Sea Facts

Drinking fish, helpful horseshoe crabs and deep-sea life

FREE DIVING

BY VINCE RHODES

Q: My wife and I saw the movie *The Big Blue* recently. I find it hard to believe that people really free dive that deep. What is the current depth record?

A: A new world record was set on November 14, 1993 by Francisco "Pipin" Ferreras. Pipin took 2 minutes 9 seconds to free dive to a depth of 410 feet and return to the surface breaking his previous record of 361 feet set in 1991 and the previous world record of 403 feet held by Umberto Pellizzari. The dive took place off Freeport, Grand Bahamas in 2000 feet of water.

There are three free diving categories. In the Constant Weight category, the diver descends and ascends using only his flippers and without varying his weight. The diver must descend making a headfirst surface dive and may not pull himself along the guideline. The 1991 230-foot record for this type of dive is held by Pellizzari.

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The second category is Variable Weight. The diver descends making use of ballast equal to one third his weight, but not exceeding a maximum of 66 pounds. The weight is normally abandoned. The diver can then pull himself up the ascent line and use his fins. This 314 foot record was set by Pipin in July 1993.

The last category is Absolute or No-Limits Diving. For this free dive, a cable with a weight attached is lowered into the water. The diver uses a sled to descend the cable to a determined depth. The sled has handles and leg rests as well as gauges, lights and a video camera. It took 1 minute 20 seconds for Pipin to reach 410 feet. His ascent was then aided by a lift bag. As he rocketed toward the surface, the lift bag exploded and Pipin was forced to swim the final four meters to the surface after being in the water for about two minutes.

The dive, sponsored by Mares, involved a support crew of approximately 25 people including 11 Italian safety divers. In addition to their role as safety divers, the Italians documented the free dive with video and still pictures. They used both air and heliox for their breathing gases.

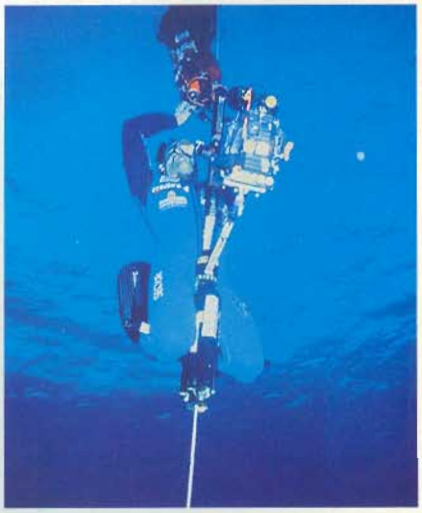
Jacques Mayol, subject of *The Big Blue*, was on hand to congratulate Pipin after his record-setting dive.

Q: A buddy of mine recently told me I drank like a fish. This sparked a rather heated discussion. Do fish drink?

A: Some do. Fish, like all animals, have adapted to their specific conditions in order to maintain homeostasis — or a balance between their internal and external environments. Because they live in water, fish have had to change physiologically to allow their body to maintain the proper amount of salt. The process they undergo to maintain this balance is known as osmoregulation.

Marine and freshwater environments pose different problems for fish. Marine bony fish have salt concentrations in their bodies that are roughly 1/3 that of the surrounding water. Differing salt concentrations cause water to move across membranes in an attempt to reach equilibrium. This process of osmosis causes marine fish to constantly lose water.

The mucous and scales which cover a fish's skin help minimize osmosis by reducing the passage of water. Unprotected areas, however, such as the gills and mouth allow unhindered osmosis. To offset this water loss, the bony fish drinks seawater. Excess salt taken in with this seawater is then excreted through the feces, urine and gills.



PHOTOS COURTESY OF MARES

Pipin set the world record for Absolute free diving in November.

Cartilaginous marine fish, such as sharks and rays osmoregulate in a different manner. These animals have high concentrations of urea, a common waste product in bony fish. Most fish excrete the urea due to its toxicity at high concentrations. Sharks and rays, on the other hand, use their urea and internal salt concentrations to match the salinity of their environment, thus preventing osmosis from occurring.

In contrast, bony freshwater fish have internal salt concentrations which are naturally higher than the surrounding water. Their problem is the opposite of the marine fish. Since osmosis causes freshwater fish to absorb water and dilute their natural salt concentration, they do not drink additional water. Instead they take in more salt and rid themselves of excess water.

DOUG PERRINE

A marine fish drinks water to regulate its body's salt content.

Q: I've heard there are vents of extremely hot water on the ocean floor. How are they formed and can anything live near them?

A: Scientists first discovered hydrothermal vents in 1977 along volcanic ridges on the ocean floor near the high-temperature, deep-sea springs near the Galapagos Islands. Since then, more of these vents have been found by oceanographers in the eastern Pacific.

These vents are formed when cold seawater flows down through cracks in the lava floor into the underlying crust. Heated to a very high temperature, the water returns to the surface through mineralized chimneys. These chimneys, also known as black and white smokers, can rise up to 13 meters above the sea floor.

White smoker chimneys, which are rich in zinc sulfides, issue a milky fluid under 300 degrees C. Black smokers, on the other hand, are rich in copper sulfides and issue jets of clear water which soon turn black due to precipitation of fine-grained sulfur mineral particles. Temperatures in these jets range from 300 degrees C to over 450 degrees C.

Within a few meters of these chimneys reside a diverse population of deep-sea life including giant clams, mussels, polychaete worms that encrust the white smokers, crabs and vestimentifera worms which lack a digestive tract. Chemosynthetic bacteria which are the primary producers for this community use reduced sulfur compounds to form organic matter from carbon dioxide. The clams, mussels and worms filter bacteria from the water and graze on bacterial film on rocks. The giant clam (*Calyptogena magnifica*) and the large vestimentifera worm (*Riftia pachyptila*) contain symbiotic chemosynthetic bacteria within their tissues.

Q: We went to the beach during a recent dive trip and my daughter came across a horseshoe crab. They look rather intimidating. Can these crabs harm you?

A: Horseshoe crabs (*Limulus polyphemus*) are actually more closely related to spiders than other crabs. All three belong to the phylum Arthropoda. While crabs belong to the subphylum Crustacea, both horseshoe crabs and spiders are grouped in the subphylum Chelicerata because of their first pair of appendages.

Horseshoe crabs are often called the oldest living fossil since they have changed little since the Triassic period approximately 200 million years ago. In fact, they are the only survivors of class Merostomata. The other members of this group are all extinct.

Horseshoe crabs are often avoided because of their long pointed tail or telson. However, there is no danger of being impaled or stung by the horseshoe crab. Although often thought of as a defensive weapon, the tail actually serves as a rudder. In addition, the animal uses its telson to flip itself over if it is washed onto its back by a wave.

Far from being harmful, the horseshoe crab has many commercial uses. At one time they were gathered and crushed for fertilizer and chicken feed although the chicken eggs tasted fishy afterwards. They are still used as lobster bait. An important medical use has also been discovered for the horseshoe crab. Lysate, an extract from the animal's blue blood, is used in cancer research and as an indicator of spinal meningitis.