



Coyote

My, What Big Teeth You Have! Inferring Extinct Carnivore Diets

Jenny Lee
Biological Anthropology Major
Zoology Minor



ANTHROPOLOGY
AND GEOGRAPHY
COLORADO STATE UNIVERSITY

Red Fox

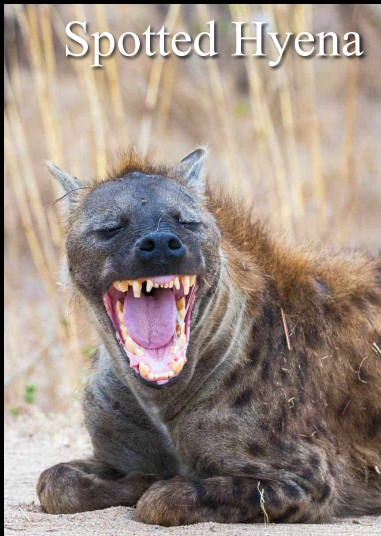


Black Bear



Wolverine

Spotted Hyena



Grizzly Bear



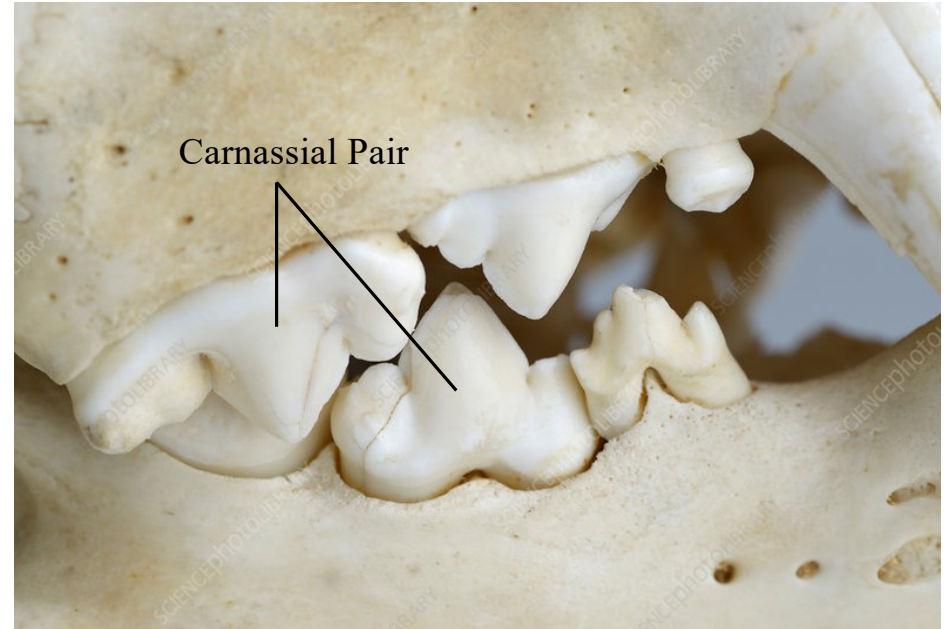
Mountain Lion



Coyote



Wolf



What is a Carnivore?

- Special dentition
 - Carnassial pair
 - Sharp teeth for shearing and slicing

Diet Effects Anatomy

- Bone crunchers (hyena)
 - Large, wide teeth
 - High bite force
- Meat slicers (wolf)
 - Longer, thinner teeth
 - Lower bite force
- Gnawers/Light crunchers (bears)
 - Will consume some bones
 - Includes omnivores here
 - Wider, robust teeth



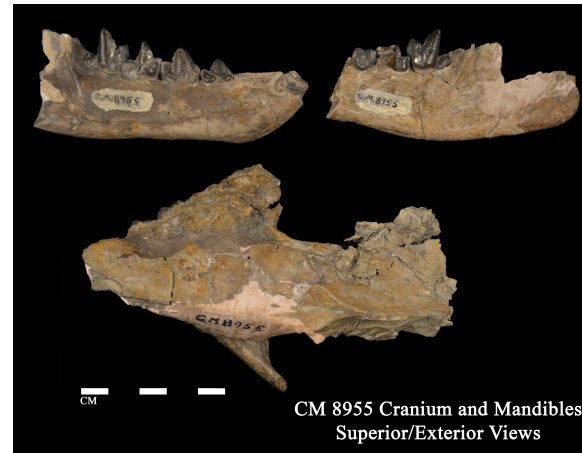
The Eocene

- 56-33.9 million years ago (Mya)
 - Tropical rainforests
 - 71.6°F
- First carnivores (Order Creodonta)
 - Gave rise to the modern order Carnivora
 - Foxes to hyenas or lions
 - Behavior?

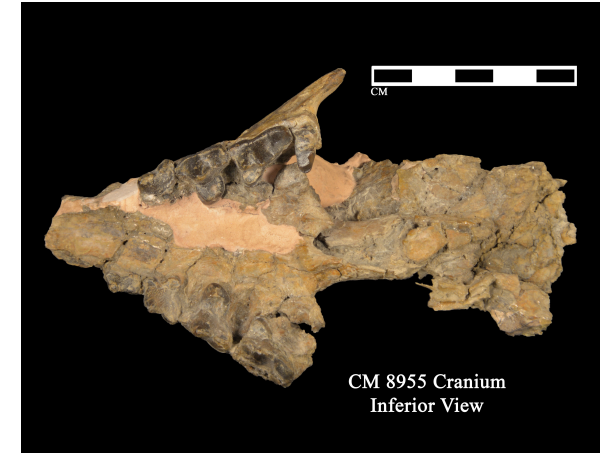


The Fossil

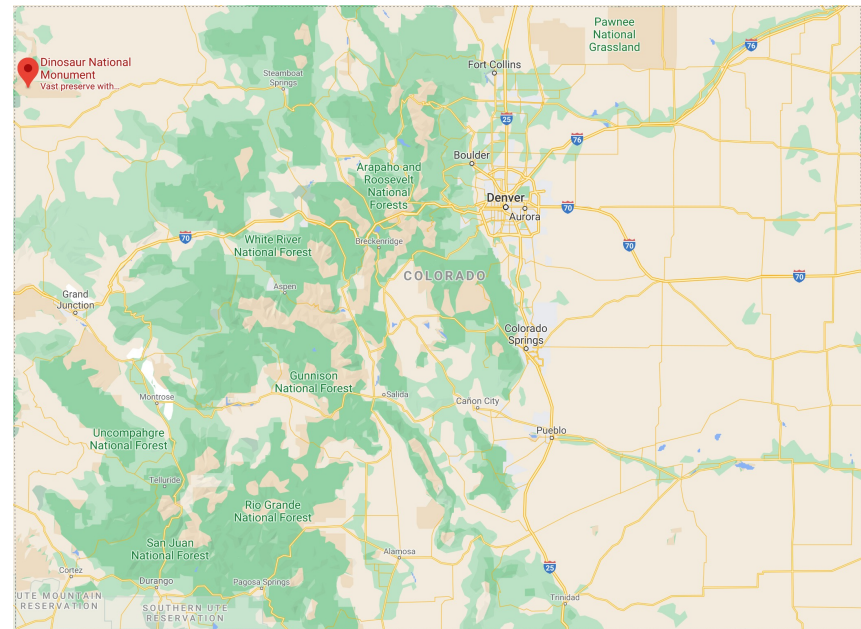
- Order Creodonta
 - Family Oxyaenidae
 - 56.8-48.6 Mya
 - Not sure what species
- Came from Colorado!
 - On loan from Carnegie Museum of Natural History



CM 8955 Cranium and Mandibles
Superior/Exterior Views



CM 8955 Cranium
Inferior View



Research Question and Procedure

What is the dietary behavior of the specimen? Bone cruncher or flesh slicer?

1. Estimate bite force from cranium
 2. Measure bone crushing abilities from teeth
 3. Compare to modern carnivores
-



CM 8955 Cranium
Superior View

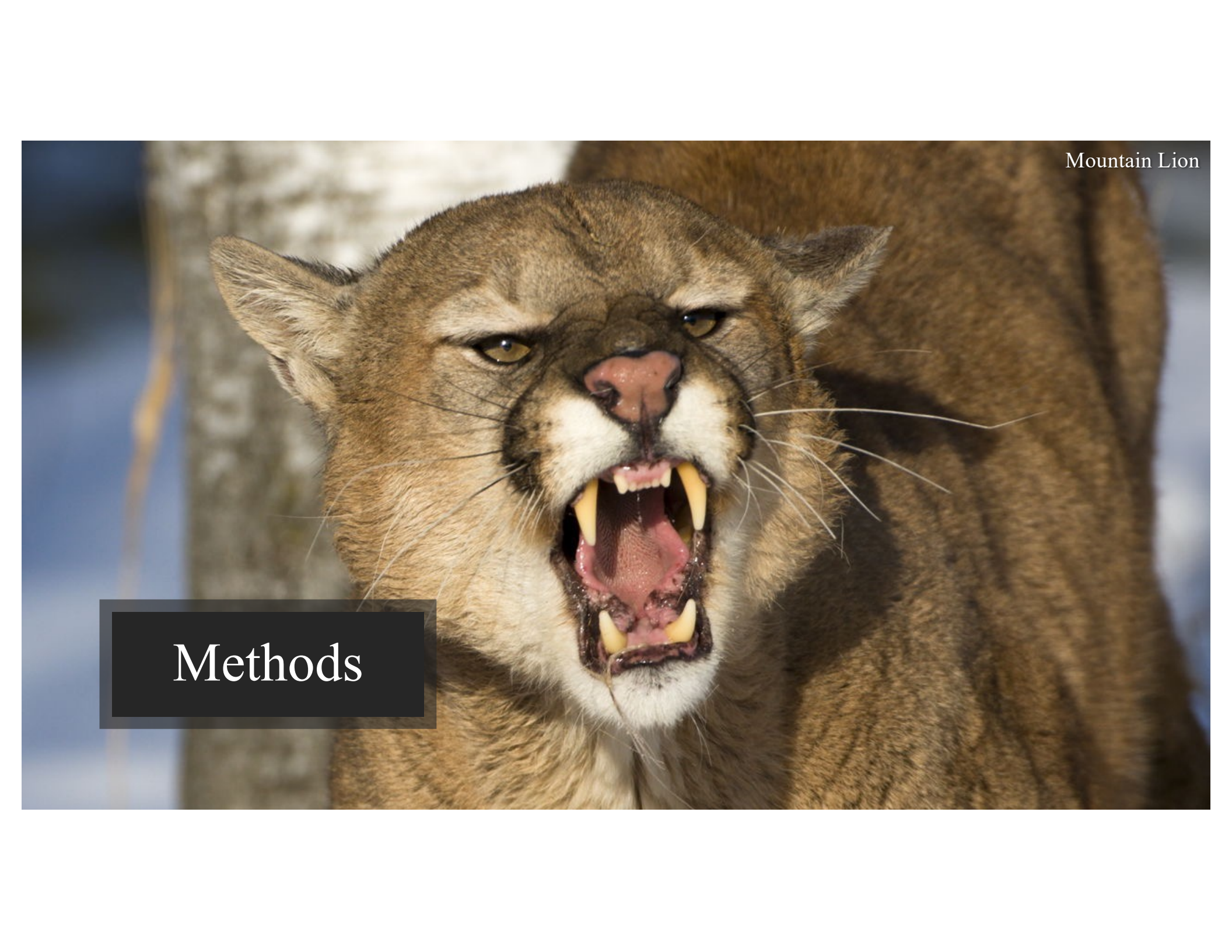


CM 8955 Left and Right Mandibles
Medial View

Predictions

- If bite force is high and the teeth are robust, we can conclude it is more like a bone crusher
- If bite force is low and teeth are long and narrow, we can conclude it is more of a meat slicer





Mountain Lion

Methods

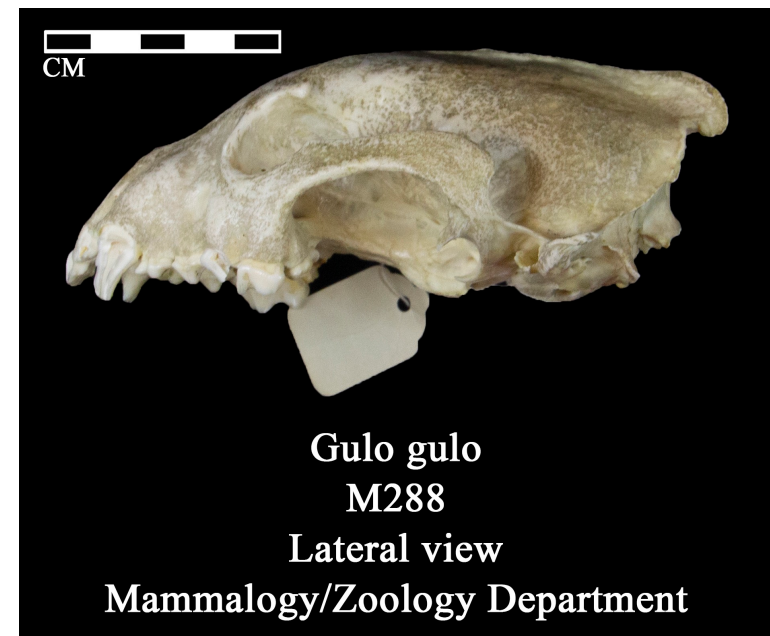
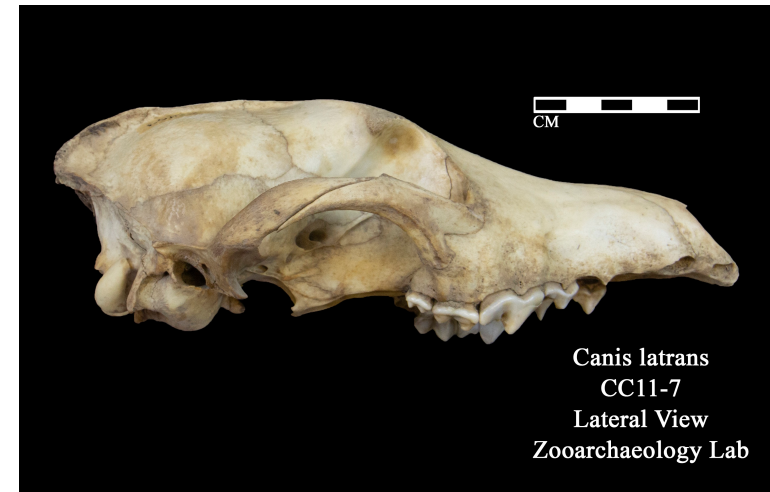
Samples

Extant Carnivores

- Hyena: 2
- Mountain lion: 2
- Wolverine: 2
- Wolf: 2
- Coyote: 5
- Red fox: 5
- Black bear: 6
- Grizzly bear: 2

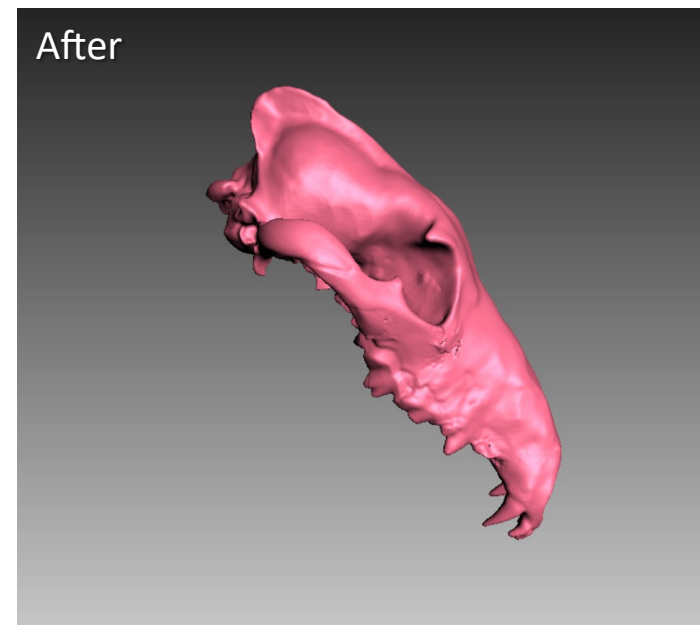
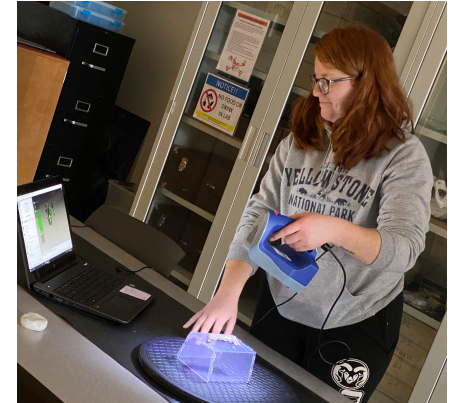
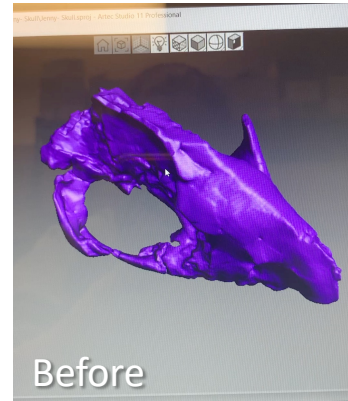
Location

- Zooarchaeology Lab
- Mammalogy/Zoology Department

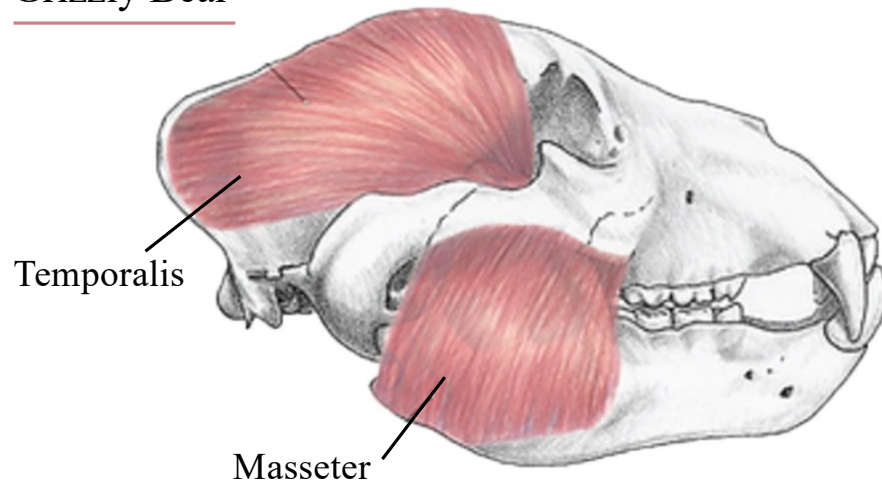


Fossil Virtual Reconstruction

- 3D Scanning and Modeling
 - Artec Spider Scanner, Artec Studio, Blender
 - Processed and aligned
 - Model created
- Inclusion of extant taxa
 - Wolf cranium (eye orbits to back of skull)
 - Hyena zygomatic arches
 - Wolf nose (canines and incisors)



Grizzly Bear

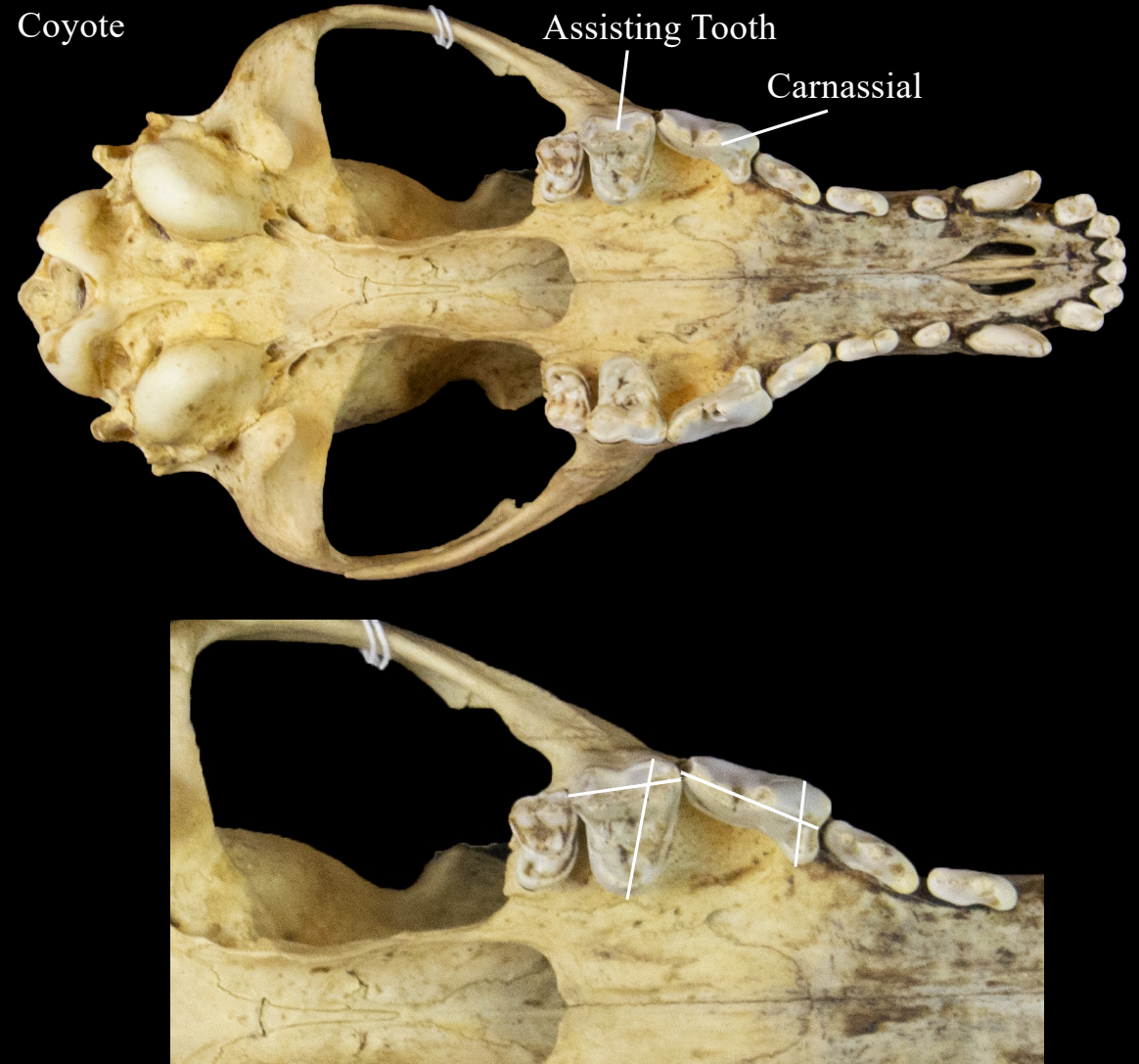


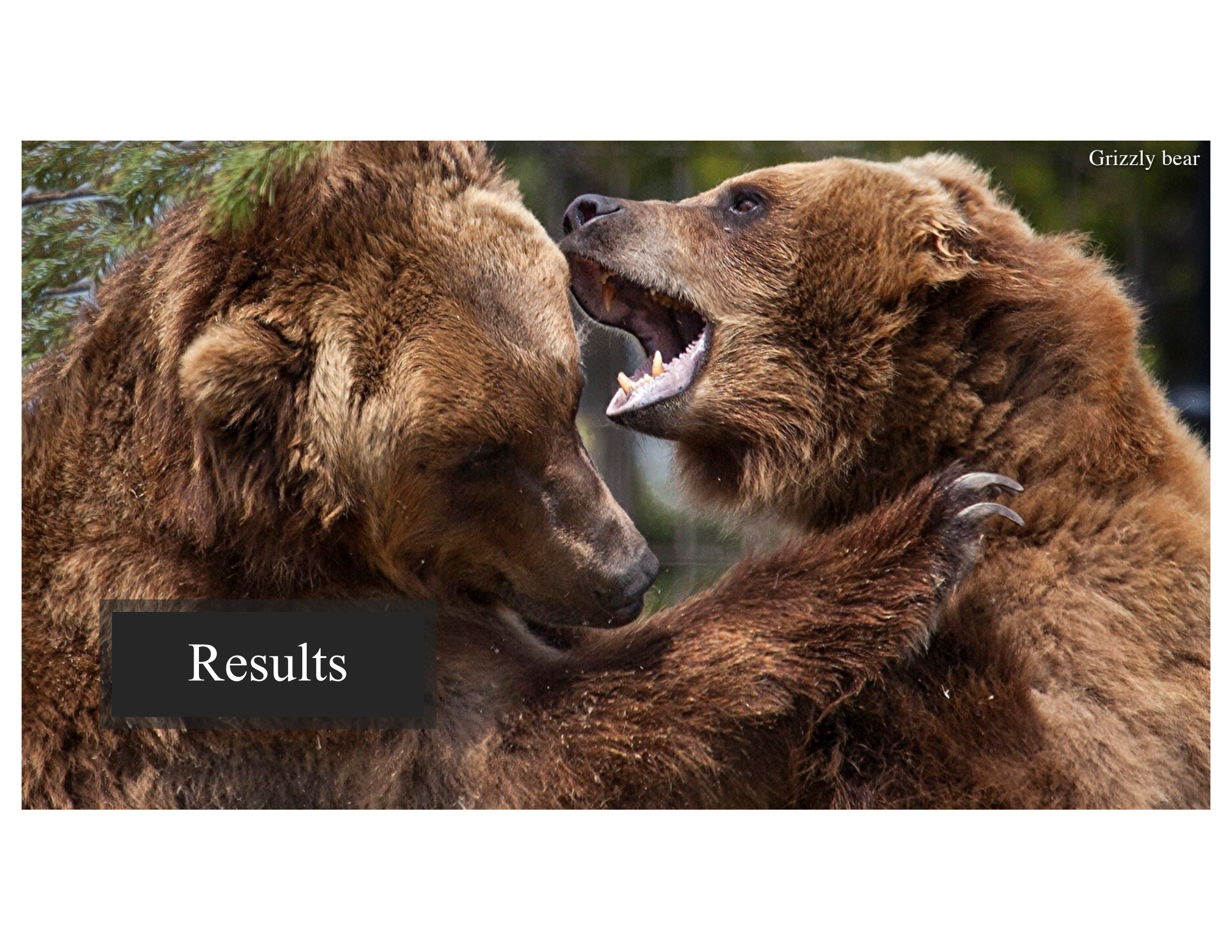
Bite Force

- Force generated by the interaction of the biting muscles, mandibles and skull, the temporomandibular joints (TMJs), and the teeth
- Measured in Newtons (N) here
 - Ex: Human bite force is about 777 N
 - Ex: Hyena bite force is over 4000 N
- Calculated by
 - Temporalis and Masseter cross-sections
- ImageJ

Bone Crunching

- Bone crunching vs. meat slicers
 - Width and length ratios
 - Carnassial tooth
 - Assisting tooth
- ImageJ

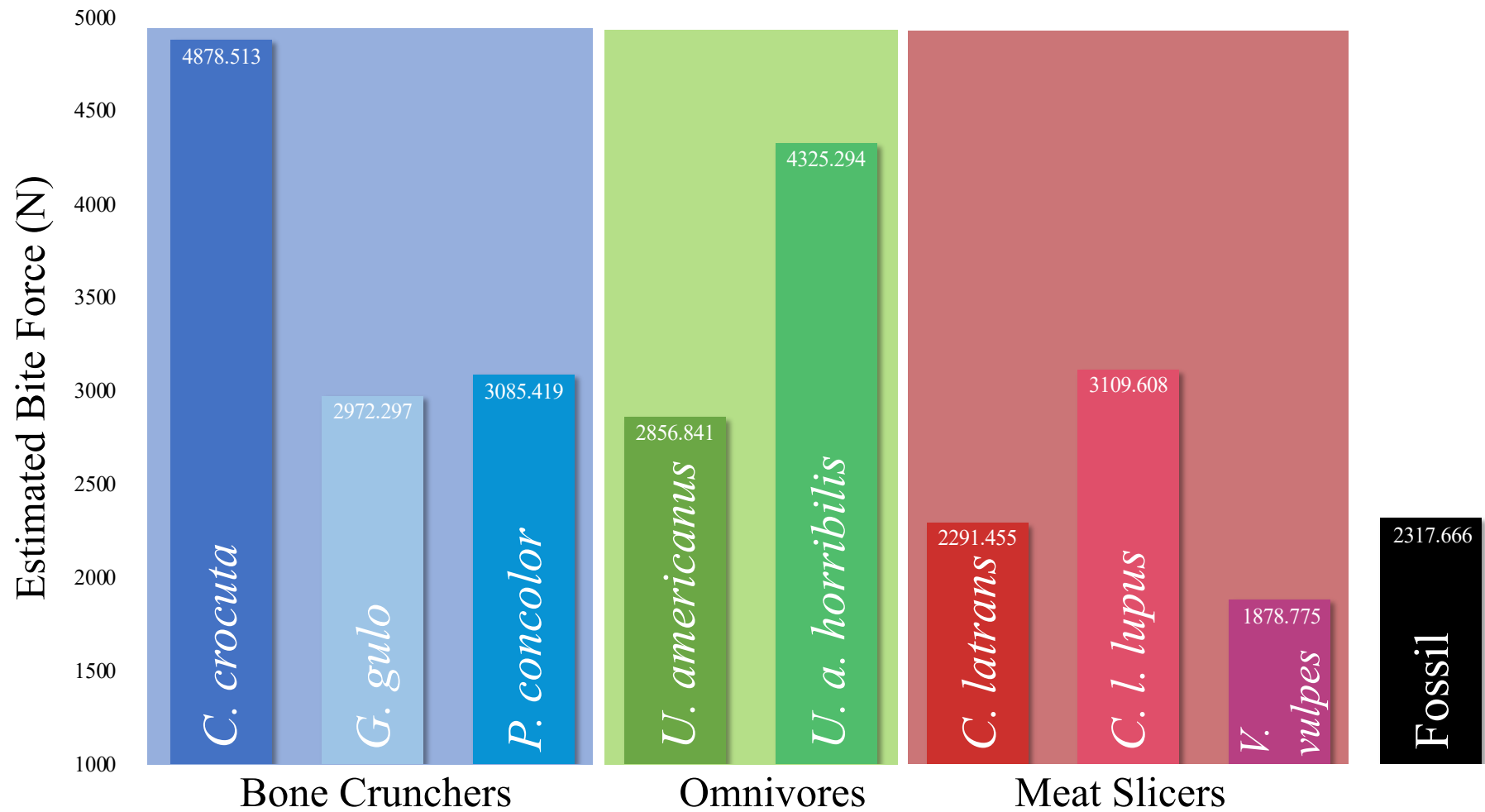


A close-up photograph of two grizzly bears in a forest. The bear on the right is facing the bear on the left, with its mouth open, showing its teeth and tongue. The bear on the left is looking down. The background is a blurred forest scene with green foliage.

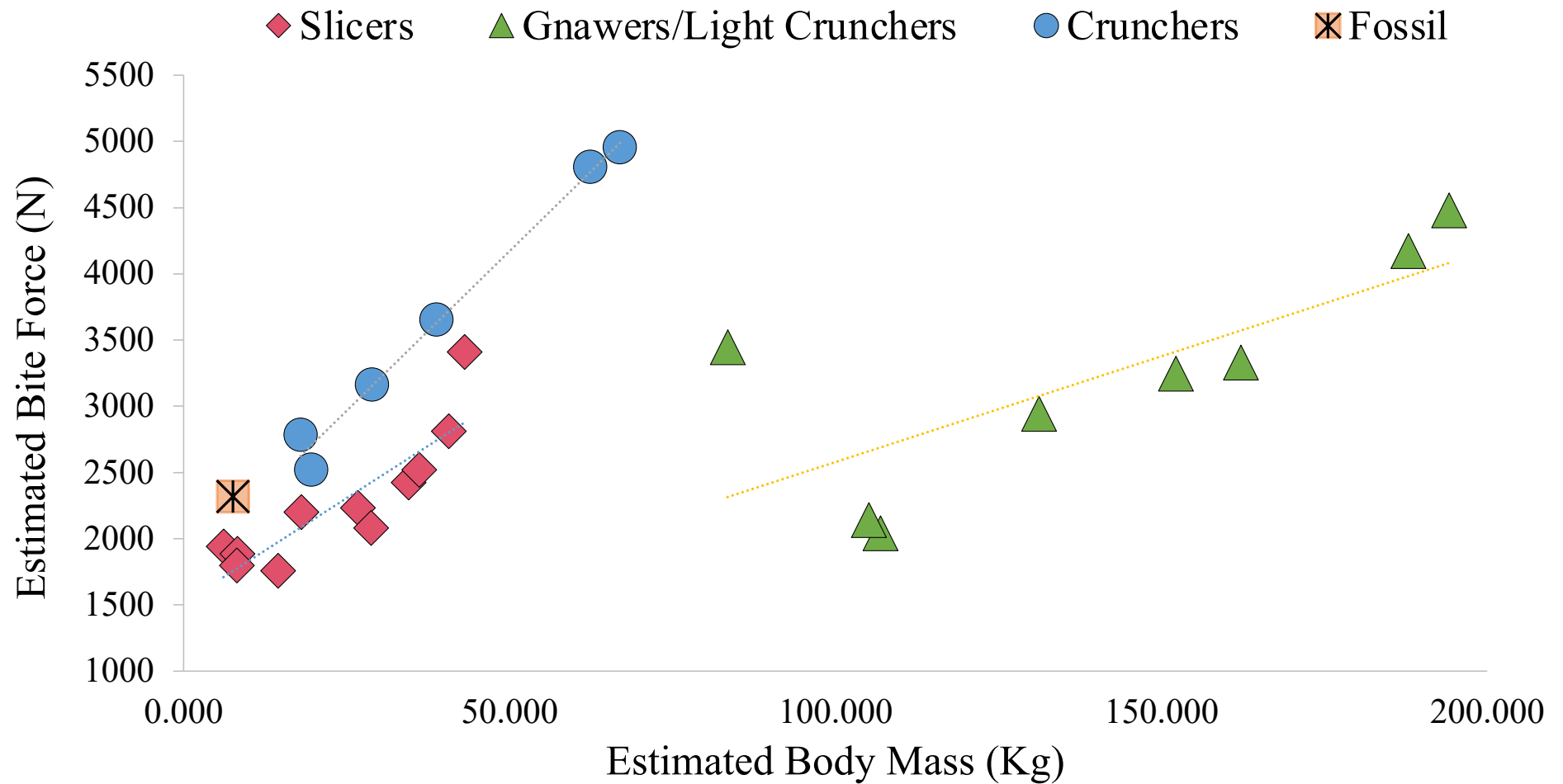
Grizzly bear

Results

Estimated Bite Force (N)

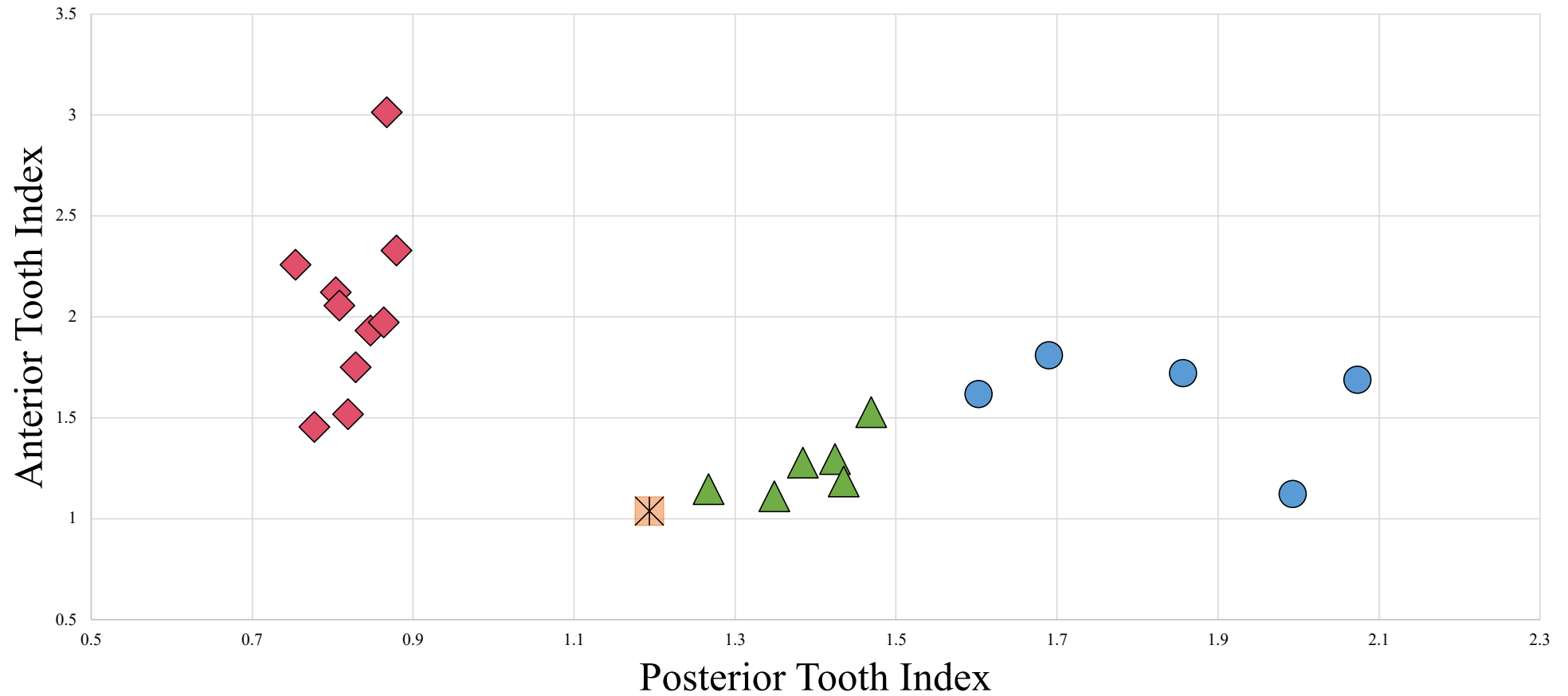


Bite Force (N) against Body Mass (Kg)



Bone Crushing Index

◆ Slicers ▲ Gnawer/Light Cruncher ● Crunchers ✕ Fossil



Coyote



Conclusion

- Bite force?
 - High bite force for body size
 - Large red fox to coyote size
 - Smaller than most bone crunching animals
- Bone crunching ability?
 - May crunch small bones, but not large ones
 - Dentition in between bone crunchers and meat slicers
- Evolutionary implications
 - Did bite force evolve before bone crunching?

Acknowledgements

I would like to thank my advisor, Dr. Connie Fellmann, for the support and guidance during this whole project.

I would like to give a huge thanks to Amy Herenci, the Vertebrate Paleontology Collection Manager at the Carnegie Museum of Natural History for loaning the fossil skull to us. Without the fossil, this project could not have happened. These fossil mandibles allowed me to slowly narrow my focus to two mammals, and to focus on one time period.

Recognition also goes towards Dominique Montaña and the Mammalogy/Zoology Department for allowing me access to their specimens for photographs and measurements.

Lastly, thank you to Dr. Michael Pante for providing the specimens in the Zooarchaeology Laboratory.