Exposing diversity: using DNA barcoding to identify more fish species in North America’s fresh water ecosystems

What is this research about?

Freshwater fish in North America are threatened by varied impacts including habitat alteration, pollution, climate change, and overfishing. Understanding the current diversity of fish species will help us understand how to manage fish populations and how fish fit into the larger environment. Even though scientists have been looking at and classifying fish for many years, new research suggests that 1 in 10 freshwater fish lineages have gone unrecognized and may form distinct species.

Past research has focused primarily on the physical or morphological features of fishes to classify them into different species. However, the appearance of fish can be misleading, particularly given the profound changes they undergo during their life cycle. A new way to examine the classification of fish species uses DNA barcoding, a method of species identification and discovery that uses a short, standardized portion of mitochondrial DNA. This research created a DNA barcode reference library for more than 80% of named freshwater fish in North America. The research also identified where fish of different species had been incorrectly classified together, and where fish previously labelled as different species were in fact the same.

What did the researchers do?

The researchers collected tissues from 902 species of fish living north of Mexico, taking multiple samples from each species whenever possible, from museum reference specimens identified by experts. This research created a library of DNA barcodes for 752 species. This project is part of the Fish Barcode of Life (FISH-BOL) initiative (http://www.fishbol.org), a global program with the aim of gathering DNA barcodes for all the world’s fishes (~31,000 species).

How can you use this research?

Ecologists can use the barcodes from this study to reconstruct food webs. Conservationists can use the barcodes from this study to identify fish eggs and larvae to help determine how well current efforts to reconstruct fish spawning habitats are working. Barcoding is also a great resource to monitoring programs that require accurate identification of immature fishes (since it can be used at any time during the life cycle).

What you need to know:

DNA barcoding is a technique that can distinguish between known species and help flag the existence of new ones. Using the DNA barcoding technique, researchers found about 28% more lineage diversity in fresh water fishes than had been previously identified using traditional approaches. This technique can be used to discover the diversity on a genetic level, which is hidden to the human eye.
What did the researchers find?

The researchers found that 90% of known species can be identified using barcodes. The DNA barcoding revealed that there were 28% more genetically divergent lineages of fishes living in North America than the previous number of species identified by experts through appearance. In addition, some fish thought to be from different species based on their appearance turned out to have identical DNA barcodes, suggesting they were actually from the same species. Similarly, DNA barcoding can also identify different species that have recently separated from other species and can help link certain species to a particular body of water.

This study revealed that there are more species of North American freshwater fish than previously thought, despite many decades of traditional taxonomic research. The results reveal that DNA barcoding helps to show which morphologically-based species are genetically distinct and which morphological differences are ‘plastic’ and do not occur on a DNA level. DNA barcoding in this study was able to improve understanding of current differences between species and highlighted the existence of cryptic biodiversity in North American fishes.

Keywords:
DNA Barcoding, taxonomy, fresh water fish, DNA, biodiversity, fish identification, evolution, aquatic ecosystem

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