Taking Project Tiger to the Classroom: A Virtual Lab Case Study

Harilal Parasuram[1], Bipin Nair[1], Krishnashree Achuthan[2], and Shyam Diwakar[1]

[1] Amrita School of Biotechnology, Amrita Vishwa Vidyapeetham (Amrita University), Amritapuri, Clappana P.O., 690525, Kollam, Kerala, India
shyam@amrita.edu
[2] Amrita School of Engineering, Amrita Vishwa Vidyapeetham (Amrita University), Amritapuri, Clappana P.O., 690525, Kollam, Kerala, India

Abstract. Understanding how population dynamics change over time is critical to many practical problems as pest control, endangered species protection etc. Teaching population ecology is not easy since data is usually collected over a very long period. This paper discusses a specific tiger population case study relating to growth rate predictions using an online virtual lab. Studying tiger populations and introduction of such data in classrooms help in creating awareness and support new pedagogies to estimate animal population dynamics. We have used online virtual labs which are ready-made tools to perform simple experiments and analysis. An important and usually complex case of population analysis as in tiger populations in India is studied in this paper. Although some major parameters like food, transient movement, and ecosystem details have been ignored, predicted data for tiger population follows closely to actual data for previous years and even predicts the growth rate with a small standard deviation of 10%. Our results with tiger populations come close to the actual census values. We propose the use of simple mathematical models to make assessment of transient animal populations such as tigers, and sharks. Also use of such ready-made pro-academic online tools encourages new studies and an enhanced pedagogy to population ecology for mathematicians, biotechnologists, wildlife institute personnel among many other cross-disciplinary scientists.

Keywords: Virtual Labs; Tiger population in India; Population Ecology; e-learning.

1 Introduction

Half of the tiger population in the world is in India. Due to reduction in their population in large numbers, from 1969 onwards the 'tiger' was declared as an endangered species (by CITES). India launched a project called "Project Tiger" with the goal of saving the tiger and its habitat. Studying and understanding the dynamics of tiger population in our country is very essential to predict (build/tune model) the tiger population in future. These predictions could help to a great extent in protecting

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from mass disappearance of endangered species. Estimating tiger population behaviors are also useful for demographic analysis and studies. We have employed a new approach of using online virtual lab tools to make studies on tiger population.

Typical tiger population studies need to cover spatial and temporal scales since the effects of anthropogenic pressures that come into conflict with ecological needs [15]. In tiger population studies, one major problem is the relative imprecision of single-year abundance estimates. Many tiger reserves are sensitive in terms of landscape matrix hostile to tigers leading to transient tiger populations [example see 15]. Using virtual lab online tools for tiger population studies is the major role of this paper. Although several critical parameters such as those related to food, disease and inter-competition were ignored, it was possible to connect the data to a feasible and surprisingly simple model based on exponential growth.

In this paper, we suggest on the applicative use of population ecology simulators as classroom models to complete the learning experience for a population ecology laboratory course. Taking such projects from response labs to classroom will help generating awareness and activity-oriented research. The paper reports the analysis, interpretation and some preliminary predictions in variations of tiger population in India.

1.1 Virtual Population Ecology Lab

Over past two decades, the areas of online teaching and web-based learning initiatives have grown tremendously especially in the areas of biology [1]. A Virtual Lab (VL) is an innovative, computer-based educational program designed to learn, understand the basic principle of experimental and theoretical science and their applications. Since practical experience is an important component in learning science subjects, the continuous practice in an experiment would make one an expert in that subject. The opportunity to deal with real system of education is not reaching to all students of all institutions across the country. These constraints could be resolved by using learning materials such as information technology (more specific e-learning platform) which includes accessibility of these labs through web sites, virtual field trips, computer simulations and virtual laboratories [2].

Early studies have found that hands-on learning, particularly computer-based (online) instruction (a VL environment), is effective in enhancing science achievement [3] and [4]. A VL is a virtual reality environment that simulates the real world for the purpose of discovery learning. It allows one to simulate/emulate real experiment and operation on the basis of its underlying basic principle [5]. Even though a VL cannot be a replacement or equal to traditional laboratory or wet laboratory, it is worth to consider the many benefits that it offers.

Large numbers of institutions are working strong to support for creating an active, engaged learning environment to enhance student learning [6] and [7]. Literature studies indicate that study materials could engage and motivate students when they were user friendly, interactive, and problem oriented [8]. The use of virtual labs will give new instructional practice that will help to create the engaged and active learning experience that is supported by the literature [8]. This method may also extend learning for those students who cannot reach the study material or experimental setup ("If you can't come to lab, lab will come to you") and our recent study indicated that