

## ScienceWatch – Who Killed the Carolina Parakeet?



**“The lack of signs of small population sizes for a long period of time indicates its extinction was an abrupt process and this makes it more likely it was human-mediated.” - C. Lalueza-Fox**

Once upon a time North America had an endemic parrot, the only one. Once it was here and then it wasn't.

The foot-long Carolina parakeet (*Conuropsis carolinensis*) ranged from the Atlantic coast to the mid-western states. Yellow and green with a bright orange face, the parrots created a colorful tableau wherever they landed.

Upon viewing a flock alight in a farmer's field, John James Audubon wrote in 1830, “They present to the eye the same effect as if a brilliantly colored carpet had been thrown over them.”

Less than a century later the Carolina parakeet disappeared in the wild, and when the last one in captivity died in 1918, the bird was declared extinct. But what killed them off? Now a team led by evolutionary biologist Carles Lalueza-Fox at Pompeu Fabra University, Barcelona, Spain, has found clues that may explain the bird's extinction. Their research is published in the January 6, 2020 issue of *Current Biology*.

The research team extracted DNA from a femur and toe pads of a Carolina parakeet collected in the early 1900's. DNA molecules get chopped up with age, and the team ended up with over 200 million DNA fragments. So they used the genome of the Carolina parakeet's nearest relative, the sun parakeet (*Aratinga solstitialis*), as a guide to assemble the pieces in the right order to reconstruct the Carolina parakeet's entire genome.

Analysis of the reconstructed genome showed that the Carolina parakeet and sun parakeet lineages split off from each other 2.8 million years ago just when the Isthmus of Panama was rising up to connect North and South America, allowing the Carolina parakeet's ancestors to move northward.

As the birds spread into the temperate forests of North America they gained hundreds of mutations that enabled them to cope with their new environment. For example, they ate a variety of plants but were the only birds known to eat the toxic seed pods of cockleburs (*Xanthium strumarium*), which is widespread in the north. Cockleburs make a toxin that attacks components of the mitochondria, which produce cellular energy. The team found that two mutations had altered the mitochondria making the parrots resistant to the poison.

Knowing the full genetic blueprint of the Carolina parakeet has led to speculation that it, like the mammoth and the passenger pigeon, should join the roster for de-extinction (<http://hras.org/sw/swsep2013.htm>). But Lalueza-Fox believes that would be an “enormous challenge” and not worth the effort until we could guarantee the bird's survival in the wild.

What killed the Carolina parakeet? The birds were shot for sport and also for their feathers that were used for hats, which could have caused their demise. But some have argued that the parrots had to compete for nesting hollows with imported honeybees or that some poultry disease wiped them out.

The answer lies in the fact that the genome sequenced by the team did not contain the signals of recent inbreeding typically found when an endangered species, with few individuals, is dying out. The genome showed lots of heterogeneity, indicating the parents of that bird still had a variety of genetic differences.

Whatever killed it “was something quick that left no mark in the genome. The inference is that this bird was not subjected to a very long demographic decline for thousands of years, it was something very quick,” said Lalueza-Fox.

The research paper ends this way: “... scarce evidence of inbreeding indicates that it suffered a very quick extinction process [and] the bird’s final extinction was likely accelerated by collectors and trappers when it became evident that it was extremely rare ... Therefore, the abrupt disappearance of the Carolina parakeet seems to be directly attributable to human pressures.”

It can’t be any clearer; we did it.

Saul Scheinbach