Cate Geiman

Summer Research 2023

**METHODS**

INTRODUCTORY

* *Getting Started with R,* Beckerman & Petchy
* Online readings on R

MULTI-SPECIES OCCUPANCY MODELING

* Camera Trapping for Wildlife Research, Rovero & Zimmermann
* Helpful video and notes: [Multi-species occupancy modeling.docx](https://docs.google.com/document/d/1TOaT2pfSr95SuteCSqAmqyt64oDSI3La/edit)

CIRCADIAN PLOTS

* Script: <https://drive.google.com/file/d/1UZlCDd2bER7SXL8t2ZSiR6PXqlj5tomv/view?usp=share_link>
* Datasets used: <https://drive.google.com/drive/u/1/folders/10Av0akBasUvMJCiwRn8HgDvFX8mJHaMy>

The overlap package was installed. Using overlapPlot() we can create plots overlaying two species’ circadian rhythm plots. The times used must be in radians, hms2rad() converts hours/mins/secs to radians. Xcenter is noon, the graph is titled, and rug = TRUE (this will show a 1-D plot). To identify which line is which species, a legend was added. It was placed at the top and each line was titled the respective species name. The colors for the legend were black and blue, corresponding to the line colors. The argument lty assigns different line types. Requiring the bayestestR package, the coefficient of overlap was calculated using overlap() to determine how much the density plots between species overlapped with each other. This value was added to the plot using the mtext() function. “Side” corresponds to which side the text will be on, “line” is vertical height, “at” is thickness of text, “adj” is horizontal placing, and “cex” is size. An overlap plot was made for each pair of species.

To obtain single species density plots, the densityPlot() function was used. For some species, a subset had to be created to isolate the desired species. The densityPlot() function requires the overlap package. Time was converted to radians using hms2rad(), xcenter is noon, the plot was titled, extend = NULL (to eliminate repeating edges), and rug = TRUE. A density plot was made for each species of tapir.

Using the package “Overlap” in the R programming language, temporal density plots were created for single species and temporal overlap plots were created to compare each species. To determine similarity between each species activity pattern, the coefficient of overlap (∆) was calculated in R. This is a value ranging from 0 to 1, with 0 indicating no overlap and 1 indicating complete overlap.

“Overlap plot: Fits kernel density functions to two data sets and plots them, shading the area corresponding to the coefficient of overlap”

RELATIVE ABUNDANCE INDEX (RAI)

The relative abundance index is a metric to measure how frequently a species appears on camera. This is determined by the following equation: RAI = [(number of independent records) / (number days camera was active)] ∗ 1000.

Tapir sightings within a 24 hour period are identified as independent records. The independent records were summed by tabulating the number of records at each site. The number of days the camera was active was determined by sorting through start and end dates of each camera’s activity and using the DAYS function in Excel to determine the total days that each camera was active. RAI was calculated for each site. There were 11 sites for Baird’s tapir, 2 sites for lowland tapir, 2 sites for malayan tapir, and 1 site for mountain tapir. This gave us 16 total sites, thus 16 unique RAI values. The package “ggplot2” was used to create a barplot for RAI.

“Relative abundance index (RAI) is a standardized metric of how frequently a species appears on the cameras. We calculated RAI for each species from all survey sites using the equation: RAI = [(number of independent records) / (number days camera was active)] ∗ 1000.”

LUNAR PLOTS

The package “suncalc” was used in R programming to identify lunar phases based on date. Lunar phase data was added to each tapir dataset. From here the data was separated into nocturnal and diurnal activity. The package “overlap” was used to create kernel density plots. Single species density plots were created for each species’ nocturnal and diurnal activity based on lunar phase. Single species overlap density plots were created to compare each species’ nocturnal and diurnal activity based on lunar phase. The coefficient of overlap was calculated as before for each overlap plot.

600 dpi for publication