

DEPARTMENT OF MATHEMATICS

VIGRE Funding Report

(due 30 days after semester of support)

Semester/Summer and Year:

Fall 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
Math 596A	Quantitative Biology Colloquium	A	Joe Watkins
Math 920	Dissertation	S	Jim Cushing

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

1. Mammalian Spontaneous Otoacoustic Emissions: A Global Standing Wave Model
September 2008, Quantitative Biology Colloquium, University of Arizona
2. Population Genetics Modeling with Absolute Fitness: Background for Yuseob Kim
October 2008, Quantitative Biology Colloquium, University of Arizona
3. Regulation of Spike Timing in Visual Cortical Circuits
December 2008, Quantitative Biology Colloquium, University of Arizona

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 fall I completed almost all of the research for my dissertation. I focused on the two case studies I am looking at, spatial patterns in *Tribolium castaneum* and *Tribolium brevicornis*. I showed that spatial versions of the LPA model (for *T. castaneum*) and SLPA model (for *T. brevicornis*) can give rise to the observed patterns, namely segregation of life cycle stages. Furthermore, I showed that density dependent dispersal and segregation of life cycle stages is a biological advantage for an inhibiting species in that it can increase total population size as well as the fraction of population given by sexually mature adults.

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 worked on statistical case study (on modeling flour beetle populations) for Math 363. Attended Joint Mathematical Meetings in Washington, DC and took part in the Employment Center.

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 - Fall 2008

I received VIGRE support for Fall 2008 to continue and conclude my dissertation research 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 two different species of flour beetles, where the larvae and adults spatially separate.

This fall I focused on research for the two case studies that will be included in my dissertation - applications to *Tribolium castaneum* and *T. brevicornis*. I showed that spatial versions of the LPA model (for *T. castaneum*) and SLPA model (for *T. brevicornis*) can give rise to the observed patterns, namely segregation of life cycle stages. For the LPA application, where space represents depth in a vial of flour, I used mixed boundary conditions (no-flux and hostile). For the SLPA spatial model, where space represents location on the surface of a tray of flour, I used no-flux boundary conditions. Spatial segregation is possible in the spatial LPA model if larvae avoid adults and adults avoid larvae. The spatial SLPA model can also exhibit segregation of life cycle stages, but exhibits multiple attractors and is sensitive to initial conditions. Inhibition is a strong promoter of spatial segregation in this model. Furthermore, I showed that density dependent dispersal and segregation of life cycle stages is a biological advantage for an inhibiting species in that it can increase total population size as well as the fraction of population given by sexually mature adults.

As part of my professional development and outreach activities, I attended the Joint Mathematical Meetings in Washington, DC, and took part in the Employment Center. I also continued working on a case study for Math 363, a statistics class starting this spring. The case study supplements the text for the course and focuses on how statistics are used in the modeling of flour beetle populations.