Scientists downsize the giant 'Dreadnoughtus' dinosaur

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Kenneth Lacovara, PhD, with the 30-foot tail of *Dreadnoughtus schrani*, stretching along the length of the wall and around the corner in his lab. Beside Lacovara's hand is a set of chevron bones. Pairs of these chevrons run beneath each of the tail vertebrae and were found for each vertebra in the tail of Dreadnoughtus. In this animal the chevrons are noteworthy for the wide area for muscle attachment on the lower portion of the Y-shaped chevron. In *Dreadnoughtus* this attachment area is broad and spatula-shaped, allowing for extremely large tail muscles -- giving this animal an extraordinarily powerful, 'weaponized' tail in Lacovara's description. Credit: Drexel University

Scientists at the University of Liverpool have shown that the most complete giant sauropod dinosaur, *Dreadnoughtus*, discovered by palaeontologists in South America in 2014, was not as large as previously thought.

Found in Patagonia, the huge fossil had almost all of the major bones intact, allowing scientists to confidently estimate its overall size - measuring in at 26 metres long.

Preserved in rock, it is thought that the animal was close to maturity but not fully grown when it died, and may have grown to be even larger. The long-necked, plant-eating dinosaur was the biggest to ever walk the earth.

To estimate the mass of *Dreadnoughtus* scientists originally used a scaling equation that predicts body mass based on the size of thigh and arm bones. This method produced a range of estimates with the average being a colossal 60 tonnes.

Scientists at the University of Liverpool, in collaboration with researchers from Liverpool John Moores University, the University of Manchester, and Imperial College, re-evaluated this estimate after it became clear that other sauropod dinosaurs, only marginally smaller than the giant, weighed considerably less than 60 tonnes.

The team used a three-dimensional skeletal modelling technique to examine body mass more directly. This method involves mathematically reconstructing a 'skin' volume around bones of *Dreadnoughtus* on a computer and then expanding that skin outline to account for muscle, fat and other tissues.

The size of expanded skin outline is based on similar data from living animals. By exploring a range of expansions the team could more

accurately predict how heavy *Dreadnoughtus* could realistically have been.

The team found that the mass of the *Dreadnoughtus* was more likely to be between 30 and 40 tonnes, considerably less than originally thought.

Dr Karl Bates, from the University's Institute of Ageing and Chronic Disease, explains: "Estimating the body mass of an extinct animal from approximately 77 million years ago of this size from only its fossilised bones is extremely challenging and relies on the availability of certain data from living animals and modelling techniques.

"The original method used to calculate the mass of the animal is a common one and has been used successfully on many specimens. The highest estimates produced for this particular giant, however, didn't quite match up.

"Using digital modelling and a dataset that took in species, alive and dead, we were able to see that the creature couldn't be as large as originally estimated."

"Our analysis suggests that only the lower estimates produced by previous methods are plausible. Estimates of 60 tonnes and above do not fit with our current understanding of the mass characteristics of living land animals."

It is unclear how accurate previous predictions on the scale of these creatures have been, but future studies of living animals and developments in modelling techniques could help build a more fulsome picture of the size and lifestyles of the dinosaurs.

The research is published in the Royal Society journal *Biology Letters*.

More information: Downsizing a giant: Re-evaluating Dreadnoughtus body mass, *Biology Letters*, rsbl.royalsocietypublishing.or … .1098/rsbl.2015.0215

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