

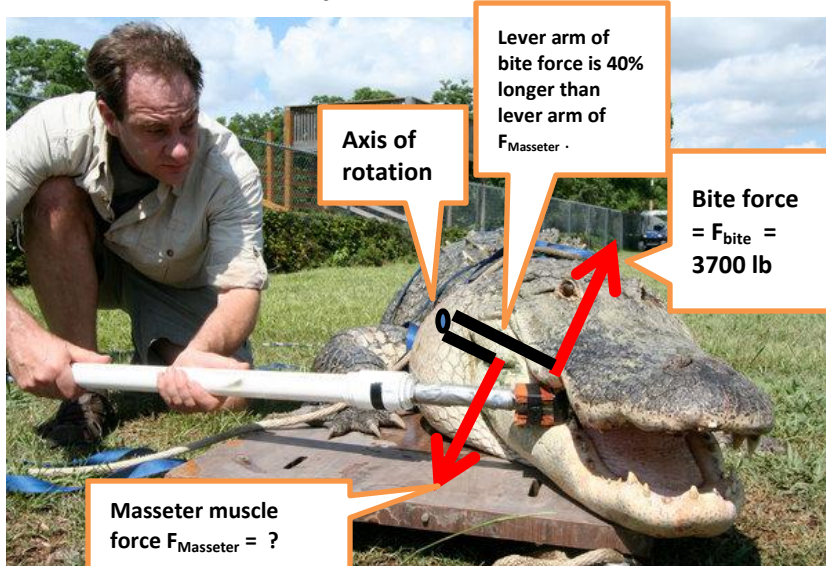
ROTATIONAL EQUILIBRIUM

Unit 15 Dr John P. Cise , Professor of Physics, Austin Community

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Send Dr Cise an e-mail on how you used this NYTimes physics application. Thanks! Dr Cise

Broad or Dainty, Crocodilian Snouts Pack Same Chomp



INTRODUCTION: By Newton's third law the bite force on object is the same as force on croc.

QUESTION:(a) With the jaw in rotational Equilibrium at left find F_{Masseter} with variables given at left? (b) Find force at axis of rotation?

HINT: Solve using conditions for static and rotational equilibrium?

ANSWERS: (a) $4810 \text{ lb.} = F_{\text{Masseter}}$
(b) 1110 lb In the direction up.

Greg Erickson, a researcher at Florida State University, testing the bite force of an American alligator with a device he designed.

Through the ages, the basic crocodilian plan for dispatching prey has been simple but effective: chomp down hard and hang on tight. The plan works largely because the **animals evolved a "design for generating really amazing bite forces,"** said Greg Erickson, a professor of biomechanics at Florida State University. "And they didn't mess with that. It has worked for 85 million years, and it is still working today." But questions have remained about the evolution of different snouts and teeth, which scientists assumed were related to bite strength. Not so, Dr. Erickson and colleagues report in the journal PloS One. In an interesting evolutionary twist, it seems that snout shape, teeth and size evolved along separate paths. And the only factor that affects bite strength is the size of the animal.

"That was a huge surprise," Dr. Erickson said. For animals with narrow, delicate jaws, like the fish-eating Indian gharial, he said, "everybody had just assumed they had really low bite forces." The finding came from a decade of work in which Dr. Erickson and his **colleagues measured the bite forces of all 23 living crocodilians** and devised a way to calculate the bite forces of fossil animals. Topping the list among the living was a **17-foot saltwater crocodile that had the highest bite force ever measured for any animal, about 3,700 pounds.** This is more than seven times that of a wolf, which can crack an elk leg bone. (**A typical saltwater crocodile has a bite force of about 2,000 pounds.**) Bite force is not that easy to measure. Mammals, for example, will not bite with full force if it might hurt their teeth. **Crocodilians, on the other hand, are like sharks, replacing teeth all the time.** They reliably bite down with maximum force, which makes them ideal for testing, and a bit scary. Dr. Erickson worked with collaborators around the world but did much of the testing at the St. Augustine Alligator Farm Zoological Park in Florida, which has all 23 species of crocodilians now living. **That was where he first tested the measuring device he had designed and built, a pressure-sensing mechanism sandwiched between two metal plates padded with bull hide.** The first time he did not know what was going to happen.