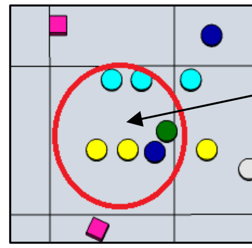
raft® RESOURCE AREA FOR TEACHING

STEAM: SCIENCE TECHNOLOGY ENGINEERING ARTS MATHEMATICS

LEARNING ACTIVITY

Sampling Biodiversity

Measuring the Richness of Life!



4 unique species in the box
- Yellow
- dark blue
- green
- light blue

Materials Needed
- ○ 25-30 types of small objects in a variety of colors, shapes, and textures, 20 identical specimens of each type (examples: beads, buttons, beans, rice or other grains, cereal, paperclips, pieces of straw, candy, pasta, etc.)
- ○ Container large enough to hold all objects
- ○ Cup, any size
- ○ Paper, regular size
- ○ Scissors
- ○ Pen or pencil

Grade Range
3-5
6-8

Topics/Skills
Science: Biodiversity, Human Impacts on the Environment, Species Richness, Collecting Data, Modeling; Math: Representing & Interpreting Data

Learning Standards
NGSS: Human Impacts on Earth's Systems (Biosphere); CCSS Math: Measurement & Data

Duration
20-30 minutes

Prep Time
10 minutes

All living things contribute to the biodiversity of the planet. In this activity students learn how to measure biodiversity in terms of species richness (the number of species living in a defined area) by sampling "species" in a "habitat" and then graphing, analyzing and interpreting the data.

Activity Challenge
Count the unique species in random samples obtained from a habitat to measure the biodiversity (species richness) within the habitat.

Preparation
1. Review the materials list and gather all items.
2. Put all small objects (specimens) into a container and mix well.
3. Cut a sheet of paper into 64 1-inch squares and number them #1-64. Put them into a cup.
4. Set the habitat grid onto a wide, flat surface and carefully pour and spread all specimens onto the habitat grid.

To Do
1. Take a numbered square from the cup and look for that number on the habitat grid (gently move the specimens if needed to see the number).
2. Count the number of unique species within the identified box on the habitat grid. **Note:** For this activity, species are considered unique if they differ in texture, color, size, translucence, etc., even if they are technically the same item (see example in picture above).
3. Record the number of unique species counted in the data table for Sample 1 (see example in table on p.4). Write that number in the column labeled "Cumulative" as well.
4. Count each unique species only one time. Track this by removing and setting aside an example of each counted species to avoid double-counting a species in future samples.
5. Repeat steps 1-4 for 20-25 more samples or until it is believed that all unique species have been found.
6. Graph the data with the sample number along the x-axis and the cumulative number of species along the y-axis (see p.5).

Observations

- Observe the shape of the curve formed by the graphed data. Where does it flatten out? Based on the graph, how many unique species are there in the habitat? How does the number determined using the graph compare to the number of species removed and set aside? (see step 4 of To Do).
- Suppose the habitat grid represents a forest. What might happen to the number of species in the habitat if there was a forest fire? How might this be reflected in the data/graph?
- How could collecting species data as modeled in this activity help scientists monitor the recovery of the forest after the fire? What do you predict the data would look like if the forest recovered after the fire?
- How might this method of sampling and counting species in a real habitat be used to monitor human impact on the environment?

Extensions

- Make a larger habitat grid using poster paper and larger and/or more squares.
- Vary the number of species and/or the number of specimens per species.
- Draw different features in the habitat grid such as streams or mountains and make inferences about the species occupying those parts of the habitat. Research real organisms that occupy similar habitats.

The Science behind the Activity

The variety of all the different livings things in a habitat or ecosystem are collectively called **biodiversity**. Plants, animals, and people may live in various habitats, but they all contribute to the biodiversity of the planet. Biologists measure biodiversity to determine the impacts of both natural occurrences and human activity on the environment. One such measure useful to biologists is **species richness**, the number of species living in each area or habitat. Biologists measure species richness by first dividing a large area into smaller, more manageable areas (like boxes in a grid). Then they count the number of different species in each small area. In the first few samples the most common or abundant species are found with minimal effort and spending more time collecting samples and/or covering a greater area typically yields more species. To see how many different species are collected as a function of sampling effort, biologists graph the data while they are actively sampling in the field. The x-axis is the sampling effort (measured as time, area, or sample number). The y-axis is the number of different species found. This graph is called a **species accumulation curve**. When the curve flattens out, sampling may stop until further measurements are needed.

Patterns in species richness help biologists understand the distribution of species. For example, species richness tends to be higher in tropical regions than at temperate or polar regions - a geographic pattern. The two most species-rich habitat types, rainforests and coral reefs, are located in tropical regions. In terms of island species, species richness is typically greater on islands that are nearer to a mainland. Similar patterns can be observed in "habitat islands" such as forested mountaintops surrounded by arid land. Species richness helps biologists recognize what is happening after natural events such as forest fires, landslides, floods, and tsunamis. It also helps policy makers to make decisions regarding human activities in the environment. For example, there might be a need for a dam on a river for electrical power but there could be undesirable environmental impacts resulting from its construction. In this case species richness measurements taken above and below the proposed dam site can serve as baseline values with which to compare over time and thus inform future policies and similar projects.

HABITAT GRID

1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56
57	58	59	60	61	62	63	64

DATA TABLE

Sample No.	Box No.	No. Unique Species	Cumulative total
Example 1	26	4	4
Example 2	33	3	7
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
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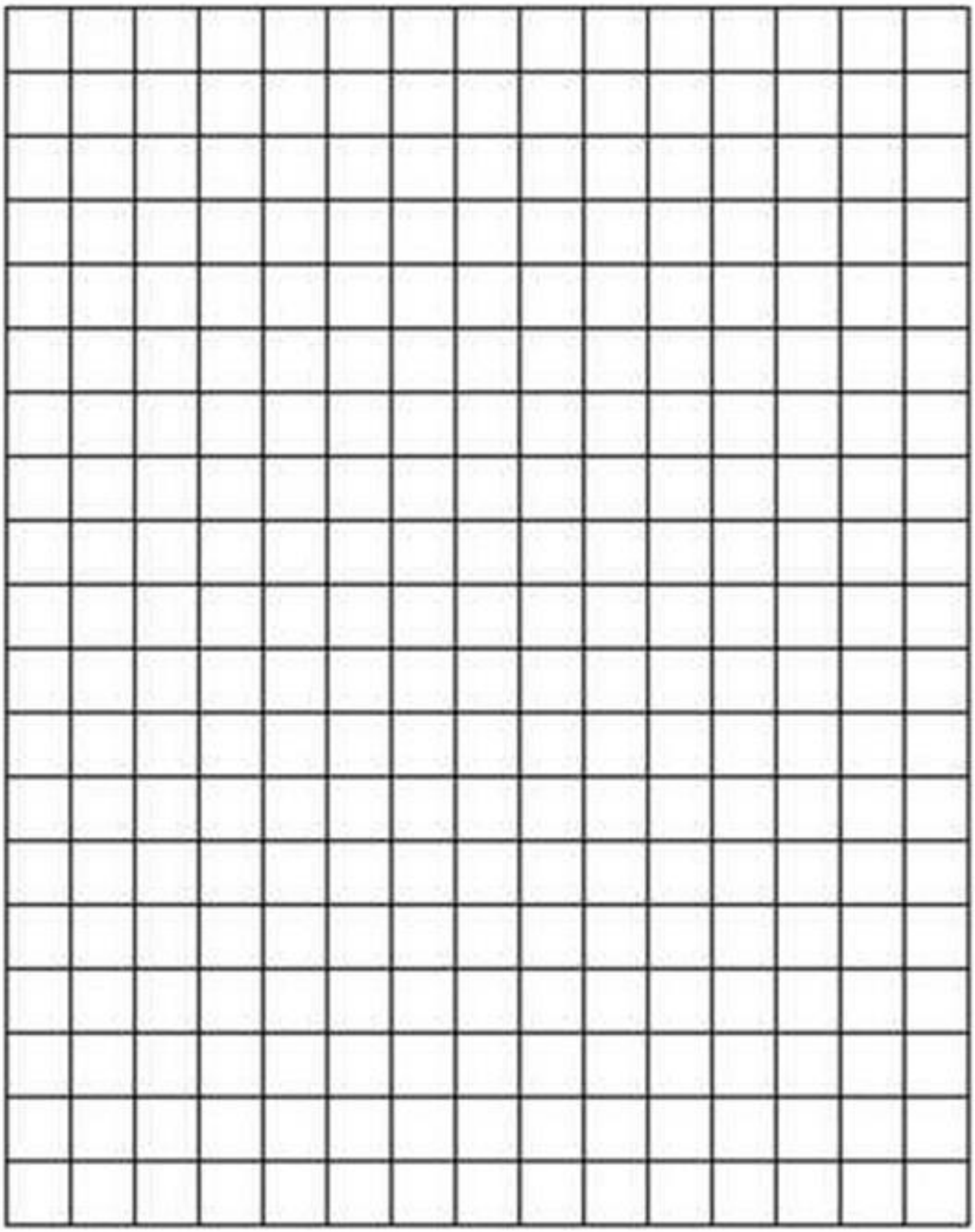
25			

(Add more rows to table as needed)

GRAPH: Number of Species vs. Sample Number

Cumulative Number of Species



Sample Number