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# RAT ATTACK! Population growth

## INSTRUCTOR GUIDE

### Module Description

This module contains exercises focused on the use and interpretation of logistic and exponential growth models. The module is based on an actual ecological phenomenon, the black rat population explosion that occurs every 48-50 years following the flowering and seed set of the bamboo *Melocanna baccifera*. As part of this module, students will gather life history information from the PBS Nova Documentary 'Rat Attack' describing this phenomenon for use in population models. Optionally the text of the documentary can be provided to students. The module activities will take approximately 160 minutes to complete.

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### Learning Objectives and Quantitative Competencies

| QUANTITATIVE COMPETENCY                                                                                                    | LEARNING OBJECTIVE                                     | ACTIVITY<br>( <i>numbers based on Excel Heavy version</i> ) |
|----------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|-------------------------------------------------------------|
| Demonstrate facility with mathematical models of biological systems and be able to make inferences about natural phenomena | Model population growth exponentially and logistically | 10, 16                                                      |
| Interpret data sets and communicate those interpretations using visual and other appropriate tools                         | Graph exponential and logistic curves                  | 11, 17                                                      |
|                                                                                                                            | Describe factors affecting different types of growth   | 21, 23                                                      |

## **Target Student Population**

This module is intended for first-year biology majors in an introductory biology course covering the topic of population growth. This activity assumes:

- Students have been exposed to population dynamics concepts including life history, population growth models, and exponential and logistic population growth equations.
- If the “Excel Heavy” version is implemented, students should have experience organizing data, creating formulas, and making graphs in Excel.

## **Module Characteristics**

### Mathematical/Statistical Concepts Covered:

- Mathematical modelling
- Data set interpretation

### In-class Activities:

- Collecting and manipulating data from case study
- Creating and interpreting graphs in Excel
- Applying biological explanations for population growth trends

### Components of Module:

- Preparatory assignment on population dynamics, suggested to be completed one week before class
- Case study video from which students will collect data
- In-class worksheet with “Excel Lite” or “Excel Heavy” versions
- Excel data template for “Excel Lite” or “Excel Heavy” version
- Guidelines for implementation

### Student Quantitative Skills Required:

- Basic arithmetic
- Graph/data interpretation

## **Implementation Instructions**

This module is designed for one lab period (~ 3 hours). In addition to the notes below, the instructor version of the lab activity has tips for implementation.

Students will need the following in order to complete the module:

- A computer with reliable internet connection to access both the module and the accompanying video
- Microsoft Excel
- Calculator (optional--students can do calculations using Microsoft Excel)

The module itself assumes students have already completed classroom time learning about exponential and logistic growth and the growth models. If students do not have this knowledge or reinforcement, there is a pre-lab activity that accompanies this module that students can complete as a pre-lab activity. This activity introduces the concept behind growth models and gives students practice calculating the models manually.

Note that there are two versions of the module that can be administered, depending on the degree of competency students have using Microsoft Excel and the desired outcomes by the instructor. The “Excel Lite” version has formulas and graphs automatically plugged in; students only need to input the variables needed for each growth equation. In the “Excel Heavy” version, students create the data table and graph manually, using the functions in Excel. All other aspects of the module are the same.

During the module, instructors should begin with a brief introduction that covers the population growth models and the “rat attack” scenario that will be covered in the module’s accompanying video. Break students into groups of 4 to work on the module. Allow students to watch the required portions of the accompanying video (linked in the module) and answer all life history question table questions in the module. Address questions as necessary. Students should then complete the rest of the module in order, which focuses on the population growth models (logistic & exponential) as well as a comparison of the populations. Once students have finished, they can independently submit the completed module questions & excel file with their calculations/graphs through the LMS.

### **Module Developers Names and Contact Information**

Please contact us if you have comments/suggestions/corrections:

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