



DIMACS EDUCATIONAL MODULE SERIES

MODULE 08-4 Modeling Biological Populations Date prepared: December 21, 2007

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Module Description Information

- **Title:**

Modeling Biological Populations

- **Authors:**

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- **Abstract:**

This module introduces three discrete-time population models: the logistic model, the Ricker model, and the Beverton-Holt model. These models are studied using real data sets from biological populations. Students use techniques from dynamical systems (iterations, cobwebs, fixed points, stability, and sensitivity analysis) to analyze population models.

- **Informal Description:**

In this module we use mathematical models to study biological populations such as the pine-looper moth, coho salmon, the common wasp, and the paramecium aurelia. Exercises throughout the module allow students to work with a model and a data set to determine how well the model fits the data, and what it predicts about the population's long-term survival. The exercises range from simple computations requiring a graphing calculator or Microsoft Excel (assumes Office 2003), to more challenging problems requiring calculus.

- **Target Audience:**

This module is aimed at high school students in their junior or senior years, and at freshman college students. It would be an appropriate module for an applied mathematics course.

- **Prerequisites:**

This module assumes some familiarity with composing functions, and with using exponential functions and logarithms. Some exercises require first semester calculus.

- **Mathematical Field:**

Mathematical Biology, Dynamical Systems, Difference Equations

- **Applications Areas:**

This module uses difference equations and technology to model population dynamics.

- **Mathematics Subject Classification:**

37N25, 39A11, 92D25

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- **Other DIMACS modules related to this module:**

Module 07-3: Using Population Models in the Teaching of Eigenvalues