ANTARCTIC WEATHER MACHINE

GRADE LEVEL 4-5

ANTARCTICA EDUCATOR GUIDE


Photo: BBC NHU

ANTARCTIC WEATHER MACHINE

GRADE LEVEL 4-5

(1) 90 minute Lesson *OR*
(2) 45 minute Lessons

Standards (NGSS):

4-ESS2-2

Analyze and interpret data to describe patterns of Earth's features.

From the Film:

In the film, ***Antarctica***, we learn that ocean currents, wind patterns, and temperature shifts play a significant role in what happens across the entire planet. Due to its place on the South Pole and its unique characteristics, this continent can shift climates, affect the movement of air, and change what weather looks like in the places that we live.

Lesson Overview:

Students label and decorate a world map with ocean currents, wind patterns, and climate to represent the connections between Antarctica and their home. Students then construct an Antarctic Machine to represent how an event in Antarctica can result in an event where they live. When they are finished, they use their illustrated map to answer questions about how wind or ocean currents in Antarctica may affect other parts of the world. Emphasize that what happens here affects us all.

Materials:

- Map of the World
- Colored pencils
- Digital or printed access to:

  http://oceanmotion.org/html/impact/conveyor.htm

  http://oceanmotion.org/images/impact/global-currents.png

  https://www.youtube.com/watch?v=M0NoOtaFrEs&t=1s

- Data Sheets for students, pp. 42-45
- Global Weather Sctivity Sheet, p. 41
- Ping Pong balls (*one or more for each group)*
- Recycled materials like toilet paper, paper towel rolls, cardboard, plastic bottles
- Masking tape, duct tape, scotch tape
- Books *(to use as ramps)*
- String
- *If Available:*
  Toy cars, dominoes, ramps *(from car toy sets)*, small fans, pulleys.

ANTARCTIC WEATHER MACHINE

EDUCATOR PREP:

Ensure students have access to a physical or digital copy of the handout to use in creating their globes. Gather the materials for each group to be able to use in this activity.

EDUCATOR GUIDE:

1. In the film, ***Antarctica***, we learn that ocean currents, wind patterns, and temperature shifts play a significant role in what happens across the entire planet. Due to its place on the South Pole and its unique characteristics, this continent can shift climates, affect the movement of air, and change what weather looks like in the places that we live.

2. Inform students that today, we will create a model that will help to visualize and analyze how Antarctica seems so far away, but has a huge impact on what happens in our current location. This cause and effect relationship is similar to a domino effect or a Rube Goldberg Machine. Covid-19 is a great example as a virus that started in China has caused a domino effect of people getting sick, some dying, which led to closures of schools, shutting down of businesses, sports, etc.

Show students a video of a Rube Goldberg machine to show how something that happens in one place can affect things in another.

Here is a commercial for ***Goldie Blox*** toys using a Rube Goldberg device:
https://www.youtube.com/watch?v=M0NoOtaFrEs&t=1s

Ask students the following questions:

How did one single event inside the house cause something else to happen in another house down the block?

Answers will include descriptions of chain reactions as one thing causes another which causes another and so on.

How could you estimate the number of different things (or events) that happened between the first and the last?

Answers may vary, but could include: counting them, counting a set of them and then guessing based on that, or estimating using the distance from the beginning of the machine to the end.

Clouds over Mt. Erebus, Mcmurdo, Antarctica

Photo: Shutterstock / Michael Lodge

ANTARCTIC WEATHER MACHINE

Imagine if you could only see the first step and the last two steps and everything else was hidden behind a curtain. How could you piece together all the in-between steps?

If you are close enough to hear what was happening, you could record it and try to piece together the sequence of events. You could also use an imaging machine, like an x-ray machine that might be able to see through at least part of the curtain.

4. Inform students that the global weather patterns are like this Rube Goldberg machine, but even more interconnected and far reaching. Imagine instead of a machine, it is a house. When something occurs in one house it also has an effect on all of the houses around it. Not only that, it affects houses across the city. That's an accurate illustration of the impact Antarctica has on what happens across the globe.

5. Students will use the blank map of the earth to label the ocean currents, prevailing winds, and temperatures across the globe to try to illustrate how something that happens in Antarctica could impact where they live.

6. Pass out to students the blank map and divide them into pairs to work together.

7. Using sites like ***weather.com,*** the ***National Weather Service,*** or ***Accuweather data***, have students look up the high and low temperatures for this month, in a few major cities around the world, including the city in which they live. Label these temperatures on their map, near the cities.

a. Sydney, Australia
b. Toronto, Canada
c. Beijing, China
d. Johannesburg, South Africa
e. London, United Kingdom
f. McMurdo Station, Antarctica
g. San Francisco, United States
h. Buenos Aires, Argentina

8. Next, If using digital resources, help them navigate to the ***Ocean Currents*** data using:

http://oceanmotion.org/images/impact/global-currents.png

If using the printed format, pass out the map and help students understand what they are seeing. Ask students to look at the data and talk to their neighbor about what they notice.

9. Encourage students to draw and label the ocean currents on their own maps using a ***blue*** pencil.

Educator Notes:

ANTARCTIC WEATHER MACHINE

10. Once they finish the ocean currents in blue, direct them to use the map on their data sheets to label the prevailing wind currents in ***brown.*** Let students know that it's okay if some of their wind lines overlap with their ocean currents.

11. Inform students that their diagram shows how global currents, temperature, and wind can take something that happens in Antarctica and affect us where we live. Now, we will build a simple model of a chain reaction to show how this happens, their Antarctica Machine. Chain reactions are what caused the Rube Goldberg device at the beginning to work – one thing led to another, and then another, and then another and so on.

12. Divide the class into groups of four students. Give each group the materials that they will use to build their Antarctica Machine, including one or more ping pong balls, recycled materials like toilet paper and paper towel rolls, tape, dominoes, books, toy cars, small fans, duct tape etc. Each group should have access to the same materials.

13. Have students mark, using masking tape, on their table that their machine starts in Antarctica and finishes where they live.

14. Inform students that using the materials provided, they are to build a machine (no more than five steps) that shows effects of global warming, whaling, or pollution can travel from Antarctica to where they live.

15. Give students about 30 minutes to build their machine.

16. Once the students have a working model of the machine, do a gallery walk so that they can see what others have designed. To do this, have one person stay behind to demonstrate the machine while the rest of the group travels to other groups to hear about their model.

17. Instruct students to use their map to answer the questions on their reflection sheets and consider how something that happens in Antarctica could affect them where they live, or other places around the globe.

18. Remind students that heat is energy which cannot be destroyed. Since both water and air are able to hold and move heat around the globe ocean currents and wind patterns, in addition to direct sunlight have a big impact on temperature, precipitation, and overall climate in places.

A tropical storm comes ashore in the Caribbean.

Photo: Shutterstock / Drew McArthur

ANTARCTIC WEATHER MACHINE

19. After students have finished creating explanations for how what happens in Antarctica affects what happens where they live, go around the room and ask each pair to share some of their interpretations with the class. When responding to their explanation, focus on highlighting their thought process and analysis over whether their explanation is correct or not. For example, respond by saying"

> ***"Your connection between the ocean current around Antarctica and the one on the southern tip of South America also makes sense to me. Have you thought about...?"***

20. Wrap up the lesson by reminding students that through modeling and data analysis, scientists work hard to understand connections across seemingly disconnected events. This work is similar to the ***Rube Goldberg Machine,*** except that everything between the first and the last event is behind a curtain and scientists try to reveal or see those events. Today, they played the role of scientists and tried to peek behind the curtain and created a model of how different pieces interact across the globe.

Educator Notes:

Global Weather Activity Sheet

Directions: Use the following to collect information about weather patterns that connect Antarctica to where you live:

Where I live: ______________________

Closest Big City (*City, State, Country*): ______________________

Current Month of the Year: ______________________

City, Country	Average High Temp.	Average Low Temp.
My home		
McMurdo Station, Antarctica		
Buenos Aires, Argentina		
Beijing, China		
Johannesburg, South Africa		
London, United Kingdom		
San Francisco, United States		
Sydney, Australia		
Toronto, Canada		

Global Weather Activity Sheet

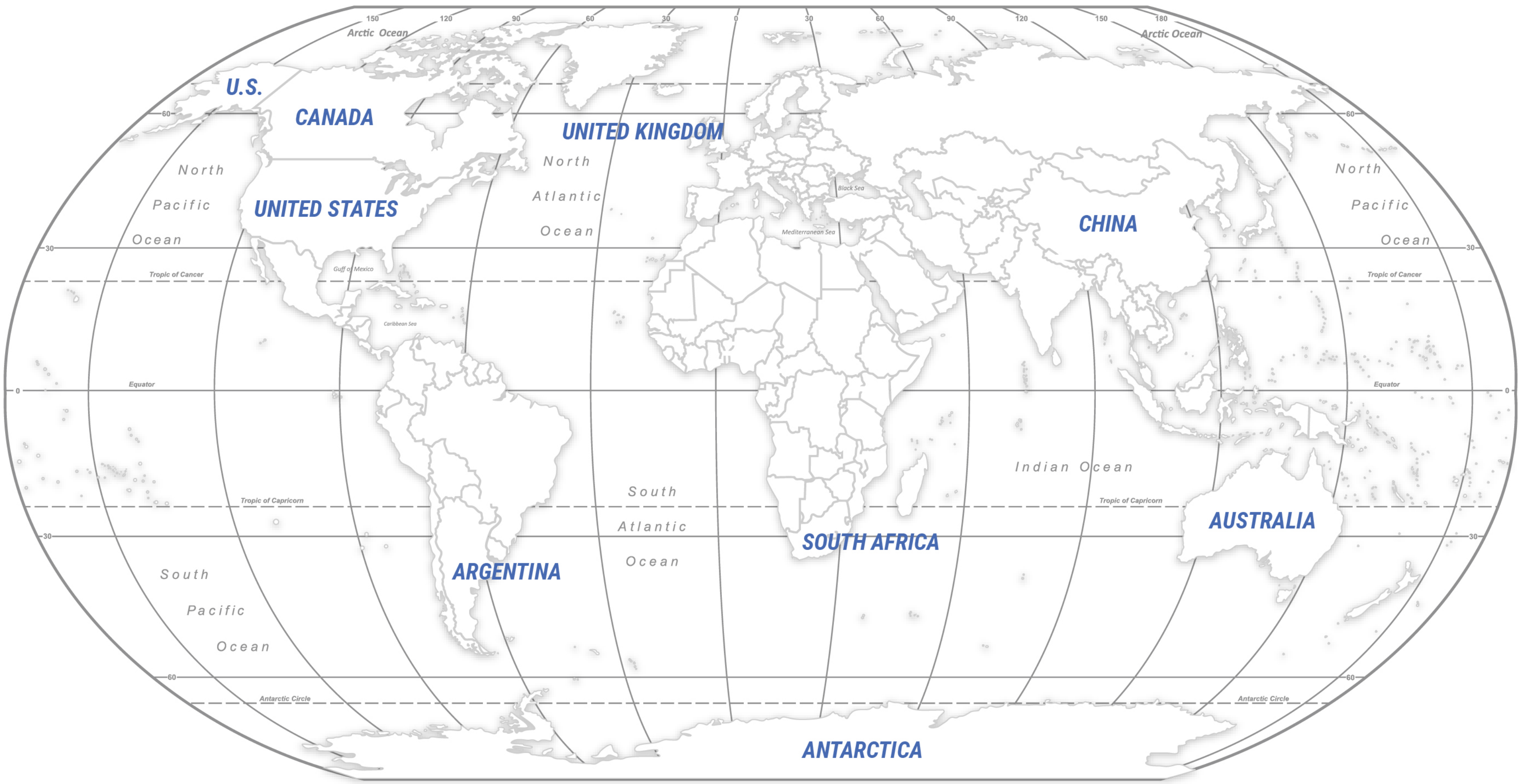
1. *Mark your hometown or closest big city on the map below.*

2. *Find the big cities and note their temperatures on the map below.*

3. *Draw the Ocean Currents in **blue** on the map below.**

4. *Draw the Prevailing Winds, in **brown**, from page #, on the map below.*

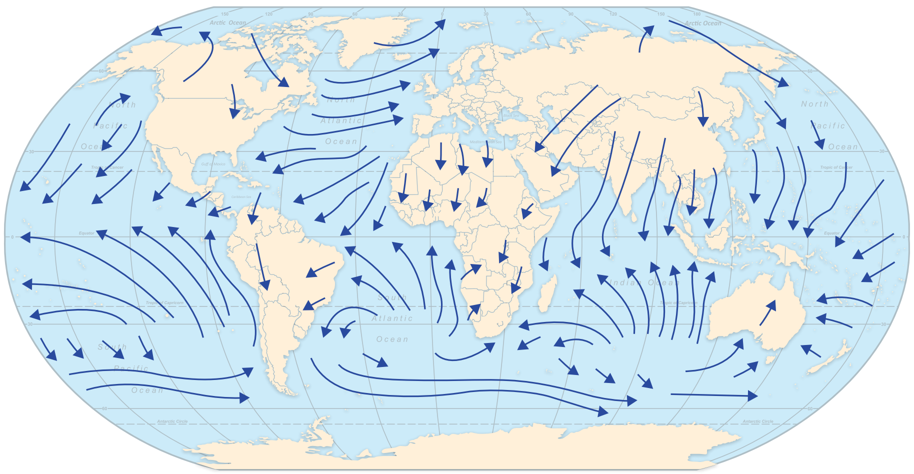
5. *Highlight a path from Antarctica to where you live, using the Ocean Currents and Prevailing Winds.*



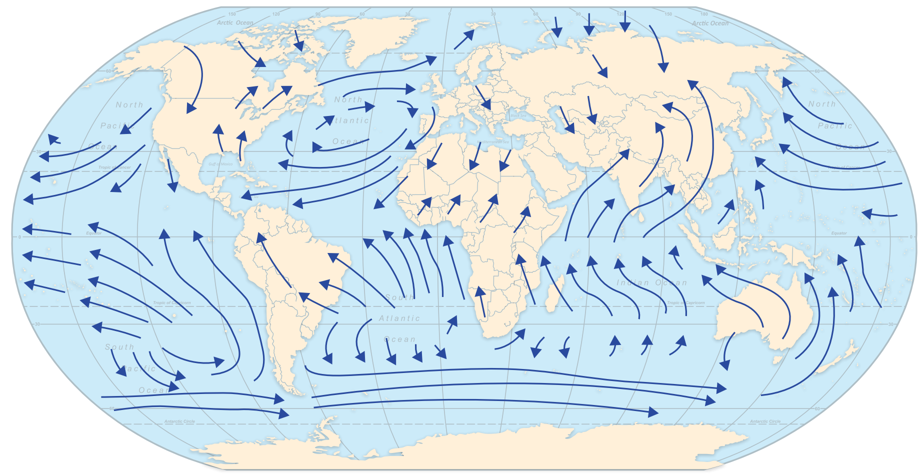
*Use http://oceanmotion.org/html/background/wind-driven-surface.htm to draw the ocean currents around the world.

Global Weather Activity Sheet

SEASONAL VARIATION OF GLOBAL WIND PATTERNS



JANUARY



JULY

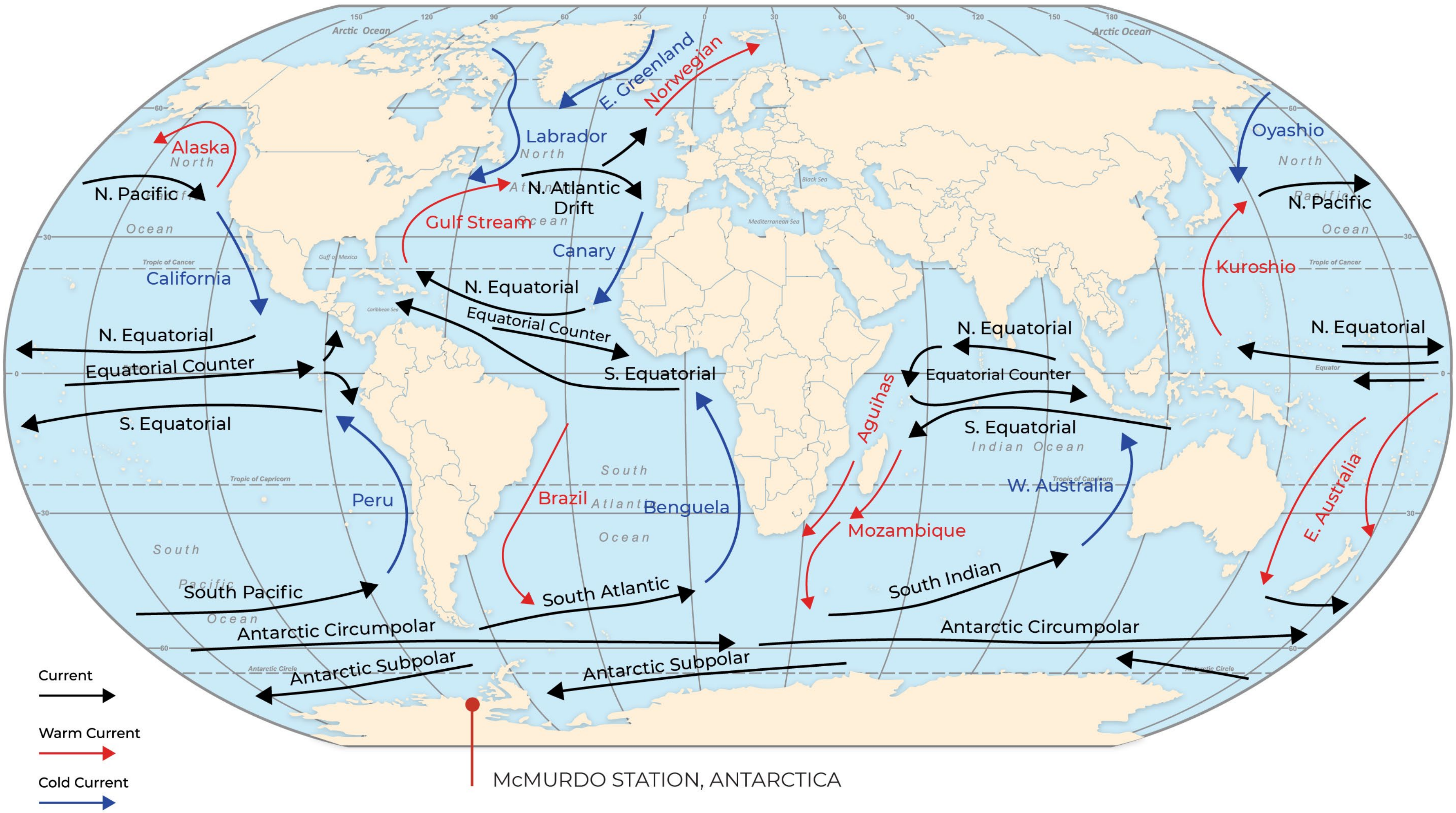
Reflection

If temperatures increase in Antarctica, causing glaciers to start melting, what impact could that have on the weather where you live? Explain using the currents, winds, and temperatures on your activity sheet.

Seasonal Variation of Global Wind Patterns courtesy of Dr. Jean-Paul Rodrigue, Department of Global Studies and Geography, Hofstra University

Ocean Currents Data

Directions: Use these data sets if students do not have access to technology to do their own research.



Temperature Data

Directions: Use these data sets if students do not have access to technology to do their own research.

LOCATION	JANUARY		APRIL		JULY		OCTOBER	
	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW
McMurdo Station, Antarctica	*-1°C (31°F)*	*-5°C (22°F)*	*-17°C (0°F)*	*-23°C (-10°F)*	*-20°C (-4°F)*	*-27°C (-16°F)*	*-14°C (6°F)*	*-20°C (-4°F)*
Sydney, Australia	*°26C (79°F)*	*°19C (66°F)*	*23°C (74°F)*	*15°C (59°F)*	*18°C (64°F)*	*10°C (49°F)*	*22°C (72°F)*	*14°C (57°F)*
Toronto, Canada	*-2.5°C (28°F)*	*-11°C (12°F)*	*12°C (53°F)*	*1°C (33°F)*	*27°C (80°F)*	*14°C (58°F)*	*14°C (57°F)*	*4°C (39°F)*
Beijing, China	*2°C (35°F)*	*-10°C (15°F)*	*20°C (68°F)*	*7°C (45°F)*	*30°C (87°F)*	*18°C (65°F)*	*19°C (66°F)*	*7°C (45°F)*
London, United Kingdom	*8°C (46 °F)*	*2°C (36 °F)*	*13°C (56 °F)*	*5°C (41 °F)*	*20°C (68°F)*	*11°C (52°F)*	*15°C (59°F)*	*8°C (46°F)*
Johannesburg, South Africa	*9°C (49°F)*	*-3°C (26°F)*	*21°C (70°F)*	*7°C (45°F)*	*29°C (85°F)*	*17°C (63°F)*	*22°C (71°F)*	*7°C (45°F)*
San Francisco, United States	*14°C (57°F)*	*8°C (46°F)*	*17°C (63°F)*	*9°C (49°F)*	*19°C (67°F)*	*12°C (54°F)*	*21°C (69°F)*	*12°C 54(°F)*
Buenos Aires, Argentina	*29°C (84°F)*	*20°C (69°F)*	*22°C (71°F)*	*15°C (58°F)*	*15°C (58°F)*	*8°C (47°F)*	*21°C (70°F)*	*13°C (66°F)*

CLOSER THAN YOU THINK

GRADE LEVEL 4-5

ANTARCTICA EDUCATOR GUIDE


Photo: BBC NHU

CLOSER THAN YOU THINK

GRADE LEVEL 4-5

60 minute Lesson

Standards (NGSS):

5-ESS2-1 Earth's Systems

Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

From the Film:

The film highlights the extremely important role that whales play in Antarctica's ecosystem and the interconnectedness of the natural systems. The presence or absence of whales directly affects the populations of phytoplankton as well as other microorganisms. We also learn the history of commercial whaling and the significant reduction in whale populations as a direct result.

Lesson Overview:

Students will understand that all things are connected and a change in one aspect of the Earth's ecosystem creates a domino like effect that can stimulate a change in another.

Select 1/5th of the class, and designate them as scientists. The remaining students will act as various parts of Antarctica's ecosystem. The Antarctica groups will create a motion rule of their system, which only they are aware of, but they all must follow as they move about the classroom. These movements should mimic living things or bodies of water in Antarctica. Their movement represents how interdependent systems can affect one another in positive ways, and the scientists must observe carefully to identify the rule. Scientists can also test different parts of the system by removing or replacing parts to see how their actions alter the system.

After the game, they will discuss their findings, systems and scientists, and recall humanity's influence on each of the variables.

Materials:

- System handouts, pp. 52-55
- Scientist Activity Sheet, p. 56 *(one per student selected)*

CLOSER THAN YOU THINK

EDUCATOR PREP:

Print enough copies of the ***Scientist Activity Sheets*** for 1/5th of your students to be able to use. Print the diagrams of systems and have one pack per group of four students.

EDUCATOR GUIDE:

1. Inform students that we will experience a model of Antarctica's ecosystem. Begin the lesson by surveying students' knowledge of systems by asking them the following questions:

What are some systems that you can think of?

Encourage the class to list as many as they can, including body systems (cardiovascular, digestive and respiratory), natural systems (water cycle, nutrient cycle, and rock cycle), mechanical systems (cars, factories, appliances). As students offer their answers, capture them on the whiteboard or on a piece of chart paper.

What do these systems have in common? How are they similar and different?

Consider student answers as a way to assess their background understanding of systems and how elements of systems work together.

2. Inform students that even though each of these systems are different, their basic framework is the same in that many pieces work together for the benefit of the whole.

3. Introduce the "spheres", small, interconnected systems that govern the natural world and ecosystems like Antarctica. The biosphere represents all the Earth's living things. The hydrosphere is all the water of the world, solid, liquid and gaseous. The lithosphere encompasses all the solid rock of the Earth and lastly the atmosphere, all the air on Earth. Inform students that when these spheres interact, they are called events.

4. Challenge students to identify which of the "spheres" were highlighted within the film. Ask students to give examples of systems present within Antarctica's ecosystem and encourage the students to think on the "events" that have or could occur in Antarctica when the spheres interact.

Photo of a working whaling station in Spitsbergen, Norway, 1907.

Photo: Freshwater and Marine Image Bank

CLOSER THAN YOU THINK

Why would understanding a system be important?

Use student answers to this question as a baseline assessment on how students think about or don't think about systems and why or how we can use systems in descriptive and prescriptive way. Answers may include the idea that systems help us to understand relationships or create logical steps that happen in a given order.

5. Inform students they will model Antarctica's ecosystem, and some students will be role playing as scientists. Designate 1/5th of the students as the scientists and ask them to step outside of the room.

6. The remaining students will represent the systems within Antarctica. Instruct them to come up with a motion rule that everyone within the system must follow as they move around the room. These movements should mimic living things or bodies of water in Antarctica. For example, each person within the system could identify two other people in the system to follow or remain in between them at equal distance, similar to a line of penguins. Or they could all choose different geometric shapes that their movements will follow.

7. Instruct the systems group that during the game, they should always remain moving and following the chosen motion rule, like wind moving across the landscape. If at any point an individual within the system is unable to follow the rule they should stop and remain still.

8. Allow the system students to practice for 1-2 minutes after they have identified their motion rule.

9. As the system students practice their rule, step out of the room and go over the rules for the scientists.

10. Inform the scientists that their goal is to identify the rule of the system inside the classroom. To help the scientists understand the system they may remove systems. Every 3 minutes the scientists may also pause the system to ask yes or no questions to the students within the system. Encourage students to use the ***Scientist Activity Sheet*** to record and discuss their observations with each other when the game is not paused.

11. Bring the scientists back into the classroom and start the game.

12. The game should be played until the motion rule is revealed. Scientists should use the scientist notepad to capture their thoughts while playing the game. If the scientists think they have figured out the game, they may pause the game, but may not ask any questions.

Educator Notes:

CLOSER THAN YOU THINK

13. When the scientists describe the rule, they must use their observations to substantiate their guess. Instead of telling them if they are right or wrong, encourage them to provide evidence that disproves an incorrect guess or if the scientists guess correctly, confirm with the participants. At this point, end the game and move on to class discussion.

14. Following the game, facilitate a whole group discussion about what it was like to be a part of system that could be influenced outside of their control and the intricacies of a system when observed. Ask students the following questions as a reflection first in their notebooks and then shared with the larger group to drive their discussion:

How is this game similar or different from what you know scientists do to learn about these systems?

Use student answers to these questions as a baseline or formative assessment about what students know about how scientists work and the scientific method.

What things did the scientists group do that was most helpful in revealing the pattern?

Student answers will vary, but may include something along the lines of observing different patterns that gave some ideas about what could be going on, thinking of a pattern and trying to see if it fit, changing something to see how it affected the movement of their classmates.

How did guesses that did not end up being right help the scientists get to the right answer?

Answers that are not correct, in this case, helped scientists to try different models and to tweak until they find the one that fits the movement.

15. Referring back to the film inform students the cyclic nature of how the biosphere (all the living things) influence and are influenced by the climate, the land, the air and even other living things like humans. Use student responses to highlight the complexity of the systems within the natural world. Some great examples of this are climate change, decreasing sea ice, whaling and the subsequent ban on whaling.

16. Inform students that the role of whales within Antarctica's ecosystem and the consequence of whaling affects the entire system, the same way that the removal of a person in the game affected the rest of the system.

Whales perform many ecosystemic services, not only to Antarctica but to the Earth's ecosystem. Marine organisms react as carbon sinks, whales specifically hold the equivalent of 30,000 trees worth of carbon. They acquire this carbon from eating krill, and help fertilize the photosynthetic plants, that use CO_2, with their poop.

A powerful flood destroyed this bridge in Sidi Ouaaziz, Morocco. This singular weather event is a result of the interaction of several "spheres."

Photo: Shutterstock / Migel

CLOSER THAN YOU THINK

17. Conclude the lesson by explaining to students that whaling has occurred in many different cultures dating as far back as 600 BCE. Commercial whaling began during the 11th century and from that time 1.5 million whales were processed for soap and margarine.

The whales that took a huge hit were the southern right whales, named because they were the right whales to hunt, that had their numbers decrease from 35,000 to 35. In 1986 a commercial whaling ban was instituted and since that time whale numbers have begun to increase.

18. Have students reflect on the experience in their notebooks using the following prompts:

Thinking about the game and what you learned about whales, how do scientists try to understand the effect of whaling in Antarctica?

Use student responses as a way to assess their learning from the lesson. They should explain how the scientists in the game used observations about how the students interacted to try to figure out the motion rule. In the same way, actual scientists observe not just whales, but all of the animals that interact with whales to understand the effect that whaling has on Antarctica's ecosystem.

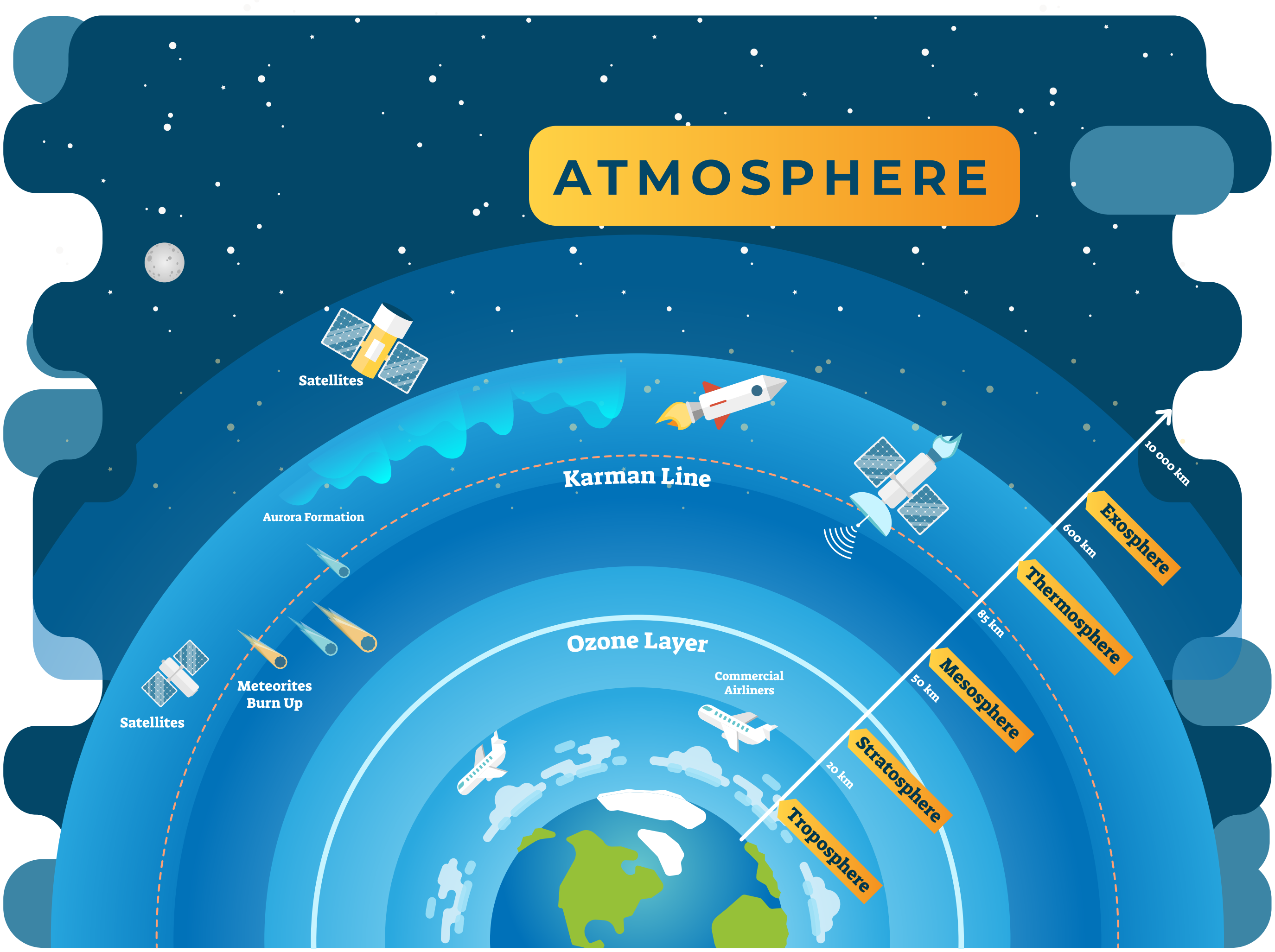
Can you think of another example where humans have done something to such an extent that it has had such a big impact on the planet?

There are limitless examples of humans harming an ecosystem through overfishing, polluting, hunting, exterminating pests...etc. Student responses should reflect an understanding that one action can cause many other things to happen.

Educator Notes:

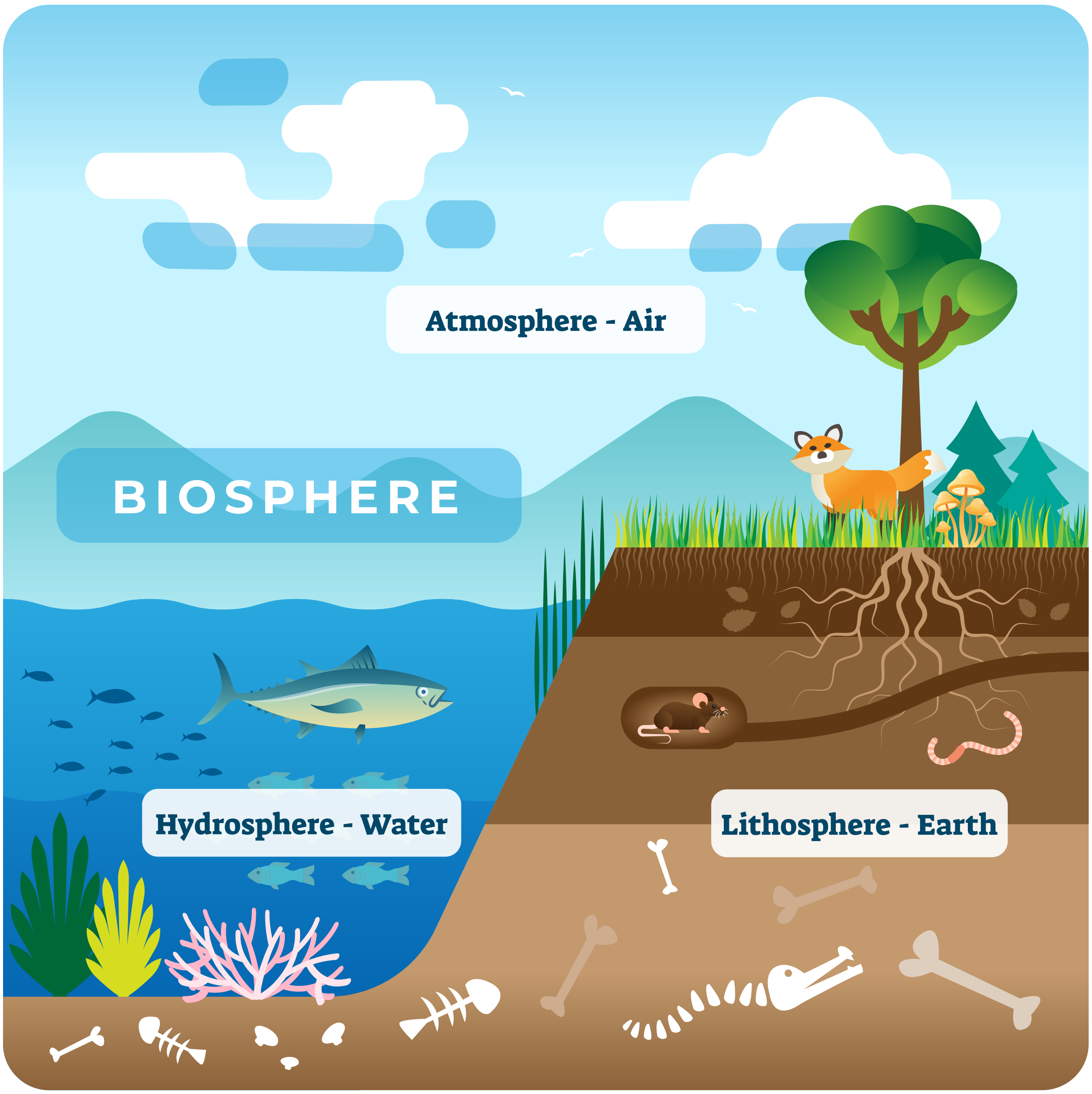
Connections: Atmosphere

Spheres are interconnected systems that describe how parts of our planet work together to make the whole. The **atmosphere** represents all the air surrounding the Earth.



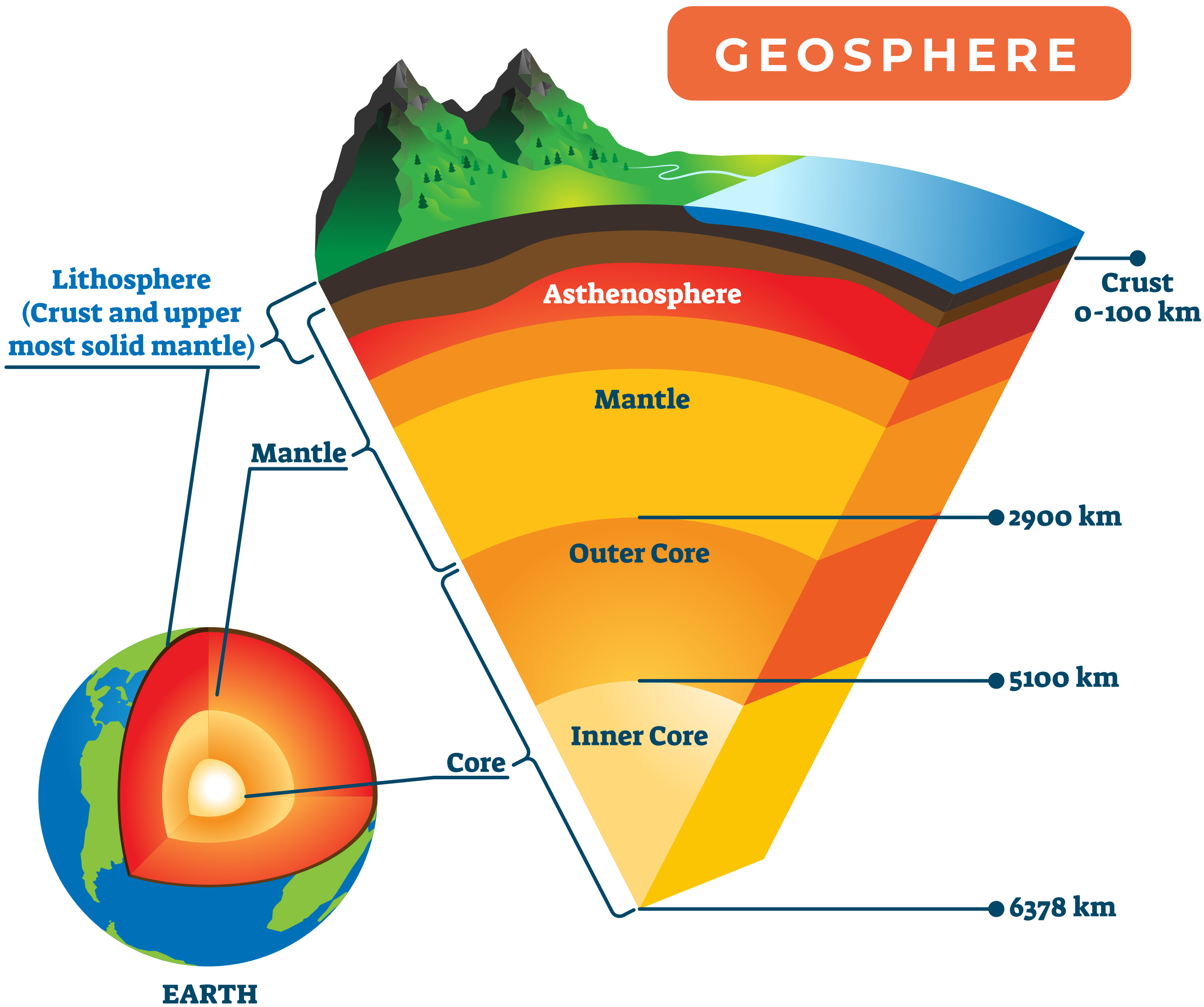
Connections: Biosphere

Spheres are interconnected systems that describe how parts of our planet work together to make the whole. The **biosphere** represents all the Earth's living things.



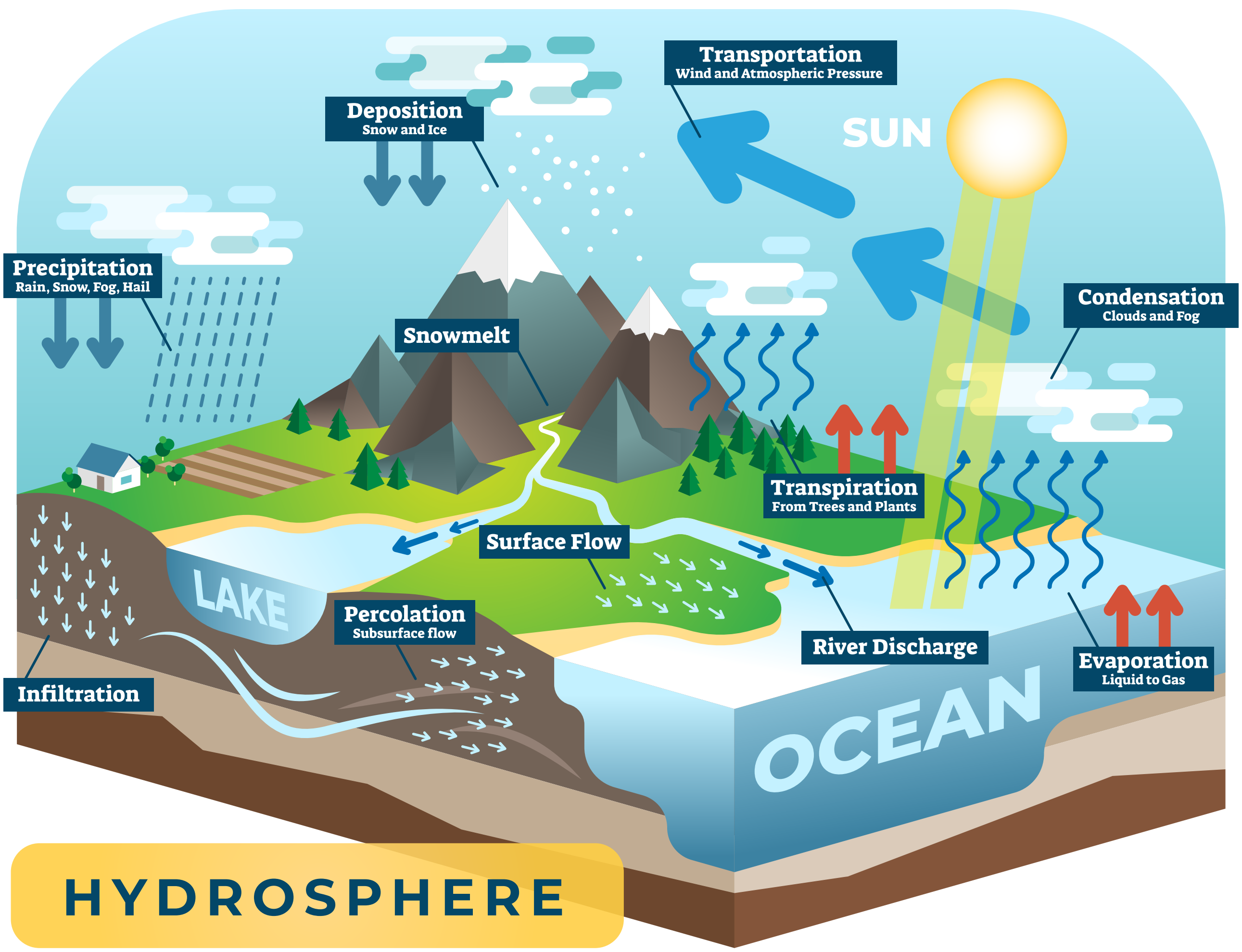
Connections: Geosphere

Spheres are interconnected systems that describe how parts of our planet work together to make the whole. The **geosphere** encompasses all the solid and molten rock of the Earth.



Connections: Hydrosphere

Spheres are interconnected systems that describe how parts of our planet work together to make the whole. The **hydrosphere** is all of the Earth's water; solid, liquid, and gaseous.



Scientist Notepad

Goal:

Attempts:

Observed Patterns:

Rules: "If this, then that." / *Example: "**If** I stand in the middle of the system, **then** Joseph stops moving.*

KRILLIN' IT: AN ANTARCTIC FOOD WEB

GRADE LEVEL 4-5

ANTARCTICA EDUCATOR GUIDE

KRILLIN' IT: AN ANTARCTIC FOOD WEB

GRADE LEVEL 4-5
60 minute Lesson

Standards (NGSS):

5-PS3-1

Use models to describe energy that comes from the food animals eat (used for body repair, growth, and motion and to maintain body warmth) was once energy from the sun.

From the Film:

The film ***Antarctica*** features the relationship between various animals and their diets. One animal that is highlighted is the krill, which is a food source for a variety of animals in Antarctica. We specifically see whales and penguins feeding on krill.

Lesson Overview:

Students will discuss the various animal relationships seen in the film and create a food web model focusing on the role of krill in the Antarctic ecosystem. They will play a food web game demonstrating the flow of energy in the Antarctic ecosystem, and highlighting the importance of krill.

Materials:

- Food Web Animal Role Cards, pp. 66-67 *(can be laminated for longer lasting use)*
- Food Web Map Handout, p. 63 *(one per student)*
- Food Web Cards, p. 65 *(one per student)*
- Candy *(or some other energy token; math Unifix cubes also work well)*
- Scissors
- Glue Sticks
- Technology to play the following video:

  http://bit.ly/AntarcticAnimalKrill

KRILLIN' IT: AN ANTARCTIC FOOD WEB

EDUCATOR PREP:

Print a copy of the ***Food Web Handout*** for each student. Print a set of the ***Animal Cards*** (per group).

EDUCATOR GUIDE:

1. In the film, ***Antarctica***, we see many animals and animal relationships highlighted. Ask students the following questions to activate their background knowledge and recollections from the film:

Which animals do you remember from the film?

Answers will vary, but may include whales, penguins, seals, sea stars, sea anemones, and elephant seals.

How did they relate to other animals?

Answers will vary, but may include that one tried to eat another, or that they fought for dominance, or that the parent penguins feed the baby penguins and more.

2. Introduce the idea of survival and share that a goal of all living things is to survive as long as possible and reproduce. Advise students that today we will be focusing on how food plays a role in the transfer of energy to animals. Ask students to turn to their neighbor and together try to answer the following question in their notebooks:

What do animals need in order to survive?

Answers may include a variety of things, including food, water, and shelter.

3. Inform students that food webs are diagrams, and a way that scientists use to understand how living things in an ecosystem relate to each other. Food webs can be as simple or complex as a spider web. They are called food webs because they are the natural intersection of food chains. A food chain is simply one strand of a more complex food web, and shows the natural relationship of predator/prey among animals.

4. Show students the six animal cards from the ***Food Web Handout***. Assign each animal to a group of four students or table groups, and ask them to create a list of what they recall from the movie for their animal. For example, what do these animals need to survive? Have each group or table share out loud with the whole class.

A ***gentoo*** penguin comes face to face with its main predator - the leopard seal.

Photo: BBC NHU

KRILLIN' IT: AN ANTARCTIC FOOD WEB

5. Ask students to consider the following questions as they watch the video ***"Animals of the Ice: Antarctic Krill".***

What food do krill need to survive?

Krill eat small plants, like phytoplankton and algae under the sea ice.

What would happen to the animals in Antarctica if all the krill disappeared?

Animals like whales, seals, and penguins would not have any source of food.

6. Hand out the ***Food Web Map.*** Inform students that a food web helps us understand how plants and animals get the energy they need in order to survive. Have students use scissors to cut out animal cards (this can also be done beforehand to save time). Students will work with a partner to place cards in the correct boxes on the sheet. Ask students to raise their hands once they are ready to check their answers. Once you have checked their food web, instruct students to glue the pictures onto their map.

7. Inform students they will be acting out their food web. Each student will be assigned an animal role to play. Inform them we will be using candy as tokens, and that they should not eat the candy until you give them permission at the end, and only if the candy is wrapped.

FOOD WEB GAME

8. Use the Animal Role Cards to randomly assign roles. Make sure to give out krill cards to ¾ of the class. Hand out at least 1 whale card, 1 seal card, and 1 penguin card for every 2-3 icefish to the rest of the class.

For example, a class of 24 would have 18 krill, 1 whale, 1 seal, 1 penguin, 3 icefish. Have students keep their animal card face down to keep secret for now.

9. Notify students that you are the sun. You will take the candy (or another token) out of a bag to hand out. Ask the students to look at their cards and have the "krill" students stand up. Give out 3 pieces of candy to every krill.

Educator Notes:

KRILLIN' IT: AN ANTARCTIC FOOD WEB

Ask the students the following question:

What do you think the candy represent? Why?

The candy represents units of energy that are transferred from the animal that is being eaten to the animal doing the eating.

10. Inform the students with krill cards that they get to store one packet of energy for themselves, but the other two pieces are available energy. Have them hold up those two pieces and sit down.

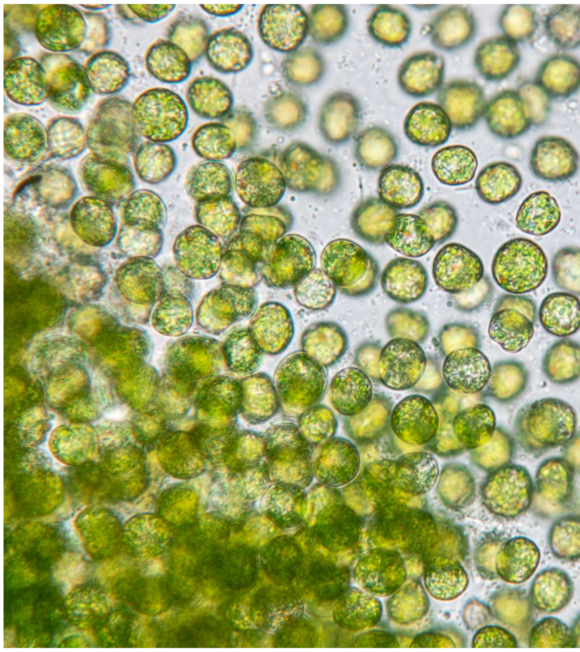
11. Ask the students with whale, seal, penguins, and icefish cards stand up. Have them go around and "eat" the krill (take their two pieces of candy available). The icefish are the smallest, so they will each eat from 1 krill. The whale is mainly dependent on krill for food so they get the most (10 krill). The seal eats 3 krill and the penguin eats 2 krill.

Note: These are guidelines, feel free to adjust the "rules" based on your class size.

12. Inform students the seal and the penguin are still hungry and need more energy so they must get their food from somewhere else, the icefish. Have the icefish store one piece of energy. Have the penguin and seal "eat" the icefish (if there's 3 icefish, have the penguin take energy from 2 icefish and the seal take 1 icefish, otherwise the icefish energy can be split evenly).

13. Inform students that the seal is still hungry. The seal can then "eat" the penguin after the penguin stores one piece of energy for itself.

14. To wrap up the game, ask students how many energy pieces they ended up with? Represent this data on a chart paper using a graph with animals on the x-axis and number of energy tokens on the y-axis.



Widespread green algae, ***Clorella***.

Photo: Shutterstock / Rattiya Thongdumhyu

KRILLIN' IT: AN ANTARCTIC FOOD WEB

15. Ask students again: what happens if there's not enough krill? Inform students this can happen due to overfishing by humans or lower levels of sea ice. Have students play the game again with only half as much krill available, graph the results again, compare, and discuss using the following questions as a group reflection:

What happens to the amount of energy available to the rest of the animals?

With only half as many krill, the other animals are not able to access the energy that is available through the phytoplankton. This means that at least some of the energy does not make it to the rest of the animals. As a result, some of the animals will die of starvation or have to find other sources of food.

Why are krill so important in Antarctica?

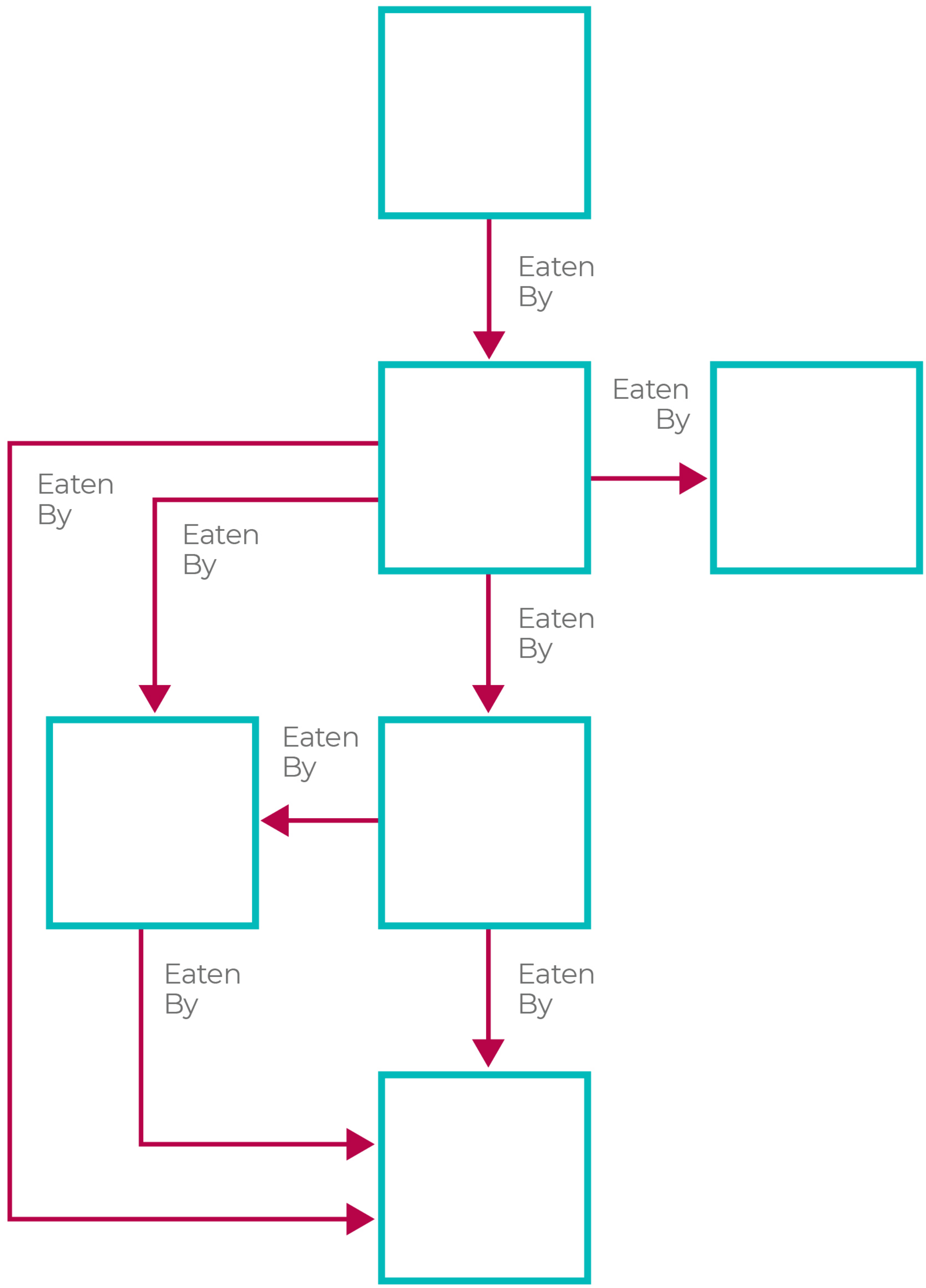
As a primary consumer, krill play a crucial role in Antarctica feeding on phytoplankton and algae so that carnivorous animals have access to the energy that is collected by phytoplankton from the sun.

16. Conclude the lesson reminding students that all biomes have food webs with different producers and consumers. These webs reflect that animals need to have certain things in order to survive and that these needs are most readily available in a healthy and balanced ecosystem.

Educator Notes:

Antarctica Food Web Map

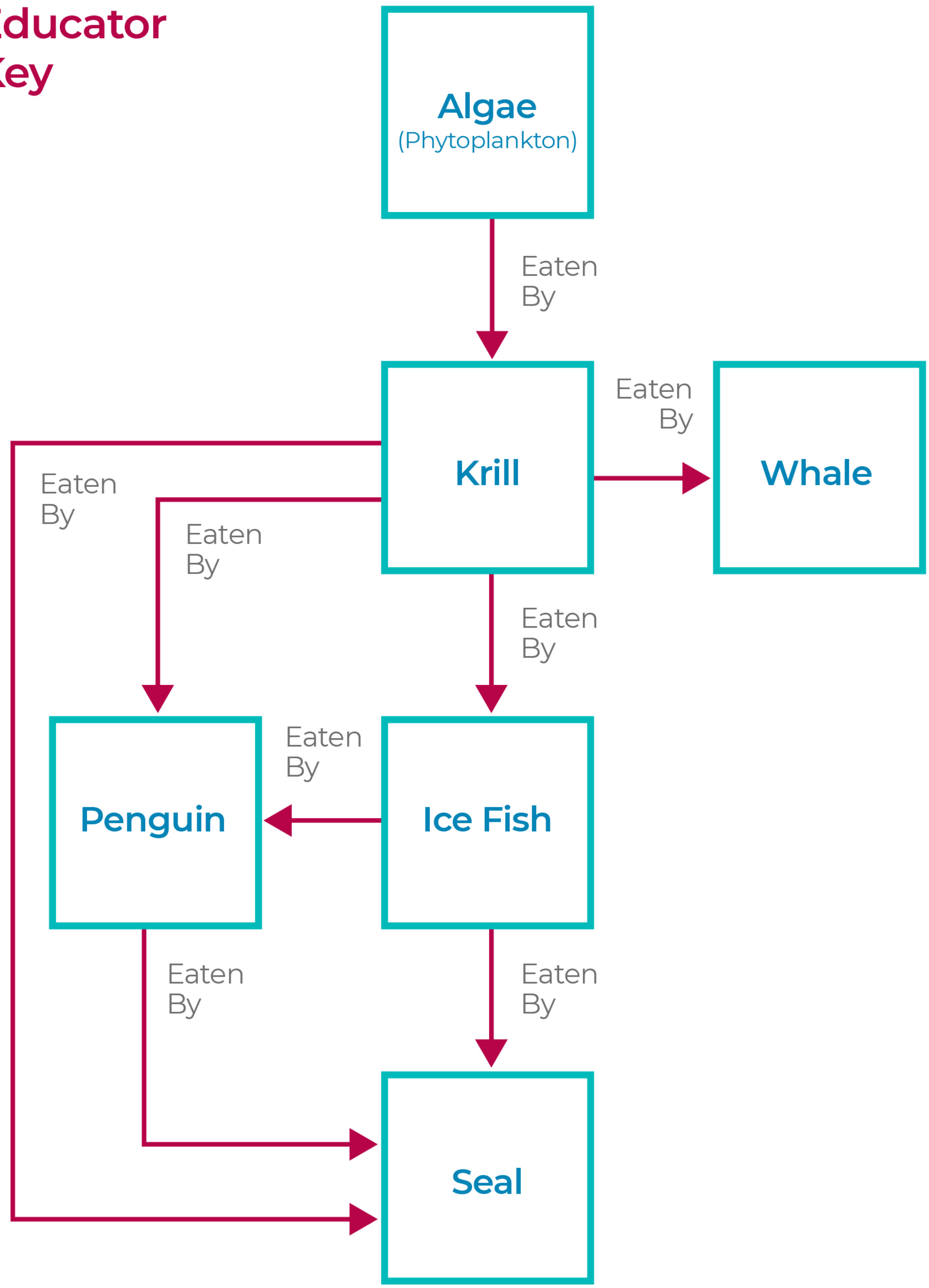
Directions: Cut out the animal cards on the following page. Paste the animals in the correct box.



Antarctica Food Web Map

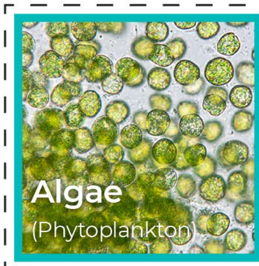
Directions: Cut out the animal cards on the following page. Paste the animals in the correct box.

Educator Key



Antarctica Food Cards

Directions: Cut out the animal cards on this page. Paste the animals in the correct box on the Food Web Activity Sheet.



Photos: Fredi Devas © BBC NHU, © Espen Rekdal, BBC NHU, Shutterstock / Rattiya Thongdumhyu, Andrea Izzotti

Antarctica Food Role Cards 1

Directions: Cut out the animal role cards on the this page to be used during the role playing game.

Photo: BBC NHU

Antarctica Food Role Cards 2

Directions: Cut out the animal role cards on the this page to be used during the role playing game.

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