Comparing Community Diversity

A group of biologists wanted to compare the fish communities between two bayous. They collected fish by electrofishing at 4 sites within each bayou. Stunned fish were identified and counted. (Stunned fish revive quickly and are returned to the water.)

Number of individuals per species collected in each of two bayous.

Fish Species	**BayouT**	p	ln p	p*ln p	**Bayou L**	p	ln p	p*lnp
Lepisosteus oculatus	102				86			
Brevoortia patronus	1640				3574			
Dorosoma cepedianum	28				6			
Cyprinodon variegatus	1009				106			
Fundulus pulvereus	366				46			
Gambusia affinis	9814				194			
Poecilia latipinna	2282				180			
Lepomis gulosus	0				30			
Lepomis macrochirus	16				36			
TOTAL		1.00				1.00		

1. Calculate the total number of individuals captured in each bayou and enter in the table.
2. Calculate the proportion (p) of the total catch represented by each species. (Use 3 significant digits.) Is this expressed as a percentage or a proportion?

3. Calculate the **species richness** for each community.

4. Calculate the **Shannon Diversity Index (H)** for each bayou.

5. Which bayou has greater species richness?

6. Which bayou has a more diverse community?

Reference

Cashner, R.C., F.P. Gelwick, and W.J. Matthews. 1994. Northeast Gulf Science. 13:107-120.

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Teaching Tips for Peer Mentors

The purpose of this activity is for students to practice applying their knowledge and to practice quantitative skills.

Have students work in pairs. One partner should do calculations for Bayout T and the other for Bayou L. Partners should then check each other's work. Make sure students calculate a proportion (0 – 1.0) in Question 2, not a percentage (0 – 100%).

Questions 3 and 4. Students should look up definitions for species richness and Shannon Diversity Index in their textbook or notes to answer these question. Don't just tell them the definition. You may want to write the formula for H on the whiteboard.

The Shannon Diversity index, H is calculated as

$$H = -\sum_{i=1}^{S_{obs}} p_i * ln(p_i)$$

p_i = number of individuals in the i^{th} species divided by the total number of individuals counted.

S_{obs} = total number of species observed, in this case, 9 species were observed.

Example: There are 102 *Lepisosteus aculeatus* in Bayou T. A total of 15,527 individual fish were counted in Bayou T. P_i for *L. aculeatus* = 106/15,527 = 0.007. Calculate p_i and $\ln(p_i)$ for each species. Multiply $p_i * \ln(p_i)$ for each species. Sum these products for all species. Because all the $p_i*\ln(p_i)$ values are negative, the sum will be negative. Notice that H, the Shannon-Wiener index is the <u>negative</u> sum (-Σ) of these products, so **H will be a positive number.**

Questions 5 and 6 are meant to emphasize the distinction between species richness (number of different species) and community diversity – a measure of whether a community is dominated by a single species or is a complex mixture of species, each of which is reasonably abundant.

Notes to Faculty

Fish abundance data are from Cashner, R.C., F.P. Gelwick, and W.J. Matthews. 1994. Northeast Gulf Science. 13:107-120.