HEAL THE BAY
SANTA MONICA PIER
AQUARIUM

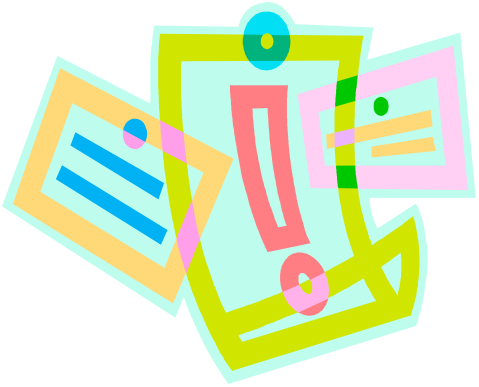
Ocean Adaptations

Teacher Packet

3rd Grade

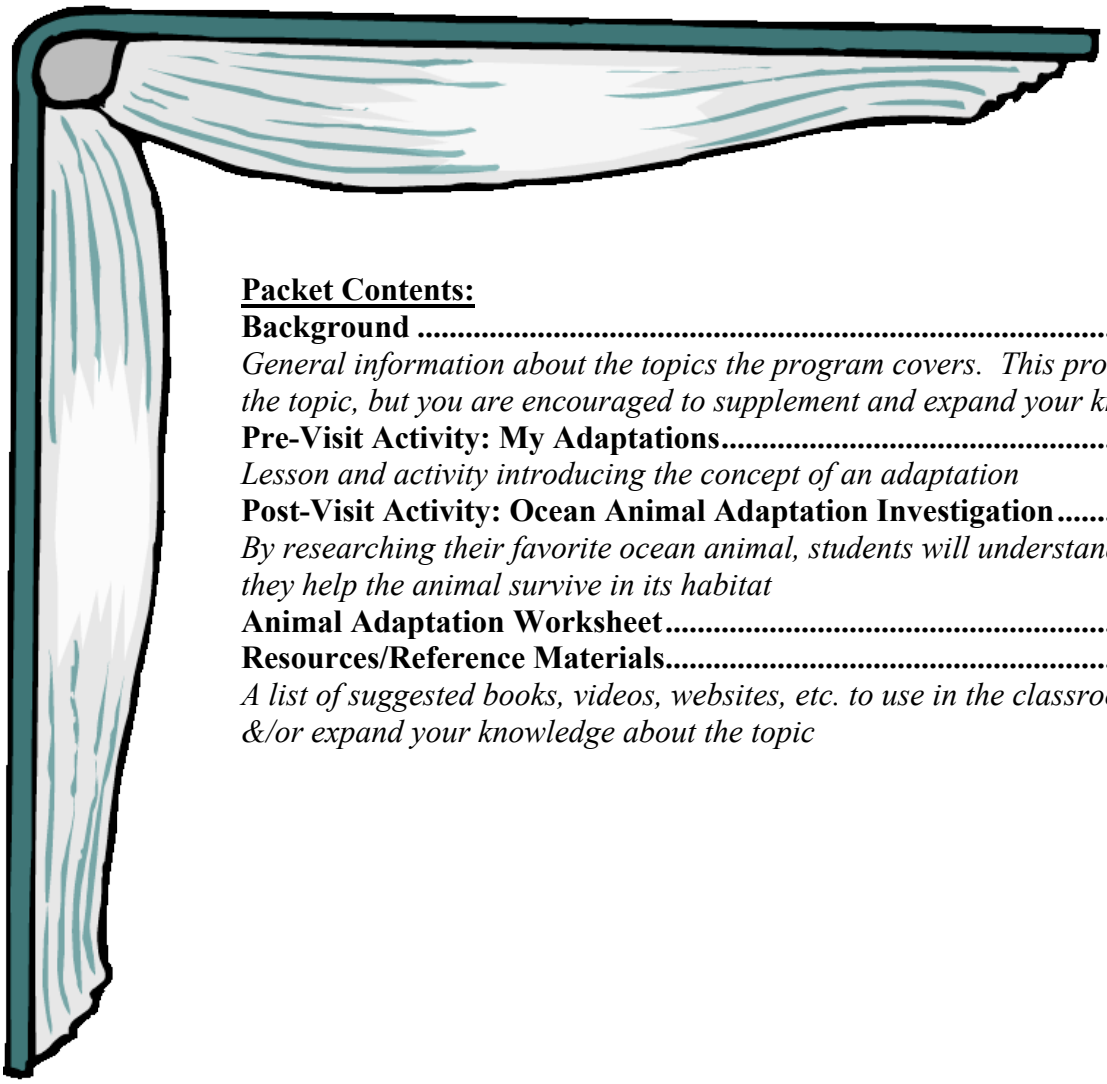
INSTITUTE of Museum and Library SERVICES

This project is made possible by a grant from the U.S. Institute of Museum and Library Services.



Notes for the Teacher:

Thank you for picking the Santa Monica Pier Aquarium as your field trip destination! We are very excited that you will be visiting our facility. This packet was developed to help you, as the classroom teacher, and your students get the most out of your visit. Enclosed in this packet, you will find information and activities that correlate to the program you will be attending with your class. You are encouraged to complete as many of the activities as you can, as they will help your students gain a better mastery of the California State Standards.



Packet Contents:

Program Introduction for the Classroom Teacher

The Santa Monica Pier Aquarium's *Adaptations* Program teaches an understanding of the concept of adaptations and how they increase an organism's chance for survival and reproduction. It is based on California State Science Standards for Grade 3 on Ecology (Life Sciences). A solid understanding of the concept of adaptations will enhance your student's experience while at the Santa Monica Pier Aquarium. The following background information and activities are designed to provide a foundation for their visit.

Earth is a diverse and varied place. Ranging from steamy tropical jungles, to arid deserts, to the windswept arctic tundra, this planet has it all. Each of these different habitats also contains an equally diverse range of life. In order to not only survive, but to also thrive and reproduce, all organisms have certain physical features or behaviors that aid in their survival, termed **adaptation** by biologists. The formal definition of adaptation is "*an anatomical structure, physiological process or behavioral trait of an organism that has evolved over a period of time by the process of natural selection such that it increases the expected long-term reproductive success of the organism.*" More simply put, an adaptation is anything about an organism or its behavior that helps it survive and reproduce. This can come in the form of a physical feature, like spines or fin shape, a behavior such as aggressiveness or being nocturnal, or a physiological process like being able to excrete excess salts. With so many different habitats on planet earth, it is impossible to have one adaptation that will suit them all. So each habitat requires a different set of anatomical structures and/or behaviors to maximize the success of an organism living there.

The concept sounds simple enough, but the different adaptations that have come about to help organisms survive in a particular habitat are anything but simple. The desert is a fine example of how a single habitat, with its extreme temperature swings and lack of moisture and vegetation, is a harsh place to live, but its inhabitants have found many different ways to survive. Desert animals can combat the heat by hiding below ground during the day and venturing out only at night, having large ears to help expel excess heat, or being a light color to help reflect much of the solar radiation that causes overheating. They can deal with the lack of water by increasing their ability to store it, as in the Gila monster storing moisture in its large reservoir-like tail. Another way of dealing with the same stressor is to defecate very dry fecal matter and concentrated urine, thus preserving what little water they can acquire. Some desert organisms, such as the kangaroo rat and the camel, can recycle moisture back into their bodies via specialized organs in their nasal cavities.

While the desert is a tough place to survive, each habitat has its own factors that make it challenging in its own right. Some general adaptation themes include:

Physical Adaptations

Camouflage: Camouflage is the matching of color, shape, or a combination of both, used to conceal the object or animal into its background. Throughout the natural world, both terrestrial and aquatic organisms use camouflage not only to avoid detection from potential predators (animals that want to eat them), but also from their prey (animals they want to eat). By not being seen, animals often do not have to resort to other methods of protection, such as speed, spines or venom, which require a larger investment of energy. The best way to not get eaten is to not be seen. Camouflage varies with each habitat, and often within a habitat.

Disruptive Coloration: This is where the coloration of an organism does not match its outline. This makes it hard for a predator to focus on, and in turn, capture a prey item. Animals such as the zebra use disruptive coloration to confuse predators.

Advertising Coloration: Many organisms are brightly colored, not to escape detection, but to warn potential predators of a bitter taste, poison, or other defense if attacked. Some species of caterpillars use advertising coloration to warn predators that they are not good to eat.

Size: How large or how small you are is a major factor regarding what habitat you can live in. Some habitats can accommodate large animals such as the Open Ocean, where other habitats are best suited for smaller organisms such as a small frog in a small pond. The size of an animal also plays a large role in that animal's ability to escape predation.

Speed: Quickness and speed are both crucial when trying to evade a predator or capture prey. Regardless of habitat, both terrestrial and aquatic, speed is often associated with top end predators. Body shape, muscle structure and a few other adaptations help increase the speed of animals. Being slow has its advantages as well, as moving slowly can make an animal hard to detect and conserves energy.

Armored Protection: Organisms, both plant and animal, large and small, use armor to protect themselves against predators and environmental pressures. This armored protection comes in a variety of styles, but all serve the same purpose. A hard shell, sharp spines, or tough skin all make it tough for the predator to harm the organism and are utilized throughout both the plant and animal world.

Behavior

Adaptations are often specific behaviors that increase the chances for survival of an organism. Unlike physical adaptations that are often easy to understand, many behavioral adaptations have taken countless observations of the organisms in their natural setting (hard to do underwater) before they are realized. Scientists are regularly discovering new behaviors, such as partnerships with other species, to help in protection or hunting success.

Migration: Moving to avoid predators or to help maintain a certain level of moisture or temperature is often utilized in lieu of physical adaptations. Some organisms like the gray whale can travel thousands of miles in order to seek food and rear young, while other organisms, such as the sea star may only move a few meters to accomplish the same goals.

Physical Orientation: Being located in a certain part of a habitat, or oriented in a certain direction can have massive effects on how well organisms survive in a particular habitat. This physical orientation may help in hunting or to lessen the impact from one or more of a habitat's stressors. The giant kelpfish not only looks like a blade of kelp, but also orients its body to mimic the blades movement in the current.

Physiological

Physiological adaptations often go unnoticed as they are internal processes. Organisms are often good at surviving in harsh climates because of these physiological adaptations. Some desert animals are good at maintaining water by defecating concentrated urine. Animals that live in the rocky intertidal zone have to deal with huge swings in salinity (level of salt concentration), and thus have physiological adaptations that enable them to handle the changes. Many animals are able to produce venom and other toxins that not only help them hunt and capture prey, but also make them less attractive to potential predators.

Adaptations are often suited for a certain habitat. Over time habitats have changed and the adaptations that are best suited for the change are perpetuated. For millions of years, our planet has been in a constant state of change, yet this change has generally occurred at a slow and even pace. This has allowed species to adapt gradually over time. When humans started to drastically change the landscape a few thousand years ago, many species have not been able to adapt to the changes and have therefore gone extinct. We have increased the rate of change of our environment through a massive population explosion and advancements in technology that have enabled us to travel further and faster than ever before, as well as to live in regions that were otherwise populated only by small nomadic tribes. This change is at a rate that is too fast for many organisms to adapt. All over our planet we are experiencing loss of biodiversity (a measure of

different types of organisms present in various ecosystems or habitats) due to this rapid change. This loss is also occurring here in Santa Monica Bay.

Due to increased pollution to the Bay, through urban runoff and changes in our coastal land usage, we have altered our local marine habitats and the organisms that live there. Many of our coastal marshes have been filled in for the development of prime coastal real estate, thus leading to a decline in many migratory birds that use these areas as resting points along their routes. In fact California has lost 90% of its historic wetlands to development, and the remaining 10% is under constant threat. Our sandy shore has also fallen prey to development, and has led to a decline in the populations of not just shore birds, but some marine mammals such as seals and sea lions. Underwater the changes are buffered by our inability to develop there, but these habitats have also suffered due to the lack of public awareness for an area that they cannot see.

Although we have caused massive change here at home and around the world, which has led to the loss of species, we have also begun to realize the importance of a clean and healthy environment. People are taking the extra steps to ensure clean beaches and waterways. We are taking better care to keep our trash off our streets and have begun to increase our recycling, reducing, and reusing efforts. We are using less harmful chemicals and creating better, more environmentally friendly options in their place. Students are writing letters to their local governments and businesses letting them know how important it is for them to help take care of our environment. Developers are looking to build in a sustainable manner and mitigate past development of sensitive habitats. And through the advancement of technology, we are exposing ourselves to many marine habitats previously undiscovered and in turn, are educating the public about their importance. This education will allow people to understand how their daily actions are effecting our natural world, and what type of solutions are available to keep the countless habitats healthy.

The animals that live in each of these habitats are generally suited to live in that habitat only (some exceptions apply). Their bodies, or their behaviors, would not allow them to survive in another habitat. Prior to the human population explosion and massive development that followed in the Los Angeles area, these habitats flourished and supported a wealth of life. As more and more humans arrived in Los Angeles, we have built houses, grocery stores, gas stations and stores. This development has destroyed the existing habitats, and therefore displaced the animals that lived there. Some habitats, like the sandy shore, marsh, and oak woodland were greatly impacted because they are areas desired most for development. Chaparral habitats were affected less because steep terrain was less suitable for building. We need to learn about and understand the many different habitats in the Los Angeles area, so that we may preserve the unique animals and plants that live there.

This education is crucial not just here in Los Angeles, but all over the world. Many habitats have been decimated, many organisms have become extinct, and many others are endangered. By understanding what is going on around our home, we will be better equipped to look beyond our local environment and make positive changes.

Clements, Frederic E., and Victor E. Shelford. 1939. *Bio-ecology*. John Wiley & Sons, New York. 425 pp.

Pre-activity Lesson: My Adaptations

Level

3rd grade

Abstract

In this lesson, students will learn about adaptations and how they help animals survive. By looking at common items we use to help us live everyday we can translate these items to organisms around the world that employ similar adaptations.

Objectives

Students will:

- ✓ Be able to define adaptation
- ✓ Be able to define habitat
- ✓ Recognize that all living things are suited to live in a specific habitat
- ✓ Identify how certain adaptations help in a certain habitat

Targeted Standard

California Science Standard, Grade 3

Life Sciences 3- *Adaptations in physical structure or behavior may improve an organism's chance for survival. As a basis for understanding this concept:*

a. Students know plants and animals have structures that serve different functions in growth, survival, and reproduction.

b. Students know examples of diverse life forms in different environments, such as oceans, deserts, tundra, forests, grasslands, and wetlands.

d. Students know when the environment changes, some plants and animals survive and reproduce; others die or move to new locations.

Environmental Principles and Concepts (EEI) corresponding learning objectives:

- Identify that plants and animals have different structures that allow them to grow, survive, and reproduce by using/consuming the goods and ecosystem services provided by natural systems. (3a)
- Provide examples of how the functioning of structures plants and animals (including humans) have for growth, survival, and reproduction depends on the health of natural systems. (3a)
- Explain that different kinds of organisms are adapted for living in different environments. (3b)
- Recognize that when the environment changes, some plants and animals will die or move to new locations because the natural system can no longer meet their needs. (3d)

Materials:

- Jacket, hat, gloves, flippers, diving mask, snorkel (or provide pictures of these items)

Implementation Overview

- Pre class set-up
  - Make a pile of the items listed above in the front of the class
- Tell the students that we are going to get ready to go on a trip, and that you need a volunteer.
- Select a student and have them come up to the front of the class.
- Tell the rest of the students that we are going to pick some things out of the pile that the student will need for his/her trip

- Tell the students that the student volunteer is going to the North Pole and ask them what it is like there?
    - Target answers:
        - *Cold*
        - *Icy*
        - *Snowy*
        - *White*
- Select students one at a time to come up and pick an item the student going on the trip will need and why they need it
    - Target answer:
        - *Jacket (to stay warm)*
- Repeat this process until the student has a jacket, hat, and gloves
- If student selects an incorrect item (snorkel, etc) discuss why this item may not be a good adaptation for the North Pole specifically.
- Select another student to come up to the front of the class as they are going to go on another trip.
- Tell the class that this student is going on a trip into the Ocean and ask them what it is like there?
    - Target answers:
        - *Made of water*
    - *As this concept can be more difficult for the students you can prompt them with questions like:*
        - *How do animals move in the ocean? (swim) what do they use to swim? (fins)*
        - *Can we breath underwater? (no) what would we need to help us breathe underwater? (snorkel)*
- Repeat this process until the student has fins, a mask, and a snorkel.
- Ask the class if the student with fins, mask, and snorkel would survive at the North Pole?
    - Target answer:
        - *No*
- Ask the class if the student with the jacket, hat, and gloves would survive in the Ocean?
    - Target answer:
        - *No*
- Explain to the students that the items that the students have on will help them survive in a certain habitat, or a place where an animal lives.
- Different items will be needed for survival in different habitats, and these different items (or things about an animal that helps them survive in their specific habitat) are called adaptations.
- Ask the students if they know an animal at the North Pole
    - Target answer:
        - *Polar bear*
- Ask them what its adaptations are
- How are they like the jacket, hat and gloves? Do they do the same thing?
- Repeat this thought process for an animal in the Ocean.
- Tell the students that it is getting warmer at the North Pole. Would they still want to bring the jacket?
    - Target answer:
        - *No*
- Ask them if the polar bear can take off its warm fur?
    - Target answer:
        - *No*
- What will happen to the polar bear if it gets too warm?
    - Target answer:
        - *Move to a colder place or die*

- *Explain to students that the environment has been changing for millions of years, but it has happened slowly so animals can move or adapt (change to suit the new conditions).* Humans have now changed the planet in a very short amount of time so organisms do not have time to move or adapt.

Discussion

- Ask students how we have changed where we live and what might of happened to the animals that used to live here?

Post-activity Lesson: Ocean Animal Adaptation Investigation

Level

3rd grade

Abstract

Students are all familiar with some sort of animal, and that every animal has adaptations to help it survive in its habitat. Animal Adaptation Investigation will allow students to research their favorite animal, the habitat where that animal lives, and find out one or more of the adaptations that animal has to help it survive. Through research and writing, students will reinforce their understanding of what an adaptation is and how it helps their favorite animal survive.

Objectives

Students will be able to:

- ✓ Define adaptation
- ✓ Demonstrate research skills by using the internet, utilizing the library, filling out the Animal Adaptation Sheet
- ✓ Identify an animal's adaptations for its habitat
- ✓ Clearly explain their findings to the class

Targeted Standards

California Science Standards, Grade 3

Adaptations in physical structure or behavior may improve an organism's chance for survival. As a basis for understanding this concept:

a. Students know plants and animals have structures that serve different functions in growth, survival, and reproduction.

b. Students know examples of diverse life forms in different environments, such as oceans, deserts, tundra, forests, grasslands, and wetlands.

Environmental Principles and Concepts (EEI) corresponding learning objectives:

- Identify that plants and animals have different structures that allow them to grow, survive, and reproduce by using/consuming the goods and ecosystem services provided by natural systems. (3a)
- Provide examples of how the functioning of structures plants and animals (including humans) have for growth, survival, and reproduction depends on the health of natural systems. (3a)
- Explain that different kinds of organisms are adapted for living in different environments. (3b)

Materials

- Internet access or access to the library
- Animal Adaptation Sheet, one per student
- Pen or Pencil, one per student

Implementation Overview

Class Structure:

- Explain to students that they are going to learn about their favorite ocean animal.
- Tell the students that they will need to research their favorite animal on the internet or with books.
    - They must find out:
        - Where their favorite animal lives (its habitat)
- Prompt the students to find out what their animal's habitat is like.

- Ask the students to find out what adaptations help their animal survive in its habitat and why?
- The students will record this information on their Animal Adaptation Sheet.

Discussion

- Have students share their favorite animal, its habitat and its adaptations to the class.

Grading Rubric

	1	2	3	4
Define *Adaptation*	No definition .	Definition incomplete.	Definition complete and includes structure, physical process, and behavior to help organism survive in its habitat.	Definition of adaptation complete and strengthened by specific examples of **how** they help an organism survive.
Description of animal's Habitat	No description.	Description lacking key components.	Description complete and includes specifics about plant life and food sources.	Description complete including extra information about food sources, water sources and other plant life.
Description of animal's *Adaptation*	No description.	Description incomplete.	One thorough and complete description of an adaptation.	Descriptions of multiple adaptations thorough and complete.
Description of how adaptations help animal	No description.	Description lacking key components.	One thorough and complete description for how adaptation helps the animal.	A thorough and complete description for each of the adaptations listed.
Worksheet	Not filled out.	Worksheet illegible.	Handwriting clear and legible and answers in proper spots.	Filled out neatly, clearly, and with all needed information in proper locations, with additional information provided by illustrations.
Presentation skills	Presentation not given.		Student spoke audibly and clearly about the habitat, adaptations and how the adaptations help the animal survive in the habitat.	Student was engaging and easy to understand while thoroughly describing the habitat, adaptations and how they help the animal survive in its habitat, with visual aids where appropriate.