Design and Analysis of Occupancy Studies Part 5

Carl James Schwarz

Department of Statistics and Actuarial Science
Simon Fraser University
Burnaby, BC, Canada
cschwarz @ stat.sfu.ca

Occupancy Modeling Final Summary

Occupancy Modeling - Final Summary

Key parameters of interest:

- Occupancy
  - in its own right; or
  - a function of covariates; or
  - a function of state; or
  - a function of other species.
- Colonization and Local Extinction at the site level
- Transition among states
- Competition among species.

Key problem is to account for FALSE NEGATIVES, i.e. failing to detect a species in a site does not mean the site is unoccupied because detection < 1. This requires multiple surveys of the same site.

Occupancy Modeling - Final Summary

Planning considerations:

- Definition of "occupancy". Occupancy $\neq$ Usage!
- Ensure closure during a season within a site.
  - Don't make span of visits within a season too long
  - Don't make a site too small
- Seasons vs. sites vs. visits.
  - Aim for 0.85+ detection over K visits
    $p* = 1 - (1 - p)^K \geq 0.85$
  - Measure enough SITES to obtain desired precision in estimated occupancy.
  - Fewer sites measured longer is better to study dynamics of occupancy.
  - Use GENPRES to study a proposed design for bias and precision. Consider hybrid designs.

Occupancy Modeling - Final Summary

Types of models we covered.

- Single-Species Single-season.
- Single-Species Multi-season .
- Two-species Single-season.
- Multi-state Single-season.

Occupancy Modeling - Final Summary

Other models we did NOT cover in this short course:

- Single-season-multi-method model - uses data similar to the multi-season model data, except that each survey within a season represents a different method of detection, instead of just another survey.
- Spatial-dependence model - Accounts for spatial correlation when surveys are chosen non-randomly.
- False-positive detection model - Relaxes assumption that no detections occur when the species is absent and estimates the probability of a false detection.

Occupancy Modeling - Final Summary

Other models we did NOT cover in this short course (continued):

- Multi-season multi-state models - extension of multi-state single-season model.
- Multi-season-two-species model - computes occupancy, colonization, extinction and detection probabilities with interactions when there two species present.
- Staggered-entry model - relaxes closure assumption such that a site may -locally colonize and go locally extinct once during the surveys (i.e. delayed arrival and/or early departure).
- Integrated-habitat-occupancy models - models changes in occupancy state in relation to changes in habitat state.
- Royle-point-count Single-season model - Uses species counts instead of just presence/absence .
- Multi-event models. Extension of detect/not detect to more than 2 classes, e.g. no detect, low call, medium calls, high calls in anuran surveys which map to 3 abundance classes with detection error. For example, the actual abundance could be high, but only a medium number of calls is observed.

Occupancy Modeling - Final Summary

Analysis

1. Unit of analysis is the occupancy history, i.e. 011..01 for each site.
2. Develop a suite of models based on biological principles.
3. Maximum Likelihood used to fit models.
4. AIC(c) used to rank models followed by model averaging.
5. Software
   - MARK, PRESENCE - stand alone
   - *RMark*, *RPresence*- advantages/disadvantages of scripting.
   - *JAGS*(Bayesian methods) - for more complex models esp. with spatial effectis
   - *unmarked*- not very user friendly.
   - GENPRES for planning studies

Occupancy Modeling - Final Summary

Where to get help?

- PhiDot forum `http://www.phidot.org/forum/index.php`
- cschwarz@stat.sfu.ca

DON'T PANIC!