Name____ Lab Section________________

Objectives:

- Help you to understand the problems intertidal organsims face in their struggle to survive and reproduce in their environment.
- Teach you how to perform basic field techniques in collecting samples from the environment.

Background material may be found in

• Chapter: 34
• Chapter: 37

Biology: Concepts & Connections, 8th ed.

Introduction

Between the high and low tide marks lies a strip of shoreline that is regularly covered and uncovered by the daily ebb and flow of the tides. This meeting ground between the land and the sea is called the **intertidal** and is home to some of the most beautiful and diverse habitats on our planet. Intertidal communities occur on sandy beaches, in bays and estuaries, on wharf pilings, and along rocky shorelines.

The plants and animals that inhabit the intertidal are hardy and adaptable. They must be able to withstand periodic exposure to air and the force of the pounding surf. In addition, the substrate in which the animals live plays an important role in determining the types of organisms found in an intertidal community. Because sand is constantly moving and shifting, sandy beaches are a much more unstable habitat than rocky shores. As a result, there tend to be fewer species adapted to live on sandy beaches. Furthermore, among those that live there, some prefer wetter areas (areas exposed to air only during low tides) while others prefer drier areas (are only under water during high tides).

In today's lab, we are going to determine what the distribution and abundance of animals is along a sandy beach in Santa Barbara, California. We are going to identify what is out there, quantify how many there are, and look for patterns in the distribution of the different species. You will learn how to make a transect, collect samples along that transect and tabulate the data. You will also calculate some basic measures of biodiversity – species richness and evenness – and compare it to the diversity of the terrestrial community you sampled previously.

Procedure

The class will be divided into teams. Each team should have one shovel, one bucket, one screen, one coffee can with holes, one transect line, and many flags.

1. Look at the beach. Note the berm, intertidal area (low tide), and the area of the most recent high tide.
2. Lay out the transect line beginning at the berm crest and go straight out to sea as far as possible.
3. Put a flag in the sand at each meter as you move down the beach. Roll up your transect line, cleaning it off as you go so it won't get clogged up with sand.
4. Beginning at the berm, take a small shovel of sand and dump it on the screen. Rinse the sand through the screen with water. This will wash all the sand away and leave the animals. Count and record the number and types of animals left on the screen. This will be sample #1 from station #1.
5. Repeat the procedure at the rest of the stations.

Data Collection

Table 13.1: Organisms found during transect sampling.

	Annelids		**Arthropods**		
Station	**Blood worms** Number found (n)	**Clam worms** Number found (n)	**Sand crabs** Number found (n)	**Sand fleas** Number found (n)	**Beach hoppers** Number found (n)
1 (berm)					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20 (water line)					
Total (n)*					

Record any other species you see at the beach (e.g. birds) and the approximate number of individuals.

Table 13.2: Organisms seen during transect sampling.

Species	**Number of Individuals (n)**

Distribution of Organisms

1. Examine your data. How many different species did you see?

2. Did you find all the different types of animals at each station you sampled?

3. Were some types more abundant at some stations and less abundant at others?

   Explain why or why not. (Your answer should be in terms of community and ecosystem structure, e.g. role of abiotic and biotic environment, effects of species interactions, etc.)

4. What adaptations do you think are necessary to allow an organism to be successful in the sandy beach habitat?

Diversity of Organisms

Calculate the species richness and evenness of the Sandy Beach community using the same methods you used during the previous biodiversity lab.

Transfer the values from the bottom line of Table 13.1 for each species and any additional species you recorded in Table 13.2 to Table 13.3 below.

Table 13.3: Organisms found during transect sampling.

Species	Total Found (n)*	n(n-1)
Blood Worms		
Clam Worms		
Sand Crabs		
Sand Fleas		
Beach Hoppers		
Total number of species (R) =	**N = ∑ n =**	**∑ n(n-1) =**

Species Richness

This value is determined by counting the total number of species found in the community. This value is R in Table 13.3. Record the species richness of your Sandy Beach community here.

R = ___________________

Relative Abundance/Evenness

Relative abundance is best shown by creating a rank-abundance curve. This is done by plotting the proportion of each species' abundance vs. its rank (from most abundant to least abundant). The greater the slope of the resulting line, the less diverse (less "even") the sample, and the flatter the slope, the more diverse or "even" the sample.

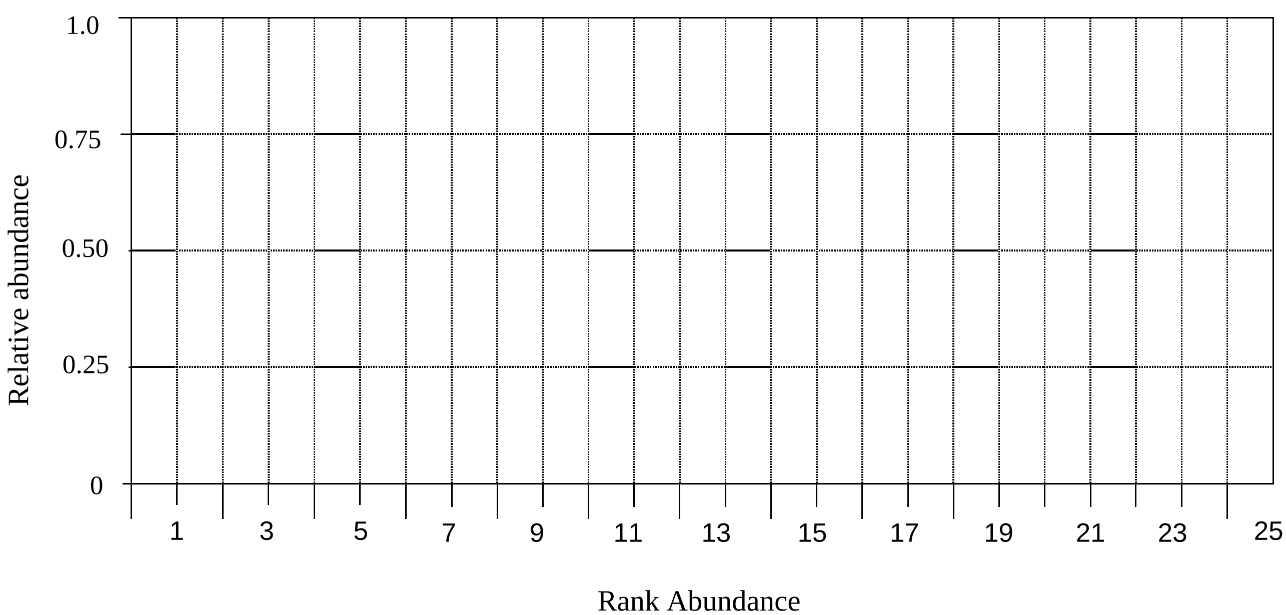
To determine the evenness of the Sandy Beach community you are going make a rank-abundance curve with your data.

1. Transcribe your data from Table 13.3, to Table 13.4, listing each species in order from most abundant to least abundant.
2. Calculate ∑ n by adding up the total number of individuals you found.
3. Calculate the relative abundance of each species by dividing the number of individuals of each species (n) by ∑ n. Put this value in the last column on Table 13.4.
4. Plot the relative abundance vs the rank abundance of each species on Figure 13.1.

Table 13.4: Rank abundance

Rank	**Species/Name of Organism**	**Number Found (n)**	**Relative abundance ($n/\sum n$)**
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
	$N = \sum n =$		

Figure 13.1: Rank Abundance Curve



Examine your rank-abundance curve to determine how "even" your area is. A line with a relatively flat slope indicates your area is more even and more diverse. A line with a steep slope indicates your area is less even and less diverse.

5. What does this curve tell you about the diversity of your area?

Simpson's Index of Diversity

The Simpson's Index of Diversity is one method for estimating diversity that takes into account both species richness and the relative abundance (evenness) of each species. This index will range from 0 to 1, where a value closer to 0 indicates less diversity and a value closer to 1 indicates more diversity.

To calculate this index, use the numbers from Table 13.3 (page 4) and Table 13.4 (page 5) and plug into the formula:

$$D = \frac{\sum n(n-1)}{N(N-1)}$$

This value is the number from the lightly shaded area at the bottom of Table 13.3.

N is the number from the lightly shaded area at the bottom of Table 13.4.

D = ________ =

Simpson's Index of Diversity = 1 – D

=

6. What does this value tell you about the diversity of your area?