



KRONOSAURUS

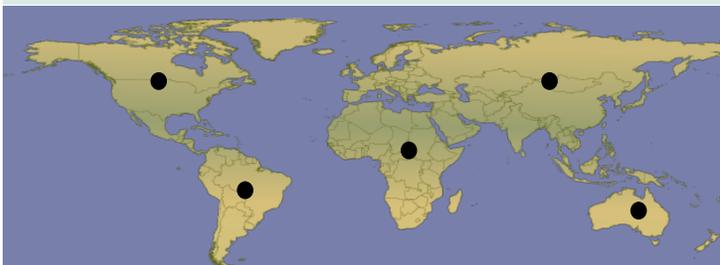
(KRON-o-SAWR-us) “Lizard of Kronos”

CLASSIFICATION

Kingdom.....	Animalia
Phylum.....	Chordata
Class.....	Sauropsida
Superorder.....	Sauropterygia
Order.....	Plesiosauria
Suborder.....	Pliosauroidae
Family.....	Pliosauridae
Genus.....	<i>Kronosaurus</i>
Species.....	<i>queenlandicus</i>

FOSSIL LOCATION

Worldwide



SIZE

Length 12.8 m (43 ft)

WEIGHT

6,000-8,000 kg
(6-8 tons)

DIET

Carnivore

LIFESPAN

No reliable estimates

TIME PERIOD

Kronosaurus
Early Cretaceous
142-115 million years ago

Triassic Period
250 - 201 million years ago

Jurassic Period
200 - 146 million years ago

Cretaceous Period
145 - 65 million years ago



INTRODUCTION

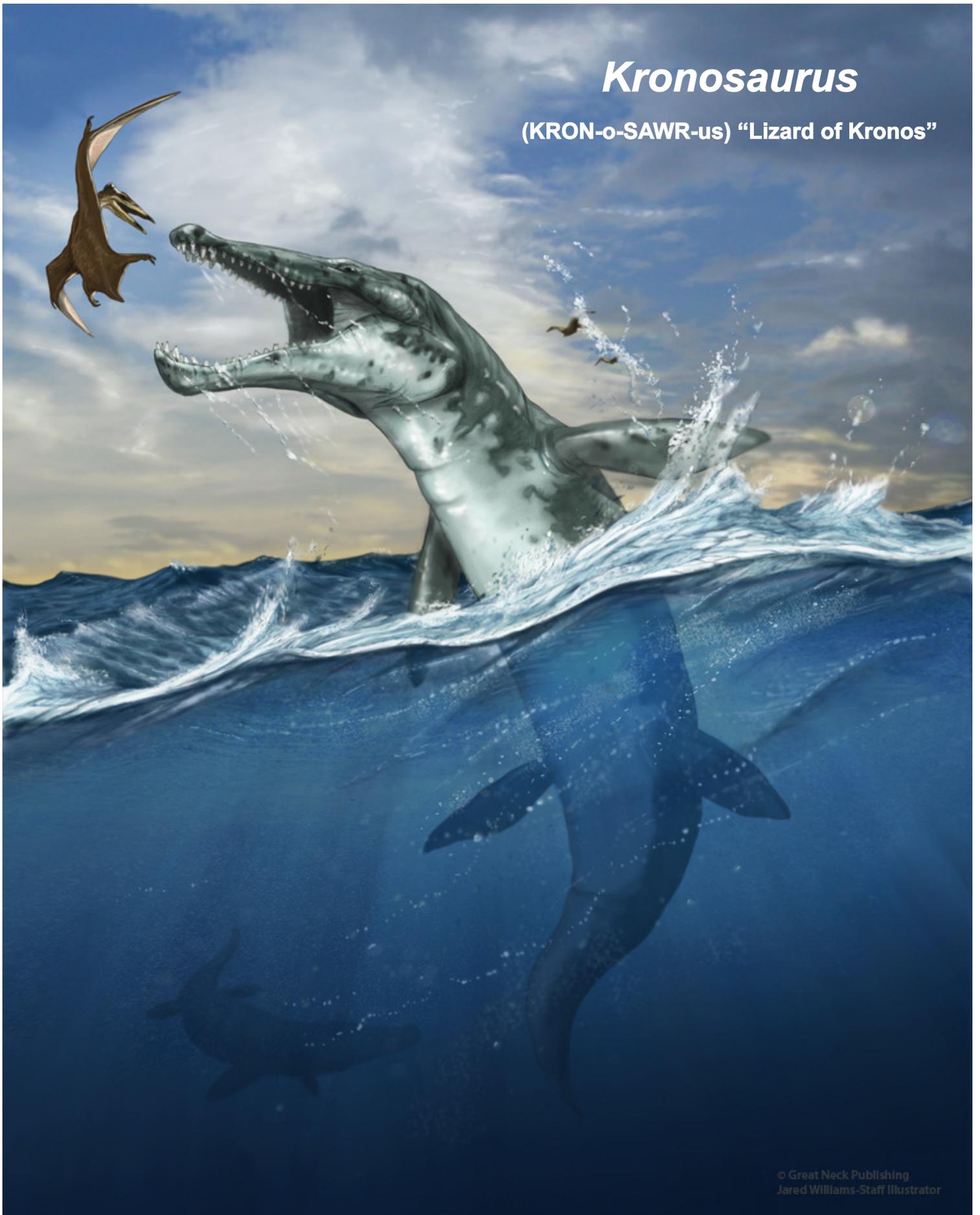
Kronosaurus is one member of the pliosaurides family that arose in the Early Jurassic period and lived through the Cretaceous period, 201–65 million years ago. During that time, *Kronosaurus* is thought to have terrorized the seas for a period of about 25 million years. It is thought that the pliosaurs were able to withstand several **extinction events** because their worldwide distribution permitted them to find sufficient prey populations to maintain a surviving population. This undoubtedly contributed to the longevity and relatively small variety of pliosaurs in the fossil record. They are characterized by long, massive skulls, shortened neck structures, and streamlined bodies equipped with two sets of large, oar-like flippers.

Pliosaurs have been found throughout the world, indicating that they were **pelagic** creatures. Throughout the span of their existence, the action of plate tectonics pulled apart the supercontinents of Pangaea to form Gondwanaland, which was then further fragmented into the continents more or less as they are known today. As the continents moved into their different positions, various oceans and seas were formed and unformed. The **Tethys Sea** split Laurasia and Gondwanaland, between the regions that became North America, Greenland, Europe, Africa and India. The North American continent was later bisected by a large inland sea, the Western Interior Seaway, that today corresponds to the plains of the Midwest. The relatively shallow waters of this sea were home to abundant sea life, including the pliosaurs and other plesiosaurs.

The pliosaurs were a diverse clade, spanning a wide variety of sizes. They are believed to have been deep water species that fed on fish, **belemnites**, and even other plesiosaurids. The pliosaurs also contained the largest carnivores ever known, including *Liopleurodon*, *Kronosaurus* and “**Predator X.**” These creatures were large enough to make a meal of *Tyrannosaurus rex* and even of *Carcharodon megalodon*, the giant ancestor of the present day Great White shark.

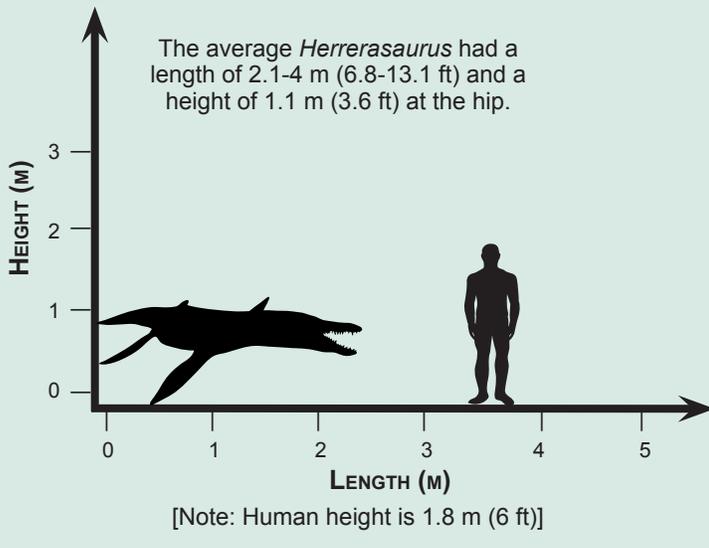
Kronosaurus

(KRON-o-SAWR-us) "Lizard of Kronos"



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MEASUREMENT CHART



CLASSIFICATION

A pliosaur, *Kronosaurus* possessed a streamlined, teardrop-shaped body designed to fly through the water. Its motion was driven by two sets of lateral flippers that clearly appear to be modified legs adapted to the aquatic environment. Pliosaurus are also characterized by a much shorter neck structure than the plesiosaurs, supporting a long, narrow flattened head with massive jaws that makes up fully one quarter of the overall length of the creature. This is in contrast to the long, narrow necks and small heads that are typical of the plesiosaurs.

In the Linnaean system of classification, the pliosaurs share certain features with plesiosaurs that identify them as a subset of the plesiosauridae. These include such things as general body shape and flipper structures. At the same time, the shortened neck structure and disproportionate head and jaw size of the pliosaurs immediately sets them apart from the plesiosaurs. The issue is somewhat confused, however, in that some Cretaceous pliosaurs are believed to have evolved from a branch of the long-necked Jurassic plesiosaurs. This, coupled to a scarcity of complete fossil pliosaur remains, has made the identification and classification of the pliosaurs a somewhat less-than-exact science. The discovery of more and previously unknown pliosaur remains around the world should eventually allow the pliosaurs to be classified more distinctly.

Cladistic analysis, which has become more common among scientists in the late twentieth and twenty-first centuries, seeks to draw evolutionary relationships among creatures by placing them in clades or groups with shared and sometimes overlapping characteristics. In a cladistical analysis, some

scientists place *Kronosaurus* in the brachauchenidae clade, with *Brachauchenius*. Other scientists have placed *Kronosaurus* in a sister relationship with *Peloneustes*, a pliosaur with blunt teeth thought to feast on ammonites, **Mesozoic** shellfish.

ANATOMY

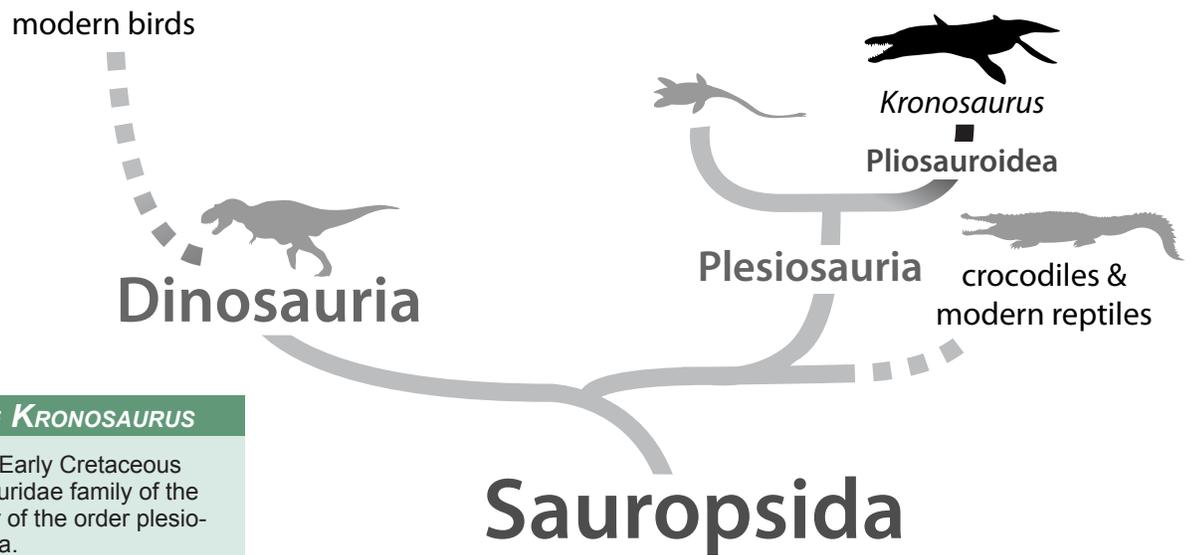
The pliosaurs have a very distinct anatomy. The overall torpedo shape suggested by their fossil remains would have allowed them to fly through the water, powered by two sets of flippers. Some are thought to have been the fastest of swimming creatures, although their shape and size would not have been conducive to high maneuverability. Their streamlined shape was complimented by relatively short neck structures, with fewer cervical vertebrae, than those of the plesiosaurs. Nevertheless, there is considerable variation in the cervical structures of different species of pliosaurs. *Macroplata*, for example, had twenty-nine cervical vertebrae, while *Kronosaurus* had only thirteen.

The neck structure of the pliosaurs supported the creatures' long head and the oversized jaws that more closely resembled those of crocodiles than of plesiosaurs. The upper jaw of *Kronosaurus* made up fully 25 percent of the creature's overall length, and was as long as some other pliosaurs just by itself. Estimates of the bite strength of *Kronosaurus* have placed it as the highest ever, at about 33,000 **psi (pounds per square inch)**. Though massive, the jaws of the pliosaurs were long and relatively narrow, armed with an impressive array of triangular, dagger-like teeth that in *Kronosaurus* were the size of large bananas. The head shape blended smoothly into the neck structure and then the body, which tapered quickly to the point of a tail from behind the rear set of flippers. This provided an overall body shape that offered the absolute minimum of resistance to movement through the water. The two sets of flippers, situated at one-third and two-thirds of the length of the body, probably looked and functioned more like wings. In movement, it is likely that they worked in opposing motions and in the manner of wings, so that pliosaurs essentially flew in the water.

INTELLIGENCE

No estimates of the encephalization quotient (EQ) of pliosaurs are available. Given the size of the creatures, however, and the overall shape of skulls that are known, it does seem likely that the pliosaurs would garner a rather higher EQ or intelligence score than that of the plesiosaurs, which must have been quite low.

The EQ of a species is determined as a relationship between the size of the brain and the mass of animals of similar size.



CLASSIFICATION OF *KRONOSAURUS*

Kronosaurus, of the Early Cretaceous period, is in the pliosauridae family of the pliosauroidae suborder of the order plesiosauria.

The trend is seen in the terrestrial dinosaurs that EQ and body size exhibit a reverse relationship, so that the larger the animal, the lower is its EQ. The long-necked sauropods such as *Brachiosaurus* and *Apatosaurus* had very small heads relative to their massive bodies. Correspondingly, their brain size was also very small, on the order of 0.05, as compared to about 5.8 for modern humans. The similarly built plesiosaurs, assuming that the definition of EQ applies to such aquatic species in the same manner that it applies to land creatures, would likely have had similarly low EQ values.

The plesiosaurs, on the other hand, were equipped with very large heads that may have housed similarly large brains. This would have produced a significantly higher value for the EQ, presumably corresponding to higher natural intelligence and problem-solving ability necessary for successful **pursuit predators**.

REPRODUCTION & POPULATION

While it is not known with certainty, plesiosaurs surely must have been viviparous because of their size and aquatic nature. No evidence has been found to demonstrate that they withdrew to land to deposit eggs in the manner of other reptiles. It is much more probable, given the body structure and size of the plesiosaurs, that offspring were born alive in environments that

offered some protection from other predators in the open sea. However, this does not preclude the possibility that some of the smaller species of plesiosaurs may have been egg-layers, capable of withdrawing to the shoreline to deposit eggs in the sand as turtles and other reptiles do.

Plesiosaur fossil remains have been found throughout the world, and new species are being identified with some regularity. These discoveries expand the diversity of the pliosauridia family in many ways. In 2006, a previously unknown plesiosaur called Predator X, which was fully 20 percent larger than *Kronosaurus queenslandicus*, was discovered on the Norwegian island of Svalbard. Smaller plesiosaurs have also been discovered there, and elsewhere. The known plesiosaurs now cover a size range from about 1.5 m (5 ft), as in *Umoonasaurus demoscyllus*, to 15 m (50 ft), as Predator X. The diversity and world-wide distribution of fossil plesiosaur remains, as well as the extended period of time in which they existed, indicate that they were well adapted and may have been quite numerous, although there is little evidence to indicate their numbers.

DIET

The plesiosaurs were distinctly carnivorous. Their bodies were built for high-speed chases through the water, and the

teeth in their oversized jaws are designed only for catching and holding prey animals. A small number of pliosaurs have been identified by teeth that would function well to crush the shells of belemnites or ammonites and other shelled creatures, but absolutely none have ever been found that indicate an herbivorous component to the pliosaur diet.

The seas of the world throughout the span of the pliosaurs were abundant with fish and other creatures, especially the large, shallow inland seas that existed in various locations at various times. The sheer abundance of suitable prey ensured that the pliosaurs could find food somewhere and survive almost any extinction event, five of which are believed to have occurred throughout the Mesozoic age, before the Chicxulub impact that ended the age of dinosaurs.

BEHAVIOR

The pliosaurs were built for speed and agility in the water. Their motion would probably have been very similar to that of present-day penguins and seals that have a very similar overall body shape. Although pliosaurs were fast and agile, some prey creatures were probably more maneuverable in short runs, and so, were able to evade immediate capture. This might indicate that pliosaurs primarily fed on creatures within their own size range and formed a **guild**. The identification of pliosaur fossil

remains of different species and sizes in the same location tends to support this notion.

It is not known whether the pliosaurs shepherded their young until they were of an age to live independently. This does seem probable, however, as the behavior is more conducive to the long-term survival of a species in an inimical environment populated by predators.

HABITAT & OTHER LIFE FORMS

The habitat of the pliosaurs can be described simply as pelagic. The open sea was their realm. It is likely that they would have lived and hunted in the relatively shallow regions nearer to shore, where the variety of suitable prey would have been the richest and most abundant. The largest pliosaurs, such as *Kronosaurus*, *Liopleurodon* and Predator X, were undoubtedly pelagic hunters, living out their lives in the deeper waters. Since their size rivaled that of modern whales, stranding on shore would have been deadly. Smaller pliosaurs, however, would possibly have been able to work their way back to the open water by using their flippers to assist movement, rather like seals and walruses do today.

The waters of the Mesozoic teemed with a rich variety of other creatures, from jellyfish and ammonites to large fish and

VOCABULARY

Belemnite: A genus of extinct cephalopods having a stream-lined, bullet-shaped internal shell. Belemnites were especially abundant during the Mesozoic age. From the Greek βελεμνον (belemnion), meaning “dart.”

Extinction Event: Any environmental occurrence resulting in the extinction of a large proportion of existing species, the best known being the Chicxulub meteor strike near the Yucatan Peninsula 65 million years ago. Several other major events are also known to have occurred, indicated by sudden absences of fossil remains in the geologic record.

Guild: A group of different species that each require the same type of food (or other resource) and acquire it from different niches within the same ecosystem, rather than competing with each other directly.

Mesozoic: The “Middle Life” period of the geologic time scale, extending from 251 million to 65 million years ago, marking the central period in which living things are known to have existed. From Greek μεσον (meson), meaning “middle” and ζοον (zo-on) meaning “life.”

Pelagic: An adjective that refers to creatures and structures

that exist or occur in the open ocean (away from the shore), from the Greek word πελαγος (pelagos), meaning “sea.”

Predator X: The name given to the remains of a *Kronosaurus*-like pliosaur discovered in the Norwegian Arctic island of Svalbard in 2006. Predator X is fully 20 percent larger than any pliosaur previously unearthed, reaching 16 m (50 ft) in length.

PSI (Pounds per Square Inch): A measurement of pressure. In this case, a more accurate description would be pound of force per square inch.

Pursuit Predator: A carnivorous creature whose primary or only method of capturing prey is to pursue or chase it. The method typically requires an enhanced ability to discern and solve problems arising from the prey’s efforts to elude capture.

Tethys Sea: An inland sea that is believed to have formed between the two major segments of Gondwana as tectonic activity separated various parts of the supercontinent from each other. The Mediterranean Sea is believed to be its present-day remnant.

reptiles. The pliosaurs would have shared their environment with contemporary creatures such as *Paleoniscum*, *Saurichthys*, *Aspidorhynchus*, *Pholidophorus*, *Henodus*, *Lariosaurus*, *Ceresiosaurus*, *Pistosaurus*, various plesiosaurs and ichthyosaurs, and a great many other types of creatures. The *Brachauchenius*, which grew to a length of 13 m (40 ft) in the Late Cretaceous period, is the last known pliosaur to inhabit the North American continent.

RESEARCH

The group of animals called pliosaurs has been known for almost two hundred years, since the identification of fossil remains of *Sinopliosaurus* by G. Young in 1820. *Liopleurodon* was described by Sauvage in 1873, *Brachauchenius* by Williston in 1903, and *Kronosaurus* by Longman in 1924. Several other species were discovered and described during this same period, and many more since then, to the discovery of *Umoonasaurus* and Predator X by different researchers in 2006.

The number of Mesozoic species, dinosaurs and non-dinosaurs alike, that have been identified to date is surprisingly low—at approximately one thousand. Of these, only about one quarter are known by complete skeletons, and many are known only by a few identifiable skeletal fragments. The full extent of prehistoric life will probably never be known. Only more exploration and careful research will reveal what species are still to be discovered.

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RICHARD M.J. RENNEBOOG

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