

T. rex more hyena than lion

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This cast of a Tyrannosaurus rex is on display in UC Berkeley's Valley Life Sciences Building. The original fossil skeleton from Montana's Hell Creek Formation is in the Museum of the Rockies in Bozeman, Mont. Credit: Randy Irmis

The ferocious Tyrannosaurus rex has been depicted as the top dog of the Cretaceous, ruthlessly stalking herds of duck-billed dinosaurs and claiming the role of apex predator, much as the lion reigns supreme in the African veld.

But a new census of all dinosaur skeletons unearthed over a large area of eastern Montana shows that Tyrannosaurus was too numerous to have subsisted solely on the dinosaurs it tracked and killed with its scythe-like teeth.

Instead, argue paleontologists John "Jack" Horner from the Museum of the Rockies and Mark B. Goodwin from the University of California,

Berkeley, T. rex was probably an opportunistic [predator](#), like the hyena in Africa today, subsisting on both carrion and fresh-killed prey and exploiting a variety of animals, not just large grazers.

"In our census, T. rex came out very high, equivalent in numbers to Edmontosaurus, which many people had thought was its primary prey," said Horner, curator of paleontology at the Museum of the Rockies in Bozeman, Mont., and Regents Professor at Montana State University. "This says that T. rex is not a cheetah, it's not a lion. It's more like a hyena."

"This putative apex predator is as abundant in the upper layers of the Hell Creek Formation as the herbivores, its reputed primary food source," added Goodwin, a curator in UC Berkeley's Museum of Paleontology and assistant director of the museum. "And it's even more plentiful in the other two-thirds of the formation. This supports the view that T. rex benefited from a much wider variety of food sources than live prey."

The dinosaur census in the Hell Creek Formation of Montana, which dates from 65-95 million years ago, was begun in 1999 by Horner and Goodwin with the financial and occasional field support of Nathan Myhrvold, former chief technology officer for Microsoft Corp. and co-founder of Intellectual Ventures of Bellevue, Wash. The results, authored by Horner, Goodwin and Myhrvold, were published Feb. 9 in the open-access journal *PLoS ONE*.

Normally, Goodwin said, top predators are one-third or one-fourth as abundant as their prey, because of the larger energy needs of carnivores. Opportunistic hunters like the hyena, however, can be twice as abundant as the top predators.

"If you count the lions and the leopards and the cheetahs in the

Serengeti, the number still does not equal the number of hyenas, because hyenas have a much wider food source," Horner said. "Cheetahs, for example, only go after things that are really fast. They don't eat turtles. But a hyena will eat a turtle, or anything else that it can catch or is dead."

Similarly, T. rex was eating anything it could, he said. "There's no evidence that T. rex could run very fast, so it wasn't out there being a cheetah. If it could get a sick animal, it would."

Horner suggests that juvenile and young adult T. rex may have been primarily flesh eaters, while the older adults, which developed proportionally larger, bone-crushing teeth as they aged, also consumed the bones and marrow of their prey.

Horner and Goodwin, together and separately, have been digging for dinosaurs in Eastern Montana for decades. The fossils date from a time when the area bordered an inland sea, which periodically advanced and withdrew over coastal plains, depositing sediment that was later exposed and heavily eroded. When Horner started his census of dinosaurs in the Hell Creek Formation around Fort Peck Lake in 1999, he teamed up with Goodwin to re-examine some of the dinosaurs discovered in the area.

Since then, through lab analysis and annual summer digs, they have shown that one named species, Torosaurus, was just a big, aged Triceratops; two dome-headed dinosaurs, Dracorex and Stygimoloch, were merely younger members of the genus Pachycephalosaurus; and the so-called Nanotyrannus was just a juvenile T. rex.

Once these fossils had been properly identified, Horner and Goodwin were able to catalog the species and relative ages of known dinosaurs in the formation, which is about 100 meters thick at exposed areas covering some 1,000 square kilometers. The census included only skeletal

remains, not teeth, because the paleontologists wanted a record of the maturity of each specimen, and teeth tell little about the age of a dinosaur at death, Goodwin said.

Collating only skeletons containing three or more bones, the researchers counted 23 Triceratops, five Tyrannosaurus and five Edmontosaurus within the Upper Hell Creek Formation. The youngest or "upper" formation dates from between 65 and 70 million years ago, just before the purported mass extinction of the dinosaurs that was attributed to a comet or asteroid impact.

A census of older sediments – the lower Hell Creek formation – turned up 11 Triceratops, 11 T. rex and six Edmontosaurus partial skeletons, along with fossil bones of three other dinosaurs: Thescelosaurus and Ornithomimus, two bird-like, bipedal meat-eaters reaching some 12 feet in length at maturity; and Ankylosaurus, an armored, four-legged plant-eater with a club tail.

"Small juveniles and older adults were relatively rare compared to large juveniles and subadults for all the dinosaurs," Goodwin said. This could be explained if juveniles lived in other locations, which is not uncommon in some species. The largest adults may simply have been relatively rare.

"This adds to an emerging picture of what the dinosaur fauna looked like during the late Cretaceous," he said.

Horner noted the greater variety of dinosaurs in the older sediments, the Lower Hell Creek Formation, compared to the younger "Upper" formation.

"Definitely there was a change in population leading up to the Cretaceous-Tertiary boundary, so something was happening to the

faunas prior to the impact," he said. "During the 10 million years after dinosaur diversity peaked 75 million years ago, the [dinosaurs](#) dwindled pretty fast, and there weren't many left at the end."

Provided by University of California - Berkeley

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