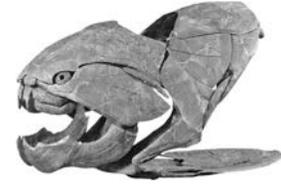


FISHING FOR *DUNKLEOSTEUS*

You're definitely gonna need a bigger boat

by Mark Peter



At an estimated maximum length of 6 to 8.8 meters (20–29 feet), *Dunkleosteus terrelli* (Fig. 1) would have been a match for even the Hollywood-sized great white shark from the movie *Jaws*. Surfers, scuba divers, and swimmers can relax, however, because *Dunkleosteus* has been extinct for nearly 360 million years. *Dunkleosteus* was a placoderm, a type of armored fish, that lived during the Late Devonian Period from about 375–359 million years ago. Fossil remains of the large species *Dunkleosteus terrelli* are present in the Cleveland Member of the Ohio Shale, which contains rocks that are approximately 360–359 million years old.

sediments that eroded from the Acadian Mountains, combined with abundant organic matter from newly evolved land plants and marine plankton, settled in the basin as dark organic muds. Over millions of years, accumulation of additional overlying sediments compacted the muds into black shale rock. The rocks that formed from the Late Devonian seafloor sediments (along with fossils of *Dunkleosteus*) arrived at their present location of 41 degrees north latitude after several hundred million years of slow plate tectonic movement as the North American Plate moved northward.

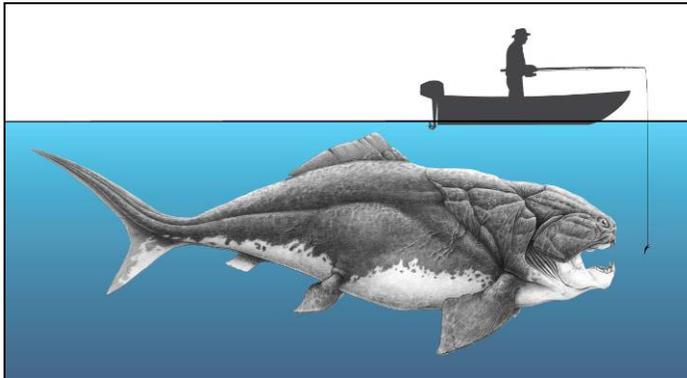


Figure 1. A reconstruction of a fully-grown *Dunkleosteus terrelli*, assuming a length of 29 feet, with angler for scale. Modified from illustration by Hugo Salais of Metazoa Studio.

Dunkleosteus cruised Late Devonian seas and oceans as an apex predator, much like the great white shark of today. But unlike the iconic shark in *Jaws*, it did not have any teeth. Instead, exposed bone on its lower and upper jaws functioned together like self-sharpening scissors. These jaws could have been used to shear through its prey, which probably consisted of smaller placoderms, bony fish, primitive sharks, and invertebrates. Smaller prey might have been swallowed whole, because *Dunkleosteus* was able to open its mouth rapidly—in as little as 20 milliseconds—creating a change in pressure and causing prey to be sucked into the mouth. Many modern fishes, such as largemouth bass, use a similar method to capture prey.

The ancient sea of *Dunkleosteus terrelli*

How did this ancient predator come to be associated with Ohio? During the Late Devonian Period, the land that is now called Ohio was covered by an inland sea that connected to the open ocean (Fig. 2). This sea was located in the subtropics, 30 to 35 degrees of latitude (about 2,000 miles) south of Earth's equator. The inland sea was located within the Appalachian Foreland Basin, a depression of the continental crust on the margin of the North American continent. The basin lay on the continental interior side of the high Acadian Mountains, forerunners of the modern Appalachian Mountains. Fine

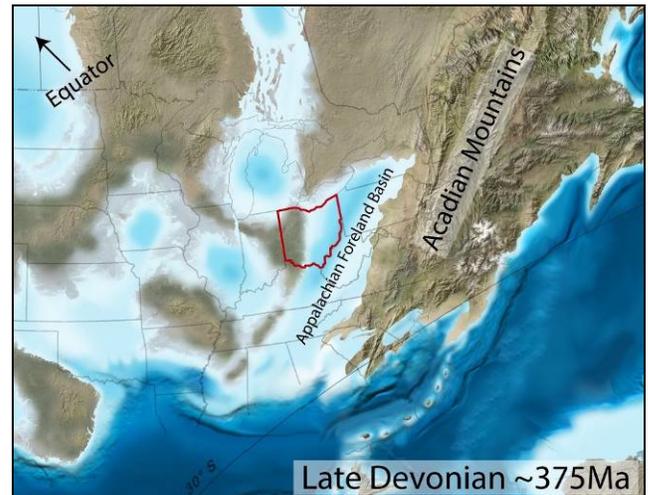


Figure 2. Paleogeographic reconstruction of eastern North America during the Late Devonian Period, about 375 million years ago (modified from Blakey: Key Time Slices of North America ©2013 Colorado Plateau Geosystems Inc.). Present-day Ohio is outlined in red.

During its life, *Dunkleosteus terrelli* likely swam near the surface, as the sea bottom was deep and not hospitable to marine life. Unlike in some shallower Devonian reef environments, animals did not colonize the seafloor of the inland sea. The preservation of high levels of organic carbon in the black shales is evidence that the seafloor was stagnant and low in oxygen. However, near the surface there would have been sufficient oxygen and light to support a complex food chain, from planktonic organisms to fishes of various sizes. At the very top of this food chain was *Dunkleosteus terrelli*.

Following death, *Dunkleosteus* carcasses may have floated with currents for a short period before settling to the bottom and becoming buried by sediments. Therefore, fossilized remains may be found some distance from where these animals lived and ultimately died. The distribution of fossils in North America, continental Europe, and North Africa suggests that *Dunkleosteus* was an active, continuous swimmer that probably ranged through the entire ancient inland sea and beyond into the open ocean.

Fishing for *Dunkleosteus*: You're Definitely Gonna Need a Bigger Boat (p. 2)

by Mark Peter, July 31, 2019

A series of Ohio fossil discoveries

In 1867, fossils of *Dunkleosteus terrelli* were discovered by amateur paleontologist Jay Terrell, a resident of Lorain, Ohio, who was collecting from the black shales along the Lake Erie shore at Sheffield Lake. The fossils were brought to the attention of John Strong Newberry, Ohio's second state geologist. Newberry, trained as a paleontologist, described the fossils in 1873. He gave the species name *terrelli* (pronounced TARE-rell-eye) to honor Mr. Terrell. For the genus name, Newberry had used *Dinichthys*, meaning "terrible fish," but decades later the species became the basis for a new genus, *Dunkleosteus* (pronounced Duncle-OST-stee-us). This name is a combination of *Dunkle*, for Professor David Dunkle, an eminent paleontologist who worked on the fossil fishes found in the Cleveland Shale, and *-osteus*, from the Greek *osteon*, meaning "bone." A specimen on display at the Cleveland Museum of Natural History has acquired the simpler nickname of "Dunk."

Numerous specimens of *Dunkleosteus terrelli* have been discovered in the Cleveland Member of the Ohio Shale, which is well exposed in parts of Cuyahoga County (Fig. 3). From the late 1800s to early 1900s, a small number of dedicated avocational paleontologists contributed most of the known specimens, excavating them by hand. In the 1920s, as land in the Big Creek basin was being developed, scientists from the Cleveland Museum of Natural history discovered additional specimens by employing a new technology, the power shovel, to unearth large concretions containing fossil fish.



Figure 3. Paleontologist Peter Bungart, photographed here with his assembled *Dunkleosteus terrelli* specimen, was an expert collector and preparator who worked for the Cleveland Museum of Natural History from 1922–1947. This specimen, collected from the Rocky River Reservation of Cleveland Metroparks in 1928, took Bungart nearly eight years to prepare.

In 1965, when excavations for Interstate Highway 71 near Cleveland were about to cut through several miles of a fertile fossil-collecting area, researchers from the Cleveland Museum of Natural History were prepared. They had obtained federal funds allocated for the salvage of paleontological finds threatened by highway construction. In cooperation with the Ohio Department of Transportation, a crew of more than thirty trained paleontologists collected fossils as they were being unearthed. This ambitious project yielded a wealth of specimens, including *Dunkleosteus terrelli*, and enabled the Cleveland Museum to build one of the world's premier collections of Devonian-age placoderms and other fossil fish.

Fossils few and far between

"It is almost useless for a man, untrained in the ways of the black shale, to come into the region hoping to find much."

—Professor Jesse Earle Hyde, 1926

Finds of fossil fish in the Ohio Shale are infrequent. Although some fossils are found in the shale itself, others are encased within large, rounded carbonate concretions that are resistant to weathering. These hard concretions erode intact from the shale but must be split open, or allowed to break naturally, to reveal any fossils within. Only a small percentage of concretions yield recognizable fossils (Fig. 4).



Figure 4. Part of a carbonate concretion bearing a lower jaw of *Dinichthys hertzeri*, a fish similar to *Dunkleosteus terrelli*. Huron Member of the Ohio Shale, ODNR Division of Geological Survey collection.

Despite environmental conditions in the Ohio Shale that favored occasional preservation of remarkably intact fossils, such as sharks complete with soft tissues and even stomach contents, *Dunkleosteus terrelli* is primarily known from head and thoracic shields, some vertebrae, and a pectoral fin. Like other placoderm ("plate skin") fish, *Dunkleosteus* was covered with bony armor only in the anterior (front) portion of its body. Minerals incorporated in this bony part of the skeleton made the armor hard and rigid, and also made this area much more likely to be preserved as fossils. Reconstructions of the entire *Dunkleosteus* body (as in Fig. 1) have either been based on more completely known small placoderms or on large modern fish.

All good things must come to an end

Armored placoderm fish were a large and diverse group that dominated Devonian seas. Like many successful forms of life, placoderms had their day in the sun, but ultimately died out. *Dunkleosteus terrelli*, along with the rest of the placoderm lineage, became extinct at the end of the Devonian Period, approximately 359 million years ago. Fortunately, the mighty predator "Dunk" left its armor behind, allowing paleontologists to recount its story.

Further Reading

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