

## Population Dynamics and Estimation (FiW 4414)

T/TH 11:00 am – 12:15 pm      317B Cheatham  
Spring 2012

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### Instructor:

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### Teaching Assistant

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Undergrad Tutors Available:

Rebecca Fraenkel ([zoo@vt.edu](mailto:zoo@vt.edu)); Paul Ngo ([dpngo25@vt.edu](mailto:dpngo25@vt.edu)); Cari Lynn Squibb ([carine09@vt.edu](mailto:carine09@vt.edu))

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### Required Textbooks (Available at the VT Bookstore and Volume II)

Mills, L. S. 2007 Conservation of wildlife populations: Demography, genetics, and management. Blackwell Publishing, Massachusetts. ISBN: 978-1-4051-2146-0

I will post sections of these 2 books on Scholar as supplementary reading:

Akçakaya, H.R.; Burgman, M.A.; and L.R. Ginzburg. 1999. Applied population ecology: principles and computer exercises using RAMAS EcoLab. Second edition. Sinauer Associates, Inc.; Sunderland Massachusetts.

Gotelli, N.J. 2001. A primer of ecology. 4th Edition. Sinauer Associates, Inc. Sunderland, Massachusetts

### This class will cover:

Estimation of population sizes and demographic parameters for wildlife and fish populations. Population growth, structure, and regulation. Population models in discrete and continuous time for harvested, non-harvested, and small populations. Age/stage structured populations, Leslie matrices, life tables, survivorship curves, metapopulations, population viability analysis, and genetic considerations in population dynamics, basic population genetics.

### Rules of Conduct:

- Students are expected to attend all scheduled lectures. If you miss a lecture do not ask the instructor for class notes. It is your responsibility to obtain any materials that may have been distributed during your absence (e.g., handouts, assignments).
- You will still be held responsible for submitting assignments that were due on the date of your absence. Students will not be awarded full credit for any assignments turned in late in cases of unexcused absence. You also will be expected to complete and submit any work or assignments announced during your absence on or before the normal expected due date.
- If you know that you have a conflict at the time an exam is scheduled, you must make arrangements with the instructor in advance to take that exam **early**. If you miss an exam without a valid excuse (for example, a serious medical or family situation... the validity of which will be determined by the instructor), you **will not be allowed** to make up that exam and will receive a grade of 0. If you know that you will be unable to attend class on a date when an assignment is due, you may submit the assignment early or meet with the instructor to make advanced preparations. Otherwise, full credit will not be awarded.

- If you have a disability for which counseling or assistance is being obtained through the Dean of Students Office, you must provide written documentation of such consultation as well as a statement that details any special needs or conditions to the instructor by the end of the first week of class. Accommodation of special needs may not be guaranteed after that time.
- The University Honor Code will be strictly enforced in this course. Work submitted in your name must be your own and should reflect only your effort, including those assignments involving computer work. All assignments that you submit shall be considered for grading unless otherwise noted. Thus, all aspects of your coursework are covered by the Honor System. Any suspected violations of the Honor Code will be reported promptly to the Honor Court System. Honesty in academic work will develop professional integrity. The faculty and your fellow students at Virginia Tech will not tolerate any form of academic dishonesty.
- If you have questions about the materials covered in lectures, or readings, do not hesitate to ask. Help the instructor recognize that something may not be completely clear by *asking questions*.

**Evaluation of Student Performance (i.e. grading)**

	Points	Percentage	
Exam 1	100	17.39%	} 34.8%
Exam 2	100	17.39%	
Problem set 1	45	7.8%	} 31.3%
Problem set 2	45	7.8%	
Problem set 3	45	7.8%	
Problem set 4	45	7.8%	
Problem set 5	55	9.56%	
Final Exam:	140	24.35%	
Total Points =		575	100%

The following grading scale will be used and *may* be lowered by the curve if necessary:

A	>92.5%
A-	89.5 – 92.4%
B+	87 – 89.4%
B	83 – 86.9%
B-	79.5 – 82.9%
C+	77 – 79.4%
C	73 – 76.9%
C-	69.5 – 72.9%
D+	67 – 69.4%
D	63 – 66.9%
D-	59.5 – 62.9%
F	<59.5%

**NOTE:** I will make use of the course homepage on the VT **Scholar** system to post announcements, assignments, course documents, clarifications, etc. It is your responsibility to check this website regularly to obtain this information.

**DISABILITY STATEMENT:** Any student who feels that s/he may need an accommodation because of a disability (learning disability, attention deficit disorder, psychological, physical, etc.), please see the instructor.

<b>Dates</b>	<b>Topics</b>	<b>Assignments due</b>	<b>Readings</b>
Jan 17 & 19	Introduction; course mechanics; definition of population ecology; begin estimation techniques (quadrat and line transect methods)		Mills 2007:Chap. 1 (all) and Chap. 4 pps. 59-66, plus handouts provided with sample problems from Krebs, 1989 and Buckland et al. 2001. DISTANCE estimation
Jan 24 & 26	Continue estimation techniques: mark-recapture (Lincoln-Peterson, Schnabel, Regression, Cormack-Jolly-Seber)		Mills 2007: Chap. 4 pps. 66 -73 & 79-87. Handouts provided with sample problems. From Krebs, 1989.
Jan 31 & Feb 2	Population growth (exponential); discrete versus continuous	Problem Set 1 due Thursday Feb 2	Mills 2007: Chap. 5 pps. 91-99. Gotelli 2001: Chap. 1 pps. 2-14 and 20-22; (Optional: Akcakaya et al. 1999: Chap 1 pages 1-27).
Feb 7 & 9	Population growth (logistic); discrete vs. continuous; $r$ vs. $K$ selection		Mills 2007: Chapter 6 (all). Gotelli 2001: Chap. 2 pps. 26-37 and 41-45. Begon et al. 2000 pages 177-181 (pdf provided on Scholar)
Feb 14 & 16	Age and stage-structured populations; Leslie Matrix; Lefkovich matrix; intro to sensitivity analysis	Problem Set 2 due Thursday Feb 16	Mills 2007: Chap. 7 pps.132-148.Akcakaya et al. 1999: Chap. 4 pps. 105 -123 and Chap. 5 pps. 157-163 and 168-171. (optional: Gotelli 2001: Chap. 3 pps. 61- 79.)
Feb 21 & 23	Life tables: static vs. dynamic; survivorship curves	First Exam Thursday Feb 23	Akcakaya et al., 1999. Chap. 4 pps. 127-133; Gotelli 2001: Chap. 3 pps. 52-61
Feb 28 & March 1	Finish life tables; Metapopulations		Mills 2007: Chap.10 pps.199-205 and 211-222. Gotelli Chap.4 pps. 82-96 & Chap. 7. (Optional Akcakaya et al.,1999. Chap. 6 pps. 183-203).
March 6 & 8	Spring Break - No Class		Catch up!
March 13 & 15	Competition and predation models	Problem Set 3 due Thurs. March 15	Mills 2007: Chap. 8 (all). Gotelli 2001: Chap. 5 pps. 100-117; Chap. 6 pps. 126 -140.
March 20 & 22	Harvested populations maximum sustained yield; fixed quota vs. fixed effort; catch per unit effort.		Mills 2007: Chap. 14 (all). Plus handouts and readings provided from Krebs 2001 and King 1995
March 27 & 29	Yield per recruit; stock recruitment; optimal yield; Beverton-Holt Stock recruitment models	Problem Set 4 due Thurs March 29	Catch up!
April 3 & 5	Dave Steffen: yield curves; comp vs. add mort. Uncertainty and variation; Population viability analysis: demographic environmental stochasticity; PVA with multiple populations	Second Exam Thurs April 5	Mills 2007: Chap. 5 pps. 99 -104. Chap.11 pps. 225 -232; Chap 12 (all). (Optional Akcakaya et al. 1999: Chap.2 pps. 34 -61 and Chap.4 pps.123-127
April 10 & 12	Simulation models: bring lap-top to class if you would like to follow along		Mills 2007: Chap 12 (cont.). (Optional Akcakaya et al 1999. Chap. 7 pages 213 – 234)
April 17 & 19	Finish PVA topics; Population genetics: review terms and measurements of diversity/variation		Mills 2007: Chap 9 pps. 176-185. Plus handouts provided from Hallerman 2003 and Frankham et al. 2002 on Blackboard.
April 24 & 26	Effective population size; Inbreeding coefficient and theory of inbreeding; outbreeding depression; Evolutionary significant units (ESUs)	Problem Set 5 due Thurs April 26	Mills 2007: Chap 9 pps. 185-198 and pps. and handouts provided from Hallerman 2003 and Frankham et al. 2002.
May 1	Genetic markers; genetic tools, applied uses of genetic approaches; course wrap-up.		Mills 2007: Chap. 3 (all) and Chapter 10 pps. 202 -211
<b>Final Exam: Friday, May 4, 10:05 – 12:05 pm</b>			