



TRUIST PIER 225

California sea lions experienced an unusual mortality event from 2013 to 2016. This means that the species faced an increase in pups being stranded due to weaning before they are fully able to care for themselves. One part of the issue was that nursing mothers were struggling to find the prey they primarily eat to get essential nutrients: sardines, anchovies, market squid and rockfish. Anchovies and sardines are particularly important as they have more calories and a higher fat content that mothers need to sustain both themselves and their pups. There are several factors still impacting the limited availability of these fish. Human fishing in particular is leading to an increase in competition for these fish because they are a large part of the economy in coastal areas. The importance of these fish leads to competition between the humans in that area as well as the sea lions. Additionally, humans are taking more than their share, overfishing regions and leading to declines in fish populations. Humans have even forced closures of their own fisheries due to overfishing a specific population.

Based on how anchovy and sardine populations are affecting sea lions, how could the limited populations of these fish be impacting the ecosystem? What could humans do to help reduce overfishing?



DOLPHIN COAST

The common bottlenose dolphin is found in temperate and tropical waters. Some dolphins travel great distances, possibly following food sources, while other dolphins stay in an area of about 42 (mi²). Bottlenose dolphins need to consume 5-7% of their body weight in fish everyday and will use a variety of hunting techniques to catch their prey. The need to acquire the energy necessary for survival means dolphins hunt frequently and must utilize speed and acceleration to accomplish these different techniques. Adult dolphins swim at an average of 3-7 miles per hour (mph) while at leisure and while hunting. Dolphins have been recorded swimming up to 18 mph to catch particularly fast fish, but they can only maintain that speed for short distances. Dolphins will utilize more than speed to catch their prey. One hunting technique is to encircle a large school of fish and herd the fish into a small, dense mass then take turns rushing in and eating.

If a dolphin is traveling north at max speed, what is the velocity? Acceleration is a change in direction in velocity, if a dolphin is using the encircling technique, how frequently are they accelerating?



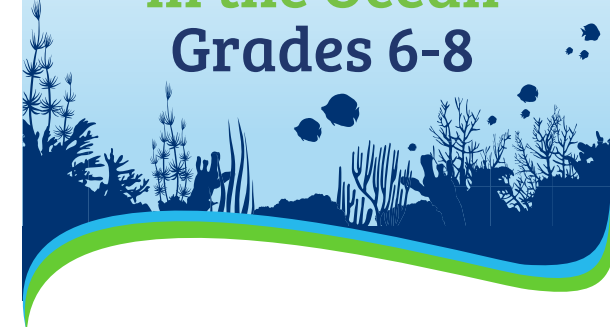
SHARKS! PREDATORS OF THE DEEP

Sharks have small, black spots around their head called Ampullae of Lorenzini. They are jelly filled pores that go down to the nerve receptors at the base of the shark's skin and are specialized electroreceptor organs that allow the shark to sense electromagnetic fields in the water. These are used to sense the weak electrical fields produced by various animals' movement at close proximity. Hammerhead sharks swim close to the sand in order to pick up on the weak electrical fields of their prey hiding beneath the sand. For example, when a fish swims, muscles contract, muscle contraction takes place when chemically dependent channels open. The movement of such ions across the membrane produces an electric field that travels away from the individual in the conducting medium. The more muscles that contract, the greater the magnitude of the field and vice versa. Furthermore, the intensity of the electric fields changes in the case of a wounded animal. For example, wounded animals tend to swim erratically, which gives off a higher pulse of the electric field which is why sharks tend to prey upon weaker animals in a group, because the erratic field is easier to detect.

How do you think magnets on fishing gear affect the shark? What do you imagine this electrical field to feel like if you were a shark? Theorize how sharks could use the Ampullae of Lorenzini to migrate.



Field Guide: Commotion in the Ocean Grades 6-8



Water plays an incredibly important role in our lives and the lives of other organisms. Water also has the power to shape environments and landscapes. Many aquatic organisms depend on the movement of the tides and current to reproduce and carry their genetic material so it can be fertilized. Other organisms depend on the water pressure and natural conductivity to hunt, like dolphins, belugas and sharks. Humans also depend on aquatic ecosystems as a source of food, travel and recreation. However, human activities in these ecosystems can pose a threat to the species that call the water home. Activities like fishing and boating can produce sound pollution that disrupts echolocation and can also ensnare animals in gear, like nets. Fortunately, within the last hundred years, humans have also been working to create protections for aquatic animals from these dangers. Take a look around Georgia Aquarium to see examples of the world's diverse aquatic ecosystems and learn about the animal ambassadors here!



GEORGIA AQUARIUM

COGNIA STEM-Certified Aquarium

AQUARIUM BOOK CIPHER

A book cipher spells out a message from text provided in a document. Use this Field Guide and the instructions below to find the message!
The following code
/ # means **Line / Word**.

CODE KEY:

Description:	20 / 1, 20 / 2
Ocean Voyager:	9 / 3
River Scout:	12 / 2
Sharks!:	8 / 4, 1 / 6
Pier 225:	18 / 8
Tropical Diver:	2 / 4

MESSAGE:

_____!



TROPICAL DIVER

Coral reefs are some of the most beautiful habitats in the world. While coral reefs promote ocean diversity, corals themselves have substantial genetic diversity. Adult corals will release gametes (eggs and sperm) after they receive the correct environmental cues; for some species this is a combination of water temperature, lunar cycle and sunset time. The species reliant on these cues will then all together release these gametes in what's known as broadcast spawning. "The timing of a broadcast spawning event is very important because corals cannot move to make reproductive contact with each other. Because colonies may be separated by wide distances, the release of sperm and eggs must be precisely timed based on the environmental cues" (NOAA). Once these gametes mix together to fertilize they become planula. Planula will swim for a bit then sink to the bottom, anchoring to a hard surface. Planula are not strong swimmers though and require the ocean currents to travel to a suitable substrate, where they will attach and grow.

What other reproduction methods or other life processes does coral rely on currents for? What could be a negative effect of broadcast spawning?



OCEAN VOYAGER: BUILT BY THE HOME DEPOT

Along the tunnel of Ocean Voyager, are reef balls (large hole-filled rock formations). These man made objects are used as a home for fish and as enrichment in the habitat. These reef balls are placed near shores to provide coral with a supportive base structure to grow, which encourages healthy reef development. Because of its contribution to coral reef growth, one reef ball indirectly helps prevent shore erosion in parts of the world. This is due to the fact that corals help reduce wave and storm impacts on shorelines. Shore erosion is a natural process brought on by waves, currents and tides. The waves and tides help both build and tear away the sediments that make up a shoreline. Erosion happens when sediments are being pulled away quicker than they can be replaced, leading to a slow reduction of the shore. Other man made materials have also been utilized to encourage marine animal growth and visitation. For example, Shipwrecks have become additional artificial reef sites, while offering some fish species protection. Even old oil rigs, no longer in use, are being converted to artificial reefs.

What are the benefits of artificial reefs? What risks would shore erosion pose for people living along the coast? If shore erosion is a natural process, why is this issue becoming more prominent?



COLD WATER QUEST

Beluga whales use echolocation to navigate, hunt and communicate. Echolocation occurs when an organism produces sound waves and sends them out into the environment. The sound waves bounce off solid objects and return to the organism, helping it understand the location of those objects in reference to itself. Sound is the most effective means of communication in the ocean since it requires less energy to travel further. Sound, just like light, travels in waves meaning it is impacted by both the pressure and the density of the medium it is traveling through. For instance in water, a sound wave can travel much further and more intensely than in air. This is because water is more dense, giving more for the waves to bounce off of. Water also reduces the amount of energy needed for waves to travel greater distances. Pressure also makes a difference in the distance a sound wave can travel. Scientists recently deployed a sound recording device in the deepest part of the ocean, the Mariana Trench, and were astounded to find it was alive with sounds. Some of which were boats on the surface passing over the trench.

Based on the information above, if both are traveling under the same pressure would a bat or beluga whale "see" further? What other sounds might be common in our oceans?



SOUTHERN COMPANY RIVER SCOUT

American alligators are considered a keystone species, most notably in the Florida Everglades, because of its vital role in the ecosystem. In the Everglades, alligators modify the habitat by digging out "alligator holes". These water-filled holes provide refuge for other animals such as fish during dry periods and also provide foraging sites for wading birds, turtles and snakes. American alligator populations in the U.S. were severely depleted at one time due to over-hunting. In the 1960's laws were passed to protect the American alligator, and research and conservation efforts began to bring them back from the brink of extinction. Since then, the recovery of this species has been extremely successful. Current wild populations are estimated to be in the millions. The American alligator is now considered to be a species of Least Concern according to the IUCN Red List, and is now a case study of the success of well managed conservation programs. This is also in part because several areas have been mapped off as preservation sanctuaries which means that no human resource collection may happen in those designated areas.

What is the difference between conservation and preservation? What other animals do you think could benefit from this kind of action?