



Influence of Climate Warming on Arctic Mammals? New Insights from Ancient DNA Studies of the collared lemming *Dicrostonyx torquatus*.

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Global temperature increased by approximately half a degree (Celsius) within the last 150 years. Even this moderate warming had major impacts on Earth's ecological and biological systems, especially in the Arctic where the magnitude of abiotic changes even exceeds those in temperate and tropical biomes. Therefore, understanding the biological consequences of climate change on high latitudes is of critical importance for future conservation of the species living in this habitat. The past 25,000 years can be used as a model for such changes, as they were marked by prominent climatic changes that influenced geographic distribution, demographic history and pattern of genetic variation of many extant species. We sequenced ancient and modern DNA of the collared lemming (*Dicrostonyx torquatus*), which is a key species of the arctic biota, from a single site (Pymva Shor, Northern Pre Urals, Russia) to see if climate warming events after the Last Glacial Maximum (LGM) had detectable effects on the genetic variation of this arctic rodent species, which is strongly associated with cold and dry climate.

Using three dimensional network reconstruction and model-based approaches such as Approximate Bayesian Computation and Markov Chain Monte Carlo based Bayesian inference we show that there is evidence for a population decline in the collared lemming following the LGM, with the population size dropping to a minimum during the Greenland Interstadial 1 (Blling/Allerd) warming phase at 14.5 kyrs BP.

Our results show that previous climate warming events had a strong influence on collared lemming populations. A similar population reduction due to predicted future climate change would have severe effects on the arctic ecosystem, as collared lemmings are a key species in the trophic interactions and ecosystem processes in the Arctic.