Researchers Rewrite Evolutionary History for Polar Bear Using Genomic Analyses

A team of U.S. and European scientists, including research geneticist Dr. Steven Fain of the U.S. Fish and Wildlife Service's National Fish and Wildlife Forensics Laboratory in Ashland, Oregon, have concluded that the polar bear is a much older and genetically more distinct species than previously thought.

The group, which was lead by Dr. Frank Hailer of the Biodiversity and Climate Research Centre in Frankfurt, Germany, published its findings in the April 20, 2012 issue of the journal *Science.*

Previous genetic studies of polar bear evolution focused mainly on mitochondrial DNA, which represents only a small portion of the entire genome. In 2010, scientists working with this more limited genetic data concluded that polar bears had diverged from brown bears some 150,000 years ago, making the species an example of surprisingly rapid adaptation to colder climates for a mammal.

The new genomic analyses, which take an in-depth look at the genetic information in cell nuclei from multiple polar, brown and black bears, date species evolution for the polar bear to 600,000 years ago – some five times earlier.

"Our approach gave us many more genetic markers to work with than were available from the standard DNA studies," said Fain.

This revised evolutionary history means that polar bear ancestors adapted to cold climatic conditions over a much longer period of time. The study also shows that polar bears demonstrate much less genetic diversity than brown bears, possibly due to population reductions in response to previous climate warming cycles.

Researchers note, however, that while the species has obviously survived those cycles in the past, this new study raises questions about potential polar bear adaptability during the current period of much more rapid and potentially greater magnitude climate change.

"The species is also simultaneously facing other threats that would not have been an issue in the past," explained Fain, pointing to both human-bear conflict and predation and the increased persistence of chemicals in the animals' food chain as examples.

Fain and his colleagues at the Service Forensic Laboratory anticipate that detailed genomic studies of this type will prove particularly useful in species identification work requiring an understanding of the record of hybridization among species.

"Mitochondrial DNA is widely used in both human and wildlife forensic genetics to determine the species and geographic origin of biological evidence. But this marker only reflects the maternal line of inheritance and cannot be used to detect interspecies hybrids," said Fain. "In contrast, nuclear DNA markers unambiguously document hybrid origin and are particularly useful in analyzing forensic evidence, which is often degraded or from mixed sources."

Forensic Laboratory scientists are currently employing the procedure used in the polar bear study to identify species-specific nuclear makers in wolves and other North American canids.

Co-authors of the *Science* paper include scientists from the Goethe University Frankfurt's Institute for Ecology, Evolution and Diversity in Frankfurt, Germany; the Conservation and Evolutionary Genetics Group, Estación Biológica de Doñana in Seville, Spain; and the Lund University Hospital in Lund, Sweden.

The National Fish and Wildlife Forensics Laboratory provides forensic analyses to help Service special agents and wildlife inspectors investigate wildlife crimes. Lab scientists, who typically examine some 2,400 pieces of evidence each year, also conduct research and contribute new findings and techniques to the field of wildlife forensics.

To learn more about the Lab, visit http://www.lab.fws.gov/ .

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