DNA Barcoding Discriminates Freshwater Fishes from Southeastern Nigeria and Provides River System Level Phylogeographic Resolution within some Species

Chris Nwani[1], Becker Sven[2], Robert Hanner[2], Okechukwu Okogwu[1]

[1] Ebonyi State University, Dept. of Applied Biology, Nigeria
[2] University of Guelph, Dept. of Integrative Biology, Canada

Abstract

Fishes are the main animal protein source for human beings and play a vital role in aquatic ecosystems and food webs. For sustainable exploitation of fishery resources, a comprehensive understanding of the ichthyofaunal composition of the water bodies is crucial. However, unambiguous identification of fish species is problematic for fisheries development in Africa, since taxonomic expertise and comprehensive taxonomic keys are often lacking Fish identification can be challenging, due to high diversity, and this is particularly true for larval forms or fragmentary remains. DNA barcoding, which uses the 5' region of the mitochondrial cytochrome c oxidase subunit I (cox1) as a target gene, is an efficient method for standardised species-level identification for biodiversity assessment and conservation, pending the establishment of reference sequence libraries.

In this study, fishes were collected from three rivers in southeastern Nigeria, identified morphologically, and imaged digitally. DNA was extracted, PCR-amplified, and the standard barcode region was bidirectionally sequenced for 363 individuals belonging to 70 species in 38 genera. All specimen provenance data and associated sequence information were recorded in the barcode of life data systems (BOLD; www.barcodinglife.org). Analytical tools on BOLD were used to assess the performance of barcoding to identify species.

Using neighbour-joining distance comparison, the average genetic distance was 60-fold higher between species than within species, as pairwise genetic distance estimates averaged 10.29 % among congeners and only 0.17 % among conspecifics. Despite low levels of divergence within species, we observed river system-specific haplotype partitioning within eight species (11.4 % of all species). Our preliminary results suggest that DNA barcoding is very effective for species identification of Nigerian freshwater fishes.

Keywords: Cytochrome c oxidase subunit 1-COI, DNA barcoding, freshwater fishes, mtDNA, Nigeria, phylogeographic structure

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