



TRUIST PIER 225 - ZOOLOGY/ANATOMY

Georgia Aquarium houses two species of pinnipeds (meaning "fin-footed"), the California sea lion and the harbor seal. But what makes the difference between a sea lion and a seal? Seals have a fused hip bone whereas sea lions do not, meaning that sea lions can rotate their hip bones to grant them a walking motion whereas seals need to scoot across land. Sea lions also have ear flaps on the side of their heads and can close their nostrils completely to keep water out while they are hunting and diving. Their fore-flippers have individual bones like fingers that have webbing and muscle between them to help with powerful swimming (similar to the structure of dolphin fins and bat wings). Both seals and sea lions have a layer of blubber between their muscles and skin to help store energy as well as preserve warmth in the cold environments that they live in. Additionally, marine mammals, including sea lions, have special adaptations in their cardiovascular system to aid in their long dives such as increased blood volume, red blood cell count, hemoglobin and myoglobin levels. All of this helps to store oxygen in their bodies to last longer and sustain these long swim periods.

Sea lions are also a sexually dimorphic species, what does this mean? What special adaptations do sea lions eyes need to have to help them in the land and sea areas they frequent?



DOLPHIN COAST - ECOLOGY

The common bottlenose dolphin is a highly intelligent animal utilizing sound for hunting and communicating. Increasingly, humans are taking to the ocean in boats for leisure, transportation and product delivery. Boats create loud noise pollution for the local species, causing some to abandon the area. The animals that remain, demonstrate altered behavioral patterns. Due to the overwhelming sound of the boats, dolphins are unable to communicate and effectively hunt. Scientists studied the effect on boat presence on common bottlenose dolphin foraging. They muffled the boat sound or coasted and found even with sound reduction, the presence deterred dolphin foraging activity as much as 49%. This decrease in foraging activity can lead to less energy intake, with potential implications for offsetting an individual's energy balance or health. To better help these dolphins and our oceans, it's pertinent to understand the human impacts involved, the specific mechanisms of those impacts, and how to reduce or mitigate the effects of these disturbances. Furthermore, having an exceptional understanding on dolphin population dynamics, feeding habits and migratory patterns will help ensure conservation efforts are allocated to the most effective regions.

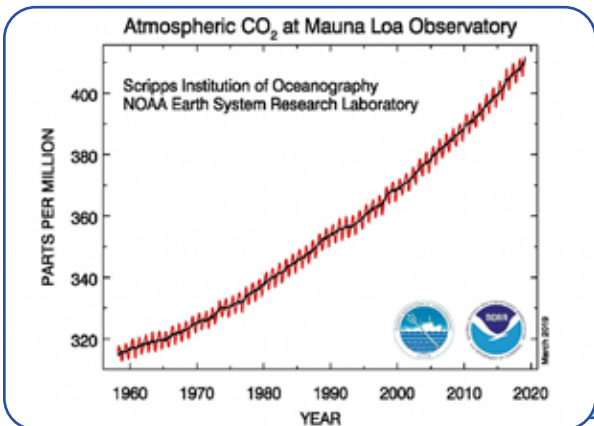
How could noise pollution caused by boats impact other species? What are potential solutions to reducing the amount of noise pollution in the oceans?



SHARKS! PREDATORS OF THE DEEP - ZOOLOGY

Sharks and their ancestors have been on Earth for 550 million years, surviving five mass extinction events. For a group of animals that has been on Earth longer than the dinosaurs, it is sad to realize that many shark species face extinction today as a result of human impacts. The most common fossil to be found for sharks is their teeth, but scientists can still learn so much from just a tooth. The first tooth fossil that came from a distant ancestor of modern sharks appeared 410 million years ago and tells us that this ancestor had a cartilaginous skeleton and similar skull structure. 380 million years ago, shark ancestors looked more similar to eels and could possibly be a closer relation to chimaeras than modern day sharks, but they did have streamlined bodies and similar fin structure. Shark and chimaera ancestors continued to be similar structurally until they diverged around the early Jurassic Period. From here, sharks developed teeth and jaws that enabled them to consume prey bigger than their own bodies. Finally, around the fifth mass extinction event (65.5 million years ago), only the smaller and deeper dwelling shark species survived. Sharks used to be large, like the megalodon, but after the extinction event the smaller species evolved to be what we recognize as a shark today.

How do you think sharks' ancestors could have survived and developed through five mass extinction events? Why are shark teeth some of the only remains found?

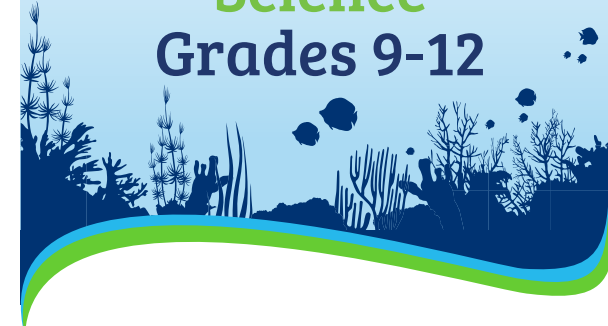


GRAPHING ANALYSIS: CO₂ LEVELS:

1. If we do not actively reduce our carbon dioxide emission for the future, what would be the continuing trend of the graph?
2. Analyzing the graph, what is the difference in parts per million from the year 2020 to 2010? What is the difference from 1970 to 1960? Using these numbers, which decade had a greater rate of increase?
3. What causes the difference in rate of increase between the selected decades?
4. What are some potential actions humans can take to reduce the carbon output?



Field Guide: Searching For Science Grades 9-12



Georgia Aquarium is a pinnacle of STEM research from the Water Quality department utilizing chemistry to the Commissary department calculating caloric intake. Keeping the animals and water healthy at Georgia Aquarium takes mass cooperation among departments with varying degrees of responsibility. Furthermore, Georgia Aquarium prioritizes educating guests on the current state of our aquatic ecosystems and ways they can help conserve and preserve these ecosystems. Explore each gallery to emphasize the pertinence of studying our oceans and how science can further understanding of the complex dynamics that maintain them. At each gallery, relate a specific science standard from the Georgia Standard of Excellence to the animals and habitats.



GEORGIA AQUARIUM

cognia STEM-Certified Aquarium



TROPICAL DIVER - CHEMISTRY

Coral is an animal composed of polyps. These polyps live in the skeletal structure made up of calcium carbonate (CaCO_3). The coral pulls calcium, bicarbonate and carbonate ions from the ocean. The coral will then mix those ions together to excrete the calcium carbonate structure. Many shelled animals in the ocean, such as mussels, perform this same process. The ions utilized in this process enter the ocean as carbon dioxide, absorbed from the atmosphere. The quantity of carbon dioxide in the atmosphere has been rapidly increasing since the industrial revolution. This increase has started to alter the chemical balance of the ocean. This imbalance shifts to a prevalence of hydrogen ions, while carbon and bicarbonate ions are decreasing. The surge in hydrogen ions is making the ocean more acidic. If the ocean continues to acidify it will dissolve existing calcium carbonate structures. The altered balance would also impact nutrients available and thus marine food webs.

Why would a decrease in calcium carbonate and bicarbonate matter to coral? If the ocean reaches too acidic of a level, what are the implications for shelled animals? Corals support 25% of ocean life, what would an acidic ocean mean for those supported animals?



OCEAN VOYAGER: BUILT BY THE HOME DEPOT - GEOLOGY

Oceanic crust is constantly moving, composed of multiple plates. The ocean has divergent, convergent and transform boundaries. At divergent plates mid-ocean ridges form. These locations create a new oceanic lithosphere. Lithosphere creation is associated with volcanic activity and earthquakes. As the plates separate, solid asthenosphere partially melts and fills the gaps. The old oceanic crust moves away from the ridge, therefore the further one moves away from the ridges the older the crust gets. Convergent boundaries can occur between two oceanic plates or one oceanic and one continental. Deep ocean trenches are found at these convergent points, also known as subduction zones. The deepest point on earth, the mariana trench is located at the convergent point of the Phillipine plate and the Pacific plate. These are two oceanic plates meeting. When an oceanic crust meets a continental crust, the oceanic plate is always subducted as it is denser and thinner. The last type, transform boundaries tend to be associated with mid-ocean ridges. The plates slip horizontally past each other running parallel to the direction in which the divergent plates are moving.

Where is the oldest segment of the ocean floor? Given the variation in plates and degrees of volcanic activity, what is the topography of the ocean floor?



COLD WATER QUEST - OCEANOGRAPHY

The Arctic ocean is the smallest of the world's oceans, but significantly larger than any sea. And unlike the other oceans, it has a large amount of ice reducing the energy exchange between the atmosphere and the ocean. The arctic ocean on the Eurasian side has many islands and peninsulas creating five marginal seas. These large marginal seas combined with exposed surface at a much higher ratio to total volume, greatly influences surface-water conditions in the Arctic Ocean. Additionally, local glaciers, ice capped mountains and defrosting in the summer leads to a large surplus of fresh water, influencing the salinity levels, density and surface conditions. As our climate is heating, there is a massive decrease in glaciers and ice found in the arctic ocean. Some ice caps have already completely disappeared. It's not clear how exactly life will be impacted, but scientists can offer an insight into potential outcomes. "For example, if the Greenland ice sheet were to completely melt and the meltwater were to completely flow into the oceans, then global sea level would rise by about seven meters (23 feet) and the Earth would rotate more slowly, with the length of the day becoming longer than it is today, by about two milliseconds" (NASA).

What are some predictable outcomes to humans if the sea levels rise seven meters? What are some potential outcomes for marine animals with that rise?



SOUTHERN COMPANY RIVER SCOUT - ENVIRONMENTAL SCIENCE

Aquaponics is a system of sustainable farming that combines aquaculture (the raising of fish) and hydroponics (farming plants without soil). Aquaponic farmers will maintain a fish population and plants, like leafy green vegetables, are grown from the water the fish live in. Nutrients from the fish waste provide the nutrients the plants need to grow that are normally found in soil. Since the water is shared between the habitats and goes through a self-sustaining filtration system, aquaponic systems use 1/10th of the water that normal soil gardens would use which reduces the amount of water pulled from local water sources. The fish typically grown in aquaponics are freshwater fish such as tilapia, barramundi, and trout. Aquaponics can do much to benefit river and lake ecosystems such as stem the erosion of soil in farming areas and prevent harmful run-off. To maintain a standard soil grown crop, farmers will use a variety of chemical fertilizers that, while being good for the plants, is not good for the fish and aquatic plants in rivers and lakes. This fertilizer can enter the ecosystem as run off from either improper land management from farmers or just natural rain and sediment transportation.

How would aquaponics, if utilized by private households, affect commercial farming? What are other benefits to river systems that aquaponics can provide?