Labs 6-7: Vertebrate Population Census

Please Read and Bring With You to Lab

What you should bring:

Sun protection: hat, long-sleeved shirt, and/or sunscreen
Closed-toed shoes
Water
This handout printed out (print additional copies of the data sheets for part 2)

What you will be provided:

Binoculars
Clipboard
Tape measures
Compass

Objectives:

- To collect population data using distance sampling
- To study the role of urbanization on the population size and diversity of various vertebrates.

Preparation:

Students should read this handout and Chapter 9 in Molles.
This lab be on campus but outdoors for the first week, and will be off-campus the next week. You will need to wear appropriate clothing; closed-toed shoes and water are required.

Introduction

Population studies allow ecologists to understand what drives changes in the abundance and distribution of species. Using our understanding of population dynamics allows us to assess the influence humans are having on other populations. Through land use decisions humans are altering the structure of the environment and thus influencing population abundance, distribution, and overall diversity. For example, land use in Phoenix changes very rapidly, potentially putting at risk native animal populations that rely on the patches of available habitat within the city.

ASU West's campus serves as a prime example of this type of change. Currently, part of campus is structured for human use, while the surrounding area is largely undeveloped with a distinct set of vertebrate populations. However, change is predicted to occur very soon that will alter the habitat used by these populations. There are currently plans for several new buildings that will used much of the undeveloped land, making it very important for us to understand:

What campus populations will be vulnerable to the planned development?

How might the size and diversity of populations be influenced by development?

How does the undeveloped land on ASU West's campus compare to native Sonoran desert communities?

Over the next two weeks of lab, we will conduct a field census to estimate the abundance and species richness of vertebrate populations on campus (week 6) and compare these populations to those of a native Sonoran Desert (week 7). Since it will be difficult for beginners such as yourselves to quickly identify the diverse array of vertebrates we might encounter, we will simplify the process by recognizing a few general "morphospecies" that share a similar shape and lifestyle.

Distance Sampling

One of the most fundamental questions in population ecology is "how many individuals are present in the population?" This question can be difficult to answer. For stationary organisms such as plants or corals we can use transect or quadrat techniques, such as you will use in a later lab. More mobile organisms such as animals provide more of a challenge. It is only in very rare circumstances that all individuals can be counted directly (such as in aerial surveys of large grassland mammals). Instead, population size must be estimated. In most natural populations, even the most dedicated and experienced biologists will miss some, or even many, individuals.

Distance sampling is a methodology to estimate densities and abundance despite the difficulty in locating all individuals (Buckland et al. 1993, Marques 2009, Thomas et al. 2012). The basic premise of this approach is that the farther an animal is from a sampling point or line (transect), the less likely it is to be observed. The rate at which observations drop off with increasing distance from the sampling line can be used to estimate the likelyhood of detection, and this in turn can be used to estimate the number of individuals that were missed. The mathematics for this analysis are beyond the scope of this class. We will use specialized software to turn observations into estimates of density (number of individuals per km^2). Distance sampling methods assume that: (1) any animal directly on the transect line is certain to be observed; (2) Animals do not move a significant amount over the course of sampling; and (3) distances and angles are measured accurately.

Procedure—Part 1 (Week 6)

1. This procedure will be carried out on the West Campus. We will meet in the classroom before proceeding outdoors.

3. Students will separate into groups of 3-4 and each group will be assigned a pair of transects across part of campus.

4. We will use **distance sampling** to estimate populations of conspicuous and easy-to-identify vertebrates. Your instructor will assign predetermined transect lines that have been measured beforehand.

5. Walk along the transect and note every vertebrate (bird, lizard, or mammal) that you can see. Identify them to the general categories listed on the data sheet: you do not need to be more specific than this (if you observe an animal not shown on the worksheet, you can add it separately and check with your instructor).

6. For each individual, make note of the location where you first observed it (if it moves, count only the first observation). Estimate the angle between the observed animal and the transect line (to the nearest 5° is suitable). A compass may be of help (but remember, you are recording the angle, not the compass bearing). You will then

need to measure the distance, in m, from where you are to where the animal was, using the tape measure.

7. Care will need to be taken to avoid double-counting any animals, particularly by different groups. You will need to coordinate with the groups nearest you if you see animals move from your area to adjacent count areas so they are only counted once.
8. Turn in your data sheets to your instructor at the end of the lab.

Procedure—Part 2 (Week 7)

1. This procedure will be carried out at Piestewa Peak Mountain Preserve, in Phoenix. This park retains natural Arizona Uplands Sonoran Desert habitat, but is, like ASU West, surrounded by urban development. It is much more extensive than our campus, so we will only study one portion.
2. We will meet at the parking area for the **north** side of **Piestewa Peak Mountain Preserve**, at the end of 40th St. To reach this site from campus, head east on Thunderbird Rd. until it becomes E. Cactus Rd. Turn south (right) on 40th St., passing Shea Blvd. until the road dead-ends at the parking lot. Allow about 25-30 min travel time from campus.
2. Using the same technique you used on campus in the previous week, repeat your survey in the area designated by your instructor. Each group will be assigned two transects of roughly the same size as on campus.
3. Turn your data in to your instructor at the end of the lab. The calculated population densities will be posted by the next day.

Analysis

We will pool data from all three lab sections for analysis. We will use special software to calculate population density (number/km^2) for each "morphospecies" using the provided data. The data from each lab section and week will represent one replicate (thus, there will be three replicates of the data from campus and three from Piestewa Peak). You will need to analyze the resulting density and species richness data using these replicates. You should compare overall animal density and species richness (number of species, or in our case, "morphospecies") between the two locations. In your writeup, you should also consider some additional analyses, such as comparing time of day or looking at the data from specific species of interest.

References:

Buckland, ST, Anderson, DR, Brunham, KP, & Laake, JL 1993. *Distance Sampling: Estimating Abundance of Biological Populations*. Chapman & Hall.

Marques, T. 2009. Distance sampling: estimating animal density. *Significance* Sept 2009: 136-137.

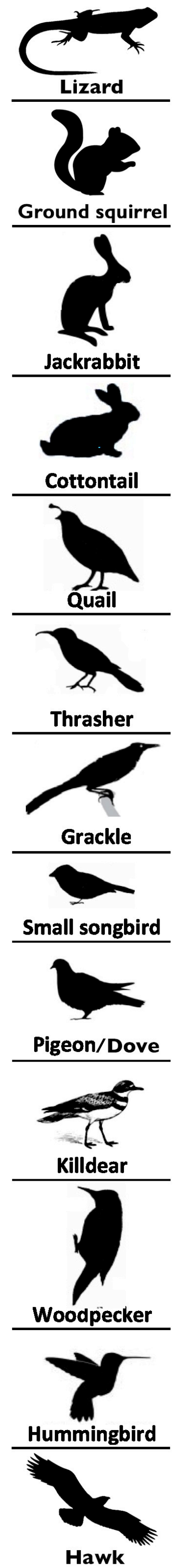
Thomas, L et al. 2012. Distance sampling. *Encyclopedia of Environmetrics*, 2nd ed. John Wiley & Sons.

__Vertebrate Population Census Data Sheet — Print additional copies as needed__

Group Member Names: ____

Location: _____________________ Transect ID: ____________ Transect Length: ______ m

Species	Distance (m)	Angle	# individuals



Vertebrate Population Census Data Sheet — Print additional copies as needed

Group Member Names: ____

Location: ____________________ Transect ID: ___________ Transect Length: ______ m

Species	Distance (m)	Angle	# individuals


Lizard


Ground squirrel

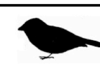

Jackrabbit


Cottontail


Quail


Thrasher


Grackle


Small songbird


Pigeon/Dove


Killdeer


Woodpecker


Hummingbird


Hawk