

Name _____

Course/Section _____

Date _____

Professor/TA _____



Activity 53.1 What methods can you use to determine population density and distribution?

1. To measure the population density of the chipmunks in a particular park, you sample several plots and capture 50 chipmunks. You mark each of their backs with a small dot of red paint and then release them. The next day, you capture another 50 chipmunks. Among the 50, you find 10 that are marked.

a. Using the mark-recapture formula below, how many chipmunks do you estimate the population contains?

$$\frac{\text{Number of recaptures in second catch}}{\text{Total number in second catch}} = \frac{\text{Number marked in first catch}}{\text{Total population } N}$$

b. What effect would each of the following discoveries have on your estimate?

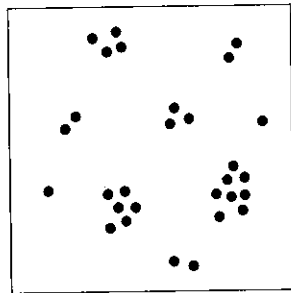
i. You later discover that you sampled the one area of the park that was most favored by the chipmunks.

ii. You later discover that the chipmunks were licking the marks off each others' backs.

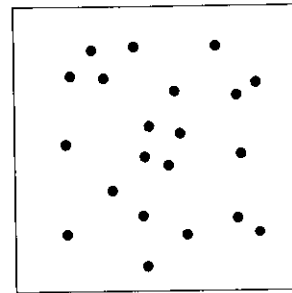
iii. You later discover that the marked chipmunks are easier to see and therefore more susceptible to predation.

- c. How could you modify your sampling program to ensure that you make more accurate estimates of population size?

2. Refer to the two proposals for the distribution of a tree species below.



Proposed distribution 1



Proposed distribution 2

- a. What type of distribution is represented in each of the proposals?

Distribution 1:

Distribution 2:

- b. Given these two possible distributions, what factors do you need to consider in setting up a sampling plan for the area? Propose sampling strategies and the results you would get if organisms were distributed as in 1 vs. 2 above. For each sampling strategy proposed, indicate how will you know if you have chosen both an appropriate quadrat size and number of quadrats to provide you a good representation of both the size of the population and the actual distribution of organisms within the sampling area.

Name _____

Course/Section _____

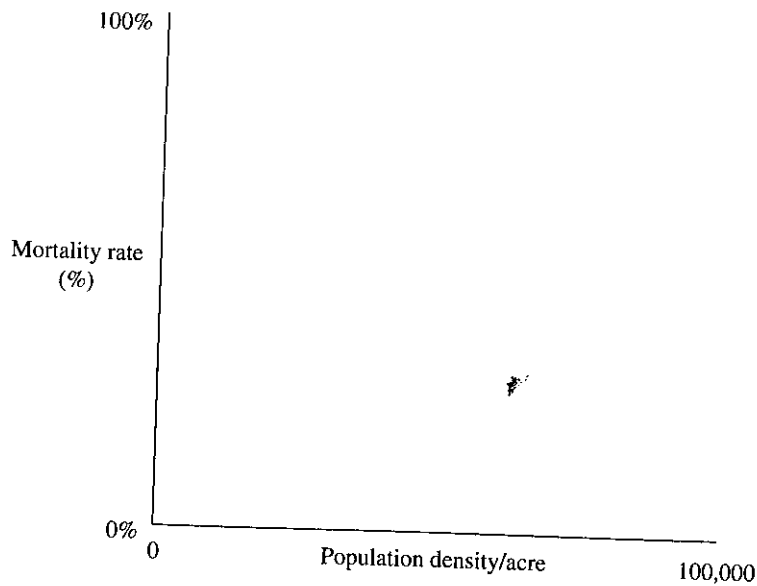


3. The following table shows the numbers of grasshopper deaths per acre per year resulting from two different agents of mortality applied to grasshopper populations of different densities.

a. Fill in the mortality rates for agents A and B in the table below.

Grasshopper population density (individuals/acre)	Deaths per year per acre		Mortality rate (%)	
	Agent A	Agent B	Agent A	Agent B
100	4	0		
1,000	40	25		
10,000	400	500		
100,000	4,000	50,000		

b. Graph the data below.



c. Which of the two agents of mortality (A or B) is operating in a density-independent manner? Explain your answer.

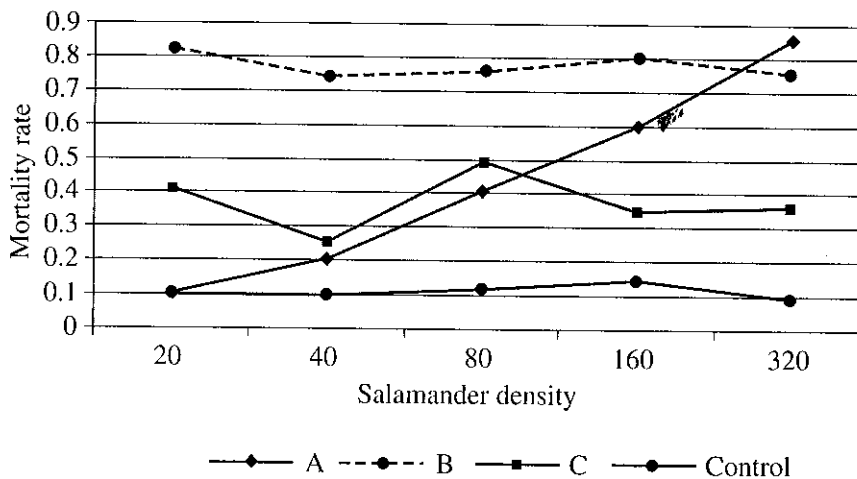
d. Which of the two agents of mortality (A or B) is likely to act as a factor stabilizing the size of the grasshopper population? Explain your answer.

53.1 Test Your Understanding

A researcher has recently discovered three species of parasites (A, B, and C) that infect developing salamanders. He suspects that one or more of these species cause fatalities during salamander development and that the death rate varies with salamander population density. To test his hypothesis, the researcher sets up a series of experiments. In each experiment, he varies the density of the salamander populations. At the start of each experiment, he infects 5% of each test population with a single parasite species and then measures the mortality/death rate after four weeks. To establish a baseline mortality rate, he sets up a control experiment that differs only in that no parasite is introduced at any density. The data table and graph below relate the mortality rate of salamanders (caused by the three different parasites) to the original density of the developing salamander population.

- a. Given the data presented in the graph, indicate whether each of the parasite species (A, B, and C) is acting in a density-dependent or density-independent fashion. Explain your answers.

Exp. 1		Exp. 2		Exp. 3		CONTROL	CONTROL
Density	A Mortality Rate	Density	B Mortality Rate	Density	C Mortality Rate	Density	Mortality Rate
20	0.1	20	0.82	20	0.4	20	0.1
40	0.2	40	0.74	40	0.25	40	0.096
80	0.4	80	0.76	80	0.49	80	0.12
160	0.6	160	0.8	160	0.35	160	0.15
320	0.85	320	0.75	320	0.36	320	0.092



- b. Looking at the data for parasites A and B, develop an argument to indicate which is more likely to cause extinction of the salamander population. Explain your reasoning.