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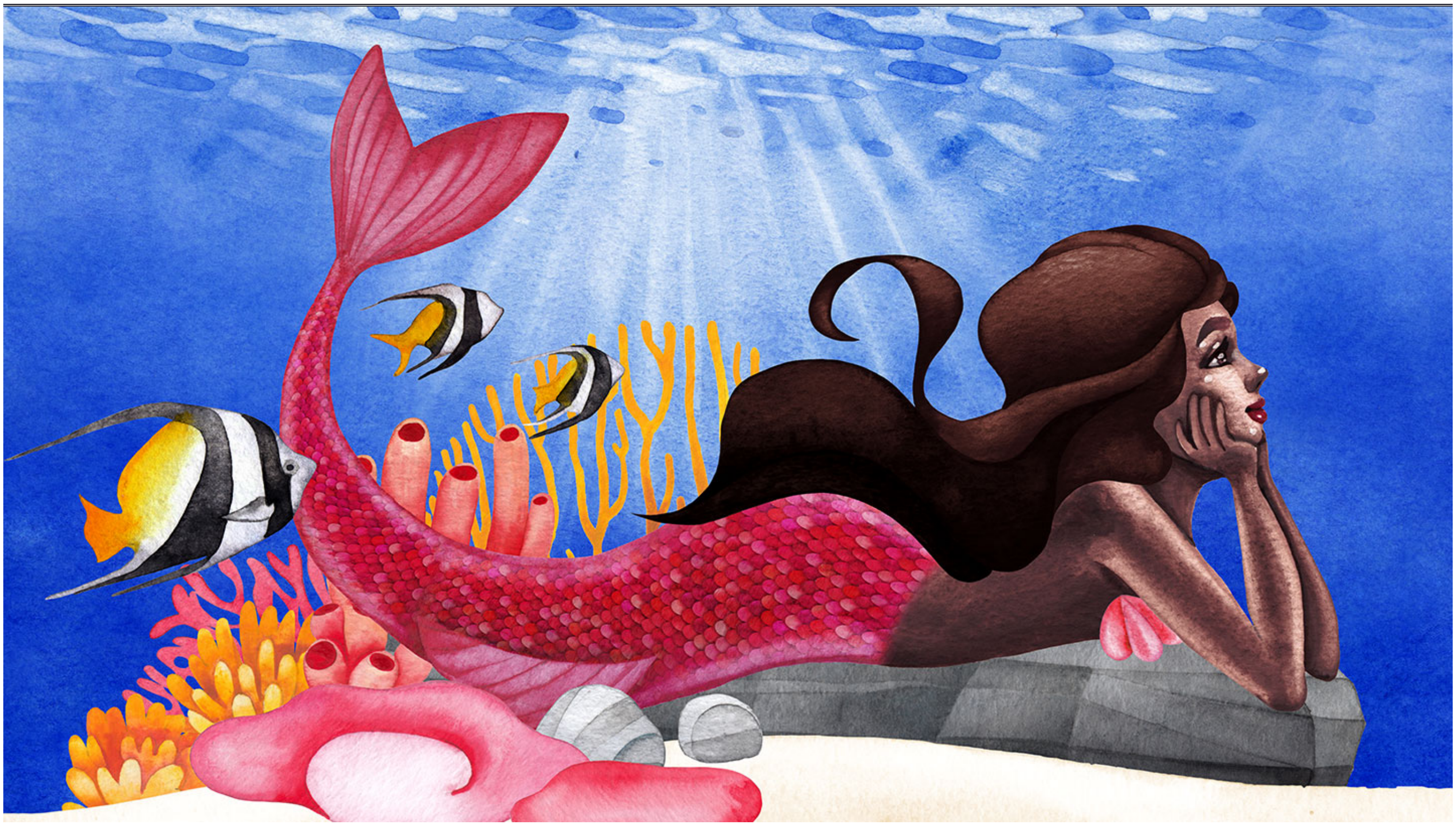

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How would a mermaid sound underwater?

A mermaid would need marine creature features to hear and produce sounds

By **McKenzie Prillaman**

12 hours ago

Mythical mermaids are often known for their fishy tails and alluring songs. But if you were underwater with one, her tunes wouldn't sound quite like they do in the movies. And you might struggle to understand the words as Ariel or her other mermaid friends burst out singing.

Even next to a mermaid, the song would sound muffled and would seem to come from all around, says Jasleen Singh. "You could still make out what she is saying, but it would sound fuller with less clarity," Singh says. She studies human hearing at Northwestern University in Evanston, Ill.

If mermaids existed, and if they sang and talked to one another, their hearing and sound-making setups might resemble marine creatures' features instead of humans'. To understand why, you have to start with the basics of sound and hearing.

Explainer: How the ears work

Sound is produced when an object vibrates. Touch your throat while you talk, and you can feel your vocal cords vibrating inside your neck. These vibrations can travel through gases, liquids and solids. In each medium, atoms and molecules get pushed around by a sound source's back-and-forth motion. These particles bump into each other in a rippling pattern of waves. Like a line of falling dominoes, the colliding particles spread sound.

Human hearing starts with sound waves entering the air-filled space in each earhole. The waves vibrate the eardrum, which wiggles three little ear bones. One of the bones taps on a snail-shaped structure in the inner ear called the cochlea. This fluid-filled structure converts the vibrations into electrical signals that the brain understands as sound.

Underwater, it's a different story. Since water plugs your ears, you rely on sound waves directly vibrating the skull. This happens on land too, but it works better below the water's surface. That's because water and bone have similar densities. When sound waves gently rattle the skull, "that is directly stimulating the inner ear — the cochlea itself," Singh says. This is called bone conduction. We humans, however, are much more attuned to the sound waves striking our eardrums. As a result, the sound quality of bone conduction is not as good as regular air conduction.

Plus, it's difficult to figure out where a sound is coming from underwater. On land, if someone starts talking on your right side, sound waves hit your right ear before your left. This slight variation in timing helps your brain find the source of a sound. But sound travels much faster in water than in air. That's because the particles that make up liquids are closer together. In water, there is virtually no time difference between sound hitting each ear. That makes underwater noise sound very full, like it's coming from everywhere.

Our sea-dwelling relatives

To hear their friends talk and sing properly, mermaids might have evolved hearing structures more like aquatic animals.

Marine mammals, such as whales, dolphins and seals, hear in a way very similar to humans, notes Colleen Reichmuth. A biologist, she studies marine mammals at the University of California, Santa Cruz. These creatures have cochleae. They also have ear bones and eardrums, though not always functional. And they have evolved some adaptations to help them hear under the sea.

The lower jaw of dolphins and some whales contains fat that directs sound to the bony middle ear. This fat has a “special chemical composition that makes it really suitable for transmitting acoustic waves,” says Laela Sayigh. She’s a marine biologist at Hampshire College in Amherst, Mass., and Woods Hole Oceanographic Institution in Massachusetts.

Some marine mammals, such as seals, have convertible ears. On land, the animals can open ear holes to pick up sound waves traveling through air. But when diving, their ear tissue swells with fluid, plugging the holes. The fluid-filled ears help transfer sound from the water to the cochleae.

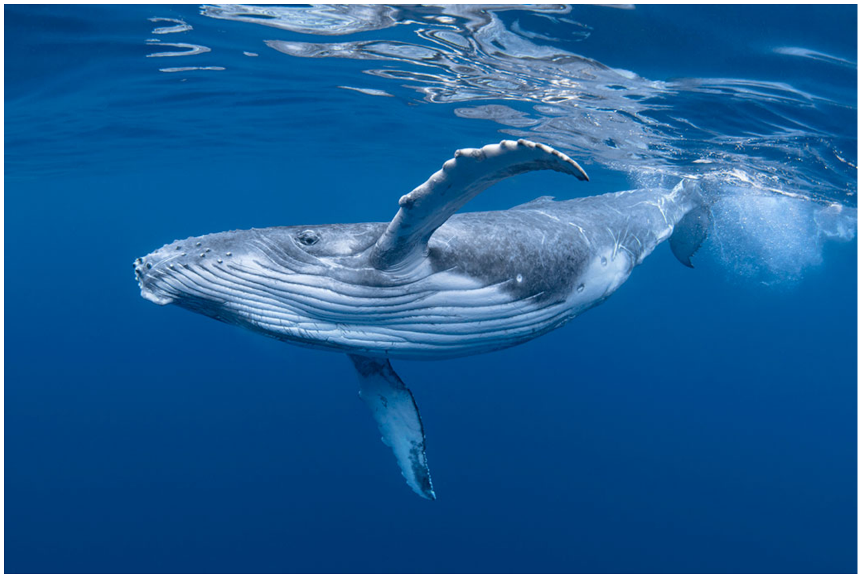
Those features could help a mermaid hear her friends’ songs more clearly. But if mermaid voices were more like those of marine mammals, their vocal systems could get a major upgrade, too.

Whales, dolphins, seals and other marine mammals can “sing” underwater, creating complex noises with musical notes or rhythms. They produce sound by passing air along tissues to vibrate them, similar to a human’s voice box. But unlike people, who must breathe out to make noise, many of these sea creatures don’t need to expel air from their mouths or blowholes to produce sound.

“Underwater, air is a precious commodity,” says Joy Reidenberg. If whales exhaled when using their voices, they would have to keep resurfacing for more air. That would interrupt their lengthy songs, Reidenberg says. She studies animal anatomy at the Icahn School of Medicine at Mount Sinai in New York City.

Instead, whales and dolphins can move air around in their bodies and even reuse it. This air recycling system would certainly help a mermaid sustain conversation or song below the surface, Reichmuth says.

For a voice that really carries, mermaids might be built like baleen whales. These whales, which include humpbacks, have huge vibrating structures in their throats that toss out sound. Some can make noises so loud and low-pitched — too low for humans to hear — that the songs could potentially travel more than 1,000 kilometers (600 miles) in the ocean. (Lower-pitched sound waves lose less energy when traveling through water than higher-pitched ones.)



Humpback whales sing beautiful, lengthy songs. But they don't need to breathe out of their mouths or blowholes to do it. These whales recycle the air supply in their bodies and can stay submerged for nearly an hour.

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Something sounds fishy

A mermaid's mammal upper half may not be the only part that could make or hear sounds. Crustaceans and fish are known to make quite a ruckus, too. In fact, snapping shrimps, typically around four centimeters (1.5 inches) long, are some of the loudest creatures on Earth. As the name implies, these shrimp snap one of their claws to produce a colossal sound.

Many fish use a similar method to make noise. They click or rub their body's bony structures together. Sea horses, for example, produce clicks by knocking the tops of their skulls into the horns on their heads. They do this when wooing a mate.

You can think of it like clicking your teeth together, says Audrey Looby. A marine ecologist, she studies fish at the University of Florida's Nature Coast Biological Station in Cedar Key.

Other species can use their muscles to vibrate an internal organ, like playing a drum. "Some fish can even communicate by expelling air out their backside," Looby says. "Essentially, fish communicating through farting." And they have special cells lining the sides of their bodies that can sense vibrations in the water, helping them to "hear."

If you met a mermaid, she might have both fish-like and mammalian structures to communicate with her underwater friends. Motion-detecting cells may line her tail, and her ears may work like a seal's to hear both in and out of water. She would probably recycle her body's air supply to talk and sing without having to keep resurfacing. But her conversations may also be sprinkled with teeth chattering, clapping — and even farting.

CITATIONS

Webpage: National Institute on Deafness and Other Communication Disorders. How Do We Hear?

Webpage: Discovery of Sound in the Sea.

Webpage: Frontiers for Young Minds. Hear and There: Sounds from Everywhere!

Journal: K. Sørensen, J. Christensen-Dalsgaard and M. Wahlberg. Is human underwater hearing mediated by bone conduction? *Hearing Research*. Vol. 420, July 2022. doi: 10.1016/j.heares.2022.108484.

Journal: C. Reichmuth et al. Comparative assessment of amphibious hearing in pinnipeds. *Journal of Comparative Physiology A*. Vol. 199, June 2013, p. 491. doi: 10.1007/s00359-013-0813-y.

Journal: J.S. Reidenberg and J.T. Laitman. Discovery of a low frequency sound source in Mysticeti (baleen whales): Anatomical establishment of a vocal fold homolog. *The Anatomical Record*. Vol. 290, June 2007, p. 745. doi: 10.1002/ar.20544.