Smithsonian-Mason School of Conservation
Smithsonian Conservation Biology Institute, Front Royal, VA, USA

Estimating Animal Abundance and Occupancy

May 19-30, 2014

Daily Course Schedule

Two 15-minute breaks are scheduled each day, one around 10:15am, the other around 3:00pm, when participants can cross the quad to the Dining Commons and get coffee, tea, cold drinks and snacks.

Day 1 (Monday, May 19)
Location: Computer Classroom 101, Academic Center
Instructors: Kolowski, White

7:30-9:00 am: Breakfast in the Dining Commons
10:00 am: Instructor and student introduction, course overview & review of rules and policies for classroom and campus.
11:00 am: Overarching concepts and a framework for estimating abundance and occupancy (Kolowski)
12:00 pm: Lunch
1:00 pm: Tour of Campus and Animal Collection, Smithsonian Conservation Biology Institute
3:00 pm: Introduction and review of statistical concepts and frameworks (White)

- Model inference and selection
- The Principle of Parsimony
- Maximum-likelihood theory
- Model Selection

5:30 pm: Dinner
7:00 pm: Introduction to MARK program
Interactive Sessions to Introduce Model and Data types, Key Concepts
Example 1: Capture-recapture (C-R) data on the European dipper in eastern France. This is the **Live-Recapture** data type known as the Cormack-Jolly-Seber Model.
9:00 pm: End

Day 2 (Tuesday, May 20) - Capture-Mark Recapture/Encounter (CMR) and the Program MARK I
Location: Computer Classroom 101, Academic Center
Instructors: White

7:30 am: Breakfast
8:30 am: Interactive Sessions to Introduce Model and Data types, Key Concepts
Example 2: Male greater sage-grouse banded in North Park, CO (**Recoveries Only** Data type)
The Design Matrix and Associated Issues

- More sophisticated model structure by modeling parameters
- Additive models in MARK ("+" notation)
- Time (occasion) and group covariates
- Individual covariates theory and application

12:00 pm: Lunch

1:00 pm: Lectures and Demonstration - Here we backup and lay a more rigorous foundation, including some needed theory and formalism. Frequent reference is made to the examples presented in the morning sessions.

- Sampling / Inductive Inference / Types of Uncertainty
- Data, notation, constants and parameters
- Modeling recovery data and open capture-recapture data
- Assumptions
- Likelihood and log-likelihood theory

2:45 pm: Computer work with "Survival Estimation from Banded/Tagged Animals Using Covariates" using North Park Sage Grouse data.

5:00 pm: Review session

5:30 pm: Dinner

7:00 pm: Evening session providing more practice with the Design Matrix

9:00pm: End

Day 3 (Wednesday, May 21) - Capture-Mark Recapture/Encounter and the Program MARK II
Location: Computer Classroom 101, Academic Center
Instructors: White

7:30 am: Breakfast

8:30 am: Morning Session – Closed Capture Models
Lectures will be followed by a computer exercise (Carothers Scheme A taxicab data) and a hands-on session with additional examples

12:00 pm: Lunch

1:00 pm: Continue work on Closed Capture Models in MARK

2:30 pm: Afternoon Session – Lecture and Demonstration

- The Known Fate models
- Example 3: Radio telemetry data on black ducks on the east coast. This is the **Known Fate** data type.
- Goodness-of-fit assessment, estimation of a variance inflation factor, c

3:00-3:45 pm: Continue work on Closed Capture Models in MARK

3:45 pm: Jolly-Seber Models followed by work on the Black-kneed Capsids Example (Open Population)

5:30 pm: Dinner

7:00 pm: Optional work time to continue on Closed Models and Capsid Pradel model example

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Day 4 (Thursday, May 22) - Capture-Mark Recapture/Encounter and the Program MARK III
Location: Computer Classroom 101, Academic Center
Instructors: White

7:30 am: Breakfast
8:30 am: Robust Design and Multi-State Models – lectures followed by work with Midway Albatross example in MARK
12:00 pm: Lunch
1:00 pm: Continue with examples for Robust Design in MARK
4:00 pm: Experimental Case Studies in MARK (e.g. Fish Dam, Pintail Ducks and Lead Pellets, Starlings and pesticides)
4:30 pm: Model Simulations using MARK
5:00 pm: Review session
5:30 pm: Dinner
7:00 pm: Hen Clam example (Cormack-Jolly-Seber Example of a Quasi-experiment)
9:00 pm: End

Day 5 (Friday, May 23) - Capture-Mark Recapture/Encounter and the Program MARK IV
Location: Computer Classroom 101, Academic Center
Instructors: White

7:30 am: Breakfast
8:30 am: Morning Session
- Variance components and the Random Effects (RE) models
- The Joint Live-Dead Encounters Models – Burnham's model and Barker's model
- Mark-Resight Models

12:30 pm: Lunch (Joint program with Conservation Immersion Seminar)
1:30 pm: Breakout Session: Breakout work with MARK and with personal data where possible. Explore the use of these various models/approaches with MARK. Material determined by students, time allocated for work on student data sets with supervision and assistance
5:30 pm: Dinner
7:00 pm: Student presentations (5) on their own research (5-7 minutes each)

Day 6 (Saturday, May 24) - Distance Sampling and the Program DISTANCE I
Location: Computer Classroom 101, Academic Center
Instructors: Kolowski

8:30 am: *Introduction to Line-Transect Sampling*
- Theory behind line-transect methods
- Encounter rates and detection function modeling
- Study design concerns, biases, assumptions and considerations

10:30 am: Brunch
12:00pm: *Introduction to the program DISTANCE*

- Data structure and importation
- Review of Analysis Engines
- Data Filters and Model selection
- Demonstration Analysis (Wooly Monkeys, Peru) – participants will follow along at their stations

2:00 pm: *Afternoon Session* (primarily analysis of provided data sets with guiding questions on worksheets)

- Dealing with Group Size Bias
- Guided analysis for Case study #1 (Impala, Botswana)
- Discussion of results, potential problems with the data, addressing biases

5:30 pm: Dinner
7:00 pm: Student presentations (5) on their own research (5-7 minutes each)

Day 7 (Sunday, May 25)

Day Off – Optional rides to/from Washington, DC

Day 8 (Monday, MAY 26) - Distance Sampling and the Program DISTANCE II
Location: Computer Classroom 101, Academic Center
Instructors: Kolowski

7:30 am: Breakfast
8:30 am: *Multipliers, Cue Counting, and Stratification*

- Lecture overview of concepts
- Hands-on computer work – Case Study #2 (Elephants in Sumatra), worksheet provided

12:00 pm: Lunch
1:00 pm: *Point Transect Data and Post-Stratification* (Case Study #3 House Wrens)
2:30pm: *Distance Sampling with Covariates (MCDS)*

- Lecture overview of concepts
- Guided analysis through Case Study #4 (Amakihi), worksheet provided

4:00 pm: *Discussion and Demonstration of Additional Topics (if time allows)* - based on participant interest and specific requests.
5:30 pm: Dinner
7:00 pm: Student presentations (6) on their own research (5-7 minutes each)

Day 9 (Tuesday, May 27)
Location: Computer Classroom 101, Academic Center
Instructors: Kolowski, Hines, Nichols, Grant

7:30 am: Breakfast
8:30 am: *Breakout Session*: Material determined by students, time allocated for work on student data sets with supervision and assistance in DISTANCE. Extra exercises provided for those that don't have their own data
12:00: Lunch
1:00 pm: *Occupancy Modeling and the Program PRESENCE I*

- Relevance of Occupancy to Ecology and Conservation
- Brief review of Statistical Background
- The Single Season Model
- Introduction to PRESENCE – fitting single season models with covariates (demonstration)

5:30 pm: Dinner

Day 10 (Wednesday, May 28) - Occupancy Modeling and the Program PRESENCE II
Location: Computer Classroom 101, Academic Center
Instructors: Hines, Nichols, Grant

7:30 am: Breakfast
8:30 am: *Continuing the Single Season Model*

- Single season model; assumptions
- PRESENCE class exercise
- Single season study design

12:00 pm: Lunch
1:00 pm: GENPRES demonstration
2:00 pm: *Multiple Season Model*

- Model Description
- Implicit and explicit dynamics
- Missing observations
- Covariates
- Demonstration using PRESENCE

5:30 pm: Dinner

Day 11 (Thursday, May 29) - Occupancy Modeling and the Program PRESENCE III
Location: Computer Classroom 101, Academic Center
Instructors: Hines, Nichols, Grant

7:30 am: Breakfast
8:30 am: Multi-season exercise with PRESENCE

- Spatial correlation and neighborhood effects
- Study design and GENPRES

Multistate Occupancy

- Single and multiple season models
- Demonstration with PRESENCE

12:00 pm: Lunch
1:00 pm: Species co-occurrence models

- Joint habitat-occupancy dynamics

Other Applications and Extensions

- False positive modeling
- Species richness or biodiversity and community dynamics

5:30 pm: Dinner

Day 12 (Friday, May 30) - Occupancy Modeling and the Program PRESENCE IV
Location: Computer Classroom 101, Academic Center
Instructors: Hines, Nichols, Grant

7:30 am: Breakfast
8:30 am: *Breakout Session*: Material determined by students, time allocated for work on student data sets with supervision and assistance.
12:00 pm: Lunch
1:00 pm: Continued consulting time and breakout sessions
2:30 pm: Final Exam for For-Credit students, continued time in lab for others
4:00 pm: Course Evaluations
5:00 pm: Group Photo and Certificate Presentation
5:30 pm: Dinner

Day 13 (Saturday, May 31)

10:30-12:30 pm: Brunch

Shuttle to Washington Dulles International Airport for participants. Time to be determined based on departure schedules.