SYLLABUS – Spring 2015

Analysis and Management of Vertebrate Populations and Communities (WIS 6934)

Venue: 219 Newins-Ziegler Hall, University of Florida main campus, Gainesville, FL

Dates: Feb 28 - March 7, 2015; Timing: 8.00 am – 5.00 pm with a one hour lunch break and 15 minute morning and afternoon breaks

Instructors:

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Course Objective:

To present a unified approach to the science, conservation and management of natural animal populations, and to provide participants with information and resources for implementation of this approach. This approach involves three major methodological components: modeling, estimation and decision making. Because of other course offerings at UF, this course will focus primarily on estimation, with lesser emphasis on modeling and decision methods.

Specific Objectives:

1. To provide a conceptual framework for the use of models and estimation methods in the conduct of science and management of animal populations and communities.
2. To show how this framework can be used to develop estimation methods applicable to various sampling and logistic situations.
3. To present the specific rationale and logic underlying the more commonly used approaches to estimating population and community-level attributes, with emphasis on tailoring these methods to meet study objectives under logistical constraints.

4. To present a general rationale and approach for the development of an animal monitoring program, with emphasis on the use of resulting inferences for science and/or conservation and management.
5. To present a logical framework for making management decisions and to identify the major components of uncertainty typically encountered in the management process.
6. To outline the implementation of a formal adaptive management process for making informed management decisions in the face of uncertainty.

Outline:

Day 1

1. Introductions

1.1. Introduction to workshop (HELLGREN, HINES) (0.25 hr)

1.2. Introduction of instructors/participants/students and their backgrounds and objectives (Group) (0.75 hr)

2. Overview Material

2.1. Conceptual framework for population ecology & management (CLEMENT?) (0.25 hr)

3. Statistical Inference

3.1. Statistical distributions (e.g., normal, multinomial) (CHAMBERT) (0.5 hr)

3.2. Parameter estimation (CHAMBERT) (0.5 hr)

- Estimator properties (bias, precision, accuracy)
- Estimation methods
- Confidence intervals

BREAK

3.3. Hypothesis testing (CLEMENT) (0.75 hr)

- Type I and II errors
- Power
- Likelihood ratio tests
- Goodness-of-fit tests

3.4. Model selection (information theoretic approaches) (MARTIN) (0.5 hr)

3.5. Bayesian model updating (MARTIN) (0.25 hr)

LUNCH

3.6. Hierarchical modeling: Bayesian approach (CHAMBERT) (0.5 hr)

3.7. Survey sampling and related issues (MARTIN) (1hr.)

- Sampling design features
  - Replication
  - Randomization
  - Control of variation
- Some designs
  - Simple random sampling
  - Stratified random sampling
  - Other (cluster, systematic, double, dual frame, adaptive)

BREAK

4. Models

4.1. Modeling for science and management (CLEMENT) (1.5 hr)

5. Estimation of State Variables (Animal Abundance, Density, Occupancy, Species Richness)

5.1. Overview (HINES) (0.75 hr)
- Why estimate state variables such as abundance?
- Role of monitoring in science and management
- How to estimate state variables: a canonical estimator
- Indices

Day 2 (Mon., Mar.7):

5.2. Observation-based methods (abundance): distance sampling
- Introduction to Distance Sampling (CLEMENT) (0.5 hr)
  - Introductory Concepts
  - Assumptions Underlying the Sampling Technique
- Estimating the proportion of animals detected & counted (CLEMENT) (0.5 hr)
  - Line Transects
  - Point transect
  - Contrasting Line Transect & Point Transect Sampling
- Survey Design & Field Protocol (CLEMENT) (0.5 hr)
  - Precision
  - Bias

BREAK

5.3. DISTANCE 4 Software (HINES, MARTIN) (1.0 hr)
- Brief overview
- Exercise

5.4. Observation-based methods (abundance): misc. (CHAMBERT) 1.25 hr)
- Marked subpopulation
- Temporal removal modeling
- Sighting probability modeling
- Multiple independent observers
- Multiple dependent observers
- Replicate counts (N-mixture models)

LUNCH

5.5. Implementing observation-based methods
- Introduction to MARK (HINES) (0.5 hr)
- Computer exercises with MARK (HINES) (0.5 hr)

5.6. Capture-based methods (abundance estimation): closed CR models 2-sample model (MARTIN) (0.75 hr)
- Data structure
- Models and estimators
- Study design

BREAK

5.7. 2-sample model exercises (MARK) (HINES) (0.75 hr)

5.8. *K*-sample closed models (CLEMENT) (1.25 hr)
- Data structure
- Models

Model testing and selection
Confidence interval estimation
Study design

Day 3 (Tue., Mar. 8):

5.9. *K*-sample closed model exercises, CAPTURE, MARK (HINES) (1.0 hr)
5.10. Density estimation with closed CR models (CLEMENT) (0.5 hr)
Ad hoc boundary strip approach
Nested grids
Gradient designs (e.g., trapping webs)
5.11. Spatially explicit cap-recap models for density estimation (CHAMBERT) (0.5 hr.)
BREAK
5.12. Computer exercise (SPACECAP or DENSITY) (HINES) (1.0 hr)
5.13. Single-season, single species occupancy (CLEMENT) (0.75 hr)
Data structure and designs
Modeling
Assumptions and their relaxation
LUNCH
5.14. Design matrices (HINES) (0.5 hr.)
5.15. Computer exercise (PRESENCE) (HINES) (0.75)
BREAK
5.16. Single-season occupancy extensions (CHAMBERT) (0.75 hr)
Multi-state occupancy
2-species occupancy
Community level occupancy
5.17. Multistate occupancy computer exercise (PRESENCE) (Hines) (0.75 hr.)
5.18. Misclassification in single-season occupancy (CHAMBERT) (0.5 hr.)
5.19. Species richness (CLEMENT) (0.5 hr.)

Day 4 (Wed., Mar. 9)

6. Inference for population (and community) dynamics

6.1. Vital rates for population and community dynamics (CHAMBERT 0.25 hr.)
Overview
Concepts, definitions, complications
Examples of surveys and analyses
6.2. Introduction to Program R (HINES, CHAMBERT, CLEMENT) (0.75 hr)
R-MARK
R-PRESENCE
BREAK
6.4. Introduction to WINBUGS () (0.75 hr)
Occupancy example

Day 5 (Thur., Mar. 10)

6.10. Survival estimation: all marked animals detected (HINES) (0.5 hr.)

Binomial survival model
Nest success
Radiotelemetry data
Study design

6.11. Computer exercises (MARK) (HINES) (0.75 hr)

6.12. Tag recovery models (CLEMENT) (0.5 hr)

BREAK

6.13. Open population Capture-recapture models

Single-age models: Basics (CHAMBERT) (0.5 hr)

Data structure
Modeling

More single-age models: (CHAMBERT) (0.5 hr)

Time-specific covariates
Multiple groups
Capture history effects
Individual covariates
Model selection
Model assumptions
Estimator robustness

6.14. MARK exercises: Single-age models (HINES) (0.75 hr)

LUNCH

6.15. Single-age models: other quantities (CHAMBERT) (0.5 hr)

Estimation of abundance and recruitment
Estimation of λ

6.16. Multiple-age models (CHAMBERT) (0.5 hr)

Data structure
Modeling

6.17. Multiple-age model exercise (Hines (0.75 hr)

BREAK

6.18 Models with transients (CHAMBERT) (0.25 hr.)

6.19. Multistate models (MARTIN) (0.75 hr)

Data structure
Modeling

6.20. Multistate model exercise (HINES) (0.5 hr)

6.21. Multistate models: miscellaneous topics (CHAMBERT) (0.5 hr)

Unobservable states
State misclassification
Band loss

Day 6 (Fri., Mar. 11):

6.22. Pollock's robust design: Basic (CHAMBERT) (0.5 hr.)

Data structure
Ad hoc approach
Model-based approach

6.23. Robust design computer exercises (HINES) (0.75 hr)

6.24. Pollock's robust design: Extensions 1 (CHAMBERT) (0.5 hr.)

Temporary emigration
Open robust design
Multistate robust design

BREAK

6.25. Pollock's robust design: Extensions 2 (CHAMBERT) (0.5 hr.)
Separation of recruitment: in situ reproduction vs. immigration
Contributions to metapopulation 8

6.26. Multiple-season occupancy dynamics (HINES) (0.5 hr)
Data structure
Modeling

6.27. Computer exercise with PRESENCE (HINES) (0.5 hr)

6.28. Multiple-season occupancy extensions (CLEMENT) (0.5 hr)
Multi-state occupancy dynamics
Joint occupancy-habitat modeling
Community level occupancy dynamics

LUNCH

6.29. Occupancy study design: Intro to GENPRES (HINES) (0.5 hr.)

7. Conservation and management decision-making

7.1. Structured decision making (SDM) (Johnson) (0.5 hr)

7.2. Decision making in the face of uncertainty (Johnson) (0.5 hr.)

7.3. Adaptive resource management (SDM for recurrent decisions with uncertainty) (Johnson) (0.75 hr.)

BREAK

7.4. Decision making in practice: worked example (Johnson) (1 hr.)

8. Exam review/questions (HINES-MARTIN-CHAMBERT-CLEMENT) (0.5 hr +)

Day 7 (Sat., Mar. 12):

9. Exam (4.0 hr) (HINES)

LUNCH

10. Discussion/Evaluation/Consultation (HINES-MARTIN-CHAMBERT-CLEMENT) (4 hr)