Great white's mighty bite revealed

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The bite force of a great white shark (Carcharodon carcharias) is the highest known for any living species, according to new research to be published in the *Journal of Zoology*. This is the first time that scientists have estimated the bite force of the great white.

Using sophisticated computer modelling techniques they have also calculated that the bite force of the great white's extinct relative, the gigantic fossil species *Carcharodon megalodon* (also known as Big Tooth) is the highest of all time, making it arguably the most formidable carnivore ever to have existed.

Shark researchers from the University of New South Wales, Newcastle University, NSW Department of Primary Industries Fisheries (Australia) and University of California (USA) reveal unprecedented information about the feeding habits of the two carnivores by analysing anatomical and biomechanical data from their skull and muscle tissues.

They generated 3-Dimensional models the skull of a 2.4-metre male great white shark on the basis of multiple x-ray images generated by a computerized tomography (CT) scanner.

Using novel imaging and analysis software and a technique known as "finite element analysis", the team reconstructed the great white's skull, jaws and muscles, remodelling them as hundreds of thousands of tiny discrete, but connected parts.

They then digitally "crash tested" this computer model to simulate

different scenarios and reveal the powerful bite of the fearsome predator, as well as the complex distributions of stresses and strains that these forces impose on the shark's jaws.

It was found that the largest great whites have a bite force of up to 1.8 tonnes. By comparison, a large African lion can produce around 560 kg of bite force and a human approximately 80 kg – making the great white's bite more than 20 times harder than that of a human. UNSW's Steve Wroe, the study's lead author, says the great white is without a doubt one of the hardest biting creatures alive, possibly the hardest.

"Nature has endowed this carnivore with more than enough bite force to kill and eat large and potentially dangerous prey," he says. "Pound for pound the great whites' bite is not particularly impressive, but the sheer size of the animal means that in absolute terms it tops the scales. It must also be remembered that its extremely sharp serrated teeth require relatively little force to drive them through thick skin, fat and muscle". The scientists also found that although shark's jaws are comprised of elastic cartilage (as opposed to the bony jaws of most other fish), this did not greatly reduce the power of its bite.

Wroe and colleagues applied the same methodology to estimate the bite force of the gigantic Carcharodon megalodon, which may have grown to 16 metres in length and weighed up to 100 tonnes -- at least 30 times as heavy as the largest living great whites.

They predict that it could generate between 10.8 to 18.2 tonnes of bite force. Fossil evidence suggests that Big Tooth was an active predator of large whales that immobilised its huge prey by biting off their tail and flippers before feeding at will.

A comparison of Tyrannosaurus rex with megalodon suggests that the great Tyrant Lizard was no match for the giant shark. " Estimates of

maximum bite force for T. rex are around 3.1 tonnes, greater than for a living white shark, but puny compared to Big Tooth."

Source: University of New South Wales