New England Aquarium
Educational Activity Series

New England Aquarium

Protecting the blue planet

Fishworks

Learning Level
Beginner

Subject Areas
Science, Art, Literacy

Preparation
In order for students to succeed at this activity, it is important that they are familiar with introductory fish information, anatomy and basic terms such as scales, fins, gills and habitat. For background information and pre-activity ideas, contact the New England Aquarium Teacher Resource Center **(www.neaq.org/teachers**).

Duration of Lesson
One to two class periods

Lesson Standards
Common Core (ELA)

- Writing Standards
- Speaking and Listening Standards
- Language Standards

MA Science Standards

- Structure and Function
- Adaptations of Living Things

Developed with support from

INSTITUTE of Museum and Library SERVICES

Fishworks is an interactive and inquiry-based activity designed to enhance student understanding of an important scientific concept—adaptation. Developed by the New England Aquarium and Untravel Media and with support from the Institute of Museum and Library Sciences, the video and activity combine elements of science and literacy learning as well as emphasize creativity and imagination.

This activity is flexible and can be used in a variety of ways depending on grade level and classroom needs. You can use it on its own or to jump-start an entire unit on adaptations or another marine-related topic. The Fishworks activity is geared to grades 3 through 5 but can be easily adapted for other grades by adjusting the detail and depth, as well as the difficulty of the vocabulary content.

Fishworks combines creativity and science and was developed to engage and motivate students to learn more about the fascinating life under the ocean. We hope that you and your students have fun with Fishworks!

Objective
The objective of this lesson is to familiarize students with the scientific concept of adaptation.

Students will understand:

- That adaptations are special features that animals are born with and that help them to survive in their habitats
- That adaptations can be physical or behavioral features
- That adaptations help animals to survive by helping them eat, move around and protect themselves

Students will be able to:

- Think critically about why fish have special features/adaptations
- Compare and contrast different fish both physically and behaviorally
- Draw and label the parts of a fish
- Explain and give examples of marine animal adaptations

Skills
Thinking critically, comparing and contrasting, making connections, writing descriptively, drawing creatively, building vocabulary

Vocabulary
See **page 5** for glossary

Background Information
While many fish have similar characteristics (i.e. gills, fins, mouths, eyes, etc.), they also differ in important ways. All fish are born with special features that help them to survive in their **habitats**. These special features are called **adaptations**.

Definition:
An adaptation is a physical or behavioral feature that an organism is born with and that helps the organism to survive and reproduce in its habitat.

An example of a human adaptation is our opposable thumbs. These body parts help us by making it easier to grab the objects around us. Fish, like humans and other animals, have special adaptations to find food, move and protect themselves.

NOTE:
Fish are **vertebrates** that live in the water, use gills to breathe and fins to swim, and have scales covering their bodies. Not all sea animals fit into this category. For example, the cuttlefish featured in the Fishworks video has gills and fins, but does not have a backbone (invertebrate) or scales and therefore does not fall into the "fish" category. In fact, it is more closely related to squid and octopus. Sea stars and sea jellies are probably most commonly mislabeled as fish because they are so often referred to as starfish and jellyfish.

Materials

- Blackboard or whiteboard
- Picture of blue tang and sand tiger shark (see **page 6**)
- Television and DVD player, or computer and Internet access
- Fishworks video (contact TRC to borrow) or go to www.neaq.org/fishworks
- Fishworks Video Worksheet and Create-a-Fish Worksheet
- Drawing and writing tools

Procedure

Part A: Introduction and Prior Knowledge Assessment

1. Ask students to name some of their favorite fish. Write the names of the animals on the board for everyone to see. Possible examples: shark, clownfish, sea dragon, eel. You can decide whether you would like to limit suggestions to fish or open it up to other marine animals.
2. With students, broadly discuss and compare the differences in how these animals look and behave (swim, eat, etc).
3. Inform students that you have two fish in particular that you would like to compare: a blue tang and a sand tiger shark. Draw a Venn diagram on the board. Tape the picture of the blue tang over one side of the Venn diagram and the picture of the sand tiger shark over the other side. With the whole class, discuss the similarities and differences between the two fish. This is a good time to review vocabulary (i.e. **fins, eyes, mouth, gills**, etc.). Focus on comparing their mouths, body shapes, defense adaptations and interesting behaviors. Guide students to begin thinking about why fish have these different and special features.

   (See **page 7** for an example of a completed Venn diagram).
4. Inform students that these special physical and behavioral features are called **adaptations**. Write the word on the board and ask students to describe the term. If you want to, you can draw a concept map to show their ideas.

   Once students are done providing you with what they know, tell them that an adaptation is a physical or behavioral feature that an organism is born with and that helps the organism to survive and reproduce in its **habitat**. Ensure that students understand the meaning of the term **habitat**. Point out a few specific blue tang and sand tiger shark adaptations.
5. Provide examples of other adaptations to enhance understanding of the concept. For example, penguins are covered in uniquely adapted feathers and have a layer of fat to keep them warm in cold habitats. Ask students for other examples of adaptations.

Part B: Fishworks Video

1. Inform students that they will watch a video on fish adaptations. Distribute the video worksheet and ask students to take out writing and drawing tools.
2. Begin the video. Pause when instructed by the video at the end of each section.

   Discuss with your students:

   - What types of mouth/body shape/defense adaptations did you see in the video? How do they help the fish eat/move around/protect itself from **predators** or find **prey**? (See **page 8** for a Summary of Adaptations that appeared in the video).
   - Can you think of another type of mouth/body shape/defense adaptation?

   Depending on the level of your students, provide appropriate guidance. You may want to model the first section for your students. Be clear about the following expectations:

   - **Drawing**
     Students can draw an adaptation from the video, an adaptation that they have seen or an invented adaptation.
   - **Writing**
     Students need to include two important parts: describing the adaptation and how it helps the animal.
     Example: My fish **has** flat, hexagon-shaped teeth **to** clamp down on hard-shelled prey.

Part C: Create-a-Fish Assignment

1. Inform students that their final task is to create a fish with special adaptations that help it to eat, move and protect itself. Depending on the level of your students, provide appropriate guidance. You may want to model expectations by creating a fish as a whole class (maybe your future class mascot!). As a whole class:
   - Choose a body shape.
   - Choose a mouth, eyes, fins and skin/scales.
   - Discuss how the fish will defend itself.
   - Label each adaptation on your drawing with an explanation of what it is and how it helps your fish to survive.
   - Give your fish a name (this should not be a personal name, but rather a species name based on the selected adaptations—for example: Torpedo Tentacle Fish).
2. When your class fish is done, instruct your students to create their own fish. Students can use the Create-a-Fish worksheet to draw their fish. Depending on your preferences, you may also want to provide students with more time and art supplies to really be creative with this project.

   Remind students that they can use adaptations that they know really exist or they can invent their own. You may want to provide time for students to research other fish (see **page 9** for book and online suggestions) in order to stimulate more ideas for possible adaptations. Encourage students to be creative!

Part D: Conclusion and Wrap-Up

3. If time permits or to introduce an oral presentation component, ask students to briefly present their fish to the rest of the class.
4. Collect student work and ask the following review questions orally as a whole group or have students submit written responses:
   - What is the definition of an adaptation?
   - Can you give an example of an adaptation?
   - What are some of the reasons animals have adaptations?

Assessment

- Fishworks Worksheet
- Review Questions
- Create-a-Fish Worksheet

(See **page 10** for checklist, rubric and answer guide.)

Possible Modifications

- Rather than have students draw their fish creations, you can have them make a collage using magazine photographs or online images. You can also have students create their fish using random supplies that you have on hand.
- Use sentence starters to help students describe their chosen adaptations.
  Ex. My fish has [describe mouth] to [how does it help it eat?].
- For a group project alternative, have students work together to create one fish. Each student can be responsible for a specific body part/adaptation. The group can then combine the individual parts to make one drawing.
- For a more advanced alternative, require students to use detailed vocabulary (caudal fin, dorsal fin, etc.).
- For a more in-depth project, require that your students create a fish for a specific habitat. The habitat can be an existing one or an invented one. Ensure that students explain how each adaptation is specific to that habitat. Ask students to write a report or story about the animal's interaction with its environment.

Suggested Extensions or Follow-Up Activities

Fishworks is a great activity to reinforce basic fish information and to introduce the very important concept of adaptation. Continue to explore the topic further by:

- Discussing and exploring adaptations more with your students. For post-activity suggestions, contact the Teacher Resource Center (www.neaq.org/teachers).
- Making connections to conservation issues. With your students, discuss how they think fish are affected by our changing ocean. If fish are specially adapted to their habitat, what happens when their habitat is destroyed by pollution? How can students help protect their favorite marine animals?

Fishworks
Glossary

Adaptation
A physical or behavioral feature that an organism is born with and that helps the organism to survive and reproduce in its habitat

Camouflage
Coloration and/or physical features that disguise or hide an animal in its natural habitat

Eye
An organ found in an animal that allows it to see

Fin
A body part found on an animal that lives in water that helps the animal move through the water

Dorsal fin – Fin located on the top of the animal
Caudal fin – Fin located on the end of the animal opposite to its head, also referred to as the tail fin
Pectoral fins – Fins located on the underside (ventral) of the animal close to the head
Anal or pelvic fins – Fins located on the underside (ventral) of the animal close to the tail

Fish
An animal that lives in the water, uses gills to breathe, fins to swim and has scales covering its body

Gill
An organ found in fish that allows them to get oxygen from the water, allowing fish to breathe

Habitat
The environment in which an organism is commonly found that provides it with food, shelter and water

Invertebrate
An animal without a backbone; insects, lobsters and sea stars are examples of invertebrates

Predator
An animal that hunts another animal for food

Prey
An animal hunted by another animal for food

Schooling
A behavior whereby fish of the same type and similar size swim together—schooling helps protect individual fish from predation and makes it easier for them to find food and mates

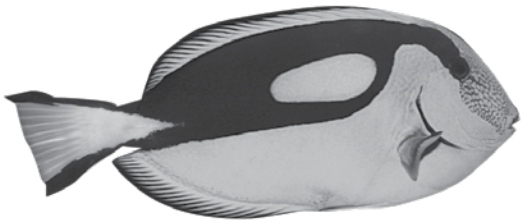
Tail
A fish's caudal fin or tail fin, the structure that protrudes at the end of the animal and helps it move through the water

Vertebrate
An animal with a backbone and internal skeleton

Fishworks

Blue Tang / Sand Tiger Shark

Blue Tang



Sand Tiger Shark

Photo: Jeff Kubina, Columbia, MD

Fishworks

Blue Tang / Sand Tiger Shark Venn Diagram

Blue Tang

Body Shape: compressed—to dart in and out of hiding places (to protect it from predators)

Mouth and Teeth: puckered mouth with teeth made for scraping off algae (to find food)

Defense: sweeps its tail to use the sharp protruding spine located near its tail to inflict wounds to predators (to protect it from predators)

Defense: coloration—bright blue to blend into the coral reef in which it resides (to protect it from predators)

Eyes

Gills

Fins

Scales

Tail

Sand Tiger Shark

Body Shape: fusiform—built for speed (to find food)

Mouth and Teeth: powerful jaw and large mouth located on its underside with rows of fishhook-shaped teeth to feed on other fish (to find food)

Behavior: gulps air at the surface of the water and keeps it in its stomach for buoyancy

Defense: coloration—dark on top and light on the bottom (countershading to hide from prey and predators)

Fishworks

Fishworks Video Summary of Adaptations

NAME	Adaptation: Mouth	How it helps animal eat
Needlefish 	beak (long and pointy mouth)	to sweep head and catch small fish
Cownose Ray 	flat, hexagon-shaped teeth	to clamp down on hard-shelled prey
Archerfish 	specialized jaw that acts as a built-in water gun	to shoot water at insects
Goosefish/Monkfish 	specialized dorsal fin that acts as a built-in fishing pole and lure	to attract unsuspecting prey
NAME	**Adaptation: Body Shape**	**How it helps animal move**
Lumpfish 	pelvic fins form a suction cup	to hold onto surfaces
Sand Tiger Shark 	torpedo-like structure; skin/tiny scales called dermal denticles	to swim quickly and quietly
Moray Eel 	long, slender body	to wiggle between rocks and reef to hide from unsuspecting prey
Large Scale Four-Eyed Fish 	eyes can see above and below the water	to see predators and prey above and below the water more easily
NAME	**Adaptation: Defense**	**How it helps animal escape predator or catch prey**
Leafy Seadragon 	leaf-like protrusions (camouflage)	to blend in with kelp and sea grass beds to hide from predators or to sneak up on prey
Cuttlefish 	chromotophores (little color cells all over their body) that allow them to change color	to blend into their surroundings in order to hide themselves from predators
Blueback Herring 	lateral line along the side of their body acts as a tiny sensor to feel what is around them	allows them to swim in large groups (schooling) in order to protect themselves from predators

Fishworks

Recommended Books and Online Resources

Your school or local library is certain to have a great selection of books that you and your students can use to learn about fish and their many adaptations. Your students can also use books, magazines and online resources to inspire ideas for the Create-a-Fish assignment. The following are a few suggestions for books (available for loan from the TRC) and online resources that you can use in your classroom.

Books

Ling, Mary, and Jerry Young. *Amazing Fish*. New York: Knopf, 1991. Print.

Pfeffer, Wendy, and Holly Keller. *What's It Like to Be a Fish?* New York: HarperCollins, 1996. Print.

Snedden, Robert, and Adrian Lascom. *What Is a Fish?* San Francisco: Sierra Club for Children, 1993. Print.

Segaloff, Nat, Paul Erickson, and Bob Barner. *Fish Tales.* New York: Sterling Pub., 1990. Print.

Sill, Cathryn P., and John Sill. *About Fish: A Guide for Children.* Atlanta: Peachtree, 2002. Print.

Wu, Norbert. *Fish Faces*. New York: Holt, 1993. Print.

Online Resources

New England Aquarium Blogs and Webcams
www.neaq.org/blogs

Aquarium of the Pacific Build-a-Fish Online Activity
www.aquariumofpacific.org/teachers/buildafish

National Geographic Kids Creature Feature
kids.nationalgeographic.com/kids/animals/creaturefeature

BBC Blue Planet Informational Website
www.bbc.co.uk/nature/blueplanet

Fishworks

Answer Sheet, Rubric and Checklist

Student Checklist

FISHWORKS WORKSHEET	
I included a drawing for each section.	
I described my drawing in each section.	
FISH CREATION	
I included a specific mouth for my fish.	
I included a specific body shape for my fish.	
I included eyes, fins and a tail for my fish.	
I included an adaptation that helps my fish to defend itself.	
I labeled my fish diagram with the appropriate vocabulary.	
I described how each adaptation helps my fish to survive.	
I gave my fish a name.	

Review Questions Answer Guide

What is the definition of an adaptation?
An adaptation is a physical or behavioral feature that an organism is born with and that helps the organism to survive and reproduce in its habitat.

Can you give an example of an adaptation?
The needlefish has a long and pointy mouth that helps it to catch small and slippery little fish. (There are many other acceptable answers.)

What are some of the reasons animals have adaptations?
Animals have adaptations to help them eat, move and defend themselves.

Create-a-Fish Rubric

CATEGORY	4	3	2	1
Understanding of the scientific concept	I described how each adaptation helps my fish to survive.	I described how most of the adaptations help my fish to survive.	I described how a few of the adaptations help my fish to survive.	I did not describe how any of the adaptations help my fish to survive.
Drawing: components	I included all components in my drawing: title, assigned adaptations, labels and descriptions.	I included most components in my drawing: title, assigned adaptations, labels and descriptions.	I included a few components in my drawing: title, assigned adaptations, labels and descriptions.	I did not include any components in my drawing: title, assigned adaptations, labels and descriptions.
Drawing: clarity and neatness	I paid careful attention to all of the following elements: clear writing, neat drawing and color.	I paid careful attention to most of the following elements: clear writing, neat drawing and color.	I paid careful attention to one of the following elements: clear writing, neat drawing and color.	I did not pay careful attention to any of the following elements: clear writing, neat drawing and color.
Description: spelling and grammar	My descriptions contain 1 to 2 spelling and/or grammatical errors.	My descriptions contain about 3 to 4 spelling and/or grammatical errors.	My descriptions contain about 5 to 8 spelling and/or grammatical errors.	My descriptions contain many spelling and/or grammatical errors.

Fishworks

Video Worksheet

NAME

DATE

As you watch the video, you will see different adaptations that fish have for eating, moving and protection. Draw and explain your favorite adaptation in each section below.

MOUTH: How does my fish EAT?

BODY SHAPE: How does my fish LOOK or MOVE?

DEFENSE: How does my fish PROTECT itself?

Fishworks

Create-a-Fish Worksheet

NAME

DATE

Create your own fish with your favorite adaptations. These can be adaptations from the video, from existing fish or you can even make up your own! Label each adaptation on your drawing with an explanation of what it is and how it helps your fish to survive. Be sure to think about:

- What kind of body shape do you want your fish to have?
- What kind of eyes and mouth do you want your fish to have?
- What do you want the fins to look like, or the scales or skin?
- How will your fish defend itself?

FISH NAME