

Different levels of biodiversity

Genetic diversity is:

- a building block of life
- responsible for the variability among individuals within any species, based on variations in genes

Genetic variability increases the chance that a species will adapt to changing environmental conditions or impacts, since some individuals will be able to handle the change better than others. The more individuals there are, the greater the chance of genetic variation. Species with a small population of individuals have limited variability and therefore have limited ability to respond to change. This is why populations of “species at risk” can be so difficult to recover. Once you get below a certain number of individuals, it is virtually impossible based on reproductive potential. **Genetic variation is the cornerstone of all biodiversity.**

Population diversity. While we often hear about species, what we generally see and interact with are populations - distinct groups of members of a particular species that have a limited exchange of genetic material among the groups. They can reproduce together but they don't often do so.

As a result, the genetic differences between populations tend to increase, even though the variability within any one population may be less than across the species as a whole. Also, because of the isolation, local impacts on one population may not be felt by another. A conservative first estimate indicates that about 220 populations per species puts the total number of populations world-wide into at least the low billions (Hughes, et. al, 1997).

Extreme population variability can be a double-edged sword. For example, lake trout in Ontario's Great Lakes were once very diverse. There were at least 15 to 20 different forms of lake trout recognized by commercial fishermen before the sea lamprey appeared. The lake trout differed in where they were found, when they spawned, and in their appearance. They were given such names as blacks, redfins, yellowfins, paper bellies, fats, humpers and sand trout. Undoubtedly, the number of genetically distinct populations was much higher.

However, even all this diversity could not withstand over-harvest, sea lamprey predation and loss of habitat, particularly inshore rubble shoals required for spawning. The catches of lake trout plunged to 10% of the original yield in Lake Superior and down to almost nothing in the other Great Lakes. When conditions improved and it came time to try and reintroduce lake trout, the results were disappointing in all but Lake Superior where enough wild populations survived to make a decent comeback.



Northern Lake Superior Shoreline

All those discrete lake trout stocks had evolved for a reason: reproductive success of lake trout in each area. The fish were in effect "tailor-made" for the area. Now many of those stocks have disappeared forever. It will take a lot of time and effort to find stocks that might be reasonable replacements.

Species diversity is all of the different kinds of living things found in a certain habitat or ecosystem. World-wide more than 1.4 million species have been identified (Wilson, 1992) but estimates of the actual number vary from 5 million up to 100 million. Fourteen million appears to be an estimate that is commonly quoted in the literature (Global Biodiversity Assessment, 2001 Summary).

In Ontario, over 30,000 species have been identified including:

- over 20,000 macro-invertebrates (insects, spiders, etc.)

- more than 4,800 plants
- more than 150 fish
- more than 1000 fungi
- 53 reptiles and amphibians
- 479 birds
- 81 mammals

Globally the estimated numbers of species are:

- 35,000 micro-organisms
- 70,000 fungi
- 273,000 plants
- 875,000 invertebrates (insects, spiders, etc.)
- 19,000 fish
- 10,500 reptiles and amphibians
- 9,000 birds
- 4,000 mammals
- 105,000 other animals

(KY Afield, 1997; CFM, 1997)

Species diversity, however, is more than just the number of species in a given area, habitat or ecosystem. Some species' importance can be out of line with their numbers, for example *keystone species*. There can also be great differences in species composition over time. Species diversity can also be greatly affected by physical conditions in the ecosystems where they live, such as differences in temperature, light, structure and chemical composition.

The point is, biodiversity cannot be reduced to a single number. There are dimensions to diversity, many of them.

Ecosystem diversity is the variety of ecosystems within a landscape or region including wetlands, prairies or savannahs, lakes and rivers, forests and agricultural landscapes. The basic principles of biodiversity apply here as well but the scope is much larger. It is at this level that the interactions and links among species and the consequences of those links are evident. Less diverse ecosystems, such as coldwater streams or small lake trout lakes, contribute to the functioning and productivity of larger areas such as bioregions.