



Penguin Zoo to You Trunk

Thank you for inviting Omaha's Henry Doorly Zoo & Aquarium® into your classroom. We hope our PENGUINS Educator Trunk is relevant to your course of study and that we have provided a valuable teaching tool for you and your students. In the trunk you will find a variety of items which can be used to enrich your study of science, math, reading, and more.

PENGUIN TRUNK CHECK-LIST

- ✓ (1) Penguins: Below the Equator Curriculum Binder
- ✓ (1) Penguins: Below the Equator CD
- ✓ (4) Replica Eggs
- ✓ (1) Container of Penguin Feathers
- ✓ (1) Flight Feathers
- ✓ (21) African Penguin Photos
- ✓ (1) Reading Safari Magazine
- ✓ (17) Mini Laminated Penguins
- ✓ (5) Penguin Identification Bands
- ✓ (15) Penguin Playing Card Sets
- ✓ (7) Life-size Penguins
- ✓ (2) Life-size Penguin Chicks
- ✓ (1) World Map

BOOKS

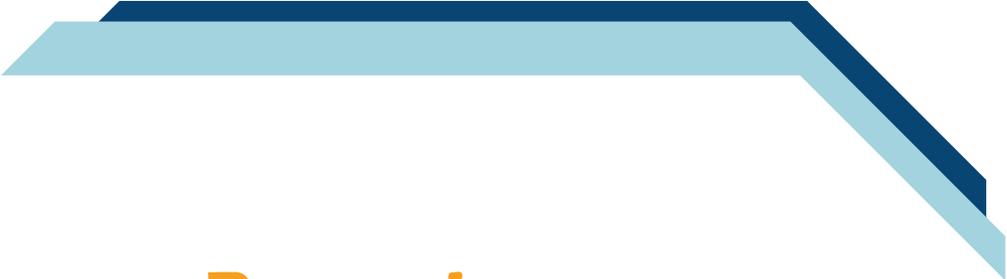
- ✓ *Humboldt Tails*
- ✓ *Penguin Pete*
- ✓ *Patti Pelican and the Gulf Oil Spill*
- ✓ *The Little Penguin*
- ✓ *A Mother's Journey*
- ✓ *The Emperor's Egg*
- ✓ *The Penguin Family*
- ✓ *Tacky in Trouble*
- ✓ *Penguins 1,2,3*
- ✓ *The Penguin*
- ✓ *Baby Penguin*

VIDEOS

- ✓ IMAX- *Survival Island*
- ✓ IMAX- *Antarctica*
- ✓ *March of the Penguins*
- ✓ *City Slickers- a Tale of Two African Penguins*
- ✓ SANCCOB- *Treasure Oil Spill 2000*
(3 min 30 sec clip)

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Penguins

BELOW THE EQUATOR

PROJECT STAFF

Omaha's Henry Doorly Zoo & Aquarium® Education Department

CHILDREN'S ARTWORK

Jenny Deutsch

DESIGN WORK

Omaha's Henry Doorly Zoo & Aquarium Design Services

***Special Thanks to the
Suzanne & Walter Scott Aquarium Penguin Crew & Bird Crew***

Omaha's Henry Doorly Zoo & Aquarium



Birds of a Feather

TOTAL TIME

50 minutes

OBJECTIVES

- > Identify characteristics of birds
- > Understand the differences between penguins and other birds

MATERIALS PROVIDED

- > Venn diagram worksheet (p.7)
- > *Why Are Penguins Birds?* worksheet (p.8)
- > Penguin Feathers
- > Flight Feathers

MATERIALS REQUIRED

- > Hula-hoops or rope to make 2 large Venn diagrams

STANDARDS

See content standards page

PREPARATION

- > Print Venn diagram worksheet (p.7)
- > Print *Why Are Penguins Birds?* worksheet (p.8)



Birds of a Feather

COMPARING AND CONTRASTING PENGUINS AND OTHER BIRDS

ITEMS TO UNPACK

- >Penguin feathers
- >Flight feathers

BACKGROUND

Penguins are birds, but they do not fly. These birds have adapted unique features which enable them to live life in the water. Birds can be classified by looking at the following characteristics.

BODY

A penguin's body is shaped like a football. This allows them to fly through the water with ease!



WINGS & FEET

Penguin wings (also known as flippers) are short and stiff, acting like paddles propelling them through the water. A penguin's feet are webbed and are used for steering and even braking!

OBJECTIVES

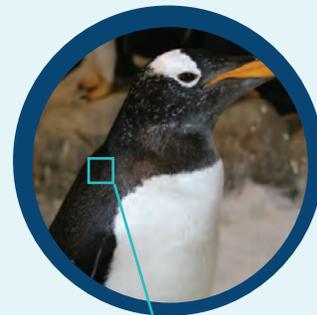
- > Identify characteristics of birds
- > Understand the differences between penguins and other birds

BONES

Penguins have solid bones, whereas birds that fly have hollow bones. How does this help penguins?

FEATHERS

Penguins have two kinds of feathers. Down feathers are thick and soft like a blanket that helps keep them warm. The outer feathers are oily, helping to keep them waterproof while swimming. Penguins have more feathers on their body than any other bird in the world, up to 100 feathers per square inch. Use a marker to see if you can fit 100 dots inside the 1-inch square.



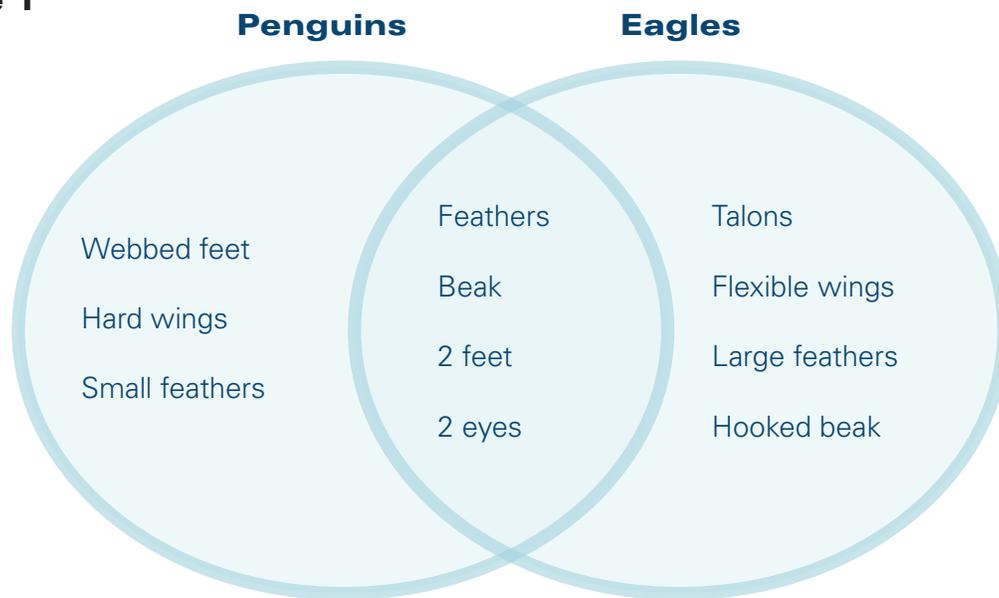
Create a inch square (pictured above) and see if your students can fit 100 dots inside of it.

PROCEDURE

How do penguins compare to other birds?

1. Using the Penguin Feathers and Flight Feathers, ask students to make observations about similarities and differences they see. Finish up the discussion by asking students what type of animal the feathers belong to, and more specifically, which bird they believe the feathers came from.
2. Ask students to picture a penguin in their minds and think about what they look like. Then ask them to think of an eagle and what it looks like. Ask students what they thought of when they pictured a penguin. Then ask what they thought of when they pictured an eagle. *How are these birds the same? How are they different?*
3. Introduce Venn diagrams to students. A Venn diagram is used to show differences and similarities between 2 or more items (see figure 1). The left circle represents characteristics of penguins. The right circle represents characteristics of eagles. The middle portion represents similarities between the two birds.

Figure 1

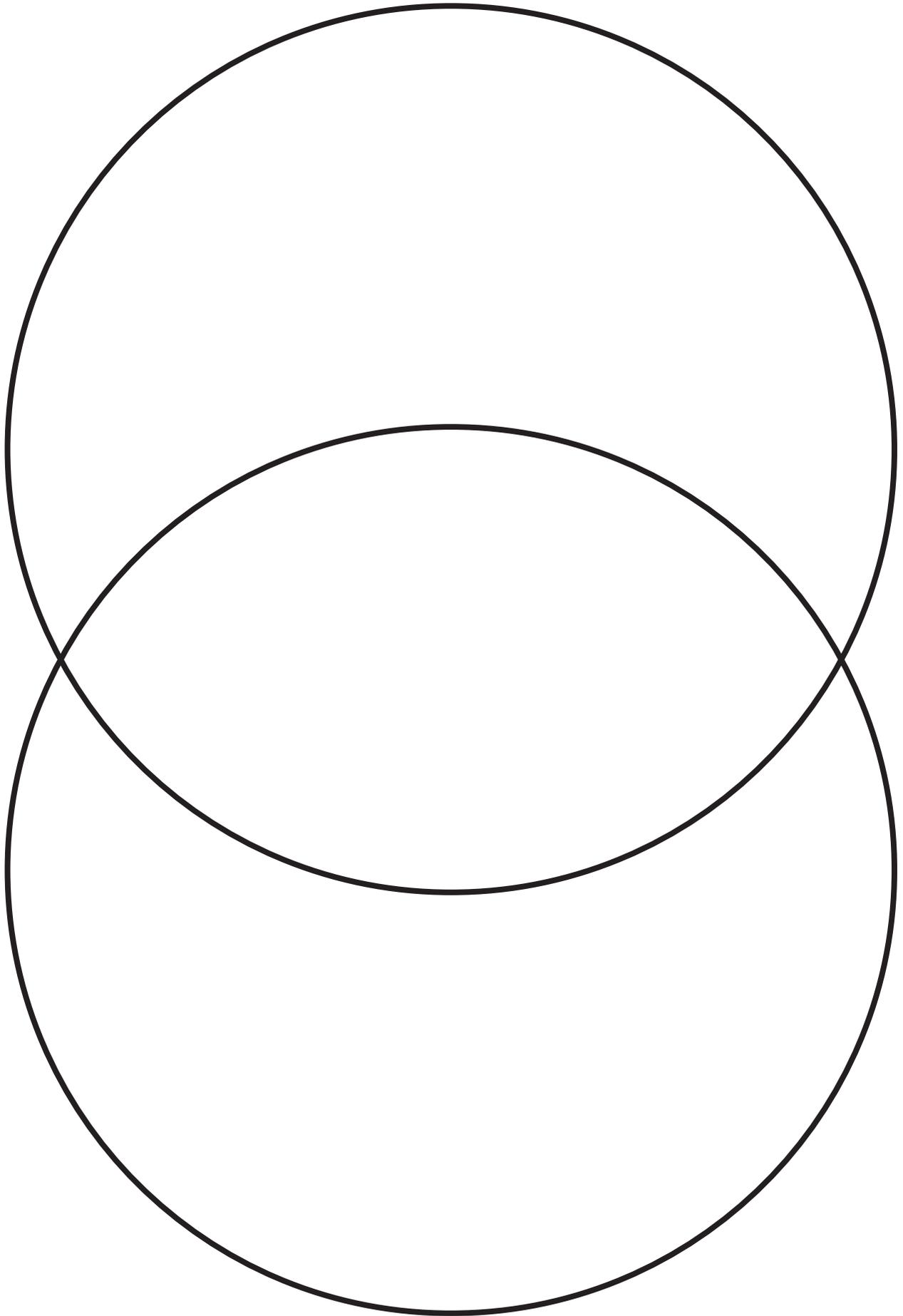


4. Next, create 2 large circles on the ground. You may use hula-hoops, tape down string to the floor or anything else to create the circles. Label one circle PENGUINS and the other a bird of your choice. Have students look at photos of each bird and record their observations. Students should place their observations in the appropriate circle. You may also print the Venn Diagram (page 7) for students to complete.

AT THE ZOO

Visit Omaha's Henry Doorly Zoo & Aquarium® and observe the characteristics of a variety of birds, including multiple species of penguin.

Name _____



Why Do Penguins Waddle?

TOTAL TIME

50+ minutes

OBJECTIVES

- > Gain an understanding of penguin movement
- > Understand how penguin movement is different when compared to other animals

STANDARDS

See content standards page

PREPARATION

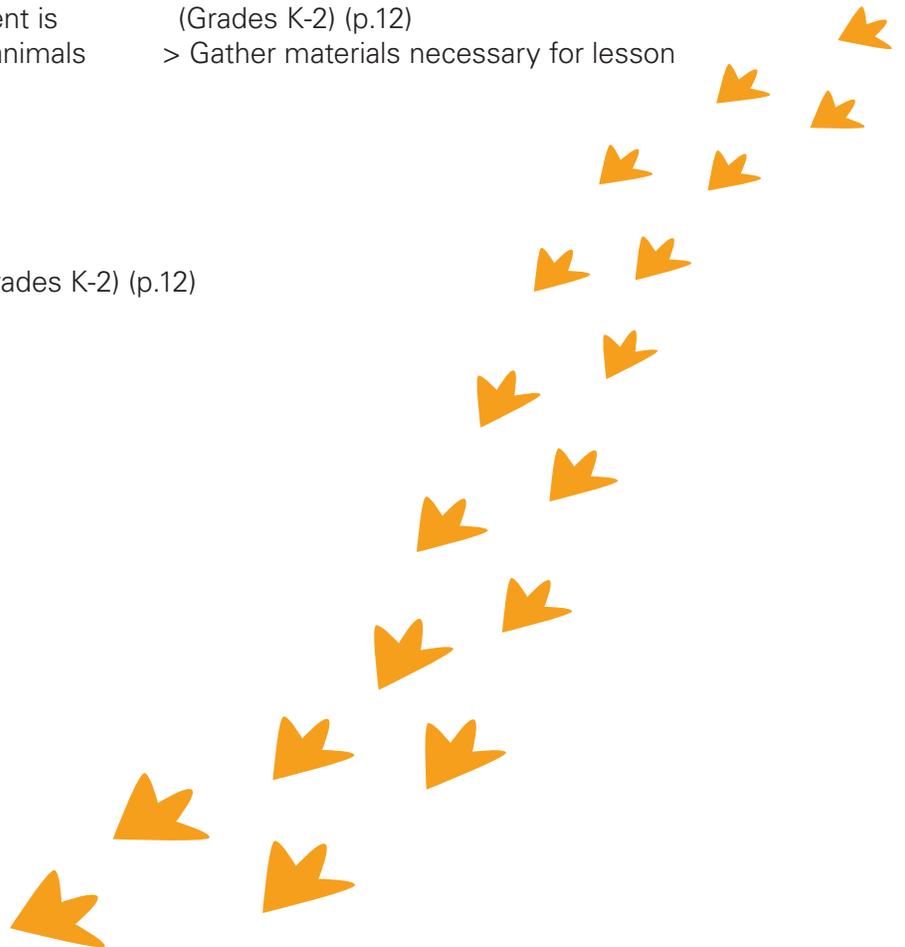
- > Print Penguin Movement worksheet (Grades K-2) (p.12)
- > Gather materials necessary for lesson

MATERIALS PROVIDED

- > Penguin Movement worksheet (Grades K-2) (p.12)
- > *Penguin Pete* (Book)
- > Various DVDs
- > Penguin X-rays

MATERIALS REQUIRED

- > Large container(s)
- > Small pop bottles (minimum of 2)
- > Water
- > Sand (or other filler)
- > Scrap paper
- > Large rubber or foam balls



Why Do Penguins Waddle?

A LOOK AT PENGUIN MOVEMENT

OBJECTIVES

- > Gain an understanding of penguin movement
- > Understand how penguin movement is different when compared to other animals

BACKGROUND

Why do penguins waddle? There is some debate concerning this question, but some scientists agree that a waddle is the best way for a short-legged animal to walk. Swaying between steps conserves momentum and uses much less energy. A penguin's legs are set far back on its body and much of the leg is covered by the body. On land this makes them walk funny, but in water it makes them glide with the greatest of ease!

At Sea

Penguins are very powerful and agile swimmers. It is said that they "fly through the water." Penguins use their feet and tails as rudders and their flippers (wings) as propellers. Penguins cannot breathe underwater so must surface to take a breath. Some penguins take a breath while swimming by leaping clear of the water (this type of swimming is called *porpoising*). Because penguin bones are denser than those of flying birds, they use less energy to stay submerged under water.

Penguins swim at higher speeds to jump clear of the water and onto land or an iceberg. Adelle penguins can propel themselves 2 meters out of the water! Generally, larger penguins swim faster than smaller penguins. Some, such as the gentoo and black-footed, have been clocked at speeds of 15 mph!

On Land

Penguins walk on the soles of their feet instead of their toes, as most other birds do. They can walk long distances at steady speeds of about 2 mph.

Some penguins, such as rockhoppers, *hop* from place to place. When there is too much snow or the penguins want to use less energy, they drop down onto their chests and *toboggan*, by pushing their body forward with flippers and toes! When tobogganing, they can move quicker than a human!

ITEMS TO UNPACK

- > *Penguin Pete* (Book)
- > Various DVDs
- > Penguin X-rays

MATERIALS

- > *Penguin Movement* worksheet (p. 12)



How do penguins move?

1. Read Penguin Pete to students and then discuss what happened in the story. *How did he move? What could he not do that Steve could do? Why do you think this is?* Here, you may choose to cue a clip from the various DVD's found in the trunk or search the internet for a clip that portrays different penguin movements, to allow students to see the other ways penguins move.
2. Next, discuss penguin movement with students. *Can penguins fly? Why not? Can they swim? How do penguins move on land or in the water? How are penguin movements different on land than in water?*
3. Let students try out their best penguin movement imitations as other students try to guess what movement they are imitating. Ask students *why they think penguins waddle?* They waddle because their feet are set so far back on their bodies. It is thought that waddling also helps conserve energy. Show students the penguin x-ray. *Can they find the legs? Where are a penguin's knees?*
4. Take discussion further if you wish. *Do you think it is easier for penguins to move through snow than it is for humans? Have some penguins adapted their movement to live life in cold climates?* In climates with snow, penguins are often seen *tobogganing*.

How do wings help penguins swim?

5. Penguin wings are adapted for swimming. They are narrow and hard, these features help propel and steer penguins through the water. *Why can't other birds dive and swim like penguins?* Most birds that fly have large, flexible wings. In the water, these wings have little or no swimming power. Penguin wings are like small paddles, they push through water better and have a lot of swimming power. To demonstrate this with your students prepare a large container full of water.
 - a. Pass out 2 pieces of paper to students. Ask students to make 4-5 equal folds in one piece of paper.
 - b. Try to paddle the water with the unfolded sheet of paper which represents the flying bird's wing. The paper does not push very well in water. *Why?*
 - c. Now try to paddle the water with the folded paper which represents a penguin wing. This paper is stiffer and smaller and pushes better!

Why is the body of a penguin better for swimming?

6. The torpedo-shaped body of a penguin is made for swimming in the ocean and helps them move through the water with ease! The body of a penguin is also too heavy for flight. To demonstrate why the body of a penguin is better for swimming than the body of a bird that flies, experiment with the following:

- a. Fill a large container with water. (large enough to fit 2 small pop bottles inside). Fill one small pop bottle with sand and leave one empty.
- b. Ask students which of the pop bottles might represent a penguin? Place both bottles in the water. *What happens?*
- c. Next, have students slowly push down on both containers if they are floating (the sand-filled container may already be under water). *Which container is easier to push underwater?* It is easier to push the sand-filled container down in the water. Thus, penguins can dive and stay submerged in the water much easier than a bird with hollow bones.

Penguin Waddle Relay

7. Divide students into two or more teams (depending on class size).
8. Divide teams in two and place opposite each other (15 feet or more apart).
9. Have the first student in line place a rubber ball between their knees. Then have them waddle (not hop or jump) to their team member waiting on the other side. Students will then hand-off the ball to the next team member and it will then be their turn to waddle to the next person. Make sure students cross the line before they touch the ball and that they don't start until the ball is properly in place. If the ball drops that team member must start over. Proceed until each member has had a turn. The team that completes the race first are the fastest penguins and they win the relay!
10. For other variations, students may try hopping with the ball held between their legs. (remember some penguins hop from place to place) *Which movement is easier for students? Are they more out of breath after waddling or hopping? How is their movement similar to a penguin's waddle?*

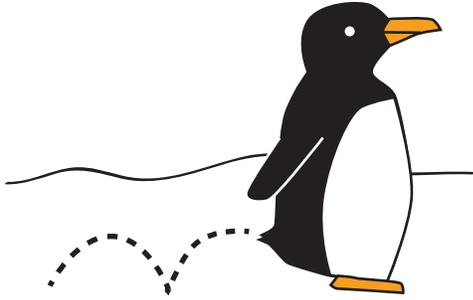
AT THE ZOO

Visit Omaha's Henry Doorly Zoo & Aquarium® and observe penguin movement. Record observations as they swim through the water and 'walk' on land.

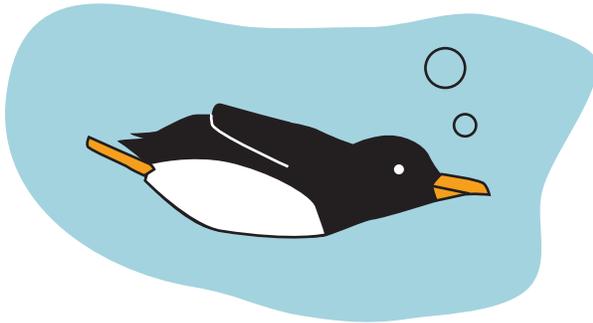
HOW IS THE PENGUIN MOVING?

Look at the pictures and decide how the penguin is moving. Using the choices below, write the correct answer on the line below the picture.

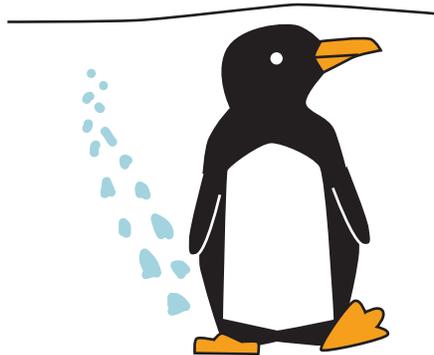
- A. Waddling** **B. Porpoising** **C. Swimming** **D. Tobogganing** **E. Hopping**







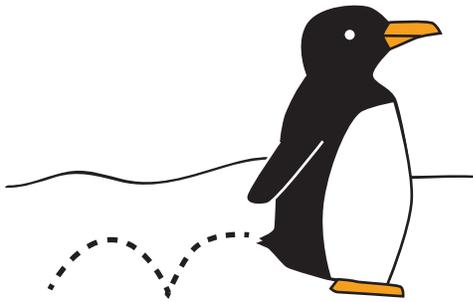




HOW IS THE PENGUIN MOVING?

Look at the pictures and decide how the penguin is moving. Using the choices below, write the correct answer on the line below the picture.

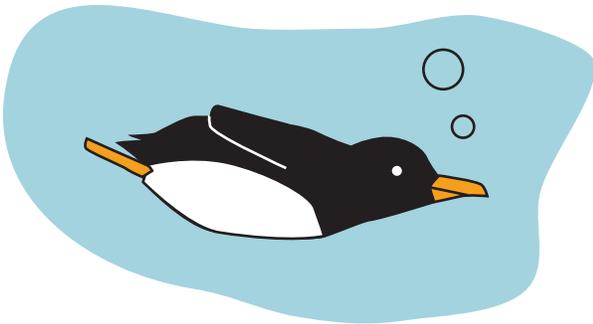
- A. Waddling** **B. Porpoising** **C. Swimming** **D. Tobogganing** **E. Hopping**



Hopping



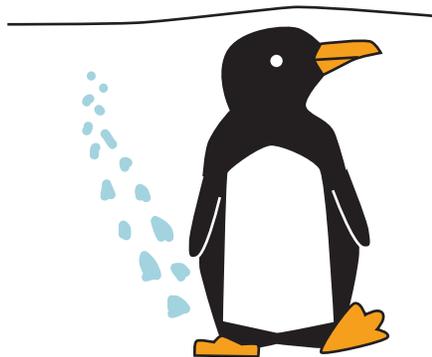
Porpoising



Swimming



Tobogganing



Waddling

Penguins Are Birds

TOTAL TIME

50 minutes to multiple class periods

OBJECTIVES

- > Discover the effects of oil on feathers
- > Learn how humans can help birds affected by oil spills
- > Understand the effects of a disaster on an ecosystem

MATERIALS PROVIDED

- > *City Slickers* DVD
- > *Oil & Feathers* worksheet (p.18)
- > SANCCOB *Treasure Oil Spill* clip
- > *Patti Pelican and the Gulf Oil Spill* (Book)

MATERIALS REQUIRED

- > Feathers
- > Cooking oil
- > Dishwashing liquid
- > Mild hand soap
- > Powdered laundry detergent
- > 5 bowls per student group
- > Water

STANDARDS

See content standards page

PREPARATION

- > Print *Oil & Feathers* worksheet (p.18)
- > Prepare soap/water mixtures for young students or you may choose to have students prepare their own mixtures following the directions given



Penguin Conservation

A LOOK AT OIL SPILLS & PENGUINS

BACKGROUND

Oil spills are devastating to the environment and all life within it. On June 23rd, 2000, a Greek bulk carrier named *Treasure* sank in the Atlantic Ocean spilling nearly 1,300 tons of oil into the surrounding waters. The oil approached Robben and Dassen Islands threatening *half* (76,000) of the world's African Penguin population.

When birds are coated with oil, they try and clean their feathers and end up ingesting the oil. Sadly, many birds die of starvation, ingesting the toxic oil, or from hypothermia. Oil on the bird's body affects their ability to float, so they do not venture into the water in search of food. It also inhibits the ability to control their body temperature. Oil which is swallowed gives them ulcers and affects their kidneys and lungs.

How do humans help? The Southern African National Foundation for the Conservation of Coastal Birds (SANCCOB) relocated 19,000 un-oiled penguins and rescued another 19,000 oiled penguins during this oil spill. Hundreds of people assisted with the cleaning and care of the oiled penguins. Fortunately, most rescued birds survived and were released!

The cleaning and treatment of one oiled penguin takes two people and at least one hour of work. The penguins are given activated charcoal which forces them to get rid of the oil they have ingested and then are rehydrated with fluids. The birds are then fed and their feathers hand-washed with a grease-cutting dish detergent once they have been stable for 24 hours.

OBJECTIVES

- > Discover the effects of oil on feathers
- > Learn how humans can help birds affected by oil spills
- > Understand the effects of a disaster on an ecosystem.

ITEMS TO UNPACK

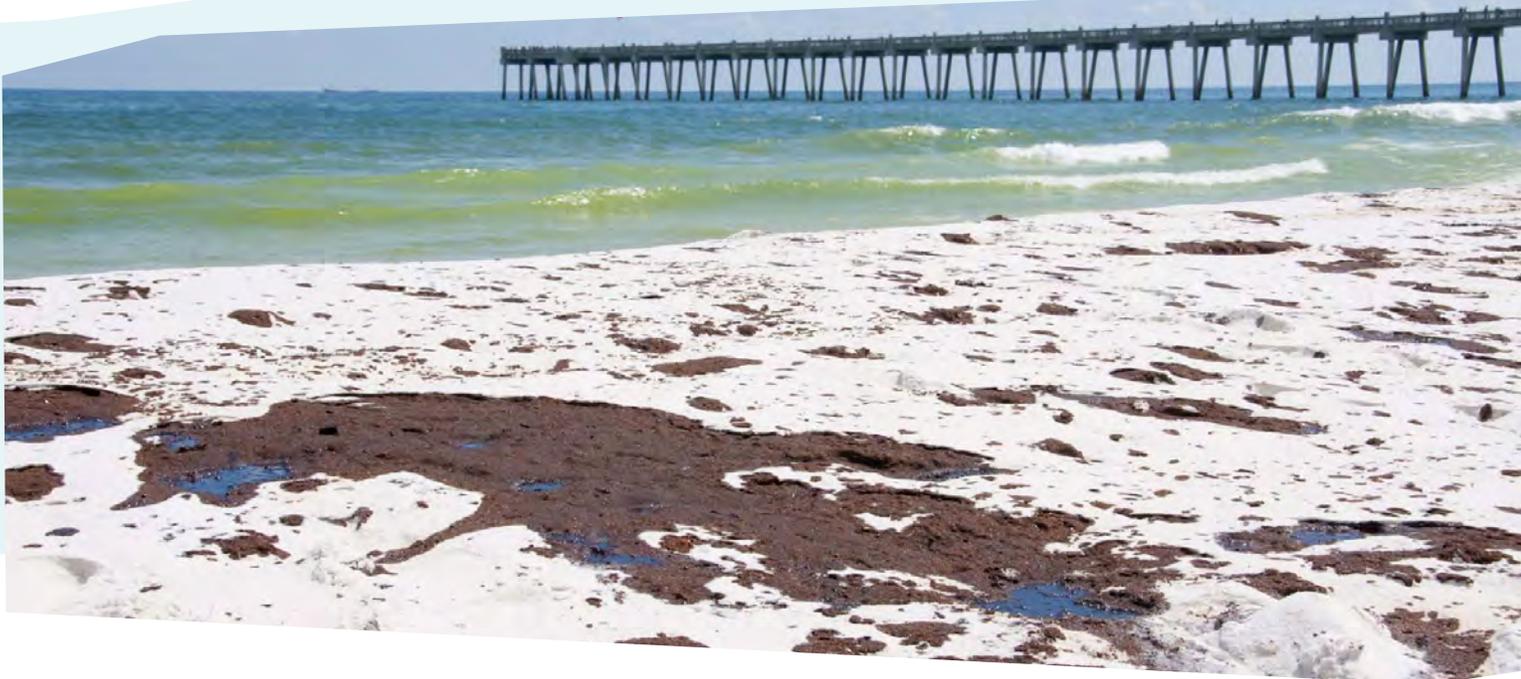
- > *Patti Pelican and the Gulf Oil Spill* (Book)
- > SANCCOB- *Treasure Oil Spill 2000* (video clip)
- > *City Slickers- A Tale of Two African Penguins* (DVD)



PROCEDURE

What is an oil spill and how can you help?

1. Begin the lesson by reading students the book *Patti Pelican and the Gulf Oil Spill*
2. Referencing the book, discuss the following with students, *Have you ever heard of an oil spill? Did you hear about the Gulf oil spill? Where else do oil spills happen? What do they affect? How are animals or the environment affected?*
3. Continue discussion by asking *how humans can help clean up oil spills? How do they help sick or injured animals affected by oil spills?*
4. Introduce the *Treasure* oil spill which occurred in 2000. Explain that nearly half of the African penguin population was affected by this spill. *How do students feel about this?* Explain how people volunteered to help rescue and clean the penguins. Play the *SANCCOB-Treasure Oil Spill 2000* clip for students.
5. Explain to students that they will be experimenting with various ways of removing oil from feathers. Before you begin the experiment, be sure to have students record their hypothesis about ways they think oil could be removed (p.18).



What cleans feathers the best?

1. Fill 5 bowls with water and label them with numbers 1-5.
2. Dissolve 1 Tbsp. of hand soap in bowl #1, 1 Tbsp. of laundry detergent in bowl #2 and 1 Tbsp. of dish detergent in bowl #3.
3. Pour vegetable or other oil on top of water in bowl #4. Bowl #5 should be filled with water only.
4. Ask students to look at their feathers and make a few observations. *What do they feel like or look like?* Have them make predictions about what will happen to the feathers if they are dipped in oil.
5. Hand out the *Oil and Feathers* worksheet to students (p.18) and ask them to make their predictions.
6. Students should dip their feathers into the oil slick in bowl #4. *What changes do they see? What has happened to the feather? Does it feel different? How might this affect the bird?*
7. Have students try and clean their feathers using the water in bowl #5. *What happens to the oil on the feather?*
8. Next, have students dip their feathers into containers 1,2 or 3 and try and rub the oil from them. Each student should dip their feather into only one of the cleaning containers. *Do they notice a difference? Which container of liquid cleans the oil better?* Remind students that nearly 19,000 penguins had to be cleaned by hand using this method. *What thoughts do they have regarding this?*
9. This experiment may be continued using various oils and/or cleaning solutions.
10. View the DVD *City Slickers- a tale of two African penguins* as a wrap up to the lesson.

EDUCATOR NOTE

As an additional activity or assessment, students may create a *Save the Penguins* poster and include the effects of oil and environmental pollution on penguins.

Oil and Feathers

	My Predictions	What Does it Feel Like?
Bowl #1 Hand Soap		
Bowl #2 Laundry detergent		
Bowl #3 Dish detergent		
Bowl #4 Oil slick		
Bowl #5 Water only		

1. What happened to the feathers when they were dipped in the oil slick?
2. How might this affect the bird?
3. Which mixture cleaned the oil from the feather the best? Why is this helpful to know?

Penguin Identification

TOTAL TIME

50 minutes per activity

OBJECTIVES

- > Use observation skills to identify penguins
- > Create an ID band based on a numbering system much like that used by Omaha's Henry Doorly Zoo & Aquarium®

MATERIALS PROVIDED

- > African Penguin photos
- > *African Penguin Outline* worksheet(s) (p.23 & 24)
- > Penguin ID bands
- > Penguin PowerPoint slides 26 & 27 (Found on the Penguins Below the Equator CD)

MATERIALS REQUIRED

- > Writing utensil
- > 2 colors of string or yarn
- > Various colors of beads

STANDARDS

See content standards page

PREPARATION

- > Print *African Penguin Outline* worksheet(s) (p.23 & 24)
- > Prepare PowerPoint slides 26 & 27



Penguin Identification

USING OBSERVATIONS TO IDENTIFY PENGUINS

BACKGROUND

It's not hard to see that most penguins of the same species look alike. They do not possess any unique identifying characteristics. At the Zoo, we need to know how to identify each individual penguin for feeding, observation and medical purposes. Upon close observation you will see that all of our penguins have a band on one or both of their wings. The bands do not harm the penguins. It's like wearing a bracelet! On each band is a set of 2-4 colored beads. These colored beads are each assigned a number (*Fig. 1*). For instance, the white beads stand for number 0, the Yellow beads stand for number 5 and so on. The beads are read from the back of the wing forward.

OBJECTIVES

- > Use observation skills to identify penguins
- > Create an ID band based on a numbering system much like that of Omaha's Henry Doorly Zoo & Aquarium®

ITEMS TO UNPACK

- > African Black-footed Penguin Photos
- > Penguin ID Bands
- > Penguin PowerPoint

Figure 1

Penguin ID

□	0 - White
■	1 - Black
■	2 - Brown
■	3 - Red
■	4 - Orange
■	5 - Yellow
■	6 - Green
■	7 - Blue
■	8 - Purple
■	9 - Grey

Penguin ID numbering system



Males have black bands.

Penguins with white bands in the Suzanne & Walter Scott Aquarium are female.

If a penguin has a black, orange and green bead on its band, that penguin's identification number would be #146. The color of the band also has meaning. If a penguin has a black band it is a male, if it has a white band it is a female. *Please note, this band color system applies only to the Suzanne & Walter Scott Aquarium penguins. The black-footed penguins do not wear gender identifying band colors.*

PROCEDURE

How are people and animals identified?

1. Begin this lesson by asking students how people are identified. *How do we tell each other apart? How does a police officer identify someone?*
2. Have students look at their fingers, *what do they notice?* Have students compare their fingers with someone else's, *are they the same?* You may choose to have them use ink and make their fingerprints on paper. The lines and swirls on our fingers are unique and no two people have the same patterns. Fingerprints are a way to help us to accurately identify people. For example, if a person commits a crime, officers will search for fingerprints which they can use later to determine who committed the crime.
3. Next, ask students how animals are identified. *How do we tell animals apart from one another? How do we identify members of the same species apart?* Some animals have unique markings, just as humans do that helps identify them, while others have no unique markings, thus making identification more difficult.

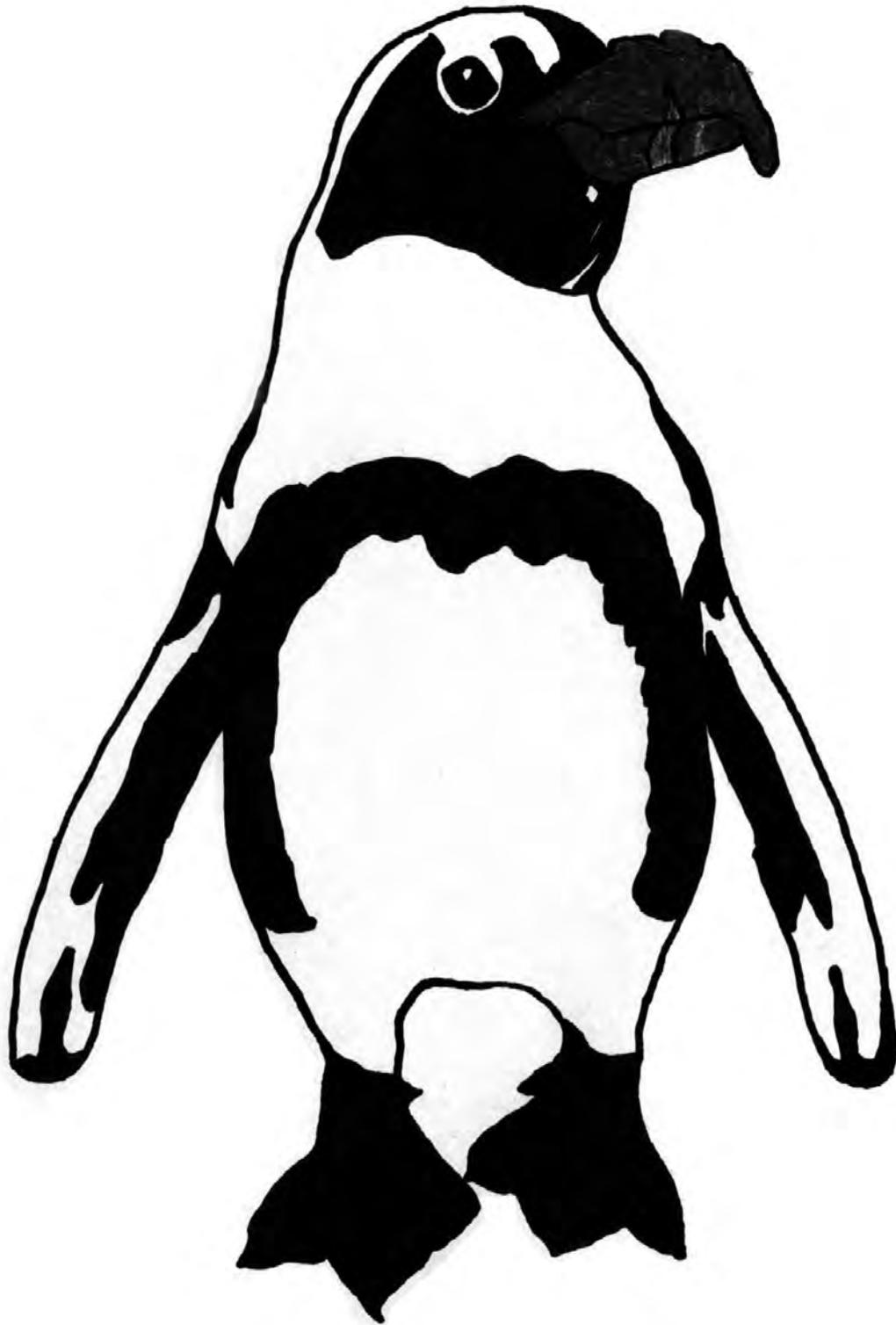
Black-footed Penguin Identification

Although it is nearly impossible to tell most penguins of the same species apart from one another, an exception exists. The African Black-footed penguin possesses a pattern of spots on their chest that is unique to each penguin. When researchers first started studying these penguins, they used the unique pattern of spots to properly identify each bird. These unique patterns help researchers collect data about population sizes and behaviors. Other animals, such as tigers, lions, and leopards, also possess physical patterns unique to each individual.

1. Show students one of the African Black-footed Penguin Photos and ask them, *what kind of penguin is this? Where do you think this penguin lives?* Explain to students this is an African Black-footed penguin.
2. Ask students if they think there is any way to pick out this penguin from a group of penguins. The spots, located on the penguin's belly, are unique to each bird. No other black-footed penguin has the same pattern.
3. Hold up another African Black-footed Penguin photo and compare it to the other penguin, using it to show the students that each penguin's pattern of spots is different. *How might these spots be useful to researchers?* Researchers use the spots to identify penguins they are studying.
4. Hand out the *African Penguin Outline* (p.23) and have students take on the role of the penguin researcher and record the unique spots of the penguins in the photos.
5. Once students have become familiar with observing and accurately recording the spots you may choose to split them into pairs or teams. One team member should view the photos and then record the spots of 2-3 penguins. Do not let the other team members know which photos have been selected. The other students should then try to match their team member's recordings with the appropriate photograph.



African Penguin Outline



African Penguin Outlines

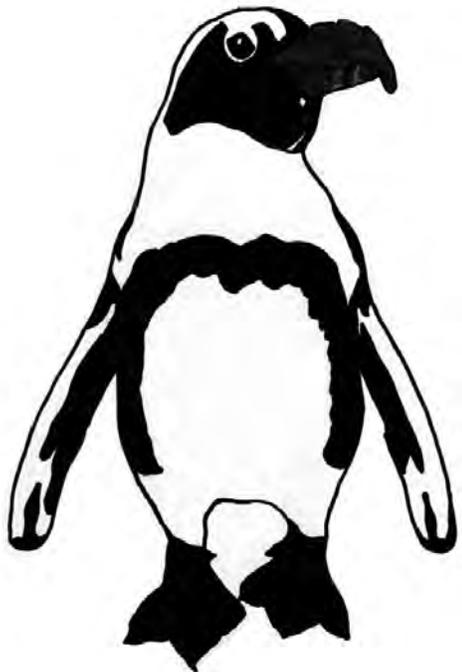
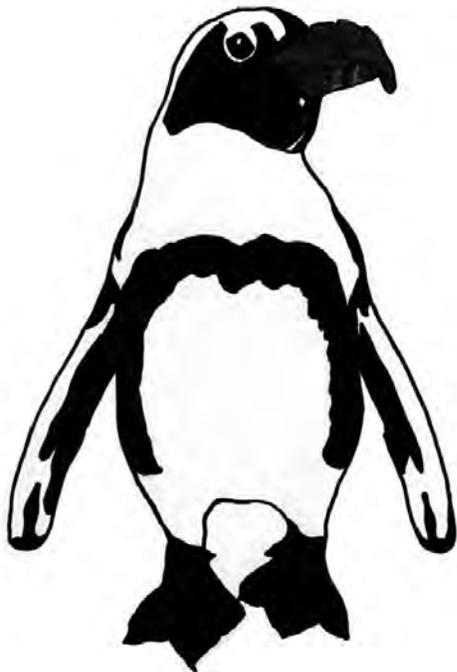
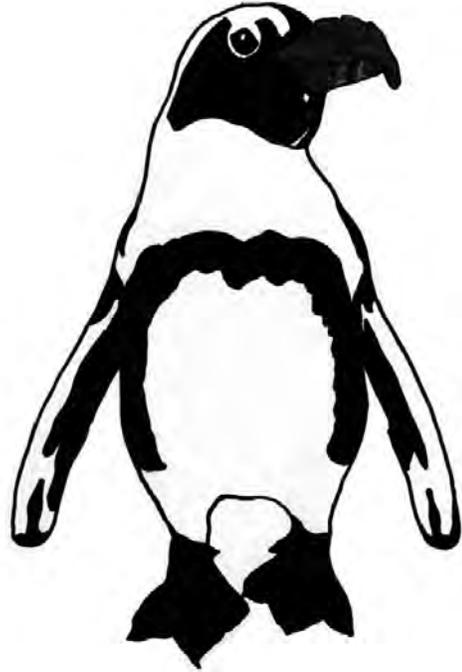
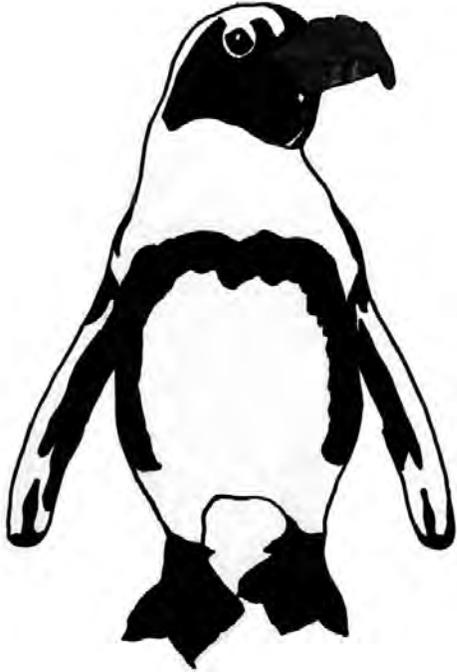


Table 1- Penguin House Names and ID Numbers

King Penguin			Gentoo		
I.D.#	Gender	House Name	I.D.#	Gender	House Name
57	M	William	105	F	Bumble Bee
143	M	Buggy	207	F	Mickey
9549	M	Louie	311	F	Juliet
997	M	Elvis	348	M	Romeo
8	F	Don	187	M	Gus
95	M	Dwayne	334	F	Kip
34	F	Marty	51	M	Cornwalis
Black-footed			Rockhopper		
I.D.#	Gender	House Name	I.D.#	Gender	House Name
18685	M	Kricket	9	F	Maude
9033	M	Jake	10	M	Ned
5667	M	Huck	13	M	Enrique
5898	F	Luey	51	M	Jon Claude
			665	M	Buddha
			805	F	Puppy
			1	F	Houdini
			22	M	Cassanova



CREATING A PENGUIN ID BAND

1. Show students pictures of penguins and ask them if they can tell any difference between the penguins. *Are there any differences in color? In size?* Most species of penguin are not identifiable as male or female just by looking at them.
 2. Ask students how they think zoo keepers or scientists tell the difference between penguins. *Is it hard to tell the difference? Why do the keepers need to know the difference between penguins?*
 3. Show students the Penguin ID Bands. *Can they see a difference in the bands? What differences are there?* The *black* band is for males and the *white* band is for females. Each penguin also has different colored beads on its band. The different colors of the beads represent different numbers. The numbers are read from the back of the wing to the front of the wing. Look at *Table 1*. Ned, who is a Rockhopper penguin, would have a black and white bead on his black band.
 4. Show students slide 25 of the Penguin Slide Show found on the *Penguins Below the Equator CD* in the *Power Point Presentation* folder. *Is this a male or female penguin? Use Figure 1* to explain that this would be penguin #73.
 5. Show students slide 26. *Is this penguin male or female? What number would this penguin be?*
 6. Next, explain to students that they will be creating their own ID band (just like the Henry Doorly Zoo & Aquarium's penguins!) Each boy student should receive one color of yarn and each girl student the other color. This color determines whether they are a boy or girl.
 7. The numbering system at the Zoo only has 10 different colors, but it is easy to find beads of at least 25 different colors. Assign each letter of the alphabet a color.
 8. Students may make an ID band based on their initials, first name, last name or date of birth. They can also create their own band ID system. For instance "Sarah" might be blue, pink, yellow and "Bobby" might be purple, yellow and green. Get creative! Students can also pick their favorite penguin from *Table 1* and create a band with the appropriate colors.
- 

EDUCATOR NOTE

Bring students to Omaha's Henry Doorly Zoo & Aquarium® to practice identifying penguins. Bring the African Black-footed Penguin Photos and have students try to find the match among our African Black-footed Penguins or bring copies of Figure 1 and Table 1 and have students identify the penguins in the Scott Aquarium.

Pass the Egg

TOTAL TIME

30-45 minutes, plus time for viewing *March of the Penguins* as applicable

OBJECTIVES

- > Understanding how King and Emperor penguins incubate their eggs
- > Discover how penguin parents work together to raise their chick

MATERIALS PROVIDED

- > Replica penguin eggs
- > *March of the Penguins* DVD
- > Life-size penguins
- > *The Emperor's Egg* (Book)
- > *A Mother's Journey* (Book)

MATERIALS REQUIRED

- > Plastic Eggs

STANDARDS

See content standards page

PREPARATION

- > View *March of the Penguins* DVD as applicable
- > Gather plastic eggs for *Pass the Egg* activity
- *Do not use replica eggs for this activity



Pass the Egg

A LOOK AT HOW PENGUINS CARE FOR THEIR EGGS

BACKGROUND

Penguins have different ways of incubating their eggs. Some penguins incubate their eggs just like any other bird, by sitting or laying on it. However, a few penguins live where the climate is cold nearly year-round, and have had to develop another method of keeping their egg warm. If an egg was laid on the ground in these cold climates it would freeze.

King penguins don't build nests and have developed a rather creative way of incubating their egg. The egg is held on the feet and covered by a flap of skin called the *brood pouch*. King penguins typically breed in two years out of three. Courtship to the fledging of the chick may take 14 months or more.

Both parents share incubation of the egg and brooding of the chick, which takes approximately 15 weeks. Typically one parent will incubate the egg while the other is searching for food in the ocean. The parent with the responsibility of incubating the egg will not eat for many weeks. They will then exchange responsibilities. The egg must be passed between the parent's feet without letting it fall on the cold ground, where it could freeze in a matter of minutes.

Once the chick hatches it is also kept warm by the *brood pouch*. The chick is unable to regulate his body temperature so must remain on the feet of the adult and covered by this warm flap of skin. As the chicks grow larger they are better able to regulate their body temperature and sometimes will huddle in large groups with one another (called a rookery). Chicks are fully fledged after nine months. It takes a lot of cooperation for parents to successfully raise their chick.

OBJECTIVES

- > Understanding how King and Emperor penguins incubate their eggs
- > Discover how penguin parents work together to raise their chick

ITEMS TO UNPACK

- > Replica Eggs
- > Life-size Penguins
- > *The Emperor's Egg* Book
- > *A Mother's Journey* Book
- > *March of the Penguins* DVD

PASS THE EGG

How do penguins care for their eggs?

1. Begin by showing students the Replica Eggs. *What type of animal do you think would hatch out of eggs like these? Do you think the same species of penguin would hatch from these eggs?*
2. Display the life-size penguins that match the eggs and have the students guess which egg belongs to each penguin. Discuss their choices.
3. Discuss penguin parenting with students. *Do penguins care for their young? Yes, penguins care for their young; from egg to fledging. What does the word incubate mean? Do both parents incubate the egg? Both parents care for the chick at some point between incubation to fledging.*
4. Ask your students *how penguins that live in cold weather keep their egg warm? Some penguins use a brood pouch; others lay on the egg much like other birds. Why is it important for the egg to be warm? The egg must be kept warm so the chick can develop and hatch. What happens if the egg is left on the ground? If the egg is left on the ground or on a nest unattended for too long the egg will not hatch. In the Antarctic regions, the egg can freeze in a matter of minutes if left unattended. What other animals keep their young warm? Animals that live in cold climates will help keep their young warm when they are very small (polar bears, birds, fox, humans, etc.) Very young animals are unable to effectively regulate their body temperature which is why many animals have their babies in the spring and summer.*
5. Discuss how penguin parents pass the egg and/or chick between their feet. *Do they have hands to hold onto the egg? How do they pass the egg between their feet? Penguins will stand and face each other and then let the chick pass between their feet. However, they must carefully roll the egg from one set of feet to the other, sometimes using their bills as a guide.*
6. Here you may choose to read *The Emperor's Egg* and/or *A Mother's Journey*. These stories illustrate that the male Emperor penguin is the primary care taker of the egg. Discuss the story or stories with students.
7. View the *March of the Penguins* DVD as applicable.



PROCEDURE

**Do not use the replica eggs for the Pass the Egg activity.*

This activity will simulate the adult penguins passing the responsibility of incubating the egg. Students must pass the egg without letting it fall on the ground.

1. Pair-up students and have them stand facing each other. Place one egg on the feet of each pair of students.
2. Explain to students that they will try to pass the egg from one partner to the other using only their feet. The egg must be passed without dropping on the ground. If the egg drops the partners must start over (signifying an unsuccessful hatch). Remind students of how penguins walk and that they can't lift their feet high like we can so they must work well together to come up with a way to successfully pass the egg.
3. Make sure students are standing the first few times they pass the egg. After a few successful passes they may explore different techniques in passing the egg (still not being allowed to use their hands). For instance, some students will sit down and face each other. Let them explore and find the easiest way of passing the egg.
4. Discuss the following questions with students; *Was it hard to pass the egg? Did the egg fall off your feet? Did it get easier to pass the egg? Do you think penguin parents ever drop the egg? What other ways did you find to pass the egg? What was the easiest way you found to pass the egg?*



Just Chillin'

TOTAL TIME

50 minutes

OBJECTIVES

- > Participate in an experiment and make observations
- > Record Observations
- > Understand how penguins stay warm

MATERIALS PROVIDED

- > *How Do Penguins Stay Warm* worksheet (p.35)
- > Penguin feathers

MATERIALS REQUIRED

- > Zip-loc bags
- > Ice
- > Lard or solid vegetable shortening

STANDARDS

See content standards page

PREPARATION

- > Print the *How Do Penguins Stay Warm* worksheet (p.35)
- > Gather materials for activity



Just Chillin'

A LOOK AT HOW COLD-CLIMATE PENGUINS STAY WARM

BACKGROUND

Where do penguins live?

All penguin species live south of the equator. One misconception is that all penguin species live where it is cold. This is not true, only 5 of the 17 types of penguins live where it is cold and only 2 (the Adelie and Emperor) call the coasts of Antarctica home for a good part of their lives. Most penguin species live in warmer areas such as Australia, southern Africa or the Galapagos Islands. The northern most species of penguin is the Galapagos penguin which lives on the Galapagos Islands. The southern most species are the Emperor and Adelie which live on the coasts of Antarctica. Others live along the coasts of South America, South Africa, New Zealand, Australia and the Antarctic Peninsula.

How do penguins stay warm?

Most penguins do not worry about staying warm, instead they must find ways to stay cool. Exposed skin, seen around the eyes in some species, is one way to cool down. Penguins also hold their flippers (wings) away from their bodies to radiate heat, or stand facing the sun to reflect heat with their white bellies.

Penguins which live in colder climates (remember not all penguins live where it is cold) have many ways to keep warm. Blubber, feathers, reduced blood-flow to extremities, and larger body size (Emperor Penguin), which reduces relative surface area and heat loss, all help penguins stay warm.

Suzanne & Walter Scott Aquarium Penguin Exhibit

At Omaha's Henry Doorly Zoo & Aquarium®, the air temperature in the penguin exhibit is kept at about 40°F and the water temperature is approximately 38°F. This exhibit features King, Gentoo, and Rockhopper penguins. All of these species of penguin live where it is cold.

Blubber

Blubber is a thick layer of body fat that helps keep an animal warm. Animals such as whales, seals, some penguins, and many others have a layer of blubber which insulates them from the cold. Heat moves from warm to cold. A penguin's body is warm and without the layer of blubber to stop the transport of heat, the penguin would get cold quickly!

Feathers

Penguins have short, overlapping and densely-packed feathers (up to 100 per square inch). Each feather has a special structure that allows it to be raised or lowered. In other words, it allows the penguin to fluff its feathers. This is not a feature unique only to penguins, many other birds have this ability. *What purpose does this serve?* When a bird fluffs its feathers air is trapped underneath. Air is an insulator so it helps keep the bird warm! The outer portion of the penguin feather is watertight, while the inner portion is the downy part which traps air.

OBJECTIVES

- > Participate in an experiment and make observations
- > Record observations
- > Understand how penguins stay warm

ITEMS TO UNPACK

- > Penguin Feathers



PROCEDURE

How do penguins stay warm?

1. Begin a class discussion by asking students: *What types of animals live where it is cold? How do these animals stay warm when it is cold? (blubber, fur, feathers, huddle together) What is insulation? What items do we see in our lives that are good insulators? (wool, coats, boots, etc.) What is blubber? How does blubber keep an animal warm? What do you do to stay warm? What would you have to do to stay warm in Antarctica or other cold environments?*
2. Introduce penguins and their abilities to stay warm in extremely cold places. *Do all penguins live where it is cold?* No, most penguins live where it is warmer. Some live in warm climates, but must swim in cold, ocean waters. Those that do live where it is cold must find ways to stay warm. *How do you think these penguins stay warm?* (blubber, feathers, trap air under feathers, huddle together, etc.) Show students the Penguin Feathers and discuss how they, among other things, help keep a penguin warm.
3. Explain to students they will be doing an experiment to help them understand how some penguins stay warm in frigid temperatures. Introduce each item that students will use in the experiment.
4. Have students make and record predictions about what they think they will feel when each item is placed on their hands. Use the *How Do Penguins Stay Warm?* worksheet (page 35).
5. Fill one bag with ice cubes and seal shut. Fill one bag with a thin layer (.25"-.5") of lard or solid vegetable shortening at room temperature and seal shut. Fill one bag with air and tightly seal shut. Leave one bag empty and seal shut.
6. Place hands side-by-side with palms facing up. Place the empty bag on the hands followed by the bag with ice. *What does this feel like?* Have students record their observations.
7. Next, place the empty bag on the hands followed by the bag of air, then the bag of ice. *What does this feel like?* Students should record their observation.
8. Finally, place the empty bag followed by the bag with lard, then air and then ice. *What does this feel like?* Students should record their observation.
9. End experiment with a class discussion about each group's findings. *Were their predictions correct? Why did their hands get cold without any bags placed between the ice and the palm of their hand? Why did their hands stay warmer when air or lard was placed in between the ice and palm of hand? How do you think this would help penguins stay warm? How does blubber help an animal stay warm?*

EDUCATOR NOTE

Penguin chicks, such as Kings and Emperors, stay on their parent's feet until they are able to maintain a warm body temperature on their own. Young chicks also huddle together, forming a crèche, for warmth. This short activity will demonstrate why adult penguins are able to better maintain a warm body temperature compared to that of young chicks.

You will need:

- > 1 large container and 1 small container
- > Warm water (warm enough for children to stick their fingers in)
- > 2 Thermometers
- > Optional materials (Oatmeal, Bowl, Spoon)

1. Fill the large and small containers with the warm water. Place a thermometer in each.
2. Observe the temperature reading on each thermometer. Allow students to either place their hand on the container or stick their finger in the water. How do they feel?
3. Wait a few minutes (time depends on the size of the containers) and allow students to place their fingers in the water once again. *What do they notice? Is there a difference in temperature? Why?*

The water in the smaller container (which represents a penguin chick) will cool off much faster than the water in the large container (which represents an adult penguin). You may also use a bowl of oatmeal to demonstrate this. A bowl of oatmeal represents an adult penguin and a spoonful of oatmeal will represent a penguin chick. Have a student try to cool off the bowl of oatmeal by blowing on it (this represents the cold winds of the Antarctic), also do the same for the spoonful of oatmeal. It is easier to cool a spoonful by blowing on it, than it is to cool the whole bowl of oatmeal.



How Do Penguins Stay Warm?

	MY PREDICTIONS	WHAT DOES IT FEEL LIKE?
Empty bag with ice bag on hands		
Ice bag and Air bag on hands		
Ice, Air and Lard bags on hands		

Below the Equator

TOTAL TIME

30 minutes to multiple class periods. This lesson can be extended to a study of the continents that penguins live on.

OBJECTIVES

- > Learn that all penguins live below the equator
- > Use a map to identify where penguins live
- > Compare and contrast habitats and climate

MATERIALS PROVIDED

- > World map
- > Miniature penguins for world map
- > *Penguins of the World* playing cards

MATERIALS REQUIRED

- > Crayons
- > Internet or access to books about penguins

STANDARDS

See content standards page

PREPARATION

Print:

- > *Where in the World Do Penguins Live?* (p.41)
- > *Where We Live* worksheet (p.43)



Below the Equator

A LOOK AT PENGUINS OF THE WORLD

BACKGROUND

Where in the world do penguins live? The answer to that is easy; all penguins live south of the equator! To be more specific penguins live all around Antarctica, on the southern tip of Africa, southern Australia, New Zealand, the Galapagos Islands, and along the western and southern coasts of South America. Only 7 of the 17 penguin species inhabit the ice and cold rocky terrain of the Antarctic. Some penguins endure temperatures over 100°F, while others endure temperatures of -100°F. The record low temperature in Antarctica is a chilling -128°F! See *Table 1 (p.39)* for more information on where penguins are found.

OBJECTIVES

- > Learn that all penguins live below the equator
- > Use a map to locate places where penguins live
- > Compare and contrast habitats and climate

ITEMS TO UNPACK

- > World Map
- > Mini Laminated Penguins
- > Penguin Playing Cards



PROCEDURE

Where do penguins live?

1. Give students an introduction to maps using the World Map. *Where is Nebraska, Iowa or other states? Where are the continents of Antarctica, Australia, Africa and South America? Be sure to introduce the term equator to them. Where is the equator?*
 2. Ask students where they think penguins live. *What does their home look like? What does it feel like? Is it cold or warm? Is it icy or rocky or covered with grass?* Call on volunteers to place the Mini Laminated Penguins on the World Map where they believe penguins live.
 3. After the volunteers have guessed where penguins live, discuss where penguins actually live. Penguins are found on the continents of Antarctica, Australia, South America and South Africa. Antarctic penguins normally live in a colder climate versus South African penguins which live in a warm climate. Emperor penguins spend most of their life on ice with no materials for nests, little blue penguins do not live on ice and they make their nests in burrows! Ask students where penguins live in relation to the equator. All penguins live south of the equator.
 4. Each day you may choose to have students learn about the continents penguins live on. (*use Table 1 for your reference*) Once students have learned about the continent and the penguins that live there, have them place the matching Mini Laminated Penguin on the World Map in the appropriate location.
 5. Hand out the *Where In the World Do Penguins Live?* worksheet (p.41). Students can color the location at which penguins live. Older students can label the equator and each continent appropriately.
 6. Using the *Where we Live* worksheet (p.42) have students compare and contrast the differences between a chosen penguin's habitat and their own.
 7. As a fun closing question be sure to ask students *How many penguins can one polar bear eat in one year?* After taking numerous guesses from students remind them of where penguins live. *Where do polar bears live?* All polar bears live in the Arctic and all penguins live below the equator. The answer is: 0. They do not live in the same habitat.
 8. Here you may choose to have students play one or more of the games described in the Penguin Playing Cards.
- 

Table 1- Where do penguins live?

South America	Africa		
Falkland Island	South Africa		
Gentoo Rockhopper Magellanic Macaroni	African Black-footed		
	Australia		
Coast of Peru	Aust. Southern Coast & Northern Tasmania		
Humboldt			
Galapagos Islands	Little Blue		
Galapagos	New Zealand		
Coasts of Chile & Argentina	Little Blue Fiordland Snares Island Erect-Crested Rockhopper Yellow-eyed		
Humboldt Magellanic			
Antarctic Continent			
Antarctic Peninsula	sub-Antarctic Islands		
Emperor Chinstrap Gentoo	S. Georgia Macaroni King	Heard & McDonald Macaroni King	Prince Edward King
Circumpolar Antarctic Coast	Crozet	Kerguelen Island	Macquarie
Emperor Adelie	Macaroni King	Macaroni King	Rockhopper Gentoo Royal King
Small surrounding islands			
Chinstrap			

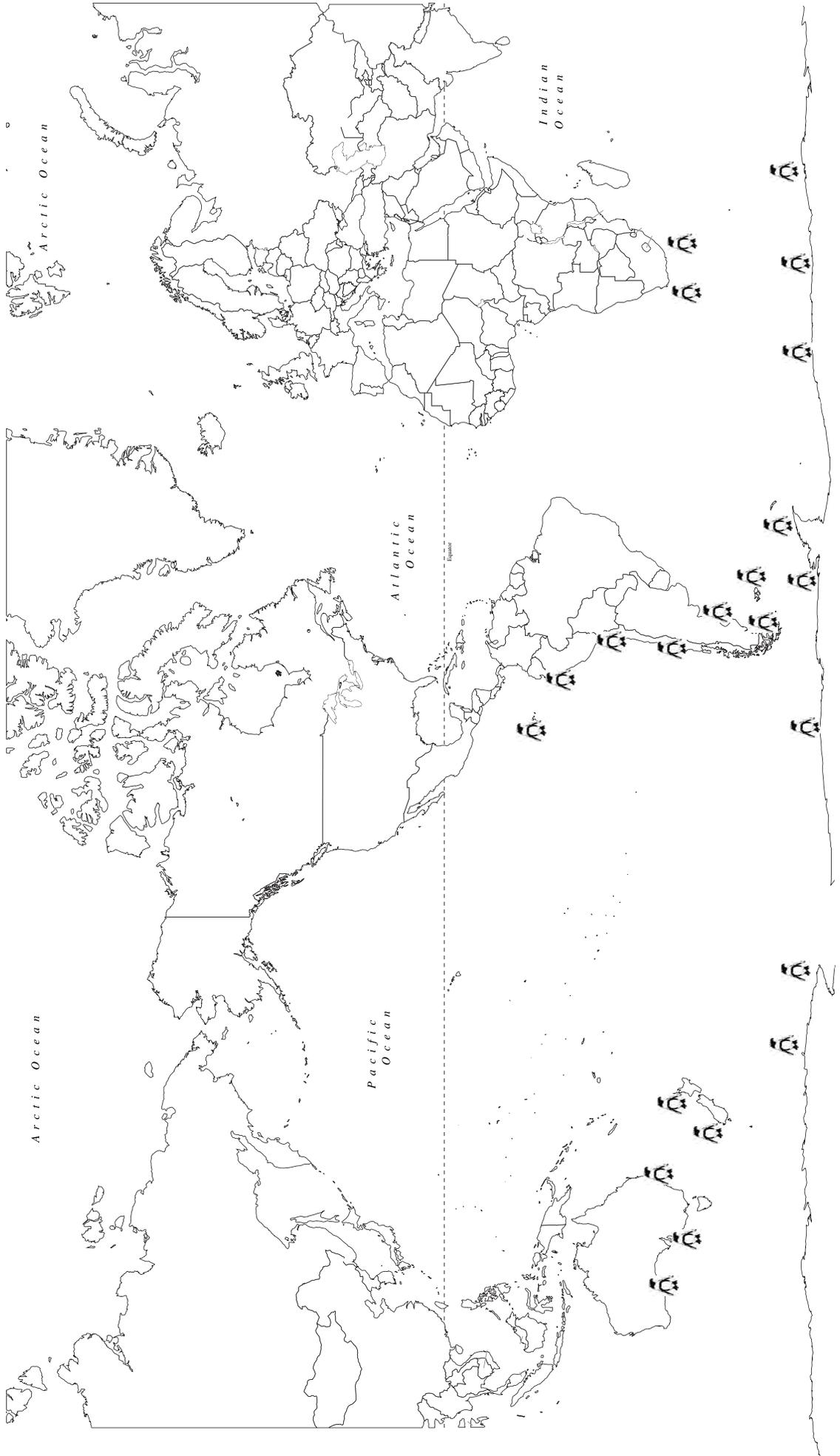
EDUCATOR NOTE

For a math extension students can conduct a survey based on what they have just learned about the continents and represent their data using a bar graph, line graph or pictograph. Following are a few sample questions.

- Would you rather visit Antarctica in the summer or winter?
- Which penguin do you think lives in the most extreme conditions?
- Would you rather live in Africa or Antarctica?
- Which penguin is your favorite?

Name _____

Where in the World do Penguins Live?



Where In The World Do Penguins Live? (CONTINUED)

Correctly label the following using the map provided:

1. The State that you live in
2. The continent that you live on
3. The Equator
4. All continents that penguins live on

In your own opinion, which penguins have the easiest life? Why?

In your own opinion, which penguins have the toughest life? Why?

Of all the continents that penguins live on, which would you most like to visit someday? Why?

Where We Live

Name _____

	My Home:	_____ Penguin's Home
Warmest Temperature		
Coldest Temperature		
Population		
Highest Point		
Lowest Point		
Amount of Snow		
Amount of Rain		

From Egg to Adult

TOTAL TIME

One class period to multiple class periods

OBJECTIVES

- > Gain an understanding of nutrition requirements
- > Use math calculations to figure nutrition requirements
- > Create graphs using data

MATERIALS PROVIDED

- > Life size penguins
- > Life size penguin chicks
- > Replica penguin eggs

MATERIALS REQUIRED

- > Calculator
- > Ruler or other measuring device

STANDARDS

See content standards page

PREPARATION

Print the following as appropriate:

- > *You Grow Like A Weed* (p.47)
 - > *Raising A Baby Penguin* (p.49)
 - > *Fish Counting* (p.51)
 - > *Be a Scientist, Measure a Penguin* (p.50)
-
- > Hang life-size penguins



From Egg to Adult

A LOOK AT HOW PENGUINS GROW & HOW MUCH THEY EAT

BACKGROUND

What do penguins eat?

Penguins spend a good part of their lives in water. In fact, a few species of penguin never set foot on land, living their lives on Antarctic ice and in the water. Although penguin species look different from one another, they all eat similar food items including; krill, various fish, crustaceans, and some squid.

What do penguins eat at the Zoo?

At the zoo the penguins are hand fed Herring and Capelin (types of fish) as their staple diet, and they are fed krill as a special treat (enrichment). The penguins are fed twice per day, once in the morning and once in the afternoon. The Aquarium penguins consume nearly 30,000 pounds of fish per year!

What do penguin chicks eat at the Zoo?

Sometimes when penguin chicks are born, the penguin parents refuse care or are unable to care for their young. If this occurs, the penguin chick is taken from the exhibit and hand-reared by zoo keepers. If left alone, this penguin chick would not survive on its own. Penguin chicks raised by zoo keepers require care 24 hours a day. Many of the chicks must be fed every 2 hours until they are weaned from formula. Chicks are fed approximately 10% of their body weight every 2 hours until they are weaned from formula.

OBJECTIVES

- > Gain an understanding of nutrition requirements
- > Use math calculations to figure nutrition requirements
- > Be able to create graphs using data

ITEMS TO UNPACK

- > Life-size penguins
- > Life-size penguin chicks

Table 1 (p.48) shows the weight gain of a Little Blue penguin chick from hatching to 40 days of age. This particular penguin chick hatched at the Henry Doorly Zoo & Aquarium and had to be hand-reared by zoo keepers.

PROCEDURE

Raising a Penguin Chick

1. Begin class discussion by asking if students *have or know someone who has pets at home? How do you take care of them?* Students should explain that they give their pets food and water, give them a clean home and maybe even play with them. *What happens if you don't take care of them?* They might get sick, etc.
2. Ask students *how they think zoo keepers take care of the animals at the zoo. Do they think it is like taking care of a pet at home?* Pets and zoo animals both need food, water and shelter. Zoo animals are not like pets though, they are still wild animals and need to be handled with care. Because there are so many animals at the Omaha Zoo (over 15,000) the keepers need to be good observers and know how to record and report information about the animals they care for.
3. *How do your students think keepers take care of the penguins? What do they eat? How often do they think penguins eat?* The keepers feed fish to the penguins 2 times per day. Sometimes they need to use a chart to record how many fish the penguins eat. The chart helps them monitor the appetite and health of each penguin in the exhibit.
4. Ask students if they have ever had to care for a baby animal. *What did they do to take care of the animal? Was it difficult? Did it take a lot of time?* Tell them about how the keepers take care of penguin chicks. *How often do the chicks get fed?* Explain that it takes a lot of time and patience to care for a penguin chick. It is always preferred that penguin parents raise their chick. However, sometimes they are unable to provide proper care for their chick. When penguin chicks are raised by zoo keepers, they require care 24 hours a day. Many of the chicks must be fed every 2 hours until they are weaned from 'formula'. Chicks are fed approximately 10% of their body weight every 2 hours until they are weaned.
5. Next, tell students that they are going to assume the role of a penguin keeper. Tell them that they will be collecting data about their penguin each day. They will record how old the penguin is, how much the penguin weighs, and how much formula needs to be fed to the penguin chick at each feeding.

6. Hand out the blank *You're Growing Like a Weed* chart. A completed chart has been provided for you so that you may provide students with a weight for the penguin chick each day. You may also choose to create multiple sets of data to create variety in the students' data.
7. Each day the students come in, they will record how many days old their penguin chick is, obtain the weight of their penguin from you, and then calculate how much formula they will need to feed their penguin.
8. Once students have collected data for the amount of days you wish, have them create a graph using their data to show the weight of the penguin chick versus his age.
9. Finally, have students complete the *How Do You Raise a Baby Penguin?* worksheet. Be sure to tell them to use their data table to help them answer the questions! Keep in mind that 1 pound=453.59 grams.

EDUCATOR NOTE

For younger students, a simpler worksheet *How Many Fish Can a Penguin Eat?* has been provided. The large fish represent Herring and the small fish represent Capelin. The numbers of fish consumed in one day represent only averages. Any given penguin can eat more or less fish. Gentoo penguins can consume 50 or more Capelin if they are very hungry, especially before they begin molting.

Using the life-size penguins, have students practice their measurements. Young students who have not yet learned to use a ruler can measure the penguin's height by using blocks or even comparing their own height to the penguin's height. Older students, who have some knowledge of measuring can use the *Be a Scientist, Measure a Penguin* worksheet to collect data for each penguin species.

In order to help a scientist identify individual animals, he or she may need to collect specific measurements from that animal. This data can later be compiled and analyzed allowing the scientist to learn more about the species and variations among individuals. Although a scientist's measurements must be very precise, this activity will instead let students refine their measuring skills and briefly introduce them to data collection.

You're Growing Like a Weed

Below is the weight and age of a Little Blue penguin chick which hatched at Omaha's Henry Doorly Zoo & Aquarium®. Create a graph using this data showing the penguin chicks weight versus his age. Be sure to label your graph correctly and give it a title!

Table 1

Penguin Chick's Age (in days)	Penguin Chick's Weight (in grams)	Amount of Formula per Feeding
1	29g	2.9g
2	29g	2.9g
4	28g	2.8g
6	25g	2.5g
8	27g	2.7g
10	36g	3.6g
12	45g	4.5g
14	60g	6.0g
16	82g	8.2g
18	109g	10.9g
20	137g	13.7g
22	172g	17.2g
24	217g	21.7g
26	276g	27.6g
28	370g	37.0g
30	435g	43.5g
32	367g	36.7g
34	456g	45.6g
36	515g	51.5g
38	604g	60.4g
40	682g	68.2g

How Do You Raise A Baby Penguin?

Use the information in **Table 1** to answer the questions listed below. Your job as a zoo keeper is to calculate how much food your newly hatched Little Blue penguin chick needs to eat. It is important to do your calculations correctly so that you do not over feed your chick and make it sick.

1. If your penguin chick is fed 10% of its body weight, how much 'formula' per feeding should the Little Blue penguin be getting when it is:

1 day old?

10 days old?

20 days old?

30 days old?

40 days old?

2. It's no wonder they put on weight quickly! Your penguin chick needs fed 6 times per day! (6:00 a.m., 8:00 a.m., 10:00 a.m., 12:00 p.m., 2:00 p.m., 4:00 p.m. and 6:00 p.m.) If the Little Blue penguin chick is fed 10% of it's body weight 6 times per day, calculate the total amount of 'formula' it receives when it is:

1 day old?

10 days old?

20 days old?

30 days old?

40 days old?

3. How much weight did the Little Blue Penguin chick gain from 1 day of age to 40 days of age?

4. Approximately how many times heavier is the Little Blue chick when it is 40 days old compared to when it hatched?

Just for fun! If human babies gained weight as fast as a Little Blue penguin, how much would a baby weigh when it is 40 days old? (Assume the human baby weighed 8 pounds when it was born)

Be a Scientist, Measure a Penguin

Name _____

Penguin Species _____

Band # _____

(Assign an identification # to your penguin)

		Unit of Measurement
Penguin Height		
Wing Length		
Beak Length		

Additional Comments:

Penguin Species _____

Band # _____

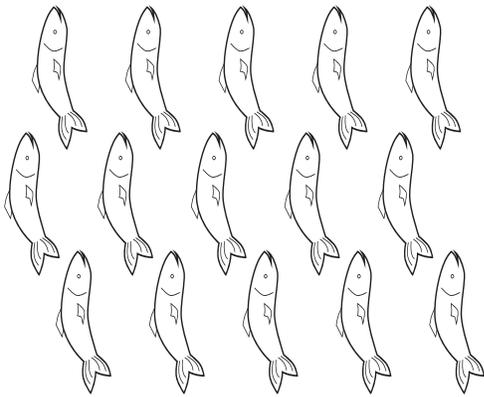
(Assign an identification # to your penguin)

		Unit of Measurement
Penguin Height		
Wing Length		
Beak Length		

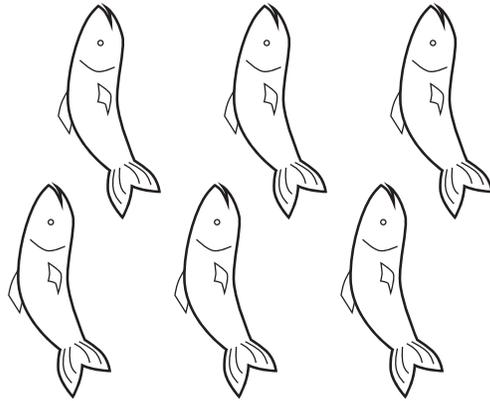
Additional Comments:

How Many Fish Can A Penguin Eat?

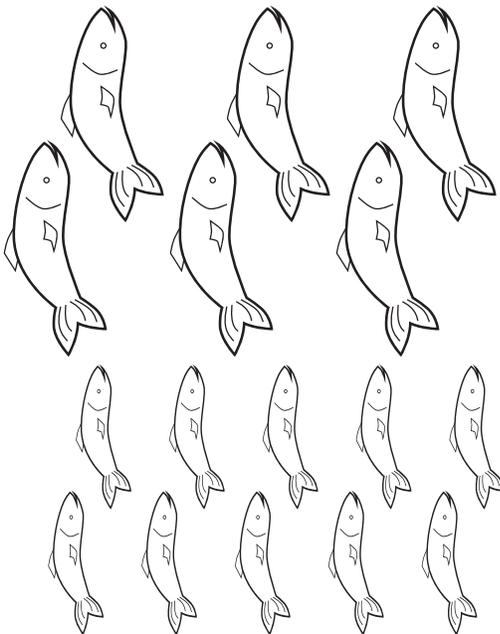
Do you want to know how many fish each kind of penguin eats in one day? Use your counting skills to find out! Remember, the big fish represent Herring and the little fish represent Capelin! Write your answers on the lines below.



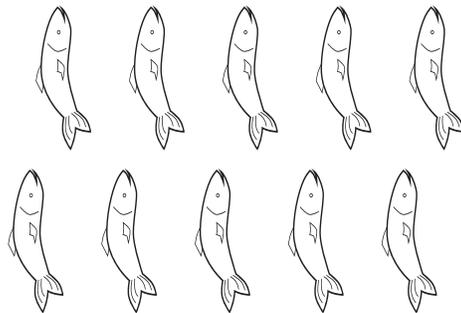
A **Rockhopper penguin** might eat this many little fish in 1 day:



A **King penguin** might eat this many big fish in 1 day:



A **Gentoo penguin** might eat this many big fish and little fish in 1 day:



A **Little Blue penguin** might eat this many little fish in 1 day:

Penguin Adaptations

> Penguins are able to control the flow of blood through their blubber. When it is cold the blood vessels are constricted and less blood is allowed to flow through them. This lessens the heat loss through that particular part of the body. When they are warm the vessels are less constricted, allowing more blood to flow and the body to cool. The same idea can be applied to their wings and feet. The temperature of the wings and feet is cooler than the inner body temperature.

> Penguins lack the numerous air spaces in their bones which other birds have.

> Penguins are *counter-shaded*. *What does this mean?* Their ventral side (belly) is white and their dorsal side (back) is black. This provides camouflage while they are swimming in the water. Predators looking at them from below see a white belly against a lighter sea surface and predators looking from above see a black back that blends in with the dark depths of the sea.

> King and Emperor Penguins have a special flap of skin called a *brood pouch*. They do not have materials available to build a nest so they use this flap of skin to cover and incubate the egg which they rest on their feet.

> Penguins can fluff their feathers which helps them cool off by allowing heat to escape. It also helps them stay warm by trapping air under the feathers.

> Because their bones are heavier it helps them sink in the water.

> Penguins have a layer of blubber (fat) which helps keep them warm.

> Penguin wings are not flexible like other bird wings. They need stiff wings to propel themselves through water, which is much denser than air. Other birds with flexible wings for flying would not be able to push their bodies through water.

> Penguins have densely packed feathers (about 71 per square inch). This gives good protection against cold.



(Above) Short, stiff wings help propel penguins through water.



(Above) King penguins provide a warm flap of feathers and skin so their young chick will not freeze.



(Above) Webbed feet aid in steering and propelling penguins through water.



(Above) Penguins have short, bristle-like protrusions in their mouth which help them catch and hold on to their prey.

Penguin ABC's

- A**ntarctic areas are home to Emperor and Adelie Penguins.
- B**lack-footed penguins live in South Africa.
- C**rèches are formed by large numbers of penguins huddling together.
- D**iving is something penguins do well. Emperors can dive the deepest at nearly 800'!
- E**mperor penguins are the largest, weighing up to 90 pounds and standing 4' tall!
- F**eathers of penguins are very small and tightly packed to prevent heat loss in frigid waters.
- G**alapagos Islands are the northernmost habitat for penguins.
- H**atching and incubating an egg is a job shared by both male and female penguins.
- I**ncubation lasts 32-64 days depending on the species of penguin.
- J**umping is one type of movement Rockhopper penguins use frequently.
- K**rill are abundant in Antarctic waters and provide food for many forms of life, from Penguins to Whales.
- L**eopard Seals are predators of penguins!
- M**olting occurs on land. Many penguins go through a catastrophic molt and are not able to enter the water during this time.
- N**ests can be rocks, sticks or burrows. Each penguin has its own nesting style. Some penguins build no nests at all.
- O**il from preening glands is spread over feathers to water-proof the penguin.
- P**orpoising penguins leap from the water to grab a breath of air.
- Q**uill is normally a term applied to flight feathers. Small, uniformly shaped penguin feathers are not designed for flight, but for warmth.
- R**ookeries are groups of penguins.
- S**wimming is what penguins do best!
- T**obogganing is a form of movement where penguins flop down on their bellies and slide along the ice.
- U**nderwater penguins can *fly* at speeds reaching 22 miles per hour!
- V**ision of penguins is adapted to underwater life. Since the reflective power of water is much greater than that of air, a penguin's eyesight is much sharper underwater.
- W**ings are short and stiff and propel penguins through the water.
- X**-factor. Penguins go to sea for as long as 6 months and travel great distances. Biologists have not been able to extensively study their behavior underwater.
- Y**ellow-eyed penguins are named for their unique eyes and are one of the most solitary penguins.
- Z**oos and aquariums all over the world are working to ensure a future for these unique birds and their habitats.

EDUCATOR NOTE

Early childhood teachers can use this page to work on letter recognition while learning about penguins. Choose a letter each day to work on and teach students the penguin fact.

After older students have learned about penguins, have them create an Alphabet book as an assessment. This page can be used as an example to help students come up with facts for each letter.



Penguin Behavior

TOTAL TIME

One class period to multiple class periods

OBJECTIVES

- > Gain an understanding of penguin behavior
- > Develop observation skills
- > Compare and contrast penguin behavior in relation to other animals
- > Collect, analyze, and draw conclusions from data

MATERIALS PROVIDED

- > Penguin Calls on *Penguins: Below the Equator* CD
- > Penguin Behavior Video Clips

MATERIALS REQUIRED

- > Calculator

STANDARDS

See content standards page

PREPARATION

Print the following as appropriate:

- > *Penguin Ethogram* (p.62)
- > *Penguin Behaviors Photographs* (p.60-61)
- > *Penguin Behaviors* (p.63)



Penguin Behavior

A LOOK AT WHY PENGUINS ACT THE WAY THEY DO

BACKGROUND

Basic questions about animal behavior initially come from observations. Before scientists can begin testing ideas, they must first study the animal in question. This may require scientists to watch the animals in their natural habitat. Observing animal behavior is complex because we cannot walk up to a penguin and ask “Why did you do that?” or “How are you feeling?” Though some behaviors are concrete, much of what we know about behavior is theoretical. It is important to avoid accessing penguins in terms of human behavior (such as happy, sad, angry).

An ethogram is a tool which helps scientists gather quantitative data of an animal’s behavior. To construct an ethogram, scientists record the number of behaviors observed in a given time frame. After spending ample time and taking copious notes, scientists then analyze the data recorded to try to make sense of the observed behaviors.

Penguins exhibit a number of different behaviors. Many of these behaviors happen for social reasons. To communicate, penguins use vocalization and exhibit physical behaviors called *displays*. These vocalizations and displays are used in a variety of ways to communicate territory and mating information. Penguins also use displays as a means of defense against trespassers. Common social behaviors among penguins include *mutual preening*, *bowing*, *ecstatic behavior*, *point and defensive gape*. Other common penguin behaviors include, *sleeping*, *eating*, *diving*, *water proofing*, *preening*, and *cooling off*.

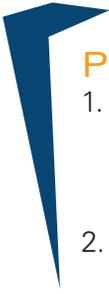
OBJECTIVES

- > Gain an understanding of penguin behavior
- > Develop observation skills
- > Compare and contrast penguin behavior in relation to other animals
- > Collect, analyze, and draw conclusions from data

ITEMS TO UNPACK

- > Penguin Calls on CD
- > Penguin Behavior Video Clips





PENGUIN ROLE PLAY

1. Introduce penguin behavior through pictures and video. You may choose to view any of the Penguin DVD documentaries provided, the Penguin Calls on CD, or Penguin Behavior Video Clips. You may also visit www.zoopenguins.org/behaviors.html.
 2. As a class, come up with a list of 7-12 penguin behaviors. Record these behaviors where students can see the list they have created.
 3. Explain to students that it is their turn to be penguins. Through role-play, the class will have the opportunity to observe twelve penguin behaviors (sleeping, resting, eating, diving in, preening, mutual preening, water proofing, cooling off, ecstatic behavior, bowing, point, defense gape). *Do any of the behaviors match the penguin behaviors we came up with as a class?* With the students, act out all twelve of these behaviors.
 4. Hand out the Penguin Ethogram worksheet (page 60). A second *Penguin Behavior* worksheet (p.61) has been included for use with younger students. Students can simply tally mark the behaviors they observe happening and then discuss what they saw. Students can practice counting the tally marks they made by each behavior and then discuss which behavior occurred the most, which behavior occurred least and which behaviors didn't happen at all.
 5. *Why is it important for scientists to observe animal behaviors?* Explain to students the concept of an ethogram.
 6. Divide the class into two groups. Half of the students are assigned the role of penguins, and half become scientists who observe and record the behaviors of the penguins. Explain to the "scientists" that they will need to choose only one "penguin" to observe. *Why might it be difficult to observe more than one animal at the same time?*
 7. "Scientists" should develop a few hypothesis. Explain to the "scientists" that they will need to make a mark next to the corresponding behavior observed at the time observed. For instance, if bowing was observed at 1 minute, put a mark next to one minute in the corresponding behavior column.
 8. Choose the amount of time for "scientists" to observe. The time has been left blank on the *ethogram* so that the teacher may fill in the appropriate periods of time. Younger students may require less time for observations, while older students may need more.
 9. Begin to role-play. Run the activity 2 to 3 times asking the students questions between each round. *How many of you observed at least 3 different penguin behaviors? Did anyone only observe one behavior? Would that be unusual in the wild?* Have students switch roles and repeat steps 6-8.
 10. Have students analyze their data and write a conclusion based on their hypothesis.
- 



OBSERVING PENGUINS AT THE ZOO

Practice observing penguin behavior at Omaha's Henry Doorly Zoo & Aquarium®. Bring the *Penguin Ethogram* worksheets (p.63) and take students to visit either the penguins in the Suzanne & Walter Scott Aquarium or the African Black-footed penguins at the Giraffe Complex. *What behaviors do you see the penguins exhibiting? What behaviors do you not see being exhibited? Can you hear the penguins?*

Great scientists always generate more questions than answers, and your students will too. Have them complete the *I Wonder* sheet (page 64) to record any questions they may have while observing the penguins.

EDUCATOR NOTE

Create a data analysis. As a class, graph five of the twelve penguin behaviors in the activity. Have each student select the number of post-it notes that corresponds with the number of times he/she observed the three behaviors. Instruct the class to build a cumulative graph of their data with the post-it notes, showing the total number of times these behaviors were observed. *Which behaviors occurred the most? Which behaviors occurred the least? Do you think this is what data from observing penguins might look like?*

*Be sure to recycle or reuse post-it notes at end of the activity.

Penguin Behaviors



Sleeping

Penguins can choose to sleep either standing up or lying down.



Resting

Penguins mostly stand, but sometimes they like to lie down and rest too.



Eating

Penguins like to eat fish.



Diving In

Penguins get ready to dive right into the water.



Preening

Cleaning their feathers so that they are in tip-top shape.



Mutual Preening

Sometimes penguins like to help each other clean their feathers.

Penguin Behaviors



Water Proofing

Penguins must use the oil found near their tail to make their feathers water repellent.



Cooling Off

Penguins will lift their wings away from their bodies to stay cool.



Ecstatic Behavior

Helps penguins find friends. Includes honking or braying.



Bowing

Penguins do this to say, "I like you."



Point

Penguins do this when an intruder is near their territory.



Defensive Gape

Penguins do this to say, "Stay away."

Penguin Behaviors

BEHAVIOR

Mark each time you see this behavior



Sleeping



**Defensive
Gape**



Eating



Diving In



Preening



Cooling Off

Penguin Behaviors

BEHAVIOR

Mark each time you see this behavior



Bowing



Resting



**Mutual
Preening**



**Water
Proofing**



**Ecstatic
Behavior**



Pointing

Penguin Playing Cards

GETTING ACQUAINTED WITH THE PENGUINS OF THE WORLD THROUGH CARD GAMES

BACKGROUND

The Penguins of the World Cards provide information and a picture of each of the penguin species found in the world. The facts on the card include items such as, height and weight of the penguin, and population status. These cards can be used in many different ways to help students become familiar with the different penguin species. Below are four games that can be played using the Penguins of the World Cards.

GUESS MY PENGUIN

1. Lay the cards out face up.
2. One player is the Chooser. The Chooser picks one penguin, but does not tell anyone.
3. Other players must guess the penguin by asking yes or no questions. For example, "Does your penguin weigh more than 8 pounds?"
4. After each questions, the players remove the cards that do not fit until finally there is only one card left.
5. All players should take turns being the Chooser.

OBJECTIVES

- > To sort and categorize data through logic and numerical reasoning.
- > Use basic math skills, such as greater than/less than and process of elimination.
- > Use basic science skills, such as observation and formulating questions.
- > Develop a greater understanding of conservation, penguins, and their natural history.

ITEMS TO UNPACK

- > Penguin playing cards



GUESS MY RULE

1. Play Guess My Penguin first to become familiar with this game.
2. The Chooser picks a secret rule about the penguins for the rest of the group to guess. For example, "only penguins that nest in burrows."
3. Demonstrate how to play with a sample rule. On a table, make a circle out of string. State the rule and place two cards inside the circle that fit the rule and two cards outside the circle that do not fit the rule. Guessers decide what the cards in the circle have in common that they do not have in common with the cards outside the circle.
4. If a guesser thinks they know the rule, they should state it, take a card from the remaining pile, and place it where they think it fits. The chooser then says yes or no.

TWO RULES

1. For a more challenging version, this game can be played after Guess My Rule. The same rules apply; however, two overlapping string circles are used to form a Venn diagram.
2. The Chooser picks two rules, such as "penguins with curved beaks" and "penguins that weigh more than 8 pounds."
3. The Chooser places two cards into each of the two circles (fits one of the rules), and two cards outside the circles (fit neither rule). He/She also places one in the intersection of the two circles (fits both rules).
4. The players again take turns placing the cards and must guess both of the rules.

LINE THEM UP

1. Make a graph on the floor or across a table.
2. Line up cards according to the penguins height. Penguins with the same measurements can be stacked on top of each other like a bar graph. *Which height is more or less common among penguins?*
3. Try this activity again lining up the cards according to weight. *Does it look different?*



**NATIONAL
SCIENCE
EDUCATION
STANDARDS**

Page #	I. Life Science	II. Unifying Concepts and Processes	III. Science as Inquiry	IV. Science in Personal & Social Perspective	V. History & Nature of Science
Just Chillin'	●	●	●		●
Pass the Egg	●	●			
Penguin Identification	●	●		●	
Why do Penguins Waddle?	●	●	●		
Penguins are Birds	●	●	●		
Below the Equator		●		●	
Penguin Conservation	●	●	●	●	
From Egg to Adult		●	●		
Penguin Behavior		●	●		
Structure & Function					
Reproduction & Heredity					
Regulation & Behavior	●				
Populations & Ecosystems	●				
Diversity & Adaptations	●				
Systems, Order & Organization					
Evidence, Models & Explanation	●				
Change, Constancy & Measurement	●				
Evolution & Equilibrium					
Form & Function	●				
Science as Inquiry			●		
Populations, Resources & Environment				●	
Science & Technology in Society				●	
Science as Human Endeavor					
Nature of Science					●