Parameter Estimation - FiW 6984 - Fall 2016
Monday and Wednesday 12:20 -2:10
133 Cheatham Hall

Instructor:	**Teaching Assistant**
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Office Hours: By appt. anytime	Office Hours: By appt. anytime

There are no required textbooks for this course. We will rely on primary literature and book chapters provided on Canvas. Highly recommended books from which this course will draw extensively and which are suggested as excellent sources for the topics covered are:

Anderson, D.R. 2008. Model based inference in the life sciences. Springer; New York, NY

Williams et al. 2002. Analysis and management of animal populations. Academic Press.

Burnham and Anderson. 2002. Model Selection and multimodel inference: a practical information-theoretic approach; second edition. Springer.

Program MARK- A Gentle Introduction. Online Software Manual.

Buckland et al. 2001. Introduction to distance sampling: Estimating the abundance of biological populations. Oxford University Press.

Royle and Dorazio. 2008. Applied Hierarchical Modeling in Ecology. Academic Press.

Royle et al. 2014. Spatial Capture-Recapture. Academic Press.

MacKenzie et al. 2006. Occupancy estimation and modeling: Inferring patterns and dynamics of species occurrence. Academic Press.

Topics:
This course focuses on methods of, and theories behind, estimating population parameters. The structure of this course is part seminar, with readings and discussion, part lab with detailed instructions to work through different examples, and part applied problem-solving, with independent work through objectives with simulated and real data.

Class meetings will be a combination of lectures, discussions, and labs designed to pull together common threads through readings and assignments, and demonstrations and exercises with different modeling platforms. This course uses problem-based learning. Lectures and practical, hands-on computer work will be taught in an integrated fashion and will focus on background and theories. We will use both simulated and real data sets implemented in available software programs to gain hands-on experience. We will primarily use readily available,

downloadable, software. A computer is a must and laptop computers with wireless capability, are required for the course. PCs are preferred over MACs because downloadable software is often incompatible with MACs unless you are running Parallels or BootCamp.

R programming:

R will be used occasionally as a teaching tool, but students will not be required to become proficient using R to do well in the course.

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.

Method of Evaluation:

Reviews (3)	**15%**
Assignments (6)	**45%**
Final Project	**25%**
Participation	**10%**
Total	**100%**

Article Reviews (3): The first review (on Null Hypothesis testing vs Information Theoretic approaches) must be turned in by everyone in ≤3page summary. Then 2 additional reviews consisting of a brief summary presented in ≤5 ppt slides to be discussed in class of an article utilizing the modeling method we discuss, with focus on the methods and inference. There will be 4 chances, as noted in the syllabus, to complete these 2 additional reviews.

Assignments (6): A scientific style paper on the assigned topic, working through objectives with an assigned data set. These require development of hypotheses, description of methods used, and evaluation and interpretation of models. Models will be turned in for double-checking that they were done correctly.

Final Project: Final projects should apply at least one of the concepts and techniques to a real world data set, preferably the student's own data, or data related to the student's graduate project. See us if you need a data set. We have several real world data sets that need analyzing.

Course Schedule and Assignments: Readings are available on Scholar. Subject to Change

Date	Topic	In class activities	Assignments/Readings due
Mon, August 20	Parameters and Population Dynamics	Introductions Pre-course Assessment Lecture: Introduction to using models to estimate population parameters.	• Review basic pop dy if needed: Gotelli (2008) Chapters 1 and 2 • Review Calculus if needed (see uploaded chapters – popular book) • Williams et al. (2002) Chapter 1-3 • Hilborn & Mangel (1997) Preface and Chap 1 • http://www.nature.com/collections/qghhqm/pointsofsignificance • http://www.phidot.org/software/mark/docs/book/pdf/chap1.pdf
Wed, August 22	Frequentist & Information Theoretic Approach	Lecture/discussion on philosophy of statistics, different paradigms, model selection	• Chamberlain (1897) • Burnham and Anderson (2002) Chapters 1 and 2 (97 pages!)
Mon, August 27	Philosophy of Statistics/model selection	Lecture	Other Readings: • Anderson/Cherry/Guthery exchange • Stephens et al. (2005) • Lukacs et al. (2007) • Optional: 2014 Ecology Special Section on p-values
Wed, August 29	DISTANCE estimation	Lecture: Distance estimation, detection functions Download DISTANCE	• **Review NHT/IT written Review Due (≤ 3 pgs)** • Thomas et al. (2010) • Buckland et al. (2001): Chapters 1, 2, and 4 • Optional: Marques et al. (2007)
Mon, Sept 3	Labor Day	No Class	Catch-up on DISTANCE Readings!
Wed, Sept 5	DISTANCE	More DISTANCE Data, Goodness of fit tests, bird data. Lab: Indonesian birds	• Choose current article using distance estimation • **Optional Review of an article (≤ 5 ppt slides) using DISTANCE for density estimation**
Mon, Sept 10	Finish DISTANCE: prob/statistics foundational Maximum Likelihood Estimators	Prob theory, MLE in Excel, Hines & Donovan (Excel example)	• **Optional Review of an article (≤ 5 ppt slides) using DISTANCE for density estimation**
Wed, Sept 12	Introduction to Occupancy	Discuss debate papers and Download PRESENCE	• **DISTANCE Assignment Due – Indonesian birds** • Anderson/Engeman debate (2001, 2003) – random student summarize • Sollmann et al. (2013) • Optional- Carbone/Janelle debate (2001; 2002)

Mon, Sept 17	Single-Species, Single-Site Occupancy in PRESENCE	Single-Species, Single-Site,	• MacKenzie (2005); Vojta (2005) • MacKenzie et al. (2002) • MacKenzie et al. (2006), Chap.1 (Introduction); Chapter 3
Wed Sept 19	Single season occupancy with site versus sampling covariates	Lab: Program Presence – site and sampling covariates	• Doherty et al. (2012) • Arnold (2010)
Mon, Sept 24	Single season with sampling covariates; Co-occurrence models in PRESENCE, parameterizations	Lecture: finish s-s sampling covariates, Start co-occurrence models in PRESENCE Start Lab: co-occurrence in bats	• **Optional Review of an article (≤ 5 ppt slides) using occupancy estimation** • Occupancy Mackenzie et al. (2004) • Bailey et al. (2009) • Farris et al. (2015)
Wed, Sept 26	Finish co-occurrence modeling	Lab: co-occurrence in bats	• **Optional Review of an article (≤ 5 ppt slides) using occupancy estimation** • Optional Sunarto et al. (2015)
Mon, Oct 1	Multi-Season Occupancy	What's the value of incorporating multiple seasons in one model? Finish: co-occurrence in bats	• **Single-season, single-site, co-occurrence Assignment due** • **Optional Review of an article (≤ 5 ppt slides) using occupancy estimation** • Mackenzie et al. (2006) Chapter 7 • Optional Farris et al. (2017) – multi-season occupancy
Wed, Oct 3	Early Closed-Population Model Theory and CAPTURE	Use program CAPTURE; Download MARK	• Gentle Intro to MARK Chapter 1 and 2 (download) • Williams et al. (2002) Chapter 14, sections 14.1 and 14.2
Mon, Oct 8	TWS- No Class		• Gentle Intro to MARK, Chapter 14 - Closed population capture-recapture models up through section 14.5 (download)
Wed, Oct 10	TWS- No Class		Catch up on reading
Mon, Oct 15	Closed capture in MARK…PIMS and groups	Lab: Estimating Bear and Civet abundance	• MARK chapter 14 complete
Wed, Oct 17	More closed capture; PIMs to DMs	Discuss MARK closed capture articles More MARK	• **Optional Abundance Review Article (≤ 5 ppt slides) due** • Mark Chapter 14, complete

Mon, Oct 22	Finish closed capture with sex as covar. Intro to Open Pop. Models: CJS	Lecture and in class examples	• **Optional Abundance Review Article (≤ 5 ppt slides) due** • Williams et al. (2002), Chapter 17, pgs. 417-426 • Gentle Introduction to MARK, Chapter 3 (pps 1-15) and 4 (pps 1-24)
Wed, Oct 24	CJS and Goodness of Fit in MARK and	Lecture and in class examples	• **Optional Abundance Review Article (≤ 5 ppt slides) due** • Gentle Introduction to MARK, Chapter 5 (pgs 5-1 to 5-7), section 5.6 (pgs 5-22 to 5-28), section 5.10 (pgs 5-37 to 5-40). • Burnham and Anderson (2008) Chapter 4
Mon, Oct 29	CJS and covariates in MARK and Model Averaging	Lecture and in class examples	• **Optional Abundance Review Article (≤ 5 ppt slides) due** • Gentle Introduction to MARK, Chapter 6: (pgs 6-1 to 6-53). • Lebreton et al. (1992)
Wed, Oct 31	More Open Population Models	Lecture: More Open Population Models Crossbill Assignment	• **Optional Abundance Review Article (≤ 5 ppt slides) due** • **Lab Bear abundance MARK Assignment due** • Williams et al. (2002), Chapter 18
Mon, Nov 5	Robust Design	Lecture: Robust Design Find Robust design article to review	• **Optional open pop survival Review Article (≤ 5 ppt slides) due** • Gentle Intro to MARK, Chapter 15
Wed, Nov 7	Density and Effective Trapping Area	Lecture/lab: Buffers, MMDM, and the delta method	• **Optional open pop or Robust Design survival Review Article (≤ 5 ppt slides) due** • Wilson and Anderson (1985) • Delta method section (pps 736-737) in Williams et al. (2002) and/or Karanth and Nichols (2002)
Mon Nov 12	Hierarchical Models and Spatial Capture Recapture and DENSITY	Lecture: incorporating the observation process, being explicit about space Download Program DENSITY	• Efford (2004) • Efford et al. (2004) • Efford et al. (2009) • Borchers and Efford (2008)
Wed, Nov 14	DENSITY - MLE methods	Working through DENSITY with civet data. Density 4-ways Assignment	• **Optional SECR/SCR Review Article (≤ 5 ppt slides) due** • Royle and Dorazio (2008) Chapter 1 • **Crossbill CJS Assignment due Friday**
Mon/Wed 19&21	Thanksgiving	No Class	No Class

Mon, Nov 26	Density – Bayesian Inference approach	Very basics of Bayes Law, MCMC, Program SPACECAP	• **Optional SECR/SCR Review Article (≤ 5 ppt slides) due** • Royle et al. (2013), Chapter 6 • Link et al. (2002), Of BUGS and Birds • Gopalaswamy et al. (2012)
Mon, Nov 28	Mark-resight in MARK	Lecture: Mark-resight models: Lincoln Petersen revisited, and more advanced applications	• **Article review (≤ 5 ppt slides) on your choice of Parameter** • Optional: Gentle Introduction to MARK, Chap 18 Optional: McClintock et al. (2009) • **Density four ways Assignment due Friday**
Mon, Dec 3	Survey of other methods	SPIM models, others	• **Optional: Article review (≤ 5 ppt slides) on your choice of Parameter** • Optional: Augustine et al. (2018). Spatial Partial Identity Models (SPIM) Work on final project
Wed, Dec 5	Presentations	Final Project Presentations	• Turn in final paper/presentation
TBD	Presentations	Final Project Presentation	• Turn in final paper/presentation