

Species Area Curve Project: Step 1

When ecologists wish to collect information about an ecosystem, it is often impractical to monitor the entire system or to obtain measurements of all the organisms in the area. However, because a single measurement is insufficient to draw conclusions about a system, it is necessary to include a series of repeated sample collections. To answer the question of “how many” samples (replicates) should be taken in order to achieve a satisfactory representation of a given ecosystem, ecologists use a method called the Species Area Curve.

Species-area curves plot the cumulative number of new species per replicate against the cumulative number of physical samples. Once the number of replicates is established for each sampling method, the number of replicates should stay the same throughout the duration of study.

NOTE: According to biologists, five replicates is the typical maximum. Usually, three or four replicates are sufficient. Depending on the health of the site, the monitor should determine if the replicate number should be capped at a lower number than what the Species Area Curve shows.

1. Utilizing the information given, construct a species area curve.

2. What is the minimum number of replications needed to satisfactorily collect all species within this theoretical ecosystem? _____.

Data Table 1

Sample #	Cum. Area (m2)	# of Species	# of New Species	Cum. # of New Species
1	1	3	3	
2	2	1	1	
3	3	5	2	
4	4	3	1	
5	5	4	2	
6	6	6	1	
7	7	7	3	
8	8	2	0	
9	9	3	0	
10	10	1	0	

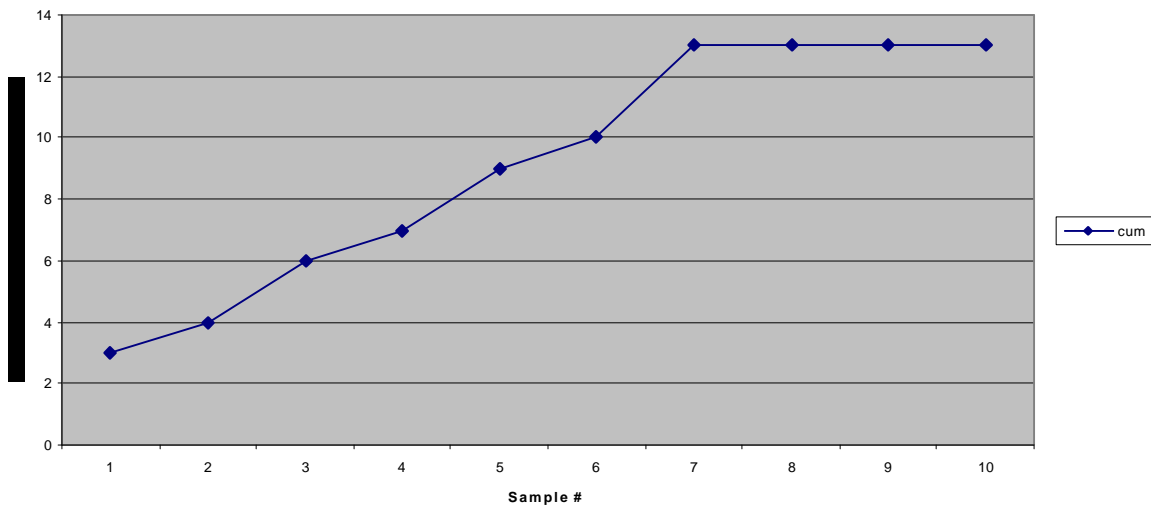
Species Area Curve Project Key: Step 1

1. Utilizing the information given, construct a species area curve.
2. What is the minimum number of replications needed to satisfactorily collect all species within this theoretical ecosystem? **7**

Data Table 1

Sample #	Cum. Area (m2)	# of Species	# of New Species	Cum. # of New Species
1	1	3	3	3
2	2	1	1	4
3	3	5	2	6
4	4	3	1	7
5	5	4	2	9
6	6	6	1	10
7	7	7	3	13
8	8	2	0	13
9	9	3	0	13
10	10	1	0	13

Area Species Curve



Determining Desired Volume and Correction Factor
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Determining Desired Volume and Correction Factor: Step 2

Because each sampling station utilizes slightly different sampling methods, it is necessary to determine the correction factor for your sampling device. Therefore, all biodiversity data needs to reflect the estimated number of species and organisms found within a standardized unit of water (i.e. 1.0 m³).

The process of standardizing data or formulating a correction factor is important so that each monitor will be able to interpret, utilize, and compare each other's river monitoring data.

NOTE: Correction factors need only be computed once for each sampling station and technique unless the sampling device or volume of water sampled changes.

Part 1: Determining Desired Volume

Given: Kick Net Dimensions = 0.32m X 0.42m

Length of Pull = 1 meter

Actual Volume of 1 Replicate = _____ cm³

3 Replicates

Actual Volume of All Replicates = _____ cm³

or _____ m³

(Show all work for credit or partial credit.)

Part 2: Determining the Correction Factor

What is the Correction Factor (CF) for this sampling technique? _____

(Show all work for credit or partial credit.)

Determining Desired Volume and Correction Factor Key 4empowerment®

Determining Desired Volume and Correction Factor Key: Step 2

Part 1: Determining Desired Volume

Given: Kick Net Dimensions = 0.32m X 0.42m $0.32\text{m} \times 1000\text{cm}/1\text{m} = 32\text{cm}$
 $32\text{cm} \times 42\text{cm} \times 100\text{cm} = 134,400 \text{ cm}^3$

Length of Pull = 1 meter

Actual Volume of 1 Replicate = 134,400 cm³

3 Replicates $134,400 \times 3 = 403,200 \text{ cm}^3$

Actual Volume of All Replicates = 403,200 cm³

or 0.4032 m³

(Show all work for credit or partial credit.)

$$403,200 \text{ cm}^3 \times 1\text{m}/100\text{cm} \times 1\text{m}/100\text{cm} \times 1\text{m}/100\text{cm} = 0.4032\text{m}^3$$

Part 2: Determining the Correction Factor

What is the Correction Factor (CF) for this sampling technique? 2.480
(Show all work for credit or partial credit.)

$$1\text{m}^3/0.403\text{m}^3 = 2.480$$

$$1,000,000\text{cm}^3/403,200\text{cm}^3 = 2.480$$

Calculate Species Diversity Using Shannon-Wiener Diversity Index 4empowerment®

Calculate Species Diversity Using Shannon-Wiener Diversity Index: Step 3

The Shannon-Wiener Diversity Index is one of the most widely used species diversity indices for examining overall community characteristics. It is derived from a function used in the field of information and has been adapted by ecologists to describe the average degree of uncertainty of predicting the species of an individual picked at random from the community. The uncertainty of occurrence increases both as the number of species increases and as the individuals are distributed more and more evenly among the species already present.

When properly manipulated, it will always result in a diversity value (H') ranging between 0 (indicating low community complexity) and 4 (indicating high community complexity). It is not necessary to key all organisms to their specific species nomenclature (i.e. organisms not expediently identified may be assigned numeric values such as species 1, 2, 3). However, in order to derive accurate diversity values, all organisms should be keyed to the lowest possible like taxonomic level.

1. Using the data below and the correction factor found in Step 2, complete the [Biodiversity Step 3 Worksheet](#) to calculate the Shannon-Wiener Diversity Index.

NOTE: This is a spreadsheet and has two tabs displaying two different pages at the bottom left of the worksheet. The first is the worksheet to determine the Shannon-Wiener Species Diversity Index. The second calculates Standard Deviation.

2. Extra Credit: Calculate the Standard Deviation using Species Diversity.

Species	Number of Individuals In Each Replicate						
	1	2	3	4	5	6	7
Stonefly Larva (Plecoptera)	4	1	1				
Caddisfly Larva (Trichoptera)	1	3	4				
Whirligig Beetle (Coleoptera)	2	3	4				
Crayfish (Cambarus)	3	0	1				
Amphipoda A	0	3	0				
Isopoda A	2	2	1				

Calculate Species Diversity Using Shannon-Wiener Diversity Index Key 4empowerment®

Calculate Species Diversity Using Shannon-Wiener Diversity Index: Step 3

1. Using the data below and the correction factor found in Step 2, complete the [Biodiversity Step 3 worksheet](#) to calculate the Shannon-Wiener Diversity Index.

NOTE: This is a spreadsheet and has two tabs displaying two different pages at the bottom left of the worksheet. The first is the worksheet to determine the Shannon-Wiener Species Diversity Index. The second calculates Standard Deviation.

2. Extra Credit: Calculate the Standard Deviation using Species Diversity.

Species	Number of Individuals In Each Replicate						
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Crayfish (Cambarus)	3	0	1				
Amphipoda A	0	3	0				
Isopoda A	2	2	1				

Species Diversity answers contained within the Biodiversity Step 3 Worksheet can be found at http://4cw3.com/en/myHomePage/teachersLounge/bio3form_ex.xls. The first tab of the worksheet contains Species Diversity using the Shannon-Wiener Diversity Index. The second tab shows how to calculate Standard Deviation using Species Diversity.