

Intermodular Description Sheet: UMAP Unit 610

Title: WHALES AND KRILL: A MATHEMATICAL MODEL

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Mathematics Field: Differential equations, mathematical modeling

Application Field: Ecology

Abstract: A predator-prey system involving whales and krill is modeled by a system of differential equations. Although the equations are not solvable, information is extracted using dimensional analysis and the study of equilibrium points. The concept of maximum sustainable yield is introduced and used to draw conclusions about fishing strategies. Students learn to construct a differential equation model, remove dimensions from a set of equations, find equilibrium points of a system of differential equations and learn their significance, learn about maximum sustainable yield and use it to draw conclusions about fishing strategies, and practice manipulative skills in algebra and calculus.

Prerequisites:

1. Ability to differentiate algebraic expressions.
2. Knowledge of integration techniques.
3. Knowledge of maxima-minima techniques of calculus.
4. Familiarity with the concept of units or dimensions.