

Simpson's Diversity Index

Complete the following problems using the equation:
$$D = \frac{N(N-1)}{\sum n(n-1)}$$

Students are not required to memorize this formula but must know the meaning of the symbols:

D = diversity index

Σ = the sum of

N = total number of organisms of all species found

n = number of individuals of a particular species

D is a measure of species richness. A high value of **D** suggests a stable and ancient site, and a low value of **D** could suggest pollution, recent colonization or agricultural management. The index is normally used in studies of vegetation but can also be applied to comparisons of animal (or even all species) diversity.

Example: A lake contains 934 brown trout, 733 smallmouth bass, 34 catfish, 2003 carp, 234 steelheads, and 32 northern pikes.

Fish	Number (n)	n(n-1)
Brown Trout	934	934 x (934-1) = 871422
Smallmouth Bass	733	733 x (732) = 536556
Catfish	34	34 x (33) = 1122
Carp	2003	2003 x (2002)=4010006
Steelheads	234	234 x (233)=54522
Northern Pike	32	32 x (31)=992
Total (N)	3970	$\sum n(n-1) = 5\,474\,620$

$$N(N-1) = 3970 \times 3969 = 15\,756\,930$$

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

$$D = \frac{15\,756\,930}{5\,474\,620} = 2.88$$

Simpson's Diversity Index – Practice Problems

When comparing two or more samples, the location with the larger D has a greater amount of diversity.

Note that a higher total population does not indicate higher diversity.

- a. An area of the Black Forest in Germany contains 134 pitch pines, 24 douglas firs, and 53 red pines.
- b. A meadow contains 1532 chestnut oaks, 342 black cherry trees, 12 white ash trees, and 1022 yellow birches.
- c. Your backyard contains 12 fleas, 34 aphids, 84 ants, 93 beetles, and 1 butterfly.
- d. An African National Park contains 15 lions, 94 giraffes, 1000 wildebeests, 50 elephants, and 5 hyenas.
- e. Mindo (a city in Ecuador) has 832 toucans, 392 red headed barbets, 3 golden headed quetzals, 500 tanagers, 899 parrots, and 50 white capped dippers.

Answer the following questions in your workbook:

1. **Calculate** Simpson's diversity index for each location. Include the table in your workbook.
2. **Distinguish** the differences in diversity between two locations listed above.
3. **Explain** what may lead to those differences.
4. **Outline** the significance of the Simpson's Diversity Index. You may refer to the following online resource and your textbook to help outline your ideas -
<http://www.countrysideinfo.co.uk/simpsons.htm>