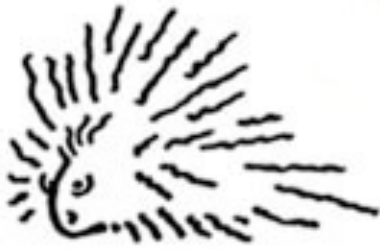


Name: _____



MAMMALOLOGY LAB 8

SPATIAL DISTRIBUTION AND ABUNDANCE

Today's exercises focus on understanding what factors influence where mammals are found and the techniques used by scientists to determine mammalian distributions, population sizes, and home ranges.

GEOGRAPHIC DISTRIBUTION

Modern mammals are found on all continents throughout the world, and they are found in nearly all possible habitats, including all the oceans of the world. It is, therefore, common to discuss the ranges of various mammalian groups in terms of *faunal regions* when describing their global distribution. Your lab manual, on **page 4**, describes the major faunal regions recognized today (Nearctic, Palearctic, Holarctic, Neotropical, Ethiopian, Oriental [now usually referred to as Indomalayan], & Australian) and where they are located.

Examine the topographic map on the wall of the lab and identify the *geographic barriers* that separate these faunal regions on the map provided below.

Figure 1-3.
The major Faunal Regions of the world.
(A.F. DeBlasse)



Name: _____

For the next two questions you will be using the IUCN (International Union for Conservation of Nature & Natural Resources) Red List web database. The Red List provides geographical distribution and conservation status of taxa that have been assessed using the Red List Categories and Criteria. All mammal and bird species have been assessed, and will be reassessed starting this year (2004). The most threatened species are listed as Critically Endangered, Endangered, or Vulnerable.

For the following question, log on to the Red List website (<http://www.iucnredlist.org/>). Click on the "Search" button in the lower right-hand corner. Next, use the search criteria in the maroon box (lower half of the screen) to find a **Critically Endangered (CR)** mammal in each of the following regions. The Red List database does not use these categories, so you will have to use your knowledge of geography to find an appropriate species. Give the common name, scientific name, major habitat, and one major threat.

Nearctic -

Ethiopian -

Palaearctic -

Indomalayan -

Holarctic -

Australian -

Neotropical -

Political boundaries are not recognized by wildlife, and these anthropogenic dividing lines can often hinder conservation efforts. Use the IUCN Database to find an **Endangered (EN)** mammal in each of these countries, and give the same information as above.

Democratic Republic of Congo (formerly Zaire) -

Indonesia -

China-

Georgia (not the U.S. state!) -

Viet Nam -

Peru -

Afghanistan -

United Kingdom -

Colombia -

Name: _____

DISPERSION INDICES

On a smaller scale we can describe the distribution of a particular species using indices of dispersion.

- 🌐 Read the part of your lab manual on *Uniform*, *Clumped*, and *Random* dispersion patterns. (p. 261)

At your lab bench you will find a “field” which contains four (4) species of “mammals” represented by *black-eyed peas*, *green beans*, *great northern beans*, and *chickpeas*. The “field” is divided into 144 quadrats (12X12), each defined by a pair of X and Y coordinates (notice the labels on the “field” edges).

1. Make your best guess as to whether each species exhibits a uniform, clumped, or random dispersion pattern and write it in on the table on the next page.
2. On the lab bench are the coordinates for 20 quadrats that have been selected at random. Count the individuals of each species in each of the quadrats. Fill in these values in the table below. You will have 20 quadrat counts for each species when you are finished.

You will have to decide how you will handle mammals that fall on the boundaries of the sampling quadrats. Will you count them all? Will you count only those that fall on certain sides of the quadrat, e.g. left? It is up to you, but you must be consistent or your results will be biased and inaccurate.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Black-eyed peas																				
Green beans																				
Great Northerns																				
Chickpeas																				

3. Calculate an **index of dispersion** (“*Index*”) for each of the four species using the formula below. You will have 4 indices (1 for each species) when you are done. Record these values in the table provided.

$$Index = N \frac{\sum (n_i(n_i - 1))}{\sum x(\sum x - 1)}$$

- N represents the number of sampling areas (in this case 20)
- n_i is the number of animals observed in the i^{th} count (in this case you will have twenty counts for each index calculated)
- $\sum x$ is the total number of animals observed in all sampling areas.

Name: _____

Species (Bean)	Distribution "Guesstimate"	Calculated <i>Index</i>	<i>F-statistic</i>	Significant? Y/N

4. If your calculated index is 1 then the species is randomly distributed. If it is less than one then it is uniformly distributed and if it is greater than 1 it is clumped. After calculating your indices, you must determine if they are statistically significant. In other words, are they truly different than 1 (random)? This is done by calculating an *F-statistic* using the following formula:

$$F = \frac{Index(\sum x - 1) + N - \sum x}{N - 1}$$

Again:

- N represents the number of sampling areas (in this case 5 or 20)
- $\sum x$ is the total number of animals observed in all sampling areas.

Compare this value to the table value (provided) using **19** for the numerator degrees of freedom (df) and ∞ (infinity) for the denominator degrees of freedom. If your calculated **F** is greater than the value found in the table then your *Index* is significant, i.e. your population really is clumped or uniform. If your calculated **F** is less than the value in the table than your population's dispersion is not significantly different from a random distribution.

Question: How did your "guesstimates" for each species compare with the results you calculated?

Name: _____

ESTIMATES OF POPULATION SIZE

Sampling Methods

In this exercise you will use two (2) sampling techniques, **completely random** and **stratified random**, to estimate the population sizes of each of the bean "species" you used above.

Completely Random Technique

1. Using the counts you made for the dispersion exercise, take your totals for each of the four species and divide by 20. This gives you the average number per quadrat.
2. Now multiply these averages by 144 (remember: the "field" has 144 quadrats). This gives you your population estimate for the entire "field".

Black-eyed Peas _____

Green Beans _____

Great Northerns _____

Chickpeas _____

Stratified Random Technique

The stratified random technique divides the "field" into four **strata** (I, II, III, & IV) and selects a random subset of quadrats within each stratum to be counted.

1. Using the stratified coordinates provided, Count the beans in the five quadrats of each stratum and enter these values in the chart below. As before, you will have to decide as a how you will handle mammals that consistent!

	I					II					III					IV				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Black-eyed peas																				
Green beans																				
Great Northerns																				
Chickpeas																				

2. Once you have 4 bean "species" totals for each of the 4 stratified areas, divide each total by 5 to get the average number of beans per quadrat. You should have 4 averages (one for each species) per 6X6 square.
3. Now multiply each average by 36 (the number of quadrats per 6X6 square).
4. Finally, sum the 4 numbers for each bean type. This gives you your population estimate for the entire "field".

Name: _____

Black-eyed Peas _____

Great Northerns _____

Green Beans _____

Chickpeas _____

- 🌐 How do the values calculated by each of these methods compare to the real numbers (total census) provided by your TA?

- 🌐 Which method, completely random or stratified random, is more accurate?

- 🌐 Does it depend on the distribution of the species?

Mark Recapture Methods

Read the section entitled “PETERSON (LINCOLN) INDEX” in your lab manual (p. 275). In this exercise you will estimate the total population size of a white beans in your sample area (a 100ml beaker) using a mark and recapture technique.

- 🌐 Fill a 100ml beaker to the brim with white beans and place them in the opaque plastic bottle.

- 🌐 Select a 2 digit random number between 15 and 45 from the random numbers table provided. To do this begin on a row, any row, and read across it until you come upon a pair of digits that are with in the specified range (between 15 and 45).

- 🌐 Remove as many white beans from the container as the random number you generated, and replace them with an equal amount of black beans. The black beans are your **marked** population.

- 🌐 Shake the container in several different directions for a minute or two to adequately mix the beans.

- 🌐 Select a second 2 digit number from the random numbers table (be sure to start on a different row than last time). Remove this many beans from the container and count the number of black beans in this sample. This is represents your **recaptured** population.

Name: _____

- 🌐 Use the **SECOND** formula on p. 275 of your lab manual to estimate the total population size of the white beans.

POPULATION ESTIMATE #1 _____

Repeat this procedure 2 more times for a total of 3 trials.

POPULATION ESTIMATE #2 _____

POPULATION ESTIMATE #3 _____

- 🌐 How reliable is this method for accurately estimating population size?

- 🌐 Does the number of black beans encountered in your second draw affect your population estimate? If so, how?

Often times, marked animals do not randomly mix into the population after capture. To test the effect of non-random assortment repeat the above procedure for 3 more trials, however, this time do not mix the beans well after adding your **marked** population. Just drop the beans in, select a random number, and remove that number of beans.

POPULATION ESTIMATE #4 _____

POPULATION ESTIMATE #5 _____

POPULATION ESTIMATE #6 _____

What effect does non-random mixing have on your estimates of population size?

In what kinds of real-life circumstances might you get this non-random mixing effect?

Name: _____

BIOLOGICAL DETERMINANTS OF HOME RANGE

Read the section entitled "HOME RANGE" (pp. 261-262) in your lab manual. At this station a chart of home range data for a variety of mammals is provided. Also listed are body sizes and dietary information. For some species the ranges of males and females are also listed.

Plot **Body Length** vs. **Home Range** on the *log-log graph paper* provided (pp. 10 and 11 in this worksheet). Be sure to use different symbols for the different types of diets (i.e. use **C** for carnivores and **H** for herbivores, etc.).

🌐 Is there any apparent relationship between **Body Length** and **Home Range** for all of the mammals plotted?

Draw "best fit" lines for the different diet categories (i.e. a carnivore line, an herbivore line, etc.).

🌐 Is there any effect of diet type on Home Range?

On the other sheet of *log-log paper*, plot **Male HR** vs. **Female HR** with male ranges plotted on the Y-axis and female ranges plotted on the X-axis. Draw a 1 to 1 line on your paper (a line that connects coordinates 1,1 2,2 3,3 4,4 etc.). This represents the expected line if males and females had identical home range sizes.

🌐 Is any kind of general trend apparent in the actual home range sizes?

🌐 Do males or females have larger home range sizes? Why?

Name: _____

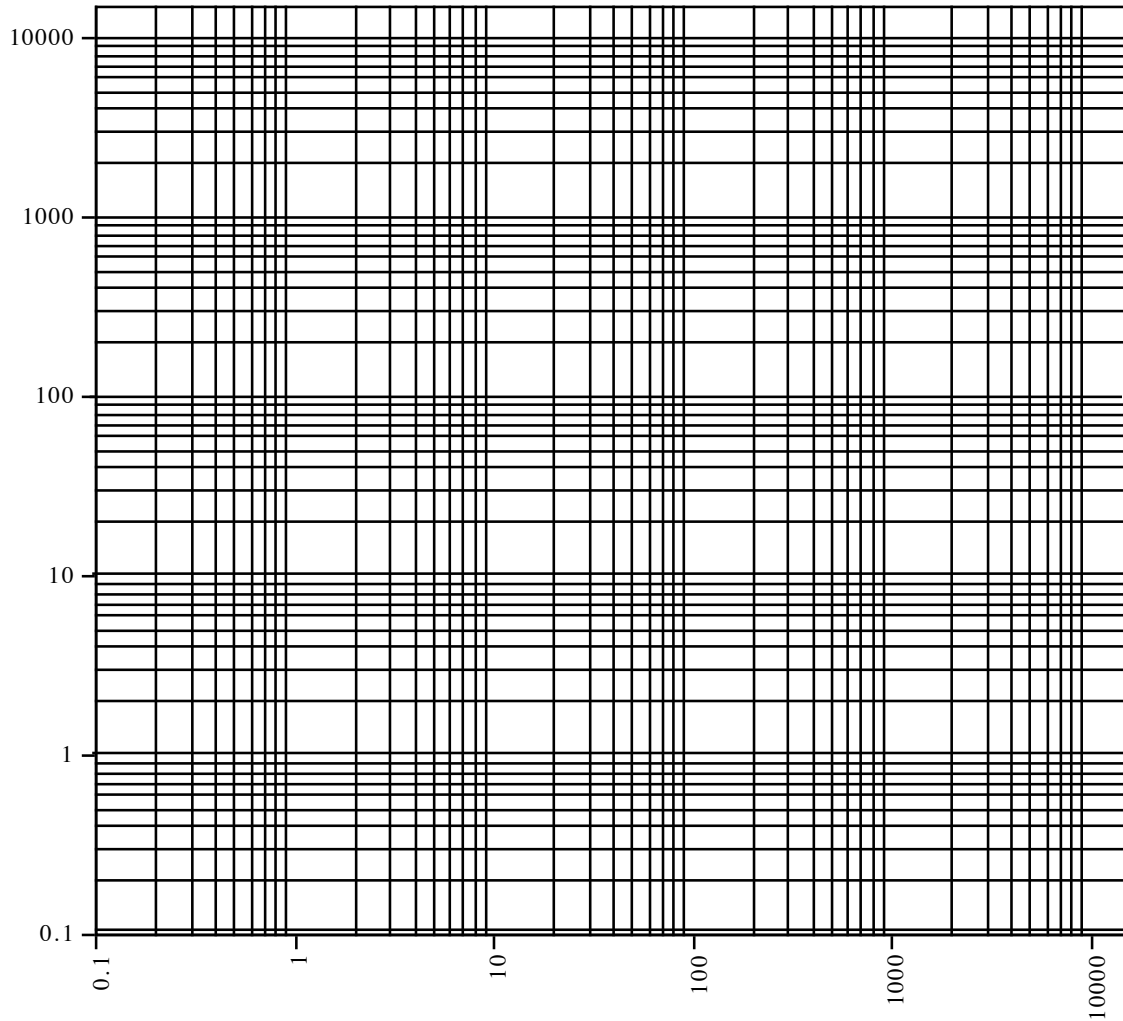
HOME RANGE CALCULATIONS

- 🌐 Read the section entitled “POLYGON METHODS” in your lab manual (p. 262).
- 🌐 Choose one of the two sets of coordinates provided in lab and plot them on the circle grid (also provided). You now have two identically arranged groups of points.
- 🌐 With one group construct the animal’s home range using the **Convex Polygon** method.
- 🌐 With the other set of points construct the animal’s home range using the **Minimum Area** method.

How do your results differ between these two methods? What are the strengths and weaknesses of each method?

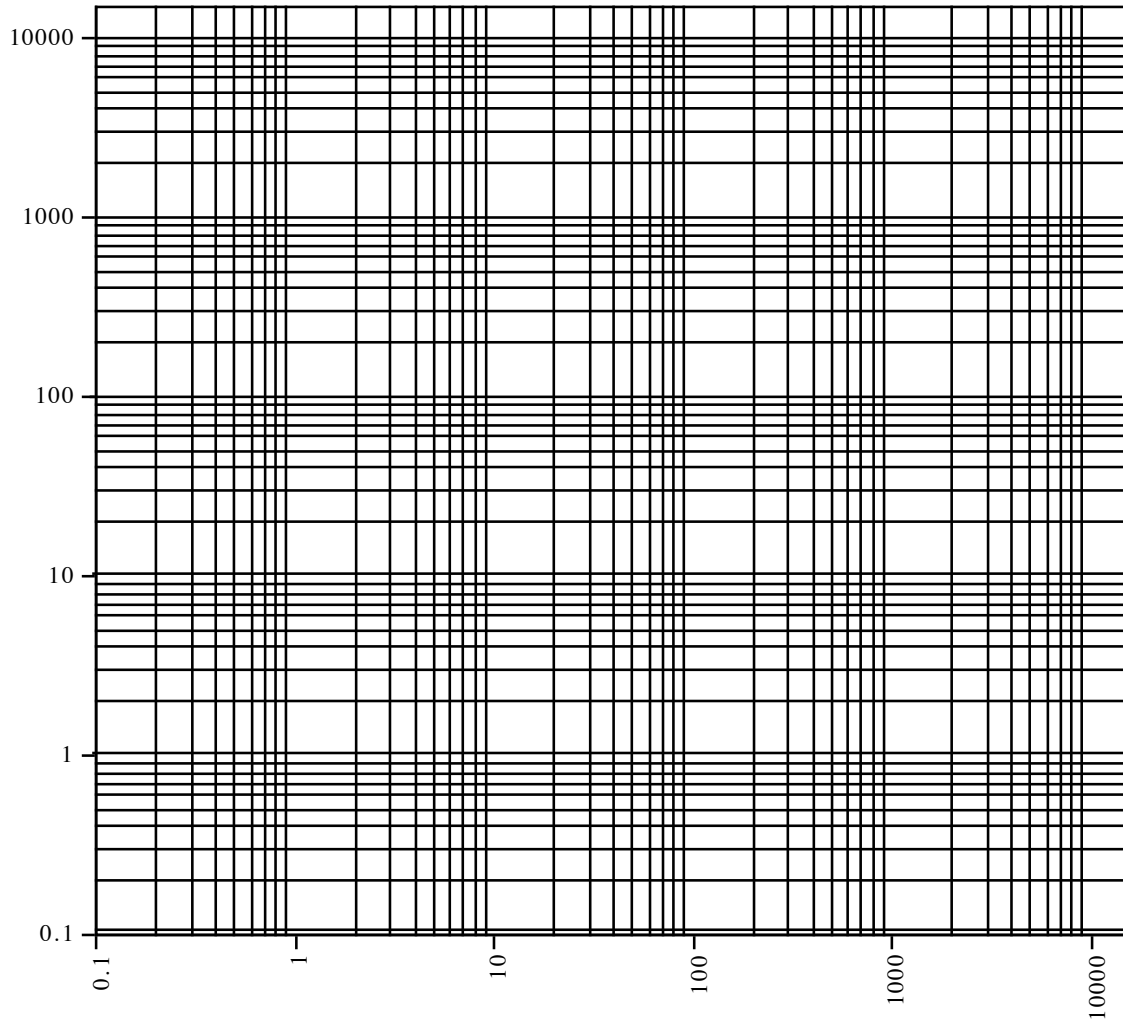
Name: _____

Body Length vs. Home Range



Name: _____

Male HR vs. Female HR



Name: _____

Circle Grid

