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Week of Feb. 9, 2008; Vol. 173, No. 6, p. 84

Whales Drink Sounds: Hearing may use an ancient path

Rachel Ehrenberg

Whales may receive sounds through the throat in addition to taking them in through the jaw, a new study finds. Understanding where sound enters the head of the Cuvier's beaked whale could point to the original acoustic pathway for all whales and provide insight into how sonar affects the animals.



DEEP LISTENER. The Cuvier's beaked whale prefers water more than 1,000 meters deep and mostly eats squid, detected by echolocation. New work has uncovered a sound pathway in this rarely seen toothed whale that may be shared by all whales.
D. Allen

The Cuvier's beaked whale is one of roughly 80 species of toothed whales, along with pilot whales, dolphins, orcas, sperm whales and others. Toothed whales are deep divers that hunt for food using echolocation—they emit sounds that bounce off objects and return to the whale, giving a "picture" of the prey's shape, size, and whereabouts.

Previous experiments and anatomical studies had found that sounds entered a toothed whale's head through a structure known as the acoustic window, an area of the lower jaw that's very thin on the outside with a large pad of fat on the inside. Sounds were thought to vibrate the thin layer of bone and

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then travel through the fat to the ear.

Ted Cranford of San Diego State University in California explored the "jaw hearing" idea further, using computer models generated from CT scans of two Cuvier's beaked whales that had died and washed up on the beach. Working with colleagues, Cranford modeled the exact geometry of the whale's head and all of its physical properties, such as bone and tissue density. The researchers then fed mathematical "sounds" into the model and watched how the sounds traveled.

To Cranford's surprise, sounds coming from directly in front of the whale seemed to travel under its jaw, not through the acoustic window. The sound waves then went through the throat, and passed through a hole in the back of the jaw to the fat by the ear.

After repeating the modeling runs and looking again at the anatomy of other whales, Cranford realized that this path—from throat to ear—might also be used by other whales, even baleen whales, the non-toothed whales that do not use echolocation. Jaw hearing may have evolved in the toothed whale lineage to provide an advantage under certain circumstances, he says. The throat pathway might actually be very old, he adds—possibly the original acoustic pathway for all whales.

"Using the throat area as a wave guide does make a lot of sense," says Michael Moore of the Woods Hole Oceanographic Institution in Massachusetts, who was not part of the study.

The study, from the March *Bioinspiration & Biomimetics*, could add insight into the observed relationship between whale strandings and sonar testing. Now other species need to be examined, says Moore, to learn whether all whales can "see" the same way with their ears.

Letters:

I have heard that whales evolved millions of years ago into their present form, including their very large brains. We humans must be relatively recent in terms of our brain structures. Are there data concerning evolutionary development in whales?

Matthew Kabrisky
Dayton, Ohio

"Learning to Listen: How some vertebrates evolved biological sonar" (SN: 5/14/05, p. 314) reviews the evolutionary steps in echolocation development in whales.—Sid Perkins

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 **References and sources for this article**

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Further Readings:

Milius, S. 2003. Bad bubbles: Could sonar give whales the bends? *Science News* 164(Oct 11):15. Available to subscribers at <http://www.sciencenews.org/articles/20031011/fob3.asp>.

Perkins, S. 2005. Learning to listen. *Science News* 167(May 14):314-316. Available at <http://www.sciencenews.org/articles/20050514/bob9.asp>.

A version of this article written for younger readers is available at *Science News for Kids*.

Sources:

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