

DEPARTMENT OF MATHEMATICS

VIGRE Funding Report

(due 30 days after semester of support)

Semester/Summer and Year:

Summer 2008

Name: Suzanne Robertson

List the graduate courses you have taken this semester (including independent studies), your grades, and the instructors:

Course	Title	Grade	Instructor

List the title, date and location of any talks you have given, either here or elsewhere:

Title: Spatial patterns in stage-structured populations with density-dependent dispersal
 Date: August 1, 2008
 Poster, Society for Mathematical Biology Annual Meeting
 Toronto, Canada

If you are working on your dissertation, include a one paragraph description of your research progress. If you have not yet begun dissertation research, describe your progress toward finding a dissertation topic and advisor and beginning that research.

This summer I was able to make further progress towards completing my dissertation research. I focused on simulations from a Juvenile-Adult spatial model with a density dependent dispersal kernel and identified conditions on dispersal parameters which promoted both spatial and temporal segregation of the two life stages. I investigated how these conditions (and model behavior) changed with an increasing value of the net reproductive number. I also continued writing up key mathematical results for my dissertation.

List publications, if any.

Check all activities you completed during the funded period:

Academics:

- Independent Study
- Oral Comprehensive Exam
- Commence Thesis Research
- Conference attendance
- Conference participation
- Complete PhD

Professional development and outreach:

- AP Calculus Visit
- High School Workshops
- Undergraduate Research Project
- Undergraduate Research Seminar
- Super TA
- Mentoring junior graduate students for the qualifying exams
- RTG (help organize)
- Research Seminar (help organize)

Other (please specify)

Continued Thesis Research and started writing statistical case study (on modeling flour beetle populations) for Math 363.

Attach a brief statment about your academic progress and professional development during the period of support.

Suzanne Robertson
Program in Applied Mathematics
University of Arizona
VIGRE Report - Summer 2008

I received VIGRE support for Summer 2008 to continue research for my dissertation with Jim Cushing. I am studying density dependent dispersal in stage-structured populations by investigating stage-structured integrodifference equation (IDE) models with density dependent dispersal kernels. I am interested in solutions that result in the spatial segregation of life-cycle stages (in the sense that each life-cycle stage peaks in a different spatial location). The search for these spatial patterns is motivated by the patterns observed in populations of flour beetles, where the larvae and adults spatially separate.

This summer I focused on simulations for Juvenile-Adult toy IDE models, with juveniles dispersing to avoid adults, and adults avoiding juveniles. I discovered that increasing juvenile dispersal sensitivity to adult density (parameter D_J) promoted spatial segregation of juveniles and adults, while increasing the dispersal sensitivity of adults to juveniles (parameter D_A) promoted temporal segregation of life-cycle stages. In this case, the model attractor is a temporal 2-cycle. At any given time, one life stage is dominant while the other is almost completely absent. I was able to create $D_J - D_A$ space maps, identifying regions in parameter space where the model exhibits different types of behavior (equilibrium, 2-cycle, 4-cycle, spatial segregation, and temporal segregation). I investigated $D_J - D_A$ space plots for three different values of the net reproductive number n , our bifurcation parameter for the model analysis. As n increases, the model exhibits more complex behavior with larger regions of parameter space giving rise to spatial patterns.

As part of my professional development and outreach activities, I attended the annual meeting of the Society for Mathematical Biology in Toronto, Canada (July 30-August 2). I presented a poster on my research. I have also started working with Joe Watkins (at the University of Arizona) on developing a case study for his upcoming statistics class Math 363. The case study will focus on how statistics are used in the modeling of flour beetle populations.