WILD 6400 – Ecology of Animal Populations - Fall 2011

Lecture/Discussion: Tuesday and Thursday 10:30-11:45 BNR 004 (basement)
Lab: Thursday 1:30-4:30 QLIB 306 (connected to NR)
Credits: 4

Instructor
Dr. David N. Koons
Office: NR 242
Phone: 797-8670
e-mail: david.koons@usu.edu
Office Hours: by appointment

Teaching Assistant
Daniel Olson
Office: BNR 217
Phone:
e-mail: dolson22@gmail.com
Office Hours: by appointment

Prerequisites: NR/BIOL 2220 (General Ecology)

Suggested Courses: It is highly suggested to have had at least an undergraduate-level coverage of population ecology, introductory calculus, and a statistics course covering regression before taking this course. WILD 6400 is an intensive course and much of the material will require careful thought if you are to understand it. Students should plan their schedules for the semester accordingly. Individuals that have great difficulty with basic statistics and computing would have to spend a large amount of extra time outside of class on this course.

Recommended Texts:
Williams, B.K., J.D. Nichols, and M.J. Conroy. 2002. Analysis and management of animal populations. Academic Press (referred to as WNC)
Gotelli, N.J. 2008. A Primer of Ecology. 4th edition. Sinauer Associates, Inc., Sunderland, MA.

Additional Readings:
Cooch, E., and G. White. 2008. A gentle introduction to Program Mark, 7th edition
Available on our course's Blackboard site.

Reading of additional journal articles and book chapters will be suggested throughout the course.

Course Description:
The focus of conservation and management is often the population, including the conservation of declining, rare, and endangered species, control of pest species, and management of sustainable abundance for harvest, viewing, and other anthropogenic desires. In WILD 6400 we will learn how to 1) estimate important demographic parameters of wild organisms (that often elude observation), and 2) construct models with these estimates to examine population dynamics for guiding conservation and management actions. We will focus primarily on populations of single species, including those without structured life cycles, those with age/stage-structured life cycles, and

spatially structured populations. In addition to ecological concepts, students will be introduced to mathematical techniques and computer software that will allow them to examine population dynamics on their own as they embark on their careers. After completing the course, students should be better prepared to judge the quality of results and conclusions of demographic and population studies. The concepts, theories, and methods learned in this class will also help students better understand evolutionary biology and aspects of community biology. This course is modeled after similar courses at other institutions, such as those taught by:
Barry Grand (Auburn http://www.auburn.edu/~grandjb/wildpop/index.html)
Jay Rotella (MSU http://www.montana.edu/rotella/courses.htm)
Gary White and Paul Doherty (CSU http://warnercnr.colostate.edu/fwcb-course-offerings/)
Mark Lindberg (UAF http://mercury.bio.uaf.edu/courses/wlf625/)
Mike Conroy (UGA http://coopunit.forestry.uga.edu/FORS8390)
Brett Sandercock (KSU http://www.ksu.ksu.edu/bsanderc/#TEA)
Evan Cooch (Cornell http://canuck.dnr.cornell.edu/index.html)
Students may find the materials on these websites extremely useful.

Lab:
Labs will consist of computer oriented sessions designed to help solidify the topics presented in lecture. We will use R and Program Mark (see helpful files on the Blackboard Vista course site, which will help you analyze your own data, and conduct modeling exercises suitable for publication (an end goal for most of your degrees). If you would rather not use R, you are also welcome to use Matlab or Python to complete labs related to population dynamics. You are also welcome to use RMARK to conduct labs related to estimation of demographic parameters (it's awesome). The point is that you learn. The software you choose is not as important. Nevertheless, it might be easiest to use the software packages used by the instructors for teaching the course.

Labs will meet in Quinney Library 306 where there are PCs with the software already installed. You are also welcome to use your own personal laptop computer. The recommended software is free! **Prior to the first lab, you will need to request a Quinney Lab computer account; you can now do this online:** http://www.cnr.usu.edu/quinney/htm/labs (there is no cost for an account).

Grading:
There will be no exams. Instead, you will be graded on rigorous lab assignments (65%), and a final project (35%). Since you cannot get an A+ at USU I do not believe in administering minuses. Thus, grades will be assigned as follows: 100 – 90% = A, 89.99 – 87 % = B+, 86.99 – 80 % = B, 79.99 – 77 % = C+, 76.99 – 70 % = C, 69.99 – 60 % = D, Below 60% = F. The grading scale may be lowered at the discretion of the instructor. All lab assignments must be turned in on time for full credit. Exceptions will be granted only under the most stringent conditions, requiring official medical or university documentation. In the event of an unavoidable conflict with class attendance or submission of assignments, make every attempt to notify me prior to class meetings or due dates. Otherwise late assignments will be docked 10% of the grade for each day late.

Term Project:
Students will be required to develop a term project in which they analyze, synthesize, and present results using concepts and methods learned in class. Students should try to choose a question and methodological tool related to their own area of research, but I must approve the subject. Although not required, students are encouraged to eventually prepare manuscripts on the subject material. Grading of the term project will be based on presentations that must include introductory material that synthesizes the pertinent literature, a description of the methods used to collect the data, description of the quantitative techniques used in the analysis, interpretation of the results, and recommendations or conservation implications.

Subject choice: Due Oct. 19. Develop a rough outline that simply lists the project objectives.

Detailed outline: Due Oct. 28. Outline should include more information about all of the required parts of a scientific paper mentioned above.

Final Presentation: Dec. 6th and 8th, a 15-minute presentation of the term project in a format suitable for a symposium or professional scientific meeting. The presentations will be delivered using PowerPoint or similar software. Presentations will be scored by the instructors, and the final grade will be based on the average scoring. Scoring will be based on the following:

- Originality – Was the project based on an original idea or was it simply repetition of an existing study? (20%)
- Content – Looking for good application of scientific method (50%)
    - Introductory material that relates to existing knowledge
    - Working hypotheses that will be tested
    - Description of the methods used to collect or generate the data
    - Description of the quantitative techniques used in the analysis to assess hypotheses
    - Interpretation of results and applications
- Organization – Was the presentation organized logically? (20%)
- Response to questions – Were responses to questions from the audience appropriate? (10%)

Teaching Assistant:
We are extremely lucky to have Daniel Olson as our teaching assistant, who received an excellent background on these topics a couple of years ago. Daniel will help oversee labs, conduct some lectures, and help grade your work. Please treat him as you would a faculty member.

Accommodations for disabilities:
Students with physical, sensory, emotional or medical impairments may be eligible for reasonable accommodations in accordance with the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973.

All accommodations are coordinated through the Disabilities Resource Center (DRC) in Room 101 of the University Inn, 797-2444 voice, 797-0740 TTY, or toll free at 1-800-259-2966. Please contact the DRC as early in the semester as possible. Alternate format materials (Braille, large print or digital) are available with advance notice.

Tentative Schedule of Lectures

The course topics will be covered in order; however, the schedule of lectures and labs will be kept flexible in order to ensure adequate coverage of each topic. Lecture and lab materials/notes will be posted on the Blackboard Vista course site.

Blue = topic related to population dynamics
Red = topic related to estimation of demographic parameters

Date	Lecture Topic
	Part I: Non-structured Populations
30 Aug	Course introduction, basics of population ecology, scientific method
1 Sep	MLE, information-theoretic approaches to inference
6 Sep	Abundance: Distance estimation with transects and point counts
8 Sep	Abundance: Distance estimation cont'd
13 Sep	Abundance: closed Capture-Mark-Recapture (CMR) and removal methods; historical to modern approaches
15 Sep	Abundance: CMR methods with covariates and individual heterogeneity
20 Sep	D-I population growth & concepts of stochasticity
22 Sep	D-D population growth & sustainable harvest
	Part II: Age/Stage-structured Populations
27 Sep	Vertebrate life history strategies
29 Sep	Kaplan-Meier and known-fate survival estimators
4 Oct	No Class – TWS meeting @ Snowbird
6 Oct	Nest survival estimators & Delta Method
11 Oct	CMR estimators for survival: CJS models; extensions to CJS for estimating survival, recruitment, and abundance
13 Oct	No Class – follow Friday class schedule on this day
18 Oct	CJS: G.O.F., QAICc, Monte Carlo model averaging, variance components
20 Oct	CJS: How to design a CMR study w/ consideration of sampling and precision
25 Oct	Matrix projection models
27 Oct	Perturbation analysis: Sensitivity, Elasticity, LTRE
1 Nov	Uncertainty; D-D and Harvested populations with age/stage structure
3 Nov	Changing environments: effects of stochastic environments on age/stage-structured population dynamics
	Part III: Spatially-structured Populations
8 Nov	Metapopulations: Levins' traditional concept
10 Nov	Occupancy models for the Levins Metapopulation
15 Nov	Multi-state Occupancy models and other extensions
17 Nov	Multi-state CMR models

22 Nov	Metapopulations: Source/Sink and multi-location Matrix models
24 Nov	No Class – Thanksgiving; Work on Projects
29 Nov	Work on Projects
1 Dec	Work on Projects
6 Dec	Project Presentations
8 Dec	Project Presentations

Tentative Schedule of Labs

1 Sep	Basic stats, MLE, and Information Criterion
8 Sep	'Unmarked' R package for distance estimation of population density
15 Sep	Program Mark for closed CMR abundance estimation
22 Sep	Modeling population dynamics
29 Sep	Kaplan Meier & Known fate survival estimation w/ clean data
6 Oct	Nest survival estimator & Delta Method (also applicable to messy telemetry data)
13 Oct	No Class – follow Friday class schedule on this day
20 Oct	CMR survival estimation using the CJS model & Study Design
27 Oct	Matrix projection modeling & Perturbation analysis
3 Nov	D-D & Stochastic growth of age/stage-structured populations
10 Nov	Patch occupancy modeling
17 Nov	Multi-state models
24 Nov	No Class - Thanksgiving
1 Dec	Work on Projects
9 Dec	Project Presentations

Associated Schedule of Suggested Readings

Date	Lecture Topic
	Part I: Non-structured Populations
30 Aug	WNC ch. 1-3, Gotelli pp. 1-5, Chamberlain 1890, Platt 1964
1 Sep	WNC ch. 4 & pp. 431-433, Cooch and White ch. 1, R intro
6 Sep	skim WNC ch. 12 (skip 12.4-12.5); Distance Sampling ch. 1 & 2 http://www.colostate.edu/depts/coopunit/download.html
8 Sep	skim WNC ch. 13 (skip 13.1)
13 Sep	WNC ch. 14 (14.3, 14.5 not covered in class), Alisauskas et al. 2009, Otis et al. 1978
15 Sep	Cooch and White ch. 14, Mahon 1980
20 Sep	Gotelli pp. 5-23
22 Sep	Gotelli ch. 2
	Part II: Age/Stage-structured Populations
27 Sep	Gotelli p. 50-56, 69-71, Bielby et al. 2007
29 Sep	WNC ch. 15 (skip 15.2, 15.3.2, 15.5), Cooch and White ch. 16, Heisey and Patterson 2006

4 Oct	No Class
6 Oct	WNC 15.3.2, 15.5, Cooch and White ch. 17, Rotella 2007
11 Oct	WNC 17.1, 17.2 (optional 17.5, 18.4, 19), Lebreton et al. 1992
13 Oct	No Class – follow Friday class schedule on this day
18 Oct	Cooch and White ch. 5, Burnham et al. 1987 (pp. 22-25, 260-269) see Gary White's webpage for a download of the Burnham book
20 Oct	Cooch and White Appendix A
25 Oct	Gotelli pp. 59-69, 71-79 (assumed knowledge: 50-58) PVA handbook pp. 30-36, Koons et al. 2006
27 Oct	WNC 8.4.2 Dobson and Oli 2001
1 Nov	WNC 8.4.2.4 Fowler 1981, Burnham and Anderson 1984
3 Nov	PVA handbook pp. 36-47, Gotelli and Ellison 2006, Koons et al. 2009
	Part III: Spatially-structured Populations
8 Nov	Gotelli ch. 4
10 Nov	Occupancy MARK notes, Occupancy book ch. 1-2, MacKenzie 2003, 2005, Barbraud 2003, Ball 2005
15 Nov	MacKenzie et al. 2004, 2009, Nichols et al. 2007
17 Nov	WNC 17.3; Cooch & White ch. 8; Hadley et al. 2007, Lachish et al. 2007, Breininger et al. 2009
22 Nov	Wootton and Bell 1992, Pascarella and Horvitz 1998, Hunter and Caswell 2005
24 Nov	No Class – Thanksgiving; Work on Projects
29 Nov	Work on Projects
1 Dec	Work on Projects
6 Dec	Work on Projects
8 Dec	10:30 – 4:00 Project Presentations NR 102 (Dean's Conference Room)