It's In the Bag!

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Abstract
This experiment seeks to evaluate several communities' species diversity using the Simpson delta index ~ To compare the similarity of species for several communities using percentage of Jaccard coefficient of community (%CC_J).

Purpose
To evaluate several communities' species diversity using the Simpson delta index ~ To compare the similarity of species for several communities using percentage of Jaccard coefficient of community (%CC_J).

Introduction
A community is "a set of two or more interacting species that live in a particular habitat." The species diversity is an important biotic factor in a community. The diversity of species has two components, richness and evenness. The number of species in an environment determines species richness. However, not all species may be equally represented. If only a few species represent most of the individuals in a community, the diversity is uneven. If a community is made up of many species and each species is relatively abundant, the community is considered relatively stable. In stable communities the loss or reduction in number of one species causes less environmental change than in communities characterized by unevenness or only a few species. "Indices of diversity and species richness are both commonly used in ecological and conservation biology studies because each type gives useful information not provided by the other. Ecologists commonly use diversity measures to compare ecological communities and to assess the adverse effects of pollution and other types of environmental disturbance."
Our population sampling techniques will be non-random and the samples will be analyzed using the Simpson delta index, ($Æ_S$). After the species diversity has been calculated, the similarity of species found in each of the sample will be calculated using percentage of Jaccard coefficient of community (%CC_J). This index will identify the percentage of the same species that is found in each sample. As the percentage of similarity increases, there are more species in common between the samples.

Materials for a class:

several bags of Chex Snack Mix
several large containers
16 paper cups or other containers
E-Z Stat statistical program.

Hypothesis

Based on your "background knowledge" of snack mixes, brainstorm a possible hypothesis that compares the species diversity of at least two snack communities from different portions of the bag. Record your final hypothesis and includes your reasons for this choice.

Procedure

(to be done in pairs with two pairs per lab group)

1. Select one level cup of snack mix from an identified container and pour out the contents onto a clean sheet of paper.
2. Identify each of the different types of ingredient (Example: small square orange cracker, peanut, etc. and list on data chart.)
3. Count total number of each of the different ingredients (species).
4. Dispose of your first sample as directed. Each lab group should continue Step 1-3 until five samples have been taken from each population.
5. Share your pair's data with the data collected by the remainder of your lab group.

Data

DATA: SOURCE OF SAMPLE A: _____

Sample 1A

DESCRIPTION	NUMBER

Sample 2A

DESCRIPTION	NUMBER

Sample 3A

DESCRIPTION	NUMBER

Sample 4A

DESCRIPTION	NUMBER

Sample 5A

DESCRIPTION	NUMBER

Total Number of Organisms in Sample A: _____
Total Number of Different Species in Sample A: _____

DATA: **SOURCE OF SAMPLE B:** _____

Sample 1B

DESCRIPTION	NUMBER

Sample 2B

DESCRIPTION	NUMBER

Sample 3B

DESCRIPTION	NUMBER

Sample 4B

DESCRIPTION	NUMBER

Sample 5B

DESCRIPTION	NUMBER

Total Number of Organisms in Sample B: _____
Total Number of Different Species in Sample B: _____

Analysis and Conclusions

1. Calculate the Simpson Delta index for each sample of the population using the following.

SIMPSON DELTA INDEX

$$\Delta_s = 1 - \Sigma\, n_i / N^2$$

N = the total number of individuals in the sample
n_i = the number of individuals in species

SAMPLE	Δ_s	SAMPLE	Δ_s
1A		1B	
2A		2B	
3A		3B	
4A		4B	
5A		5B	

2. Calculate the percentage Jaccard coefficient using the following

$$\%CC_J = 100\ CC_J = 100S_c\ / S_T$$

S_c - number of species common to both samples
S_T - total number of species in both samples

3. Choose a statistical method for determining whether the differences seen in these populations are statistically significant and support your hypothesis.

4. Conclusion: (Based on your statistical results.)

Teacher's Note

Advantages:

- Flexibility of model - Not weather or site dependant.
- No living species-plant or animal is impacted.
- Good introduction to quantitative population measurements.
- Easily adapted to a variety of other questions - Students can design own community comparisons based in mass, size, density.
- Teacher can divide the populations in categories based on other criteria.
- Students can eat the specimens, if desired.
- Teacher can design different population by determining ahead of time the diversity of species and number of individuals.

Materials:

- Almost any mixed materials can be substituted for the Chex Snack MixÔ. Possible substitutions include dried soup beans (there are many different types and the material would last many years- but, of course the students would not get to eat the data), Fruit LoopsÔ, mixed nuts, other snack mixes, mixtures of metal screws and nuts. If "species" materials change, evaluate the size sample to be collected.
- Paper cups (large enough to give good sample for species being counted)
- E-Z Stat computer program or knowledge of t-test.

Preparation:

- Open several bags of Chex Snack MixÔ from the bottom and allow bottom half of ingredients to be pooled into a single container. Collect top half of bags separately and place into large container.

Analysis And Results:

- Before beginning, decide how to count broken pieces- as two individuals or one. Non-paired t-test should be used to identify if there is a statistical difference in populations.