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### Deep diver.

A Cuvier's beaked whale breaches off the coast of Italy.

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## Why Do Whales Get the Bends?

By John Cannon  
*ScienceNOW* Daily News  
14 December 2007

The Cuvier's beaked whale is a master of the ocean's crushing depths. It can dive as deep as 2 kilometers in search of prey, the deepest known for any mammal. So scientists have been at a loss to explain why, in response to naval sonar testing, this champion cetacean sometimes succumbs to the same decompression sickness that afflicts scuba divers. A new mathematical model suggests that, by replicating the sounds of a predator, sonar forces the whale to adopt a risky diving pattern.

Researchers have suspected a link between sonar testing and whale deaths for nearly 20 years. In 2000, the U.S. Navy said its sonar exercises led six beaked whales to fatally beach themselves in the Bahamas,

and stranded whales have died near sonar-testing sites in at least five other cases since then. It hasn't been clear how the sonar disorients the animals and causes such strandings, but some marine biologists suspect that the intense sound waves force whales to shoot to the surface, and they've found evidence that tiny nitrogen bubbles expand in the whales' tissues and damage vital organs ([ScienceNOW](#), 9 October 2003). The same thing happens when scuba divers surface too quickly—a condition known as the bends. But a whale holds its breath when diving, preventing nitrogen buildup, so the theory didn't seem to hold water. A group led by marine biologist Peter Tyack of Woods Hole Oceanographic Institution in Massachusetts suspected that whales alter their diving behavior in some other way.

Whales make repeated shallow dives when trying to evade predators. The team wondered whether such behavior could be risky, especially because naval sonar—which is similar in frequency to the calls of the beaked whale's most feared adversary, the killer whale—could be forcing the whales to

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adopt a similar diving pattern. So the researchers mathematically analyzed dive behavior in Cuvier's beaked whales and in dolphins to test whether nitrogen bubbles could expand in whale tissue during repeated shallow dives. The team incorporated known physiological data into a model that charts how the bubble size might increase in the circulatory system, brain, muscles, and fat tissues when a whale dives repeatedly to between 30 and 80 meters for as long as 3 hours.

During normal diving behavior, scientists believe, the lungs of marine mammals collapse when they plunge past 72 meters in depth. That "clever mechanism," Tyack says, prevents nitrogen from infiltrating the bloodstream. The team's model predicts that if the whales' lungs do not collapse during a long series of shallow dives, the increased pressure can cause nitrogen bubbles to diffuse into tissues, increasing the risk of bubble formation on ascent. Limiting the duration of sonar testing may prevent the animals from diving in these harmful patterns, the team concludes in the current issue of *Marine Mammal Science*.

Noting that diving behavior is extraordinarily difficult to study in live animals, marine biologist Terrie Williams of the University of California, Santa Cruz, calls the model "extremely useful." As new research shores up gaps in the model's assumptions--with actual observations to corroborate the avoidance behavior, for example--scientists can try to home in on a safe length and level of sonar exercises, clarifying the murky waters surrounding this debate. "Now it's a question of how quickly [decompression sickness] happens," she says.

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