

Goals of the SeaWorld and Busch Gardens Education Departments

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

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

“For in the end we will conserve only what we love. We will love only what we understand. We will understand only what we are taught.” — B. Dioum

Penguins

K–3 Teacher’s Guide

PART OF THE SEAWORLD EDUCATION SERIES

Research/Writing

Donna Potter Parham

Technical Advisors

Brad Andrews

Wendy Turner

Education Directors

Lorna Crane

Hollis Gillespie

Bob Mindick

Joy Wolf

Editorial Staff

Jody Byrum

Judith Coats

Deborah Nuzzolo

Donna Parham

Illustrations

Doug Fulton

Noelle Phillips

SeaWorld San Diego

Creative Services

Photos

Mike Aguilera

Ken Bohn

Bob Couey

Frank Todd

SeaWorld San Diego

Photo Department

Covers

Front: Adélie penguins (*Pygoscelis adeliae*) leap from the antarctic sea.

Back (clockwise from upper left): Humboldt penguin (*Spheniscus humboldti*) chicks, a rockhopper penguin (*Eudyptes chrysocome*), a SeaWorld aviculturist feeds Humboldt penguins, a SeaWorld Adventure camper meets a Magellanic penguin (*Spheniscus magellanicus*).

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Penguins

K–3 Teacher’s Guide

A SEAWORLD EDUCATION DEPARTMENT PUBLICATION

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To the Teacher

The ***Penguins*** Teacher’s Guide for grades K–3 was developed at SeaWorld to help you teach your students—in an active, hands-on way—about penguins and the ecology of the ocean. Our goal is to integrate science, mathematics, art, and language. SeaWorld curriculum supports the *National Science Education Standards*.

The brief background information in this Guide was written for you, the teacher. It will help you do these activities with your students. We suggest you also refer to some of the materials listed on page 24 for more in-depth information. SeaWorld strives to provide teachers with up-to-date information and activities that motivate students to appreciate and conserve wildlife, the oceans, and the natural world.

Do you have comments or suggestions regarding the activities in this Teacher’s Guide? We’d love to hear your opinion. Write the SeaWorld San Diego Education Department, email us at SWC.Education@seaworld.com or call 1-800-380-3202.

Goals of the *Penguins* Unit

Students will explore the natural history of penguins and recognize that humans are an interconnected part of penguins' ecosystems.

Objectives

After completing the SeaWorld *Penguins* unit, students will be able to...

1. Recognize that there are several species of penguins and that they all live south of the equator.
2. Describe two penguin adaptations.
3. Explain how a penguin fits into a food chain.
4. Describe how penguins care for their chicks.
5. Express a concern for how human activities may impact penguins' survival.
6. Choose to change their behavior to conserve species.
7. Share their learning experience with family and friends.

Vocabulary

adaptation — a modification of a species, occurring as a result of natural selection. Adaptations enhance a species' ability to survive.

antarctic — of, at, or near the continent of Antarctica.

countershading — a type of protective coloration in which the dorsal (top) surface is darker than the ventral (underneath) surface. When lighting is from above, the animal appears inconspicuous.

endangered — in danger of becoming extinct.

down — the covering of fine, soft feathers of a young bird; also the soft underfeathers of adult birds.

food chain — a diagram that shows the transfer of energy via "who eats whom" in an ecosystem.

food web — a diagram that shows the

interconnected feeding relationships in an ecosystem. A food web is a complex pattern of several interlocking food chains.

predator — an animal that eats other animals. An introduced predator is a predator that doesn't naturally occur in a particular environment, but was brought there by people.

preen — to clean, arrange, and oil feathers.

prey — *v*: to hunt and eat other animals.
n: an animal eaten by another animal.

Species Survival Plan — a program for managing the captive populations of certain threatened or endangered animals, administered by the American Zoo and Aquarium Association (AZA).

threatened — facing a possible threat of extinction, but not facing as great a threat as an endangered species. Threatened species are likely to become endangered.

What is a Penguin?

A penguin is a bird.

All birds have feathers. Penguins have more feathers than most other birds—nearly 11 feathers per square centimeter (about 71 feathers per square inch).

Penguins *preen* their feathers to keep them in good condition, so that they keep water away from their skin. A penguin preens with its bill. A gland near the base of the tail secretes oil that a penguin distributes throughout its feathers.

A fine *down* covers most newly hatched chicks. Down feathers are not waterproof. Adult waterproof feathers grow in after several weeks or months.

Penguins “fly” only under water.

While many birds are lightweight so they can fly, penguins are heavy so they can swim and dive for food. A penguin’s wings are modified into paddlelike flippers. Although these flippers can’t get a penguin off the ground, they’re great for swimming. Webbed feet help a penguin steer as it swims.

Color me countershaded.

All penguins are dark on their backs and white on their chests. How does this *countershading* provide camouflage? Looking down into the dark sea, you might not notice a dark-colored penguin. And if you were below the penguin looking up, the light color of its chest could blend in with the filtered sunlight shining through the water.

Don’t look for penguins in the Arctic.

The earth is divided in half by the equator. All 17 species of penguins live south of the equator. Two species, the emperor and the Adélie, breed only on



penguin feather,
actual size

Overlapping, waterproof feathers cover this chinstrap penguin. Feathers trap a layer of air that helps a penguin keep warm.

the frozen *antarctic* continent. At the other extreme, the Galápagos penguin lives almost astride the equator—on the Galápagos Islands off the coast of Ecuador, South America. The rest live along the Antarctic Peninsula, subantarctic islands, and coastal areas of South America, Africa, Australia, and New Zealand.

Penguin Parents



Penguin chicks “pip” by poking a small hole in the egg. They chip at the shell until they can push off the top. Chicks may take as long as three days to chip their way out.

Which came first, the penguin or the egg?

Like other birds, penguins lay eggs. Some species such as the Humboldt, Magellanic, and fairy penguins nest underground in burrows. These are species that breed in regions where temperatures can range from very cold to quite hot. The temperature of an underground burrow stays relatively constant for the eggs and chicks.

Adélies, chinstraps, and some other species use stones, vegetation, and other materials to make nests.

Some species never build nests. A king or emperor penguin incubates a single egg on the top of its feet. A featherless patch of abdominal skin keeps the egg warm.

Are you my mother?

Penguin chicks require attentive parents for survival. Parents brood (keep warm) chicks by covering them with their brood patch. Both parents feed the chick regurgitated food. Sometimes parent birds cannot take care of their chicks. When this happens at SeaWorld, keepers hand-raise penguin chicks.

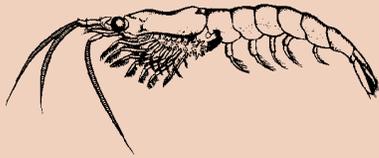


An emperor penguin parent holds its chick on the top of its feet, keeping the chick warm under a loose fold of abdominal skin. A fine down covers the newly hatched chick.

Penguin Survival

What do penguins eat?

Penguins eat mostly squids, fishes, and krill. Krill are small crustaceans—relatives of shrimps, crabs, and lobsters. Penguins feed at sea. They catch prey with their strong bills and swallow it whole.



The antarctic krill (illustrated here at actual size) is about 5 centimeters (2 inches) long—and prey for penguins.

Not just penguins eat krill.

Blue whales, right whales, crabeater seals, leopard seals, fishes, and many antarctic seabirds also eat krill. A colony of 5 million Adélie penguins may eat nearly 8 million kg (17.6 million lb.) of krill and small fishes daily.

Several nations already harvest krill as a source of protein. The commercial value of krill may encourage large-scale harvesting of this resource in south polar waters, which would impact penguins and other marine animals that rely upon krill as a food source.

Are penguin populations safe?

All penguins are legally protected from hunting and egg gathering. But other threats still remain. Introduced land *predators* such as cats and dogs prey on penguins. Overeager sightseers and photographers may come too close to breeding areas. Probably the most important problems that penguins face are habitat destruction, oil spills, pollution, and reduction of food resources from overfishing.

The future looks brighter than the past.

SeaWorld is a participating institution in the American Zoo and Aquarium Association *Species Survival Plan* (SSP) for the Humboldt penguin. Since the early 1970s, more than 100 Humboldt penguins have hatched at SeaWorld San Diego.

Through breeding efforts at zoological parks such as SeaWorld and by careful regulation of human interactions, the penguins' future looks secure. If we all continue to act responsibly, we can keep it that way. You can do your part by recycling, saving energy, supporting research on penguins, and learning all you can about penguins and their world.



Humboldt penguins are endangered, and SeaWorld San Diego participates in the Humboldt penguin Species Survival Plan.

A Peek at Penguins

There are 17 species of penguins. Use these cards to help your students identify each penguin species. Copy and cut apart the cards. Distribute a set to each student or group. Have them find out —

- Which is the tallest penguin?
- Which is the heaviest penguin?
- Which is the most numerous penguin?
- Which is the most *endangered* penguin?

NOTE: *Distribution* indicates breeding distribution. *Population* may be expressed as number of individuals or number of breeding pairs, which is estimated by counting penguin nests during the breeding season.

emperor penguin

Aptenodytes forsteri

size: 112 cm (44 in.), 27–41 kg (60–90 lb.)

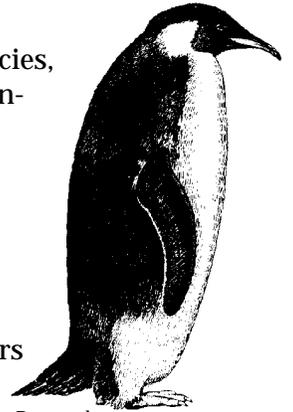
distribution: Antarctica

ID: Largest of the 17 species, emperors have lemon-yellow ear patches that open out onto the chest.

prey: fishes, squids

predators: leopard seals, killer whales, skuas

population: 218,000 breeding pairs



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king penguin

Aptenodytes patagonicus

size: 94 cm (37 in.), 13.5–16 kg (30–35 lb.)

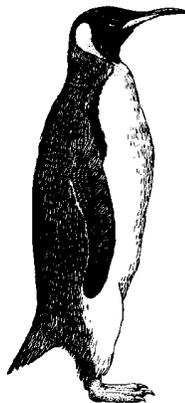
distribution: subantarctic islands

ID: A king penguin's vivid orange, teardrop-shaped ear patches are closed off from the white chest.

prey: squids, fishes

predators: leopard seals, skuas, giant petrels, gulls, sheathbills

population: 1.6 million breeding pairs



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Adélie penguin

Pygoscelis adeliae

size: 46–61 cm (18–24 in.), 3.5–4.5 kg (8–10 lb.)

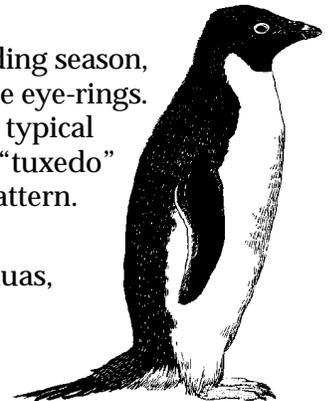
distribution: Antarctica

ID: During the breeding season, adults have white eye-rings. Adélies have the typical black and white "tuxedo" penguin color pattern.

prey: mainly krill

predators: leopard seals, skuas, sheathbills

population: 2.5 million breeding pairs



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gentoo penguin

Pygoscelis papua

size: 61–76 cm (24–30 in.), 5.5–6.5 kg (12–14 lb.)

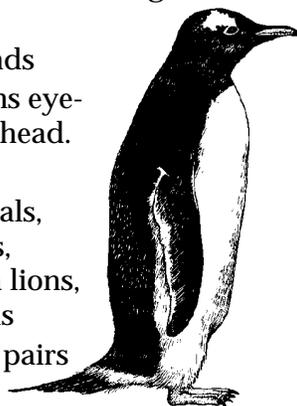
distribution: antarctic and subantarctic islands

ID: A white band runs eye-to-eye across the head.

prey: krill, squid

predators: skuas, leopard seals, antarctic fur seals, New Zealand sea lions, Southern sea lions

population: 317,000 breeding pairs



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chinstrap penguin

Pygoscelis antarctica

size: 46–61 cm (18–24 in.), 4 kg (9 lb.)

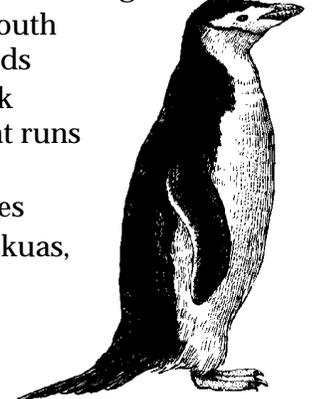
distribution: antarctic and South American islands

ID: Look for a black "chinstrap" that runs under the chin.

prey: krill, small fishes

predators: leopard seals, skuas, sheathbills

population: 7.5 million breeding pairs



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rockhopper penguin*Eudyptes chrysocome*

size: 41–46 cm (16–18 in.), 2.5 kg (5–6 lb.)

distribution: subantarctic islands

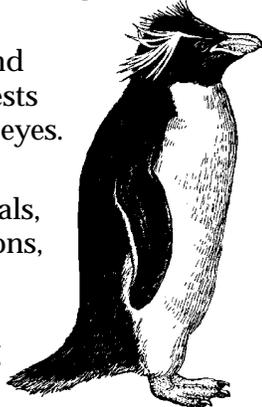
ID: Look for red eyes and drooping yellow crests that start behind the eyes.

prey: fishes, squids, krill

predators: New Zealand fur seals, New Zealand sea lions, Southern sea lions, skuas, gulls

population: 1.8 million breeding pairs—*vulnerable*

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**macaroni penguin***Eudyptes chrysolophus*

size: 51–61 cm (20–24 in.), 4.5 kg (10 lb.)

distribution: subantarctic islands in the Atlantic and Indian oceans

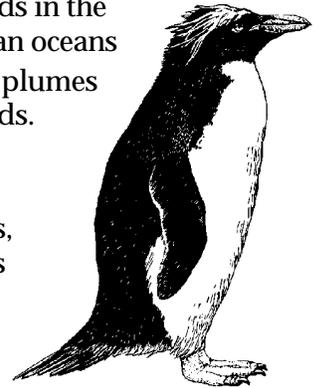
ID: A crest of orange plumes extends backwards.

prey: squids and krill

predators: leopard seals, antarctic fur seals, skuas, sheathbills

population: about 9 million breeding pairs—*near threatened*

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**royal penguin***Eudyptes schlegeli*

size: 66–76 cm (26–30 in.), 5.5 kg (12 lb.)

distribution: Macquarie Island

ID: Royals are the only crested penguins that have white throats and cheeks.

prey: krill, squids

predators: New Zealand fur seals, skuas, giant petrels

population: 850,000 breeding pairs—*vulnerable*

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**Fiordland crested penguin***Eudyptes pachyrhynchus*

size: 61 cm (24 in.), 2.5–3 kg (6–7 lb.)

distribution: subantarctic islands and New Zealand

ID: Yellow crests above the eyes and a stout bill.

prey: small fishes, crustaceans, cuttlefish

predators: New Zealand fur seals, stoats (weasel relatives)

population: 2,500 to 3,000 breeding pairs—*vulnerable*

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**erect-crested penguin***Eudyptes sclateri*

size: 64 cm (25 in.), 2.5–3.5 kg (6–8 lb.)

distribution: Australia; New Zealand; Bounty, Campbell, and Auckland Islands

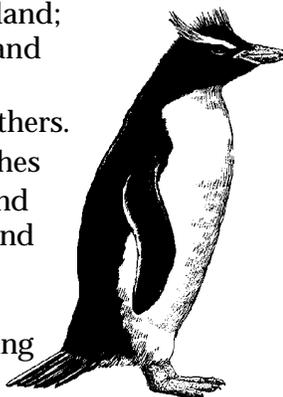
ID: An erect crest of feathers.

prey: probably squids, fishes

predators: possibly New Zealand sea lions, New Zealand fur seals, Australian sea lions

population: 50,000–60,000 breeding pairs—*endangered*

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**Snares Island penguin***Eudyptes robustus*

size: 64 cm (25 in.), 2.5–3 kg (6–7 lb.)

distribution: south of New Zealand in the Snares Islands

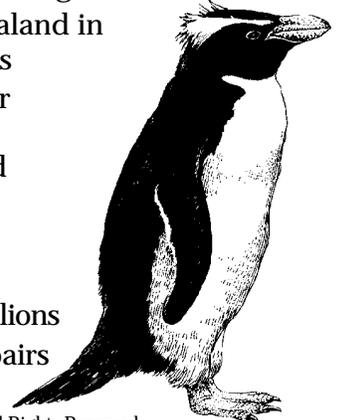
ID: Darker and larger than the similar Fiordland crested penguins, with a heavier bill.

prey: squids, fishes

predators: New Zealand sea lions

population: 23,000 breeding pairs—*vulnerable*

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yellow-eyed penguin

Megadyptes antipodes

size: 76 cm (30 in.), 6 kg (3 lb.)

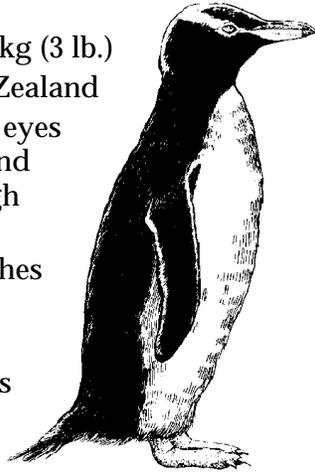
distribution: southeast New Zealand

ID: Look for yellow eyes and a yellow band that runs through each eye.

prey: squids, small fishes

predators: New Zealand sea lions

population: 6,000 individuals
—*vulnerable*



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fairy penguin

Eudyptula minor

size: 41 cm (16 in.), about 1 kg (2 lb.)

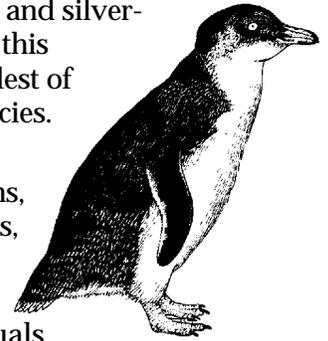
distribution: southern Australia and New Zealand

ID: Slate blue feathers and silver-gray eyes identify this penguin, the smallest of all 17 penguin species.

prey: small fishes

predators: Australian sea lions, fur seals, dogs, cats, stoats, ferrets

population: about 700,000 to 1,200,000 individuals



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Magellanic penguin

Spheniscus magellanicus

size: 61–71 cm (24–28 in.), 5 kg (11 lb.)

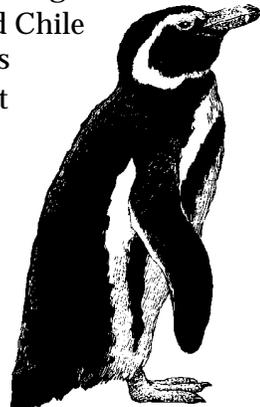
distribution: Falkland Islands and Chile and Argentina coasts

ID: Look for two distinct brown chest stripes.

prey: small fishes, cuttlefish

predators: Southern sea lions, leopard seals, Patagonian foxes

population: 1,300,000 pairs
—*near threatened*



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Humboldt penguin

Spheniscus humboldti

size: 56–66 cm (22–26 in.), 4 kg (9 lb.)

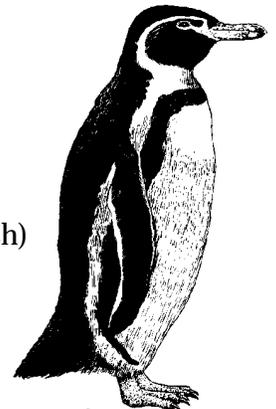
distribution: islands off western South America, and along the coasts of Peru and Chile

ID: Look for just one chest stripe.

prey: anchovetta (small fish)

predators: possibly sharks and Southern sea lions

population: 33,000 individuals
—*endangered*



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African penguin (formerly black-footed penguin)

Spheniscus demersus

size: 61–71 cm (24–28 in.), 3 kg (7 lb.)

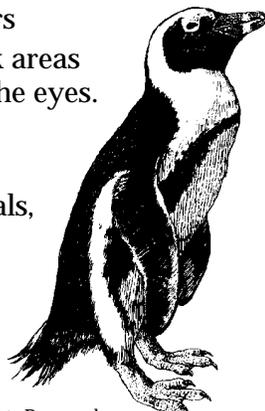
distribution: South African waters

ID: Look for fleshy pink areas around and above the eyes.

prey: squids, crustaceans, fishes

predators: South African fur seals, Southern sea lions, octopus, sharks, sacred ibis, gulls

population: 180,500 individuals
—*threatened*



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Galápagos penguin

Spheniscus mendiculus

size: 53 cm (21 in.), about 2.5 kg (5–6 lb.)

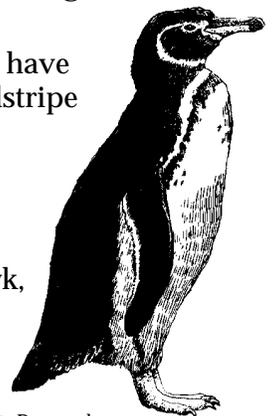
distribution: Galápagos Islands

ID: Galápagos penguins have a narrow white headstripe and almost totally black flippers.

prey: small fishes

predators: sharks, eared barn owls, Galápagos hawk, feral cats, dogs

population: 1,500 to 4,000 pairs
—*endangered*



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My Penguin Memory Book

OBJECTIVE

Students will keep a daily journal, recording facts about penguins.

MATERIALS

- notebook (one per student)
- pencils
- markers, crayons, or paints

BACKGROUND

All scientists keep logs or journals about what they are studying. In a log, they record what they saw, learned, or wondered about. The log can be a personal diary, or it may be used as a reference when they publish their scientific discovery.

ACTION

1. Have the students imagine that they are penguin scientists. They write down what they learn about penguins each time penguin topics are discussed in class. Remind

students to record the date of each journal entry.

2. To inspire students, write something about penguins on the board each day.

- Penguins are birds.
- Penguins are black and white.
- Some penguins live in Antarctica.
- Penguins lay eggs.
- Penguins have feathers.
- My favorite penguin is the...

3. Students illustrate each page and the journal cover.



Hubbs-SeaWorld Research Institute scientist Dr. Ann Bowles records penguin vocalizations inside the SeaWorld Penguin Encounter®.

A Body of Geography

OBJECTIVES

Students will be able to demonstrate that all penguins live south of the equator and relate where various species of penguins live.

MATERIALS

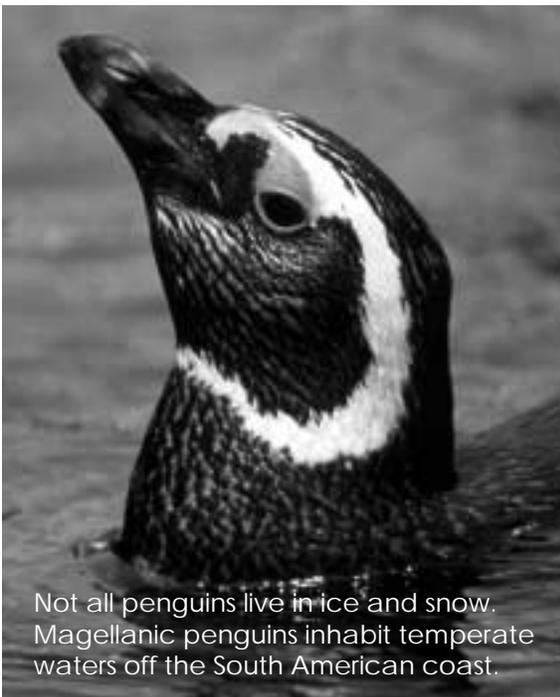
- globe and Southern Hemisphere map on page 11
- photocopied penguin illustrations (pages 6-8)
- tape

ACTION

1. Show students a globe and point out the equator, the north pole, and the south pole. Explain that the north polar region is called the Arctic and the south polar region is called the Antarctic. Point out the continent of Antarctica on the globe. Tape penguin illustrations to areas on the globe where each species is found.
2. Next, have students stand and pretend to be a globe. Use these directives: "Everybody put your

hands on your waist. Your waist is the equator. Where is the north pole?" (Children touch or point to the tops of their heads.) "Where is the south pole?" (Children touch or point to their toes.)

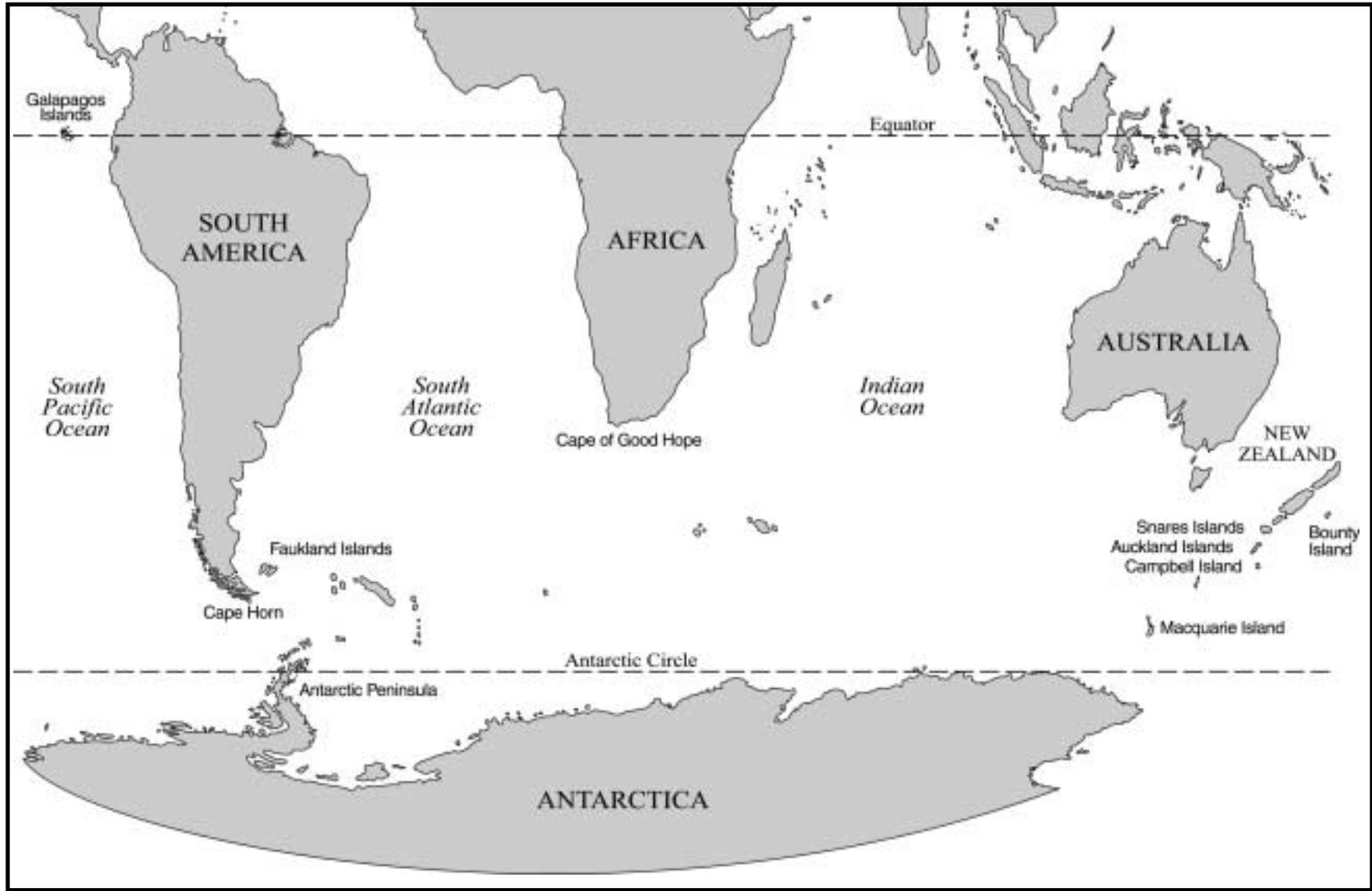
3. Ask students to tap themselves where various penguin species live. See page 11 for penguin species distribution. Here are a few ideas:
Galápagos belly button
Humboldt right thigh
African left thigh
Magellanic . . . just above right knee
yellow-eyed . . right knee
royal left knee
rockhopper . . midcalf/shin
gentoo left ankle
king right ankle
Adélie right foot
emperor left foot
4. Choose a student volunteer and have classmates tape pictures of penguins on the volunteer.



DEEPER DEPTHS

Research the history and exploration of areas where penguins live.

Southern Hemisphere



Black and White Buddy

OBJECTIVES

Students will demonstrate that penguins are countershaded and show how countershading disguises a penguin. Students will identify the adaptation that gives penguins color (feathers).

MATERIALS

- black, white, and orange construction paper
- craft pattern pieces on page 13
- glue
- about 5–10 white cotton balls per student
- two plastic “googly” eyes per student (optional)



ACTION

1. For very young students, prepare the following materials. (Older students can cut out penguin body parts.)

Using the pattern pieces on page 13, cut the penguin body from black construction paper, belly (oval) from white construction paper, feet (triangles) from orange construction paper, and beak (diamond) from orange construction paper. If you aren't going to use googly eyes, cut eyeballs (circles) out of black and white construction paper.

2. Distribute penguin bodies and feet. Students glue penguin feet onto their penguins' bodies, folding the feet so that they stand out at a 90° angle.
3. Distribute beaks and show students how to fold them in half (to form triangles) and glue half to their penguins' heads, so that the other half points outward. Distribute eyes and have students glue penguin eyes in place.

4. Finally, distribute white cotton balls and have students glue these onto the white belly of their penguin. (Gluing works best if the students put a small amount of glue on their penguin and press a cotton ball onto it.)
5. Spread black construction paper on the floor. Show students how to hold their penguins facing down, as if the penguins were swimming.

To show students how countershading helps disguise penguins, have students lower penguins below their eye level. Point out that, looking down, a penguin's black back blends in with the dark ocean bottom (in this case the dark floor).

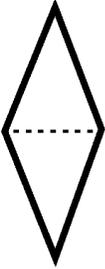
Now have students raise penguins above eye level. Point out that, looking up, the penguin's white belly blends in with the lighter surface waters (in this case the lighter ceiling).

Black and White Buddy pattern sheet



EYES

Cut eyes or use plastic "googly" eyes from a craft store.



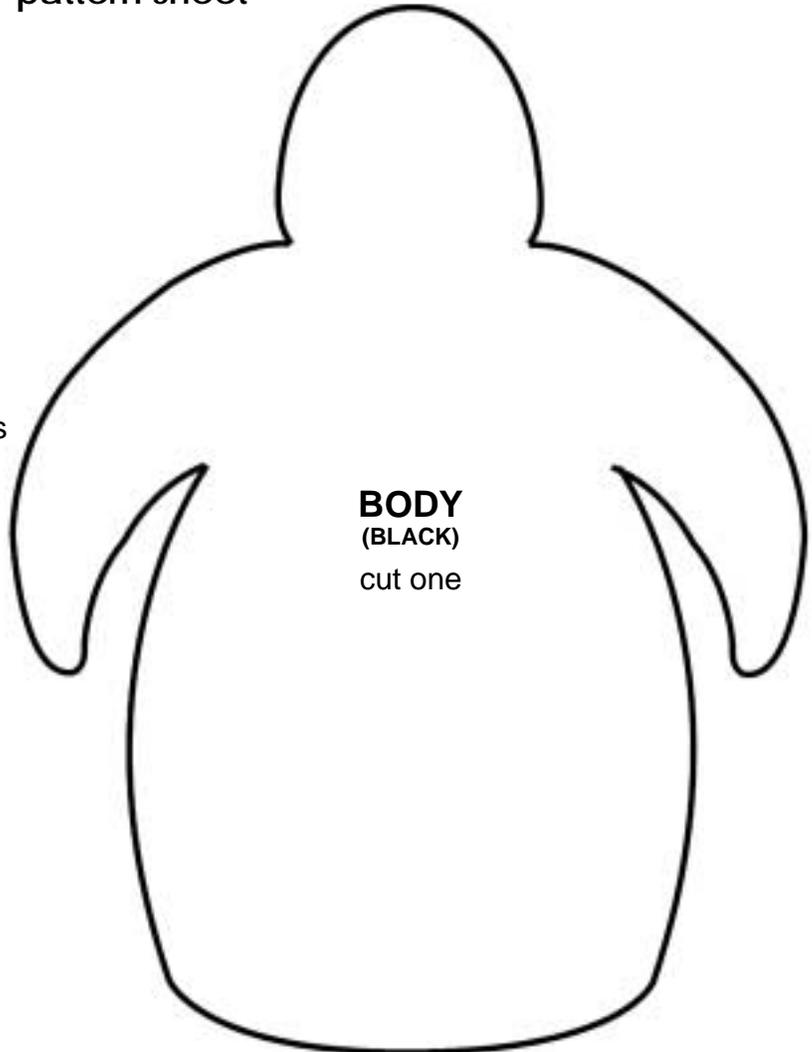
BEAK
(ORANGE)
cut one

Fold beak in half and glue half to penguin's head, giving beak a 3-D effect.

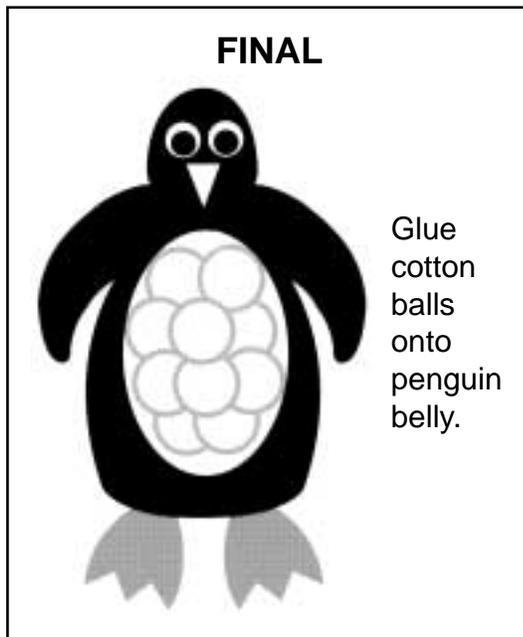


FEET
(ORANGE)
cut two

Glue feet onto body then fold them so that they stand out at a 90° angle.

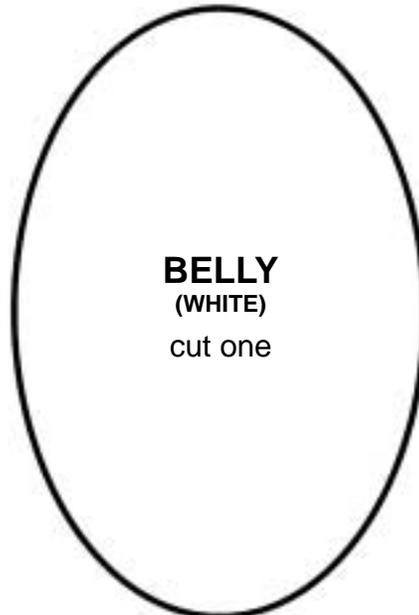


BODY
(BLACK)
cut one



FINAL

Glue cotton balls onto penguin belly.



BELLY
(WHITE)
cut one

Penguin Spelling Games

OBJECTIVES

Students will learn to recognize, spell, and write words about penguins and Antarctica.

MATERIALS

per student:

- copy of ***Penguin Spelling Games*** funsheet on pages 15–16
- pencil and eraser

ACTION

1. Distribute ***Penguin Spelling Games*** funsheets, pencils, and erasers to students.
2. Write the words *arctic* and *antarctic* on the board. Explain that the word *arctic* means the north polar region. The word *antarctic* means the opposite (ant-) of the arctic, or the south polar region. State that the students must first learn to spell arctic correctly, then add “ant” to make antarctic.
3. Count the number of letter “c”s in the words arctic and Antarctica. There are two “c”s in each. (Many writers forget the first “c” and write *artic*. Practice pronouncing the words arctic and antarctic with strong emphasis on the first “c.”)
4. Have students circle the correct spelling of the other antarctic words.
5. Next, write the word “Antarctica” vertically on the board. Show the students how to use the letters to create other words describing the antarctic (as you might do in the game Scrabble®).
6. Write these penguin spelling words on the board: *polar, snow, south pole, sea, weather, ice, mountains, birds, cold, whales*.
7. Students fill in the missing letters on their funsheets in the spaces provided. Allow students to work on the word puzzle as a group or individually.

ANSWERS TO MISSING LETTERS PUZZLE

p	o	l	a	r				
	s	n	o	w				
s	o	u	t	h	p	o	l	e
	s	e	a					
w	e	a	t	h	e	r		
		i	c	e				
m	o	u	n	t	a	i	n	s
		b	i	r	d	s		
		c	o	l	d			
w	h	a		l	e	s		



This gentoo penguin is at home in Antarctic ice and snow.

Penguin Spelling Games

1. Circle and count the letter **c** in these words:

arctic	_____
antarctic	_____



2. Circle the correct spelling of these words. Then show how to correct misspelled words:

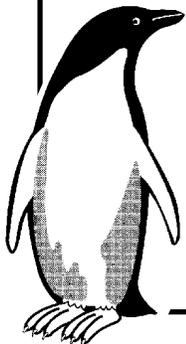
penguin	or	penquin
oshin	or	ocean
seals	or	seles
krill	or	kril
antartica	or	antarctica
whale	or	wale
ice	or	ise

3. Finish the word puzzle below. First, write the words you have learned about penguins. Then use the word *Antarctica* as your base word. Fill in the missing letters.

My penguin spelling words:

polar _____

	—	o	l	a	—		
			s	n	—	—	
	s	—	—	t	h	—	—
		—	e	a			e
—	e	a	—	e	r		
			i	c	—		
	—	o	u	—	t	—	—
				—	i	—	d
				c	o	—	d
	w	—	a	—	e	s	



Penguin P.E.

OBJECTIVES

Students will imitate the locomotion styles of penguins and other antarctic animals.

MATERIALS

- ❑ large play area

BACKGROUND

Penguins use flippers to swim. On land they may walk, hop, or slide. Penguins, whales, fishes, and other ocean animals must swim to find food and escape from predators.



ACTION

1. Take students to an outdoor play area or large room. Have students spread out across the play area.
2. To begin this activity, have students pretend to be swimming penguins. Demonstrate how students' arms will become penguin wings, called flippers, and move in an up-and-down motion. To steer, penguins bend their tail and flippers. When they are ready to jump out of the water, penguins swim very fast, then jump out onto the ice. Have students role-play these motions (flap arms, wiggle body, jump).
3. Once all of the penguins have jumped ashore, describe how penguins walk to their nests. Emperor penguins walk slowly and regally. They may point beaks and eyes downward slightly. They have very short legs and take small steps. Have students walk like emperors.

Other penguins, like chinstraps, can walk much faster. They hold their wings out for balance and run to their nest sites. Their legs are still short but they can run almost as fast as people can. Have students hold out their arms and run in place.

Rockhopper penguins hop. They hold both feet together and hop from rock to rock up steep hills. Have students hop around. How far can the student penguins hop? Does hopping make them more tired?

4. Students should now sit down to catch their breath. While resting, describe how many types of animals live in antarctic seas. Some, like whales, move their tails up and down. To demonstrate, have students hook their thumbs together so hands look like a whale's tail. Move tails up and down. Now have students move their tails side to side like a fish.

Other animals have more than one set of legs to swim with. Introduce krill (page 5). To swim like a school of krill, have students lie on their backs and kick their legs and wave their arms in the air.

5. Have everyone sit up and take a few deep breaths. Talk about the animals they became. Do any students have a favorite? Do any students know of another animal and how it moves? As you end the activity, make sure legs and arms still work as you return to moving like people.

The Food Connection

OBJECTIVES

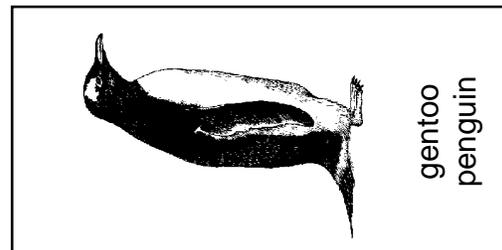
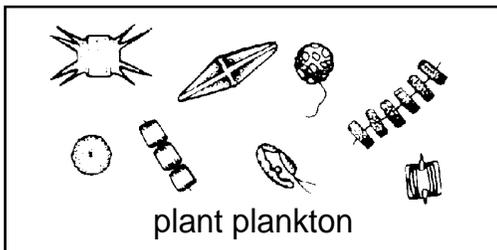
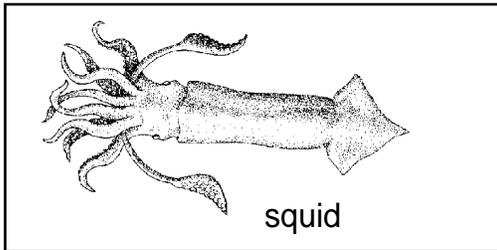
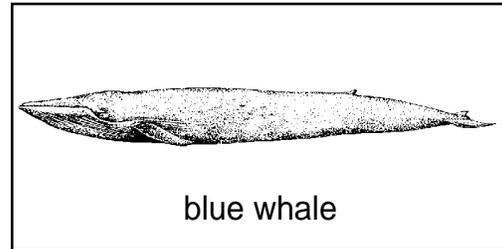
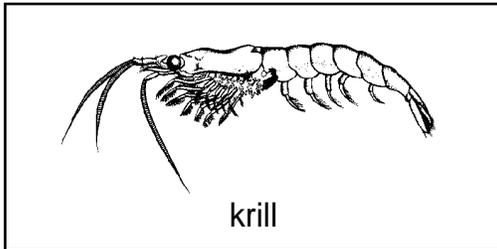
Students make connections among penguins and other antarctic animals.

BACKGROUND

A food chain is a diagram that shows "who eats whom." A food web is a diagram that shows some of the many interconnected feeding relationships in an ecosystem. Food chains and food webs help us understand relationships in an ecosystem.

MATERIALS

- classroom bulletin board and tacks
- Copies of cards below. Copy the following quantities, enlarged at 150%.
 - blue whale 1
 - killer whale 1
 - gentoo penguin 1
 - squid 2
 - krill 4
 - plant plankton 8 or more
(enough for each student to have a card)
- large sun illustration or yellow circle
- coloring pencils or crayons
- 3" x 5" index cards
- yarn
- scissors



ACTION

2. Distribute one card to each student. Students color their illustrations and glue them to index cards.
3. Ask for the student with the killer whale card to come forward. What do killer whales eat? (*Penguins*) Ask for the student with the penguin card to come forward and hold hands with the killer whale. What do penguins eat? (*Krill*) Ask for a student with a krill card to come forward and hold hands with the penguin. What do krill eat? (*Plant plankton*) Ask for a student with a plant plankton card to come forward and hold hands with the krill. Where do plants get energy? (*From the sun*) Attach an illustration of the sun (or a yellow circle) to a classroom bulletin board and have the plant plankton touch the sun. The students have just illustrated a food chain. Students sit down.
4. Now the whole class will work together to illustrate a food web. Ask students with plant plankton cards to bring their cards to the bulletin board. Explain that these are microscopic plants that drift in the sea. Like plants on land, plant plankton gets its energy from the sun. Tack the plant plankton cards to the bulletin board (near the sun). Use yarn to link each plant plankton card to the sun.
5. Next, have students with krill cards bring their cards to the bulletin board. Krill get energy by eating plankton. Tack the krill cards to the bulletin board. Use yarn to link each krill card to two or more plankton cards.
6. Students with squid cards bring their cards to the bulletin board. These squid get energy by eating krill. Tack the squid cards to the bulletin board. Use yarn to link each squid card to two krill cards.
7. Ask the student with the penguin card to bring it to the bulletin board. Gentoo penguins get energy by eating krill and squid. Tack the penguin card to the bulletin board. Use yarn to link it to one krill card and one squid card.
8. Ask the student with the blue whale card to bring it to the bulletin board. Blue whales get energy by eating krill, and it takes a lot of krill to feed a blue whale. Tack the blue whale card to the bulletin board. Use yarn to link it to each krill card.
9. Ask the student with the killer whale card to bring it to the bulletin board. Killer whales get energy by eating fishes, marine mammals, and (in the Southern Hemisphere) penguins. Tack the killer whale card to the bulletin board. Use yarn to link it to the blue whale card and to the penguin card.
10. Ask students to talk about the diagram. Include the following discussion points:
 - The sun is the source of energy for our planet. Only plants can use the sun's light to make energy.
 - Animals must eat plants or other animals to make energy.
 - All the plants and animals in the system are interconnected. One cannot be removed without affecting others.
 - How do people affect a food chain?

Adding and Subtracting Penguins

OBJECTIVES

Students will solve math problems about penguins.

MATERIALS

per student:

- Adding and Subtracting Penguins*** funsheet on page 21
- pencil
- scratch paper

per class:

- tape measure
- butcher paper

ACTION

1. Photocopy the ***Adding and Subtracting Penguins*** funsheet and distribute to students. Explain new vocabulary words before students begin the exercises. Students complete question 4 on the back side of the funsheet.
2. For question 3, tape butcher paper to a wall and mark 44 inches on the paper. Label the mark "emperor penguin." Then mark each student's height on the same piece of paper.

DEEPER DEPTHS

Students use penguin information to write their own story problems.

ANSWERS

1. $26 - 13 = 13$
2. $7 \text{ eggs} + 9 \text{ penguins} = 16$
- 3b. (Example) *Debbie is 36 inches tall. She is shorter than an emperor penguin.*
- c. (Example) $36 \text{ in.} < 44 \text{ in.}$

How does a student's height compare to the height of an emperor penguin?



Adding and Subtracting Penguins

1. There are 26 penguin mothers and chicks on the ice. Of these, 13 are chicks. How many are penguin mothers?

2. Predators eat penguins and penguin eggs. If a seal eats three penguins, a skua eats seven eggs, a shark eats five penguins, and a killer whale eats one penguin, how many penguins and eggs were eaten by these predators?

_____ eggs + _____ penguins = _____ penguins and eggs

3. Emperor penguins are the largest of all penguins. Some reach 44 inches tall. Find out if you are taller, shorter, or the same height as an emperor penguin:

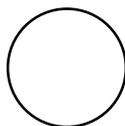
- a. How tall are you? Have your a partner or your teacher measure your height in inches. Write your height here:

- b. Write a sentence with words that compares your height to an emperor penguin.

- c. Write a math sentence comparing your height to an emperor penguin. Use the symbol $>$, $<$, or $=$.

4. Use the shapes below to draw a penguin. You may use each shape more than once. Draw on the other side of this paper.

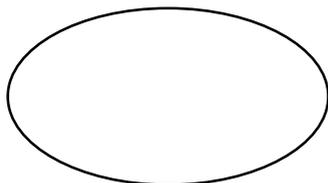
circle



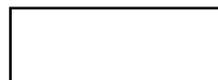
square



oval



rectangle



triangle



A Slick Operation: Oil Spill Lab

OBJECTIVES

Students will be able to demonstrate and discuss the effects of oil on a bird's feathers and discuss a variety of ways humans might be able to remove it.

BACKGROUND

Oil spills can be devastating for marine animals. Penguins and other marine birds rely on clean feathers for water-proofing and insulation. When fouled with oil, the birds try to clean their feathers. Sadly, the birds often die of starvation, of hypothermia, or from ingesting the toxic oil.

In June 2000 an iron ore carrier sank off the coast of South Africa, leaking tons of oil into the sea. The oil spill threatened the African penguins inhabiting Dassen and Robben Islands, which comprise about 40% of the total African penguin population.

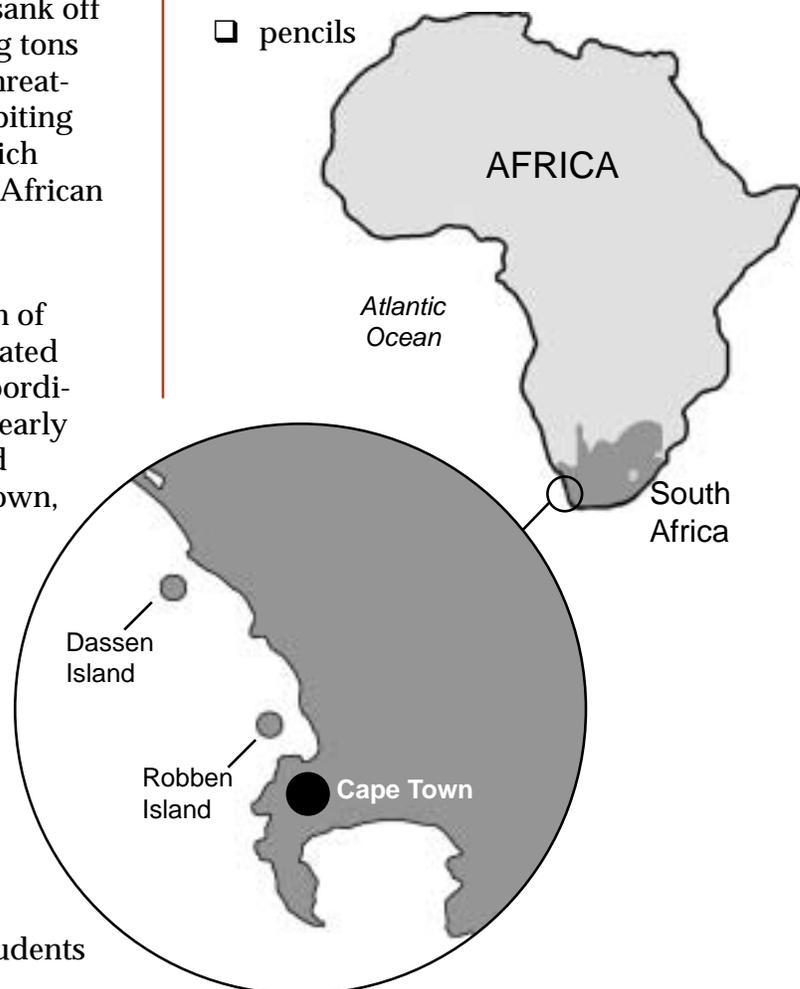
The Southern African National Foundation for the Conservation of Coastal Birds (SANCCOB) relocated 19,000 un-oiled penguins and coordinated rehabilitation efforts for nearly 19,000 oiled penguins. SeaWorld penguin experts flew to Cape Town, South Africa to assist with the cleaning and care of the oiled penguins. They washed the penguins with a grease-cutting dishwashing detergent and rinsed them with fresh water, repeating the process until the penguins were oil-free.

Hubbs-SeaWorld Research Institute scientists have studied ways to clean oil from marine animals. In this activity, your students perform a similar study.

MATERIALS

per student group:

- three large clean feathers (*Examples: ducks, parrots—from the beach, ponds, pet stores, local zoos, or craft stores*)
- vegetable oil
- five large bowls
- water
- 1 Tablespoon mild hand soap
- 1 Tablespoon powdered laundry detergent
- 1 Tablespoon dishwashing liquid
- paper
- pencils



ACTION

For each group:

1. Fill all five bowls with water. Label three bowls: #1, #2, and #3.
2. Dissolve a tablespoon of mild hand soap in bowl #1, a tablespoon of powdered laundry detergent in bowl #2, and a tablespoon of dishwashing liquid in bowl #3.
3. Pour a slick of vegetable oil on top of the water in bowl #4.



SeaWorld bird experts clean a duck fouled with oil. First they wash off the oil with dishwashing detergent and water, then they dry and warm the duck.

4. Give each group three feathers and have students examine each feather's texture and weight. Have them dip feathers in the oil and then examine them. Discuss how oil changed the feathers and the effects that oil might have on a bird.
5. Ask the students to hypothesize about ways to remove the oil.
6. Have the students try to wash off the feathers in plain water (bowl #5). Ask them to describe what happens to the feathers.
7. Next, students try to wash the feathers in each of the detergent solutions. (Use one feather per bowl.) Ask the students to write down which (*solution #1, #2, or #3*) worked the best. Let the students compare their results and record them on a chalkboard or other large writing surface.
8. Reveal the names of the detergents and show the containers they were in.
9. Discuss what would happen to a bird in an oil spill. Why are feathers important to birds? How do birds clean their feathers? What might happen if a bird ingests the oil?

DEEPER DEPTHS

Test other hypotheses that students suggest to remove the oil. Try other types of oils and detergents. Investigate why and where oil spills occur. What kinds of animals are found in these places?

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*Available through SeaWorld San Diego. Call 1-800-380-3202 for prices.

Penguins Pre/Post Assessment

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

- Draw a picture of a penguin. Show a friend your penguin's eyes, wings, and feet.
 - Name all the different kinds of penguins you know.
 - On a globe or world map, show where you might find the different kinds of penguins that you know.
 - Pretend you are a penguin. Show how you walk on land and swim in the ocean. Can you fly? What do you eat? Show how you would take care of your egg and your chick.
 - Draw a simple food chain that includes a penguin, some krill, and a killer whale.
 - Name one way that people can help conserve penguins.
-

National Science Education Standards Connections in this Guide

*Connections to National Science Education **Life Sciences** Standards include...*

- Characteristics of organisms
- Organisms and environments
- Life cycles of organisms

*Connections to National Science Education **Personal and Social Perspectives** Standards include...*

- Types of resources
- Science and technology in local challenges
- Changes in environments

*Connections to National Science Education **History and Nature of Science** Standards include...*

- Science as a human endeavor

*Connections to National Science Education **Science as Inquiry** Standards include...*

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

Unifying Concepts and Processes to help students understand the natural world include...

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

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

Want more information?

If you have a question about aquatic animals, call **1-800-23-SHAMU** (1-800-237-4268). TDD users call **1-800-TD-SHAMU** (1-800-837-4268). These toll-free phone numbers are answered by the SeaWorld Education Department.

The SeaWorld Education Department has books, teacher's guides, posters, and videos available on a variety of marine animals and topics. Call or write to request an Education Department Publications catalog.

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SeaWorld San Diego

(800) 380-3202
500 SeaWorld Drive
San Diego, CA 92109-7904

Discovery Cove

(407) 370-1280
6000 Discovery Cove Way
Orlando, FL 32821-8097

SeaWorld Orlando

(800) 406-2244
7007 SeaWorld Drive
Orlando, FL 32821-8097

Busch Gardens Tampa Bay

(813) 987-5555
P.O. Box 9158
Tampa, FL 33674-9158

SeaWorld San Antonio

(210) 523-3606
10500 SeaWorld Drive
San Antonio, TX 78251-3001

Busch Gardens Williamsburg

(757) 253-3000
One Busch Gardens Blvd.
Williamsburg, VA 23187-8785