From minute to massive—mammal size evolution explained

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(Phys.org) —Scientists have added another piece to the evolutionary puzzle to explain why certain mammal families evolved to be very large, while others remained tiny.

In research published in *Proceedings of the Royal Society B*, an international group of scientists including Monash University's Dr Alistair Evans proposed a new theory explaining the diversity of mammal sizes - from the Etruscan shrew which weighs around two grams, to the blue whale which clocks in at almost 200 tonnes. Surprisingly, baby weight relative to adult body mass is key.

Dr Evans, of the Monash School of Biological Sciences, said size impacts on all aspects of an animal's physiology and anatomy, and the roles it can play in ecosystems.

"Size is fundamental to your life and your body – how fast your heart beats, how much food you need to eat, and how you move," Dr Evans said.

Following the extinction of the dinosaurs, mammals flourished and their size increased dramatically. The study examined the maximum size of groups including whales, elephants, primates and rodents over this period to examine the constraints on size.

The researchers found that species that matured more quickly and produced a larger mass of young each year relative to body weight were

able to evolve to a larger maximum size. Further, they are likely to reach that size in fewer generations.

This high rate of biological production is vital, regardless of whether many small young or just one large offspring are born in a year.

Dr Evans said whales were an excellent example of the theory.

"The blue whale is the largest animal to have evolved, even larger than dinosaurs, and it reached this size at the fastest rates we recorded. Key to this success is that they produce large young that mature quickly, reaching around 30 metres in eight to 10 years," Dr Evans said.

Lead author of the study, Dr Jordan Okie from Arizona State University, said primates were at the opposite end of the spectrum.

"Primates have a low production rate and have evolved very slowly. They have never got bigger than about 500 kilograms," Dr Okie said.

The study also linked maximum size to mortality rate. Because larger animals tend to breed less frequently than smaller animals, if the mortality rate doubles, the maximum size is predicted to be 16 times smaller.

"This is a really surprising finding," said Dr Evans.

"It points to why many of the large animals went extinct after the last Ice Age, as changing climates probably increase mortality rates. Large animals are also at high risk of extinction in modern environments because it takes a long time for their population to rebound from disasters."

In the future, this work will be extended to help explain how extinction

risk may be reduced in the face of climate change.

Provided by Monash University