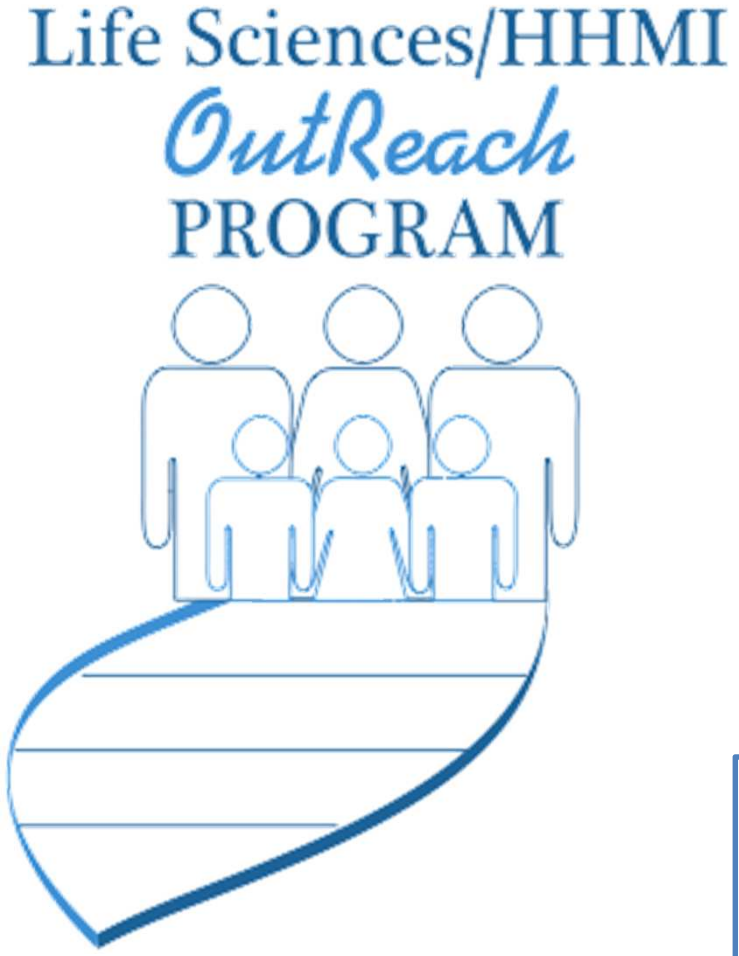

A Shoreline Tour & The Simpson Diversity Index

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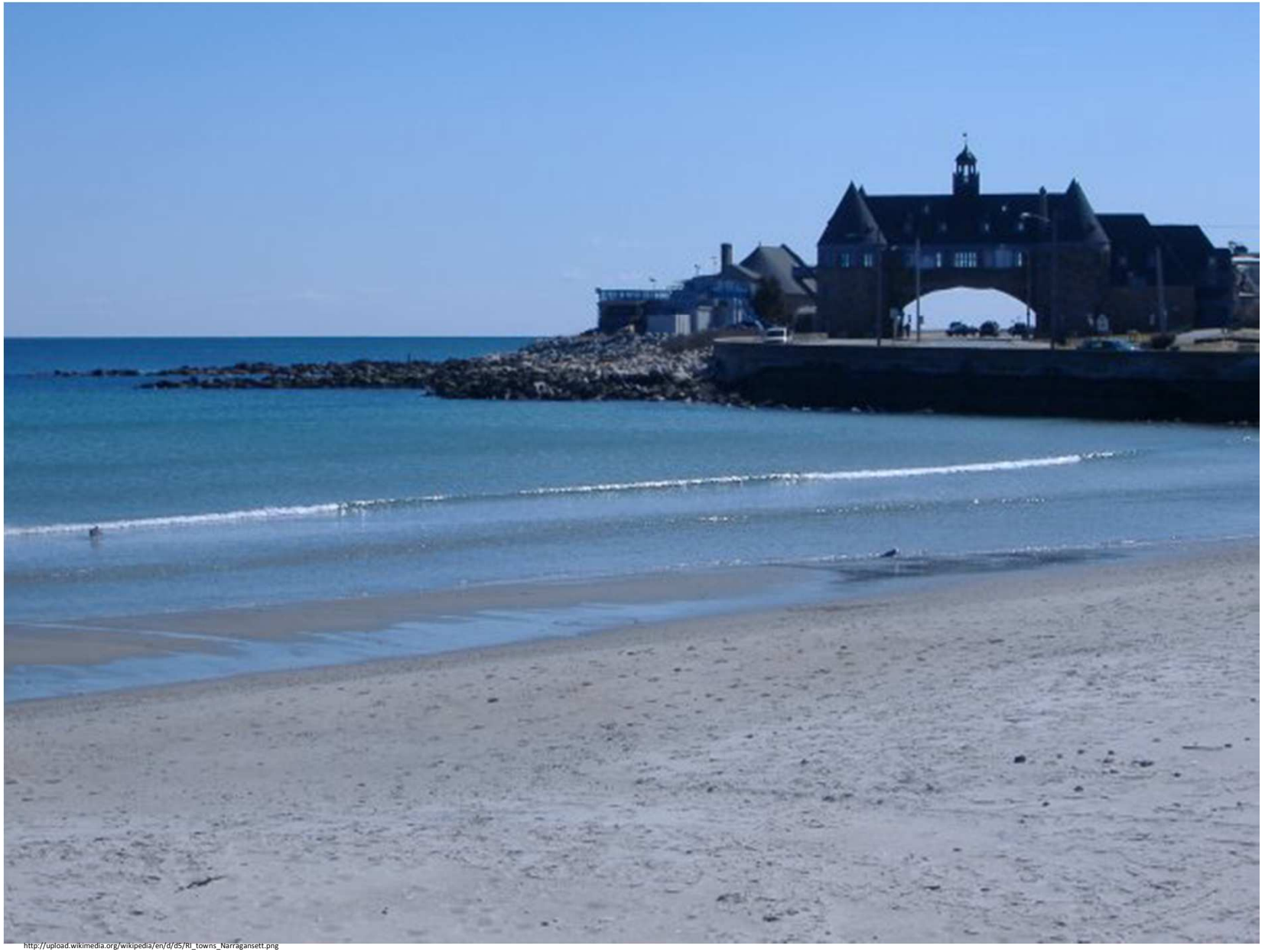
Summer 2010 Workshop in Biology and Multimedia for High School Teachers



http://upload.wikimedia.org/wikipedia/en/d/d5/RI_towns_Narragansett.png

Ecosystem Assessment

- Ecosystem diversity assessment often involves a description of organism richness and evenness.
- Richness = the number of organisms in a particular area
- Evenness = a quantitative comparison of the number of organisms in a particular area
- The Simpson diversity index is the most commonly used in order to compare the richness of different areas.

(Damon, McGonegal, Tosto & Ward, 2007)

Simpson Diversity Index Methodology:

- 1) A random sampling technique is used to search for organisms present in the ecosystem.
- 2) Each of the organisms found is identified.
- 3) The total number of individuals of each species is counted.
- 4) The diversity index (D) is then calculated.

In comparing the diversity of different environments, or the change in diversity over time, a higher index value is indicative of a more diverse environment.

(adapted from Allott, Andrew, 2007)

Simpson Diversity Index

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

D= diversity index

N= total # of organisms in the ecosystem

n= # of individuals of each species

(Damon, McGonegal, Tosto & Ward, 2007)

Shoreline Surveys & Calculations

- Sample data from two shorelines will be provided for investigation. Using the data presented for each shoreline environment:

1) Fill out a data collection sheet(one is provided for you at SusanTaylorWorksheet.docx)

2) Calculate the Simpson diversity index for environments 1 & 2.

3)Predict which environment is more diverse.

A Sample of Life at the Shore

Organisms under investigation:

Common Periwinkle

Common Sea Star

Mussel

Horseshoe Crab

Lobster

Common Periwinkle

http://en.wikipedia.org/wiki/File:Littorina_littorina.jpg

Common Sea Star

Mussels

http://upload.wikimedia.org/wikipedia/commons/4/45/CornishMussels.JPG

Horseshoe Crab

http://upload.wikimedia.org/wikipedia/commons/1/1b/Horseshoe_crab_female.jpg

Lobster

http://upload.wikimedia.org/wikipedia/commons/7/74/Lobster_NSRW.jpg

Shoreline Data

Environment 1

- Common periwinkle-18
- Common sea star-5
- Mussel-15
- Horseshoe crab-1
- Lobster-1

Environment 2

- Common periwinkle-16
- Common sea star-5
- Mussel-8
- Horseshoe crab-5
- Lobster-6

Calculations & Predictions

- STOP. Pause here before you go to the next slide. Take a moment to complete your calculations & predictions. Record your work & your answers:
- Environment 1 D=?
- Environment 2 D=?
- Which environment is more diverse?

Calculation Verification

- The following slides contain calculation charts & answers to help you confirm your work.

Environment 1

Organism	n	n(n-1)
common periwinkle	18	18(17)=306
common sea star	5	5(4)=20
mussel	15	15(14)=210
horseshoe crab	1	1(0)=0
lobster	1	1(0)=0
total	N=40	536

Environment 1

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

$$D = \frac{40(39)}{536} = \frac{1560}{536} = 2.91$$

Environment 2

Organism	n	n(n-1)
common periwinkle	16	16(15)=240
common sea star	5	5(4)=20
mussel	8	8(7)=56
horseshoe crab	5	5(4)=20
lobster	6	6(5)=30
total	N=40	366

Environment 2

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

$$D = \frac{40(39)}{336} = \frac{1560}{336} = 4.26$$

Environmental Comparison

- How did you do???
- Environment 1 D=2.91
- Environment 2 D=4.26
- According to the Simpson diversity index values, Environment 2 is more diverse since it has a higher value than Environment 1.

Further Investigation

- Here are some suggestions for further study:
- Using the same organisms, create different scenarios by varying N(the total number of organisms present) or by varying the number of each organism to see how it affects the Simpson diversity index.
- Select an alternate ecosystem and organisms of choice, complete various data tables and calculations.
- Expand this investigation of diversity by making actual field collections in order to work with data you have collected yourself.

References Cited

- Allott, Andrew, Biology for the IB Diploma, Oxford: Oxford University Press, p. 156.
- Damon, Alan, McGonegal, Randy, Tosto, Patricia & William Ward, Higher Level Biology, Edinburgh Gate, Harlow, Essex: Heinemann International, 2007, p.572-3.
- Common Starfish Image. http://en.wikipedia.org/wiki/File:Starfish.jpg
- Horseshoe Crab Image. http://en.wikipedia.org/wiki/File:Horseshoe_crab_female.jpg
- Lobster Image. http://en.wikipedia.org/wiki/File:Lobster_NSRW.jpg#globalusage
- Mussels Image. http://en.wikipedia.org/wiki/File:CornishMussels.JPG
- Periwinkle Image. http://en.wikipedia.org/wiki/File:Littorina_littorina.jpg
- Shoreline Image. http://en.wikipedia.org/wiki/File:RI_towns_Narragansett.png