccessible. Ecologically **they are** referred to as energy gathering phase. The abundance of the adult population depends on the chance of successful metamorphosis before they are killed by unfavourable conditions or ravages of predation and disease.

