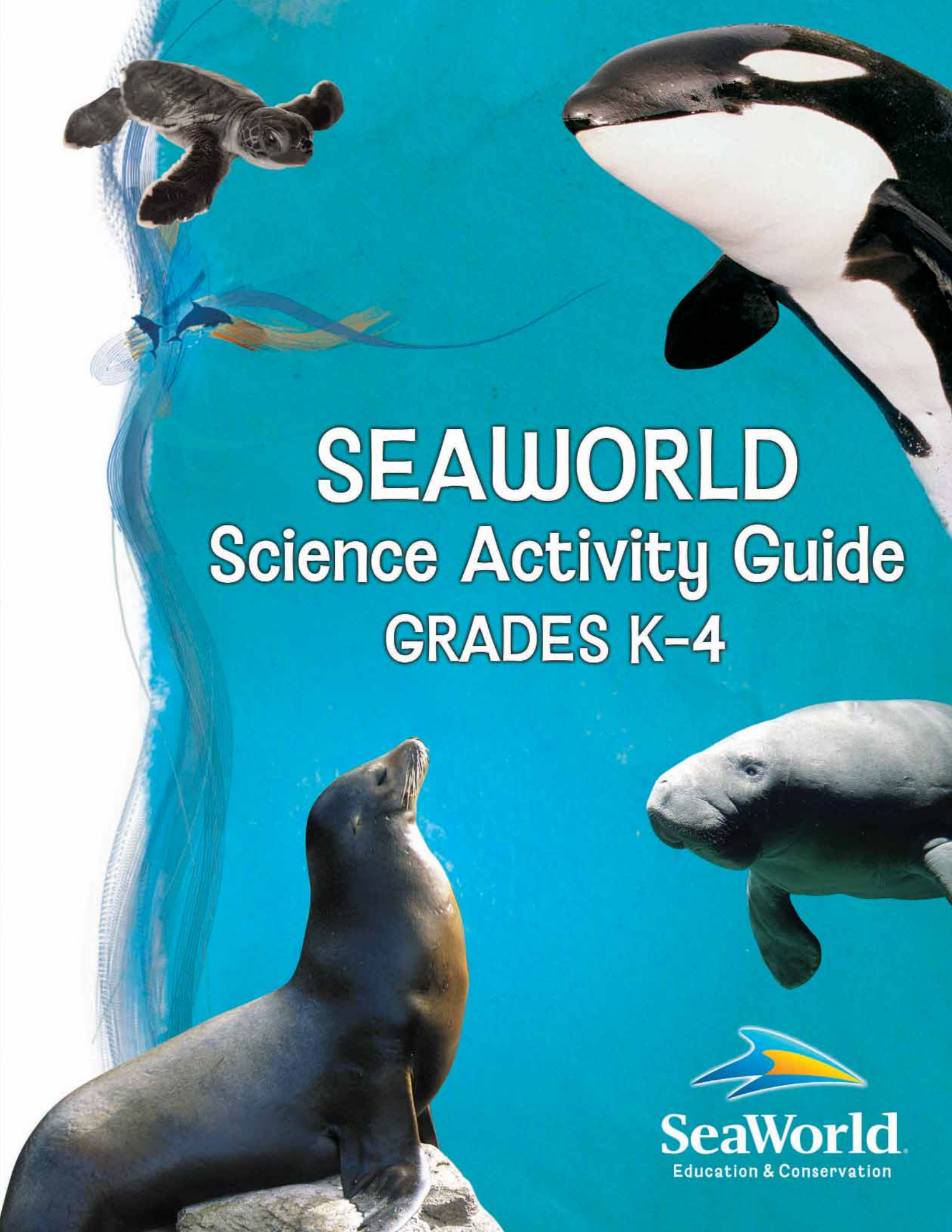


# SEAWORLD
## Science Activity Guide
## GRADES K-4

SeaWorld
Education & Conservation

Education & CONSERVATION

Based on a long-term commitment to education and conservation, SeaWorld strives to provide an enthusiastic, imaginative, and intellectually stimulating atmosphere to help students and guests develop a lifelong appreciation, understanding, and stewardship for our environment. Specifically, our goals are…

- To instill in students and guests of all ages an appreciation for science and a respect for all living creatures and habitats.
- To conserve our valuable natural resources by increasing awareness of the interrelationships of humans and the environment.
- To increase students' and guests' basic competencies in science, math, and other disciplines.
- To be an educational resource to the world.

## Pre/Post Assessment

Use this assessment to discover how much your students already know about ocean animals and ecosystems before you begin this unit and later as a conclusion to your study.

- How many different ocean animals can students name?
- Classify animals as a mammal, fish, or bird. How are they similar? How are they different?
- Describe how marine animals communicate with one another. Why are different types of communication important in marine habitats?
- Name one endangered animal. Why is this animal endangered? How can you help?
- What is an adaptation? What are some adaptations marine animals have to survive?
- Draw a picture of a dolphin. Identify and label the body parts that help the dolphin live in the ocean. Explain how the body parts work and what dolphins and other whales have to help them keep warm in the ocean.
- How do you use the ocean and its resources? What can you do to help conserve resources?

SeaWorld Education & Conservation

Printed in the United States of America


Published by the SeaWorld Education & Conservation Department
500 SeaWorld Drive, San Diego, California, 92109-7904

# SeaWorld Science Activity Guide

## K – 4th Grade

## A SEAWORLD PUBLICATION

## CONTENTS

# To the Teacher...

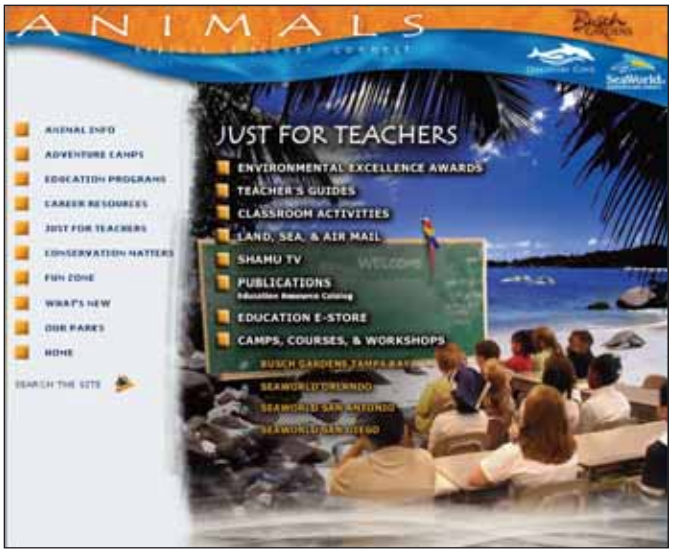
This activity guide was developed at SeaWorld to help you teach your students — in an active, hands-on way — about marine animals and the ecology of the ocean. Our goal is to integrate science, mathematics, language and literacy, and art. SeaWorld curriculum supports the National Science Education Standards and California Science Content Standards (see next page for details).

# SeaWorld.org

Each activity contains brief background information and vocabulary to introduce the science concepts to your students. Vocabulary terms are italicized. More extensive information can be found on our ***ANIMALS*** Web site at ***SeaWorld.org***. The *Animal Info* section of our Web site contains in-depth Animal Infobooks, enriching Animal Bytes, and much more. Each activity in this activity guide may have a symbol denoting what type of further information is available online. Refer to the key below. This information can be used to supplement the background information in this activity guide and provide additional knowledge to answer student questions.

| InfoBook available | Animal Byte available |
|---|---|
| IB | B |

Visit the *Just for Teachers* section of ***SeaWorld.org*** to find even more resources and activities. All of our teacher's guides are available in PDF format for your use. Also, be sure to check out *Land, Sea, & Air*, the monthly e-newsletter designed just for teachers. Subscribe online to receive educational information about animals, their habitats, and how we can work together to make a difference in the world. Archives of past newsletters and activities are also available.




**Still have questions? Email us at SWC.Education@SeaWorld.com**

# Connections to California Science Content Standards

The Science Content Standards are identified by the number of the standard set and the letter of the component of that set. Please refer to *Science Framework for California Public Schools* for a description of each standard set and its components.

| Activity | Kindergarten | Grade 1 | Grade 2 | Grade 3 | Grade 4 |
|---|---|---|---|---|---|
| Animal Diversity | 2.abc 4.de | 2.acd | 4.ac | 3.ab | |
| Blubberlicious | 4.abe | 2.a 4.b | 4.abg | 3.a 5.de | 3.b 6.cdf |
| Penguin Rescue | 1.a 2.c 4.e | 1.b 4.be | 4.g | 3.d 5.de | 6.cdf |
| Who am I? | 2.ac 4.de | 2.a 4.a | 4.ac | 3.a | 3.b |
| Something's Missing! | 2.abc 4.be | 2.a 4.a | 2.cd 4.e | 3.a | |
| Hold Your Breath! | 4.c | 4.cd | 2.e | 5.c | 6.f |
| Super Manatee | 2.abc 4.be | 2.abcd 4.a | 2.a | 3.acd | 3.b 6.c |
| When Sharks Go Swimming… | 4.e | 2.a 4.ab | | 3.abc | 3.ab |
| Arctic Connections | 2.a 4.e | 2.bc 4.a | 4.ad | 1.a 3.cd | 2.ab |
| Shrink or Swim | 1.a 4.e | 2.a 4.b | 4.ag | 3.cd 5.d | 3.b 6.cdf |
| The Cycle of Life | 4.e | | 2.abcd 4.d | 3.a | |
| Sounds for Survival | 4.ae | 2.a | 1.g 2.acd | 3.a | 6.f |
| The Ocean & You | 3.c | 4.bc | 3.e 4.e | 3.cd 5.ce | 3.a |
| Penguin Relay | 2.c | 2.ac | 2.abc | | |
| Train Your Friends | | | 4.g | | 6.f |

# National Science Education Standards

**Life Sciences Standards**
- Characteristics of organisms
- Life cycles of organisms
- Organisms and environments

**Personal and Social Perspectives Standards**
- Types of resources
- Changes in environments
- Science and technology in local challenges

**History and Nature of Science Standards**
- Science as a human endeavor

**Science as Inquiry**
- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

**Unifying Concepts and Processes**
- Systems, order, and organization
- Evolution and equilibrium
- Evidence, models, and explanation
- Form and function
- Change, constancy, and measurement

*National Research Council. National Science Education Standards. Washington, D.C.: National Academy Press, 1996*

# Animal Diversity

## Materials

- copies of animal cards (on pages 5–7) per student or student group

## Objectives

- To classify animals into groups based on common characteristics
- To learn characteristics of animal groups

## Introduction

Scientists classify animals into groups based on characteristics that they all share. The following groups of animals are classified based on the listed characteristics:

***Mammals***
- Have hair/fur*
- Are warm-blooded
- Give live birth to young
- Nurse young
- Breathe air

***Birds***
- Have feathers
- Lay eggs
- Are warm-blooded
- Have wings

***Fish***
- Have scales
- Breathe underwater using gills
- Are cold-blooded
- Have fins

***Reptiles***
- Are cold-blooded
- Breath air
- Lay eggs
- Have scales

* Dolphins, whales, and porpoises are born with a few hairs around their rostrum. These hairs usually fall out shortly after birth.

## Action

1. Distribute copies of a set of animal cards to each student or student group.
2. Have students cut apart the cards.
3. Discuss the characteristics of the animal groups listed above. Based on these characteristics, ask students to classify their animal cards into one of the four groups. Discuss results with students. Why did they classify them in the way that they did? Were they right or wrong?

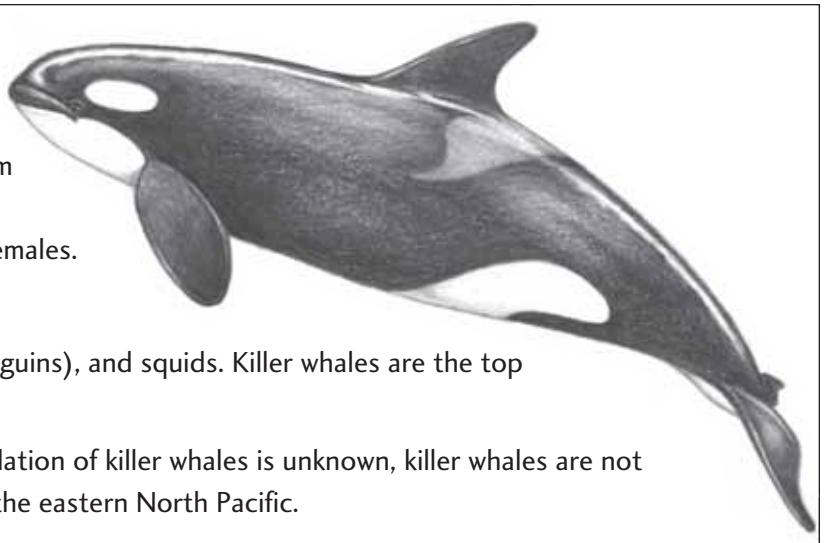
*For older students: Assign an animal card to a small student group. Learn more about the animal by visiting the school library or* SeaWorld.org. *Have the groups present their findings to the class.*

*For your SeaWorld visit: If students have questions about any of the animals, challenge them to find the answers during your SeaWorld Instructional Field Trip.*

*The cards can also be used to prepare lesson plans and lead discussions using the facts provided.*

## killer whale

*Orcinus orca*



**Size:** Killer whales may reach lengths of 4.9 to 6.2 m (16–22 ft.) and weigh 1,361 to 5,442 kg (3,000–12,000 lb.). Males are much larger than females.

**Distribution:** oceans worldwide

**Diet:** fishes, marine mammals, seabirds (such as penguins), and squids. Killer whales are the top predator of the ocean.

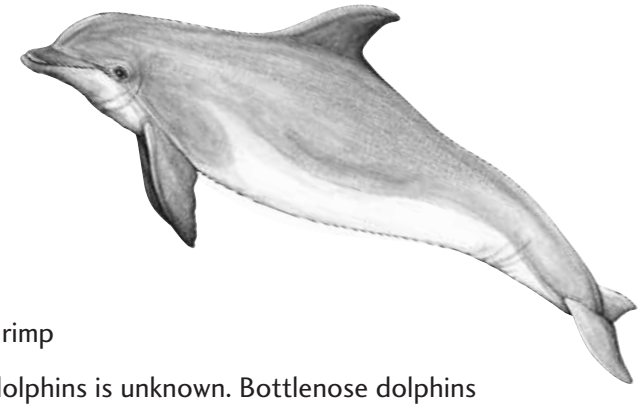
**Population & Status:** Although the worldwide population of killer whales is unknown, killer whales are not endangered, with the exception of a community in the eastern North Pacific.

**Fun Fact:** Killer whales live in groups called pods. A pod may have less than 5 to about 30 individuals and may be a mix of males, females, and calves of all ages.



## bottlenose dolphin

*Tursiops* spp.



**Size:** Bottlenose dolphins reach lengths of 2 to 3.9 m (6.6–12.8 ft.) and can weigh 150 to 200 kg (331.5–442 lb.). Males are slightly larger than females.

**Distribution:** temperate and tropical oceans worldwide

**Diet:** a variety of fishes, squids, eels, and crustaceans such as shrimp

**Population & Status:** The worldwide population of bottlenose dolphins is unknown. Bottlenose dolphins are not endangered.

**Fun Fact:** Both young and old bottlenose dolphins chase one another, carry objects around, toss seaweed to one another, and use objects to invite each other to interact. Scientists believe these activities may be practice for catching food.



## green sea turtle

*Chelonia mydas*

**Size:** Green sea turtles reach lengths of about 78 to 112 cm (31–44 in.) and can weigh 68 to 186 kg (150–410 lb.).

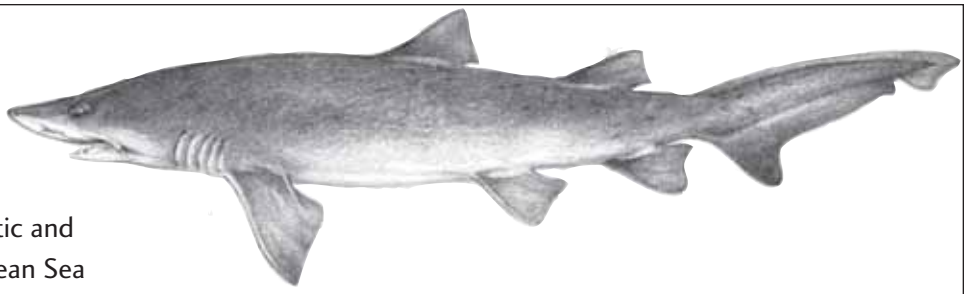
**Distribution:** Atlantic Ocean, Gulf of Mexico, along the coast of Argentina (South America), Mediterranean Sea, Pacific Ocean and Indo-Pacific oceans

**Diet:** Green sea turtles have finely serrated jaws adapted for a herbivorous diet of sea grasses and algae.

**Population & Status:** The worldwide population of green sea turtles is unknown. Green sea turtles are endangered.

**Fun Fact:** The green sea turtle gets its name from the color of its body fat.

## sandtiger shark



*Carcharias taurus*

**Size:** to 3 m (10 ft.)

**Distribution:** warmer waters in the Atlantic and Indo-Pacific Oceans and the Mediterranean Sea

**Diet:** mackerel, eels, flatfishes, crabs, lobster, and squids

**Population & Status:** The worldwide population of sandtiger sharks is unknown. These sharks are listed as "vulnerable" by the IUCN which means they could become endangered soon. They have a low reproductive rate, giving birth to only one or two pups every two years. This makes their populations slow to recover from overfishing.

**Fun Fact:** A sandtiger shark often rests motionless just above the bottom. To do this, the shark gulps air at the surface and then holds the air in its stomach.



## emperor penguin

*Aptendoytes forsteri*

**Size:** Emperor penguins can reach a maximum height of 112 cm (44 in.) and weigh between 27 and 41 kg (60–90 lb.).

**Distribution:** coasts of the Antarctica

**Diet:** squids, fishes, and crustaceans

**Population & Status:** The worldwide population of emperor penguins is estimated to be between 270,000 and 350,000 individuals. They are not currently endangered, however, penguins are vulnerable to overfishing of primary food sources, pollution such as trash in the ocean, and global climate change.

**Fun Fact:** Emperor penguins do not build nests. The male penguin stands upright and incubates a single egg on top of his feet under a loose fold of abdominal skin called a brood patch. After the female transfers the egg, she goes to sea to feed while the male incubates the egg. She returns just before the egg is ready to hatch.



## California sea lion

*Zalophus californianus*

**Size:** Males may weigh up to 400 kg (880 lb.) while females are much smaller at up to 110 kg (240 lb.). In length, males reach 2 to 2.5 m (6.5–8 ft.) and females reach 1.5 to 2 m (5–6.5 ft.).

**Distribution:** British Columbia to northern Mexico

**Diet:** squids, fishes, and octopuses

**Population & Status:** The worldwide population is estimated to be around 200,000 individuals. California sea lions are not endangered.

**Fun Fact:** Adult male California sea lions have a prominent sagittal crest (on top of their head), making them easy to distinguish from females and young males.

## Caribbean flamingo

*Phoenicopterus ruber ruber*

**Size:** Caribbean flamingos reach heights of 80 to 145 cm (31–57 in.) and may weigh 1.9 to 3 kg (4.2–6.6 lb.). Females are slightly smaller than males.

**Distribution & Habitat:** South America and the Caribbean

**Diet:** algae, plankton, and aquatic invertebrates such as crustaceans and molluscs

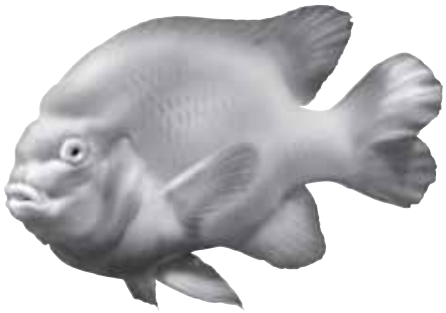
**Population & Status:** The worldwide population of Caribbean flamingos is estimated to be 850,000 to 880,000 individuals. These flamingos are not endangered.

**Fun Facts:** Newly hatched flamingo chicks are not bright pink. The coloration comes from the food they eat. It can take up to two years for a flamingo to become bright pink.



## garibaldi

*Hypsypops rubicundus*



**Size:** to 36 cm (14 in.)

**Distribution & Habitat:** Monterey Bay, California to southern Baja California, Mexico. Garibaldi usually live in shallow, rocky reefs with abundant algae and occasionally wander into kelpbeds searching for food.

**Diet:** a variety of marine invertebrates

**Population & Status:** Its bright orange color and aggressive nature make the garibaldi an easy target for spear fishermen. A decline in numbers led to legal protection of the garibaldi; it is illegal in California to spear or catch a garibaldi. If caught, garibaldis need to be released alive.

**Fun Facts:** Rather than blend into its surrounding kelp forest habitat, the aggressive and territorial garibaldi is brightly colored to warn off intruders. The garibaldi is the California State Marine Fish.



## polar bear

*Ursus maritimus*

**Size:** Polar bears can reach heights of 2 to 3 m (6.6–9.8 ft.). Adults weigh 150 to 650 kg (331–1,433 lb.). Males are much larger than females.

**Distribution & Habitat:** throughout the Arctic on sea ice, islands, coastlines, or in water

**Diet:** ringed and bearded seals, walruses, whales, fishes, and vegetation

**Population & Status:** Polar bears are listed as "threatened" under the Endangered Species Act. Warming Arctic temperatures threaten polar bear habitats and food sources.

**Fun Facts:** It may look white, but a polar bear's thick fur coat is actually translucent (clear). This helps their black skin absorb more sunlight, keeping them warm in chilly Arctic weather.

# Blubberlicious

## Materials

- one ping-pong ball sized piece of Model Magic per student
- large bowl of ice water per group
- stop watch
- copies of *Blubberlicious* worksheet per student

## Objectives

- To introduce students to the *scientific method*
- To learn how whales keep warm

## Introduction

Heat loss in water is about 25 times faster than in air at the same temperature. Despite this incredible rate of heat loss, whales maintain a core body temperature somewhere between 36°C and 37°C (96.8–98.6°F). This temperature is similar to that of other large mammals. How do whales stay so warm in cold water? Whales deposit most of their body fat into a thick insulating *blubber* layer just underneath the skin. Blubber is a specialized type of fat that consists of layers of fat cells and connective tissue. Blubber *insulates* a whale and slows heat loss in the cold ocean water. The blubber layer can reach a thickness of 50 cm (20 in.) on a bowhead whale. Blubber also gives a whale its *fusiform* body shape, making it streamlined and allowing energy-efficient swimming. Blubber acts as an energy reserve when a whale's food intake is reduced.

## Action

1. Discuss ways humans stay warm in cold weather/water. Ask students how they think whales survive in cold water habitats. Introduce the *scientific method* by suggesting an experiment to discover how whales stay warm.
2. Divide students into small groups and assign them to an ice water bowl. Distribute *Blubberlicious* worksheets. Have students hypothesize what will happen if they put their index finger into the ice water and have them record their responses on their worksheets.
3. Have students place their index finger in the water until it is too cold for them (tell students to remove their finger if it becomes numb or turns blue). Make sure to time how long they were able to last and record the data on their worksheets.
4. Introduce the term *blubber* and explain how it insulates whales. Ask students to hypothesize what will happen if their finger is covered in "blubber" and have students record responses on their worksheets.
5. Give each student a piece of model magic to wrap around their finger, making sure there are no holes. Have the students place their "blubber finger" back into the cold water. Time how long it took for their fingers to get cold and record data.
6. Compare their results from both experiments. Ask your students to form a conclusion about how blubber works.

*Deeper depths: Make a list of ocean animals that do not have blubber. Ask students how they think these animals stay warm (ex: penguins have feathers and manatees live in warm water).*

*For younger students: Turn their fingers into whales! When students add blubber, they can create their own whale by forming pectoral flippers, tail flukes, and a dorsal fin. Have their whales dive into the water!*

# Blubberlicious

Name _____

## Hypothesis

*If I place my bare finger in cold water, then* _____.

*If I place my finger with "blubber" in cold water, then* _____.

**Data** – *Record your results in the chart below*

| Results | bare finger | finger with "blubber" |
|---|---|---|
| Time: | | |

**Results & Conclusion** – *Write a sentence about what happened in your experiment.*

_____

_____.

## Discussion

*Circle the animals that have blubber:*

| | | |
|---|---|---|
| manatee | penguin | dolphin |
| beluga whale | dog | human |
| shark | sea star | killer whale |

*Listed below are the steps of the scientific method. Number each step in order from #1 to #5.*

_____ experiment

_____ observations & research

_____ conclusion

_____ problem

_____ hypothesis

# Penguin Rescue

## Materials
**(per student group)**

- three large, clean feathers (from pet store or craft store)
- vegetable oil
- five large bowls
- water
- 1 tablespoon mild hand soap
- 1 tablespoon powdered laundry detergent
- 1 tablespoon dishwashing liquid
- copies of *Penguin Rescue* worksheet (per student)

## Objectives

- To demonstrate and discuss the effects of oil on a bird's feathers
- To introduce students to the scientific method

## Introduction

Penguins rely on clean feathers for waterproofing and *insulation*. When fouled with oil, the birds try to clean their feathers, using their beak to do so. Sadly, they often die from starvation, *hypothermia*, or from ingesting the toxic oil. In June 2000, an iron ore carrier sank off the coast of South Africa, leaking tons of oil into the sea. The oil spill threatened the African penguins inhabiting Dassen and Robben Islands, which comprise about 40% of the total African penguin population. The South African National Foundation for the Conservation of Coastal Birds relocated 19,000 un-oiled penguins and coordinated rehabilitation efforts for nearly 19,000 oiled penguins. SeaWorld penguin experts flew to Cape Town, South Africa to assist with the cleaning and care of the oiled penguins. They washed the penguins with a grease-cutting detergent and rinsed them with fresh water, repeating the process until the penguins were oil-free. Scientists have studied ways to clean oil from marine animals. In this activity, students can perform a similar study. IB B

## Action

*For each group:*

1. Fill all five bowls with water. Label three bowls: #1, #2, and #3.
2. Dissolve a tablespoon of mild hand soap in bowl #1, a tablespoon of powdered laundry detergent in bowl #2, and a tablespoon of dishwashing liquid in bowl #3.
3. Pour a slick of vegetable oil on top of the water in bowl #4.
4. Examine each feather's texture and weight. Now dip them in oil (bowl #4) and examine how the oil changed the feathers. Discuss the effects that oil may have on a bird.
5. Ask students to hypothesize ways to remove the oil from the feathers.
6. Try to wash the feathers in plain water (bowl #5). What happens to the feather?
7. Try to wash the feathers in each of the detergent solutions. Use one feather per bowl. Ask the students to record all of their observations and report their results to the class.
8. Discuss what would happen to a bird in an oil spill. Why are feathers important to birds? How do birds clean their feathers? What might happen if a bird ingests the oil?

*Deeper depths: Investigate where and why oil spills occur. What other types of animals may be affected by oil spills? How can humans prevent oil from reaching the ocean?*

*For your SeaWorld visit: Visit the Penguin Encounter and see if you can find any penguins cleaning their feathers using their beaks or swimming in the water.*

# Penguin Rescue

Name _____

## Hypothesis

*Circle one detergent you think will best clean the oiled feathers:*

hand soap  powdered laundry detergent  liquid dishwashing soap

## Observations

| Describe what each feather looked like: | before oil | oiled | oiled in plain water | after being washed in each solution |
|---|---|---|---|---|
| Feather #1 | | | | |
| Feather #2 | | | | |
| Feather #3 | | | | |

## Results & Discussion

*Which detergent solution cleaned the feathers best?* _____

*List two ways feathers protect birds:*

_____  _____

*Besides large oil spills, how does oil get into the ocean? How can humans prevent this from happening?*

_____

_____

_____

# Who am I?

## Materials

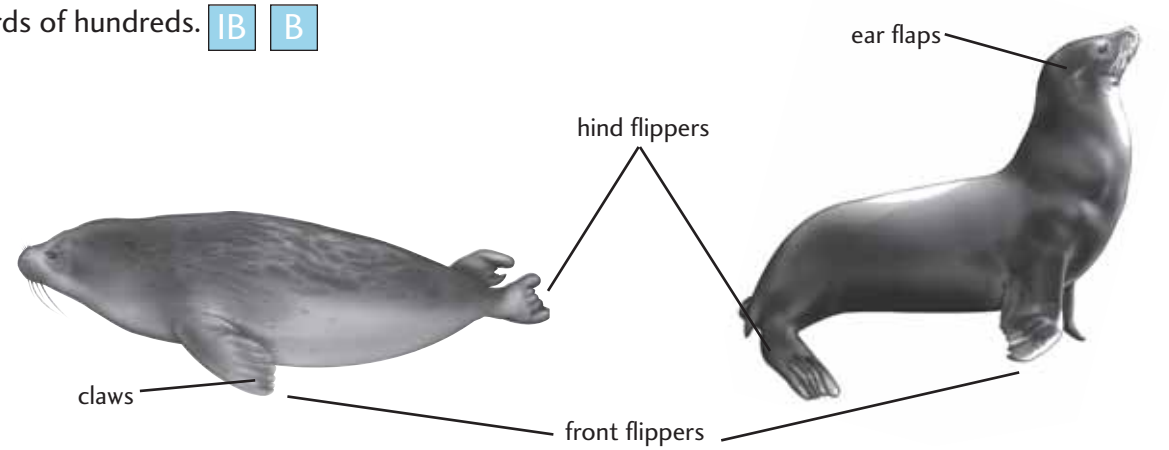
- copies of *Who Am I?* worksheet per student
- crayons
- pictures of seals and sea lions (optional)

## Objective

- To compare and contrast seals and sea lions

## Introduction

Seals, sea lions, and walruses belong to the scientific order *Pinnipedia*. These animals have four *flippers* — broad flat limbs supported by bones. Sea lions are called "eared seals" because they have external ear flaps on the sides of their heads. Sea lions have large front flippers which they use to swim and can rotate the hind flippers forward to "walk" on land. Seals do not have ear flaps, only tiny openings to their ears. They have short, clawed front flippers and cannot rotate their hind flippers. They swim using their hind flippers. Sea lions tend to live in large groups and interact with each other. They are also very vocal. Seals are less social and have quieter vocalizations. Walruses have no ear flaps but can rotate the hind flippers to "walk" on land. They are highly social and live in herds of hundreds. IB B




## Action

1. Ask students if they can describe a sea lion. What does it look like? Where does it live? How does it swim? How does it move on land? Ask students the same questions about a seal and a walrus.
2. Draw an outline of a seal and a sea lion on the board. Pattern the outlines using the illustrations on the *Who am I?* worksheet.
3. Ask students to describe some differences they see between these two animals. Make sure to emphasize the differences described on the worksheet.
4. Distribute *Who am I?* worksheets and crayons to each student. Ask students to write the name of the animal below each picture. Have students draw the missing body parts. Color the animals when finished.

*Deeper depths: Show students pictures of various seal and sea lion species. See if students can correctly identify each as a seal or a sea lion.*

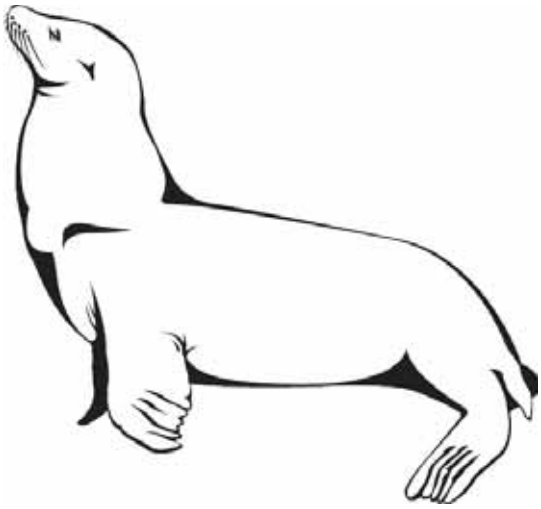
*For older students: Make a chart comparing seals, sea lions, and walruses.*

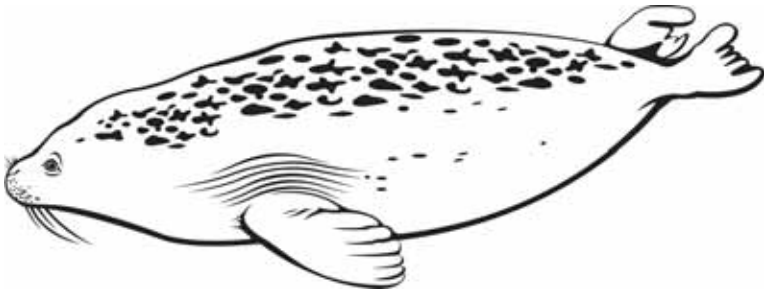
*For your SeaWorld visit: Visit Pacific Point to compare and contrast seals and sea lions.*

# Who am I?

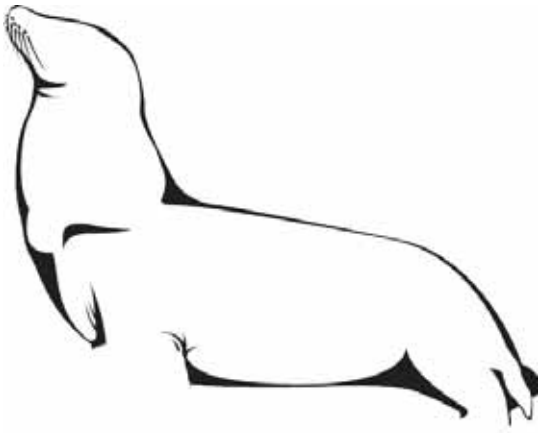
Name _____

Can you tell which animal is a seal and which is a sea lion? Write the names on the lines below the drawing. Then help their friends by drawing flippers, ears, eyes, and whiskers.





_____ _____



**Write the name of the third member of the Pinniped family. (Hint: it lives in the Arctic and has tusks):**

_____

**Circle the animal that makes louder vocalizations:**

seal sea lion

**Circle the animals that can "walk" on their flippers:**

walrus seal sea lion

# Something's Missing!

## Materials

- copies of *Something's Missing!* worksheet per student
- crayons, markers, or pencils
- photos or illustrations of different dolphin species for reference

## Objective

- To identify the parts of a dolphin's body

## Introduction

A dolphin has streamlined body parts that help it swim easily through the water. The *dorsal fin*, located on the center of its back, is made of dense, fibrous connective tissue — there is no bone inside. The dorsal fin acts as a keel, giving the dolphin some stability as it swims. Each lobe of a dolphin's tail is called a *fluke*. Like the dorsal fin, flukes have no bones or muscle inside. A dolphin uses the powerful muscles along its back and tail stock to move its flukes up and down, propelling the dolphin forward through the water. As it swims, a dolphin uses its *pectoral flippers* to steer, and with the help of the flukes, to stop. Pectoral flippers are a dolphin's forelimbs. If you looked at an X-ray of a dolphin's pectoral flipper, you would see what looks like finger and hand bones! A dolphin breathes through a single *blowhole*, located on top of its head. A muscular flap covers the blowhole, making a watertight seal when dolphins dive. To take a breath, dolphins contract the muscular flap. When dolphins relax the muscles, the flap stays tightly closed. The snoutlike projection on a dolphin's face is called a *rostrum*. Inside the rostrum are almost 100 teeth used for grasping and tearing food, not chewing. IB B

## Action

1. Using a photo or illustration for reference, review the body parts of a dolphin and what they are used for. For younger students, role-play each of the parts.
2. Distribute worksheets and writing utensils to each student.
3. Explain that this group of dolphins needs some help. Each dolphin is missing a body part. Direct students to draw the missing parts on the dolphins, using the pictures to guide them. Younger students can simply draw lines that match the missing body parts with the correct dolphins.

*Deeper depths: Have students write the name of each part next to the illustration to practice writing.*

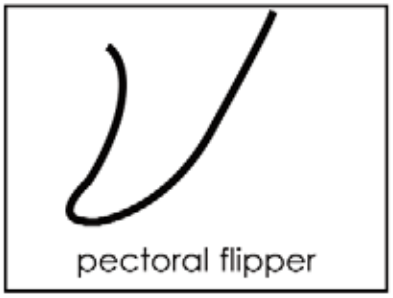
*For your SeaWorld visit: Observe bottlenose dolphins at Rocky Point Preserve and ask students to point at and name each body part they learned.*

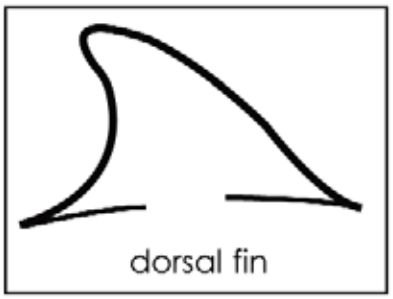
The bottlenose dolphin's streamlined body, together with its flippers, flukes, and dorsal fin, adapt this mammal for life in an aquatic environment.

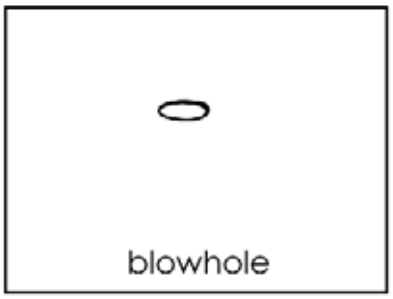
# Something's Missing!

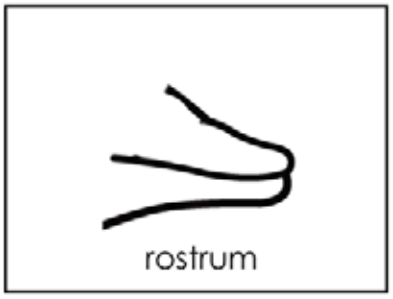
Name _____

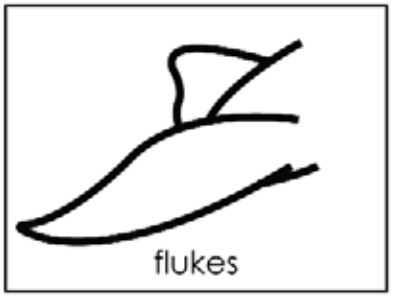
Each of these dolphins is missing something! Help them by drawing in the correct body part.

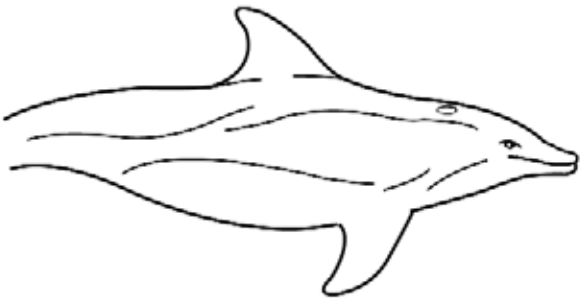


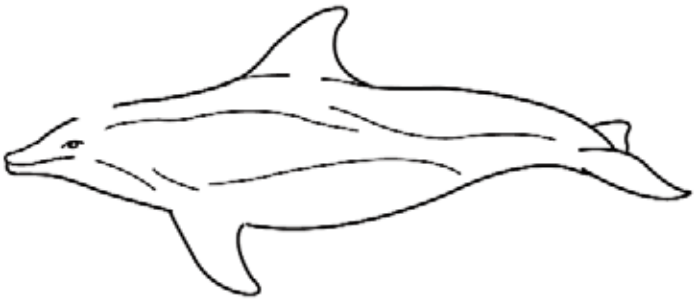



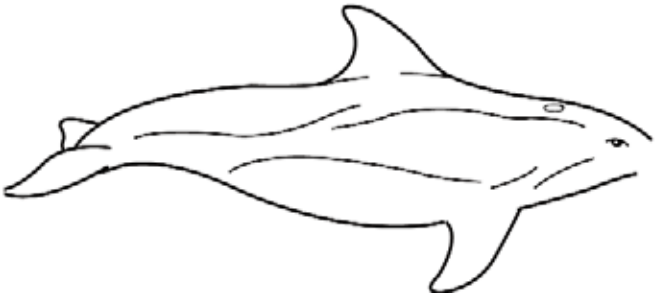







# Hold Your Breath!

## Materials

- copies of *Hold Your Breath!* worksheet per student
- blue, green, and red crayons
- pencils and paper (optional)

## Objective

- To identify how deep marine animals can dive

## Introduction

Marine animals must dive to find food. Some, such as sea birds, dive just below the water surface to find prey. Others, such as pilot whales, dive to great depths to find prey such as squid. Some animals can dive to great depths, but usually find their food in shallower water. For example, harbor seals can dive to 90 m (295 ft.). However, they probably don't routinely dive this deep because most of their prey — shellfish and fishes — lives in shallow water. IB B

## Action

1. Distribute copies of the *Hold Your Breath!* worksheet.
2. Students determine which animal dives deepest, which dives shallowest, and which two animals dive to equal depths. They color these animals according to the directions.

*For older students: Construct a bar graph to illustrate the information on their worksheet.*

*Deeper depths: Deep-diving animals are able to hold their breath a long time. Refer to the chart below for some examples. Ask students how long they think they can hold their breath for. You can time them to see how close they were to their guess. Make sure students do not intentionally hold their breath too long.*

*For your SeaWorld visit: Visit the harbor seals, sea turtles, and bottlenose dolphins to observe their breathing patterns.*

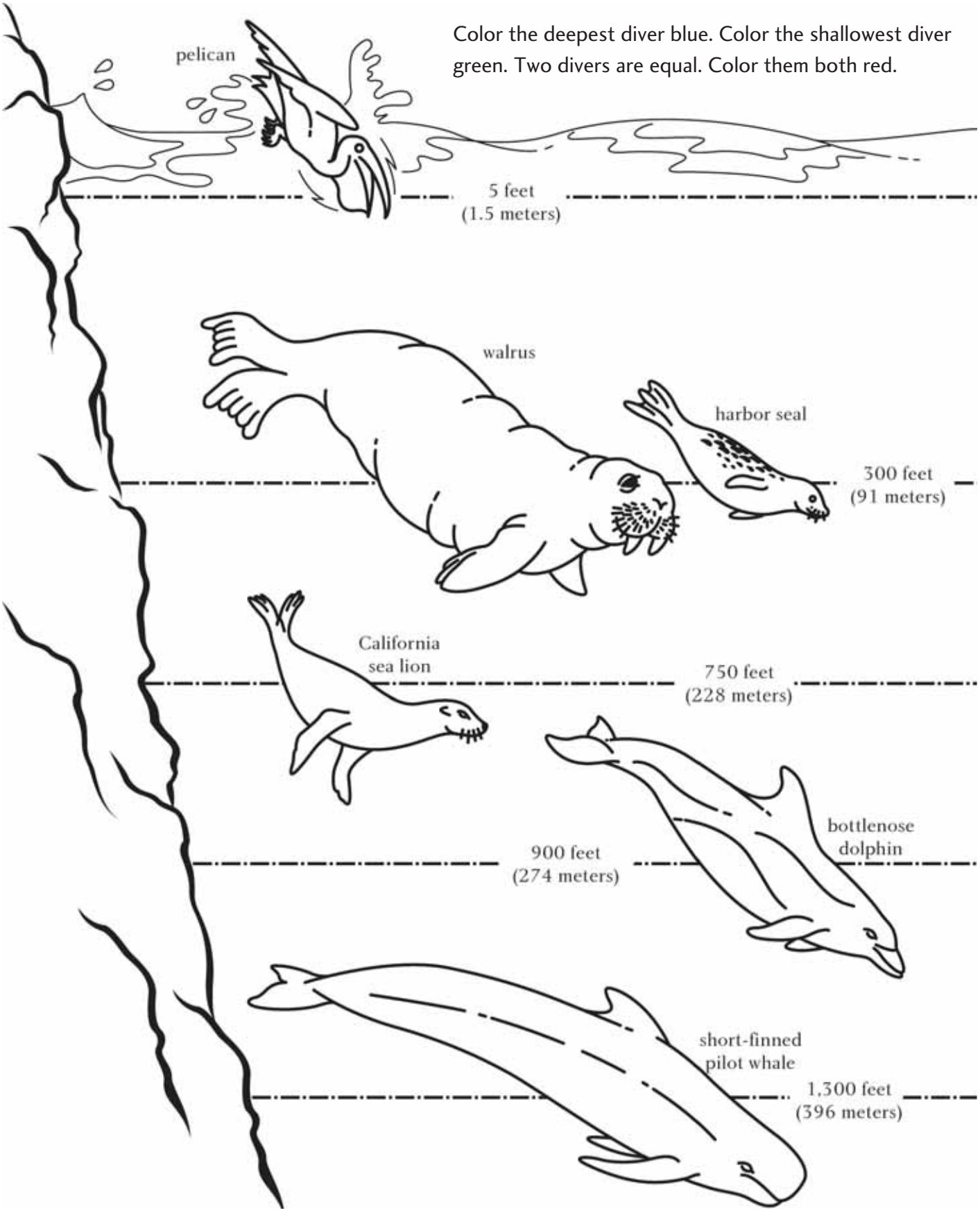
| Animal | Amount of time they can hold their breath |
|---|---|
| harbor seal | 30 minutes |
| bottlenose dolphin | 12 minutes |
| green sea turtle | 5 hours |
| sperm whale | 60 to 90 minutes |
| king penguin | 4 minutes |

During long dives, a green sea turtle's heart rate slows to conserve oxygen: nine minutes may elapse between heartbeats.

# Hold Your Breath!

Name _____

Color the deepest diver blue. Color the shallowest diver green. Two divers are equal. Color them both red.



# Super Manatee

## Materials

- crayons or markers
- manatee outline worksheet (either one per student or one enlarged copy to use in small groups)

## Objective

- To review manatee adaptations and environmental challenges

## Introduction

Florida manatees are one of the most *endangered* marine mammals in the United States. Because they lack an insulating blubber layer, manatees are highly susceptible to cold; it's not unusual for them to die during extremely cold weather. However, human activities pose a much greater threat to manatees:

- **Watercraft strikes.** Each year, many slow-swimming, dark-colored manatees are hit by boats and other watercraft resulting in serious injuries and even death.
- **Habitat destruction.** Much of the suitable manatee habitat in Florida — sea grass beds, salt marshes, and mangroves — has been destroyed or built upon for human use, leaving the manatees without a stable food supply.
- **Pollution & entanglement.** Manatees may eat trash or become entangled in fishing line or nets.

IB B

## Action

1. Define *endangered* and discuss challenges to manatee survival. Write these challenges on the board.
2. Individually or in small groups, have students brainstorm new and creative manatee *adaptations* to overcome these environmental challenges as a "Super Manatee." Have students illustrate these adaptations on their manatee outlines. Examples include a rocket pack to swim faster and avoid boats, sweaters to keep warm, or a hard shell to protect from boat collisions.
3. Have each student or group present their "Super Manatee" to the class.

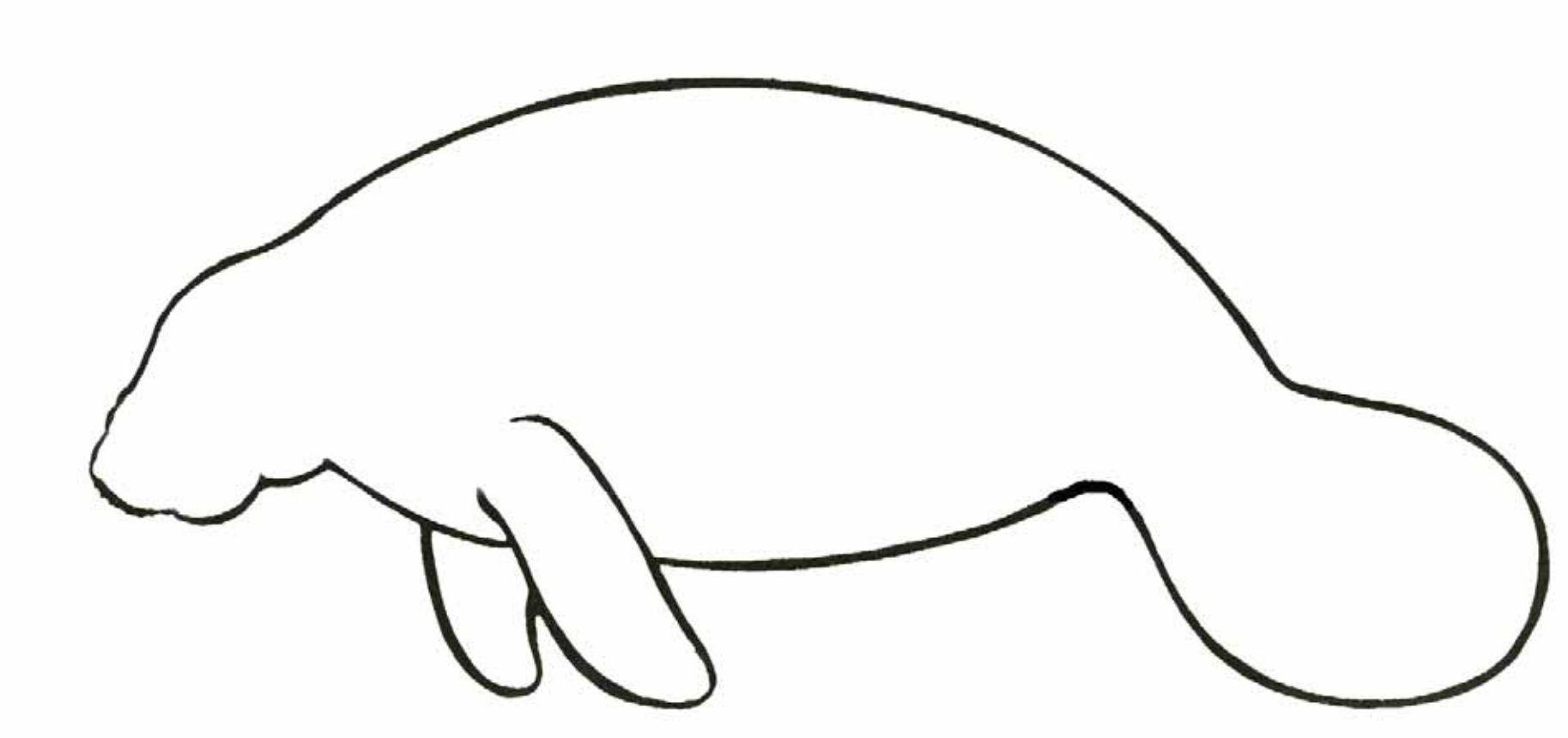
*Deeper depths: Even if you don't live in Florida, you can help protect manatees and their environment. Discuss with students ways they may impact manatees and simple things they can do to help.*

Because they are slow-swimming and dark colored, manatees are often hit by fast-moving boats.

# Super Manatee

Name _____

Manatees are endangered. Help your manatee survive by giving it "super" adaptations.



List three "super" adaptations your manatee has:

_____ _____ _____

How will these adaptations help your manatee survive?

_____

_____.

# When Sharks Go Swimming...

## Materials

- construction paper for the cover
- white paper for drawing
- stapler or yarn to secure book pages
- copies of *When Sharks Go Swimming...* worksheet per student
- crayons or markers

## Objectives

- To introduce students to habitats and ecosystems
- To learn how animals survive within certain habitats

## Introduction

As a group, sharks are adapted for a wide range of aquatic *habitats* and eat almost anything. Listed below are different sharks that are adapted for a particular habitat.

- **leopard sharks**. These sharks are found in kelp forests. Their spotted coloration camouflages them from larger predators in the shady kelp fronds. Their sleek body allows them to easily navigate through the dense forest fronds.
- **nurse sharks**. These sharks are found on sandy bottoms of the ocean floor. They have a long, almost flattened tail to allow them to rest on the bottom. Their brown and sometimes mottled coloration camouflages them with their habitat.
- **great white sharks**. These sharks are found in the open ocean. Their large, muscular body and powerful tail help them to swim fast. They are light to dark gray in coloration on top and white underneath, camouflaging them from their prey.
- **white-spotted bamboo sharks**. The small size of these sharks allows them to squeeze into coral reefs. Their spotted coloration allows them to blend in with their coral and rocky surroundings to hide from larger sharks and other predators. IB B

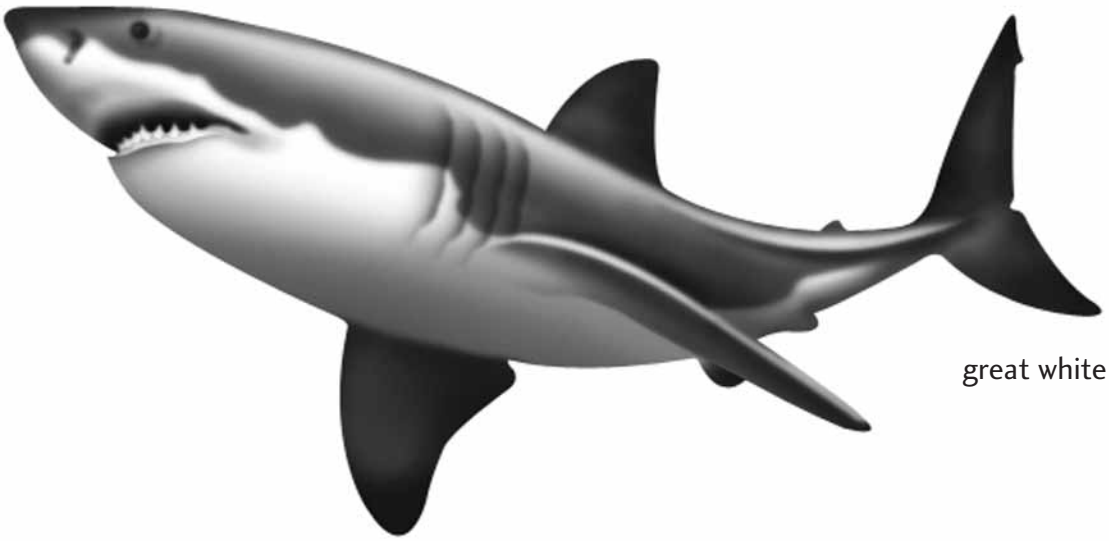
## Action

1. List the following four habitats on the board: kelp forest, sandy bottom, open ocean, and coral reef. Ask students to describe what each of these habitats looks like.
2. Distribute copies of the shark drawings. Have students cut them out.
3. Discuss with students which shark would be suited for each of the four habitats. Discuss how their adaptations help them thrive in these environments.
4. Ask students what other ocean animals besides sharks might live in these habitats. What would a shark living here eat? Write down student responses so they may use them later.
5. Help each student create a book with four pages to draw and write on. Use construction paper for the covers and white paper for the inside pages. Secure the pages by stapling or tying with yarn.
6. Title the book "*When Sharks Go Swimming…*" At the top of each page, write the phrase "This shark sees…." Students can either complete the phrase with words or drawings. Students will draw a picture of the shark's habitat and glue the appropriate shark in the habitat.

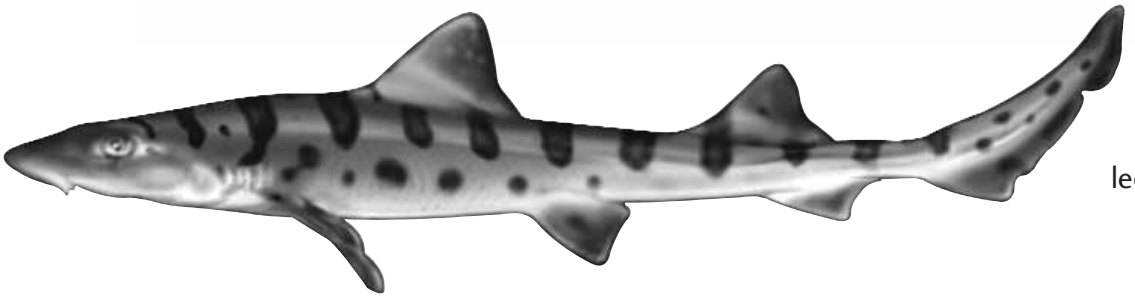
*For your SeaWorld visit: At the Shark Encounter, ask students to count how many different kinds of sharks they can see.*

# When Sharks Go Swimming...

1. Cut each shark out.
2. Make a book using construction paper for the cover and white paper for the inside pages.
3. Title your book, "When Sharks Go Swimming..."
4. On each page write "This shark sees..." Then you can draw what their habitat looks like and what they might eat. Glue each shark into the correct habitat.

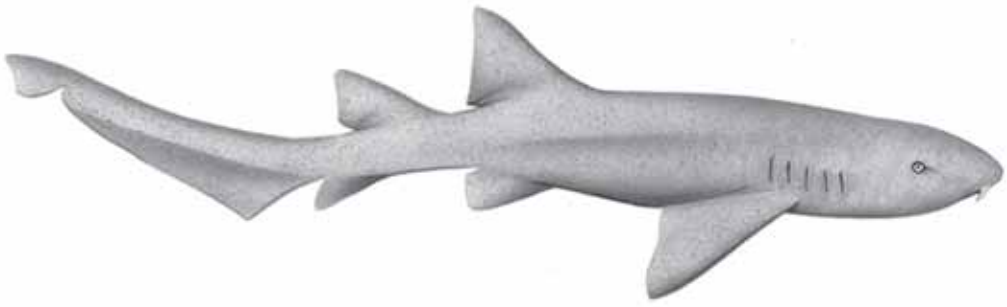


great white shark



leopard shark

white-spotted bamboo shark



nurse shark

# Arctic Connections

## Materials

- copies of *Arctic Connections* worksheet per student
- pencils or markers

## Objectives

- To learn how animals are interconnected with the Arctic ecosystem
- To learn how humans can impact these interrelationships

## Introduction

Wherever animals live, they depend on either plants or other animals for food. In every ecosystem there are *predators* and *prey*. To understand the relationship and delicate balance between predators and prey, scientists use a tool called a *food chain*. A food chain is a diagram that shows "who eats whom" in an ecosystem. In a single ecosystem there may be many food chains that interconnect in many ways. A combination of food chains in an ecosystem is called a *food web*. Food webs show us that if one population is impacted by environmental changes, many others will also be affected.

Most food chains begin with the sun providing energy to a plant, and an animal eating that plant. In the Arctic, the sun provides energy for *phytoplankton* (plant-plankton) to grow. Many other animals prey on phytoplankton, including krill and fishes. An arctic food chain might include a harp seal that eats a cod, which eats plankton. In turn, a polar bear might eat the harp seal. A food web might also include a polar bear, but the diagram shows connections to many prey items — harp seals, ringed seals, bearded seals. The food web expands to show prey items for all the seals and so on. B

## Action

1. Distribute a worksheet to each student.
2. Discuss each item with students. Make sure they are able to identify each item.
3. Ask students to identify a three component food chain, a four component food chain, and a five component food chain. Have them write their responses in the space provided on the worksheet.

*Deeper depths: Challenge students by eliminating predators or prey. What would happen if krill began to disappear? What would happen to seal populations if polar bear populations decreased? How can human actions influence populations that may disrupt a food web?*

Polar bears are apex predators (top predators) of the Arctic ecosystem.

### Correct answers

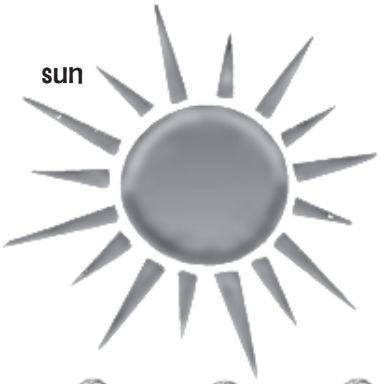
The items in the food chain are (from top to bottom. left to right): sun, krill, phytoplankton, ringed seals, polar bear, bowhead whale, and Arctic cod. Student responses may include any of the following chains, or pieces of chains:

sun ⇨ phytoplankton ⇨ cod ⇨ ringed seal ⇨ polar bear
sun ⇨ phytoplankton ⇨ krill ⇨ bowhead whale

# Arctic Connections

Name _____

Fill in the spaces below to show food chains with three, four, and five items using the items on this page.

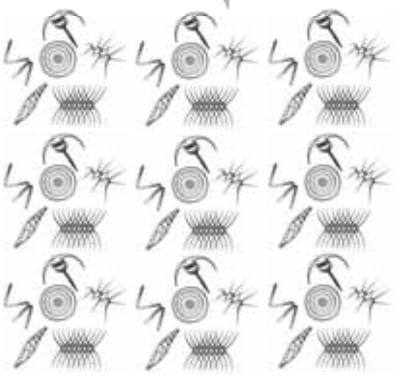




krill


ringed seals


polar bear


phytoplankton


bowhead whale

Arctic cod

three item food chain: _____ ⇨ _____ ⇨ _____

four item food chain: _____ ⇨ _____ ⇨ _____ ⇨ _____

five item food chain: _____ ⇨ _____ ⇨ _____ ⇨

_____ ⇨ _____

# Shrink or Swim

## Materials

- copies of *Shrink or Swim* worksheet per student

*Per student group*

- water
- salt
- measuring cup
- assorted cups or containers
- 2 peeled potato sticks
- other assorted fruits and vegetables including whole, small apples, unpeeled potatoes, carrots, and cherry tomatoes (2 of each per group)

## Objectives

- To explore how animals protect themselves from salinity changes in water
- To perform an experiment using the scientific method

## Introduction

Our bodies contain small amounts of sodium, potassium, and chloride to help maintain healthy cells and nerves. Our tears taste salty because they contain sodium chloride (NaCl, salt).

Animals and people must keep a certain concentration of these elements and others in their bodies to live and move. Aquatic animals often maintain an internal fluid balance that is different from the outside water (either salty or fresh). What happens when the balance becomes disrupted? Animals may lose water (become *dehydrated*) when surrounded by very salty water or gain water when surrounded by fresh water.

In the ocean, *salinity* changes often. Ocean animals have adaptations to help them survive changes in salinity. Outside body coverings, such as the hard carapace of a lobster or the shell of a snail help keep in moisture. How does our skin help keep water in or out of us? Ask if student's fingers wrinkle after a long bath or swim.

## Action

1. Divide students into even groups. Have each group fill two containers with water. Each group adds one teaspoon of salt per cup of water to one of the containers. Label this container "potato with salt." Label the second container of water "potato without salt."
2. Add water to fill additional containers for other fruits and vegetables. Add one teaspoon of salt per one cup of water to each container.
3. Add peeled potato sticks to both the salt and no salt containers. Place one of each of the other fruits or vegetables into a container with salt. Keep one of each fruit or vegetable dry for comparison. Mark the starting time.
4. Carefully check for changes after 30 minutes have passed. After one hour, remove all of the samples making sure not to mix them up. Use the chart provided to record observations.
5. Compare the potato stick in salt and fresh water. Do you notice any changes? Did the sample in salt water get soggy? If so, the potato in the salt water lost water. How does the sample in the fresh water feel? If it is firm, you can assume that it did not lose water.

The hard shell of a sea snail protects it from rapidly chaging salt concentrations.

# Shrink or Swim

Name _____

## Hypothesis

*Circle the correct response. If I put a potato in salt water, then it will :*

*gain salt* *lose salt*

| Observations: | After 30 minutes | After 1 hour |
|---|---|---|
| Potato sticks with salt | | |
| Potato sticks without salt | | |
| Other items with salt: | | |
| | | |
| | | |
| | | |
| Other items without salt: | | |
| | | |
| | | |
| | | |

## Results & Discussion

*Did the skins of other fruits and vegetables provide protection?*

_____,

*List one way an ocean animal can protect itself from gaining too much salt.*

_____.

# The Cycle of Life

## Materials

- copies of the *Crab Life Cycle* wheel and cover per student
- construction paper
- brads
- scissors
- crayons

## Objectives

- To learn how animals change as they grow
- To learn a complete life cycle of a marine invertebrate

## Introduction

*Metamorphosis* is the process by which an organism transforms from one stage in its life to another, such as from larva to adults. Many ocean animals have complex *life cycles*, morphing through several developmental stages before reaching adulthood.

Crabs are a good example of a complex marine *invertebrate* life cycle. After mating, female crabs carry eggs on their abdomen and release them into the water. Once the eggs reach a certain developmental stage, they hatch in larva called *zoeae* (singular – zoea, pronouced *zoh-ee-uh*). These zoeae drift with the ocean currents because they are too small to swim. After about four to five weeks and about seven *molts* the zoeae have developed into *megalops*. The megalops are still too small to swim. They appear to be a cross between a lobster and a crab and are now about 45 days old. This stage only lasts about one week until the megalops have molted into juvenile crabs. Juvenile crabs resemble adults, only they are much smaller. They can swim or walk along the ocean bottom and hide in underwater grasses for protection from predators. Juveniles will molt many times, possibly up to twenty, before reaching adulthood. It can take 12 to 18 months for a crab to reach adulthood. Water temperature and salt concentration can affect the timing of crab life cycles. B

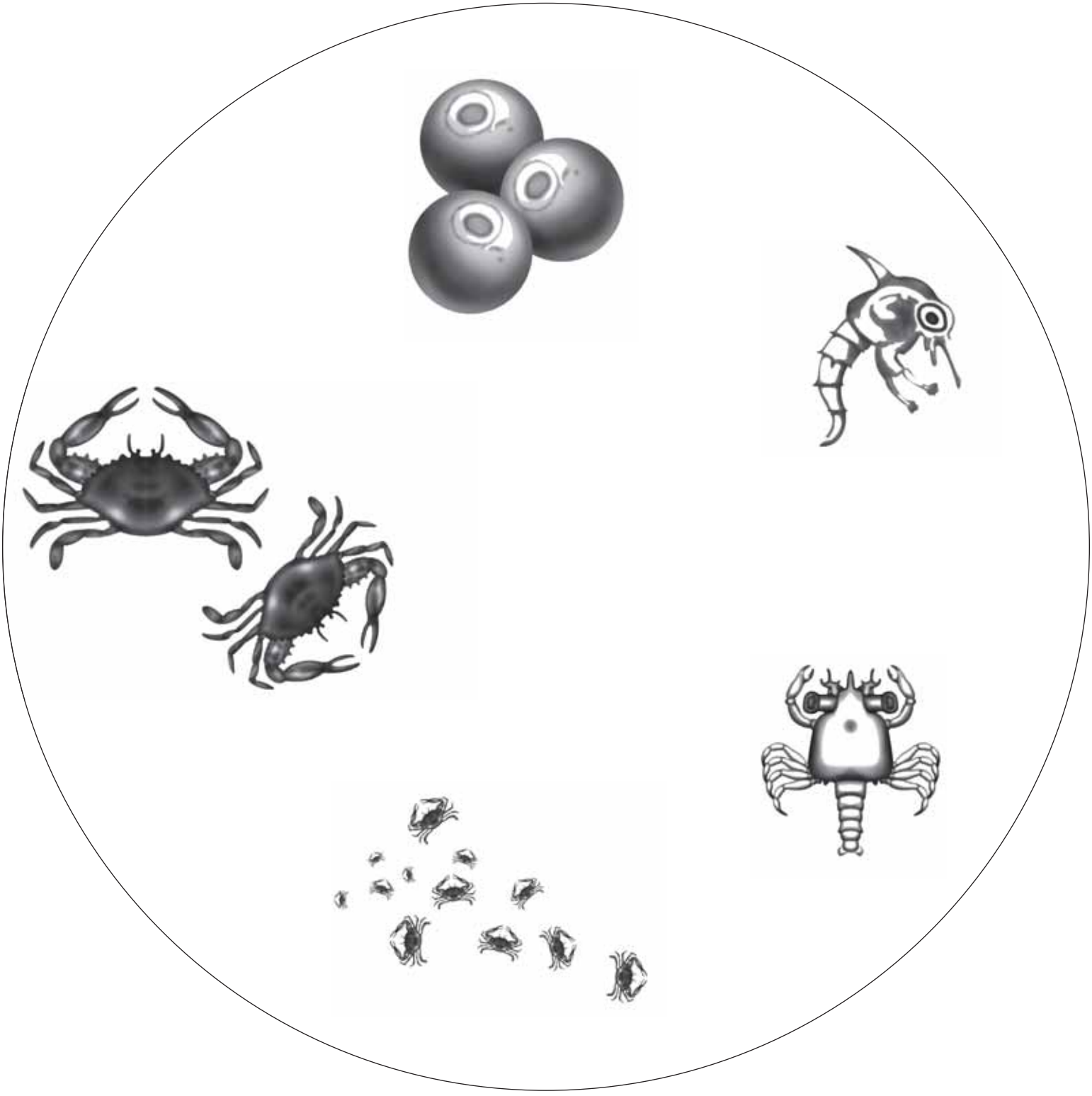
## Action

1. Introduce students to life cycles and metamorphosis. What are some animal life cycles that students are familiar with?
2. Review the crab life cycle with students.
3. Have students cut out the life cycle wheel (page 27). It may be helpful to mount the wheel on a piece of construction paper. This will make it easier to turn.
4. Students will cut out the cover of the life cycle wheel (page 28). They will cut on the dotted lines to remove a triangle from the cover. This is where they will view each phase.
5. Students will connect the wheel and the cover with a metal brad.
6. As students turn the wheel, they can write the name of each phase of the life cycle by the drawing that represents that phase. Students can also write the amount of time that each phase lasts.

*Deeper Depths: Discuss with students ways that crabs of the same species may vary from each other.*

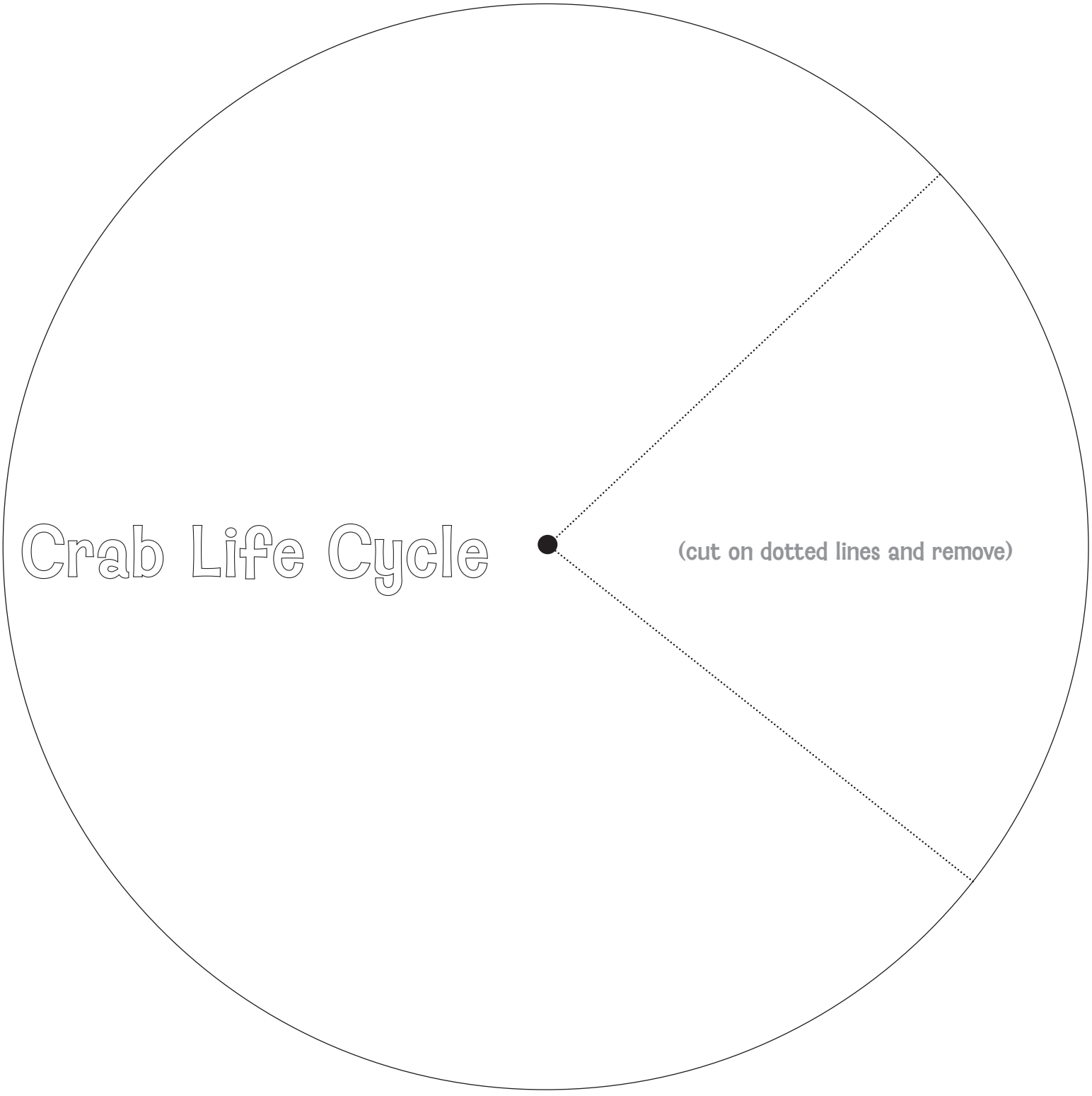
# The Cycle of Life

Cut out the entire circle. Glue it onto construction paper and cut around the circle, leaving some of the construction paper showing.



# The Cycle of Life

Cut this circle out. Then, cut on the dotted lines. You may color and decorate your wheel cover. Place the wheel cover on top of the wheel with the life cycle phases on it. Place a metal brad through the center of the wheels to secure them. As you turn the wheel, write the name of each life cycle stage and how long each stage lasts.



# Sounds for Survival

## Materials

- blindfolds (optional)
- various noisemakers – one for each student, two of each kind (whistles, clickers, pencils to tap together, etc.). You can also assign a noise that a student can make on his/her own (clapping, snapping, squeaking, tapping, etc.)

## Objectives

- To explore the survival advantages of producing sounds
- To learn how animals communicate with one another

## Introduction

Producing sound is an important behavior for many animals. Many marine animals use sounds to locate and identify their offspring. How would a mother sea lion find her pup in a crowded rookery? Female sea lions use a specific vocalization during the mother-pup recognition sequence. This occurs when a female returns to the rookery after feeding to locate her pup. The female emits a loud trumpeting vocalization, which elicits a bleating response from her pup. What about a penguin in a nesting area? Penguins are difficult to tell apart, so penguin calls help them to distinguish mates and chicks. Marine animals also use sound to locate prey and to detect predators that may be in the area.

## Action

1. Discuss how animals communicate with one another. Ask students to infer some survival advantages of creating sound. Prompt students by asking them how individual animals might locate one another in a dark ocean or on a crowded beach.
2. Divide students into two equal groups and place them on separate sides of the room or a field/playground. Distribute one type of each noisemaker to one group, and then distribute matching noisemakers to the other group.
3. Blindfold students or ask them to keep their eyes closed.
4. Have students move across the designated area making the assigned noise. Each student tries to locate his or her partner by listening for the matching sound.
5. Once the students have found their noise partner, discuss the experience. How did they find each other? Was it difficult or easy? Which sounds were the easiest to locate (loud, soft, low or high pitch)?
6. Ask students what they can conclude about animal vocalizations.

Female sea lions can recognize their pup by its vocalizations.

# The Ocean & You

## Materials

- copies of *The Ocean & You* worksheet and *My Conservation Pledge* worksheet per student
- pencils, markers, or crayons

## Objectives

- To gather and organize data and form conclusions
- To learn how students can impact the ocean

## Introduction

Humans interact with the ocean ecosystem. We use the ocean for transportation, harvesting food and minerals, and recreation. And because all water eventually reaches the ocean, the things we do on land also affects the oceans. Some of our interactions with the ocean ecosystem can be harmful. Coastal animals such as bottlenose dolphins and habitats such as tide pools are likely to be affected by *pollution*, habitat destruction, heavy boat traffic, and global *climate change*.

*Conservation* means taking care of our environment by wisely managing its *resources*. We do this by interacting with the ecosystem in responsible ways. You are conserving when you turn off lights in an empty room, when you recycle, and when you turn off water while you are brushing your teeth.
As we consider using ocean resources, we must also recognize that we are a part of this ecosystem. We have the responsibility to study our ecosystem and learn how it works so that we know how our interactions will affect it. This knowledge is important when we make decisions about how we may or may not use ocean resources.

## Action

1. As a class, discuss how humans interact with the ocean ecosystem both negatively and positively. Introduce the terms pollution and conservation.
2. Distribute copies of *The Ocean & You* worksheets to each student.
3. Divide students into small groups (up to four students) to complete their worksheet. Students will fill in their group members names at the top of the chart. They will write an X in the boxes underneath the students' names if they have ever done any of those activities.
4. Students will total the amount of X's they have for each activity and write the results in the "Totals" column. Older students may calculate percentages or create bar graphs of their results.
5. When the groups are finished, compare the results as a class.
6. Discuss how much you use the ocean and its resources. Discuss ways to help conserve ocean resources and resources worldwide.
7. Distribute copies of *My Conservation Pledge* worksheet to each student. They may color and decorate their worksheet. Students write down one way they will help to conserve resources and protect the environment. You can post these in your classroom.
   Examples include:

   *"I will remember to shut off lights when I leave a room."*

   *"I will bring a reusable lunch bag to school instead of a paper or plastic bag."*

   *"I will recycle aluminum cans and plastic bottles at home."*

# The Ocean & You

Write your name and your group members' names in the top line. Ask each group member if they have ever used the ocean for the activities listed below. If they have, put an X in the box below their name, next to that activity. Do the same for the conservation questions. Then, write the total number of X's you have for each question in the "Totals" column. Compare your results with other groups.

| **Names:** | | | | | **Totals:** |
|---|---|---|---|---|---|
| **How do we use the ocean?** | | | | | |
| boating | | | | | |
| fishing | | | | | |
| visiting the beach | | | | | |
| surfing | | | | | |
| swimming | | | | | |
| eating seafood | | | | | |
| visiting tide pools | | | | | |
| whale watching | | | | | |
| **How do we conserve?** | | | | | |
| recycling | | | | | |
| turning off lights | | | | | |
| conserving water | | | | | |
| throwing away trash (not littering) | | | | | |
| other | | | | | |

# My Conservation Pledge

**To help conserve resources and save our environment, I pledge to**

_____

_____

_____.

**Name**_____ **Date**_____

SeaWorld
Education & Conservation


# My Conservation Pledge

**To help conserve resources and save our environment, I pledge to**

_____

_____

_____.

**Name**_____ **Date**_____


SeaWorld
Education & Conservation

# Penguin Relay

## Materials

- safety cones or sidewalk chalk
- styrofoam or plastic egg (one for each team)

## Objectives

- To introduce students to challenges that penguins face when incubating eggs
- To encourage teamwork while working in a large group

## Introduction

Like other birds, penguins lay eggs. Some species such as the Humboldt, Magellanic, and little penguins nest in underground burrows. Adélies, chinstraps, and some other species use stones, plants, and other materials to build nests.

Some species never build nests. King and emperor penguins *incubate* a single egg on top of their feet. Before leaving to feed at sea, the female penguin carefully passes the egg to the male. A featherless patch of abdominal skin on the male, called the *brood patch*, keeps the egg warm. Male emperor penguins incubate the egg for 62 to 66 days during the harsh Antarctic winter. During this time, the male cannot eat and must obtain energy from his thick layer of fat. By the time the female returns, a male can lose almost half of its body weight.

In emperor and king penguins the egg is pear-shaped, with one end tapering almost to a point. With this elliptical shape, if an egg falls off of the feet of a parent bird, the egg rolls in a circle instead of away from the parent. IB B

A newly hatched penguin chick remains in the safety and warmth of the brood patch.

## Action

1. Discuss with students how emperor and king penguins incubate their eggs.
2. Take students outside to a large, open area. With cones or chalk, mark a start and end point.
3. Divide students into equal teams and have them line up at the starting point.
4. At "GO!", the first person in line walks (or waddles) to the end point while balancing the egg on their feet. If the egg falls off, they must pick up the egg and start from the beginning. Once they make it back to the start point, they must pass the egg off to the next person in line without using their hands.
5. The race continues until the last team member makes it back to their team with the egg safely on top of their feet.
6. Back in the classroom, discuss the relay with students. Was it easy being a penguin parent?

# Train your Friends

## Materials (optional)

- whistle
- object to use as a target (yard stick, pointer, etc.)

## Objectives

- To illustrate animal training techniques
- To learn the value of positive reinforcement

## Introduction

Humans have trained animals for thousands of years and SeaWorld has trained marine mammals for more than 40 years. In a zoological environment such as SeaWorld, training animals aids in the *husbandry* and care of animals; adds educational value for park visitors; allows research that may not be possible in the wild; and provides the animals with physical and mental stimulation. SeaWorld trainers strive to make training fun, interesting, and stimulating for the animals. In doing so, the animals are motivated to participate. SeaWorld animal training is based on three building blocks — building a positive relationship, positive reinforcement, and target recognition.

The first step in animal training is to build a positive relationship with an animal. Trainers spend time with an animal to become more comfortable around it and observe its natural behavior and temperment. The animal has to learn to trust the trainer, and the trainer learns to trust the animal.

When an animal performs a behavior that produces a positive result, the animal is likely to repeat that behavior. The positive result is called a *positive reinforcer*. Humans learn by the same principles. If student behavior is reinforced by attention and praise, students are likely to repeat the behavior. Marine mammal training at SeaWorld is based on a variety of positive reinforcers including food, rub-downs, ice cubes, toys, and one-on-one time with a trainer. When an animal performs an unwanted behavior, the trainer uses a *LRS* — least reinforcing scenario. The trainer does not reinforce the animal for the unwanted behavior and after a brief period of calmness, the trainer provides the animal with another opportunity for reward.

Most behaviors cannot be learned all at once. Complex behaviors are *shaped* through small steps. For example, when children learn how to ride a bicycle, most begin on a tricycle, then a bicycle with training wheels, and then a larger bicycle. Each step toward reaching the final goal is rewarding. To help shape behaviors, trainers teach animals to *target*. Trainers use their hands as a target: animals are trained to come to the trainer's hand, touch it, and await the next signal. When a behavior takes place away from the trainer, a target pole — a long pole with a white float on the end — is used to direct the animal. Each time the animal touches the target, they are reinforced.

Animals are trained to associate a signal with each behavior they learn. The signal — which may be visual, auditory, or tactile — is the *stimulus* for the animal to do a particular behavior. When behaviors are done correctly, they must be immediately reinforced. Often, behaviors occur far away from the trainers, so they cannot immediately reinforce the animal. To communicate to the animal they have performed a correct behavior and they will be reinforced, a trainer uses a *bridge signal* — to bridge the gap between behavior and reward. The bridge signal may be a whistle (for whales and dolphins) or the word "okay" for sea lions and otters. IB

## Action

1. Introduce training principles and techniques to students. To demonstrate these techniques choose one student (the "performer") to be "trained." Have that student stand outside the classroom.
2. With the rest of your class, ask them to choose a behavior they would like to teach their classmate.
3. Invite your performer back inside. Ask him/her what kind of reinforcement they would like (students clapping, small candy, etc.).
4. Using your hand (or a yard stick) as a target, guide the performer to the first step of the behavior. Each time he/she touches the target, "bridge" him/her (blow the whistle or say the word "okay"). Then, provide them with the positive reinforcement of their choice.
5. For example, if you are trying to get the performer to shake his/her head, move the target on the left side of his/her head. When he/she touches the target, bridge and reinforce. Move the target to the right side, then bridge and reinforce when they touch the target again. You can speed up the movement of the target until the performer achieves the behaviors.
6. Hopefully your performer will be able to follow the target and catch on to the behavior. Once the performer has achieved the desired behavior, try it again using smaller hand signals instead of a large target.
7. To see how much your students learned, pair them up to train each other. You can time them, assign specific behaviors, or record their successes on the board.

*Deeper depths: What are some of the challenges to animal training? How do trainers overcome these challenges?*

*For your SeaWorld visit: During your Animal Education Show, look for the training techniques you have discussed with your students. Challenge students to count how many hand signals or bridge signals they observe.*

The building blocks of animal training at SeaWorld (clockwise from top left): building a positive relationship, target recognition, and positive reinforcement.

# Vocabulary

**adaptation** – the modification of a species, occuring as a result of natural selection. Adaptations enhance a species' ability to survive.

**blowhole** – the opening to the lungs of a dolphin, similar to a human's nostrils.

**blubber** – a layer of fat cells and fibrous connective tissue, between the skin and the muscle of most marine mammals.

**bridge signal** – a conditioned reinforcer that communicates that an animal has performed correctly.

**brood patch** – a bare patch on a bird's underbelly with a network of blood vessels to increase the body temperature of that area. Used to incubate eggs and brood chicks.

**climate change** – any significant change in measures of climate lasting for an extended period; may be caused by natural factors and processes or human activities that affect the atmosphere's composition.

**conservation** – taking care of our environment by wisely managing its resources.

**dehydrate** – to lose water or body fluids.

**dorsal fin** – the appendage on the back or top of an aquatic animal.

**endangered** – in danger of becoming extinct.

**flipper** – a broad, flat limb supported by bones and adapted for swimming.

**flukes** – the horizontal lobes of the tail of a whale, dolphin, or porpoise, made of connective tissue (not bone).

**food chain** – a simple straight-line diagram that shows "who eats whom" in an ecosystem.

**fusiform** – a shape that is wide in the middle and tapers toward each end.

**food web** – a diagram that shows the many complex interconnections of "who eats whom" in an ecosystem.

**habitat** – the normal, usual, or natural place where a plant or animal lives.

**herbivorous** – a diet consisting of only vegetation.

**husbandry** – the science and practice of breeding and caring for animals.

**hypothermia** – a medical condition that happens when an animal's body temperature falls below normal.

**incubate** – to apply heat to an egg, either by an adult bird or artificial means (such as an incubator).

**insulation** – material that prevents or reduces the passage of heat.

**invertebrate** – an animal without a backbone

**least reinforcing scenario (LRS)** – the consequence that follows undesired behavior, combined with the trainer's signal for the animal to emit calm behavior.

**megalops** –the last larval stage of a crab, before it molts into a juvenile.

**metamorphosis** – the process by which an organism transforms from one stage in its life to another.

**molt** – to shed and replace the outer layer of feathers, hair, skin, or hard outer skeleton.

**pectoral** – located on the chest.

**phytoplankton** – microscopic floating plants and algae.

**Pinnipedia** – scientific family containing seals, sea lions, and walruses.

**pollution** – harmful elements that alter or affect an environment in a negative way, such as chemicals that poison the water supply or trash in the ocean.

**positive reinforcer** – a stimulus that strengthens a behavior.

**plankton** – tiny plants and animals that drift in oceans, lakes, ponds, and rivers.

**predator** – an animal that eats other animals.

**prey** – *n:* an animal eaten by another animal.

**resources** – a source of supply or support.

**rostrum** – a snoutlike projection.

**salinity** – the amount of dissolved salt in water.

**scientific method** – the basis for scientific inquiry. Includes observation and research, a hypothesis, an experiment and data collection, and a conclusion.

**shaping** – the step-by-step process of training complex behavior.

**stimulus** – environmental changes that bring about a response from an animal.

**target** – a focal point that directs an animal toward a position or direction.

**zoea** (zoh-ee-uh) – free-swimming larval stage of a crab.

**SeaWorld Science Activity Guide**
**Grades K–4**
PART OF THE SEAWORLD EDUCATION SERIES


***Research & Writing***
Tiffany Golota

***Editorial Staff***
Deborah Nuzzolo
Patricia Schick

***Illustrations & Cover***
Salma Martin-Fardon
August Stein

***Photos***
Mike Aguilera
Bob Couey

***Technical Advisors***
Thad Dirksen
Alan Garver
Tom Goff
Wendy Turner
Joy Wolf


## SeaWorld Educational Resources

DVDs and books are available in SeaWorld gift shops or through the SeaWorld Education & Conservation Department. Call (800) 25-SHAMU and press 4, for more information. Or visit the e-store at *ShamuShop.com*.

SEAWORLD BOOK SERIES

**Grades Pre–3**

Penguin March.

This is a Dolphin.

SeaWorld Preschool Funbook. Activities & Songs.

**Grades 4 and above**

Behind the Scenes. Animal Training at SeaWorld Busch Gardens, and Discovery Cove.

The Commerson's Dolphin Story.

Killer Whales. Creatures of Legend and Wonder.

Dolphin Discovery. Bottlenose Dolphin Training and Interaction.

Penguins. Flightless Birds of the Southern Hemisphere.

Pinnipeds From Pole to Pole. Seals, Sea Lions, and Walruses.

Sharks! From Fear to Fascination.

The Story of Manatees. Siren's Song.

To the Rescue! The SeaWorld/Busch Gardens Animal Rescue & Rehabilitation Program.

Wild Careers. Working with Animals.

A World Beneath the Waves. Whales, Dolphins, & Porpoises.

Journey to Atlantis Funbook.

Wild Arctic Activity Book.

Shamu's Funbook.

Penguin Funbook.

Manatee Funbook.

SHAMU TV WILDLIFE DVDS

Bring the wonders of wildlife into your classroom with Shamu TV, the award-winning environmental education series for all ages. Each show is about 30 minutes long.

Saving a Species: The Manatee Story

Saving a Species: The Rhino Story

Saving a Species: The Sea Turtle Story

Saving a Species: The Shark Story

Saving a Species: The Whale & Dolphin Story

Saving a Species: The Gorilla Story

Saving a Species: The Penguin Story

Saving a Species: The Elephant Story

Saving a Species: The Story of Cats

Saving a Species: Animals in Peril

Saving a Species: Careers in Conservation

SeaWorld
Education & Conservation