Invasive humans

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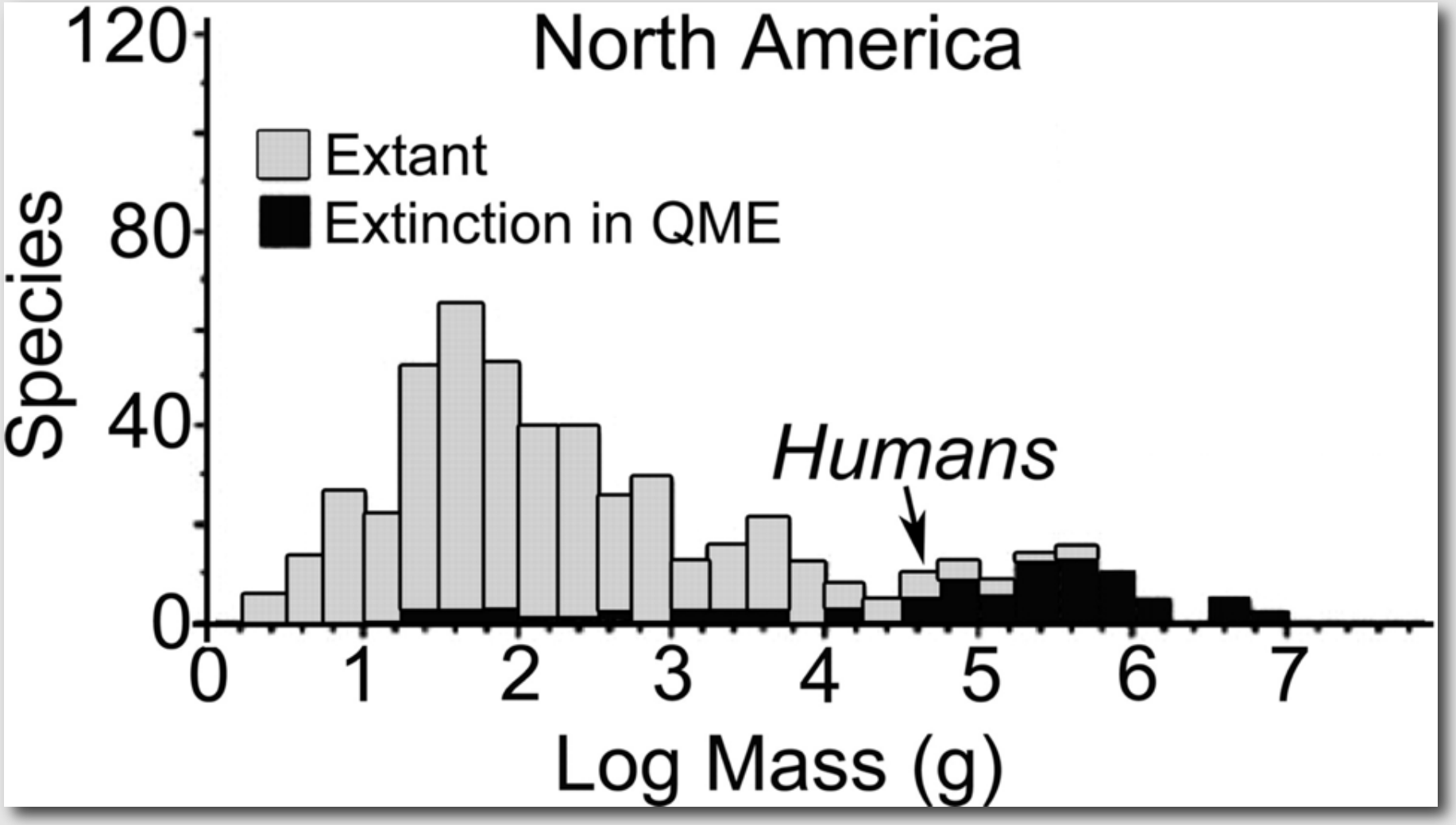
EEB464 Fall 2019

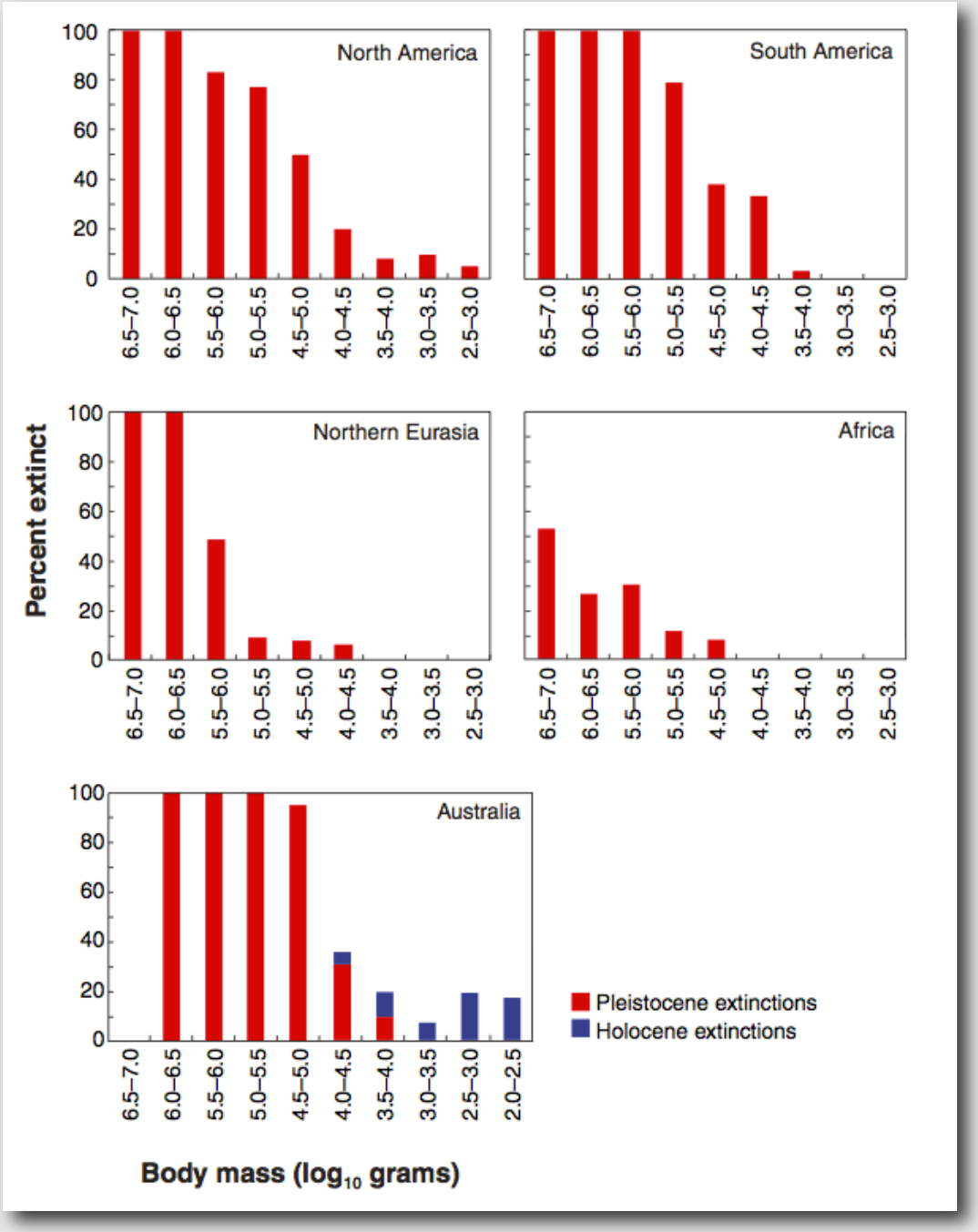
Learning objectives

- Identify potential causes of Quaternary mass extinction
- Find biases in which groups went extinct
- Learn about ways we can test ideas of potential causes

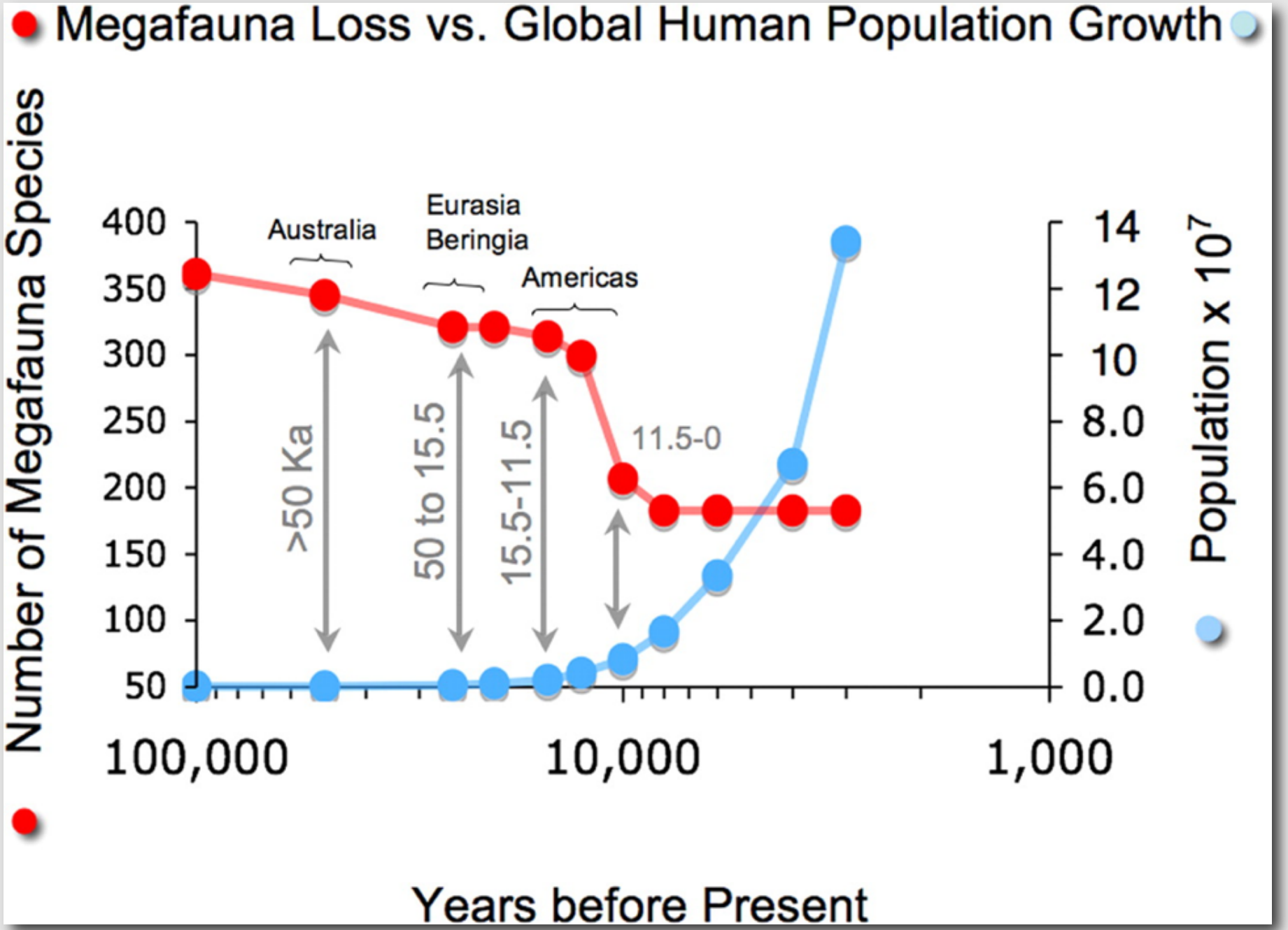
https://genographic.nationalgeographic.com/human-journey/



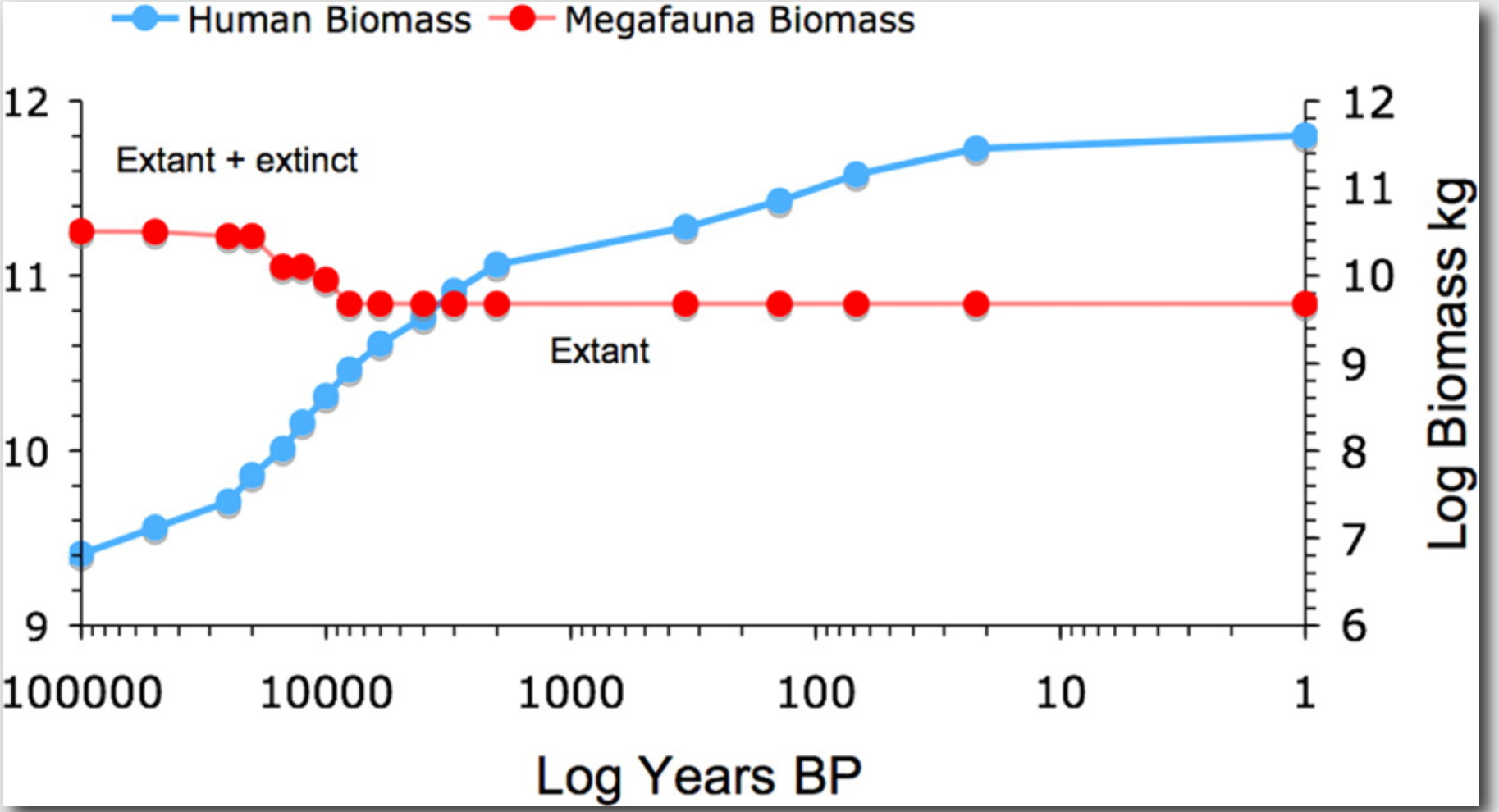
Barnosky 2008



Koch and Barnosky 2006



Barnosky 2008



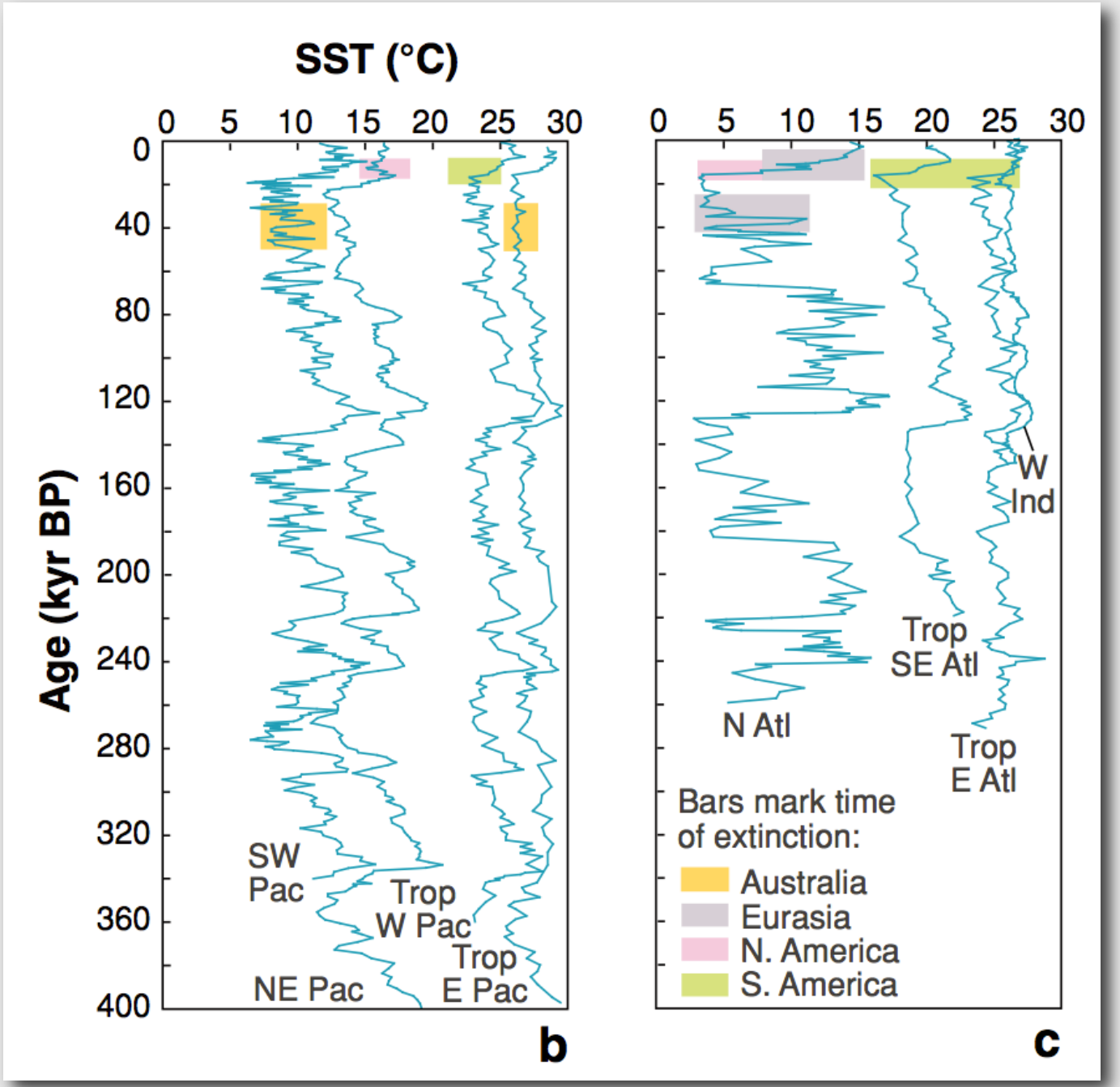
Barnosky 2008

Table 1 Hypotheses to explain the late Quaternary extinctions

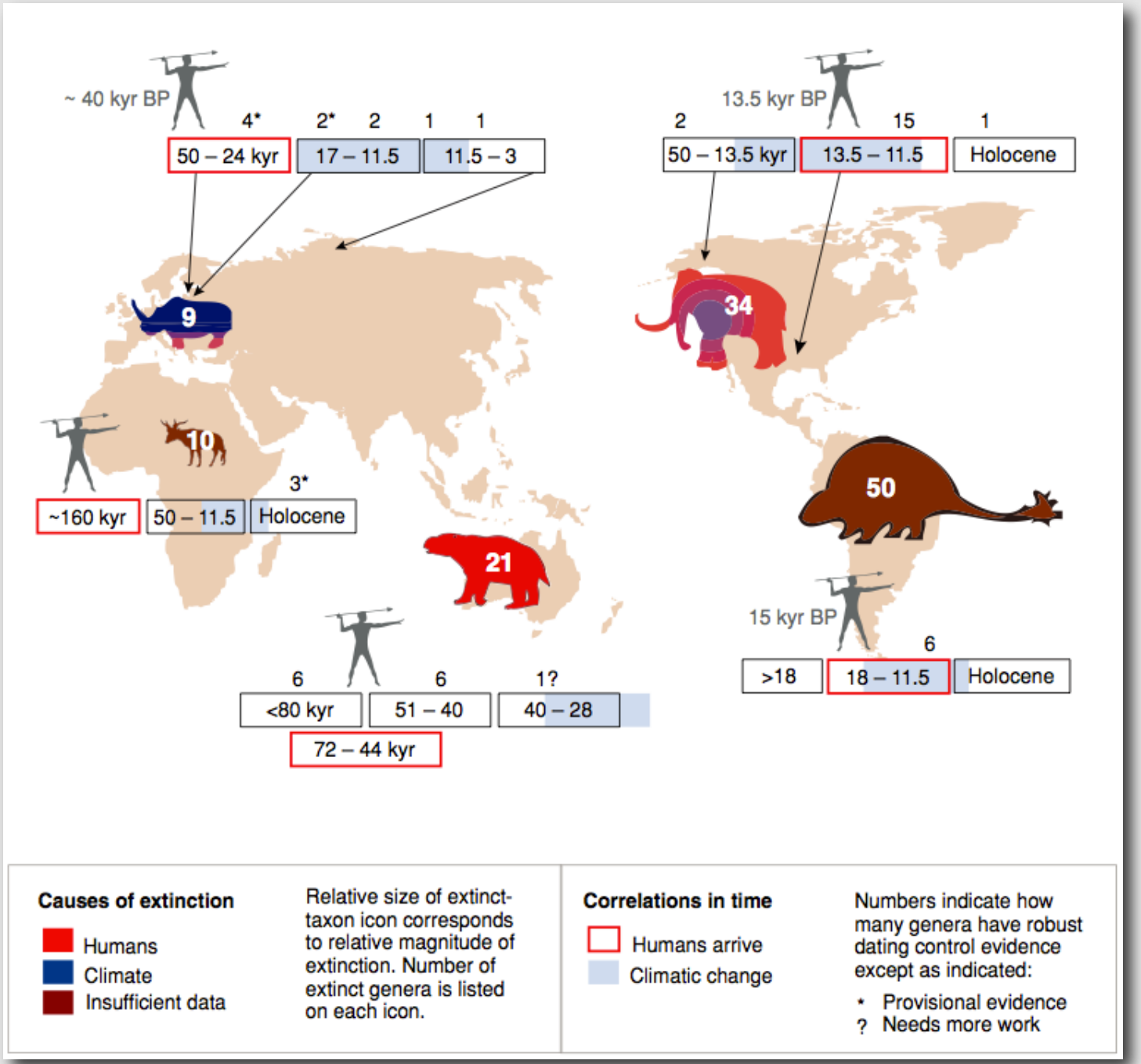
Type or name	Description
Environmental hypotheses	
Catastrophes	Megadrought, rapid cooling, bolide impact?
Habitat loss	Preferred habitat types lost or too fragmented
Mosaic-nutrient hypothesis	Loss of floras with high local diversity
Co-evolutionary disequilibrium	Disruption of coevolved plant-animal interactions due to flora rearrangement
Self-organized instability	Collapse of system due to intrinsic dynamics
Human impacts other than hunting	
Habitat alteration	Loss or fragmentation of viable habitat due to human impacts, including fires
Introduced predators	Direct predation by dogs, rats, cats, pigs, etc.
Hyper-disease	Introduction of virulent diseases
Overkill hypotheses	
Blitzkrieg	Rapid loss of prey due to overhunting
Protracted overkill	Loss of prey after prolonged interaction with predator
Combined hypotheses	
Keystone megaherbivores	Ecosystem collapse due to loss of landscape altering megaherbivores, perhaps with increase in fire
Prey-switching	Nonhuman carnivores switch prey as humans usurp preferred prey
Predator avoidance	Herbivores restricted to inviable refugia

Modified from Burney & Flannery (2005).

Koch and Barnosky 2006



Koch and Barnosky 2006



Koch and Barnosky 2006

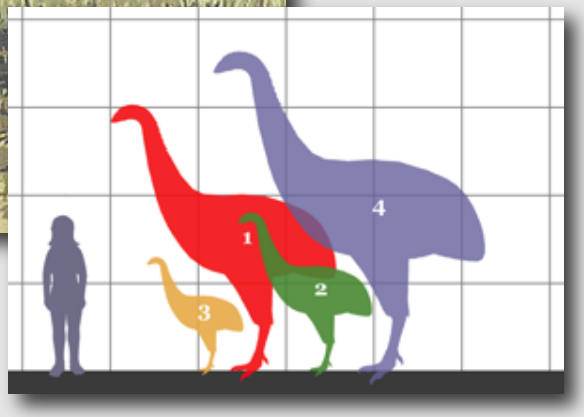
Robust dating verifies simultaneous climate change and the first contact with substantial human populations in the conterminous United States, where extinctions were rapid and pronounced. Support for human impacts includes (a) indisputable hunting of two extinct species, (b) clustering of extinctions within 1500 years (perhaps less) of first contact with Clovis hunters, (c) widespread distribution of Clovis hunters, (d) simulations, and (e) more pronounced extinction than in earlier glacial-interglacial transitions. On a broader North American scale, the demise of megafaunal species without significant human presence in Alaska is consistent with a stronger role for climate at the edges of species' geographic ranges.

SUMMARY POINTS

1. Between fifty and ten thousand years ago, most large mammals became extinct everywhere except Africa.
2. This extinction, with its extreme focus on large and slow-breeding animals, was unusual relative to extinctions earlier in the Cenozoic.
3. The unusual body-size selectivity of the extinction, and its rough synchrony with the global geographic expansion of modern humans are compelling evidence that the extinction was precipitated by human activities, especially hunting.
4. Climate change likely affected the timing, geography, and perhaps magnitude of this anthropogenically triggered extinction.
5. The intersection of rapid climate change with initial human contact seemed especially deadly for megafauna.
6. The extinction of so many species in near-time raises vexing questions for ecologists and conservation biologists.

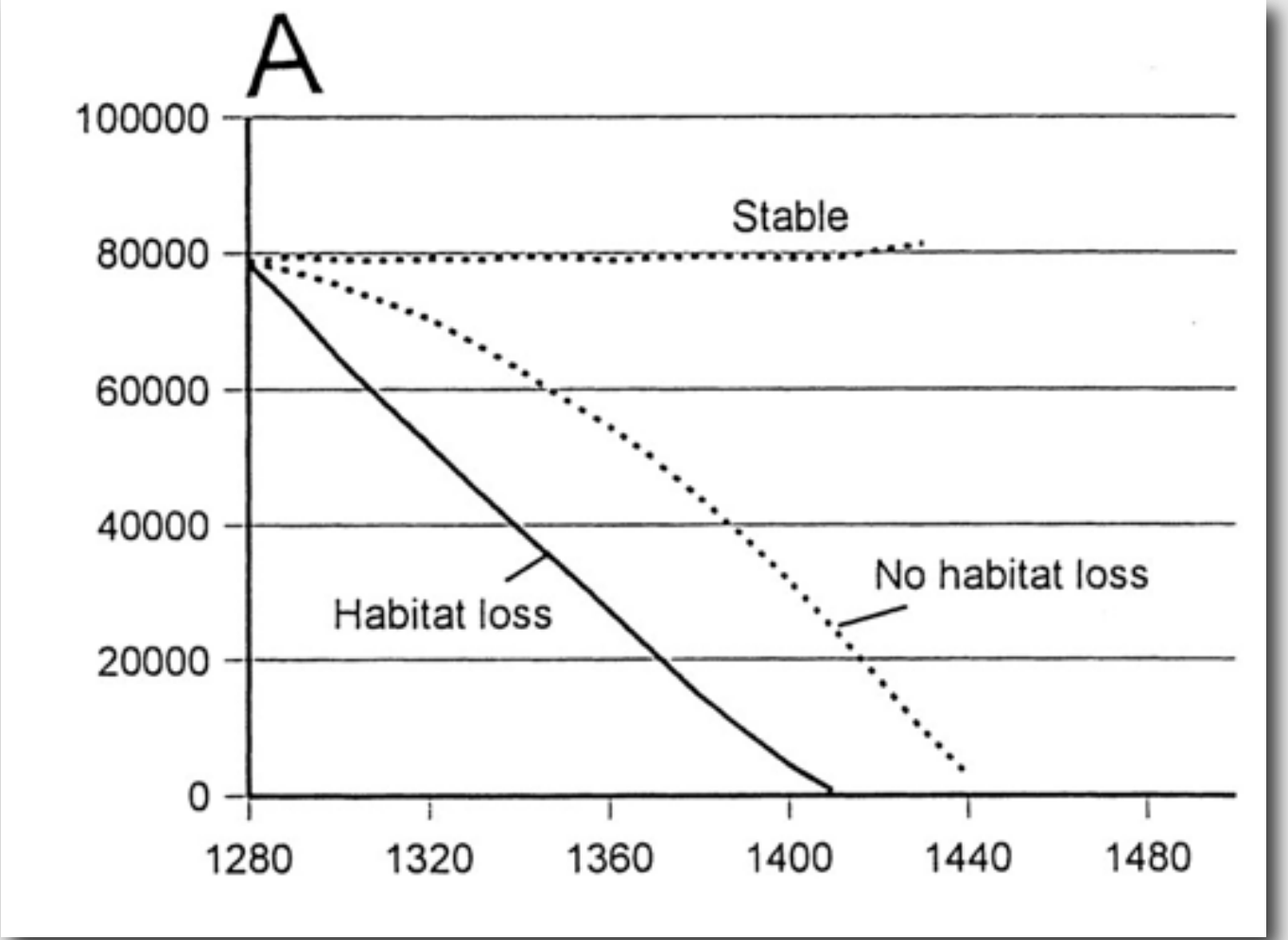
Koch and Barnosky 2006

John Megahan



The objective was to explore the effects on the total moa population of low levels of exploitation concomitant with a small initial human population, coupled with the habitat loss induced by those people. For the model to be conservative and not to underestimate the time to moa extinction, we used an initial population of 100 people. We also selected low to medium human population growth rates, minimal rates of habitat removal in only two areas of the two main islands of New Zealand, and the lowest cropping rates suggested by Anderson. We estimated the total population of moas (all species) at the time of human settlement, from a regional analysis of distribution and abundance, to be 158,000 birds, which is about twice the population previously suggested. Only consumption of adult moas (>1 year old) was considered. Consumption of moa eggs, known to have been considerable, was ignored. **At all stages, therefore, we chose population sizes and parameters that would minimize losses to the moa population, to ensure that the model would not underestimate the duration of the extinction process.**

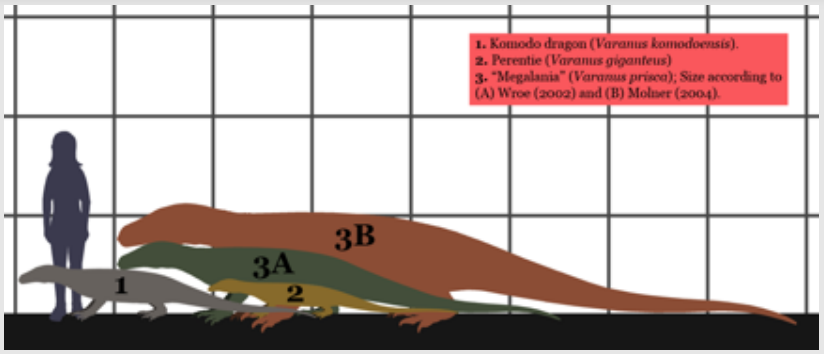
Holdaway and Jacomb, 2000

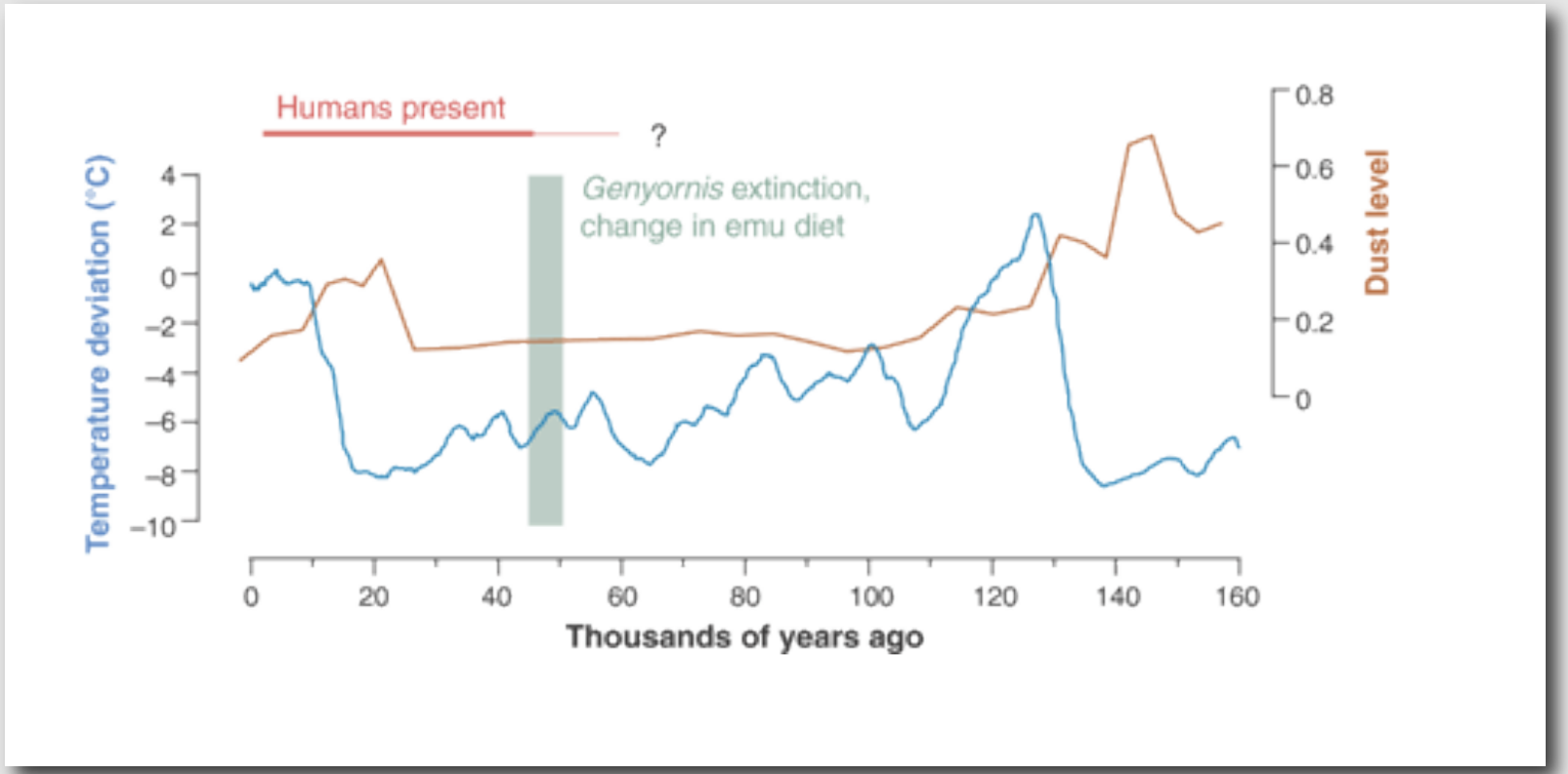


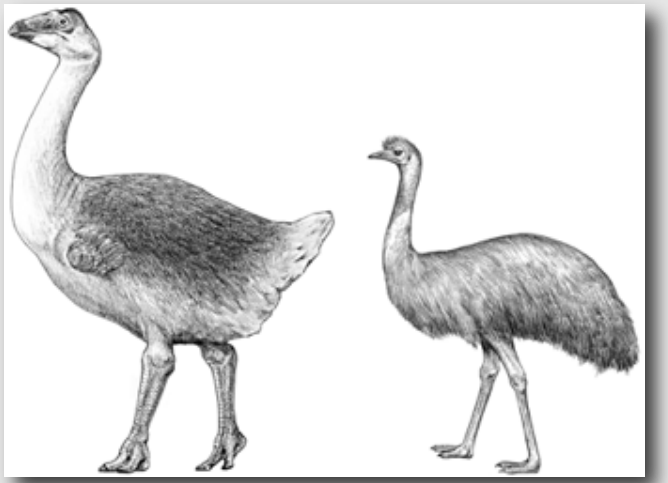
One female moa per 20 people per week; human population 100, increasing at 1% p.a.

Holdaway and Jacomb, 2000

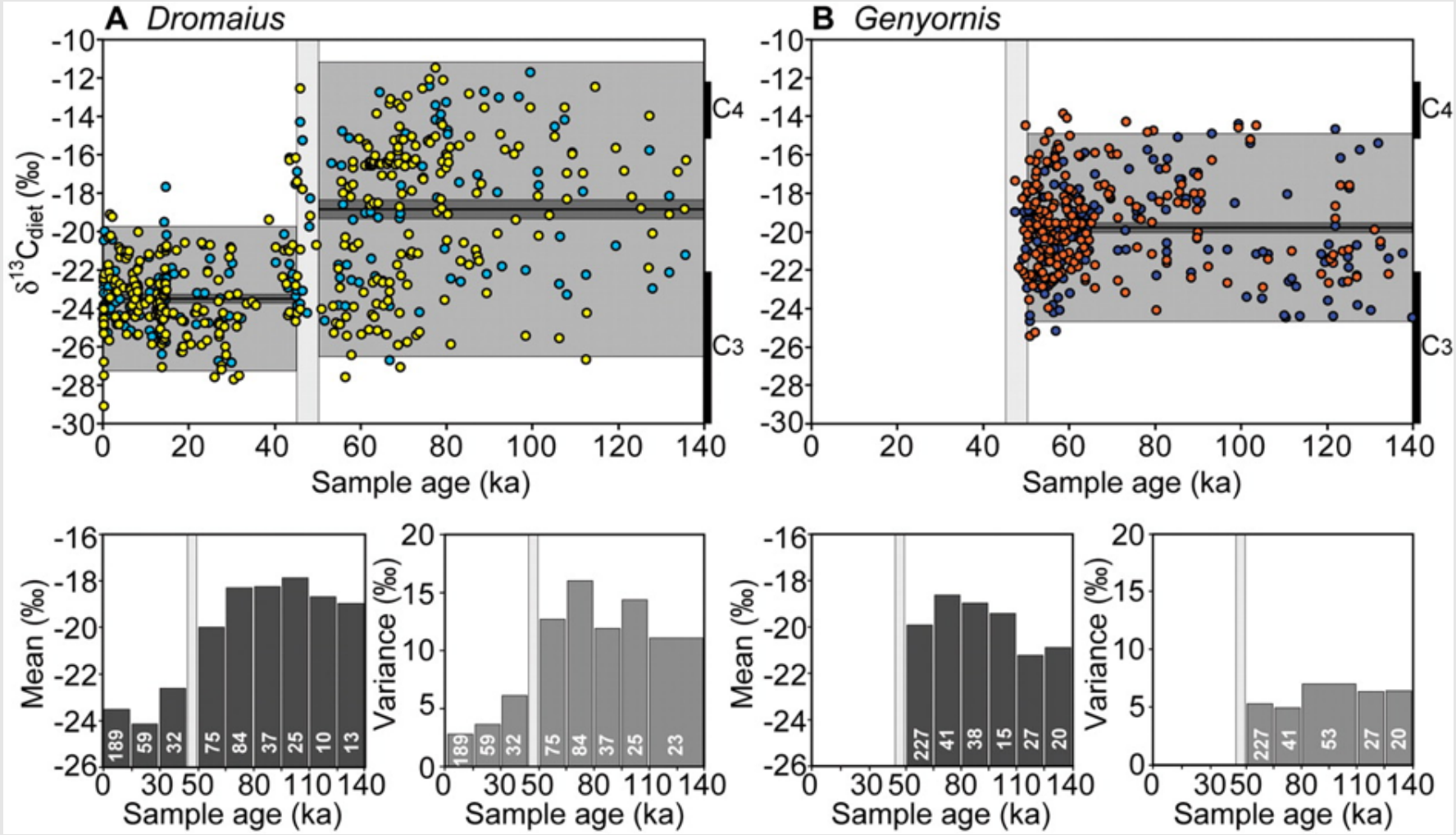
Roberts and Brook, 2010







Johnson 2005



Most of Australia's largest mammals became extinct 50,000 to 45,000 years ago, shortly after humans colonized the continent. Without exceptional climate change at that time, a human cause is inferred, but a mechanism remains elusive. A 140,000-year record of dietary $\delta^{13}C$ documents a permanent reduction in food sources available to the Australian emu, beginning about the time of human colonization; a change replicated at three widely separated sites and in the marsupial wombat. **We speculate that human firing of landscapes rapidly converted a drought-adapted mosaic of trees, shrubs, and nutritious grasslands to the modern fire-adapted desert scrub.** Animals that could adapt survived; those that could not, became extinct.

Miller et al. 2005

Humans are weird because we are social, brainy, have tools (hairy apes with ranged weapons and fire).

Can you imagine other species having this effect?