

A bigger nose, a bigger bang: Size matters for echolocating toothed whales

November 16 2018



A graphical rendition of a diving sperm whale using its echolocation. Sperm whales exemplify the evolutionary drive for highly intense echolocation -- their nose is a massive sound generator that can take up as much as 1/3rd of the body

size of an adult male. Sperm whales are the largest toothed whales, with adults reaching a body size of up to 18m; as deep-divers, they pursue squid at depths of up to 2000m, lasting for up to an hour; its huge nose is a giant sound generator that creates and then focuses the most intense sound in the animal kingdom.

Credit: Chris Johnson

A new study sheds light on how toothed whales adapted their sonar abilities to occupy different environments. The study shows that as animals grew bigger, they were able to put more energy into their echolocation sounds—but surprisingly, the sound energy increased much more than expected.

Trying to find your lunch in the dark using a narrow flashlight to illuminate one place at a time may not seem like the most efficient way of foraging. However, by replacing light with sound, this seems to be exactly how the largest toothed predators on the planet find their food. A [paper](#) out this week in the journal *Current Biology* shows that whales, dolphins and [porpoises](#) have all evolved to use similar narrow beams of high-intensity sound to echolocate prey. Far from being inefficient, this highly focused sense may have helped them succeed as top predators in the world's oceans.

Thirty-two million years ago, the ancestors of toothed whales and [baleen whales](#) diverged, and the ancestors of toothed whales—including dolphins, porpoises and [sperm whales](#)—evolved the ability to echolocate—to send out sound pulses and listen for the returning echoes from objects and prey in their environment. This new sense allowed these [animals](#) to navigate and find food in dark or murky waters, during the night, or at extreme depths. Since then, this [evolutionary step](#) has allowed these animals to occupy an amazing diversity of habitats, from shallow freshwater rivers to the great ocean deeps.

The new study, led by Frants Havmand Jensen at the Aarhus Institute of Advanced Studies in Denmark, sheds light on how toothed whales adapted their sonar abilities to occupy different environments. He found that as animals grew bigger, they were able to put more energy into their echolocation sounds—but surprisingly, the sound energy increased much more than expected.

"Normally, organs tend to grow proportionally to the rest of the body, but as echolocating whales became larger, their sound-generating structures started taking up more and more of the body," says Professor Peter Teglberg Madsen of Aarhus University who co-authored the study. "This likely reflects an evolutionary pressure for long-range prey detection—it allowed larger whales to find prey further away, letting them hunt more efficiently in deep water," says Jensen. The pinnacle of this evolutionary push is the [sperm whale](#), where the nose used to generate and focus sonar pulses can make up as much as one-third of the body of adult males.

While size has a big influence on how loud echolocation signals are, animals of all sizes from 1.5-meter harbor porpoises to 16-meter sperm [whales](#) used a consistently narrow biosonar beam to inspect their surroundings, akin to using a narrow-beam flashlight to search for food in the dark.

"This is really similar to how our own vision works—we see best in just a narrow field of view, which we turn toward whatever we want to look at," says Dr. Mark Johnson from University of St. Andrews, a co-author of the study. "These narrow sonar beams may help animals make sense of complex environments with lots of echoes." Using a narrow sonar beam has other advantages, as well. "Focusing the [sound](#) energy in one direction also helps increase the range at which prey can be detected and thus could lead directly to higher foraging rates—provided the beam doesn't get too narrow," adds Jensen.

More information: *Current Biology* (2018). [DOI: 10.1016/j.cub.2018.10.037](https://doi.org/10.1016/j.cub.2018.10.037)

Provided by Aarhus University

Citation: A bigger nose, a bigger bang: Size matters for echolocating toothed whales (2018, November 16) retrieved 26 April 2024 from <https://phys.org/news/2018-11-bigger-nose-size-echolocating-toothed.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.