



## Dunkleosteus terrelli—Ohio's State Fossil Fish

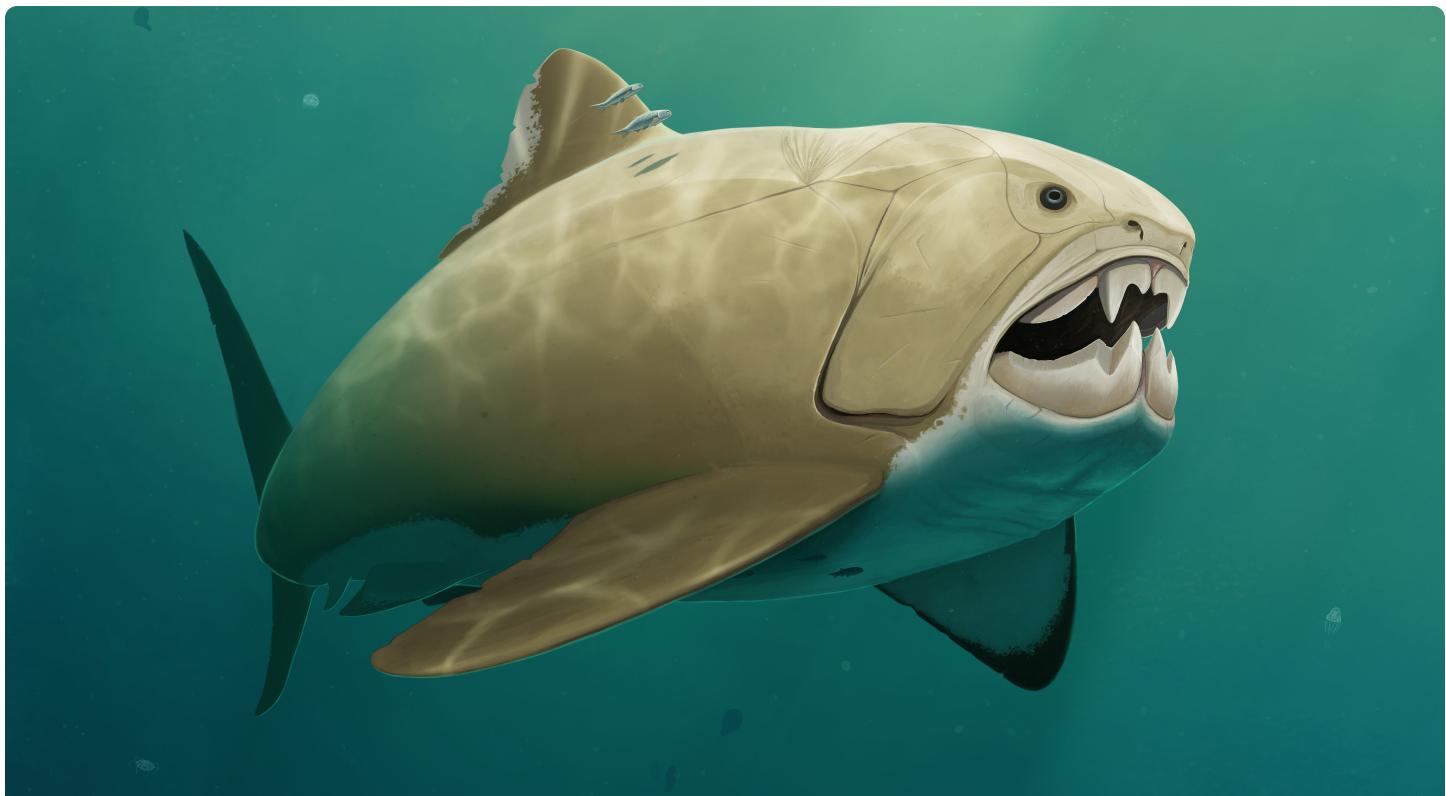


Figure 1. Living reconstruction of *Dunkleosteus terrelli* by paleoartist Kyle Hartshorn of Cincinnati, Ohio.

by Mark E. Peter

### The State Fossil Fish

In 2020, the extinct species *Dunkleosteus terrelli* (fig. 1) was designated the official Fossil Fish of Ohio. As such, it became the second fossil animal on Ohio's list of state symbols. Previously, in 1985, the large trilobite *Isotelus*, which occurs in rocks exposed in southwestern Ohio, had been named the State Invertebrate Fossil.

*Dunkleosteus terrelli* (pronounced "dun-kul-OS-tee-us tare-RELL-eye") was an arthrodire placoderm (an extinct armored fish with a jointed neck) that lived near the end of the Devonian Period, the "Age of Fishes." With maximum length estimates ranging from ~4 to 9 meters (13 to 30 feet), *D. terrelli* was among the largest predators living during the Devonian Period. The world's largest and most complete specimens of *D. terrelli* have been collected from 360 million-year-old black shale rocks in northern Ohio, specifically within the Cleveland Shale Member of the Ohio Shale Formation. Many of these fossils now reside in the Cleveland Museum of Natural History, where a reassembled skull on exhibit has acquired the nickname "Dunk." (Throughout the rest of this text, "the Dunk" is used as a shorthand for the species *D. terrelli*.)

### Meet "the Dunk"

*D. terrelli* is known primarily from fossils consisting of the bony plates that covered portions of its head and trunk. Like other placoderm ("plate skin") fish, the Dunk possessed bony "armor" only on the anterior (forward) portion of its body. Minerals within the bones of the armor made it hard and rigid and more likely to be preserved as fossils. The remainder of the body probably lacked hard plates and is mostly unknown. Reconstructions of the entire *Dunkleosteus* body have been based on more completely known extinct placoderms and on large extant fishes.

Evidence suggests that *Dunkleosteus* was an apex predator that cruised the surface waters of the Late Devonian seas, much like the great white shark does in today's coastal marine environments. However, unlike the great white, the adult Dunk lacked teeth. Instead, sharpened exposed bone on its lower and upper jaws was used to shear through its prey, which likely consisted of other placoderms, bony fishes, primitive sharks, and invertebrates.

Scientists Philip Anderson and Mark Westneat have modeled the Dunk's feeding mechanism. As with other arthrodire ("jointed neck") placoderms, the Dunk had a pair

of joints that allowed bones of the skull to articulate with bones of the trunk armor (fig. 2). These joints were part of a mechanism that enabled the Dunk to lift its head while simultaneously dropping its lower jaws, achieving a maximum gape of about 45 degrees. Opening of the mouth could have occurred rapidly—in as little as 20 milliseconds—potentially creating a pressure change with sufficient suction to draw prey into the mouth. Anderson and Westneat also calculated the Dunk's bite force, which was among the greatest for animals of its size. With a forceful bite, the Dunk could have pierced the armor of other placoderms and hard shells of ammonoid cephalopods.

## Ohio Dunk discoveries

During Late Devonian time, land that is now Ohio was located in the subtropics, 30–35 degrees of latitude south of Earth's equator, and was covered by an inland sea. Fine sediments eroded from mountains to the south and east, combined with abundant organic matter from marine plankton and newly evolved land plants, settled in the basin as dark organic muds. Over millions of years, accumulation of overlying sediments compacted the muds to form black shale. Remains of fishes that had settled to the sea bottom became entombed within the rock.

In 1867, fossils of *D. terrelli* were discovered by amateur paleontologist Jay Terrell while collecting from the black shales at Sheffield Lake along the Lake Erie shore. John Strong Newberry, Ohio's second state geologist, described the fossils in 1873 as *Dinichthys* ("terrible fish") *terrelli*. The species name *terrelli* honored its discoverer, Mr. Terrell. The species was later assigned to another genus, *Dunkleosteus*. This name is a combination of *Dunkle*, for Professor David Dunkle, an

eminent paleontologist who studied the Cleveland Shale fishes, and *-osteus*, from Greek *osteon*, "bone."

Many *D. terrelli* specimens have been recovered from river and stream exposures of the Cleveland Shale in northern Ohio. From the late 1800s to early 1900s, dedicated amateur paleontologists contributed most specimens. Beginning in the 1920s, professionals from the Cleveland Museum of Natural History, including paleontologist Peter A. Bungart, made additional discoveries. Some fossils were encased inside hard concretions within the shale and had to be extracted and meticulously reassembled.

During the mid-1960s, excavations for Interstate 71 cut through the Cleveland Shale along the valley of Big Creek in Cuyahoga County. Under the supervision of Dr. William Hlavin, the Cleveland Museum of Natural History made the first-ever use of a section of the Federal Highway Act that provides for the salvage of paleontological material. Over the course of several years, the Museum engaged in extensive collecting in cooperation with road construction crews and the Ohio Department of Transportation. This endeavor allowed the Cleveland Museum to build one of the world's premier collections of Dunk fossils and other Late Devonian fishes. These fossils have contributed greatly to the scientific knowledge of fish evolution and life in Devonian seas.

*D. terrelli*, along with all remaining placoderms, became extinct at the end of the Devonian Period, approximately 359 million years ago. Luckily, the mighty Dunk left its armor behind as part of the fossil record. Given the long and productive history of discoveries within the state, it is appropriate that Ohio has claimed *Dunkleosteus terrelli*—the most fearsome predator of the Devonian—as its State Fossil Fish.

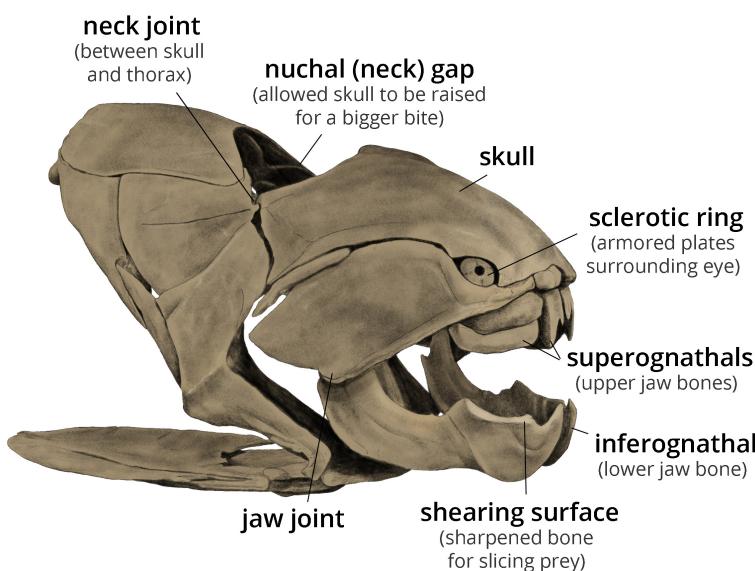


Figure 2. Reconstructed *Dunkleosteus terrelli* fossil specimen comprised of the bony armor plates that covered parts of the head and thorax. Specimen measures 1.4 meters (4.6 feet) long. A gap in the armor on the dorsal (top) side and a jointed neck allowed the skull to be rotated upwards.

## References & Further Reading

- Anderson, P.S.L., and Westneat, M.W., 2007, Feeding mechanics and bite force modelling of the skull of *Dunkleosteus terrelli*, an ancient apex predator: *Biology Letters*, v. 3, p. 76–79.
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