Unraveling why distantly related species look similar in *Haplochromis* cichlid fishes

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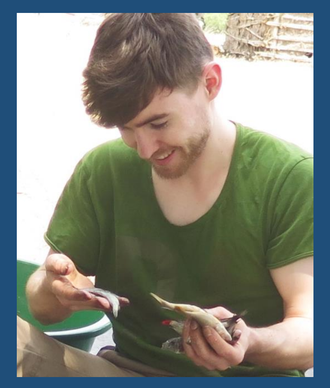

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Introduction

Speciation is the process when a single species splits into two or more distinct species. This happens faster in some species than in others. For example, modern humans evolved 200 thousand years ago and remained a single species since. During the same period, *Haplochromis*, a genus of African cichlid fishes, evolved from a single population into more than 700 species within Lakes Albert, Edward, Kivu, and Victoria. These cichlid species look different from each other and display strong differences in diet and habitats. While species that live within the same lake look different from each other, they often resemble species from other lakes.

Why do species from different lakes look so similar? To investigate this question, we collected genomic (DNA) data to determine how species are related to each other and if their genomes can reveal us how these strong similarities evolved.

Algae eaters

Many algae eaters have rounded heads and broad oral jaws set with many rows of closely set teeth that enable them to scrape algae from rocks

Snail eaters

Many snail eaters crush the shells of snails using strongly enlarged pharyngeal jaws (an additional set of jaws in the back of their throats)

Fish eaters

Many fish eaters have elongated bodies and long oral jaws with sharp teeth to actively hunt or ambush fish

Looking at DNA

We collected genomic (DNA) data from nearly all species from Lakes Albert, Edward, and Kivu and from several species from Lake Victoria. We reconstructed how these species are related to each other using the whole genome. This revealed that all species from Lake Victoria are more closely related to each other than to any other species. The same is true for all species from Lake Albert. However, this is not the case for the species from Lakes Edward and Kivu, most species from these lakes form one large cluster. Hereby, the species from these four lakes form three replicate evolutionary radiations, meaning that the strong similarities between these species evolved at least three separate times.

Genomes are complex and species are not always related in the same way in all regions of the genome. For example, in some small genomic regions (here referred to as genes), we found that most fish eaters from different lakes are more closely related to each other than to species from the same lake. This might partly explain why distantly related fish eaters from different lakes look very similar.

We will further investigate how these distantly related species acquired the same genes and whether these genes can truly explain the observed similarities between these species.