Lab 8 Assignment — Occupancy Models in Program PRESENCE
Due before your next lab

Answer each of the following questions, and submit your answers by uploading a single WORD file to ELC. Unlike previous labs, copy and paste results from Excel and PRESENCE (or R) to the WORD file. You should also copy and paste entire screenshots to show the relevant output. Name the file something like `Chandler-lab8.docx`.

Graduate students and undergraduates that don't have access to a Windows operating system should use the R package 'unmarked'.

Occupancy models in program PRESENCE

Preliminaries: Installing program PRESENCE

If program PRESENCE isn't already installed on your computer, you can download it here: `https://www.mbr-pwrc.usgs.gov/software/presence.html`. Unfortunately, it only runs on Windows operating systems. If you don't have Windows, you will need to do the assignment using the R package 'unmarked', which is described in the other lab handout `lab-occupancy-R.pdf`.

Preliminaries: Getting Data into Program PRESENCE
(1) Open PRESENCE
(2) Go to `File > New Project`
(3) Select `Input Data Form`
(4) Specify the number of rows (sites), columns (occasions), and (for Exercise I) the number of site covariates.
(5) Fill in the number of occasions per season (No. Occ/season). For Exercise II, this is the number of teams per year.
(6) Copy and paste occupancy data from Excel into the PRESENCE spreadsheet.
(7) If you have a site covariate, click the `Site Covars` tab and copy and paste the covariate values (and the covariate name in the first row) using the option `Edit > Paste w/covnames`.
(8) Use `File > Save As` to save the project somewhere on your computer. Save it to `Documents` or another location that isn't restricted. Click `No` when it asks if you want to use the last column as frequencies.
(9) Close the PRESENCE spreadsheet, and click `OK` on the project information window.
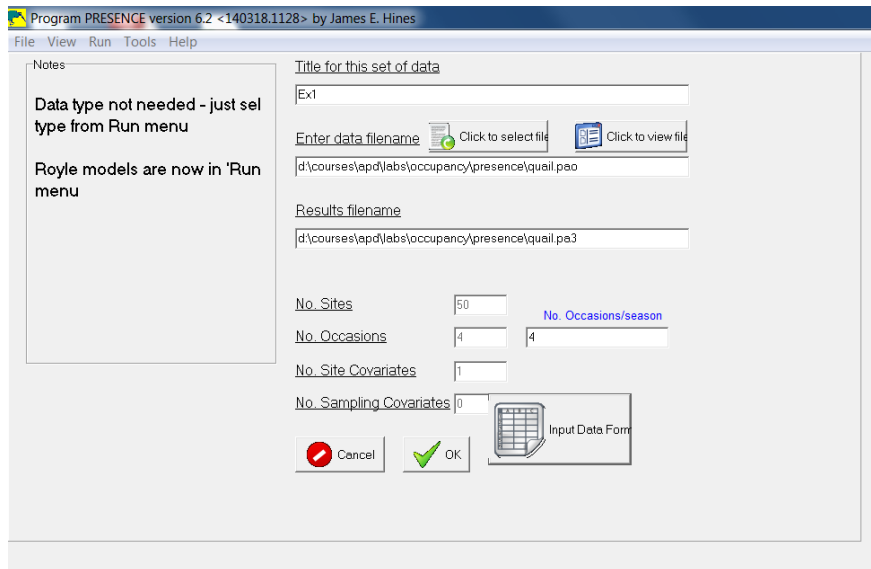
Figure 1: This is where you tell PRESENCE about your data

Exercise I: Single-season models

Suppose we are interested in estimating occupancy of bobwhite quail (*Colinus virginianus*) in abandoned ag fields. We randomly select 50 sites and survey them 4 times each May. The resulting data indicate whether at least one quail was detected at each site on each visit in each season.

In addition, you think there is a possibility that vegetation height affects both occupancy and detection probability so you measure average vegetation height at each site. Vegetation height will be the covariate used in the analysis.

Create a new PRESENCE project and import the quail data. You will need to specify that there are 50 rows, 4 columns, 4 Occ/season, and 1 site covariate: `veght`. Make sure you use `Paste with covname` when adding the `veght` site covariate (see instructions above).

(a) Run the simple single-season analysis without changing the defaults (`Run > Analysis:single-seaso` Report the estimates and standard errors for psi (ψ) and p. Interpret these estimates (ie, what are the definitions of psi and p in this context?). These can be found by right-clicking on the name of the model (which will be something like `1 group, constant P` and clicking on `View model output`. There is LOTS of output. You want to focus on the `Individual Site Estimates`, which should look something like this:

```
==============================================================
    Individual Site estimates of <psi>
                Site                estimate  Std.err   95% conf. interval
psi             1 site 1          :  0.700    0.0771     0.4638 -  0.7578

==============================================================
    Individual Site estimates of <p1>
                Site                estimate  Std.err   95% conf. interval
p1              1 site 1          :  0.4000   0.0528     0.3888 -  0.5928
p2              1 site 1          :  0.4000   0.0528     0.3888 -  0.5928
p3              1 site 1          :  0.4000   0.0528     0.3888 -  0.5928
p4              1 site 1          :  0.4000   0.0528     0.3888 -  0.5928

==============================================================
```

Figure 2: Estimates, standard errors, and confidence intervals for psi (ψ) and p.

(b) Now run another model using `veght` as a predictor variable (covariate). This is tricky. First, choose `Run > Analysis:single-season`. Then, click on `Custom`, which will open up the "design matrix". Now right click to `Add col` on the Occupancy tab (see Fig. below). Next, click the cell under `a2` and select `Init > *veght` to indicate that you want to model psi as a function of vegetation height. Do the same thing under the `Detection` tab, but note that there are multiple rows for a1 and a2 this time. Make sure the first column of each matrix has 1's not 0's (see screenshots below). Close the design matrix window and then name the model something like `psi(veght)p(veght)` and hit `OK to Run`.

(c) Is this model better than the first, based on AIC? The lower the AIC the better the

Figure 3: This is where you tell PRESENCE about the covariates in the model.

model.[1]

(d) Right-click on the model and choose `View model output` to find the parameter estimates under `Untransformed Estimates of coefficients for covariates (Beta's)`. The estimate `A1` is the estimate of the intercept, and `A2` is the slope parameter defining the relationship between psi and vegetation height on the logit scale. Use these estimates to create a plot of the relationship between occurrence probability and vegetation height. The Excel sheet has a template for you to fill in. Add the graph to your Word document.

(e) Based on your graph, does occurrence probability increase or decrease with vegetation height?

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[1]AIC $= -2 * \log(\text{likelihood}) + 2 * \text{nParameters}$. AIC favors models that explain a lot of variation in the data using a small number of parameters.

Exercise II: Multi-season model

Use the southern two-lined salamander (*Eurycea cirrigera*) data from the past few years to do the following. Note: I pooled the data from the 5 swipes of each team.

(a) Close your old project, restart PRESENCE, and create a new project by importing the salamander data. You will need to indicate that there are 15 sites, 35 columns, and 7 occasions per season. The last piece of information tells PRESENCE that there were 5 seasons (with 7 team surveys per season).

(b) Use Program PRESENCE to estimate psi (ψ), gamma (γ), epsilon (ϵ), and p (`Run > Analysis:multi-season > simple multi-season` and accept default settings). The estimates can be found by right clicking on the model name and choosing `View model output`. Look for the `Real parameter estimates`. Report the 4 unique estimates and standard errors by creating a table in your Word document.

(c) Provide clear interpretations of your estimates.

(d) Based on these estimates, is there any reason to believe that occupancy has decreased over these years? Explain.

(e) How certain are you of these conclusions? Answer by describing how well you think our study design met the assumptions of the multi-season occupancy model.