Avian Genomics Celebrates 22 Years of Annoying Birdwatchers

by CLIFF DOMINY

May 13, 2001: I remember it now - my wife and I were exploring the Peruvian cloud forest somewhere above Aguas Calientes. A power outage in the valley had delayed our train, allowing us to venture out of town for a bit of birdwatching and photography. Fortunately, this was not a problem—the weather was bird-perfect, and my trusty 35mm film camera wouldn't need a charge for another six months.

That day, we added the Andean Motmot and several other species to our life list. But nature had more to offer—enter the Rufous Antpitta. The charming little bird appeared, hopped about for a fleeting moment and then vanished, as birds do, for better grubs in an adjacent inaccessible ravine.

Today, with a wistful smile, I reflect on that moment. Then I delete the Rufous Antpitta from my 2025 World List. You see, it is no longer a recognised species. Ornithologists promoted its twelve former subspecies to separate species, so it must be removed.

My inner toddler blames avian genomics for this- allow me to elaborate.

Genomics: what's in a name?
An animal's genome is the sum total of all its DNA - every base pair, every gene from every chromosome. Avian genomics is, therefore, a powerful new tool that allows ornithologists to refine the Class Aves (Bird) family tree with unprecedented accuracy. Comparing the entire genomes of the world's birds to each other is an essential addition to the classical science of taxonomy, which constructed the existing Bird Family Tree based on anatomy, plumage, range, and calls.

Genomics: the B10K project
The Bird 10,000 Genomes Project, called the B10K Project, is behind the rapid accumulation of genomic data. B10K has an ambitious agenda- to sequence the genome of every species of bird on Earth. Launched in 2010, the project achieved a significant milestone in 2014, having sequenced representatives from 34 of the 40 recognised bird orders. By 2020, the focus shifted to sequencing at the family level, completing genomes for 218 of the 248 recognised bird families—a remarkable achievement. See the reference below.

The ultimate goal of B10K is to sequence every bird genus and species. Currently, the project has completed genomes for 3811 bird species, about one-third of the world's total. As more results pour in, it might have to change its name to B12K.

Genomics: resetting the clock
By analysing various bird genes, scientists have created a "molecular clock" The more the genes differ from one another, the further back in time their hosts would have shared a common ancestor. Genomics can compare entire genomes and has brought unparalleled precision to the process.

The avian fossil record shows that birds experienced a rapid species radiation about 65 million years ago (Mya). This coincided with the meteor impact in the Gulf of Mexico that killed the dinosaurs. It makes perfect sense—the proto-birds that survived the meteor strike had their choice of empty habitats to colonise, which expanded the diversity of species on Earth. Indeed, most passerines, Earth's most diverse bird order, evolved from this event.

The B10K project has uncovered some interesting insights into the exact sequence of this evolution. According to their paper at https://pubmed.ncbi.nlm.nih.gov/38560995/ ancestors of the modern-day *Mirandithornes* (flamingoes and grebes) and *Columbaves* (pigeons, doves, and sandgrouse) had evolved two million years before the extinction event. Here is genetic proof that doves and cockroaches can survive anything!

The other perching birds (passerines) appeared about 54 Mya and rapidly expanded from around 20 Mya to give us the species diversity our ancestors would have enjoyed.

Genomics: fine-tuning the details
Of course, to be fair, there are now more species on the planet than ever before, thanks again to the B10K project. Genomics excels at high-resolution science. Therefore, it was no surprise when things became complicated at the species level of the family tree.

In 2024, we gained a net 125 bird species, 141 achieved by splitting former subspecies, Antpitta style, into separate species, and 16 species lost to "lumping"—the opposite process. The latest Clements World Checklist of Birds now recognises 11145 bird species … for now.

Genomics: raising the dead
Genomics also plays a critical role in the conservation of endangered species. The little bush moa of New Zealand is unaware of its place in genomic history—understandably so, as the species has been extinct for seven hundred years. In June 2024, this flightless bird, the size of a turkey, became the latest species to have its genome sequenced.

The research, conducted at Harvard University, sparked fascinating discussions about the potential to one day bring the little bush moa back to life. While such an idea is currently in the realm of science fiction, future technology may indeed make this possible.

Genomics: the way forward
In 1819, German explorer and conservationist Johan Spix shot a little blue macaw while exploring Brazil. This bird, later named the Spix's Macaw, has ever since suffered a gradual but inevitable decline because of habitat destruction and poaching. Parrot collectors will pay a premium for the species.

By 1995, scientists had identified just one surviving male in the wild. Efforts to introduce a captive female into his territory ended tragically when the new bird collided with a power line.

In 2019, the Spix's Macaw received an official declaration of extinction in the wild. However, avian genomics offered hope. Researchers analysed the genomic diversity of the 30 remaining captive birds to begin a breeding program.

In 2022, conservationists released eight genetically diverse Spix's Macaws into the wild, with plans for more releases in the future. While it's too early to determine the success of this initiative, it highlights the critical role genomics plays in the conservation and breeding of endangered species.

Genomics is a force for good, and it is here to stay. Its scientific insights and conservation benefits far outweigh the feelings of any particular life-list. Perhaps a return to South America may be in order; after all, there are twelve new antpittas to be found.

Reference: Stiller J, Feng S, Chowdhury AA, et al. Complexity of avian evolution revealed by family-level genomes. *Nature*. 2024; (8013):851-860. doi:10.1038/s41586-024-07323-1

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New – Policy Acknowledgement Form

The HNC's Board of Directors has recently approved new policies related to the health and safety of all individuals associated with HNC activities. **All volunteers are required to review the policies and sign an online form** acknowledging that they have read and understood the policies. This requirement was introduced at the prompt of HNC's insurer and requirements from a granting agency; these policies and signing requirement align with how other local organizations manage their volunteers.

If you are a volunteer with HNC activities, please review the Policies and sign the online form.

Questions can be directed to HNC's Volunteer Director, Charlie Briggs, volunteer@hamiltonnature.org.

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