Introduction to Bayesian population analysis

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Overview:
This course introduces many key models used in the analysis of distribution, abundance and survival, as well as their spatial and temporal patterns, in a Bayesian analysis framework. It largely follows the book "Bayesian population analysis using WinBUGS" published by Academic Press. We will use programs R and JAGS to fit and understand some of the most widely used models for the analysis of animal and plant populations.

Over the quarter, we will review concepts in Bayesian model fitting, hierarchical parameterizations, state-space model formulations and model convergence diagnostics, among other topics. Each two-hour class session will involve a lecture, followed by in-class computer lab exercises. Over the duration of the course, you will be expected to formulate and execute an analysis on one of your own data sets using techniques learned during the course. Grading will be based on the completion of homework assignments, and a final project report based on the your final project.

Recommended pre-requisite knowledge:
A previous course in introductory statistics, a foundation in R programming, and a basic understanding of Bayesian statistics are pre-requisites to the course.

Advice:
Do all the readings prior to the lecture on the subject. Your ability to digest and apply concepts introduced during the lectures will greatly benefit from careful reading of the text.

Grading:
50% - Final project presentation
50% - Weekly homework assignments

Schedule:

Week 1: Introduction to Bayesian methods
- Lab: Fit a Poisson GLM to BBS data
- Book reading: Chapters 1, 2

Week 2: Introduction to count data models (Poisson, binomial errors)
- Lab: Fit a binomial GLM to nesting success data
- Book reading: Chapter 3

Week 3: Introduction to random effects, mixed models, hierarchical models

Lab: Fit a hierarchical linear model in JAGS, explore random effects parameterizations using WON rockfish data

Book reading: Chapter 4

Week 4: State-space models: distinguishing between ecological and observation processes

Lab: Fit a state space model to WON rockfish data

Book reading: Chapter 5

Week 5: Closed population models and data augmentation

Lab: Fit a model using data augmentation

Book reading: Chapter 6

Week 6: CJS model: estimating survival from capture-recapture data

Lab: Estimate survival using kelp bass capture-recapture data

Book reading: Chapter 7

Week 7: Multi-state capture-recapture models

Lab: fit movement model using capture-recapture data

Book reading: Chapter 9

Week 8: Estimation of abundance from counts in metapopulation designs with imperfect detection

Lab: Estimate abundance across a structured population using capture-recapture data

Book reading: Chapter 12

Week 9: Estimation of occupancy and species distributions from detection/non-detection data (site-occupancy models)

Lab: fit habitat preference model using blue whale data

Book reading: Chapter 13

Week 10: Student presentations