Mid-Atlantic Phenomena Database

NOAA Chesapeake Bay Office

National Oceanic and Atmospheric Administration
U.S. Department of Commerce

Welcome!

This database includes natural phenomenon found in the Mid-Atlantic region and was started by Ruby Ondatje, a Science Education Intern with the NOAA Chesapeake Bay Office. This list is only a start and will be updated with more phenomenon.

This database is meant to support educators in modifying or creating lessons or units that include local phenomenon. Using local phenomenon can increase student engagement by making the content more relevant to their lives and community, create opportunities for students to investigate the phenomenon in-person, and if appropriate, take action.

Do you have more ideas to add? Contact Krysta at krysta.hougen@noaa.gov

Overview

Each phenomenon includes potential guiding questions, a synopsis of the phenomenon, related science concepts, background information, data, educational resources related to the phenomenon, Disciplinary Core Ideas from Next Generation Science Standards, and career connections.

The careers listed are restricted to those found on O*NET. The resource includes information on job skills, activities, employment trends, and the variety of job titles that fall under each broad career type.

The phenomenon are organized as those focused on the Chesapeake Bay and its tributaries and those occurring on land within the Mid-Atlantic region.

Standards Referenced

Next Generation Science Standards Disciplinary Core Ideas

Life Science	Physical Science
LS1: From Molecules to Organisms: Structures and Processes LS2: Eocystems: Interactions, Energy, and Dynamics LS3: Heredity: Inheritance and Variation of Traits LS4: Biological Evolution: Unity and Diversity	PS1: Matter and its Interactions PS2: Motion and Stability: Forces and Interactions PS3: Energy PS4: Waves and their Applications in Technologies for Information Transfer
Earth & Space Science	**Engineering & Technology**
ESS1: Earth's Place in the Universe ESS2: Earth's Systems ESS3: Earth and Human Activity	ETS1: Engineering Design ETS2: Links Among Engineering, Technology, Science, and Society

Phenomena & Standards

Chesapeake Bay & its Tributaries

	LS1	LS2	LS3	LS4	ESS1	ESS2	ESS3	PS1	PS2	PS3	PS4	ETS1	ETS2
Artificial Reef Habitat		✔					✔					✔	✔
Blue Catfish Invasion	✔	✔		✔			✔						
Bottlenose Dolphin Echolocation	✔	✔									✔		
Conowingo Dam Sediment Plumes						✔	✔			✔		✔	✔
Crab Jubilee	✔	✔				✔							
Dead Zones		✔				✔	✔						
Emerging Contaminants	✔	✔					✔						
Habitat Squeeze	✔	✔											
Oysters as Keystone Species	✔	✔										✔	✔

Phenomena & Standards

Chesapeake Bay & its Tributaries

	LS1	LS2	LS3	LS4	ESS1	ESS2	ESS3	PS1	PS2	PS3	PS4	ETS1	ETS2
Pistachio Tide	✔					✔	✔						
Plastics in the Water		✔				✔	✔						
Poplar Island Restored Habitats		✔					✔					✔	✔
Red Beard Sponge Reproduction	✔		✔										
Salty Freshwater Streams		✔				✔	✔						
SAV and Turbidity	✔	✔											
Soft-shell Blue Crabs	✔												
Stratification and the Coriolis Effect						✔			✔		✔		
Striped Bass Population Changes	✔	✔					✔						

Phenomena & Standards

Chesapeake Bay & its Tributaries

	LS1	LS2	LS3	LS4	ESS1	ESS2	ESS3	PS1	PS2	PS3	PS4	ETS1	ETS2
Sturgeon: Living Fossils	✔	✔		✔			✔						
Watershed Hydrology & Hypoxia		✔				✔							
Vibrio	✔	✔					✔						
Zombie Mud Crabs	✔	✔											

Phenomena & Standards

Land-based phenomena across the Mid-Atlantic

	LS1	LS2	LS3	LS4	ESS1	ESS2	ESS3	PS1	PS2	PS3	PS4	ETS1	ETS2
Acid Mine Drainage						✔	✔	✔					
Bioluminescence	✔												
Distant Wildfires and Local Air Quality							✔						
El Niño						✔	✔						
Erosion					✔	✔	✔			✔		✔	✔
Ghost Forests and Marsh Migration	✔	✔				✔	✔						
Jewelweed Exploding Seeds	✔	✔		✔									
Migration Hotspots	✔	✔		✔									
Monarch Butterfly Migration	✔	✔		✔									

Phenomena & Standards

Land-based phenomena across the Mid-Atlantic

	LS1	LS2	LS3	LS4	ESS1	ESS2	ESS3	PS1	PS2	PS3	PS4	ETS1	ETS2
Osprey Population Decline	✔	✔					✔						
Periodical Cicadas	✔	✔		✔									
Periwinkle Snails Internal Clocks	✔	✔		✔									
Pollinators	✔	✔											
Riparian Forest Buffers	✔	✔					✔					✔	✔
Sea Level Rise						✔	✔	✔	✔	✔	✔	✔	✔
Sinkholes						✔	✔					✔	✔
Urban Heat Island Effect					✔		✔			✔	✔	✔	✔

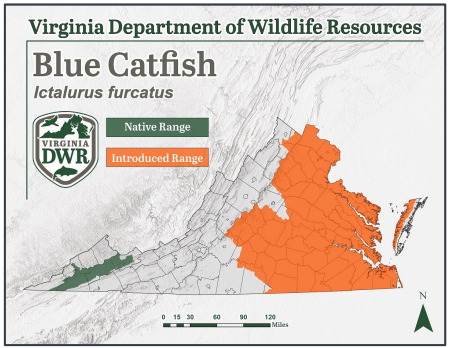
Chesapeake Bay and its tributaries



Artificial Reef Habitat

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
Can people build a successful underwater habitat?	An artificial reef is created from human-made structures and may mimic aspects of natural, underwater reefs. Artificial reefs are made from retired structures like ships, lighthouses, and bridges or the reefs are constructed using things like rock, wood, tires, and cinder blocks. Some artificial reefs welcome tourists. Mallows Bay-Potomac River National Marine Sanctuary, south of Washington, D.C., has over 100 submerged wooden ships that are supporting a thriving ecosystem above and below water.	Ecosystem resilience Adaptation	What is an artificial reef? Artificial Reefs Mallows Bay-Potomac River National Marine Sanctuary	Artificial Reef: 10 years of growth (video) First Calculation of Artificial Reef Area in U.S. Ocean Published (video and data) Aerial Video of Artificial Reefs (Mallows Bay) Design, Distribution of Artificial Reef Structures Affect Fish Abundance (video) Mid-Atlantic Ocean Data Portal (Artificial Reef map layer selected)	How can we evaluate ecosystem health to determine if restoration is needed? (grades 9-12) Shipwrecks as Reefs: Biological Surveys (grades 6-8) Coral Check-up (grades 7-9)	LS2; ESS3; ETS1; ETS2 Environmental Restoration Planners Environmental Scientists and Specialists Biologists Zoologists and Wildlife Biologists Environmental Economists Biologists Construction Managers

Blue Catfish Invasion

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
How does an animal become invasive? *How can we manage an invasive species?*	In some rivers of Virginia, Blue Catfish account for 75% of the total fish biomass. The fish is also spreading rapidly through other parts of the Chesapeake Bay and its tributaries. Their success is due to their large size, salinity tolerance, reproductive success, diverse diet, and few predators. 	Habitat needs Ecosystem interaction Fish biology Salinity	Blue Catfish Are Spreading Rapidly in Maryland Waters Understanding the Chesapeake's catfish problem Blue Catfish	Invasive Blue Catfish in the Chesapeake Bay: A Risk to Realizing Bay Restoration Investments iNaturalist Blue Catfish observations	Blue Catfish - Invasive Species (grade 3) Aquatic Invasive Species Introduction and Spread (grade 3-12)	LS1; LS2; LS4; ESS3 Environmental Scientists and Specialists Natural Sciences Managers Zoologists and Wildlife Biologists Environmental Economists Biologists

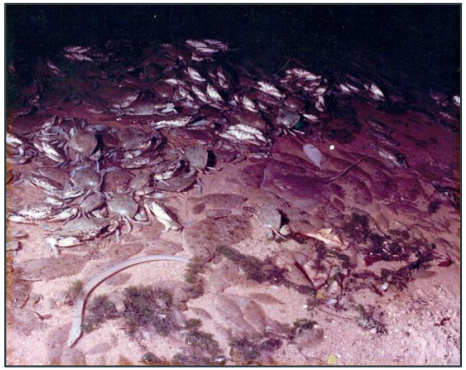
Bottlenose Dolphin Echolocation

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
Why do Bottlenose Dolphins use echolocation? *How does boating impact Bottlenose Dolphin populations?* *What is the relationship between Bottlenose populations and underwater sound pollution?*	Bottlenose Dolphins rely on sound when hunting, communicating with their pod, or navigating dark waters. This echolocation works through a tissue complex in the nasal region. This complex is thought to vibrate as air is pushed through the "phonic lips" (dorsal bursa) section of the internal structure. The vibration of the surrounding tissue produces a sound. The clicking and squeaking sounds travel through water and reflect off objects reverberating back to the dolphin, the major areas of reception being the fat-filled cavities of the lower jaw bones.	Sound pollution Animal and Human interaction Sound Waves Echolocation	Bottlenose Dolphin NatGeo Common Bottlenose Dolphin All About Bottlenose Dolphins - Communication & Echolocation (includes sound recordings)	Dolphin sightings in the Bay Bottlenose dolphin (video shows echolocation)	Lesson Echolocation: Using Sound for Sight (grade 4-6) Echolocation in Action (grades 6-8)	LS1; LS2; PS4 Zoologists and Wildlife Biologists Biologists

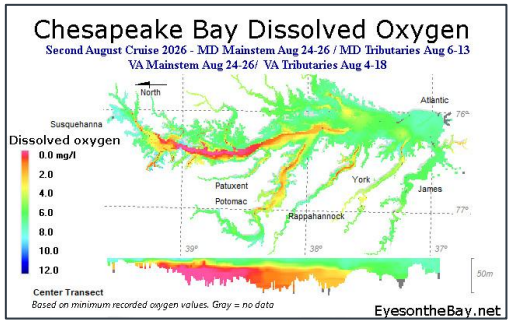
Conowingo Dam Sediment Plumes

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
How does the Conowingo Dam impact water quality?	Conowingo Dam is a hydroelectric dam located on the Susquehanna River in Maryland. This dam was completed in 1928 and led to the area being electrified. The dam significantly changed the hydrology and sediment flow of the area up and down stream. While excess sediments and pollution was initially blocked, the dam has slowed in its ability to hold sediments. Extreme weather events producing excessive rainfall cause “scour” events. These events overwhelm the amount of water flowing through the dam, releasing large amounts of sediments, nutrients, and pollutants at once. This is significantly more than the natural gradual flow of sediment into the Bay, often causing harmful algae blooms and dead zones.	Properties of matter Pollution Sediment Harmful algae Blooms Extreme weather	Sediment reservoirs in lower Susquehanna reach capacity, deliver more pollutants into Bay Conowingo Dam What's With That Damn Dam? The Conowingo Story Bay 101: Conowingo Dam (video)	Sediment plume south of the Dam after a 2011 storm Sediment plume south of the Dam after a 2018 storm	Engineer a Dam (grades 4-12) Unit on Dams (grades 4-6) - Lesson on Dam Impacts - Lesson on Your River’s Health	ESS2; ESS3; PS3; ETS1; ETS2 Environmental Scientists and Specialists Natural Sciences Managers Water Resource Specialists Hydrologists Environmental Engineers Environmental Economists

Crab Jubilee

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
Why are there so many crabs near the shoreline?	Low dissolved oxygen in deeper waters pushes crabs into shallower waters and closer to the shoreline where oxygen levels are higher. Sometimes huge numbers of crabs are seen out of the water to avoid suffocation. 	Habitat needs Water quality Weather Algae Bloom Hypoxia or Dead zones	Algae bloom causes 'crab jubilee'	Chesapeake Bay Water-Column Habitat Data Four rare Chesapeake Bay “oddities” to learn about this leap year	The Jubilee Phenomenon (grades 9-12) The Jubilee Phenomenon (grades 6-8)	LS1; LS2; ESS2 Zoologists and Wildlife Biologists Biologists

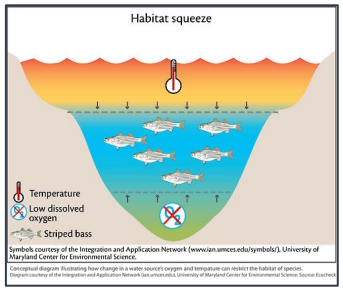
Dead Zones

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
What killed the fish?	Areas of little or no dissolved oxygen caused by a variety of natural and human caused factors. Most plant and animals can not survive in these areas which is why they are called “dead zones”.  	Habitat needs Water quality Weather Pollution impacts / Runoff Harmful Algae blooms	Dissolved Oxygen Bay sees worst dead zone in the past five years	Maryland Hypoxia Report Maryland Dead Zones map Harmful Algal Bloom Forecast 2025 Chesapeake Bay dead zone (annual report)	NOAA: The Dead Zone (grades 9-12) Into the Dead Zone (grades 9-12) Dead Zones in Coastal Ecosystems (grades 9-12) Dead Zones (grades 5-8)	LS2; ESS2; ESS3 Environmental Scientists and Specialists Natural Sciences Managers Remote Sensing Scientists and Technologists Microbiologists Biologists Agricultural Engineers

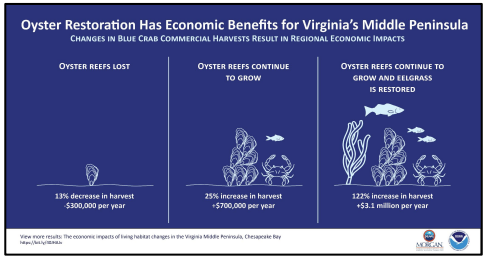
Emerging Contaminants

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
How are contaminants being introduced to water sources? *How are living things impacted by these contaminants?*	Chemicals from everyday products like pharmaceuticals, cosmetics, and cleaning products can become contaminants when they reach our waterways. Some chemicals like PAHs, PCBs, and mercury have been monitored for decades. Emerging contaminants are chemicals who may be negatively impacting the environment but their full impact is still being studied. These are also called contaminants of emerging concern (CEC). When introduced into the environment these chemicals can have unintended consequences for wildlife.	Habitat protection Ecosystem cycling Water treatment Human Impact	Emerging Contaminants FAQs Emerging Contaminants in the Bay	CEC Dataset PFAS in National Drinking Water, PA, MD, VA, DE, DC, WV, NY PFAS in the Delaware River Basin Maryland Fish Consumption Advisory map	What's in the Water? Lesson 2: Introduction to Emerging Contaminants (grades 9-12) PBS: Poisoned Waters, Teacher Lesson (grades 9-12) Tracking Pollution - A Hazardous Whodunnit (grades 9-12) Learn, Protect, and Promote Water (grades 6-8)	LS1; LS2; ESS3 Environmental Scientists and Specialists Industrial Ecologists Water Resource Specialists Environmental Engineers Microbiologists

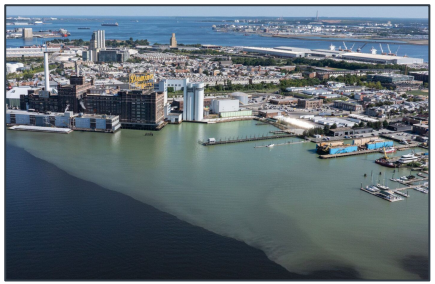
Habitat Squeeze

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
Why are more organisms sharing habitats?	When land is developed and environmental parameters like temperature, salinity and dissolved oxygen are degraded, organisms can experience a shrinking of available habitat. For example, rising temperatures can make the surface water too hot to inhibit and prevent the upper oxygenated water from mixing with lower water. Add in excess nutrients from runoff and the lower parts of the Bay become dead zones with no oxygen. This leaves a narrow band of available habitat. 	Climate Land development Estuaries Hypoxia Competition Environmental Stress	Marine heat waves create habitat squeeze in the Chesapeake The Coastal Squeeze	Impacts of changing Bay habitat conditions on Summertime Resident Chesapeake Bay Striped Bass Habitat Habitat Squeeze	Sea Level Rise and Coastal Squeeze (grade 9-12)	LS1; LS2 Environmental Scientists and Specialists Remote Sensing Scientists and Technologists Zoologists and Wildlife Biologists Biologists

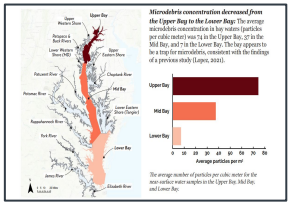
Oysters as Keystone Species

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
Why do animals use oyster reefs as habitat? *How can we rebuild oyster reefs?* *What is the most effective restoration material?*	The Chesapeake Bay is the site of the largest oyster restoration in the world. Oyster reefs enhance water quality and provide habitat to other creatures. Mature reefs provide shelter, act as a nursery, and act as a barrier from extreme weather.  	Habitat needs Water quality Economic Stimulation Symbiotic relationships	From the Field: Rebuilding oyster reefs in Harris Creek, Md. (video) Oyster Reef Habitat Restored Oyster Sanctuaries Host More Marine Life NOAA-Funded Research Highlights Economic Effects of Oyster Reef Restoration	Videos of an oyster reef before and after restoration in Harris Creek, Maryland Before Restoration Video After Restoration Video Oysters Clean the Bay! (Filtration Time-Lapse video)	NOAA Oyster Curriculum for Elementary, Middle and High Lessons from the Billion Oyster Project (grade K-12) Oyster Internal Anatomy (grade 9-12)	LS1; LS2; ETS1; ETS2 Zoologists and Wildlife Biologists Environmental Restoration Planners Fish and Game Wardens Biologists

Pistachio Tide

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
What turned the water green?	Pistachio tides happen when a quick drop in air temperature cools the water at the surface, causing it to sink and displace the lower level water that carries sulfur bacteria. When this bacteria is exposed to sunlight it turns into hydrogen sulfide which smells and turns the water green. 	Habitat needs Thermal inversion Photosynthesis Weather Harmful Algae	Pistachio Tides: An Explainer Pistachio Tide kills thousands of fish in Baltimore's Inner Harbor Why are there so many dead fish in Baltimore Harbor?	Weather or Pollution: What's to Blame for Baltimore's Unprecedented Fish Kill? Pistachio Tide video in Baltimore Harmful Algal Bloom Maryland map	State of your Bay (grades 6-12) Examining a Fish Kill (grades 4-8)	LS1; ESS2; ESS3 Environmental Scientists and Specialists Microbiologists Biologists

Plastics in the Water

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
How can plastic use impact the health of the Bay?	Plastic use and pollution has increased in the last 60 years. With only 9% of plastics successfully recycled, the majority of plastics are brought to landfills or littered, left to pollute our waterways. Large pieces of plastic breakdown into smaller pieces called microplastics which are consumed by creatures. These plastics leach chemicals into marine organisms cells and eventually humans. We can mediate this problem by starting at the source. Reducing the amount of disposable plastic we use, reusing the plastic we do own, and recycling the plastic we can no longer reuse helps reduce the amount of plastic pollution entering the water ways.	Plastic Lifecycle Human Impact Chemical contamination Food web	Death by plastic: Bay's sea turtles, marine mammals imperiled by growing debris Small plastics are a big problem	Plastic Pollution Discovery Across Chesapeake Bay (video) Charting the Chesapeake: Uncovering the Mysteries of Microdebris 	Plastic, Plastic, Everywhere (grades 6-12) Marine Science Lessons (including plastics) (variety of grades) Wave of Plastic (grade 6)	LS2; ESS2; ESS3 Water Resource Specialists Industrial Ecologists

Poplar Island Restored Habitats

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
If we rebuild habitats will organisms come back?	Poplar Island was a bustling community in the late 1800s and early 1900s. The island was once home to farms, a school, church and post office but was abandoned when excessive amounts of the island eroded away. By the 1990s all that remained of the island was small clusters rising above the Bay. Poplar became a restoration site when the Maryland General Assembly required that all dredged material must be beneficially used. Poplar island has been reconstructed to the historic footprint of the island by relocating dredged material from the Baltimore harbor. Many partners are monitoring the progress and success of the restoration site and now Poplar has become an internationally-known restoration model.	Restoration Habitat science Erosion Human impact	About Poplar Island Poplar Island restoration gives Chesapeake new life	A Disappearing Island Restored (images and link to short animation) Poplar Island Bird Data Tern monitoring Diamondback terrapin monitoring Fish monitoring	Lesson collection from the Terrapin Education and Research Partnership (all grades) Restore an Island (grades 1-6) Create a Habitat (grades K-3) Plant and Animal Habitats (grade 2)	LS2; ESS3; ETS1; ETS2 Environmental Restoration Planners Industrial Ecologists Natural Sciences Managers Conservation Scientists Environmental Engineers Soil and Plant Scientists Environmental Economists Construction Managers

Red Beard Sponge Reproduction

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
How do Red Beard Sponges reproduce?	Red Beard Sponges live on rocks, reefs, piers, and pilings in the Chesapeake Bay. These sponges grow in both shallow and deep water, feeding on zooplankton and microscopic algae as it filters water. Red Beard Sponges reproduce asexually when segments break off and establish new buds separate from the original organism. During sexual reproduction, the larvae are fertilized within the sponge. Free-swimming larvae attach to hard surfaces once they've settled to the bottom.	Filter feeding Asexual & Sexual reproduction Habitat	Red beard sponge Sponge Reproduction	Red Beard Sponge on iNaturalist 	Sponges (grades 9-12) Sponge Reproduction (grades 9-12) Sponges 5E Learning Cycle (grades 9-12) Sponge videos and student worksheets (grades 6-8)	LS1; LS3 Zoologists and Wildlife Biologists Biologists

Salty Freshwater Streams

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
Why are some freshwater streams salty?	Salt used on roads and sidewalks during the winter can reach streams, groundwater and aquifers during spring rains. The salt can impact wildlife and enter people's drinking water. Sometimes water conductivity is measured rather than water salinity. Because dissolved salts and other inorganic chemicals conduct electrical current, conductivity increases as salinity increases.	Salinity Habitat needs Human Impact Runoff	Research shows Chesapeake Bay streams are getting saltier By the Numbers: 2.5 million How do road salts impact Chesapeake critters?	Four Seasons of Salt Threaten Wildlife Watershed Health (click Conductivity to see the score for that indicator) Salt Watch Results (scroll down to see map)	Chesapeake Bay: Eyes on Salinity (grades 6-12) Salinity and Tides in York River (grades 6-9) Salty Streams and Safer Streets MWEE curriculum (grades 6-8) Salt Water in Streams (grades 6-12)	LS2; ESS2; ESS3 Hydrologists

SAV and Turbidity

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
How do Bay grass populations and turbidity represent a positive feedback loop?	Submerged Aquatic Vegetation (SAVs) is a foundational element of the Chesapeake Bay's food chain, habitat and filtration system. SAVs rely on clear water conditions to allow sunlight to penetrate the water. Without SAVs, erosion, nutrient pollution and silt get mixed into the water column, creating murky dark water. This creates high turbidity and reduces ecological productivity of SAVs and the organisms that rely on them.	Water Quality Ecosystem services Photosynthesis Habitat Feedback Loops	SAV monitoring program Biologists track bay grass abundance for clues about water quality Below the Surface of Monitoring: Water Clarity	Short videos of SAVs in Arundel River, MD: Video 1, Video 2, Video 3 Maryland SAV coverage timeline Chesapeake Bay SAV Watchers Data Water quality monitoring in Virginia and Maryland SAV monitoring map	Where Has All the SAV Gone? (grades 9-12) SAV Me! (grades 9-12) Submerged Aquatic Vegetation (SAV) Education (grades 9-12) 	LS1; LS2 Environmental Scientists and Specialists Soil and Plant Scientists Biologists

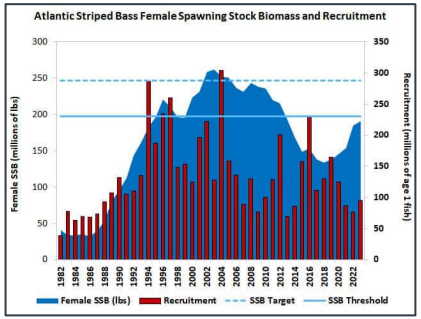
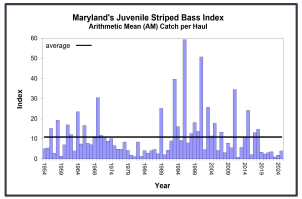
Soft-shell Blue Crabs

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
Why do Blue Crabs molt?	Blue Crabs grow as they age, molting more frequently as juveniles and less frequently as mature adults. The beginning of this process can be marked by a thin white line, which deepens to a pink and then red before it molts in the blue area of the crab's swimming fins. In order to shed their chitin exoskeleton, the crab grows a softer exoskeleton under their hard shell, typically making them a third larger each time. The crabs absorb water, swelling to a size large enough to fracture the back of the old shell. Once the shell is sufficiently cracked, the crab begins the slow process of backing out of the shell into a sheltered area while it remains vulnerable as the new shell hardens.	Ecdysis (Molting) Cell reproduction Survival strategy Fish biology	Blue Crab Clues of a growing blue crab	Blue Crab molting video Maryland and Virginia annual Blue Crab Survey	Zoom in on Aquaculture (grades 9-12) Bridge DATA - The Blue Crab's Chesapeake Journey (grades 9-12) Blue Crab 101 (grades 6-12) The Case of the Disappearing Blue Crab (grades 9-12)	LS1 Zoologists and Wildlife Biologists Fish and Game Wardens Water Resource Specialists Biologists

Stratification and the Coriolis Effect

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
Why does the Bay flow in two different directions? *Why does temperature and salinity vary throughout the Bay?*	The Chesapeake Bay is a mix of fresh, salty, and brackish water. The freshwater is sourced from tidal rivers and the salt water is sourced from the Atlantic Ocean. The difference in salinity causes a gradient, with the less dense freshwater remaining at the surface while higher salinity water sinks to the bottom. The eastern shore of the Bay is often saltier than the west due to the fresh tributaries and the Coriolis Force. This phenomenon, caused by the Earth's rotation, pushes water in the Northern Hemisphere to the right. Temperature also influences the current of the Bay. Warm water flows near surface while cooler, denser water sinks creating two distinct temperature layers called stratification. These layers, coupled with weather, create countering flows as warmer, lighter, fresher water flows down towards the mouth of the Bay while cooler, saltier water flows up the Bay underneath.	Coriolis Effect Thermal dynamics Circulation Salinity Density Nutrient flow	Physical Characteristics	Chesapeake Bay Operational Forecast System (CBOFS) (current data) Chesapeake Bay Interpretive Buoy System (current and historical)	Modeling Weather Patterns and the Coriolis Effect (grades 3-8) Coriolis Force, Coriolis Effect, and the Impact of Coriolis Effect on Climate (grades 9-12) Chesapeake Bay: Eyes on Salinity (grades 6-12) Salinity and Tides in York River (grades 6-9)	ESS2; PS2; PS4 Hydrologists

Striped Bass Population Changes

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
Why does the Striped Bass population fluctuate?	In parts of the Chesapeake Bay, the population of striped bass has been below average from 2018 to 2025. There are many factors that impact their population from the success of spawning to the number of fish reaching adulthood. 	Habitat needs Fish biology Invasive Species Ecosystem interactions Water quality	Seven years of bad luck for striped bass, survey shows Environmental impacts - Spring 2025, Winter 2025, Fall 2024, Summer 2024, Spring 2024 Blue Catfish in the Chesapeake are Gobbling Up Everything in It Striped Bass	Atlantic Striped Bass Striped Bass iNaturalist data 	Striped Bass curriculum (grades 10-12) Fish Habitat and Humans (grades 4-8) Fish Survey Activity	LS1; LS2; ESS3 Environmental Scientists and Specialists Zoologists and Wildlife Biologists Biologists Fish and Game Wardens

Sturgeon: Living Fossils

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
What qualities have allowed sturgeon to live from prehistoric times to today?	The Atlantic Sturgeon have supported communities on the eastern coast of North America from Canada to Florida for thousands of years. From indigenous populations to Jamestown settlers, the bony fish has been a primary source of nutrition. The prehistoric fish are often called "living fossils" because they date back to the jurassic period, 200 million years ago. Due to habitat loss and changes, and overfishing, all populations of the Atlantic Sturgeon in the United States are listed as threatened or endangered.	Evolution Adaptation Endangered Species	Atlantic Sturgeon (NOAA) Atlantic Sturgeon: An Ancient Relic from Prehistoric Times Atlantic Sturgeon	The Search for Sturgeon: A Prehistoric and Endangered Fish (video) Restoring the Ancient Sturgeon - Greater Atlantic Region (video) Atlantic Sturgeon Population Estimates Atlantic Sturgeon Stock Assessment Atlantic Sturgeon Critical Habitat James River VA Sturgeon Sightings	ShoreRivers MWEE: Sturgeon Environmental Literacy Model and video (grade 3) Sturgeon Lesson plans from NOAA (grades 3-12) Where in the Water is the Atlantic Sturgeon? (grades 9-12)	LS1; LS2; LS4; ESS3 Zoologists and Wildlife Biologists Biologists

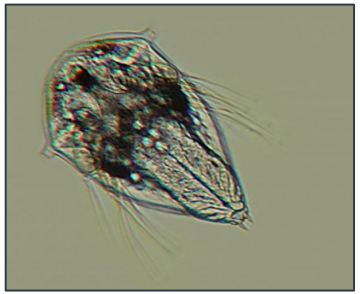
Watershed Hydrology & Hypoxia

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
How can farming practices in one state impact water quality in another state downstream?	Traditional agricultural practices frequently use nitrogen and phosphorus based fertilizers. While these methods can increase yield, the excessive addition of manufactured nutrients alters natural levels in the nutrient cycles. Agricultural runoff is the main contributor to harmful algal blooms. Over the course of one year, roughly 300 million pounds of nitrogen enter the Chesapeake Bay. This excessive nutrients causes algae to rapidly bloom, blocking sunlight from underwater grasses and suffocating bay organisms by absorbing massive amounts of dissolved oxygen from the water. This sharp decline in dissolved oxygen causes hypoxia or a “dead zone” which is uninhabitable because of low dissolved oxygen levels.	Nitrogen cycle Phosphorus cycle Water cycle Regenerative farming Non-point source pollution Soil Degradation Eutrophication	Protecting Water Quality from Agricultural Runoff Map of Land Use and Hydrography datasets Runoff Pollution Facts and Video Pennsylvania's Agricultural Management plan	Model my watershed My Waterway - health of local waterway Chesapeake Bay Watershed Data Dashboard	Water Quality, Is There a Point? (grades 4-12) Conowago Valley High School MWEE Water Quality (grades 9-12) Exploring Your Watershed (grades K-6)	LS2; ESS2 Hydrologists Farm and Home Management Educators Soil and Plant Scientists Water Resource Specialists Industrial Ecologists Remote Sensing Scientists and Technologists Agricultural Engineers

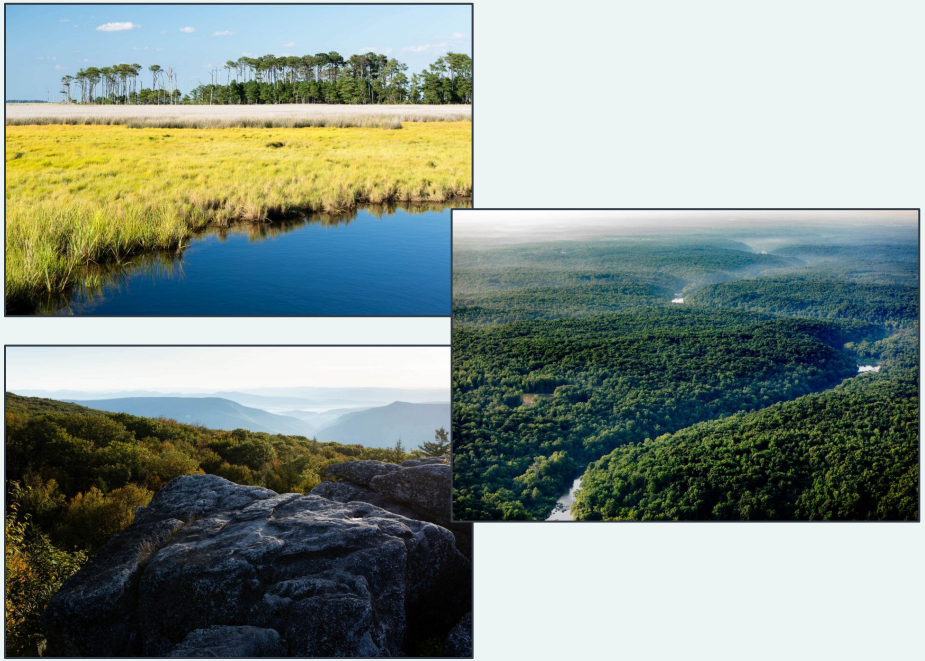
Vibrio

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
How do people come in contact with harmful bacteria? *How can people avoid interacting with harmful bacteria?*	*Vibrio* spp. are bacteria that naturally occur in coastal waters. Specific species and strains can be harmful to human health. Infections from *Vibrio vulnificus* are rare and serious and are acquired by eating raw shellfish or infected water entering a wound. *Vibrio parahaemolyticus*, most commonly associated with consuming raw or undercooked seafood, accounts for the majority of *Vibrio* cases in the United States.	Bacteria Pathogens Public health	Learn About Vibrio Bacteria Vibrio Background	*Vibrio vulnificus* Data and Models for the Chesapeake Bay *Vibrio parahaemolyticus* Data and Models for the Chesapeake Bay and Delaware Bay and Coastal Inland Bays	Understanding Bacteria (grades 9-12) Oh Shuck! Oyster Farming: Threat of Vibrio Infection (video) (grades 6-12) Raw Seafood (grades 9-12)	LS1; LS2; ESS3 Environmental Scientists and Specialists Zoologists and Wildlife Biologists Microbiologists Biologists

Zombie Mud Crabs

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
What is a parasite? *How can a parasite turn another animal into a "zombie"?*	Chesapeake Mud crabs have fallen victim to *Loxothylacus panopaei* (Loxo), an invasive, parasitic barnacle. The parasite was introduced to the Chesapeake Bay in the 1960s. This parasite is able to monopolize control of the crabs mechanics and nervous system, even stopping reproduction. The mud crab behavior is altered as it acts as a host and nurse to a parasitic egg sac. 	Parasitism Invasive Species Evolutionary Adaptation	Mud Crabs and Body-Snatching Parasites Body snatchers are on the hunt for mud crabs Alien Invader (video)	Zombie Crabs at the Smithsonian Environmental Research Center (Flickr page) iNaturalist: Loxothylacus panopaei	Creepy Creatures: Parasites and Adaptation (grades 8-12) Parasites and Parasitism (grades 6-8)	LS1; LS2 Zoologists and Wildlife Biologists Biologists

Land-based phenomena across the Mid-Atlantic



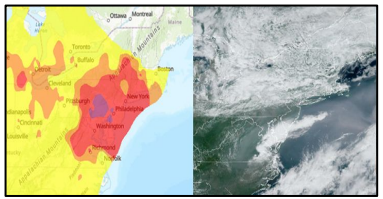
Acid Mine Drainage

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
How can mines be restored to protect public health? *How have mines altered natural systems and geography?*	Acid mine drainage (AMD) is one of the largest issues for Pennsylvania streams. Acid mine drainage is the formation of highly acidic water carrying toxic metals into waterways, severely injuring or killing off wildlife. This most frequently occurs in abandoned underground coal mines flowing into groundwater or nearby streams. This phenomena occurs when sulfur-bearing minerals are released during mining. Once in the air, the minerals react with water to create acids capable of leaching toxic levels of iron, aluminum, and magnesium into the streams.	Acidity Oxidation Chemical Interaction Nutrient & Mineral Interaction Restoration	Abandoned Mine Drainage Abandoned Mine Drainage | US EPA Acid mine drainage cleanup a worthy goal, but will it help the Chesapeake Bay?	Out of Sight, Out of Mine Locations of AMD sites in Pennsylvania Environmental Impact of Acid Mine Drainage (video) 	Graphing Trends in Environmental Data (grades 9-12) Mining in Maryland (grades 9-12) Hands-On Experiments to learn about Acid Mine Drainage (grades 6-12)	ESS2; ESS3; PS1 Environmental Scientists and Specialists Conservation Scientists Hydrologists

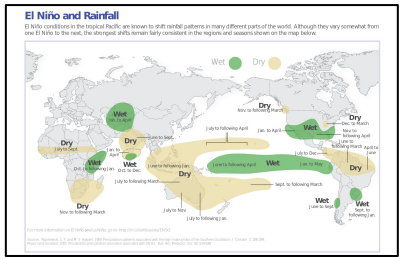
Bioluminescence

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
What causes water to glow? *What are the advantages in nature to glow?*	Throughout this region you can find organisms glowing in the air, land, and water. Bacteria, plankton, fireflies, atmospheric plasma, jellyfish, and fungus are just some of the source of glow within the Mid-Atlantic region. 	Bacteria Bioluminescence Plankton Reproduction	Nature's dazzling parade of lights Alexandrium Monilatum How Fireflies Glow – and What Signals They're Sending | NC State News From backyards to the Chesapeake Bay, luminescent critters light up the night	Harmful Algal Blooms Firefly mapping Search bioluminescent species on iNaturalist	Exploring Bioluminescence in Aquatic Animals (grades 5-7) Bioluminescence – An Adaptation for Deep-sea Survival (grades 6-8) Creatures of Light: Nature's Bioluminescence (grades K-12)	LS1 Zoologists and Wildlife Biologists Microbiologists Biologists

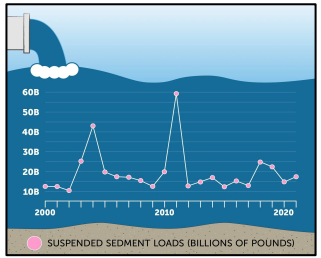
Distant Wildfires and Local Air Quality

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
How do Canadian Wildfires affect the Mid-Atlantic?	As climates get warmer and drier, forest fires become more frequent and intense. The smoke caused by these events can affect regions hundreds of miles away and the impacts can last for weeks. The most direct health effect of wildfires is respiratory and cardiovascular irritation caused by particulate matter. 	Air Quality Particulate Matter Human Health	Canada Wildfires Hurt Bay Air Quality, Boating Visibility (video) Wildfire haze focuses attention on regional air quality Chemical Traces of 2023 Canadian Wildfires Detected in Maryland Months After Smoke Subsided How Far Can Wildfire Smoke Travel?	Summer of 2023 marked by Canadian wildfire smoke Purple Air Quality maps Multiyear Air Quality tile plots Current Air Quality Current and past Air Quality map	Air Quality lesson plan (grades 6-8) Air Quality mini lessons (various grades) Air Quality and your Health (grades K-2)	ESS3 Remote Sensing Scientists and Technologists Atmospheric and Space Scientists

El Niño

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
How does El Niño impact the world's climate? *What are the impacts of* El Niño?	El Niño happens about every two to seven years, lasts about 9 to 12 months and can impact the climate of the entire Earth. During El Niño, the surface temperature in the tropical Pacific Ocean warm and the atmosphere responds by weakening prevailing winds and moves the Pacific jet stream. In the United States, this usually results in a milder winter in the north and wetter conditions in the south. 	Global Climate Weather impacts Weather patterns	Understanding El Niño & ENSO ENSO Health Impacts 10 Things to Know about this very strong El Niño	Probability graphs Global Sea Surface Temperature An illustrated guide to 100 percent chance of El Niño	Investigating El Niño: For teachers Ocean Impacts of an El Niño Event (grades 6-12) What are the causes and effects of ENSO? (grades 9-12) El Niño in the Pacific	ESS2; ESS3 Remote Sensing Scientists and Technologists Hydrologists Atmospheric and Space Scientists

Erosion

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
How is land use impacting biodiversity? *What is the most effective erosion mitigation strategy?* *Which communities will be the most affected by increasing erosion?*	Erosion is the natural process by which land is worn down over time by water, wind, and ice. Along the coasts, erosion is amplified by the increasing rate of intense storms and sea level rise. Modern mitigation strategies focus on land cover like installing native grasses and aiding natural structures like creating wetlands to lessen the impact from storm waves and rising sea levels and support biodiversity. 	Erosion Wave dynamics Water Quality Biodiversity Engineering Nutrient flow Hydraulic cycle	Does Rebuilding an Island Rebuild Fish Habitat? Coastal Erosion | U.S. Climate Resilience Toolkit Building Resilience to Coastal Flooding on the Eastern Shore of Maryland Sediment Runoff	Map of Land Use and Hydrography datasets Use Google Earth's historical imagery tool to see how a site has changed overtime	Rooted & Free Nature School MWEE Runoff Impact and Control (grades 1-6) Water: Naturally Cleaned (grades 5-6)	ESS1; ESS2; ESS3; PS3; ETS1; ETS2 Environmental Engineer Conservation Scientists Hydrologists Soil and Plant Scientists

Ghost Forests and Marsh Migration

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
What causes Ghost forests to form?	Ghost forests are dilapidated coastal forests that have been intruded by saltwater. The trees are left dead and bleached in marshes across the Bay as sea level rise increases their exposure to saltwater, causing the plant to experience "carbon starvation". Carbon starvation occurs when a plant that requires freshwater cannot photosynthesize because of salinity levels, essentially starving the organism. Ghost forests are also indicators of marsh migration. Marsh migration happens when marshes move away from their current location because of rising sea levels towards higher and drier lands.	Sea level rise Saltwater intrusion Photosynthesis Shifting habitats	What is a ghost forest? Ghost Forests in the Chesapeake Bay Region (video) Marsh Migration in Delaware	Haunted by the ghosts of forests past Sea Level Rise Viewer (map data for sea level rise and marsh migration)	Ghost Forest (grades K-4) Marsh Migration Mania! (grades 6-12) *you'll need to scroll down to find the lesson*	LS1; LS2; ESS2; ESS3 Environmental Restoration Planners Foresters Conservation Scientists Soil and Plant Scientists Biologists

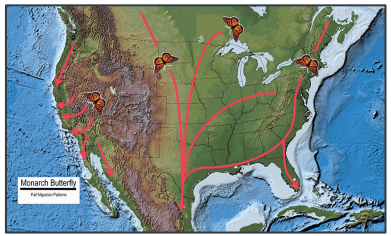
Jewelweed Exploding Seeds

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
How do seeds "move"? *Why do Jewelweed seeds explode?*	Spotted Jewelweed, also known as touch-me-nots, are annual flowers native to the eastern region of the United States. Their seeds "explode" from the seed pod for seed dispersal. The explosion is mechanically powered. As the seed pod grows, water pressure builds inside and the slightest touch will make them burst open; sending seeds as much as 5 feet away. 	Germination Seed dispersal Evolution	Jewelweed, the wildflower with exploding seed pods Jumping Jewelweed	Jewel Weed Seed Pods Explode (video)	Seeds on the Move (grade 2) Seed Dispersal Strategies (grade 2) Nature Detectives: Mystery of the Exploding Seed Pods (video)	LS1; LS2; LS4 Soil and Plant Scientists Biologists

Migration Hotspots

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
Why do thousands of birds fly over the same spot every year?	Migration routes and timing can be impacted by weather, food availability, resting spots, and rising air currents. A combination of these factors can create migration hotspots or funnels that concentrate thousands of migrating birds. 	Habitat needs Air currents Migration	Raptor Migration	Hawk Mountain, PA Migration Data eBird eBird Status and Trends	Cornell K-12 Education (variety of grades) Migration Patterns (grades 6-8) Migration Explorer (grades 6-8)	LS1; LS2; LS4 Zoologists and Wildlife Biologists Biologists

Monarch Butterfly Migration

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
How do caterpillars become butterflies? *How have shifting temperatures challenged Monarch populations?* *How do Monarchs know when to migrate and where to go?*	Monarch butterflies migrate each year to an overwintering location - some traveling 3,000 miles! The eastern Monarch population (generally those east of the Rockies) migrate to the Sierra Madre Mountains of Mexico. The western population overwinter in California. Environmental cues like weather, day length and resource availability tell monarchs when to migrate.  	Environmental Changes Migration Hibernation Metamorphosis	Monarch Butterfly Migration and Overwintering Monarch Migration	Monarch Population Status Journey North: Monitoring Migration Cape May, NJ Monarch Point Counts	Monarch Butterfly Teachers and Student Resources (grades PK-12) Teaching Tools About Monarchs (grades 3-5) Monarch Challenges: Science Lesson (grades 3-5) Monarch Butterfly Habitat: Science Lesson (grades K-2) Climate Change Impacts Butterflies: Writing Lesson (grades K-2)	LS1; LS2; LS4 Zoologists and Wildlife Biologists Biologists

Osprey Population Decline

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
Where have all the ospreys gone? *What is contributing to the decline of Osprey hatchlings?* *What is the relationship between menhaden and osprey?*	Osprey populations in the Chesapeake Bay and its tributaries have been declining, reaching levels lower than during peak DDT use. One hypothesis is that the decline in the menhaden population is a major factor. The unique fatty tissue of the menhaden are a vital nutrient source for reproduction. Menhaden also serve as a keystone species for a variety of other species on the East coast such as the Striped Bass and Blue Crabs.	Habitat needs Climate Sustainable Fisheries Fish Migration Food webs	Webinar: A Tale of Two Species Massive new study says ospreys are thriving in some parts of the Chesapeake Bay – but not enough Osprey population along the seaside of the Delmarva Peninsula has collapsed Menhaden research receives federal funding All About Birds: Ospreys	Osprey Web Cam Widespread reproductive deficits in Chesapeake Bay ospreys Menhaden Background and stock assessment 2025 Menhaden stock assessment Osprey Nest Data Menhaden and Forage Fish Management	Osprey Elementary Lesson Plans (grade 3) Success of the Osprey: A Formerly Endangered Species (grade 3-8)	LS1; LS2; ESS3 Zoologists and Wildlife Biologists Biologists

Periodical Cicadas

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
Why do some cicadas appear every 17 years?	Cicadas have a few periodical species which mature on 13 or 17 year cycles. A brood is when a large number of cicadas emerge at once (up to 1.5 million per acre!). While there is still some scientific debate on the reasoning for this, the most popular theory is the predator satiation theory. Predator satiation is the method of prey overwhelming their natural predator by rapidly appearing in extreme quantities. By showing up in quantities impossible for predators to consume, cicadas increase the probability of survival and reproduction. 13 or 17 year cycles allow this to happen, as predators cannot evolve to rely on periodical cicadas as a stable seasonal food source.	Survival Strategy Food Web Life Cycle	FAQ - Cicada Crew Climate and Periodical Cicadas	Video of a cicada brood Cicada information and mapping iNaturalist Cicada observations	Periodical cicadas are back! (grades 5-12) Periodical Cicadas Teaching Resources	LS1; LS2; LS4 Zoologists and Wildlife Biologists Biologists

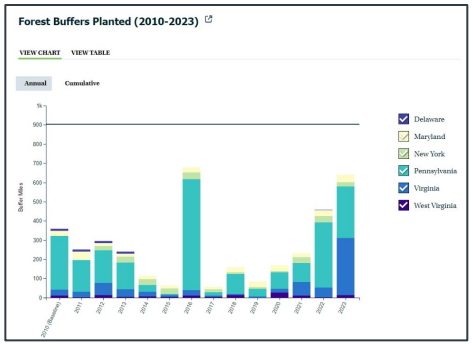
Periwinkle Snails Internal Clocks

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
How do periwinkles know when to climb up grasses to avoid the tide?	Periwinkle snails feed on detritus, which is a mix of bacteria, microalgae, and small pieces of marsh grass (specifically spartina marsh grasses). Periwinkle snails avoid predators by sensing the pheromones of predators and through their internal clock signifying when the tides come in and their vulnerability increases. There is variation between marsh periwinkle populations as as evident in their internal clock which mirrors the local tidal schedule. Periwinkles are an indicator species meaning they are very sensitive to particular toxins (think the marsh version of canary in a coal mine!). Because of this they are often used in toxicology trials.	Defense strategies Adaptation Internal clocks	Spartina Grasses and Periwinkle Snails Periwinkle Snails in Peril, from "In the Grass, On the Reef" (video) Marsh periwinkle	Timelapse of Periwinkle snails climbing up mangrove roots (video) Tidbit Tuesday: Periwinkle snails (video) 	Snail Fronts and Salt Marsh die-offs (grades 9-12)	LS1; LS2; LS4 Zoologists and Wildlife Biologists Biologists

Pollinators

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
Why are pollinators so important?	Pollinators are extremely vital to our food systems. One in every three bites of food is the work of pollinators germinating crops to support farming and feed livestock. Many vital plants rely on pollinators to maintain their populations, creating a symbiotic relationship with pollinators. 	Food systems Pollination Germination Ecosystem health	Native Chesapeake plants and their picky pollinators Pollinators: Tiny Creatures Making a Big Difference in Our Lives	World Without Bees: A Silent Crisis for Food, Farmers & the Future Global Pollinator Watch	Bees and Pollinators Bee and Pollinator Activities (grades K-5) Nature's Partners (grades 3-6) What kinds of landscapes keep bees healthy? (grades 6-12)	LS1; LS2 Zoologists and Wildlife Biologists Environmental Scientists and Specialists Landscape Architects Conservation Specialist Soil and Plant Scientists Biologists

Riparian Forest Buffers

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
How do forests impact water quality?	Forests growing alongside waterways, or Riparian Forest Buffers, can play a big role in the health of the waterway. These forests can slow and reduce the amount of runoff entering the waterway which can reduce the amount of pollutants and sediment reaching the water. They also stabilize streambanks, can moderate stream temperature and provide food and habitat for aquatic species.  	Habitat health Riparian buffers Land Use Sediment load	Forest Health Riparian Forest Buffers	Chesapeake Riparian Forest Buffer Network Maryland Forests: Forested Buffers i-Tree Landscape	Making the Forest the Best It Can Be (grade 5) Healthy Forests (grade 4-5) Who Cares About the Forest? (grades 7-12) Riparian Forest Buffers: The Link Between Land & Water (grades 7-12) Healthy Rivers (grades 6-8)	LS1; LS2; ESS3; ETS1; ETS2 Environmental Restoration Planners Foresters Conservation Scientists Soil and Plant Scientists Environmental Economists Biologists Agricultural Engineers Construction Managers

Sea Level Rise

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
How can we better prepare infrastructure for rising sea levels? *How have communities been affected by changing shorelines?*	As carbon dioxide emissions have increased exponentially over the past 50 years, there has been increases in global air and ocean temperatures and changes in circulation patterns and other processes that contribute to sea-level rise. The increased quantity of water from melting ice in the ocean coupled with the fact that warmer water takes up more space has resulted in an average global sea level rise of 8-9 inches since 1880. The rising sea levels are threatening coastal communities and habitats.	Albedo effect Environmental Changes Thermal Expansion Greenhouse effect Engineering Carbon dating (monitoring melting ice cores)	Maryland's Sea Level Rise Projections Pg. 21 & 22 Global Sea Level Sea Level Rise Sea Level Rise: Adaptation Strategies	Sea Level Rise Viewer	NASA Lessons in Sea-Level Rise (grades 5-12) NOAA Sea Level Rise (grades 6-12) Collection of Sea Level Rise Lesson Plans (grades 3-12)	ESS2; ESS3; PS1; PS2; PS3; PS4; ETS1; ETS2 Hydrologists

Sinkholes

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
Why do sinkholes form?	There are areas throughout the Mid-Atlantic that are susceptible to sinkholes because the rock below the surface is naturally dissolved by groundwater, like carbonate rock and limestone. Water easily dissolves minerals in these rocks leaving open spaces, or voids, within the rock. A sinkhole happens when surface soil collapses into a rock void. Sinkholes are natural occurrences. Overtime, water can wash into the voids and make them larger and unstable. Human activities can also speed up this process. For example, groundwater removal can lead to a sinkhole.	Substrate Material Geology Groundwater depletion Hydraulic cycle	What causes a sinkhole? Sinkholes Sinkholes from USGS	Sinkholes from USGS 30-Foot-Wide Sinkhole Swallows Front Yards in Pennsylvania Town (video) Map of areas susceptible to sinkholes 	Sinkhole Emergency! (grades 3-5) Journey Through Earth's Transformations: Erosion and Sinkholes (grades K-2)	ESS2; ESS3; ETS1; ETS2 Industrial Ecologists Water Resource Specialists Hydrologists Soil and Plant Scientists Construction Managers

Urban Heat Island Effect

Guiding Question	Synopsis	Science Concepts	Sources	Data & Imagery	Educational Resources	NGSS & Career Connections
Why is downtown hotter than outside the city center? *How can city planners mitigate the urban heat island effect?*	The urban heat island effect is the phenomenon of increased actual and real-feel temperatures in highly developed urban centers. This occurs because the materials that make up the urban landscape such as concrete and metal retain more heat than grass and trees. This creates a heat island in cities which increase energy consumption and heat-induced health risks. 	Feedback loop Air Quality Climate Albedo	Heat.gov: Urban Heat Islands Code Red	What Are Heat Islands? Future Heat Events and Social Vulnerability Detailed maps of urban heat island effects in Washington, DC, and Baltimore	Urban Heat Islands Lesson Plans (variety of grades) Urban Heat Island Effect (grades 9-12) Investigating heat islands (grades 6-8) Schoolyard Urban Heat MWEEs for grades 9-11: Air Temperature; Water Temperature; Surface Temperature Code Red: The Role of Trees	ESS1; ESS3; PS3; PS4; ETS1; ETS2 Foresters Landscape Architects Urban and Regional Planners