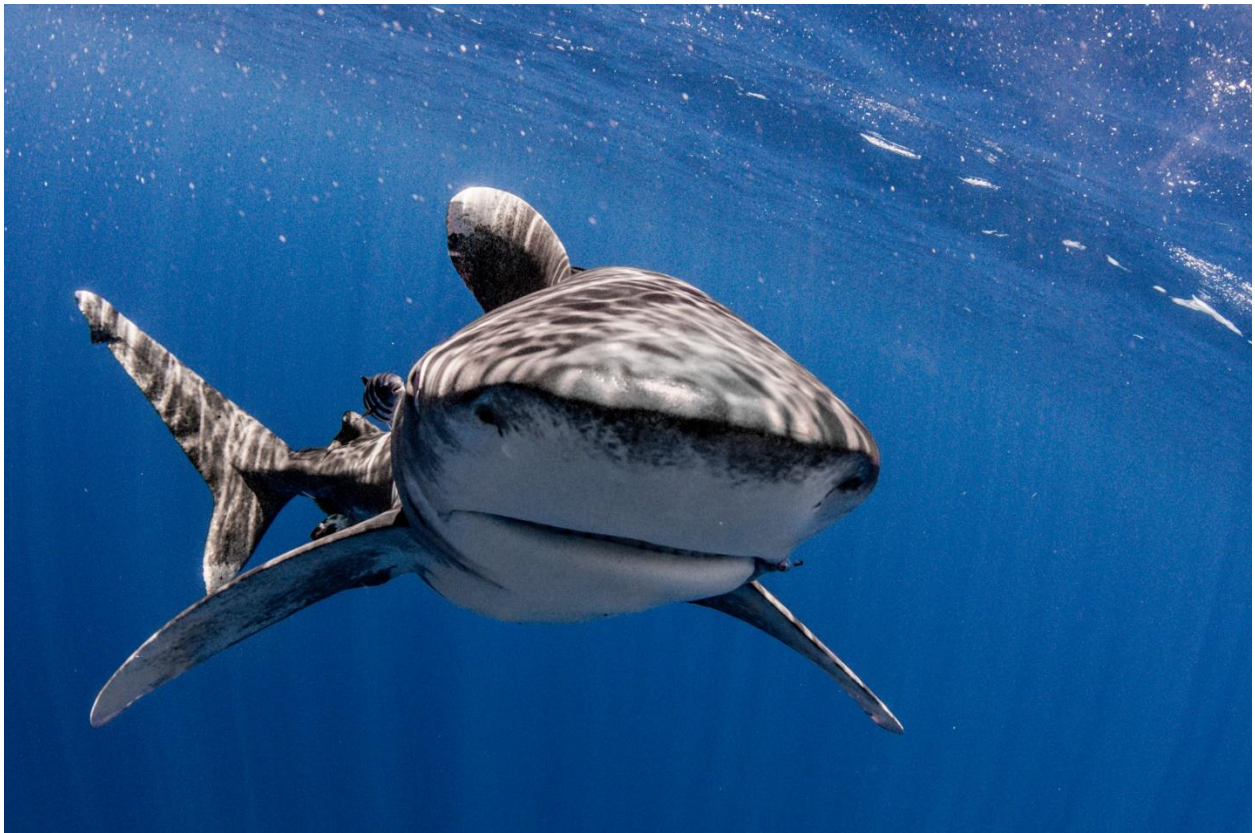


CAN SHARKS REALLY SMELL A DROP OF BLOOD A MILE AWAY?



Caine Delacy



[Ocean First Institute](#) is a nonprofit organization with the mission of ocean conservation through research and education. We work to protect the ocean and imperiled species through scientific research, while also educating individuals to take positive action for the environment through community projects, expeditions, and outreach programs.

THE SHARK OLFATORY SYSTEM

WHAT ARE SENSORY SYSTEMS?

Ever since you were a baby, you've been using your five senses: sight, sound, smell, taste, and touch. Each of these senses function because of a particular sensory system that your body possesses. A **sensory system** is the part of the body's nervous system responsible for processing sensory signals and information. These systems consist of sensory receptors throughout the body, as well as pathways between these receptors and the brain. When receptors pick up on sensory signals, a message is sent via these pathways to the brain, which is responsible for processing that sense (a.k.a. **sensory perception**).

Some animals possess a trait known as **chemoreception**, which is a physiological process whereby organisms respond to chemical stimuli. Humans happen to have two forms of chemoreception: taste and smell. Sharks also utilize chemoreception, but they are famous for being able to detect very small amounts of chemical stimuli in the water.

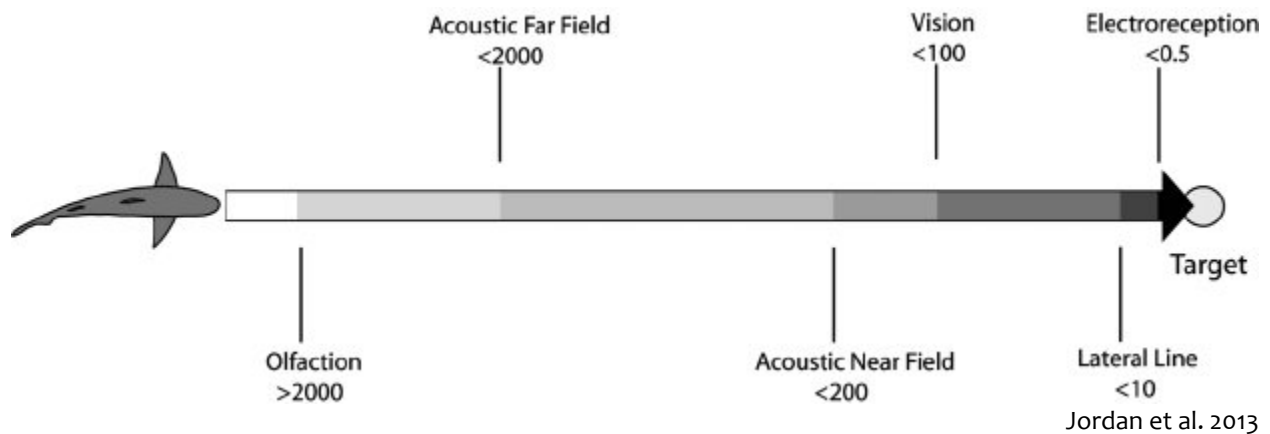
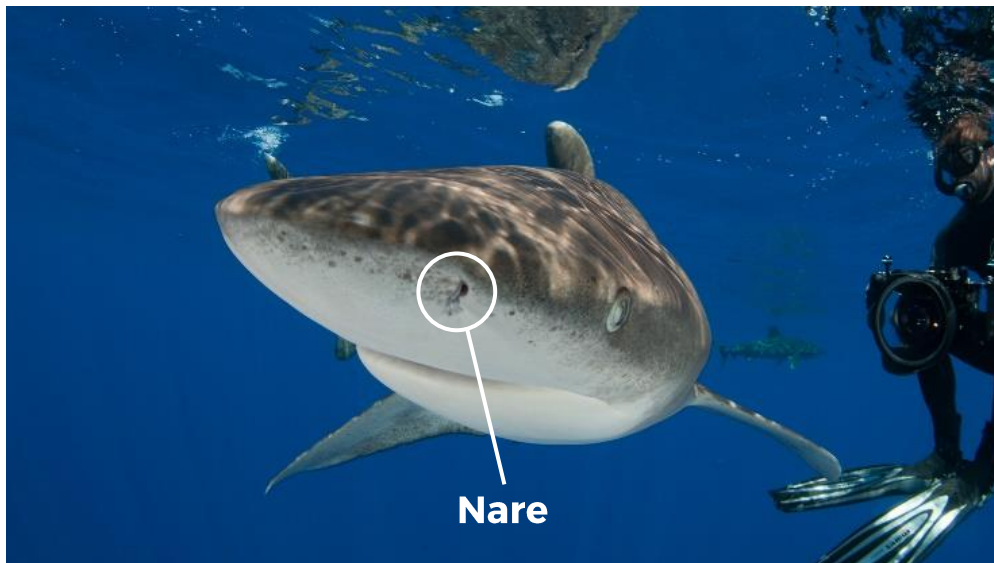


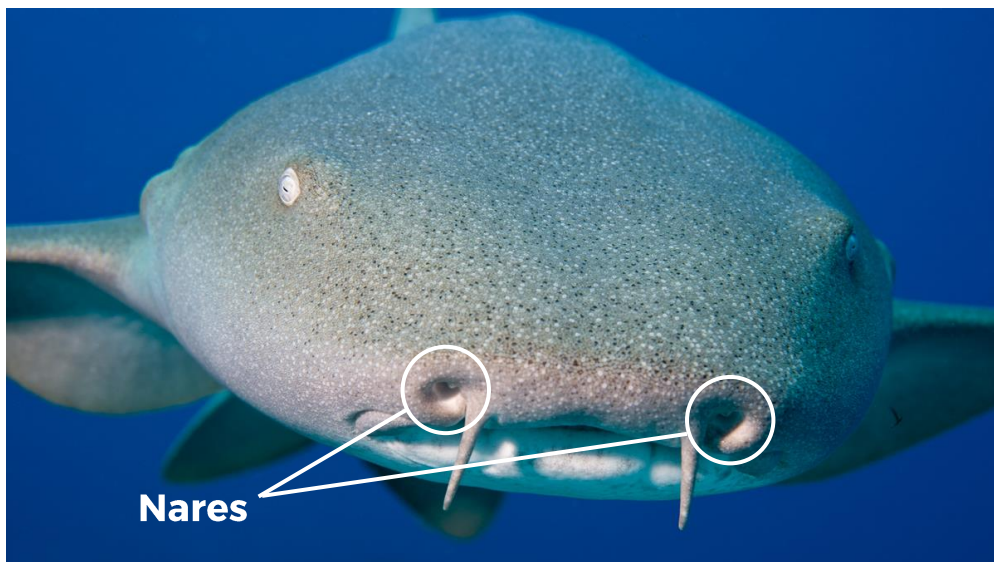
Figure 1: Approximate detection distances (in meters) for sharks associated with sensory signals emitted by a target, such as a prey item.

HOW DOES THE OLFACTORY SYSTEM WORK?

We've all heard the stories about how incredible a shark's sense of smell is. But, what is it that makes these creatures able to smell so well? Like humans, sharks have an **olfactory system**, otherwise known as the sensory system used for odor detection. However, the human olfactory system is combined with our respiratory system. Our noses are used for both breathing and smelling, while a shark has two separate features for each process. Gills on the sides of their heads facilitate oxygen uptake, while two **nares** (like human nostrils) on the shark's head detect surrounding odors.



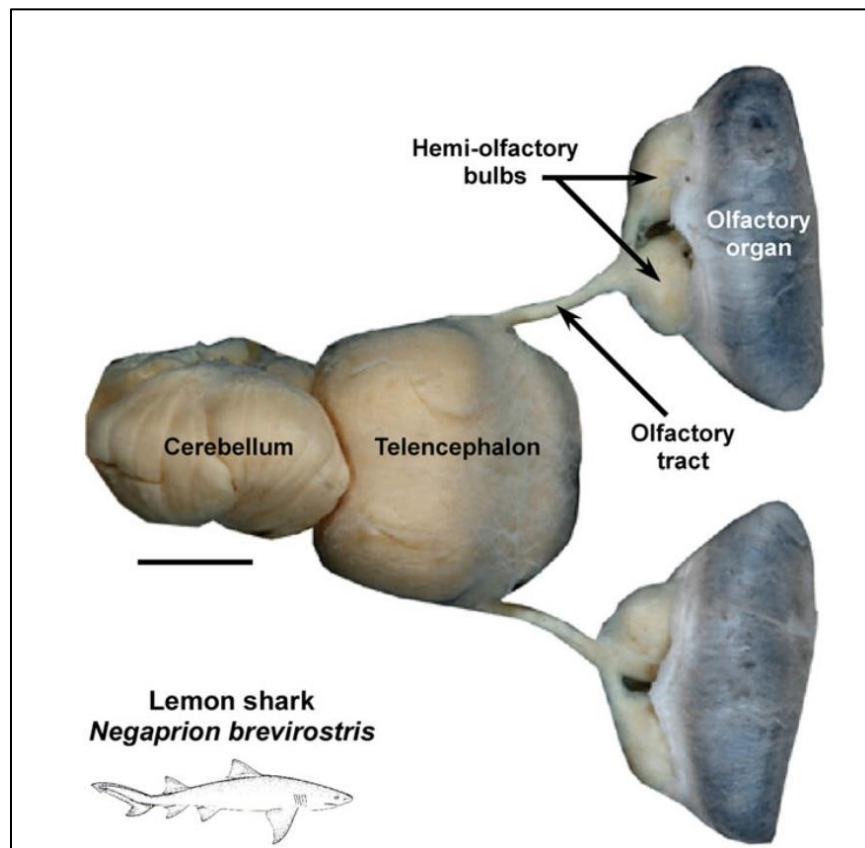
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OLFACTORY SYSTEM (CONTNUED)

Olfaction works similarly in most vertebrates. When you smell a cup of coffee, freshly baked brownie, or a bouquet of flowers, the odor enters the nose and then activates **sensory neurons** in the nasal cavity. For sharks (see Fig. 2), specially designed skin folds known as **olfactory lamellae** inside the nasal cavity contain olfactory receptors that detect odor messages. These receptors then send electrical signals to sensory neurons within the **olfactory bulbs** of the brain. These signals continue into the olfactory tract and the olfactory lobe of the cerebral hemisphere.



Meredith et al. 2013

Figure 2: The above photograph shows the organization of the lemon shark's olfactory system in relation to its brain. Learn more about shark olfactory system anatomy and how it is studied in OFI's [Can Sharks Really Smell a Drop of Blood a Mile Away? webinar](#) with Dr. Tricia Meredith.

HOW SENSITIVE ARE SHARKS TO ODORS?

Inside a shark's olfactory organ is tissue layered over plates called **olfactory lamellae**. The amount of tissue in these cavities is much greater for sharks than for other fishes. In some sharks, the olfactory lobes weigh two-thirds of the total brain weight! For years, scientists thought that the large surface area of the shark's olfactory organs gave sharks a better sense of smell. However, recent research has indicated that sharks with more surface area in the tissues of their olfactory organs were no better at detecting odors.

THE SIGNIFICANCE OF SMELL IN A SHARK'S LIFE

Like many other animals, the priorities of a shark are relatively simple: obtain food and oxygen, maintain homeostasis (i.e. keep internal body conditions stable), and reproduce. The shark's complex olfactory system plays a large role in identifying the presence of prey, successfully hunting their prey, and reproducing.

ADDITIONAL RESOURCES

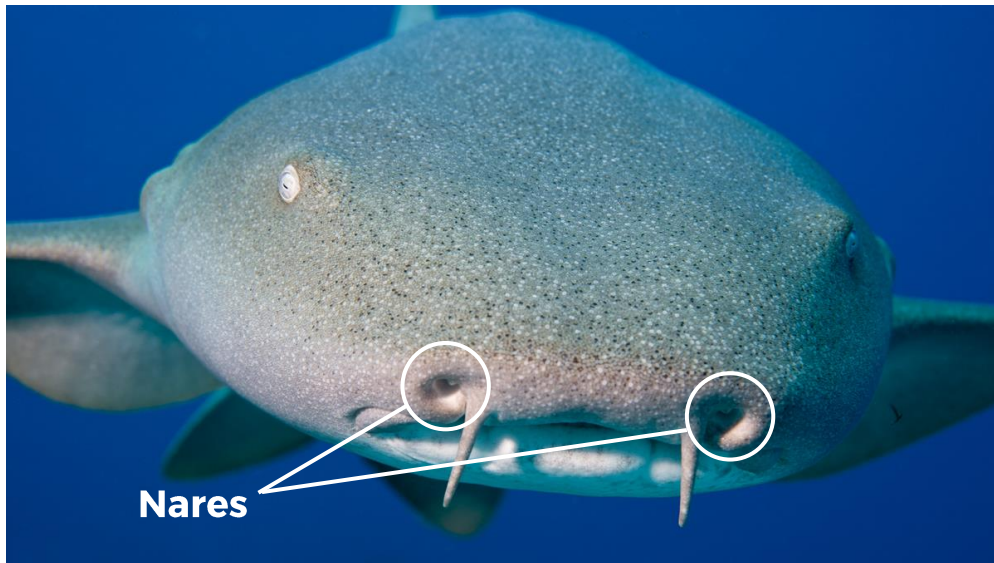
- Check out Ocean First Institute's [Can Sharks Really Smell Blood a Mile Away? webinar recording](#) with Dr. Tricia Meredith to move beyond shark myths and to tackle the real science behind one of the sharks' most famous senses: the sense of smell.
- Learn more about how sharks detect their prey with this [informative video](#) from the Atlantic White Shark Conservancy.
- [Read more](#) about shark biology, ecology, and evolution, provided by the ReefQuest Centre for Shark Research.
- Read about another sensory myth: [poor human olfaction is a 19th century myth](#).
- Ever wondered if sharks can sneeze? Find out [here](#).

Sensory System Activity

Grades 1-5

ACTIVITY SUMMARY

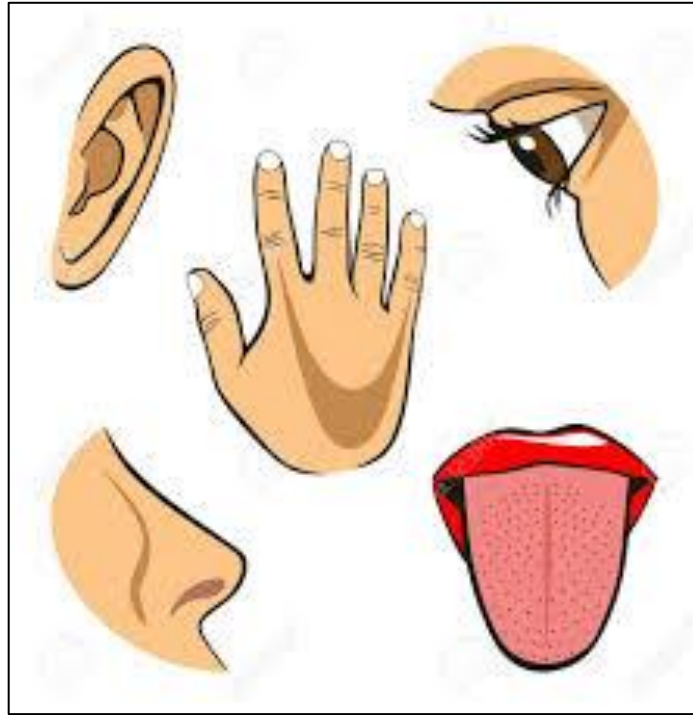
Sharks have odor-detecting cells inside their nares (like human nostrils) that allow them to hunt prey and find other sharks. In this activity, students will use their sense of smell just like a shark!



Graham Casden

INSTRUCTIONS

1. Gather several different opaque jars or containers in your house and label them by number. You should not be able to see inside the jars!
2. Fill each container with a different fragrant item. Some examples include spices or fragrant foods.
3. Have each participant take turns smelling each jar.
4. Record what you think is in each jar on a piece of paper.
5. Once everyone has gone, compare answers, see what's in each jar, and go through the discussion questions below.



DISCUSSION QUESTIONS

- Were some items harder to smell? Easier? Why do you think that was the case?
- Can you think of a time where you used more than one sense at a time?
- How do your senses help you find out more about something?

EXTENSION ACTIVITY

- Try another activity where you hide certain items (such as different ocean animal figurines, sea shells, sunglasses, etc.) in containers and have students guess what they are by touch.