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August 2006
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Curriculum Guide to the Aquarium
A teacher’s guide to planning a field trip to the National Aquarium in Baltimore

Description
Since its opening in 1981, the National Aquarium in Baltimore has been dedicated to stimulating interest in, developing knowledge about, and inspiring stewardship of aquatic environments and is, therefore, an excellent educational resource. Each year over 150,000 students visit the Aquarium and encounter the unique inhabitants of our planet’s coral reefs, open oceans, rain forests, Chesapeake Bay, and other habitats. Field trips are led by teachers and chaperones at your own pace on a journey of discovery through the Aquarium.

The Teacher’s Curriculum Guide is designed to help you plan, organize, and enjoy a field trip to the Aquarium with your students. The companion Teacher’s Activity Guide to the National Aquarium in Baltimore contains before, during and follow-up activities to use with your students. Download the Teacher’s Activity Guide at www.aqua.org.

This Guide provides you with:

- An overview of the Aquarium’s exhibits, habitats, and animals.
- Suggestions on how to use the major exhibits to teach to specific standards from the Maryland State Voluntary Curriculum.
- Tips for chaperones to help students learn even more from the experience.
Notes to the Teacher

* Please make sure to fill out and submit the “Field Trip Justification” form to your Administration to gain approval for your field trip. Also, this form helps you to plan your Aquarium field trip.

* Please read your contract carefully. Groups may not enter before the scheduled time because space in the building is limited.

* Please check your planning packet for maps and additional online resources.

* You and your chaperones are the tour guides for your students and are responsible for the behavior of your group.

**CHAPERONES MUST REMAIN WITH STUDENTS AT ALL TIMES.**

* If possible, please meet with your chaperones ahead of time. At that time, you can:
  * Distribute “Chaperone Suggestions” and “Teaching Tips for Chaperones.”
  * If you are using an activity worksheet, copy and distribute to your chaperones. Discuss the best ways to assist the students during the field trip.
  * Review the Aquarium rules with your chaperones.
  * Discuss your objectives for learning during the trip.

* Prepare your students by following the pre-visit activities suggestions provided in the Teacher’s Activity Guide at www.aqua.org.

* Review common courtesy and rules of behavior:
  * Students must stay with their chaperones.
  * Food, drink, and gum are not allowed in the Aquarium.
  * The Aquarium is a museum – running and loud or disruptive behavior are not allowed.

* Some of our exhibits have regularly scheduled feeding and presentation times. Please check in the Lobby for presentation times.
Field Trip Justification Form

Destination: National Aquarium in Baltimore
Pier 3, 501 East Pratt Street
Baltimore, MD 21202-3194

School: ____________________________________________ Principal: ________________________________

Date of Trip: __________________________ Teacher-in-Charge: ______________________________

Class or Group of Students: ____________________________ Number of Students: __________________

Time of Departure from School: ______________ Time of Return to School: ________________

Transportation:
Company Used: __________________________
Phone Number: __________________________

Arrangement of Meals:
___Pre-Order Box Lunches
   * Number of Lunches: __________
___Buy Lunches in Food Court
___Leave Aquarium and buy lunches

Costs:
Transportation Costs: $___________
Admission Cost for Students: $___________
Program Cost: $___________
Pre-order Box Lunches: $___________

Total Cost per Student: $___________

Cost of Additional Chaperones: $_______

Chaperones:
Number of Chaperones Required: __________
Number of Chaperones Attending: __________

Ratio of Chaperones to Students: __________

Plans for informing Chaperones with Guidelines and Objectives for the field trip: ________________________________

Objectives of Trip and Anticipated Outcomes: ________________________________

Administrative Approval:
o Approved
o Denied/Reason: ____________________________________________________________

Administrator Signature: ____________________________ Date: ___________
Chaperone Suggestions

Please copy this information and distribute it to chaperones prior to the Aquarium field trip.

Tips on Being a Great Chaperone
You play an important role in making this trip to the National Aquarium in Baltimore both an educational success and a memorable experience for the students. Being a chaperone is challenging, but very rewarding. We hope these suggestions will make your task easier and more enjoyable.

As a chaperone, you have several roles:

You are the leader of your small group of students.
- Lead your group on their journey through the Aquarium galleries.
- Know which students are in your group.
- Please make sure to keep your group together; the Aquarium tour route is one way, so it’s very difficult to go back to find stragglers.
- Be sure you know where and when to meet the rest of your school at the end of your visit.

You help students learn.
- Ask the teacher about the educational goals for the trip.
- Find out if the students have a special project or worksheet to complete.
- Ask if the teacher has information that allows you to help the students complete their task.

You are responsible for the behavior of your group.
- Students must stay with their chaperones at all times.
- For the safety of the animals in our care, drinks, food, or gum are not allowed in the Aquarium.
- Respect other visitors at the Aquarium by not running or shouting anywhere in the building.
- Did you know that sound travels through water? That is why we ask you to not tap on the aquarium glass and disturb the fish and other animals.
- If the students have a worksheet to fill out, please use a clipboard and secure a pencil to the clipboard with a string. The aquarium glass and display panels scratch easily if you write directly on them.
- If necessary, the Aquarium reserves the right to ask undisciplined or unchaperoned groups to leave the building.
Teaching Tips for Chaperones

While exploring the Aquarium galleries, you can help your students learn about the Aquarium animals and how they live. Here are some tried and true ways to focus the attention of your group.

Ask thought-provoking questions.
Stop at an uncrowded exhibit and ask your students to compare different animals. Examine mouths, fins, shells, or appendages. Observe how fish behave. How do they move? Do all fish swim the same way? How do you think they protect themselves? Use the graphics panels and identification labels to give you ideas for good questions. Finding the correct answer is not as important as thinking creatively about the question.

Watch for interesting behaviors.
Have the students look for feeding, aggressive interactions, courtship, or territorial behaviors.

Guess how some of the animals got their common names.
Why is it called a horseshoe crab? Or a butterflyfish? The common names are located on the identification labels.

Involve all the students in your group.
Wait for answers. Do not worry if some students take what seems like a long time to answer you. Do not let one or two especially eager students get all the attention.

Use the trained Exhibit Guides.
Look for Volunteer Exhibit Guides wearing blue uniform shirts and khaki pants. Exhibit guides are usually located at the Children’s Discovery Corner and in the Rain Forest, but are commonly stationed throughout the building. They are happy to answer your students’ questions, point out especially interesting animals, and help the students handle invertebrates such as horseshoe crabs and whelks in the Children’s Discovery Corner.

Take advantage of scheduled feeding demonstrations.
Upon entering the Aquarium, refer to the posting in the Lobby of the Main Aquarium or inquire at the Information Desk about scheduled feeding demonstrations. The husbandry staff and volunteers give informative talks during these sessions, and your students may be able to ask questions following the feeding.

Enjoy your visit and the experience of helping students learn!
Aquarium Exhibit Overview

Harry and Jeanette Weinberg Waterfront Park

Outside of the main Aquarium building, a recreation of the coastal, Piedmont, and Allegheny Mountain regions of Maryland serves as a natural oasis in the Inner Harbor.

This area is freely accessible and contains park benches, paved footpaths, shade trees, and a variety of plants. This Harry and Jeanette Weinberg Waterfront Park provides a relaxing setting to reflect on the diversity of Maryland’s ecology and our individual roles in the health of the Chesapeake Bay region.

Are You a Part of the Watershed?

Within the Harry and Jeanette Weinberg Waterfront Park is an inlaid map of the Chesapeake Bay watershed. A watershed is the area of land where all of the water that drains off of it including rivers, streams, rainwater, and melting snow flows into a larger body of water. While the body of the Chesapeake Bay is located only in Maryland and Virginia, the Chesapeake Bay Watershed covers approximately 64,000 square miles and is comprised of parts of six states: Pennsylvania, West Virginia, Delaware, New York, Maryland, and Virginia. That means that any pollution affecting waterways hundreds of miles away, may eventually affect the health of the Bay.

Threats to the Chesapeake Bay Watershed

While it is easy to blame those within close proximity to the water for the large quantities of litter that make their way into the Bay, our cities’ sewer systems everyone within the watershed is responsible for the health of the Chesapeake Bay. Just imagine - that small piece of trash that you threw on the ground today could be washed down into the sewers during the next rainfall and out through a drainage pipe into one of the Chesapeake Bay’s 50 major tributaries. The trash will eventually make its way into the Chesapeake Bay itself. And while that small piece of trash does not seem like a lot, too many of those small pieces add up to create quite a mess that litters the coastline and hurts wildlife.

Another threat to the Bay is eutrophication or water pollution caused by the introduction of large amounts of nutrients. While increased nutrients may at first seem to be a benefit to the large amounts of submerged aquatic vegetation (SAV) that have

Voluntary State Curriculum

Pre K:
3.A.1.b: Observe and collect data about how some plants are alike in the way they look and in the things they do.

Kindergarten:
3.P.1.c: Describe ways that animals and plants interact with each other and with their environment, such as birds nesting in trees, deer eating plants, bees pollinating flowers, spiders eating insects, etc.

Grade 1:
6.B.1.b: Recognize and describe that individual and group actions, such as littering, harm the environment.

Grade 2:
6.A.1.a: Explain that some natural resources are limited and need to be used wisely.

Grade 3:
2.C.1.b: Describe the natural features in their immediate outdoor environment, and compare the features with those of another region in Maryland.

Grade 4:
6.B.1.a: Identify and describe that human activities in a community or region are affected by environmental factors.

Grade 5:
6.B.2.a: Explain how human activities may have positive consequences on the natural environment.

Grade 6:
6.A.1.d: Identify and describe problems associated with obtaining, using, and distributing natural resources.

Grade 7:
6.B.1.a: Identify and describe a local, regional, or global environmental issue.

Grade 8:
6.B.1.b: Identify and describe how human activities produce changes in natural processes.

Core Learning Goals:

Grades 9-12:
3.5.3: The student will investigate how natural and man-made changes in environmental conditions will affect individual organisms and the dynamics of populations.
traditionally lined the coastline of the Bay it is, in fact, quite detrimental. With the addition of nutrients, algal populations thrive. These algal blooms float on the surface of the water and limit the growth of SAV by blocking necessary sunlight. As the algae begin to die and sink to the bottom, decomposers, such as bacteria, break it down and, in the process, use up valuable oxygen. Thus, the addition of nutrients and the resulting algal blooms kill the SAV that provides food and shelter for countless animals. Areas called “Dead Zones” are created. These are areas where there is not enough oxygen for animals to survive.

**Animal Planet Australia: Wild Extremes**

Australia, whose official name is the Commonwealth of Australia, is slightly smaller than the continental United States and is the only country to occupy a single continent. It is the most sparsely populated continent after Antarctica. Australia consists of six states and two territories.

Australia is known for its unique animals found nowhere else on earth. Animals such as the kangaroo, koala, wallaby, echidna, platypus, cassowary, kookaburra, and flying fox can all be found in Australia’s various habitats. The amazing adaptations and lifestyles of these animals enable them to find water, food, and shelter within their environment. One region that experiences dramatic changes in seasons, creating an extreme environment to live in, is the Northern Territory. The Northern Territory is the main focus of the new exhibit at the National Aquarium in Baltimore, *Animal Planet Australia: Wild Extremes.*

The Northern Territory is a hot and rugged area of Australia that covers about one-sixth of the Australian continent. The distance from the northern-most point to the southern-most point of the Territory is about the same distance as from New York to Miami. Of a population of about 175,000, 27% are of Aboriginal descent. The natural features of the Northern Territory include a flat coastline with swamps, mud flats, and mangroves; desert or semi-arid plains, often referred to as the Outback; tropical rain forests; and savannahs. One of the most familiar landmarks of this region is Uluru, also called Ayers Rock.

Extremes in weather patterns occur that define this region as the land of flood, drought, and fire. These periods of varied and dramatic seasonal change are so distinct that they are broken down into six seasons, which are all important to the cycle of life.

<table>
<thead>
<tr>
<th>Voluntary State Curriculum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre K:</strong></td>
</tr>
<tr>
<td>3.A.1.a: Observe and collect data about how some animals are alike in the way they look and in the things they do.</td>
</tr>
<tr>
<td><strong>Kindergarten:</strong></td>
</tr>
<tr>
<td>3.D.1.c: Describe that the external features of plants and animals affect how well they thrive in different kinds of places.</td>
</tr>
<tr>
<td><strong>Grade 1:</strong></td>
</tr>
<tr>
<td>3.A.1.d: Classify organisms according to one selected feature, such as body covering, and identify other similarities shared by organisms within each group formed.</td>
</tr>
<tr>
<td><strong>Grade 2:</strong></td>
</tr>
<tr>
<td>3.F.1.b: Explain that changes in an organism’s habitat are sometimes beneficial to it and sometimes harmful.</td>
</tr>
<tr>
<td><strong>Grade 3:</strong></td>
</tr>
<tr>
<td>3.F.1.c: Describe ways in which changes in environmental conditions can affect the survival of individual organisms and entire species.</td>
</tr>
<tr>
<td><strong>Grade 4:</strong></td>
</tr>
<tr>
<td>3.A.1.b: Identify general distinctions among organisms that support classifying some things as plants, some as animals, and some that do not fit neatly into either group.</td>
</tr>
</tbody>
</table>
With wildlife rarely, if ever, seen in North America, *Animal Planet Australia: Wild Extremes* will expose you to this unique environment and help you develop a unique understanding of the importance of water to life.

**Animal Identification**

*Gray-Headed Flying Fox:* These are bats that hang from the branches of trees, often in groups made up of many thousands called camps. Flying foxes eat the fruit, nectar, and pollen from trees. Like most bats, the flying fox is important to forest health because it pollinates and disperses seeds of many important tree species.

*Pig-Nosed Turtle:* This aquatic turtle, also called the Fly River turtle, is the only freshwater turtle with flippers resembling those of marine turtles. They are omnivorous, but prefer to feed on the fruit and leaves of the wild fig.

*Johnston's Freshwater Crocodile:* Equally fast on land or water, these freshwater crocodiles may gallop at speeds up to 18 miles per hour. They have strong legs, clawed webbed feet, and powerful tails. They have smooth, narrow, tapering snouts and a mouth lined with 68 - 72 sharp teeth. The major threat to these animals is habitat destruction. Population estimates differ, but there are probably 100,000 individuals in the wild.

*Black-Headed Python:* One of Australia’s more beautiful pythons, this aptly named snake has a glossy, jet-black head and neck and from 70 to 100 dark bands across the rest of its body. They prey almost exclusively on reptiles (lizards and snakes), including venomous snakes. They appear to be immune to the venom of Australia’s most toxic species.

*Frilled Lizard:* This lizard is famous for its spectacular neck frill, displayed when the animal is disturbed or alarmed. At the same time the lizard raises its frill or ruff, it opens its mouth wide, darkens its color, and stands rocking on its hind legs, all the while making an ominous hissing sound. If a predator is not scared away, this arboreal lizard will retreat to a treetop.
Wings in the Water

The exhibit’s alliterative title is derived from the graceful flying appearance of the stingrays as they move through the water. This 265,000-gallon exhibit houses a number of species of stingrays. Most of the stingrays are cownose rays, which have a blunt face and pointed pectoral fins that move like a bird’s wings. Other species, like the southern stingray, are more disc-shaped and swim through the water by rippling their pectoral fins. Several species of small sharks, large silver fish called tarpon, and a green sea turtle are also on display in this exhibit.

There are approximately 400 species of rays. Some rays use venomous spines located on their tails for protection. Most ray-related injuries occur when someone accidentally steps on the animal hidden beneath the sand and the animal tries to protect itself. Stings can be quite painful. If you are wading in shallow water where stingrays might be hiding, it is wise to do the “stingray shuffle” – shuffle your feet through the sand to alert the stingray of your presence.

Divers enter the exhibit several times each day to feed the animals a daily total of approximately 30 pounds of food. A typical feeding includes small fish called smelt, clams, shrimp, krill, and squid. To keep the divers from being accidentally poked by the spine of an excited ray, the spines are partially cut off before the animal goes on exhibit. Over time, these spines do grow back.

You will get a different view of this exhibit through underwater viewing windows towards the end of your Aquarium visit after descending the ramps of the Atlantic Coral Reef and Open Ocean exhibits. From this vantage point you can find the mouth and gills on the underside of the ray’s body. The eyes of the stingray are located on top of its body so they can still see even if their body is buried in the sand. What are those holes that keep opening and closing behind the ray’s eyes? Those are called spiracles. That is where the stingray draws clean water in to its body to pass over its gills so it can breathe.

Ray Identification

Cownose Rays: A well-defined indentation in the head gives these rays a lobed appearance like a cow’s nose. Two fleshy lip-like fins are set below the head and are used for scooping and funneling food. As they swim during feeding behaviors, the pointed pectoral fins of cownose rays have often been mistaken for the dorsal fins of sharks.

Voluntary State Curriculum

Pre K:
3.A.1.b: Identify some of the things that all animals do, such as eat, move around and describe how their features (observable parts) help them do these things.

Kindergarten:
3.A.1.a: Identify and describe features (observable parts) of animals and plants that make some of them alike in the way they look and the things they do.

Grade 1:
3.A.1.b: Compare similar features in some animals and plants and explain how each of these enables the organism to satisfy basic needs.

Grade 2:
3.D.1.a: Observe and describe individuals in familiar animal populations, such as cats or dogs, to identify how they look alike and how they are different.

Grade 3:
3.C.1.c: Identify and describe some features of the ocean floor.

Grade 4:
3.D.1.b: Explain that the characteristics of an organism affect its ability to survive and reproduce.

Grade 5:
3.A.1.a: Identify and describe features of some of the plants and animals living in a familiar environment and explain why these organisms are well suited to their environment.

Grade 6:
3.F.1.c: Explain that within any environment organisms with similar needs may compete with one another for resources.

Grade 7:
3.A.1.e: Use analogies, models, or drawings to represent that animals and plants have a great variety of body plans and internal structures that define the way they live, grow, survive, and reproduce.

Grade 8:
3.D.1.b: Recognize that adaptations may include variations in structures, behaviors, or physiology, such as spiny leaves on a cactus, birdcalls, and antibiotic resistant bacteria.

Core Learning Goals:

Grades 9-12:
3.A.1: The student will explain how new traits may result from new combinations of existing genes or from mutations of genes in reproductive cells within a population.
Pelagic Stingrays: Unlike many species of rays, pelagic stingrays are found in open ocean water rather than on shallow, sandy bottoms. Their species name, *violacea*, refers to their violet/gray coloration that helps them blend into the dark surroundings of the open ocean.

Roughtail Rays: These diamond-shaped rays have tails usually three to four times their body length, covered with thorns and prickles that extend up the body midline. The largest roughtail recorded was 800 pounds and 82 inches wide. Roughtail rays have been known to live 40 to 50 years.

Southern Stingrays: Up to five feet wide, these shallow water rays can usually be found buried with only their eyes and spiracles visible. Females give birth to three to five young in the late spring and early summer. The pups are about eight inches across at birth.

Shark Identification

Bonnehead Shark: This small shark reaches up to 5 ½ feet in length. Though it is a member of the same family that includes the hammerhead, bonnetheads are non-aggressive. It is the second smallest species of hammerhead.

Blacknose Shark: The blacknose shark has a distinctive spot on the tip of the snout, although the spot may fade with age. The blacknose shark commonly reaches about 4 feet in length, but it can grow as long as 6 ½ feet. This species sometimes forms large schools. They feed primarily on small fish.

Zebra Shark: The name sounds as though this animal should be striped, and indeed, as a juvenile, it is. As this non-aggressive animal matures, it becomes spotted. Adults average about 10 feet long, and the tail is a significant part of that length. Zebra sharks are very sluggish and typically rest on the ocean bottom. They are suction feeders, searching for mollusks (like clams), shrimp, crabs, and small fish with their barbels, or whiskers.

The Green Sea Turtle

The Aquarium’s green sea turtle, Calypso, has an interesting story. It was suffering from a condition called cold stunning when it was found stranded off the coast of Long Island, New York in 2000. Cold stunning is a condition similar to hypothermia in humans – the turtle’s body temperature was a frigid 40.7° Fahrenheit when it arrived for treatment. Its body temperature normally ranges from 76° to 80° Fahrenheit! The turtle’s flipper was amputated due to a
severe infection that it obtained in the wild. Because of the loss of its flipper, veterinarians and animal care experts from the U.S. Fish and Wildlife Service deemed the animal non-releasable. The animal was transferred to the Aquarium to live in Wings in the Water with a diversity of other animals including rays, sharks, and other fish species.

**All Sea Turtle Species Are Listed as Threatened or Endangered**

In nature, sea turtles face a host of life and death obstacles to their survival during all stages of their lifecycle. Raccoons, foxes, dogs, seabirds, and ghost crabs prey upon turtle eggs. Young sea turtles are eaten by seabirds, crabs, and carnivorous fish. Adults may be eaten by tiger sharks.

Humans, however, are the greatest threat to sea turtles. All sea turtle species are impacted by human activities. Worldwide, sea turtle populations are affected by the harvest of both turtles and their eggs. In some countries, adult sea turtles are harvested for their meat. The market for turtle products, like authentic turtle shell jewelry made from the shells of hawksbill sea turtles also threatens sea turtle populations. Despite legislation in many countries against the harvest of sea turtle eggs, poaching is common and enforcement is difficult.

In many parts of their range, nesting is hindered or disrupted by coastal development and other human activities. After hatching at night, baby sea turtles find their way to the ocean by following the brightest horizon, which naturally occurs as moonlight reflects off of the ocean. In developed areas, many head towards the bright artificial lights of houses, hotels, or other structures and die before they reach the water.

In recent years, many populations, including those in Florida and Hawaii, have been seriously affected by fibropapilloma, a disease that may be linked to marine pollution. Turtles with this disease develop fleshy tumors on the skin and internal organs that can eventually impair vision, feeding, breathing, and other vital functions.

The United States has implemented a number of legislations to protect sea turtles in local waters. Despite these efforts, thousands are killed every year as bycatch, non-target species accidentally killed during specific fishing practices. Sea turtles also die following entanglement in discarded fishing net or from the ingestion of marine debris, especially plastics.
Everyone can help sea turtle conservation efforts:

- Don’t buy sea turtle products.
- Join organizations that protect the marine environment.
- Join the fight against marine debris – sea turtles are among the animals most likely to mistake plastic and other trash for food.

**Maryland: Mountains to the Sea - Level 2**

Your journey through the Chesapeake Bay watershed continues on Level 2 with *Maryland: Mountains to the Sea*. Its four displays trace the water cycle through different wetland environments from the Allegheny Stream in the mountains of western Maryland, through the sunlit Tidal Marsh and Coastal Beach, and then out to the deeper, darker Continental Shelf.

Wetlands are areas that share characteristics of both aquatic and terrestrial ecosystems. They are characterized by areas of standing water for at least part of the year, hydric soil or soil that holds water, and by specially adapted plants and animals. Wetlands provide numerous benefits to the Chesapeake Bay and its surrounding watershed including flood buffering, erosion control, bank stabilization, and water quality improvement.

Wetlands throughout the Chesapeake Bay region are being damaged or lost at an alarming rate as a result of coastal development, rising sea levels, and damage from non-native species. The Aquarium has formed partnerships with various organizations throughout the Bay region and created numerous volunteer opportunities to restore tidal wetlands through cleanups and grass plantings. Volunteers have assisted with the planting of tens of thousands of plants to create a four-acre tidal wetland on the Eastern Neck National Wildlife Refuge, an area eroding at a rapid rate. The Aquarium has also conducted numerous successful sea grass, oyster, and salt marsh restorations, including an ongoing effort at a seven-acre brackish water marsh site at Fort McHenry National Monument and Historic Shrine. To learn more about Aquarium conservation programs please visit our website at [www.aqua.org/conservationevents.html](http://www.aqua.org/conservationevents.html).

**Chesapeake Bay Watermen, Crabs, and Oysters**

Chesapeake Bay watermen is the term used for those people who make their living fishing, oystering, or crabbing on the Chesapeake Bay. These watermen usually own their own boat and

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**Voluntary State Curriculum**

**Pre K:**

3A.1.c: Use oral language to compare pictures or models of several animals (or plants) that look alike and of several animals (or plants) that look different and respond to questions that are raised by those who observe the pictures.

**Kindergarten:**

3D.1.a: Observe, describe, and give examples and describe the many kinds of living things found in familiar places.

**Grade 1:**

3C.1.a: Examine a variety of populations of plants and animals (including humans), to identify ways that individual members of that population are different from one another.

**Grade 2:**

2E.1.a: Identify the many locations where water is found.

**Grade 3:**

2C.1.b: Describe the natural features in their immediate outdoor environment, and compare the features with those of another region in Maryland.

**Grade 4:**

3D.1.c: Describe ways in which organisms in one habitat differ from those in another habitat and consider how these differences help them survive and reproduce.

**Grade 5:**

3A.1.a: Identify and describe features of some of the plants and animals living in a familiar environment and explain ways that these organisms are well suited to their environment.

**Grade 6:**

3D.1.e: Explain that in any particular environment individual organisms with certain traits are more likely than others to survive and have offspring.

**Grade 7:**

3A.1.b: Identify general distinctions among organisms that support classifying some things as plants, some as animals, and some that do not fit neatly into either group.
gear and sell their catch to different wholesale seafood houses. The life of a waterman is hard. It involves long days of strenuous work throughout all of the seasons and in all types of weather. Being a waterman means that your livelihood is dependant on the health of the Chesapeake Bay. Unfortunately, the health of the Bay has been declining and with it there has been a decline in the health and numbers of some of the most economically important animals in the Bay – blue crabs and oysters. Without improvement in the populations of Chesapeake Bay blue crabs and oysters, the Chesapeake Bay Waterman may become a thing of the past.

Blue Crabs

Overharvesting and the loss of SAV, or submerged aquatic vegetation, have led directly to a decrease in blue crab populations in the Chesapeake Bay. Without the protective cover that bay grasses offer, soft-shelled crabs (those that have recently molted) are vulnerable to predation. Recent efforts to improve the plight of the blue crabs include improved crab fishery management, reducing the harvest, restoring the bay grasses, and reducing nutrient pollution in order to improve summer water quality conditions.

Oysters

The Chesapeake Bay oyster population has been in decline over the past century due to historic overharvesting and, more recently, habitat degradation and the ravages of the diseases MSX and Dermo. Research is currently underway to determine if the introduction of a non-native oyster species (the Asian oyster, *Crassostrea ariakensis*) might help the native oyster (the American oyster, *Crassostrea virginica*) population. Scientists want to introduce an oyster species that will demonstrate a lower mortality from MSX and Dermo. It may also be beneficial to introduce a species that grows to harvestable sizes faster than the three years it takes for the native oyster. The introduction of this new species into the Chesapeake Bay could mean reduced harvesting pressure on the native oyster species; a greater number of oysters would mean increased biofiltration of Bay waters by the oysters; and more oysters would provide a hard substrate for the future development of oysters and the formation of oyster reefs. Research is ongoing to determine if the benefits of the introduction of a non-native species outweigh the risks.

Grade 8:

3.D.1.b: Recognize that adaptations may include variations in structures, behaviors, or physiology, such as spiny leaves on a cactus, birdcalls, and antibiotic resistant bacteria.

Core Learning Goals:

Grades 9-12:

3.5.4: The student will illustrate how all organisms are part of and depend on two major global food webs that are positively or negatively influenced by human activity and technology.
**Animal Identification**

*Eastern Painted Turtle:* These turtles get their name from the bright yellow patches on their heads. During warm weather, painted turtles bask in the sun for much of the day, alternating basking with foraging on aquatic plants and animals.

*Killifish:* Killifish are abundant in salt marshes. They are well-adapted to the extreme variations of salinity, temperature, and oxygen that occur in tidal marshes. Killifish help control mosquitoes by feeding on their larvae. They are also useful as bait fish and are easily caught in minnow traps. Long-legged, wading birds, like great blue herons and egrets, are particularly fond of killifish.

*Blue Crab:* These aggressive crabs forage along the bottom of tidal creeks in salt marshes, looking for small invertebrates or scavenging on larger animal carcasses. They are eagerly sought after by both humans and natural predators like raccoons for their tasty meat.

*Diamondback Terrapin:* These gentle turtles feed on mollusks and small crabs. They live in the brackish water of salt marshes and mangrove swamps along the east coast of the United States and down to Mexico. They were hunted almost to extinction and are gradually returning. The University of Maryland, College Park uses the diamondback terrapin as its mascot, hence the Maryland Terrapins.

*Flounder:* These bottom-dwelling fish settle into sand or mud and wait for small prey items to pass by. Like most fish, a flounder begins life with one eye on either side of its head; over time, however, one eye migrates. Eventually the fish has two eyes on the top side. Different species of flounder may be left- or right-handed. To determine whether a flounder is left- or right-handed, hold it with the brown side up, belly side (where the gills open) facing toward you. If the head faces right, it’s “right-handed.” If it faces left, it’s “left-handed.”

**Surviving through Adaptation - Level 3**

An adaptation is a special modification of a plant or animal that makes it better fit to live in its environment. The displays in this gallery demonstrate many ways that animals have adapted to their various aquatic environments.
Animals are adapted in many ways that allow them to survive in the water. They have developed specialized appendages like fins, legs, and tentacles that help them catch food, move through the water, or defend themselves against predators. Their body shapes allow them to move easily through water, attach firmly to surfaces, or bury themselves in sand. Color patterns may camouflage animals and disguise their shapes and sizes from predators. These adaptations have come about to avoid predation or because of competition for food, space, or a mate.

**Surviving**

This exhibit displays freshwater fish that are very primitive in structure. Today’s sturgeons, gar, and pumpkinseeds remain virtually unchanged from their ancient ancestors.

**Evolving (Changing)**

Use of an area’s resources in different ways permits a great diversity of life. This exhibit displays many species of cichlids that can be found in Lake Malawi in Africa. Each species is derived from a basic form that became more specialized in order to exploit different diets, methods of feeding, periods of activity, and uses of cover.

**Shocking**

This exhibit is devoted to the electric eel. A system of colored lights above the exhibit and a sound amplifier allow you to see and hear a representation of the voltage being generated by the eel. Electric eels belong to a group of fish that use electricity for navigation, communication, defense, and predation.

**Moving**

Fin power moves the most numerous group of vertebrates – fishes. Compare some of the different ways fish in this exhibit use their fins to propel themselves through the water. Not all fish get swimming power from their tails.

**Feeding**

Two animals are showcased in the Feeding exhibits, the octopus and the anemones. The octopus is an active predator that feeds on
its prey at night. It eats fish and crustaceans. While anemones appear to be delicate flowers, they are actually venomous animals. Stinging cells help to stun passing prey, and the tentacles draw the meal into the anemone's mouth.

Adapting

Look closely at these small exhibits and see some of the adaptations that help animals fill their niches! Observe the sea horses that slurp their planktonic meals through tube-like mouths. Watch the cowries and some of its gastropod cousins make quick work of algae by licking it up with their radulas, or rasping tongues. See mudskippers use modified pectoral fins to climb out of the water while they breathe through their skin.

Life in the Deep

Pictures show some of the adaptations of deep sea fish to life in the deep dark sea. Look for large eyes to collect limited light, huge mouths to eat any sized prey they might encounter, and bioluminescent lures to attract limited prey. What other adaptations might a fish need in the deep, dark, cold, high pressure world of the abyss?

Lurking

This exhibit simulates a wreck of a ship circa 1940. It does not take long for the ocean to change barren shipwrecks into dynamic ecosystems, teeming with fish and invertebrates. Smaller fish and crustaceans hide among the cracks and crevices. Larger predatory fish lurk near wrecks in search of a meal. Though these large fish appear docile and sluggish, they accelerate with explosive speed, catching their prey by surprise. Look for the green moray eel hiding in the wreckage.

Hiding

Is it a rock or a fish? You better be able to answer that question before you step on either a stonefish or a scorpionfish. Both of these fish have toxic spines, however they prefer to hide rather than fight. They are both masters of disguise, remaining very still and resembling pieces of rock or coral on the sea floor.

Displaying

Colors and patterns are the focus of this exhibit. Color displays are used in different ways by different fish. Some fish use bright coloration as a warning, while others use bright colors to confuse potential predators.
Still others may use coloration to communicate with fish of their own species. Many fish can even change colors based on their mood.

**Occupying**

This exhibit displays a living coral reef in which many fish and invertebrates find separate ecological niches. They occupy a small space, each making its living in a different way. This exhibit is an exciting venture since it is very difficult to keep corals alive in an artificial environment. One of the two graphics panels surrounding the exhibit discusses the intricacies of creating this exhibit, while the other features the unique relationship of corals with the tiny single-celled algae, known as zooxanthellae, that live inside their tissues. Among the animals that can be seen here are spiny urchins, various stony corals, sea whips, and anemones.

**Migrating**

Many fish migrate to reproduce or to follow food supplies. Some, like the striped bass, also called the rockfish, live and feed in salty water, but move to fresh water to spawn, or lay their eggs. Animals that migrate from salt water to fresh water habitats are called anadromous. Other fish, like the American eel, live in fresh water rivers and streams, but swim to the Sargasso Sea, just north of the Bahamas, to spawn. Animals that migrate from fresh water to salt water habitats are called catadromous.

**Surviving in Murky Conditions**

This exhibit focuses on adaptations to habitats that contain little or no light. The soldierfish have large eyes that help to collect the maximum amount of light that passes through the water during the night when these fish are most active. Pinecone fish are also nocturnal and have a light organ composed of symbiotic phosphorescent bacteria located under each eye. These light organs help to attract their prey. Some fish live in caves where no sunlight can reach them. The blind cavefish have no need for eyes and have honed their other senses to compensate for their lack of sight.

**Skeletons**

Many groups of animals have colonized the sea. The skeletons of some are displayed above you at the end of Level 3. Compare the forelimbs of the hanging skeletons to your own limbs to see what modifications for swimming have occurred. You will see skeletons of an albatross, a white marlin, a porpoise, a penguin, and a sea turtle. A large fin whale skeleton is discussed in greater detail below.
**Fin Whale Skeleton**

The skeleton of the fin whale is on permanent loan to the Aquarium by the New York State Museum at Albany. The whale may have weighed as much as 120,000 pounds. This skeleton alone weighs 5,000 pounds. The whale was killed in the spring of 1880 off Cape Cod and taken to Ward Scientific, a well-known biological supply firm. George Ward, the founder of the company, cleaned and maintained the skeleton and then sold it to the museum. The skeleton lacks the baleen that hung from the top jaw of the living whale. It is often mistaken for a fossil because of the bones of the pectoral fins. Their fins have a series of bones very much like human bones. The only difference is that they have more bones in the central digits. A complete description of the fin whale skeleton can be found on the graphic panel at the end of Level 2.

**North Atlantic to the Pacific - Level 4**

**Sea Cliffs**

This recreation of the rocky coast of Iceland contains three related species of pelagic, or oceanic, birds: Atlantic puffins, black guillemots, and razorbills. There are no penguins on display. They spend most of their life far out in the North Atlantic Ocean. When feeding, they dive after fish and krill, swimming with their wings, so that it appears that they are flying under water. Unlike penguins, they can also fly in the air. All three species belong to a Northern Hemisphere bird family known as the alcids.

As is characteristic of many organisms that live in the open ocean, these birds are dark on the top and white on their bellies. This coloration, called countershading, is typical of animals that live in open ocean whether they are penguins, tuna, killer whales, sharks, or puffins. It makes the animals less visible to predators swimming below or above them. Visitors may confuse puffins with penguins, which are also black and white. Penguins are generally larger, do not fly, and are found in the Southern Hemisphere.

**Bird Identification**

*Atlantic Puffin:* This bird has a triangular-shaped orange bill. The puffin relies on all facets of the environment. It flies through the air, breeds on land, and swims in the ocean in search of food. Because it depends on the air, land, and sea, the puffin is the mascot of the National Aquarium in Baltimore.

*Razorbill:* These birds have short, thick black bills. Related to puffins and the extinct great auk, razorbills also catch fish by “flying” under

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**Voluntary State Curriculum**

**Pre K:**
3.A.1.a: Observe and collect data about how some animals are alike in the way they look and in the things they do.

**Kindergarten:**
3.D.1.b: Using pictures, films and illustrated texts identify, describe and compare living things found in other places, such as the desert, arctic, ocean, etc. to those found in familiar places.

**Grade 1:**
3.E.1.a: Examine organisms in a wide variety of environments to gather information on how animals satisfy their need for food.

**Grade 2:**
3.D.1.a: Observe and describe individuals in familiar animal populations, such as cats or dogs, to identify how they look alike and how they are different.

**Grade 3:**
2.C.1.d: Recognize and explain that an ocean floor is land covered by water.

**Grade 4:**
3.D.1.a: Describe ways in which organisms in one habitat differ from those in another habitat and consider how these differences help them survive and reproduce.

**Grade 5:**
3.A.1.g: Identify and describe features of some of the plants and animals living in a familiar environment and explain ways that these organisms are well suited to their environment.
water. During the summer, razorbills molt all of their flight feathers making them unable to fly until a new set grows back.

**Black Guillemot:** These birds have sharp, pointed bills. Black guillemots are unique among alcids in that their clutch contains two eggs instead of just one. They feed on a variety of small fish, crustaceans, mollusks, and worms.

**Kelp Forest**

Off the California coast there are “forests” in the sea. They are made of huge brown algae called kelp that grows in dense stands along rocky parts of the coast. Gas-filled floats located below each frond of the kelp work like buoys to pull the long strands of kelp up toward the sunlit surface. The kelp forest provides food and a refuge from predators for a wealth of invertebrates such as sea urchins, sea stars, crabs, and snails, as well as a diverse group of fish. Many open water sportfish spend their early life hiding in the nursery that the kelp forest provides. Harbor seals, California sea lions, and sea otters forage for food among the kelp strands. Sea otters even use the kelp as an anchor. They roll up in the strands floating at the surface when they are ready for a nap. Kelp is also integral as a thickening and stabilizing agent in processed food and household products. All of the kelp in this exhibit is artificial, made from molds of real kelp.

**Animal Identification**

**Garibaldi:** Garibaldi are brightly colored red-orange fish named after the Italian patriot Garibaldi who united Italy. He and his followers wore bright red shirts. The bright color helps these fish advertise that they are defending territories from other garibaldi. As juveniles they have small blue spots on their body and lack the bright orange coloration. They are the state of fish of California and are protected by law.

**California Sheephead:** Each of these fish begins life as a female and then changes into a male at about 7 or 8 years of age. During the sex change, the color and shape of the fish also change. While females have a gently sloping forehead, males develop a more protruding forehead.

**Pacific Reef**

The wonderfully colorful and diverse world of the tropical Pacific coral reef is beautifully translated in this exhibit. In the Aquarium’s early years, this exhibit had only fabricated coral. Now, much of the coral is living. Among the coral branches, under ledges, in the warm waters – fish are everywhere! Their brilliant colors and patterns are likened to those of butterflies.
Why are the Pacific reef fish so colorful? No one can say for sure. Since the fish stay close to their hiding place in the reef, drab protective coloration is not necessary. Some color patterns do appear designed to disrupt the outline of the fish against the bright colors of the reef. Fish that appear absurdly bright in a tank may be quite well hidden against the corals. Other fish may use color to advertise for mates or help them establish territories. Color patterns may show age, with different colors for juveniles and adults, or may distinguish sexes or social status within a species.

**Animal Identification**

**Banggai Cardinalfish**: Males of this species incubate eggs in their mouths and continue to hold the young in their mouths for a time after hatching. Once on their own, the coloration of the fish allows them to hide easily among the spines of sea urchins.

**Clown Anemonefish**: Made famous by the Disney Pixar film “Finding Nemo,” these brightly colored fish live among the tentacles of sea anemones. Scientists believe that anemonefish are protected from the sting of the anemone by a special mucus layer over their skin. All clown anemonefish begin life as males and then become females as they mature.

**Neo-Tropical Forests - Levels 4 & 5**

Tropical rain forests are lush forests found near the equator primarily in three areas of the world: South America, Asia, and Africa. Over half of the world’s rain forests are in South America with extensions into Central America. The Asian tropics contain a quarter of the world’s rain forests with most of the remainder in western Africa. Rain forests consist of four layers: the forest floor, the understory, the canopy, and the emergent layer.

As the name implies, tropical rain forests are warm and very wet with some rain forests receiving up to 25 feet of rain each year! The temperature in a tropical rain forest never drops below freezing and, because they are located at the equator, the sun is always overhead during the day.

**Amazon River Forest**

The Amazon River Forest exhibit recreates the beginning of the flooding season for the Rio Negro, an Amazon tributary. The “greenery” in the exhibit consists of virtually all live plants. The logs and submerged “trees” in the exhibit are fabricated. You will follow a

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**Voluntary State Curriculum**

- **Pre K**: 3.A.1.d: Identify some of the things that all animals do, such as eat, move around and describe how their features (observable parts) help them do these things.
- **Kindergarten**: 3.A.1.c: Identify a feature (wings, for example) that distinguishes one group of animals from other groups and observe a variety of animals that have that feature to describe other similar external features they might share.
- **Grade 1**: 3.B.2.a: Gather information and direct evidence that humans and other animals have different body parts used to seek, find, and take in food.
- **Grade 2**: 3.F.1.c: Investigate a variety of familiar and unfamiliar habitats and describe how animals and plants found there maintain their lives and survive to reproduce.
- **Grade 3**: 2.c.1.a.: Identify and describe some natural features of continents.
riverbank and then pass two smaller exhibits that illustrate the difference between the rainy season and the dry season.

The rainy season lasts for five to seven months of the year. During this time, the rivers of the Amazon Basin rise, flooding the forest to a depth of thirty feet or more. Thus, where birds are nesting in the dry season, fish are swimming during the rainy season.

The Amazon’s flooded forests are home to an astounding diversity of animals with behaviors and adaptations that help them to survive in this unique region. In this exhibit, there are more than 50 species of tropical fish on display; dwarf caimans bask on logs; large turtles swim among the fish; and pygmy marmosets, the world’s smallest monkeys, scamper through the trees.

The rivers in the rain forest are often murky and dark. A number of animals have developed special sensory organs in order to make their way. Many groups of fish have developed “whiskers” which help them search the muddy river bottom for food. These whiskered fish are collectively called “catfish.” Others rely on senses other than sight. For instance, electric eels use electrical currents to sense prey in the dark water.

**The Amazon River**

The Amazon River is approximately 4,000 miles long and its basin is 2,700,000 square miles, approximately the size of the United States. Its mouth is nearly 200 miles wide and depths can reach as much as 330 feet. It carries the greatest volume of water of any river in the world and has a network of 500 tributaries and sub-streams; in fact, one fifth of the world’s fresh water flows through the Amazon and its tributaries.

The water cycle in the Amazon Basin is as follows: water evaporates from the ocean, travels west through the trade winds, falls to the forest floor, seeps into the soil or runs off into the streams and rivers, and finally returns to the ocean. The rainy season in the Amazon Basin produces between 20 to 80 inches of rain from January to June. The dry season has a minimum of 4 inches of rain per month.

The flow of the Amazon River is approximately 6,350,000 cubic feet of water per second or 170 billion gallons per hour. This is 10 times the volume of the Mississippi and more water than the Mississippi, Nile, and Yangtze Rivers combined. The Amazon River dilutes the salinity of the Atlantic Ocean as far as 100 miles out from the coast.
Species Diversity

Rain forests have very high species diversity. They occupy about 7% of the land of our planet, but have more than 50% of all the earth’s species of plants and animals. The Amazon region contains more than 40,000 species of plants and trees and more than 500 species of moths and butterflies. Up to 117 species of trees have been counted in just one half square mile of Amazon rain forest and more than 300,000 species of insects have been classified. At least 2500 species of fish have been identified in the Amazon River, more than in the whole Atlantic Ocean, or about three times the total for all of North America.

Rain Forest Plants

Plants in the rain forest grow all year long and form thick layers of lush vegetation. The growth of tall trees with dense foliage prevents sunlight from getting through and leaves the forest floor quite dark. Trees that are small and have high light requirements specialize in colonizing areas where there is plenty of light, like the clearing formed from a fallen tree. The colonists grow very rapidly so that they can reproduce and disperse their seeds before the larger trees grow above them and shade them out.

Some plants grow on other plants in their pursuit of light. Vines climb trees in order to reach the sun’s rays. Small plants like bromeliads, orchids, and philodendrons live above the forest floor attached to the trunks and branches of trees. They are not parasites because they only use the tree as a perch. Because these plants live on other plants, they are called epiphytes (epi = on, phytos = plants).

Plants that are adapted to very low light live on the dark forest floor. Small palms and many other plants you might recognize as houseplants are common. Their tolerance for low light and need for warmth make them well-adapted to life indoors.

Rain Forest Animals

The forest provides many places to live. Animals that can climb, glide, or fly are particularly well-adapted to life among the treetops. Insects, spiders, frogs, lizards, vine snakes, sloths, monkeys, and jungle cats climb high above the rain forest floor in search of food or shelter. One species of poison dart frog even completes its entire life cycle high in the trees in water trapped by the leaves of epiphytes called bromeliads. The sloth moves slowly from tree to tree, hanging upside down under a branch as it eats leaves. It is so slow that in the rain forest, its fur will become green with algae which actually helps to camouflage it and adds protection from predators like the harpy eagle.
Birds, bats, and flying insects (particularly bees and butterflies) are highly successful in the rain forest. Hundreds of species of bats feed at night. Some search for flying insects while others eat fruit or lap nectar from flowers high above the forest floor. During the day, birds also feed on insects, fruits, and nectar. A few birds are predators on larger animals such as other birds, lizards, snakes, and monkeys.

Many rain forest species are distasteful or poisonous. Animals that have this defense against predation are often brightly colored. This “warning coloration” acts as advertising to predators by warning them to beware. In poison dart frogs, brilliant green, orange, yellow, blue, or red colors allow predators to recognize them and stay away. Natives of western Colombia smear poison from three of the most toxic species of these frogs on their hunting darts to paralyze small game.

When people think of rain forest fish, they think of piranhas. Movies have made this South American fish famous as a vicious predator. The truth is less exciting. While they do have very sharp teeth that can bite chunks from larger prey, piranhas feed primarily on fish, fruits, and seeds. During the flood season, they swim out into the forest in search of food.

**Destruction of Rain Forests**

Recent improvements in medical care and the use of pesticides in tropical countries have greatly reduced deaths from diseases and parasites. Consequently, human populations have increased very rapidly. Some countries have a population doubling time of as little as 18 years. As populations grow, tropical forests are being cut for lumber and firewood and cleared for farming. The rate of destruction is alarming. Africa and Central America have already lost more than half of their forests. At the current rate of destruction, only a quarter of today’s tropical forests will remain in 20 years.

Tropical rain forests represent a tremendous reserve of genetic diversity. For example, there are more types of fish in the Amazon basin than in the entire Atlantic Ocean. As the forests disappear, species are becoming extinct before they are even discovered. Many of these species might have become economically important. Some species might have offered new genetic material for agricultural research. Others might have been sources of new drugs or chemicals. We already depend on rain forest species for important drugs, spices, beverages, chocolate, and natural rubber. We will never know how many other useful species have become extinct.

Climatic patterns can be altered by removing vegetation. Scientists are concerned that the destruction of the Amazon Basin forests may alter
global weather patterns. A reduction in rainfall is already observed in some areas of the tropics.

More than 200 species of fish in the Amazon feed on seeds and fruit from the forest. Cutting rain forest significantly reduces these fish populations, not only by eliminating the source of seeds and fruits, but also by promoting soil runoff and the buildup of river silt. Local people depend on these fish as a source of protein. Where the forests have been cut, fishermen have gone out of business. Many of the native tribes in the Amazon Basin are disappearing as roadways push inward. A graphic panel on Level Four, immediately before your entry into the Amazon River Forest, dramatically spells out the rate and consequences of rain forest destruction.

The Aquarium’s staff and visitors are helping to save endangered rain forests, acre by acre, by supporting the Ecosystem Survival Plan (ESP). The ESP works in cooperation with the Nature Conservancy to purchase, and thereby permanently protect, rain forest land. Donations made to the Aquarium’s conservation parking meter located in the Tropical Rainforest exhibit have contributed to this program. One hundred percent of the funds received are designated to purchase private land holdings to be added to national park systems in Latin America.

Animal Identification (Amazon River Forest - Level 4)

**Giant Amazon River Turtle:** These are one of the largest freshwater turtle species in the world. Females have a shell length of up to 40 inches, while males have a maximum shell length of 19 inches. People have over-harvested these turtles and their eggs for food. Hence, they are rare throughout the Amazon.

**Dwarf Caiman:** The eyes and nostrils of these crocodilians are on top of their head. Thus, a caiman can breathe and see above water while the rest of its body is submerged.

**Tambaqui:** This large fish is a cousin of the piranha, however it primarily eat fruits and seeds. Rather than having sharp triangular teeth for tearing flesh, its teeth resemble molars used for grinding and crushing.

**Black Armored Catfish:** Rainforest rivers are sometimes dark in color. Fish have adaptations to help them search for food. Like other catfish, this one has sensory barbels or “whiskers” to help search for food.

**Pygmy Marmoset:** This is the smallest monkey species in the world, growing to a little more than 12 inches from head to tail. Specialized canine teeth gouge trees for sap and also make quick work of insects. The marmoset is a close relative of the golden lion tamarin, which can be found on Level 5 in the Tropical Rain Forest exhibit.
**Bird Identification (Tropical Rain Forest)**

*Scarlet Ibis:* The brilliant red color of the scarlet ibis comes from a diet high in carotene. Its long, down-curved bill is used for finding mollusks and crustaceans in the wild. Native to the north coast of South America, its long legs are adapted for wading as well as perching in the rainforest trees. The young are chocolate brown and turn red by three years of age.

*Blue-Crowned Motmot:* These birds are often hard to find because they perch quietly, waiting for insects. While perching, they swing their tails like pendulums or tilt them to one side. Their name comes from the sound of their call.

*Yellow-Headed Amazon Parrots:* These birds can be found perched on the tree located by the bridge as you exit the Rain Forest. A parrot’s beak has many uses. It is powerful enough to crack hard seeds and nuts while it sharp edges cut fruit. Parrots also use their beak as a third claw as they climb in search of food.

*Screaming Piha:* Who is making that noise? The bird with the loud wolf whistle is the screaming piha – the loudest bird in the world. Follow its voice, however, and it will lead you to a rather small, non-descript, grey bird.

**Animal Identification (Tropical Rain Forest - Level 5)**

*Piranhas:* These notorious fish probably evolved from their seed-eating relative, the pacu, which accounts for their strong jaws. Piranhas don’t really deserve their menacing reputation. They prefer to feed on sick or injured fish rather than strong, healthy animals.

*Green Iguana:* Reptiles are cold-blooded and, therefore, cannot produce their own body heat. Look for these large lizards warming themselves along the windowsills of the Rain Forest exhibit.

*Two-Toed Sloth:* Two-toed sloths are more active than the exceptionally slow moving three-toed sloths. These animals spend their entire lives hanging in the trees. Sloths are usually active at night and spend most of the day sleeping. Curled up, they are about the size of a bowling ball.

*Golden Lion Tamarin:* The colorful name of these small monkeys is derived from the gold mane of long hair, parted in the middle and extending around the head and under the chin. Golden lion tamarins spend most of their time in the trees, descending to the ground only to cross open spaces. Very long hands and fingers are adapted for probing into hollows and crevices for insects.
Coral Reefs

Coral reefs grow in the warm, shallow, clear seas of the Western Atlantic, Western Pacific, and Indian Oceans. Reefs are made from the slowly accumulated limestone skeletons of animals called stony corals. Corals are relatives of sea anemones. Feeding at night, their extended fleshy bodies look like small anemones as they catch tiny animals called zooplankton using the stinging cells in their tentacles. During the day, most stony corals withdraw into their calcareous exoskeletons.

Corals have some very specific requirements for growth that limit their distribution. Reef-building corals are restricted to warm water. Since polar waters move down along the western margins of continents, reefs are generally restricted to the eastern margins. Consequently, coral reefs form off the coast of Florida, but not California. The major areas of reef development are the Caribbean and the Indo-Pacific regions.

Zooxanthellae

Corals are animals, but they require light to grow. We know plants require light, but why would animals need it? Inside the tissue of corals are incredible numbers of tiny, single-celled algae. These algae, called zooxanthellae, make up as much as half of the living material in a coral.

The algae require intense sunlight for photosynthesis. The coral receives sugars and oxygen from the zooxanthellae and, in return, the zooxanthellae receive polyp wastes – nitrogen, phosphate, and carbon dioxide. Because algae require light, their coral hosts are restricted to relatively shallow (30 m) clear water. Turbid, or cloudy, water kills corals because little light reaches the zooxanthellae. Areas with high freshwater runoff also lack corals since corals require water with a salinity of between 25 - 40 ppt. Corals do best in water with a salinity of 35 ppt, this is considered full strength sea water. Corals can survive without the algae. If corals are kept in the dark, they will even purge themselves of the algae. However, corals are unable to build their calcium carbonate skeletons without these photosynthetic zooxanthellae. This interdependence of coral and algae is an example of mutual benefit from a symbiotic relationship.

The Reef Habitat

The reef structure can be massive since corals secrete their calcium carbonate skeletons on top of other dead coral masses. The reef is cemented together with the help of calcareous algae. The many holes, nooks, and crevices provide shelter for fish, shrimp, anemones, and various other marine animals. Whenever the stony coral dies, seaweeds and invertebrates such as sponges settle and grow in profusion. Other...

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<td>Grade 4:</td>
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<tr>
<td>3.F.1.a: Identify and describe the interactions of organisms present in a habitat.</td>
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<td>Grade 5:</td>
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<tr>
<td>3.A.1.e: Identify and describe features of some of the plants and animals living in a familiar environment and explain ways that these organisms are well suited to their environment.</td>
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<td>Grade 6:</td>
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<tr>
<td>3.F.1.e: Explain that within any environment organisms with similar needs may compete with one another for resources.</td>
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<td>Grade 7:</td>
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<tr>
<td>3.A.1.c: Use analogies, models, or drawings to represent that animals and plants have a great variety of body plans and internal structures that define the way they live, grow, survive, and reproduce.</td>
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<td>Grade 8:</td>
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<tr>
<td>3.D.1.b: Recognize that adaptations may include variations in structures, behaviors, or physiology, such as spiny leaves on a cactus, birdcalls, and antibiotic resistant bacteria.</td>
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invertebrates, including shrimp, crabs, sea anemones, and sea urchins, live in cracks and caves among the corals. Fish swarm into and around the reef. The reef is both a source of food and a refuge from the larger predators that roam the open water around the reef. Because of their incredible diversity, coral reefs are often referred to as the “rain forests of the sea.”

Like rain forests, these delicate ecosystems are being damaged by a variety of human activities. Farming and development on land create increased sedimentation on reefs. Human sewage and byproducts of farming lead to overgrowth of seaweeds. Anchors from ships and boats often break coral. Divers and snorkelers damage reefs by touching them with their hands, fins, or cameras.

In April of 1995, the Aquarium launched Project ReefAction, a program to inspire behavior that will preserve threatened coral reef habitats. Exhibits, graphics, fieldwork, research, and educational programs are all included in the project. A significant element of the project is the marine conservation parking meter at the top of the Atlantic Coral Reef, the first in the country to benefit marine habitats. Funds raised by the parking meter are used to protect coral reef habitats.

The Exhibit

The Aquarium’s Atlantic Coral Reef exhibit is always fascinating. You can see schooling behavior, compare modes of swimming, find cleaning stations where small porkfish are picking parasites from larger fish, and search for territorial damselfish.

This exhibit does not have living corals because the Aquarium cannot reproduce the needed full sunlight for such a large exhibit. Furthermore, to collect enough living coral to stock this exhibit would be destructive to the environment. The base of the Atlantic Coral Reef is fiberglass-reinforced concrete that has been painted. The corals, sponges, and sea whips are urethane resins that were molded from real coral skeletons and then colored like real corals. These “corals” are very accurate models. The Aquarium does feature two smaller exhibits that contain living coral: the “Occupying” exhibit located on Level 3 and the Pacific Coral Reef exhibit located on Level 4.

Divers feed the fish by hand several times each day to ensure that everyone is eating and not being crowded out by larger fish. The herbivores, or plant eaters, get broccoli, lettuce, nori (seaweed paper), and green peas. The carnivores, or meat eaters, in the exhibit are fed several different sizes of krill, shrimp, clams, squid, and cut-up fish.
**Animal Identification**

*Lookdown:* This thin schooling fish with a “pushed in” face swims continuously, schooling in the surface waters. It never rests. Its narrow forked tail is characteristic of a constant swimmer.

*Parrotfish:* These brightly colored fish graze on coral polyps and algae with their beak-like mouths. The hard coral skeleton is crushed by teeth in the fish’s throat, passes through the digestive system, and is deposited on the reef as white coral sand.

*Triggerfish:* This fish uses speed and a wedge-shaped head to chase prey into cornered areas and to pick food from tight spots. The triggerfish’s mouth design also permits it to feed upon spiny sea urchins using a technique of “plucking” and “stabbing” to reach the soft body parts of the animal. This fish has a sharp “trigger” on its head that it raises to wedge itself into reef nooks and to deter predators from eating it.

*Porcupinefish:* When they are scared, these large, bulbous fish inflate with water to increase their size and raise their spines. A strong, beak-like mouth allows them to crack through shells of snails, sea urchins, and crabs.

*Spadefish:* Adult black and white striped spadefish swim in schools around the exhibit. However, when they are young, spadefish are often found on white sandy bottoms where they resemble fallen blossoms of mangrove trees. You may find juveniles located in the Coastal Beach exhibit located on Level 2.

*Porkfish:* These fish are very popular with the other fish in the coral reef because they act as cleaner fish. They set up cleaning stations where larger fish allow the porkfish, or other cleaner fish, to remove parasites and dead scales and skin from their bodies.

**Open Ocean**

*“Shark!”* Simply the mention of the word conjures up images of gigantic, bloodthirsty monsters with huge, sharp, jagged teeth. Actually, there are approximately 400 varieties of sharks ranging in size from the 6-inch dwarf lantern shark to the 50-foot long whale shark. More than half of the known shark species never exceed 3 feet in length.

Sharks and their relatives - the skates and rays - are called cartilaginous fish. They differ from most fish in that their skeleton is made of tough, flexible cartilage rather than bone. In humans, cartilage is the material that allows the nose and ears to wiggle, and provides cushioning for joints.

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**Voluntary State Curriculum**

**Pre K:**
3.A.1.d: Identify some of the things that all animals do, such as eat, move around and describe how their features (observable parts) help them do these things.

**Kindergarten:**
3.A.1.c: Identify some of the things that all animals do, such as eat, move around and describe how their features (observable parts) help them do these things.

**Grade 1:**
3.A.1.c: Use the information collected to ask and compare answers to
The diet of sharks differs between species. The largest fish in the world, the 50-foot long whale shark, feeds on tiny organisms called plankton. Some sharks feed on marine mammals like dolphins and seals, while others feed on fish, including other sharks. Some even eat crustaceans such as crabs, and mollusks such as clams. A shark only needs to eat about 1% to 10% of its body weight in food per week depending on its species, activity level, and individual metabolism. That means that a 350 pound sand tiger shark that requires a diet of only 2% of its body weight per week only eats 7 pounds of food each week!

Sharks are important as apex predators – a species on the top of the food chain. They feed on a variety of smaller fish and marine mammals, keeping population sizes in check and maintaining the health of those populations by feeding on sick and dying animals. Changes in populations at any level of the food chain can have wide ranging effects on the rest of the chain.

**Shark Conservation**

Sharks have much more to fear from us than we do from them. It is estimated that about 100 million sharks, rays, and skates are caught and killed each year as a result of fishing, finning (the removal of a shark’s fins), or bycatch (the accidental catch of a species by a commercial fishery targeting another species).

Shark numbers are vulnerable to over-fishing for many reasons. They mature very slowly, sometimes taking as many as 30 years to reach reproductive age. In general, they do not produce many offspring at one time. Unlike bony fish which usually spawn, producing huge numbers of tiny offspring, many sharks produce a small number of larger offspring. They often reproduce infrequently and their nursery grounds, often located in estuaries, are vulnerable to human pressure.

**The Exhibit**

Sharks are some of the most popular and fascinating animals at the Aquarium. The Aquarium’s 225,000 gallon Open Ocean exhibit houses several species of sharks: sand tiger sharks, nurse sharks, and sand bar sharks. There is also a freshwater sawfish – a fish more closely related to stingrays and skates than to sharks.

Sharks at the Aquarium are fed fresh fish directly from the fish market about once a week. While there is no scheduled feeding time for the sharks, there is a video monitor located at the top of the Open Ocean exhibit that illustrates how sharks are fed at the Aquarium.
Animal Identification

_Sand Tiger Shark:_ Although several eggs develop at one time in the female sand tiger shark’s branched uterus, the first two pups to hatch feed on the remaining eggs and embryos while still within the mother. This is known as intrauterine cannibalism. Each of these shark pups is about 3 feet long at birth! This large shark can reach a length of about 10 feet and a maximum weight of 350 pounds.

_Sandbar Shark:_ This shark reaches a maximum size of about 8 feet in length and a maximum weight of 260 pounds. Its natural predators are tiger sharks and sometimes great white sharks. However, its main predators are humans. The sandbar shark is the primary targeted species on the east coast of the United States. It is also harvested in the eastern North Atlantic and South China Sea for its fins, meat, skin, and liver.

_Nurse Shark:_ Visitors often think this shark is in trouble when they see it lying on the bottom of the Open Ocean exhibit. This shark can pump water over its gills, so it does not need to swim in order to breathe. These sharks reach a length of about 9 feet and a maximum weight of 230 pounds.

_Freshwater Sawfish:_ The sawfish is more closely related to rays than to sharks. Females of this species give birth in rivers. The young spend several years in these rivers before swimming out into the ocean. Freshwater sawfish can reach a length of about 21 feet!

Children’s Discovery Cove - Pier 4, Level 1

This is a hands-on exhibit where visitors can interact with animals that are native to the Mid-Atlantic Coast of the United States. The animals in this exhibit are representative of those that live in or below the intertidal zone. The intertidal zone is defined by the upper reaches of the high-tide zone and the lower reaches of the low-tide zone. Tide pools are found within this zone in rocky coastal areas. These are places where the outgoing waters are trapped in low spots, forming pools where animals can take refuge during the low tide. Sandy beaches and mud flats are also intertidal environments that are exposed at low tide.

Intertidal organisms experience extreme environmental conditions and must withstand the effects of tides, waves, exposure, and changes in salinity.

Voluntary State Curriculum

Pre K:

3.A.1.b: Identify some of the things that all animals do, such as eat, move around and describe how their features (observable parts) help them do these things.

Kindergarten:

3.A.1.b: Compare descriptions of the features that make some animals and some plants very different from one another.

Grade 1:

3.A.1.a: Use the senses and magnifying instruments to examine a variety of plants and animals to describe external features and what they do.

Grade 2:

3.D.1.b: Examine pictures of organisms that lived long ago, such as wooly mammoths, saber tooth tigers, horseshoe crabs and describe how they resemble organisms that are alive today.
When the tide is out, intertidal organisms are exposed to the air. They must not dry out, and they must withstand air temperatures which vary from hot in the summer to bitter cold in the winter. Some organisms have adapted in the following ways to prevent drying out:

- Snails withdraw into their shells; some snails secrete a mucous seal.
- Anemones gather in large masses to reduce the body surface area exposed to the air. Some actually cover their bodies with light-colored shells to reflect light away from their bodies.
- Limpets fit themselves into small depressions they have ground in the rocks.
- Mussels and barnacles close their shells tightly to retain water.

Whether on rocky shores or sandy beaches, intertidal plants and animals must survive the action of the waves. Intertidal organisms protect themselves from being smashed against rocks or cast up and stranded on beaches in the following ways:

- They fasten themselves securely to rocks. Abalones have strong, muscular feet; kelp have strong holdfasts.
- Animals avoid the waves by crawling under or between rocks or plants. Crabs crawl into crevices in rocks, and small animals hide in the holdfasts of kelp. Enerusting algae grow under rock ledges.
- They burrow into the sand.
- They have protective body structures. Many mollusks have shells; kelp have strong, smooth blades (leaves); chitons have flat armored bodies.

Intertidal organisms must also tolerate abrupt changes in salinity. When the tide is out, they may be soaked in fresh water from rains, but when the tide returns, they quickly return to a salt water environment. Water in tide pools also may evaporate, concentrating the salts and, thus, increasing salinity. Organisms adapt to changes in salinity in two ways. Some, like mussels, retain sea water inside their shells, while others, like fish that live in tidepools, quickly adjust their internal salt balance.

To ensure the animals’ health and the safety of our visitors, we have institute some new “do’s and don'ts” at the Discovery Corner.

Please Do:
1. Touch the animals underwater with two fingers.
2. Wash your hands at the station before leaving the area.
3. Let the Aquarium staff help you and answer your questions!
Please Do Not:
1. Remove the animal from the water.
2. Lift the animals up out of the sand, if they are buried and resting.

**Animal Identification**

*Spider Crabs:* These crabs have long spindly legs that may reach a foot or more in length. One kind of spider crab is called a decorator crab because of its curious habit of attaching seaweed and other pieces of its environment to its back using a glue-like substance made in its mouth. Tubeworms, algae, and other sea creatures live on the shells of these crabs. These trappings make excellent camouflage for this slow-moving crab.

*Sea Urchin:* The sea urchin is radially symmetrical, the basic pattern for echinoderms. Its spherical, limy skeleton, called a test, forms a base for tube feet and spines. The tube feet can be extended and have powerful suction cups on their ends. The spines of various species vary in color, length, diameter, and design. On the underside of the urchin, a chewing mechanism, called Aristotle’s lantern, consists of five white, teeth that allow the urchin to feed on algae as well as living and dead animal matter.

*Whelks:* These are the largest northern sea snail ranging in size from 3 inches to 16 inches. They are carnivores and scavengers. They have a rasping, tongue-like radula that can file through bivalve mollusk shells, like those of clams, and eat the animals within.

*Horseshoe Crabs:* Horseshoe crabs are often called living fossils. They have remained unchanged for about 200 million years. Fossil remains have been dated as far back as 300 million years. The horseshoe crab is not a true crab. It is in its own special class in the phylum Arthropoda, which also includes the classes of spiders, insects, and true crabs. Its closest living relatives are spiders, scorpions, and ticks.