

## Biodiversity at the Grocery Store

### Species Diversity on Islands of Different Sizes

The number of species in a biological community is termed **Species Richness (N)**. For example, a tropical rainforest has more **Species Richness** than a North Carolina deciduous forest. **Species diversity**, on the other hand, takes into account the relative abundance of a species and not just its occurrence. If a community is composed of a few species, or if few species are abundant, the **Species Diversity** will be low. For example, in a community of 100 individuals distributed among 10 species, the maximum possible diversity would occur if there were 10 individuals of each of the 10 species. High species diversity indicates the presence of a complex ecological community. The community would exhibit a complex food web with numerous intraspecific and interspecific interactions as well as a tremendous variety of ecological niches. The minimum diversity would occur if there were 91 individuals of 1 species, and 1 individual representing each of the other 9 species. Historically, one of the most commonly used measures of species diversity is the **Shannon-Weiner Diversity Index (H)**. The **S-W Index** has been used to measure the habitat quality which may have been degraded by some type of human activity such as sewage effluent. The **S-W Index** is associated with the concept of uncertainty. High diversity is associated with high uncertainty meaning that it would be difficult for you to predict the identity of the next randomly picked organism in your ecosystem. Low diversity means that you would be relatively certain of the identity of the next randomly encountered organism. Therefore, the **S-W Index** is a measure of the likelihood that the next individual enumerated (i.e., counted or identified by the scientist) will be the same species just encountered. The **S-W Index** ranges from 0 to approximately 4.6. A value near 0 would indicate that every species in the sample is the same. Conversely, a value near 4.6 would indicate that the number of individuals are evenly distributed among numerous species. Values in the middle of the range are a toss up - which is an obvious flaw in the **S-W Index** and is the reason that care should be taken when using such a measure.

Steps to calculate **Shannon-Weiner Diversity Index** are:

Formula:  $H = -\sum(P_i \log[P_i])$

- 1) Calculate  $P_i$  for each species by dividing the number of each species by the total number of individuals enumerated.
- 2) Multiply the number calculated in Step 1 by its natural log.
- 3) Add the negative sums calculated in Step 2 for each of your species.

## Assignment: Biodiversity at the Grocery Store

Species diversity is usually higher on larger islands than on smaller islands because smaller islands have fewer habitats and subsequently support smaller populations of fewer species. In this activity you will compare the species richness (**N**) and species diversity (**H**) of "foodstuffs" on "islands" of different sizes (i.e., the shelves of five local grocery and convenience stores).

- 1) Preselect five "foodstuffs" such as canned tuna, ice cream, boxed cereal, canned soup, fruit, etc., for which you plan to measure species richness (**N**) and species diversity (**H**).
- 2) Visit five grocery and convenient stores and count the number of "species" and the number of individuals within each "species" for each of your five "foodstuffs."
- 3) Determine the total "island" area for each store by summing the shelf space (length x width x height) for all of your "species" (report in square meters).
- 4) Determine the species richness (**N**) for the five different "islands".
- 5) Calculate the species diversity (**H**) for the five different "islands".
- 6) Create a data table to present species richness (**N**), species diversity (**H**), "island" size ( $m^2$ ), and population size.
- 7) In a written commentary, discuss whether species richness (**N**), species diversity (**H**), and population size are related to "island" size.

Remember to refer to the grading rubric when writing up your analysis.

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