

July 16, 2012

# Whales, Somehow, Are Coping With Humans' Din

By **WILLIAM J. BROAD**

Perhaps we can save the whales — or at least their hearing.

Scientists have long known that man-made, underwater noises — from engines, sonars, weapons testing, and such industrial tools as air guns used in oil and gas exploration — are deafening whales and other sea mammals. The Navy estimates that loud booms from just its underwater listening devices, mainly sonar, result in temporary or permanent hearing loss for more than a quarter-million sea creatures every year, a number that is rising.

Now, scientists have discovered that whales can decrease the sensitivity of their hearing to protect their ears from loud noise. Humans tend to do this with index fingers; scientists haven't pinpointed how whales do it, but they have seen the first evidence of the behavior.

"It's equivalent to plugging your ears when a jet flies over," said Paul E. Nachtigall, a marine biologist at the University of Hawaii who led the discovery team. "It's like a volume control."

The finding, while preliminary, is already raising hopes for the development of warning signals that would alert whales, dolphins and other sea mammals to auditory danger.

Peter Madsen, a professor of marine biology at Aarhus University in Denmark, said he applauded the Hawaiian team for its "elegant study" and the promise of innovative ways of "getting at some of the noise problems." But he cautioned against letting the discovery slow global efforts to reduce the oceanic roar, which would aid the beleaguered sea mammals more directly.

The noise threat arises because of the basic properties of seawater. Typically, light can travel for hundreds of feet through ocean water before diminishing to nothingness. But sound can travel for hundreds of miles.

The world's oceans have been getting noisier as companies and governments expand their undersea activities. Researchers have linked the growing racket to deafness, tissue damage, mass strandings and disorientation in creatures that rely on hearing to navigate, find food and care for their young.

The danger has long been a political football. In 2008, the Supreme Court heard a lawsuit by the

National Resources Defense Council against the Navy over ocean noise; the court ruled that naval vessels had the right to test sonar systems for hunting submarines. But environmentalists saw a tacit victory in getting the nation's highest court even to consider the health of sea mammals in a debate over national security.

The latest development took place at a research facility off Oahu — at an island where the opening shots of “Gilligan’s Island” were filmed.

Scientists there are studying how dolphins and toothed whales hear. In nature, the mammals emit sounds and listen for returning echoes in a sensory behavior known as echolocation. In captivity, scientists taught the creatures to wear suction-cup electrodes, which revealed the patterns of brainwaves involved in hearing.

The discovery came in steps. First, Dr. Nachtigall and his team found the animals could adjust their hearing in response to their own sounds of echolocation, mainly sharp clicks. The scientists then wondered if the animals could also protect their ears from incoming blasts.

The team focused on a false killer whale named Kina and sought to teach her a conditioned behavior similar to how Pavlov taught dogs to salivate upon hearing a bell.

First, the scientists played a gentle tone repeatedly. Then they followed the gentle pulse with a loud sound. After a few trials, the warning signal alone caused Kina to decrease the sensitivity of her hearing.

“It shows promise as a way to mitigate the effects of loud sounds,” said Dr. Nachtigall, founding director of the [Marine Mammal Research Program](#) at the University of Hawaii. “People are generally very excited about it.”

In May, Dr. Nachtigall and his colleagues presented the findings to acoustic scientists and groups meeting in Hong Kong, including the Acoustical Society of America. The team cited the protective deafening as a potential way to help sea mammals cope with noisy blasts from naval sonars, civilian air guns and other equipment.

In the future, the team plans to expand the research to other species in captivity and ultimately to animals in the wild. “We have a problem in the world,” Dr. Nachtigall said of the oceanic roar. “And we think the animals can learn this response very rapidly.”

Scientists unconnected to the mammal research called it important. “It’s a big deal,” said Vincent M. Janik, a prominent marine biologist at the University of St. Andrews in Scotland. In an e-mail, he said it revealed a rare ability among the planet’s creatures.

Carl Safina, president of the Blue Ocean Institute, a conservation group in Cold Spring Harbor, N.Y., called the discovery a potential window into what sea mammals may already do on some

occasions to protect their hearing.

“I’ve sometimes wondered why these high intensity sounds don’t cause problems all the time,” he said in an interview. “Maybe it’s that, once the animals hear something very loud, they can adjust their hearing — dial it down and protect themselves.”

Scientists say the extraordinary hearing of sea mammals evolved to compensate for poor visibility beneath the waves and to take advantage of the unique qualities of seawater. Sound travels five times faster than in air and undergoes far less diminishment.

The heads of whales and dolphins are mazes of resonant chambers and acoustic lenses that give the animals not only extraordinary hearing but complex voices. The distinctive songs of humpback whales appear to be sung exclusively by males seeking mates.

In recent decades, scientists have linked the human cacophony to reductions in mammalian vocalization, which suggests declines in foraging and breeding. And the problem is poised to get worse: In May, the Navy disclosed draft environmental impact statements ([Atlantic](#) and [Pacific](#) operations) that said planned expansions could raise the annual hearing losses among sea mammals to more than one million.

Zak Smith, a lawyer with the Natural Resources Defense Council, [recently called](#) the new estimates “staggering.”

A question of science, Dr. Nachtigall said, is whether the levels of protective deafening found in Kina can be increased. The team plans to study the auditory response in such species as bottlenose dolphins and beluga whales before trying it on wild populations.

The big political hurdle is financing, he said. Federal support for the sea mammal research has declined in recent years, and industry is only starting to show interest in the finding.

“I’m pulling in money where I can,” he remarked. Dr. Nachtigall said the research was costly because sea mammals need high levels of care.

But he called it revealing and rewarding. “When it comes to whales and sound,” Dr. Nachtigall said, “we’re just starting to understand.”

