MARINE BIOLOGY

3–8 Science Unit Study

THE GOOD AND THE BEAUTIFUL

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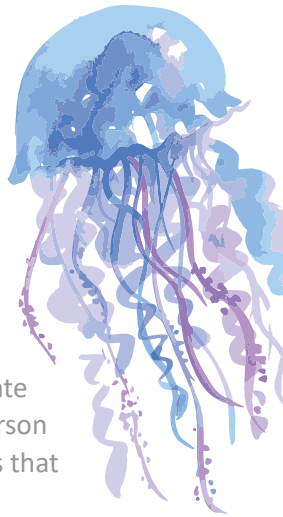


Unit Information

Science Journal

All The Good and the Beautiful science units include activities in a student journal. Each student should have his or her own student journal, and the parent or teacher will direct the student regarding when to complete the activities as directed in the lessons. Science journals can be purchased by going to goodandbeautiful.com/science and clicking on the Marine Biology unit link.

Science Wall

All The Good and the Beautiful science units include vocabulary words to be placed on your science wall, which is a wall or trifold presentation board in your learning area to which you can attach the vocabulary words and other images. ***Cut out the vocabulary word cards at the beginning of the unit.*** The course will indicate when to place them on the wall.

Lesson Preparation

All The Good and the Beautiful science units include easy-to-follow lesson preparation directions at the beginning of each lesson.

Activities and Experiments

Many of The Good and the Beautiful science lessons involve hands-on activities and experiments. An adult should always closely supervise children as they participate in the activities and experiments to ensure they are following all necessary safety procedures.

Experiment Videos

Go to **goodandbeautiful.com/sciencevideos** and click on the *Marine Biology* link or use the Good and Beautiful Homeschool app to see videos of experiments used in this unit. This is a convenient way to watch experiments that may be more complicated. Children often learn best through hands-on experience; therefore, this unit includes a supply list and instructions for all experiments, and you may choose to do as many as you wish.

Unit Videos

Some lessons include videos that were created by The Good and the Beautiful. Have a device available that is capable of playing the videos from **goodandbeautiful.com/sciencevideos** or from the Good and Beautiful Homeschool app.

Content for Older Children

Some lessons include extra content that is more applicable for older children (grades 7–8). Parents or teachers may choose to skip this content if instructing only younger children.

Content for Younger Children

Some lessons include extra content that is more applicable for younger children (grades 3–6). Parents or teachers may choose to skip this content if instructing only older children.

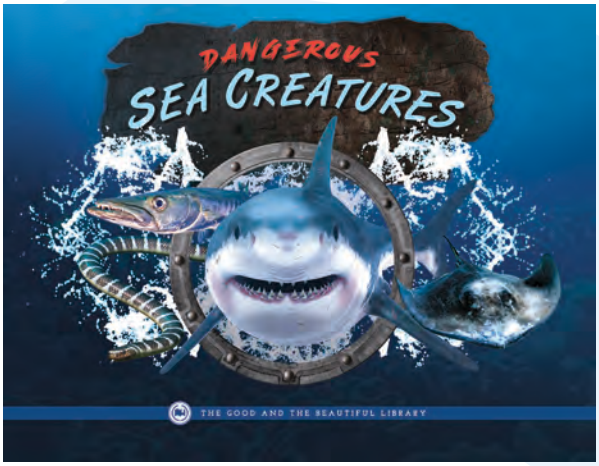
Versions

New discoveries in marine biology are being made on an ongoing basis. This course is reviewed and revised periodically to keep the information as up-to-date as possible. This version is the third edition of this unit.

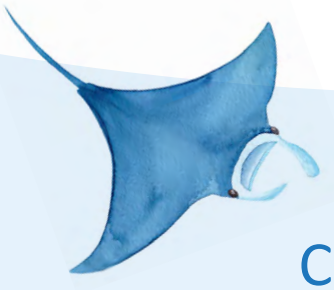
Read-Aloud Book Pack

The two books below are optional read-aloud books that complement this unit. These books can be purchased as a book pack by going to **goodandbeautiful.com/science** and clicking on the *Marine Biology* link.

Dive! Explore Coral Reefs Around the World
by Sue Stuever and Kelley Williams

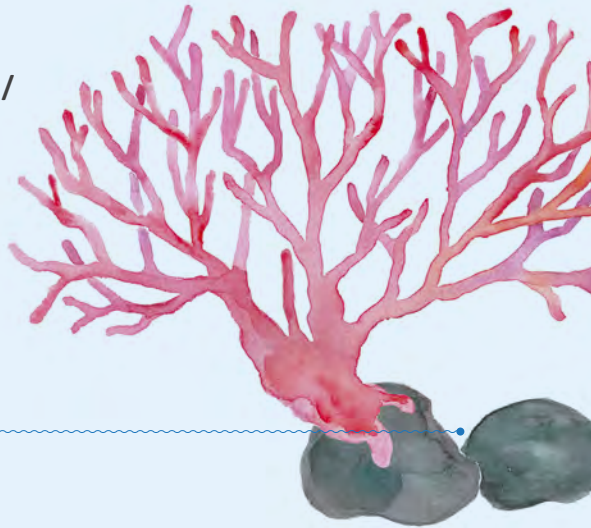


Dangerous Sea Creatures
by The Good and the Beautiful Team



CORRELATED BOOKS

The Good and the Beautiful has several books that correlate well with the *Marine Biology* unit. It can be a wonderful experience for children to read books on their levels related to the subjects they are learning in science. The library includes both fiction and nonfiction books that are organized according to reading level. Find these correlated books by going to **goodandbeautiful.com/science** and clicking on the *Marine Biology* science unit product page.



GRADES 7–8

Lesson Extensions

How the Extensions Work

Each lesson has an optional lesson extension for children in grades 7–8. Complete the lesson with all the children, and then have the older children complete the self-directed lesson extension. These extensions are located in the *Grades 7–8 Marine Biology Student Journal*.

Answer Key

The answer key for the lesson extensions can be found on the free Good and Beautiful Homeschool app in the science section. Visit **goodandbeautiful.com/apps** for information on accessing the app. The app can be accessed from a computer, phone, or tablet.

Flexibility

The amount of time it will take to complete each lesson extension will vary for each child. The average time is about 10–15 minutes per extension. Parents/teachers and children may choose to omit parts of the lesson extension if desired. Encourage the children to stretch their capabilities, but also reduce work if needed.

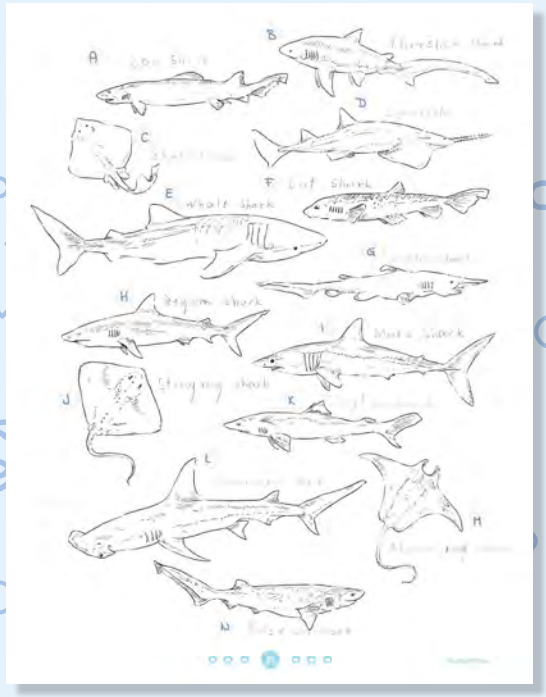
Taking Notes

Some of the grades 7–8 lesson extensions have the children summarize the material read. Teach the children to look for key information, summarizing the most important points. Students can also add notes with their thoughts and the facts that are most interesting to them.

Optional Grades 7–8 Reading Book

We recommend *Explore the Ocean Floor* by Ileana Board as extra reading for students in grades 7–8. This book can be purchased by going to **goodandbeautiful.com/science** and clicking on the *Marine Biology* unit link.

Explore the Ocean Floor
by Ileana Board



Supplies Needed

This section is divided into supplies needed for **activities** and supplies needed for **experiments**. If you would prefer to watch the experiments instead of performing them, you can watch all the experiments at **goodandbeautiful.com/sciencevideos**. The activities, however, are not filmed.

Lesson 1

NOTE: Before beginning this lesson, fill a pitcher with tap water. Add 2–3 drops of blue food coloring. Pour the mixture into an ice-cube tray and freeze for 3–4 hours.

- Globe or map
- Pitcher
- Blue food coloring
- Ice-cube tray
- 9"x13" glass baking dish
- 3 tall glasses or jars
- 8 Tbsp salt
- 8 Tbsp sugar
- Spoon
- 3 fresh eggs
- Dry-erase marker
- Water (including warm tap water)

Lesson 2

- Glue stick
- Scissors

Lesson 3

- 15 unlined index cards for each child
- Crayons, pens, markers, or other drawing materials
- Stapler or binder clip
- Variety pack of seashells (with starfish and sand dollars, if possible), available at craft stores or online

Lesson 5

- Colored pencils or crayons

Lesson 6

- Colored pencils or crayons

Lesson 7

- "My Marine Invertebrates Booklet" in the student journal from the previous lesson
- Colored pencils or crayons

Lesson 8

- Scissors

Lesson 9

- Glue stick
- Scissors

Lesson 10

- Scissors
- Glue stick (optional)
- 1 small can of tomato juice or bottle of lemon juice
- Tablespoon and teaspoon measuring spoons
- Permanent marker
- 8 paper cups
- Water

Lesson 11

- Water
- About 2 c ice
- About 2 c shortening
- 4 quart-sized zipper bags
- Large mixing bowl
- Timer/stopwatch
- Spoon
- Permanent marker

Vocabulary

Instructions: Cut out the vocabulary cards in this section. Place them on your science wall when prompted to do so in the lessons. Review the vocabulary words several times during this unit and, if desired, at various times throughout the school year.

Marine Biology

the branch of science that investigates the organisms that live in salt water

Ocean

a large area of sea typically divided into geographic locations: Atlantic, Pacific, Indian, Arctic, and Southern

Oceanic Pelagic Zones

water in the open ocean divided into different zones based upon how much sunlight reaches that depth of water

Tide Pool

a shallow body of water that remains within rocks along the intertidal zone during low tide

Coral Colony

coral polyps that grow together in a group

Coral Reef

a limestone ridge that is formed from hard coral

Invertebrates

animals with no backbone or spinal column

Ocean Characteristics

Objective

Help the children understand the characteristics of the oceans God created.

Preparation:

- ☐ Fill a pitcher with tap water. Add 2–3 drops of blue food coloring. Pour the mixture into an ice-cube tray and freeze for 3–4 hours.

Activity Supplies:

- Globe or map

Experiment Supplies:

- Pitcher
- Blue food coloring
- Ice-cube tray
- 9"x13" glass baking dish
- 3 tall glasses or jars
- 8 Tbsp salt
- 8 Tbsp sugar
- Spoon
- 3 fresh eggs
- Dry-erase marker
- Water (including warm tap water)

☐ Ocean Painting Study

Have the children stand up with their arms outstretched. Show them the painting of an ocean included at the end of this lesson.

Read to the children: Imagine that we are all standing safely on the top of these cliffs overlooking the ocean, feeling and smelling the fresh, salty sea wind; hearing the crying seagulls and crashing waves; and gazing out across the mighty, seemingly endless ocean. It's hard not to feel wonder and awe when we behold the mighty ocean.

In this science unit, we will experience even more awe and wonder as we explore not just what we see on the surface of the ocean, but also the wonders in it. Can you guess how much of the earth is covered by oceans? About 71% of the surface of the earth is covered by oceans! In each of the upcoming lessons, we will discover the abundant treasures of the ocean and the variety of plants and animals God created to live in the ocean.

☐ Science Wall

Place the vocabulary cards MARINE BIOLOGY and OCEAN on your science wall. Read and discuss the words and definitions.

☐ Oceans of the World Activity

Display a globe or map of Earth and, with the children, find the oceans. Read to the children: How much of the earth is covered by water? [71%] What do you notice about the oceans on the earth? Do you notice that all the oceans are connected together? **Have the children use their fingers to trace a path connecting all the oceans.** Some scientists now consider this to form one "world

3. **Rinse the spoon. Then in the glass labeled "Sugar Water," add 8 Tbsp sugar and stir.**

Read to the children: We are going to place one egg in each glass. **Do not place the eggs yet.** What do you predict will happen when we place an egg in each glass? Your prediction is called a *hypothesis*. Turn to the "How Salt Affects Buoyancy Experiment" page in Lesson 1 of your student journals, and then draw or write your hypothesis in the "My Hypothesis" portion.

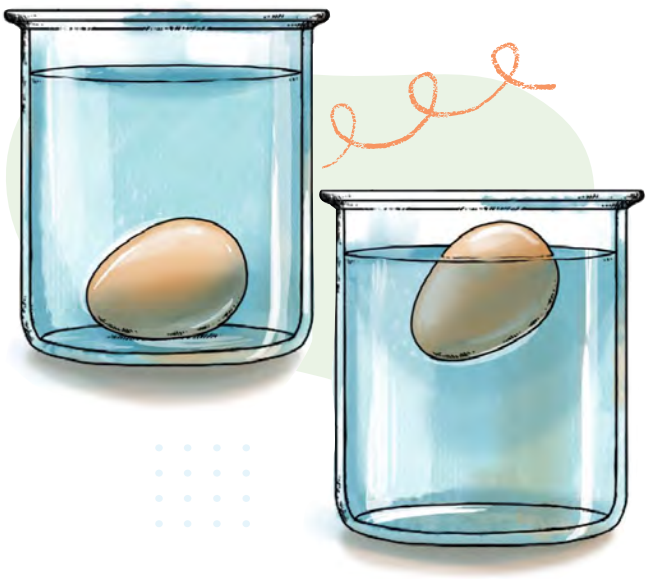
With a spoon, carefully place a fresh egg in the glass labeled "Control." Slowly remove the spoon from underneath the egg and observe what happens. Repeat this step with each glass.

Discuss what the children observed and have them record their observations in the "My Results" portion on the "How Salt Affects Buoyancy Experiment" sheet.

Read to the children: Why do you think the egg in the salt water floated, but the egg in the control glass did not float? The *density* of an object is what determines if it sinks or floats. Density is the amount of weight an object has in relation to its size. For example, imagine I have a bowling ball and a balloon that are exactly the same size. Which is heavier? The bowling ball is heavier. It is denser than the balloon, so its weight is different, even though they are the same size.

Water also has a density. An object will float if it is less dense than water. An egg is denser than water, so it will sink. However, when we added salt to the water, it increased the density of the water, giving it more weight, so the egg floated. (The amount of salt in the water is referred to as *salinity*.)

How would you describe the density of the sugar water? [It is less dense than salt water, but denser than regular water.] The salinity of water and therefore its



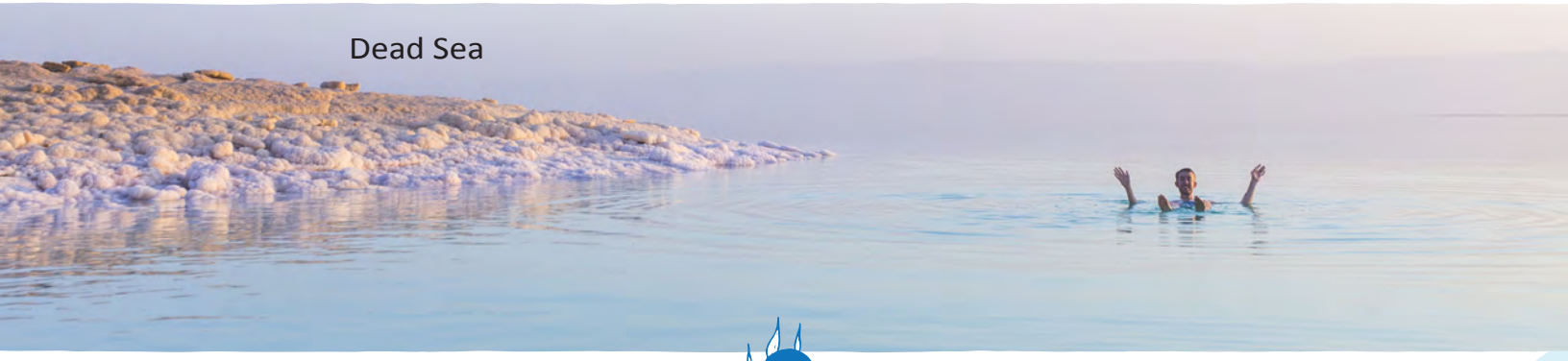
density, which is greater than fresh water, explains why things float more easily in the ocean. The ocean has a salinity rate of 3.5%.

Show the children the picture of the Dead Sea on this page. The Dead Sea, which borders Jordan and Israel, has a salinity of 34% and is famous for its extremely high density of salt water. People can float in the Dead Sea without much effort. The Great Salt Lake in Utah, USA, ranges in salinity between 5% and 27% depending on the conditions and depth. The Great Salt Lake is also known for how easily it allows people and objects to float.

☐ Lesson 1 Extension

7-8

Have students grades 7–8 complete the self-directed Lesson 1 extension titled "What a Colorful Cargo Spill Taught Us About Ocean Currents" in their student journals.



"Rocky Cliff with Stormy Sea, Cornwall" by William Trost Richards (1833–1905), 1902

MARINE BIOLOGY
LESSON 3

TIDES AND INTERTIDAL ZONES

Objective

Help the children understand the tides and the intertidal zones.

Preparation:

- ☐ None

Activity Supplies:

- 15 unlined index cards for each child
- Crayons, pens, markers, or other drawing materials
- Stapler or binder clip
- Variety pack of seashells (with starfish and sand dollars, if possible), available at craft stores or online

☐ Sea Discussion

Have a child read the following quote, and then discuss what it means.

> "The ocean stirs the heart, inspires the imagination, and brings eternal joy to the soul."
>
> —Robert Wyland

Read to the children: In the Bible we read, "And God called the dry land Earth; and the gathering together of the waters called he Seas: and God saw that it was good" (Genesis 1:10). In this lesson we are going to talk about the shore, which is the place where dry land and seas meet, and the habitats that are found there.

☐ Poetry Reading

Read the poem "A Life on the Ocean Wave" by Epes Sargent at the end of this lesson, and then discuss the following with the children:

Where does the poem say that home is? What animals are discussed in the poem? What other animals do you think live near the shore?

☐ Ocean Tides

Read to the children: Twice each day the ocean tides flow up the shore. Do you know what a tide is? A tide is the rising and falling of the ocean water against the shore. The water is high on the shoreline during ***high tide***, and it is low on the shoreline during ***low tide***. This happens because a bulge is created in the ocean from the gravitational pull of the moon and the sun. The water on the sides of the earth that face toward and away from the moon feel a stronger force, or pull, on them. This motion creates a low tide and a high tide twice each day, with one slightly higher than the other.

☐ Tide Flip-Book Activity

Have the children draw a simple beach picture with the water at a low level on one index card. (This represents low tide.) On the next, have them draw the same picture with the water at a slightly higher level on the sand. They should continue drawing slight increases in the water height until the eighth index card. (This card represents high tide.) Then have the children begin drawing the water receding from the sand gradually, until it is back at the beginning level. Place a binder

Read to the children: These are skeletons of creatures that live within the intertidal zone. Looking at their skeletons, what characteristics do you notice that would allow them to live in their changing environment? [Discuss size, shape, color, and other characteristics—such as how a starfish's tube feet help it adhere to rocks in the tide pool, the shape of shells can help animals avoid drying out, spiral-shaped shells can become homes to hermit crabs or other small creatures, and a shell's color can help protect a sea creature against predators by blending into its environment.] ***Note:* In most places it is illegal to take live sand dollars from their environment.**

Other organisms that live in the intertidal zone include barnacles, mussels, sea anemones, hermit crabs, crabs, sea sponges, sea lettuces, sea cucumbers, sea urchins, algae, and sea birds. We will continue to learn more about these amazing organisms God has created in upcoming lessons.

☐ **Lesson 3 Extension** 7-8

Have students grades 7–8 complete the self-directed Lesson 3 extension titled "The Ocean's Life-Sustaining Movements" in their student journals.

A Life on the Ocean Wave

By Epes Sargent (1813–1880)

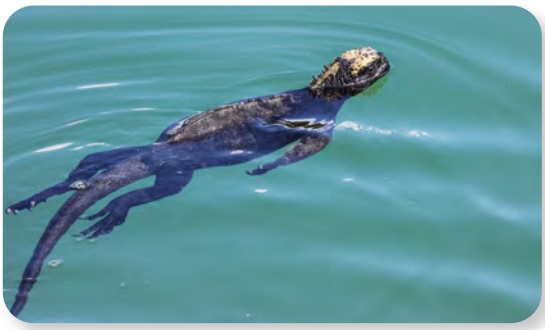
A life on the ocean wave,
A home on the rolling deep,
Where the scattered waters rave,
And the winds their revels keep!
Like an eagle caged, I pine
On this dull, unchanging shore:
Oh! give me the flashing brine,
The spray and the tempest's roar!
Once more on the deck I stand
Of my own swift-gliding craft:
Set sail! farewell to the land!
The gale follows fair abaft.

We shoot through the sparkling foam
Like an ocean-bird set free;—
Like the ocean-bird, our home
We'll find far out on the sea.
The land is no longer in view,
The clouds have begun to frown;
But with a stout vessel and crew,
We'll say, Let the storm come down!
And the song of our hearts shall be,
While the winds and the waters rave,
A home on the rolling sea!
A life on the ocean wave!

Coral Picture Activity

The first one is called the saltwater crocodile. Most crocodiles live in fresh water, but there are a few that live in salt water. Some species are less aggressive than others, and some crocodilian mothers build a nest for their eggs and guard them until they hatch.

Another marine reptile is the sea snake. These snakes have flat tails that work like paddles to help them swim. They also have flaps that close down over their noses when they swim so that water does not flow in. Eels look like sea snakes, but they are not; they are actually fish.



Although most lizards live on land, there is one type of lizard called the marine iguana that swims in the ocean. It also has a flat tail to help it swim. Marine iguanas eat algae, including kelp.

We have already mentioned sea turtles, but let's learn more about them. Sea turtles lay eggs on land, usually in the same place they hatched. When the baby sea turtles break open their eggs, they scurry to the ocean,

trying to avoid predators. Adult sea turtles live to be between 60 and 100 years old. The largest sea turtle found was a leatherback sea turtle, and it weighed more than 900 kg (2,000 lb)!

☐ Sea Turtle or Turtle Activity

Lay out the characteristic tiles before the children and show them the sheet titled "Sea Turtle or Turtle." Have the children read each characteristic and place it by either the sea turtle or the turtle. Answers are in orange below.

☐ Lesson 8 Extension

7-8

Have children grades 7–8 complete the self-directed Lesson 8 extension titled "Marine Organism Adaptations" in their student journals.

"Sea Turtle or Turtle" answers: cannot pull inside its shell [sea turtle]/can pull inside its shell [turtle]; has claws [turtle]/does not have claws [sea turtle]; most do not hear well [turtle]/has good hearing [sea turtle]; has flippers [sea turtle]/has webbed feet [turtle]; lives on land and in fresh water [turtle]/lives in the ocean except when nesting [sea turtle]; some migrate great distances [sea turtle]/does not migrate [turtle]

SHARKS

Objective

Help the children learn about the characteristics and variety of sharks in the ocean.

Preparation:

- ☐ Cut out the "Shark Facts Puzzle Pieces."

Activity Supplies:

- Scissors
- Glue stick (optional)

Experiment Supplies:

- 1 small can of tomato juice or bottle of lemon juice
- Tablespoon and teaspoon measuring spoons
- Permanent marker
- 8 paper cups
- Water

☐ Sharks Are a Type of Fish

Read to the children: What do you think of when you hear the word "shark"? Many people think of sharks as scary creatures! It is true that they have powerful jaws and razor-sharp teeth, but we will discover many more interesting things about sharks in this lesson.

Did you know that sharks are a type of fish? Most fish have bony skeletons, but sharks have cartilage skeletons. They belong to the class of Chondrichthyes [con–DRIK–theez]. In Greek, *chondro* [CON–dro] means "cartilage," and *ichthys* [IK–theez] means "fish," so the name literally means "cartilage fish." Feel your ears and the tip of your nose. Do you feel how soft and flexible they are? They are made of cartilage. The rest of your body contains bones. The skeletons of sharks, which are made of cartilage rather than bone, help sharks to be more flexible.

☐ Shark Facts Puzzle Activity

Give the children the "Shark Facts Puzzle Pieces" that you cut out before starting the lesson. Read to the children: Sharks have highly developed bodies that help them survive in their environments. They have several fins to help them maneuver in the water as they swim. Some deep-sea sharks are also bioluminescent. Let's learn more about sharks with this puzzle. **Have the children assemble the puzzle, using the puzzle grid if needed, while reading the information on each piece.**

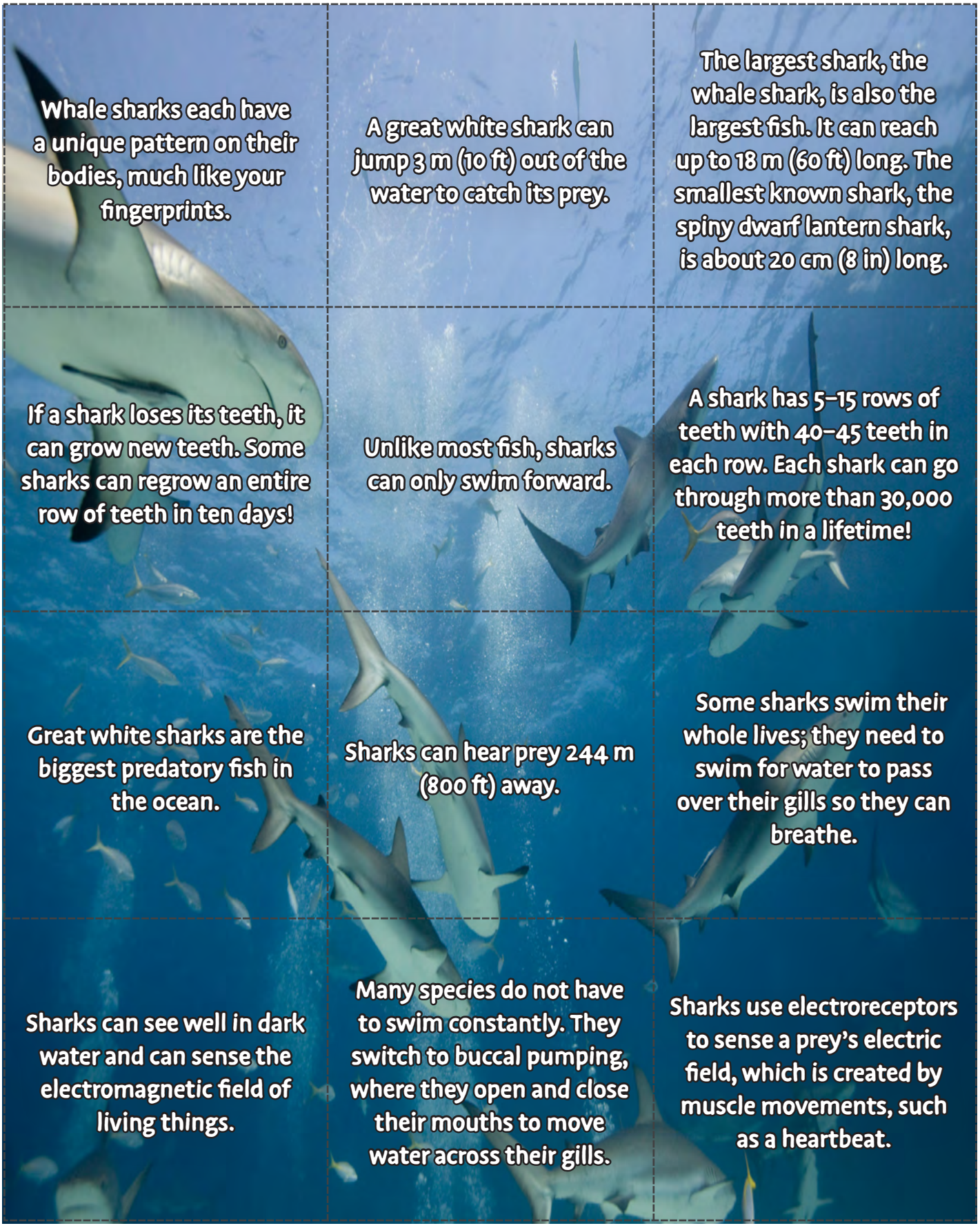
☐ Shark's Sense of Smell Experiment

WATCH ONLINE

Have the children follow the steps below to complete the "Shark's Sense of Smell Experiment" or watch the video titled "How Good is a Shark's Sense of Smell Experiment" at goodandbeautiful.com /sciencevideos or on the Good and Beautiful Homeschool app.

Carefully pass around tomato juice or lemon juice and ask the children to smell it. What did you need to do to

SHARK FACTS PUZZLE PIECES



Whale sharks each have a unique pattern on their bodies, much like your fingerprints.	A great white shark can jump 3 m (10 ft) out of the water to catch its prey.	The largest shark, the whale shark, is also the largest fish. It can reach up to 18 m (60 ft) long. The smallest known shark, the spiny dwarf lantern shark, is about 20 cm (8 in) long.
If a shark loses its teeth, it can grow new teeth. Some sharks can regrow an entire row of teeth in ten days!	Unlike most fish, sharks can only swim forward.	A shark has 5–15 rows of teeth with 40–45 teeth in each row. Each shark can go through more than 30,000 teeth in a lifetime!
Great white sharks are the biggest predatory fish in the ocean.	Sharks can hear prey 244 m (800 ft) away.	Some sharks swim their whole lives; they need to swim for water to pass over their gills so they can breathe.
Sharks can see well in dark water and can sense the electromagnetic field of living things.	Many species do not have to swim constantly. They switch to buccal pumping, where they open and close their mouths to move water across their gills.	Sharks use electroreceptors to sense a prey's electric field, which is created by muscle movements, such as a heartbeat.

MARINE MAMMALS
PART 2

Objective

Help the children learn about the characteristics and variety of whales, dolphins, and porpoises in the ocean.

Preparation:

- ☐ Cut out the sheets titled "Whale Tails." Be sure to keep the whale strips in order of shortest tail to longest tail.

Activity Supplies:

- Skein of yarn or sidewalk chalk
- Measuring tape (optional)
- Scissors
- Glue stick

Experiment Supplies:

- Hair comb
- Water
- Small bowl
- Cup
- Handful of cereal, grapes, raisins, or other small food items

☐ Cetaceans

Read to the children: In the Bible we read, "And God created great whales, and every living creature that moveth, which the waters brought forth abundantly, after their kind" (Genesis 1:21). In the last lesson, we learned about the Pinnipedia suborder and the Sirenia and Carnivora orders of the marine mammals. In this lesson we are going to learn about the order Cetacea [si–TAY–shuh].

I'm going to give you a clue about one of the three mammal groups in this order. See if you can guess what mammal it is. This mammal loves to jump and play. It has a long snout and a skinny body. It communicates with others of its kind by creating a variety of sounds that include whistle, click, bark, and yelp sounds. Do you know what this Cetacean [si–TAY–shun] is? It is a dolphin! The two other mammal groups in this order are porpoises and whales. All these species breathe air and live their entire lives in the water. Dolphins, whales, and porpoises have fins, flippers, and tail flukes to swim. They may look similar to fish, but fish swim by moving their bodies from side to side, and cetacean mammals swim by moving their bodies up and down.

Whales, which are part of the order Cetacea, are divided into two main categories: ***toothed whales*** and ***baleen whales***.

Echolocation and Sounds

Read to the children: Toothed whales have a mass of tissue in their foreheads called a *melon*. Scientists believe that it is from this organ that toothed whales are able to use ***echolocation***. Let's break down this word. What does "echo" mean? [a sound that bounces off an object and returns as a repeated sound] What does "location" mean? [place or position] Animals can use echoes, or sounds, to travel and to find the location, or place, of food. Toothed whales and dolphins produce specific signals, whistles, and clicking sounds that move throughout their environments as sound waves. Those sound waves echo, or bounce, off the objects around them and return to the whales. The whales are then able to interpret the sounds and use this information to determine the size and distance of objects around them.

Science Wall

Place the vocabulary card ECHOLOCATION on your science wall. Read and discuss the word and definition.

Listen to Whale Sounds Activity

Read to the children: Baleen whales also make noises, but scientists believe their sounds may be used for navigation and communication rather than echolocation.

The sounds these whales make are varied and fascinating.

Visit goodandbeautiful.com/sciencevideos or the Good and Beautiful Homeschool app and listen to the "Lesson 12 Whale Sounds" audio to hear noises that toothed and baleen whales make.

Whale Tails Activity

With this activity the children will be able to visually see the length of each whale. This can be done in your home with yarn, but the longer strings will need to be stretched throughout your home. Alternatively, if the weather and circumstances permit, this activity can be done outside by marking a sidewalk or long driveway with sidewalk chalk. Measurements can be made either by taking steps as indicated or by using a measuring tape.

Give a child the skein of yarn and have another child hold one end of the yarn (without unraveling it yet). As you read the facts about the harbor porpoise, have the child holding the skein take five steps away from the other child while gently unraveling the yarn. Tell the children that this represents the length of the harbor porpoise. Continue with each of the whales, in order of length, adding the necessary steps and unraveling the yarn accordingly. (The additional steps needed are noted on each sheet.)

Lesson 12 Extension

7-8

Have children grades 7–8 complete the self-directed Lesson 12 extension titled "Whales Use Sounds to 'See' and 'Talk'" in their student journals.

Whale Tails

1 Harbor Porpoise
1.5 m (5 ft) (5 steps)

- Among the smallest marine mammals
- Can live up to 24 years
- Sometimes travel far upriver, away from their ocean homes
- Make varied sounds, some at frequencies humans cannot hear
- Tend to be shy, solo animals
- Hunt small fish and squid
- Often found close to the shore

2 Bottlenose Dolphin
4 m (13 ft) (+8 steps)

- Very social; help each other when mothers give birth
- Communicate with each other and can make very loud noises
- Age can be determined by the number of layers in their teeth
- Can stay underwater for around 12 minutes
- Can jump up to about 5 m (16 ft) out of the water
- Live in oceans, bays, and river estuaries
- Can stun prey with tail and swallow prey whole
- Work together to hunt for food

3 Beluga Whale
4.3 m (14 ft) (+1 step)

- Belong to large social pods of hundreds or even thousands
- Closely related to the narwhal
- Known as “sea canaries” because they are one of the most vocal of all whales
- Can move their heads up and down and side to side
- Like other Arctic whales, do not have dorsal fins
- Can swim backward

4 Narwhal
4.9 m (16 ft) (+2 steps)

- Usually only males develop tusks
- Known as “unicorns of the sea” because of their long, tusklike tooth
- The spiral tusk can bend nearly a foot before breaking
- Live their lives in the frigid waters of the Arctic
- Tusks can grow up to 3.1 m (10 ft) long
- Tusks are used to hunt and stun prey and find a mate
- Can dive up to 1.6 km (1 mi) deep and pop up between broken pieces of the ice to breathe

MARINE BIOLOGY

Grades 3-6

STUDENT JOURNAL

This journal belongs to:

THE GOOD AND THE BEAUTIFUL

INSTRUCTIONS

This student journal accompanies *The Good and the Beautiful Marine Biology* science unit. It contains all the activity and journal pages that are needed to complete the unit. Each student will need a copy of the science journal.

Have each student spend enough time to create high-quality work as the activities and worksheets are completed. Students may enjoy looking back on their past discoveries after they've finished.

TABLE OF CONTENTS

Lesson 1

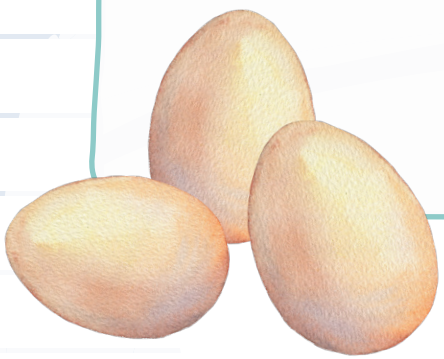
HOW SALT AFFECTS BUOYANCY EXPERIMENT

MY HYPOTHESIS:

Control	Salt	Sugar
I predict the egg in the water will	I predict the egg in the salt water will	I predict the egg in the sugar water will

MY RESULTS:

Control	Salt	Sugar
The egg in the water	The egg in the salt water	The egg in the sugar water



OCEAN LIFE CLASSIFICATION

Fungi can live here.

The smallest living things in the ocean belong to this kingdom.

Bioluminescence can make these appear as if they are glowing.

An estimated 80% of all living creatures make their home here.

This is the number of groups or kingdoms of marine life classifications.

Members of this kingdom can be both vertebrates and invertebrates.

Most of this kingdom lives on land. Seaweed are algae that belong to this kingdom.

This is the main food source that almost all marine life depends on.

When they cover vast areas, they are known as seagrass _____ .

Most of these live near the ocean's surface.

The blue whale is the _____ animal on the planet.

P	D	Y	V	C	P	R	O	M	K	B	M	G	T	W	V	A	N
K	W	O	U	E	U	H	H	R	F	C	Z	J	K	C	F	W	Z
Z	A	N	I	M	A	L	K	X	T	V	J	B	X	B	N	O	N
L	A	R	G	E	S	T	P	L	A	N	T	S	Q	F	B	C	O
K	M	P	E	V	G	B	A	C	T	E	R	I	A	L	N	Y	M
F	I	S	H	Y	D	V	Z	M	G	G	N	C	B	O	V	Y	G
V	S	M	P	V	X	O	B	R	Z	L	R	Q	F	O	J	F	A
I	C	G	T	Y	P	R	O	T	I	S	T	S	I	R	K	U	L
J	E	L	L	T	X	U	P	G	L	V	X	J	V	C	N	N	G
M	E	A	D	O	W	S	U	V	E	I	S	B	E	O	Z	G	A
W	Z	R	O	Q	C	M	P	C	J	W	J	A	Y	B	B	I	E
E	S	X	F	P	B	N	L	G	I	U	O	C	E	A	N	L	D

Lessons 6–7

My Marine Invertebrates Booklet

Cnidarians

CORALS, JELLYFISH, AND ANEMONES

Cnidarian Facts

Jellyfish

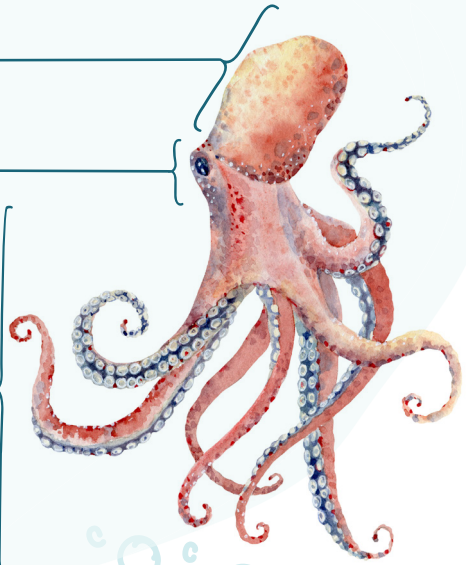
Anemones

Mollusks

MUSSELS, CLAMS, SNAILS, SQUID, AND OCTOPUSES

WORD BANK

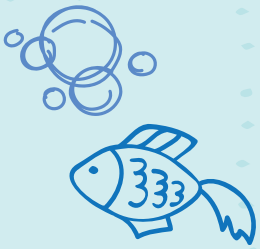
head / muscular feet / visceral hump

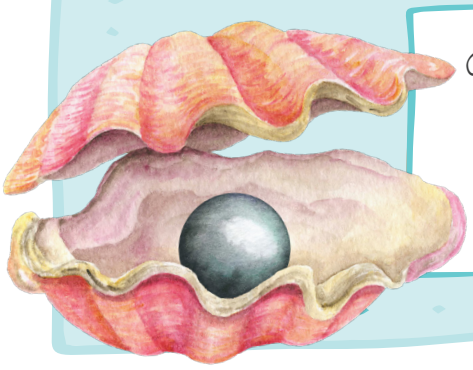


Bivalve Mollusks

MUSSELS AND CLAMS

How many shells do bivalve mollusks have?





Circle the correct answer. All bivalve mollusks can make pearls.

TRUE / FALSE

MARINE REPTILES

Circle the correct word in each sentence.

Most crocodiles live in fresh / salt water.

The marine iguana / crocodile has a flat tail to help it swim in the ocean.

Marine iguanas eat kelp / plankton and algae.

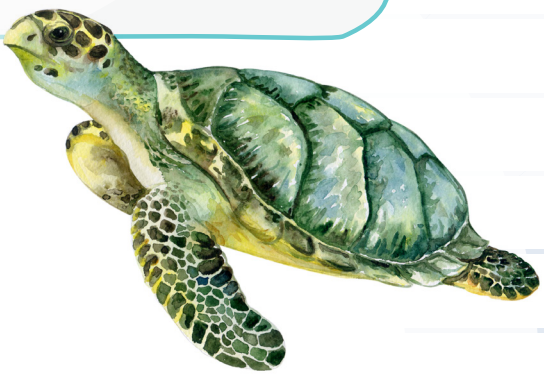
A sea snake's flat tail works like a paddle / fin to help it swim.

Sea turtles / snakes have flaps that close down over their noses so that water does not flow in.

Sea turtles / snakes live between 60 and 100 years.

The largest sea turtle in the world is the loggerhead / leatherback.

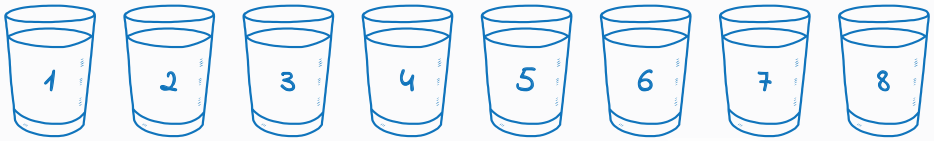
Sea turtles lay eggs in the same place where they were born / hatched.



SHARK'S SENSE OF SMELL EXPERIMENT

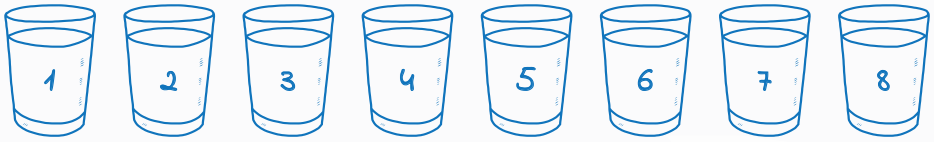
MY HYPOTHESIS:

In which cup will I notice the smell first? Color it in.



MY RESULTS:

In which cup did I notice the smell first? Color it in.

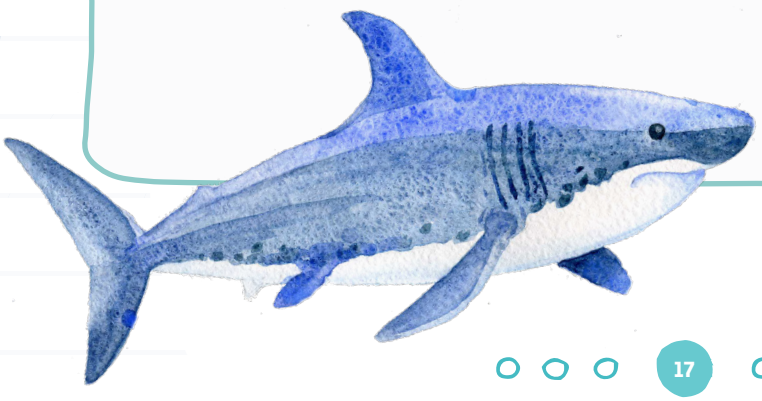


What part am I able to smell? Circle it.

- 1 part per 10
- 1 part per 100
- 1 part per 1,000
- 1 part per 10,000
- 1 part per 100,000
- 1 part per 1,000,000
- 1 part per 10,000,000
- 1 part per 100,000,000

FACTS:

What facts have you learned about a shark's sense of smell?



MARINE BIOLOGY

Grades 7-8

STUDENT JOURNAL

This journal belongs to:

THE GOOD AND THE BEAUTIFUL

INSTRUCTIONS

This student journal accompanies *The Good and the Beautiful Marine Biology* science unit. It contains all the activity and journal pages that are needed to complete the unit. Each student will need a copy of the science journal.

The *Marine Biology* lesson extensions are also found here. These extensions are optional for older students (grades 7–8) to complete on their own. Each extension is accompanied by lined paper so the student can keep his or her work in one place.

Have each student spend enough time to create high-quality work as the activities and worksheets are completed. Students may enjoy looking back on their past discoveries after they've finished.

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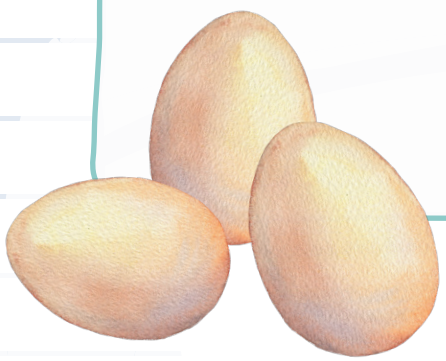


EXTENSION

Instructions:

1. Read the article below.
2. Pretend you are a reporter writing about the cargo spill. Write a newspaper headline about it.
3. List 3–5 facts about the spill and what scientists learned from it that you would include in a newspaper article.

What a Colorful Cargo Spill Taught Us About Ocean Currents

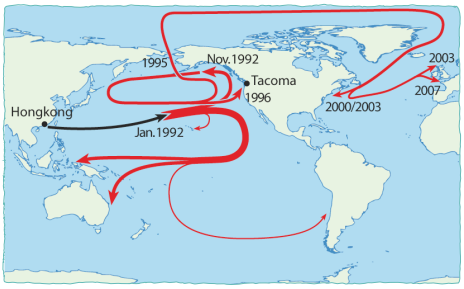
In 1992 a cargo ship in the Pacific Ocean lost a crate carrying 28,800 colorful plastic bath toys—yellow ducks, green frogs, blue turtles, and red beavers. The ship was carrying the toys from Hong Kong, China, to the United States when a storm washed the shipping container overboard. Few people could have guessed what these rubber duckies and other toys traveling the world would teach us about the ocean!

How is it possible that these bath toys traveled the world? Ocean ***currents*** carried them. A current occurs whenever something like water, air, or energy travels in a specific direction—a flow. Regions of the ocean flow in a specific direction. Look again at the "Ocean Currents" page from the lesson and notice the flow of the warm and cold water.

Currents not only affect where spilled cargo goes, but they also affect marine life. Ocean currents move the water, heat, nutrients, and oxygen on which marine organisms depend.

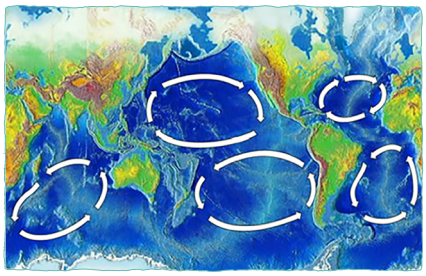
Living things themselves are moved along by ocean currents. Plankton, which are eaten by many animals, are moved by these currents. Many animals that swim freely as adults are unable to move much on their own until adulthood and are pushed by currents until that stage. Other organisms that end up anchored to the seafloor, such as coral and mussels, begin as larvae that drift in the currents.

An oceanographer named Dr. Curtis Ebbesmeyer studied ***flotsam***, the wreckage of a ship or cargo that is floating in the water, to learn more about ocean currents. In 1990, when a load of Nike sneakers and other shoes were knocked off a ship, he enlisted a team of beachcombers to help him track them. When he heard about the colorful bath toy flotsam in 1992, he began tracking where the rubber duckies and other toys washed up, too. Based on this and other data, Dr. Ebbesmeyer created computer models to follow and predict currents. He predicted many of the toys would wash up on the shores of the state of Washington, USA, in 1996. He was correct!



The bath toys traveled the world.

Now, decades later, some of those colorful animal toys are still traveling the ocean. Some have washed up on various shores—Alaska, Hawaii, Australia, Washington, Oregon, and South America. A few have ended up as far away as Eastern Canada and Western Europe. Some toys have even been found frozen in Arctic ice. A couple thousand are stuck in the northern Pacific Ocean, traveling round and round in a circular ocean current known as a ***gyre*** [JIRE]. Scientists knew about this North Pacific Gyre, one of five major ocean gyres, but they did not know how long it took for water to travel in one complete orbit of this gyre. Now, thanks to the little floating toys, they know it takes about three years.



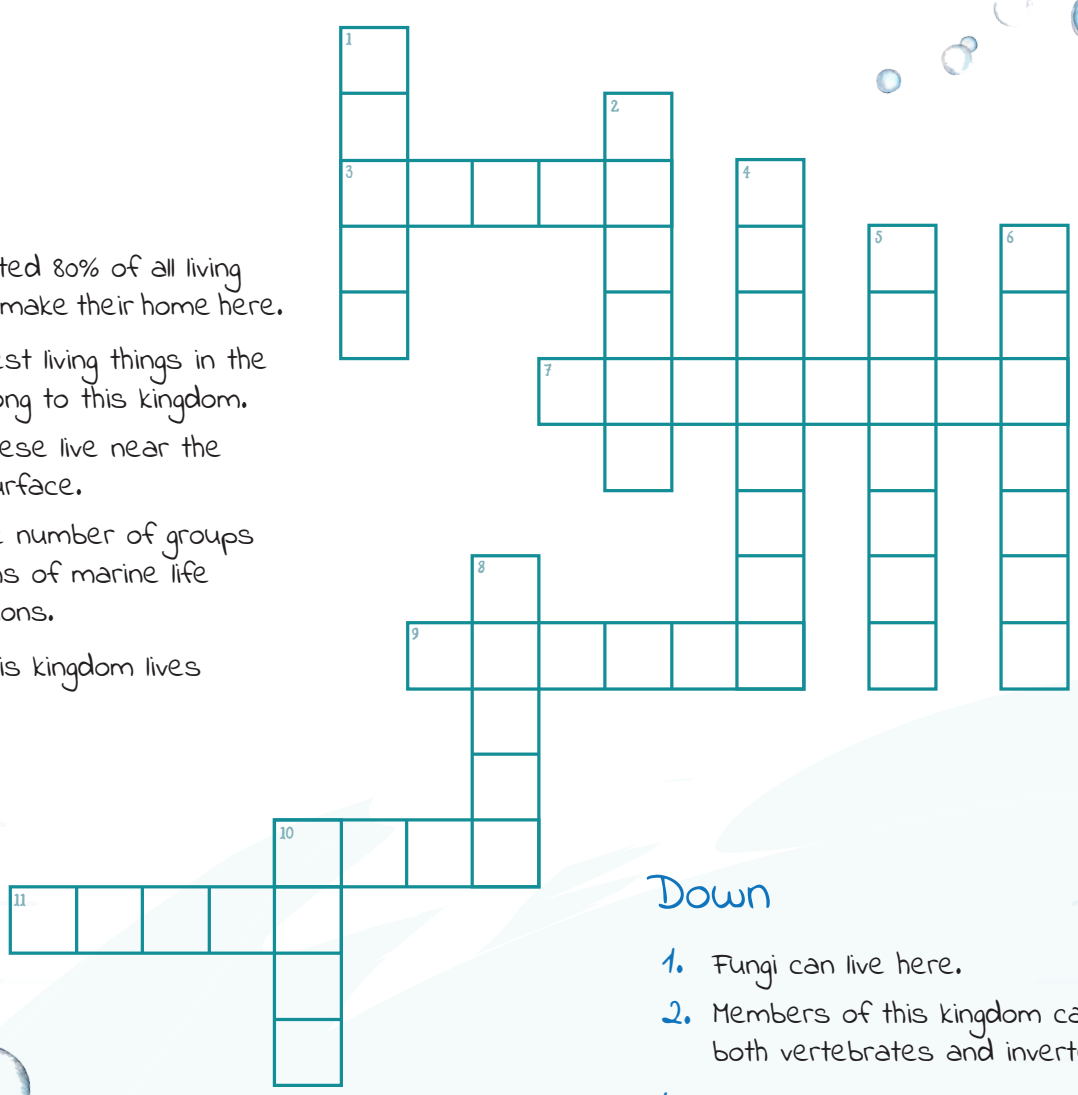
World seawater moves in five main gyres.

Traveling on the Currents

Traveling across the ocean is much easier and faster when you follow the currents rather than going against them. Benjamin Franklin is credited with being the first to chart the path of the Gulf Stream, a strong ocean current from the Gulf of Mexico to the Atlantic Ocean. He used that knowledge to plot new courses to and from the American colonies in the 1700s. These new routes shaved weeks off travel time and reduced the cost of goods going to and from the colonies.

Lesson 4

OCEAN LIFE CLASSIFICATION



Across

3. An estimated 80% of all living creatures make their home here.
7. The smallest living things in the ocean belong to this kingdom.
9. Most of these live near the ocean's surface.
10. This is the number of groups or kingdoms of marine life classifications.
11. Most of this kingdom lives on land.

Down

1. Fungi can live here.
2. Members of this kingdom can be both vertebrates and invertebrates.
4. Seaweed are algae that belong to this kingdom.
5. The blue whale is the _____ animal on the planet.
6. When they cover vast areas, they are known as seagrass _____.
8. This is the main food source that almost all marine life depends upon.
10. Bioluminescence can make these appear as if they are glowing.

EXTENSION

Instructions:

1. Read the information and view the charts.
2. Follow the directions and, using the "Shark and Ray Family Dichotomous Key," read the descriptions to see which shark or ray family fits that description. Write its name next to the correct picture. Refer to "Parts of a Shark" as needed.

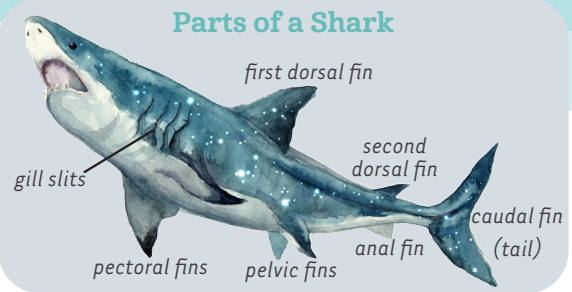
Getting More Specific with Sharks

To classify organisms more specifically, scientists group them by certain characteristics, such as physical features or behaviors. A tool called a ***dichotomous*** [die–KAH–ti–mis] ***key*** can help identify an organism using the process of elimination. To use a dichotomous key, look at an organism or a picture of one. In this case, look at one of the lettered pictures on the next page, starting with animal A. (Rays are in the same class as sharks.) Starting with sentence #1A at the top of the key, read the pairs of statements on the "Shark and Ray Family Dichotomous Key." Notice that statements are grouped in twos; the prefix *di-* means "two." Choose the statement that correctly describes animal A. Continue to identify each shark or ray. Always start back at the beginning of the key to identify the next animal and write the correct type of animal on the line next to each shark or ray.

Shark and Ray Family Dichotomous Key

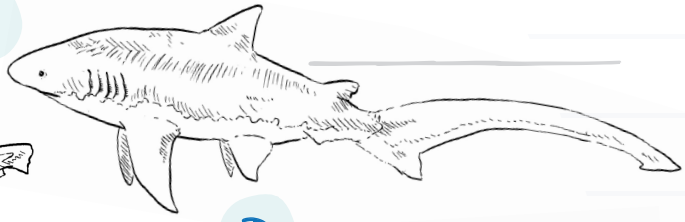
1A	The body is the shape of a kite.	*Go to #12*
B	The body is not the shape of a kite.	*Go to #2*
2A	There is no pelvic fin, and the nose looks like a saw.	*Sawfish*
B	There is a pelvic fin.	*Go to #3*
3A	There are six gill slits.	*Cow Shark*
B	There are five gill slits.	*Go to #4*
4A	There is only one dorsal fin.	*Cat Shark*
B	There are two dorsal fins.	*Go to #5*
5A	The mouth is at the front of the face like a human's, giving it a small nose.	*Whale Shark*
B	The mouth is on the underside of the head.	*Go to #6*
6A	The head goes out on the sides, and eyes are on the extensions.	*Hammerhead Shark*
B	The head does not go out on the sides.	*Go to #7*
7A	The top half of the caudal fin is the same size and shape as the bottom half.	*Mako Shark*
B	The top half of the caudal fin is different in shape and size from the bottom half.	*Go to #8*
8A	The first dorsal fin is very long, almost half as long as the body.	*False Cat Shark*
B	The first dorsal fin is regular length.	*Go to #9*
9A	The caudal fin is very long, almost as long as the body.	*Thresher Shark*
B	The caudal fin is regular length.	*Go to #10*
10A	There is a long point (like a needle) on the end of the nose.	*Goblin Shark*
B	The nose does not have a long point.	*Go to #11*
11A	There is no anal fin.	*Dogfish Shark*
B	There is an anal fin.	*Requiem Shark*
12A	There is a small dorsal fin near the end of the tail.	*Skate*
B	There is not a small dorsal fin near the end of the tail.	*Go to #13*
13A	The front of the animal has two points that look like horns.	*Manta Ray*
B	The are no points that look like horns.	*Stingray*

Parts of a Shark

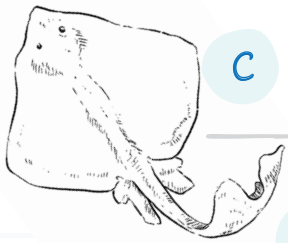


A

B

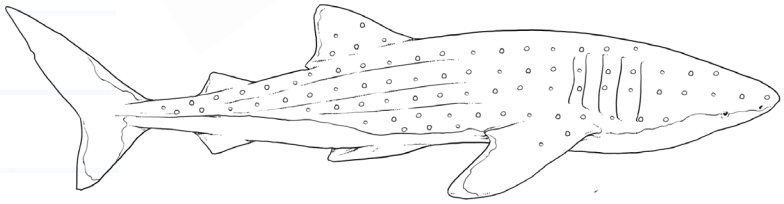


C

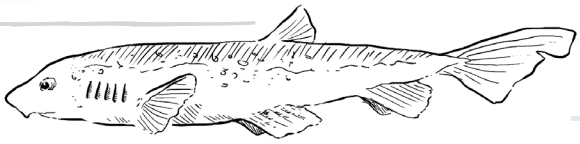


D

E



F



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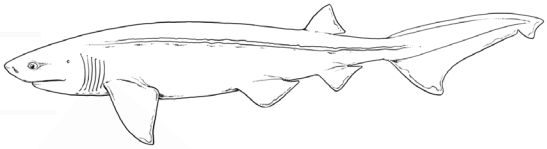
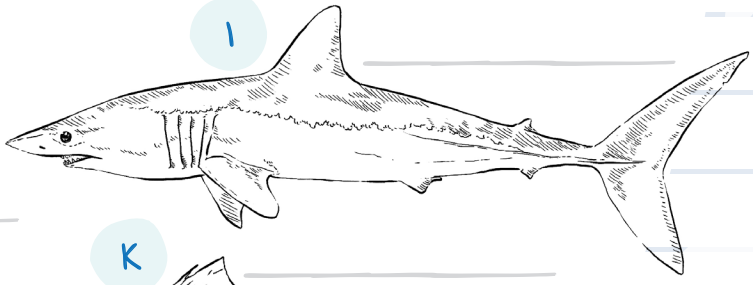
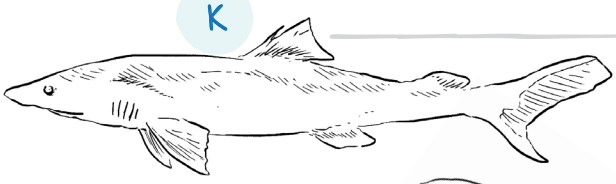


I



J

K



L

M

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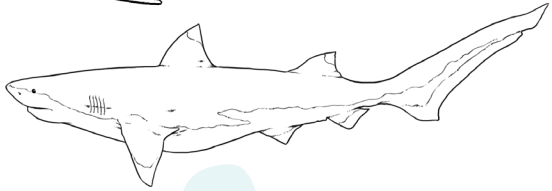


Lessons 6–7

My Marine Invertebrates Booklet

Cnidarians

CORALS, JELLYFISH, AND ANEMONES

Cnidarian Facts

Jellyfish

Anemones

Echinoderms

STARFISH, SAND DOLLARS, SEA CUCUMBERS, AND SEA URCHINS

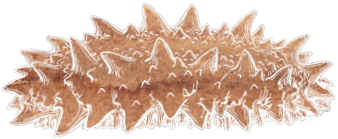
Echinoderm Facts

Feeding Echinoderms

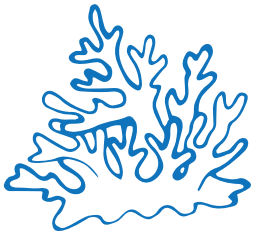
Sea Urchin

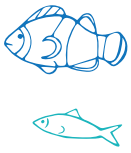
Starfish

Sea Cucumber



Sand Dollar





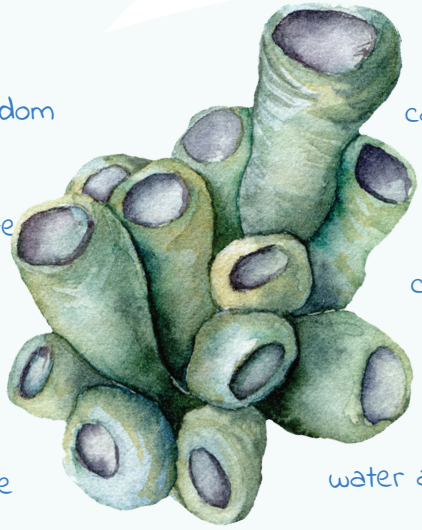
Sponges

belong to the _____ kingdom

need only_____ cell to survive

are like a _____ system

need _____ to survive



can be used for _____

can live at _____ depth

water and food flow through _____

EXTENSION

Instructions:

1. Read the article.
2. Fill in the infographic on the next page.

Case Study of the Colossal Squid

Throughout history, there have been fantastical legends about giant octopuses or other sea creatures that attack ships. While we do not know of any species of octopus large enough to attack a ship, there are some very large species of squid.

The largest squid, in terms of mass, is the colossal squid *Mesonychoteuthis* [MEE–zaw–nih–koe–TOO–ih–this] *hamiltoni*, for the Greek words *meso,* meaning "middle"; *onycho,* meaning "claw"; and *teuthis,* meaning "squid." The beak of a colossal squid, made of the hard material chitin, is shown here. It looks like a parrot's beak.

Smithsonian Institution

We did not even know of the existence of the colossal squid until 1925, when some unknown arms were found in the stomach of a sperm whale. Since then, we have learned what we know of the colossal squid through just a few specimens. Current estimates suggest an adult colossal squid may reach a maximum size of 12–14 m (39–46 ft) and weigh 750 kg (1,650 lb). If these are accurate, the colossal squid is the largest known invertebrate on the planet!

In February 2007 a New Zealand fishing crew in Antarctic waters hauled in their gear and found a nearly dead colossal squid munching on a fish they had caught. The crew tried to free the squid by making it let go of the fish, but it would not. They tried freeing the fish from the line, but they could not. They set about collecting the squid for transport back to New Zealand. It took the crew two hours to get the 495-kg (1,091-lb), 4.5-m (15-ft) cephalopod aboard!

Colossal squid are rarely found and live in deep ocean waters. They are aggressive hunters with the largest beaks of any squid, which they use to tear through prey. If that is not dangerous enough, they also have 25 rotating hooks split among two rows on the ends of each of their tentacles. We know very little about their diet, except that they like to eat large Patagonian toothfish, which is what that squid was clamped onto when the New Zealand fishing crew found it.

From what we can tell by examining the stomach contents of ocean creatures, the largest predators of colossal squid are sperm whales, the largest toothed predators on Earth.

So, whatever happened to the colossal squid caught by the fishing crew? It was transported back to New Zealand, frozen in a large cube of seawater, and handed over to the Museum of New Zealand Te Papa Tongarewa. It was carefully thawed over several days in a bath of icy seawater, partially dissected, and preserved for display. When workers dissected the squid, they found the largest eyes of any creature known: 27 cm (11 in) wide, and that was in its thawed, collapsed state! When the squid was alive, the eye was probably up to 40 cm (16 in) across, which is about the diameter of a large dinner platter.

The colossal squid is extremely rare but has been found occasionally. Who knows? Maybe the legends are true!

SHARK'S SENSE OF SMELL EXPERIMENT

MY HYPOTHESIS:

In which cup will I notice the smell first?

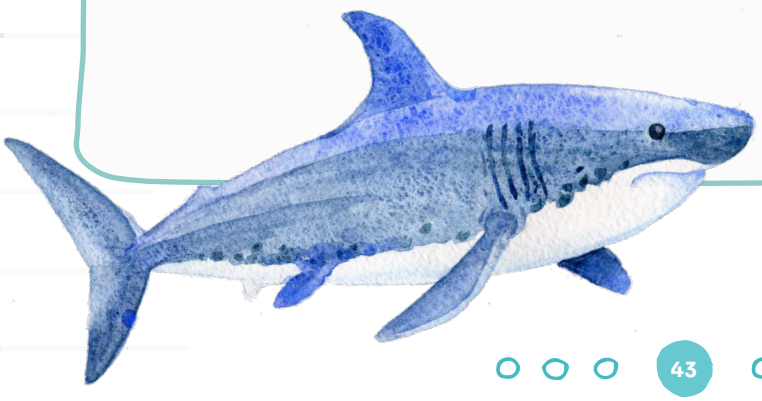
MY RESULTS:

In which cup did I notice the smell first?

What part am I able to smell? (Hint: use the chart in your course book.)

FACTS:

What facts have you learned about a shark's sense of smell?



EXTENSION

Instructions:

1. Read the information from the interview with Dr. David Shiffman.
2. In your science journal, write 2–3 questions that you would ask him about sharks or marine conservation if you could.
3. Copy the definitions into your science journal.

An Interview with a Shark Conservation Biologist

Dr. David Shiffman grew up reading every book about sharks that he could get his hands on. He loved sitting by the shark tank at the Pittsburgh Zoo, and, as soon as he was old enough, he learned to scuba dive and became a certified diver. For five years he attended a marine biology summer camp in the Florida Keys. Dr. Shiffman earned degrees in biology, marine biology, and ecosystem science and policy. He is interested in how humans conserve and manage chondrichthyan fishes (sharks and rays).

What first made you interested in marine biology? I've been interested in marine biology as long as my family can remember, even though we grew up far from the ocean. I've always known this is what I want to do with my life—but it's OK if you don't know what you want to be when you grow up yet!

Why does your work focus on sharks rather than another marine organism? I've loved sharks as long as my family can remember, and when I learned in later science classes that they are ecologically important and threatened with ***extinction***, that seemed like a worthy pursuit for my professional studies.

Why are sharks important to marine ecosystems? Predators are always important to healthy functioning ecosystems—they keep the food chain in balance by keeping prey populations under control. The same thing is true in the ocean; when we lose sharks, it can send ripple effects through the whole ecosystem—and the ocean is an ecosystem that billions of humans depend on for food.

What does conservation mean when it comes to sharks? Humans are killing too many sharks, mostly via unsustainable overfishing, either for their fins or for their meat, either intentionally targeting them or accidentally catching them as ***bycatch***. The goal of shark conservation is to reduce the number of sharks killed so that populations remain healthy. This does not mean no shark fishing ever; it means no unsustainable shark fishing.

What do you wish every 7th and 8th grader knew about shark conservation? Sharks are not a threat to humans. We're better off with healthy shark populations off our coasts than we are without them, and many species are in trouble. Fortunately, we can help save them!

What advice do you have for a junior high student interested in marine biology? Read everything you can. Take all the science and math and writing classes you can. Don't ask, "When will I need to know this?" Because if you want to be a scientist, you need to know this.

What can young people do to protect marine life? The single biggest thing that most people can do to help the ocean is to stop eating unsustainable seafood—you can eat ***sustainable*** seafood using guides like Seafood Watch. You can also reduce your ***carbon footprint***, use less plastic, and things like that. But overfishing is the greatest threat to marine ***biodiversity***.

Note: The Monterey Bay Aquarium Seafood Watch program at seafoodwatch.org makes recommendations about seafood caught or farmed in ways that are less harmful for the environment. Ask for permission before going online.

Definitions

Extinction: the dying out of a species

Bycatch: species not purposely caught when fishing

Sustainable: using natural resources in a way that could continue for a long time

Carbon footprint: the amount of carbon dioxide released into the atmosphere because of a person's energy use

Biodiversity: the variety of living things in a given place

HOW DO OCEAN ANIMALS STAY WARM EXPERIMENT

MY HYPOTHESIS:

Control

How long can I leave my hand in the icy water without protection?

With Protection

How long can I leave my hand in icy water with blubber protection?

MY RESULTS:

Control

How long was I able to leave my hand in the icy water without protection?

With Protection

How long was I able to leave my hand in icy water with blubber protection?

List two other benefits of blubber.