DNA evidence suggests humans hunted moa to extinction

March 18 2014, by Bob Yirka

Giant Haast's eagle attacking New Zealand moa. Artwork: John Megahan. Copyright: PLoS Biology. Via Wikipedia.

(Phys.org) —A new study conducted by an international team of researchers points to humans as the cause of the sudden extinction of all species of moa in New Zealand approximately 600 years ago. In their paper published in *Proceedings of the National Academy of Sciences*, the team describes DNA testing they carried out, along with archeological evidence, which they claim, proves that humans were the cause of the demise of the large flightless birds.

Moa were endemic to New Zealand—prior research has suggested they likely evolved to their flightless state over millions of years. Their closest relatives are South American birds known as tinamous—which can fly.

Prior research has suggested that moa were already a declining species when humans (Polynesians in 1300) first arrived in New Zealand, due to volcanic or other environmental factors. In this new effort, the research team refutes earlier findings, claiming that they have evidence that proves that humans were solely responsible for the birds' demise.

To find out if the birds were in decline, the researchers performed two types of DNA analysis (mitochondrial and nuclear) on 281 different sets of fossilized bones from four different species. The age of the specimens ranged from 12,966 to just 602 years ago. In so doing they found no evidence of a species in decline. Normally, they note, a species in trouble becomes less genetically diverse as the population dwindles. In the case of the moa, there were no such signs, instead, it appeared the population was healthy and even growing right up to the time that humans first appeared. Two hundred years later, they were all gone.

The researchers note that prior to the arrival of humans, the moa had just one predator, a type of large (Haast's) eagle that has also gone extinct, likely due to the demise of its main food source. There is no evidence that Haast's eagles increased in population, decimating the moa. The team also notes that large mounds of moa bones have been found at various sites, which also included eggshells. The archeological evidence suggests humans ate moa at all stages of their life, which would of course have made it very difficult for the birds to reproduce.

Taken together, the researchers conclude, the evidence indicates that the sole blame for the extinction of the moa lies with early humans who hunted them to extinction.

More information: Extinct New Zealand megafauna were not in decline before human colonization, Morten Erik Allentoft, *PNAS*, DOI: 10.1073/pnas.1314972111

Abstract

The extinction of New Zealand's moa (Aves: Dinornithiformes) followed the arrival of humans in the late 13th century and was the final event of the prehistoric Late Quaternary megafauna extinctions. Determining the state of the moa populations in the pre-extinction period is fundamental to understanding the causes of the event. We sampled 281 moa individuals and combined radiocarbon dating with ancient DNA analyses to help resolve the extinction debate and gain insights into moa biology. The samples, which were predominantly from the last 4,000 years preceding the extinction, represent four sympatric moa species excavated from five adjacent fossil deposits. We characterized the moa assemblage using mitochondrial DNA and nuclear microsatellite markers developed specifically for moa. Although genetic diversity differed significantly among the four species, we found that the millennia preceding the extinction were characterized by a remarkable degree of genetic stability in all species, with no loss of heterozygosity and no shifts in allele frequencies over time. The extinction event itself was too rapid to be manifested in the moa gene pools. Contradicting previous claims of a decline in moa before Polynesian settlement in New Zealand, our findings indicate that the populations were large and stable before suddenly disappearing. This interpretation is supported by approximate Bayesian computation analyses. Our analyses consolidate the disappearance of moa as the most rapid, human-facilitated megafauna extinction documented to date.

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