BATHYNOMUS
A Living Sea Monster

by REGINA WETZER

In December 1877 the U.S. government commissioned the Coast Guard Steamer *Blake,* under the supervision of the great oceanographer and naturalist Alexander Agassiz, to explore the bed of the Gulf Stream in the Straits of Florida between the southern part of the state and Cuba. The *Blake* made repeated dredgings as deep as 3,600 meters (11,811 feet). From these great depths many previously unknown animals were brought to the surface. Before 1838, fewer than twenty species of Crustacea were known to exist in the West Indies region; the *Blake* expedition added more than 150 new species in 40 new genera to those already described. Among those new species was the first specimen of the giant isopod *Bathynomus*. This first specimen captured was an immature male, a mere 23 centimeters (9 inches) in length, taken at Station 29 at a depth of over one mile (1,720 meters or 5,643 feet), west of the Dry Tortugas. Alphonse Milne-Edwards, an eminent specialist in crustaceans, first reported this specimen. Recognizing this singular beast as representing a new genus and species,the famous carcinologist christened it *Bathynomus giganteus (bathy* = deep, *nomus* = home).

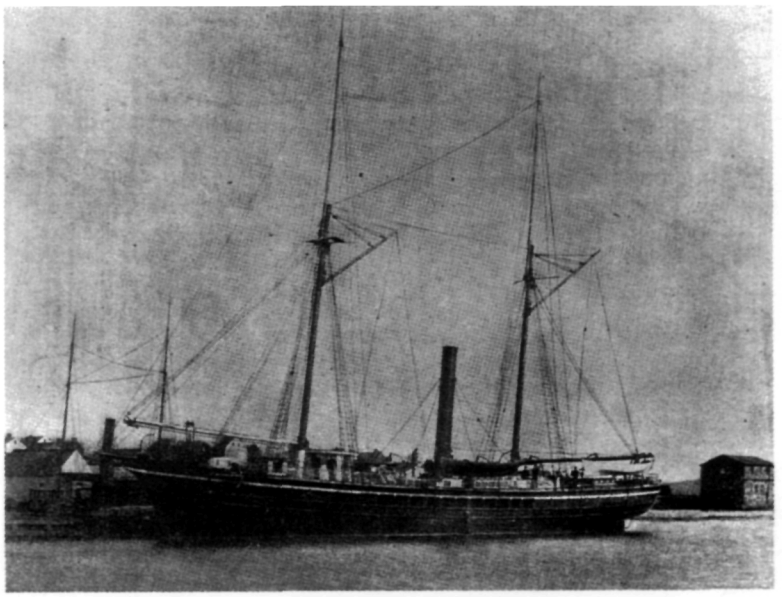
The discovery of a gigantic deep-sea isopod immediately aroused great interest, and the species was soon mentioned in a number of popular books on the deep sea. The first published illustration of the species appeared not in a technical paper, but in a popular book, Filhol's *Vie au fond des mers* ("Life at the Bottom of the Ocean"), published in 1885. In 1891, Wood-Mason and Alcock reported on three females of this species dredged from the depths of the Bay of Bengal in the Indian Ocean, but it was not until 1905 that additional Atlantic specimens were reported in the literature. Published accounts of *Bathynomus* appeared sporadically throughout the first decade of this century, but over time the enormous initial public interest in the "monster" diminished.

Bathynomus belongs to a crustacean order known as the Isopoda, a group comprising over four thousand described parasitic and free-living species. In addition to isopods, crustaceans include such better-known celebrities as lobsters, crabs, and shrimp. In a fashion similar to that of a shrimp, an isopod's body is composed of a distinct number of calcified rings or segments. One pair of appendages arises from each segment, and the name "isopod" derives from the fact that all the legs are more or less similar to one another (*iso* = similar, *pod* = feet). The isopod body is typically divided into three distinct functional regions: the head, thorax, and abdomen.

Isopods are found in any remotely habitable environment. They are common on land and in fresh water, from the poles to the equator, from mountain tops to caves, and from tropical jungles to the driest deserts. Common pill bugs or roly-poly bugs, which are found under rocks and logs, are also isopods, but are members of a group specifically adapted for life on land. However, these remarkably adaptive creatures reach their greatest numbers in the sea, where they range from the intertidal zone to the great ocean depths, over ten thousand meters below the surface. Many isopods are parasites on the other sea creatures, including fishes, turtles, crabs, shrimp, and even other isopods.

Isopods are remarkable in their adaptations to this multitude of environments. What the Galapagos finches achieved in their island archipelago, the isopods have attained worldwide. Corresponding to this great global adaptive radiation, isopods exhibit tremendous variation in size. Adults of the smallest isopods attain lengths of less than one millimeter (approximately the size of the period at the end of this sentence), while most are 0.5 to 2.5 centimeters (0.2 to 1.0 inches) long. The largest species *(Bathynomus giganteus)* can achieve a body length of 46 centimeters (18 inches), about the size of a lobster dinner for two. Such a size range is comparable to that of the shrew and the blue whale, which represent the extremes in mammals.

In addition to the record-holding species *B. giganteus,* the genus *Bathynomus* contains eight other species ranging in size from 10 to 33 centimeters (4 to 13 inches). All members of this genus are remarkable for their enormous size and for their distinctive morphological attributes. Four species, *B. doderleini, B. affinis, B. propinquuis,* and *B. decemspinosus* occur in the Japan-Philippine Islands–South China Sea area. *B. giganteus,* the largest species, has been recorded in the Bay of Bengal, the Arabian Sea, the Gulf of Mexico, and in the southwest Atlantic off Brazil. *Bathynomus miyarei* was described in 1978 and was found from Ceara to the Rio Grande do Sul, Brazil, in depths varying from 22 to 280 meters (72 to 918 feet). An additional bathynomid discovery was made in deep water along the New South Wales coast of eastern Australia and has been named *B. kapala.* Two additional species have been collected very recently. *B. immanis* is reported from the Queensland coast,



The Coast Guard Steamer **Blake.** ***In 1877, under the supervision of the great oceanographer and naturalist Alexander Agassiz, scientists aboard the*** **Blake** ***captured the first specimen of*** **Bathynomus giganteus** ***in the West Indies region. Courtesy of the Hancock Foundation Library.***

A plate from the 1902 Milne-Edwards and Bouvier study, reproduced here at near the crustacean's maximum length of 18 inches. Photograph by Allyn G. Smith.

Eastern Australia, and *B. pelor* from Port Hedland, Western Australia. The Indo-Pacific area has the greatest abundance of bathynomid species, with 7 of the 9 species occurring between the longitudes of 100 and 160 degrees east. As deep-water trawling and scientific exploration takes place elsewhere in the world's oceans, it is likely that more species will be discovered.

The original description of *B. giganteus* in 1879 was brief and dealt almost exclusively with its remarkable size, enormous eyes, and unusual respiratory organs, the latter consisting of bundles of complex fingerlike gills at the base of each abdominal appendage. A. Milne-Edwards and Bouvier later (1902) published a very thorough study of the anatomy of this species, providing many excellent illustrations. Subsequently, in 1908, R. E. Lloyd provided a detailed description of the internal anatomy. The largest *Bathynomus* recorded in the published literature is a 36-centimeter (14-inch) adult from the Dry Tortugas off Florida, and the smallest is an immature female just 3.4 centimeters in length. Dr. R. Brusca, Curator of Invertebrate Zoology at the Natural History Museum of Los Angeles County, recounts examining specimens exceeding 46 centimeters (18 inches) in length taken by Caribbean trawlers.

Contrary to what is observed in the vast majority of deep-sea organisms, *Bathynomus* has exceptionally well-developed eyes. The eyes are compound like those of other arthropods and insects, and in *Bathynomus* each eye is composed of up to four thousand separate, square facets. Instead of being situated on the upper surface of the head, as in most species of isopods and crustaceans, they occupy the lower surface at the base of the antennae. Other isopods usually have thirty to forty facets in each eye, and most deep-sea and cave-dwelling isopods are completely blind. The increase in eye size in *Bathynomus* is not simply an effect of the increase in size of the animal, but is probably a result of adaptation to life in the deep sea. Less than 0.5 percent of the light striking the ocean's surface penetrates below 100 meters, and the most discriminating human eye can detect sunlight only to depths of about 400 meters. It would seem that in order to function in the darkness at great depths, the eyes of *Bathynomus* have become grossly enlarged relative to their shallow-water cousins. Unfortunately, we have no idea what a deep-sea creature like *Bathynomus* really "sees," but it must be a rather colorless world or at least a relatively monochromatic one, for at the great depths inhabited by these isopods only hues of blue and green light are present.

Gigantism occurs in many groups of organisms. Much speculation and numerous hypotheses have been offered in an effort to explain this phenomenon. Often, within a group of closely related species, the tendency toward gigantism increases as one moves from the warm equatorial regions toward the poles and from the warm shallow seas to the cold deep oceans. In general, cold-water species also grow and develop more slowly, exhibit lower metabolic rates, and live longer than their warm-water counterparts.

The monstrous appearance of *Bathynomus* is due in part to the first three pairs of large, prehensile legs. These are followed by four pairs of ambulatory legs, but all are armed with numerous spines and end in sharp, curving "claws." The powerful mandibles, which possess sharp incisors and tearing molar processes, are typical of voracious carnivores. The mandibular jaws are followed by two additional pairs of maxillary jaws. These six head appendages work together to hold, tear apart, and chew deep-sea creatures that fall prey to *Bathynomus*.

However, very few people have ever seen *Bathynomus* in its own world, as only deep-sea submersible vehicles allow observation in the depths at which these creatures live. Based on the isopod's agile swimming and large, muscular grasping legs, it seems almost certain that they can capture large and mobile prey, such as deep-sea bottom-dwelling fishes and crustaceans. Fishes collected in the same capture nets as these isopods are often badly mutilated, while the isopods reveal distended guts, suggesting they had fed ravenously on the helpless fish during their journey to the surface. The presence of large quantities of radiolarians and sponge spicules in the guts of different species of *Bathynomus* suggest that these isopods may also feed as scavengers. Attack of living prey in the natural environment has yet to be documented, but the presence of copepods, fish scales, nematodes, and shrimp remains in *Bathynomus* gut samples reinforces suspicions of an omnivorous, predacious habit and rather undiscriminating tastes. The enormous size of these isopods also suggests that they must consume a substantial diet, although at the depth and temperatures in which they live, their metabolism may be quite slow.

No fossil *Bathynomus* have been discovered, although one possible candidate

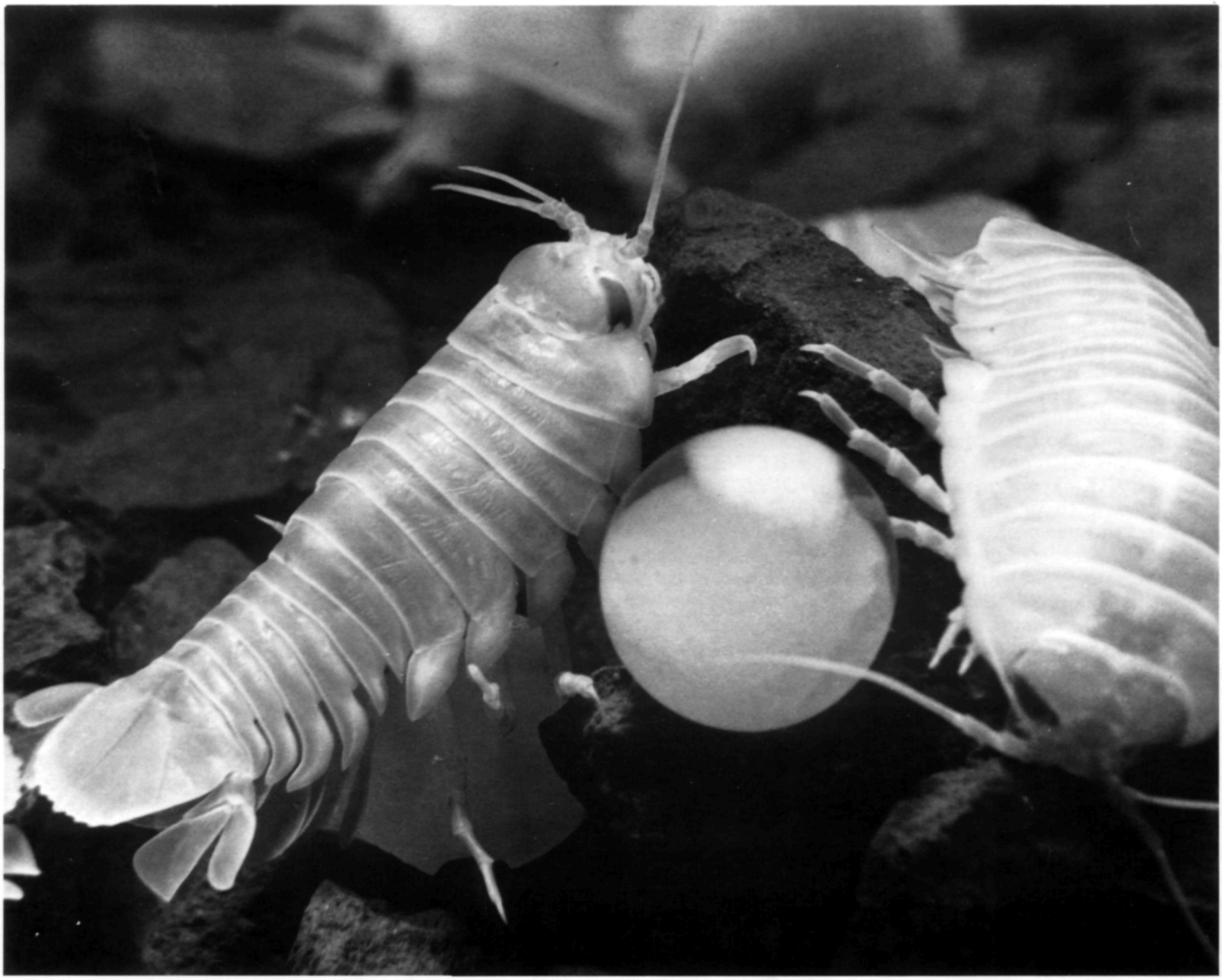
A juvenile that was successfully maintained at the New York Aquarium. The voracious and omnivorous Bathynomus *uses its powerful mandibles to tear and cut apart its victims. Photograph by Bill Meng, courtesy of the New York Aquarium and New York Zoological Society.*

is a fossilized fragment dating from the middle Miocene epoch (15 million years ago) and discovered in the Okayama Prefecture of Japan. Two other Cretaceous (75 million years ago) isopod fragments, both placed in the extinct genus *Pelaega*, may also be bathynomids. One is from Bedfordshire, England, the other from a Texas formation. The fossil fragment of *Pelaega guadalupensis* indicates that the body length of this specimen approximated a juvenile *B. giganteus* in size, although it is not possible to determine the stage of development from the fragment. Unfortunately, isopods do not fossilize well, and it is impossible to ascertain with certainty the real taxonomic disposition of these three fragmentary remains.

Apart from a few taxonomic studies, very little is known about *Bathynomus*. This is due in part to the technical difficulties of sampling at great depths. Bathynomids live below the limits of SCUBA techniques and may be capable of swimming fast enough to dodge most biological dredges trawled from oceanographic ships. With recent advances in commercial and scientific deep-sea fishing gear, such as baited free-release traps, bathynomids are now caught more often, though they still remain rare in research collections. Catch size of the Japanese species *B. doderleini* appears to be correlated with the topography of the sea bottom. This species is restricted to the waters of the Kuroshio Current, off central Japan, where it has been captured in greater abundance on gentle slopes than on steeper submarine inclines.

Preliminary experiments by Japanese biologists suggest that *B. doderleini* actively feeds at 8 degrees Celsius and stops feeding at water temperatures below 3 degrees C on the steeper slopes of the northern Japan Sea, and in the waters along the Pacific Coast of Japan north of latitude 38 degrees north. Thus, the absence of bathynomids from these area is possibly due to the extremely cold temperatures, although the influence of other environmental factors remains to be investigated.

In 1976 collectors from the New York Aquarium dredged up six large *Bathynomus giganteus* off Pensacola, Florida. The isopods ranged in size from 26 to 36 centimeters (10 to 14 inches). Another collection was made in 1980, and in addition to mature males and females, juveniles just 9 centimeters (3.5 inches) in length were obtained for exhibit. Gravid females carrying developing embryos were also captured for exhibit. Isopods have no larval stages; the embryos and young states are brooded in a pouch, or marsupium, in a fashion similar to marsupials. When the young hatch



Two juvenile* Bathynomus *and a large, undeveloped egg at the New York Aquarium. Photograph by Bill Meng, courtesy of the New York Aquarium and New York Zoological Society.

and leave the mother's brood pouch, they closely resemble the adults, but lack the seventh pair of legs. The New York Aquarium specimens were successfully maintained on morsels of fresh squid and fish in a 450-gallon tank at 8.8 degrees C (48 degrees F). To simulate their sunless environment, but to allow public viewing, dim red lights illuminated the exhibit. Their bizarre appearance, coupled with occasional bursts of rapid swimming movements, rolling from side to side with straightened bodies, drew daily crowds of observers to the aquarium.

Increasing numbers of *Bathynomus* are now being caught by commercial fishermen and scientists trapping red crabs *(Geryon)* off Florida. The isopods appear to survive the long trip of 600 to 1,200 meters to the surface, as well as extreme pressure and temperature changes, better than deep-sea fishes. Very little is known about their physiology, and it is not known if they suffer decompression sickness. In an effort to determine if deep-sea species can be recompressed at the surface so that their natural activities can be observed, Dr. Mary Wicksten and one of her graduate students, Brian Cocke, at Texas A & M University, are experimenting with *Bathynomus* from the Gulf of Mexico. If these creatures can be successfully recompressed, it will be possible to measure their respiration rates and photograph their activity patterns under conditions closely simulating their natural habitat.

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Sweeter than Crab
A *Bathynomus* Dinner for Eight

6 to 8
fourteen- to fifteen-inch
Bathynomus giganteus

Place whole, crawling crustaceans, one at a time, in a microwave oven (550 watt). Cook on high power for four or five minutes. Split carapace, carefully avoiding breaking the stomach open. Remove meat (found mostly along the inside of the dorsal carapace and around legs); use meat in any recipe requiring crab meat. The texture is very similar to crab meat, but tastes quite a bit sweeter. Serves 8.

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