

Name: \_\_\_\_\_

### How Biodiverse is Lake Superior?

Five lakes form what is called the Great Lakes: Huron, Ontario, Michigan, Erie, and Superior. Being so large they have tides and waves, and they are often called inland seas. Lake Superior is the deepest out of the Great Lakes, and the coldest. It is estimated that 53 species of fish inhabit Lake Superior, which includes both native and non-native species. This increases to 88 when you include the wetlands and estuaries. How biodiverse is this?

Biological diversity, or biodiversity, refers to the abundance of species in an area. This can be measured either by counting the number of species (the more biodiverse a region is, the more species that can be found there) or by looking at the chance of finding a new species with each sample (the higher a chance of finding a new species, the more biodiverse the region is).

Write a report that answers the following questions. Be sure to explain all answers and show all work in calculations. Cite all references for any information you had to look up.

1. If you were to measure biodiversity by how many species are in an area, what is a possible way to calculate the baseline (expected) biodiversity?

Answers may vary. One possible solution would be to assume that species are evenly distributed across the planet. We could define expected biodiversity as the number of species in a given area. Say there are 100 land species, divide that by the amount of land on earth and we could have a base of number of land species per unit area.

Another possible solution is to define expected biodiversity as the chance of finding a new species. If you assume that every species has an equal chance of being selected, then the chance would be 1 over the total number of species.

2. Using your answer from question 1, what is the expected biodiversity of Lake Superior? You may have to do some research to get the needed information.

One possible solution: assume an even distribution of species and volume instead of area. There are 170 species of fish in the Great Lakes (<http://www.seagrant.wisc.edu/home/Topics/FishandFisheries.aspx>). The total volume of the Great Lakes is 5439 mi<sup>3</sup> (Wikipedia). Thus we expect  $170 \div 5439 = 0.03$  species per cubic mile.

A second solution, using the total number of fish species in the world, as well as the percent of water being in Lake Superior, results in an estimate of 3150 species.

If one decides to calculate based on chance of finding a new species, one could get  $\frac{1}{88}$ .

3. Find the actual biodiversity of Lake Superior, using the same method you used to calculate your expected biodiversity.

Lake Superior has a volume is  $1180 \text{ mi}^3$ . This gives us an actual biodiversity of  $88 \div 1180 = 0.07$  species per cubic mile.

If doing the chance method, one would need to go out on a trawl and gather data. Take multiple samples and count the number of species. Find how many samples it takes to get a new species, and then calculate the actual chance of finding a new species.

4. Based on your numbers, how would you describe the biodiversity of Lake Superior? Explain.

Going per unit volume, it appears that Lake Superior is higher in biodiversity than the rest of the Great Lakes.

Answers may vary, depending on the other calculations used. For example, if using your estimate from the total fish species, Lake Superior has much fewer than 3150 species and thus is not biodiverse.

5. Lake Superior is known to be oligotrophic, meaning that there is a deficiency of plant nutrients. Does this information change your interpretation of your data? Explain.

Possible answer: If there is a deficiency of plant nutrients, then there should not be a lot of fish, and probably not a lot of fish species. This would lead me to think that my estimates for biodiversity are incorrect.

6. What are some possible downsides to the method you used to calculate biodiversity?
7. Could there be an alternate way to calculate? Explain what this could be.
8. What concepts from algebra did you use to get your calculations?

Possibilities: proportions, percents, probabilities, area, volume.