PATHFINDER EDITION NGPATHFINDER.ORG APRIL 2009

NATIONAL GEOGRAPHIC Explorer!

Living Color 2

LIFE SCIENCE

Reading Strategy: As you read this story, think about how the ideas and information fit together.

Living

By Gary Miller

Important Insects. *Butterflies like this peacock butterfly help flowering plants thrive.*

Color

They flitter. They flutter. And they fill the air with color. Follow the flight of butterflies and see how they keep plants in bloom.

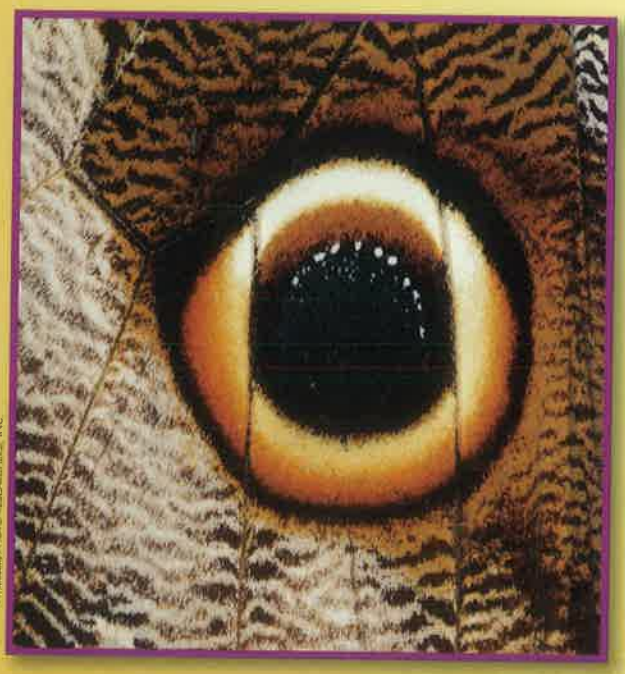
The monarch butterflies begin to arrive in October. At first, a few; then many thousands land. Some have traveled 3,200 kilometers (2,000 miles). They have flown as high in the air as 3,000 meters (10,000 feet).

The butterflies are looking for a warm place to spend the winter. And Pacific Grove, California, is the perfect spot. There, the monarchs dart through a small grove of eucalyptus trees. They make a beautiful blur of bright orange and black.

Flying Jewels

Monarchs are just one of more than 17,000 known species of butterflies. Butterflies live in just about every part of the world. They survive in many habitats. You can find them from frozen Arctic plains to tropical rain forests.

Butterflies come in every color of the rainbow. Some flash emerald green with traces of yellow. Others have wings laced with pink and purple. The patterns on their wings vary, too. You can find wings with swirling stripes or tiny dots. Some even have huge, fake eyes.



DR. KEITH WHEELER/PHOTO RESEARCHERS, INC.

Fooled You! *Tiny scales on a butterfly's wing create a fake eye. It can scare away birds.*

Butterfly Basics

What makes a butterfly a butterfly? For starters, butterflies are insects. So all butterflies have six legs. Butterflies also have antennae on top of their heads. Each antenna ends in a club shape.

When you see a butterfly, what's the first thing you notice? Probably its wings. They are paper-thin. Butterfly wings are also **symmetrical.** That means the colors and patterns on the left wing mirror those on the right wing.

A butterfly's color comes from its scales. Thousands of tiny scales cover its wings. The scales have an unusual texture, or feel. It affects light in amazing ways. The scales on a butterfly's wing can reflect light in a rainbow of rich colors.

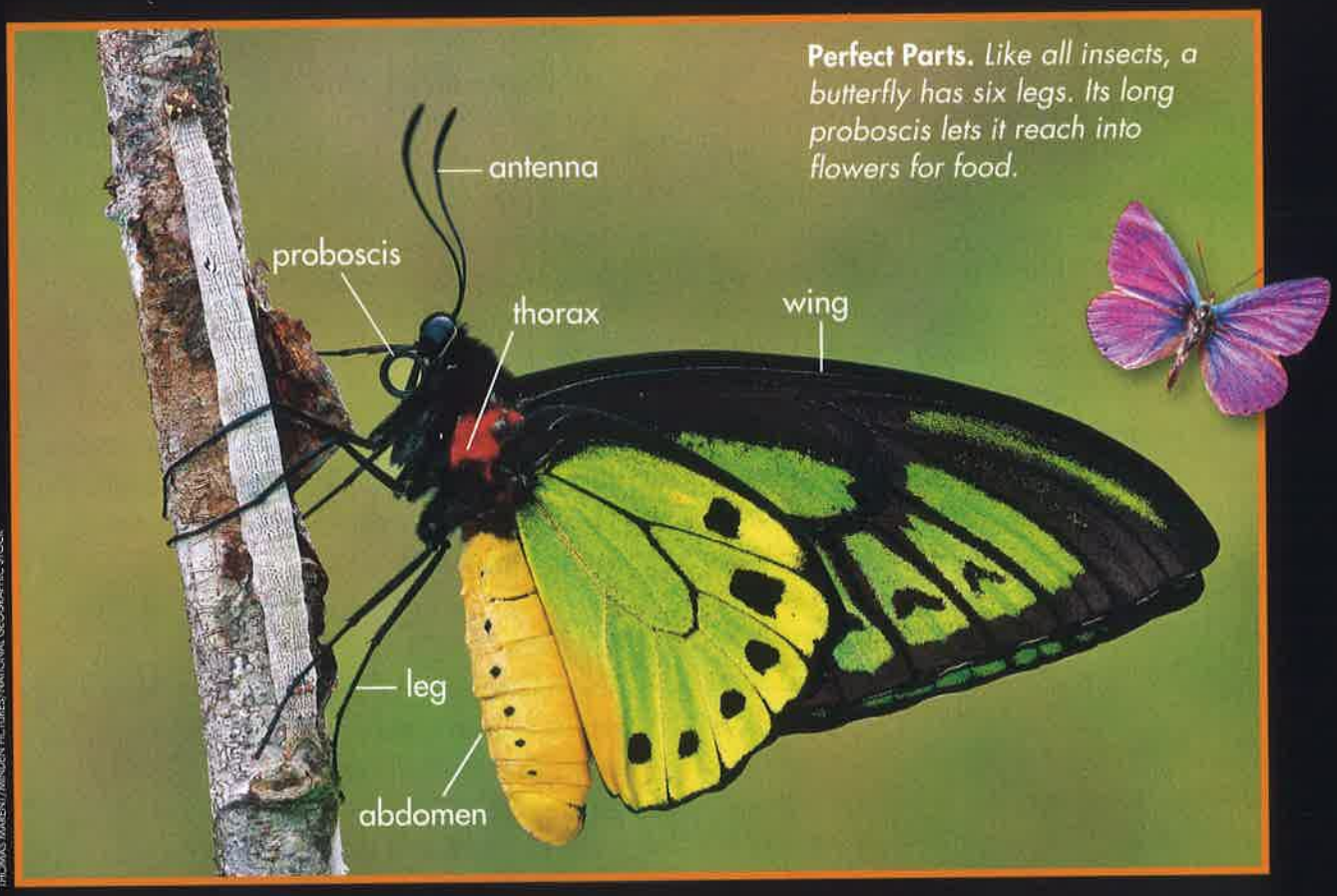
Scientists are studying how this works to create new makeup. The makeup would change color depending on where you are standing when you look at it. Butterfly scales are also giving scientists ideas for computer and cell phone screens. The screens will be brighter and easier to see.

Butterfly Beginnings

A butterfly's life cycle has four phases. They are egg, caterpillar, **pupa,** and adult. This entire cycle is called **metamorphosis.** First, a female lays her eggs on a plant. Several days pass. Tiny caterpillars then squirm out of the eggs.

For food, the caterpillars nibble the plant. They grow big and strong. Some caterpillars escape predators. They make it to the next part of the cycle. That is the pupa phase.

During the pupa phase, the caterpillar forms a **chrysalis** around itself. Inside, its body breaks down and forms new parts. It grows six legs. It grows antennae and wings. At last, the chrysalis breaks open. An adult butterfly wriggles out. It dries its wings. Then it takes flight. Often, an adult heads straight for a flowering plant. This is the start of an important relationship.



Perfect Parts. *Like all insects, a butterfly has six legs. Its long proboscis lets it reach into flowers for food.*

THOMAS MARENT/MINDEN PICTURES; NATIONAL GEOGRAPHIC STOCK

DARRELL GULIN/SCIENCE FACTION

Rainbow Reflection. *What colors do you see on this butterfly's wings? In certain light, the wings of a Chinese peacock butterfly look green, blue, violet, and even red.*

Food and Flowers

An adult butterfly feeds only on liquids. Nectar is its main food. It is made by flowering plants. To drink nectar from a flower, a butterfly sips through its proboscis. That's a long, hollow tube on its head.

While the butterfly eats, the flower's pollen sticks to its legs. Pollen is a yellow powder that plants need to reproduce. When the butterfly flies from one flower to the next, it carries along the pollen. A little pollen falls off at each new flower. That fertilizes the plant. So the plant is able to make new seeds.

This relationship has existed for millions of years. Butterflies need nectar to eat. Plants need butterflies and other flying animals to reproduce. It's a perfect partnership.

Plant Partners

Over the years, butterflies and plants have slowly changed. In some cases, they have changed to fit one another in wonderful ways.

One good example is the palamedes swallowtail. It often feeds on the flowers of yellow-fringed orchids. The flowers are shaped like long tubes. An animal needs an extra long proboscis to reach the nectar. That is just what the swallowtail has! Yet it hasn't always been that way.

Scientists think that long ago, the orchid's flowers were shorter. The swallowtail's proboscis may have been shorter, too. Over time, both plant and butterfly changed.

Bad Taste

Sometimes, sweet nectar brings plants and butterflies together. Other times, the relationship isn't so sweet. Monarch caterpillars munch on milkweed. It is a toxic plant. The caterpillars build up a resistance to the poison. So it doesn't harm them. In fact, it helps!

The poison a monarch eats as a caterpillar helps it survive when it is an adult butterfly. If predators, such as birds, try to munch on a monarch butterfly—yuck! The poison makes the butterfly taste terrible. That may make the bird think twice before it takes a bite out of another monarch.

Human Impact

The relationship between butterflies and plants is an ancient one. But people sometimes upset that relationship. One way is by using pesticides, or poisons. These poisons are used to kill insects that eat food crops. Sadly, pesticides kill butterflies, too.

That's not the only problem. People often clear land for buildings. When they do, they cut down the plants butterflies need to survive. Fewer butterflies means fewer pollinators for flowering plants. Without pollinators, new plants will not grow.

The survival of butterflies is not just important for plants. It's important for people, too. How can you help? Plant a garden filled with flowering plants. It won't be long before it's filled with butterflies' living color!

For the Record

- **The largest butterfly is the Queen Alexandra's birdwing. It can grow to 28 centimeters (11 inches) across.**
- **The *Tongeia minima* of China is the world's smallest known butterfly. Its wingspan is only about 15 millimeters (half an inch).**
- **Some butterflies can fly as fast as 48 kilometers (30 miles) per hour.**
- **A painted lady butterfly can fly for 997 kilometers (620 miles) without resting.**

Queen Alexandra's birdwing

© DON JOHNSTON/AGE FOTOSTOCK/PHOTOLIBRARY

Plant Partner. *Monarch caterpillars eat toxic milkweed plants. When they are adults, the poison will make them taste bad to birds.*

PAUL ZAHL

Drink Up. *This butterfly uses its long proboscis to sip nectar from flowers.*

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Wordwise

chrysalis: hard case that forms around a butterfly during the pupa stage

metamorphosis: big changes some animals go through to become adults

pupa: stage of an insect's life between egg and adult

symmetrical: having matching colors, parts, or shapes on both sides

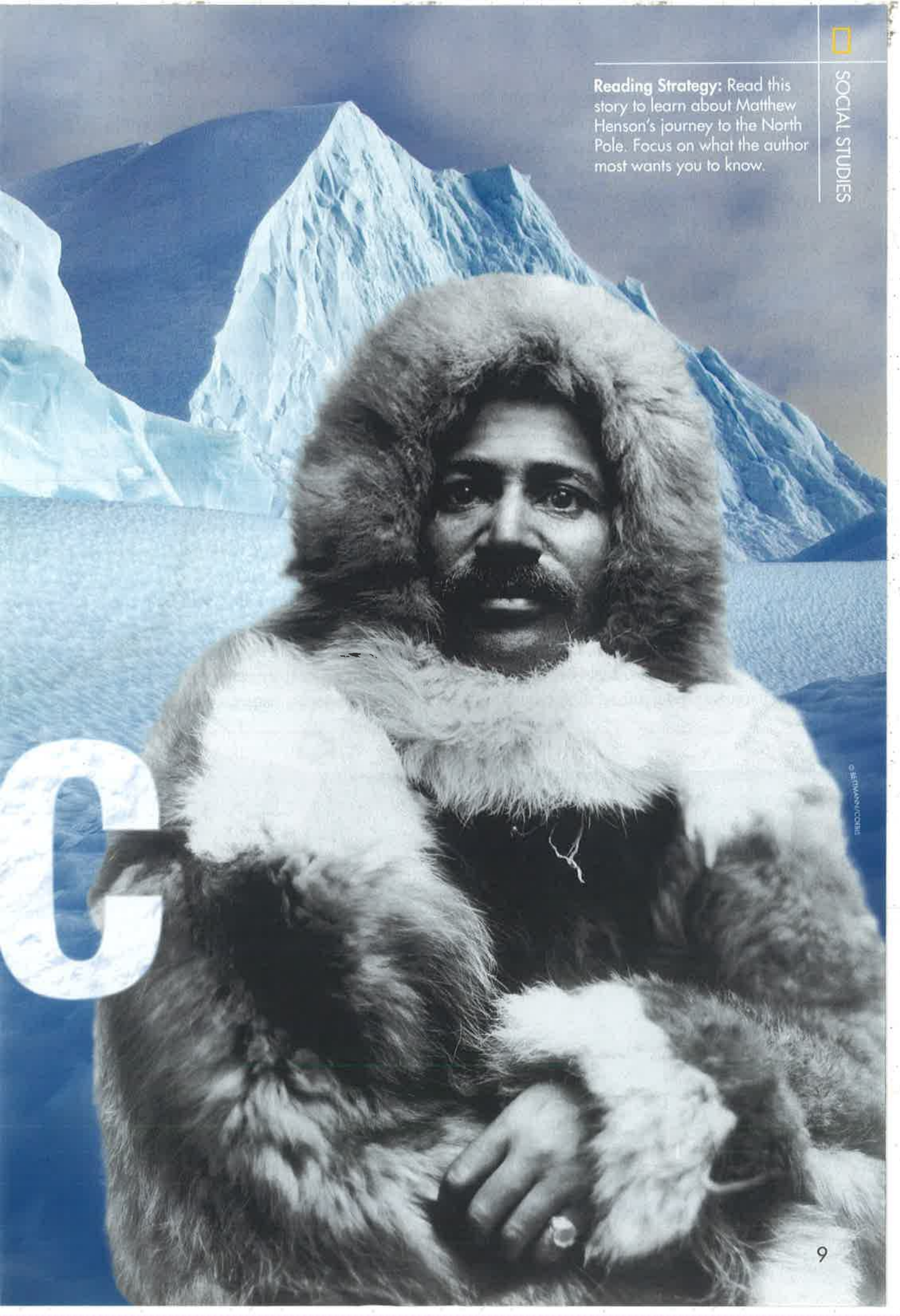
Exactly 100 years ago, African-American explorer Matthew Henson did what no one had ever done before. He braved freezing cold, ice, and racism to reach the North Pole.

ARCTI ADVENTURER

By Dolores Johnson

Author of National Geographic's book *Onward*

Reading Strategy: Read this story to learn about Matthew Henson's journey to the North Pole. Focus on what the author most wants you to know.



© BETTMANN/CORBIS

Matthew Henson charged fast across the ice. The North Pole was just miles away. It was April 1909, and no one had ever reached the top of Earth before.

Henson carved a path in the ice. The runners of his sledge sliced through crusted snow like knives. His dogs howled with excitement as they pulled the sled.

Suddenly, the ice cracked. Henson, his dogs, and the sledge plunged into the icy waters of the Arctic Ocean. Henson struggled. He swallowed frigid water. Had he wasted his life chasing a dream, only to fail?

Ice Dangers

Many explorers had tried to reach the North Pole. They faced a brutal maze of dangers. Pressure ridges rose as high as six-story buildings. Deep crevasses, or holes, gaped in the ice. Temperatures dropped as low as minus 50° Celsius (minus 59° Fahrenheit).

That spring, as Henson raced toward the Pole, the ice began its annual thaw. Leads, or watery breaks in the ice, made travel very dangerous. Yet Henson was determined to succeed.

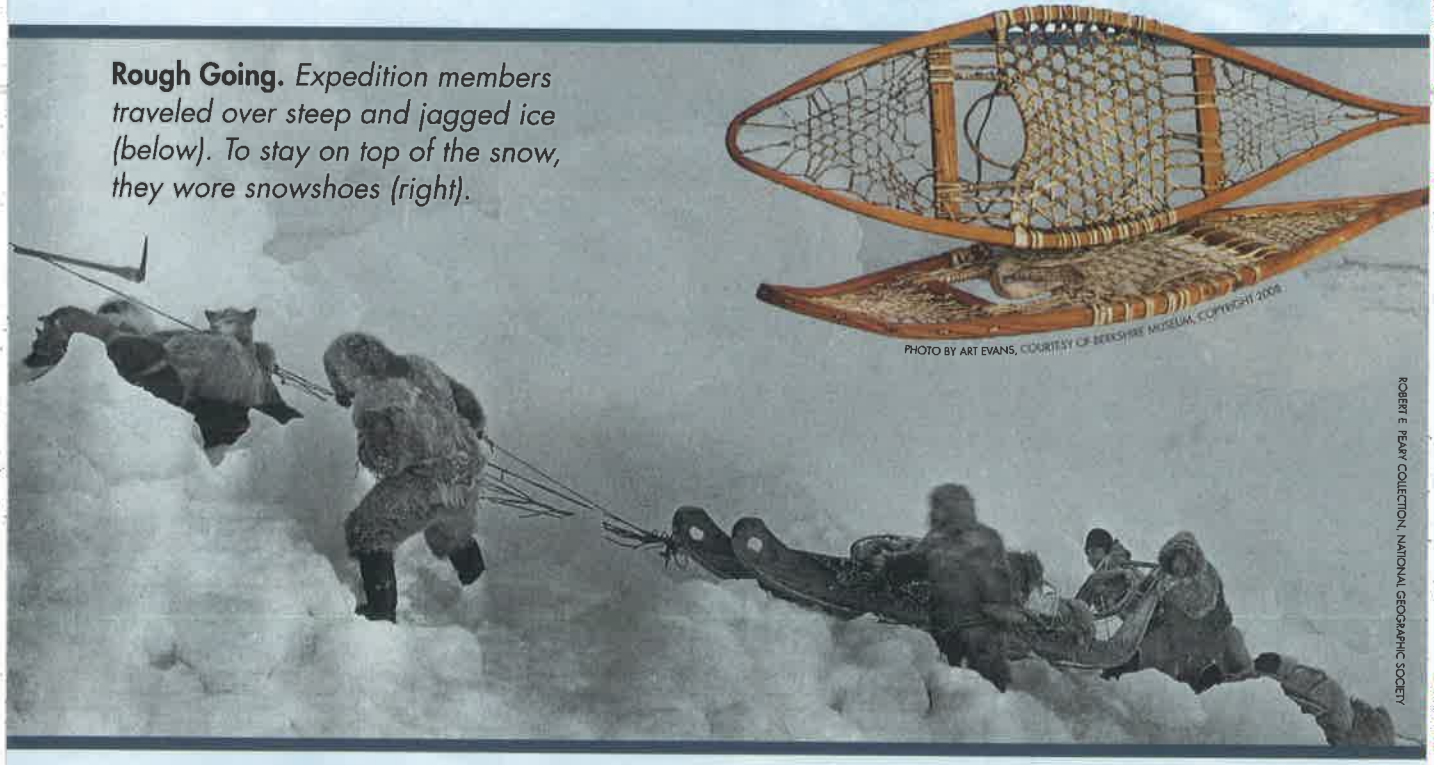
The Journey Begins

Henson's Arctic dream began 18 years earlier with an offer from explorer Robert Peary. The pair had worked together in Nicaragua. Peary was an engineer. Henson began working as Peary's servant. He quickly became his right-hand man.

In 1891, Peary began planning a trip to Greenland, within the **Arctic Circle.** He wanted to use Greenland as a base for a later **expedition** to the North Pole. Peary wanted Henson's help. Yet he wondered if a man whose ancestors came from the warm climate of Africa could survive the cold.

"I'll go North with you, sir, and I think I'll stand it as well as any man," a confident Henson said. Peary agreed. On the trip, Henson built sledges. He also hunted, cooked, and even made crutches when Peary broke his leg.

Both men wanted to be celebrated explorers like Christopher Columbus. Henson thought that if he succeeded, he could help make all African Americans feel proud. At the time, most black people in America worked unskilled jobs. They certainly were not expected to become famous, respected explorers.



Rough Going. *Expedition members traveled over steep and jagged ice (below). To stay on top of the snow, they wore snowshoes (right).*

PHOTO BY ART EVANS, COURTESY OF BERKSHIRE MUSEUM, COPYRIGHT 2008

ROBERT E. PEARY COLLECTION, NATIONAL GEOGRAPHIC SOCIETY

Survival Skills

In Greenland, expedition members stayed with the native people, the Inuit. Henson learned the Inuit language. He treated them as family. "I have come to love these people," he wrote in a book about his travels. The Inuit called Henson "Maripaluk"—Matthew, the Kind One.

They taught Henson skills needed to survive in the harsh Arctic. He learned how to build icehouses, called igloos. He learned how to hunt caribou and musk oxen.

Inuit women used fox fur and seal and deer skins to sew warm outfits for the explorers. The Inuit also taught the explorers the key to Arctic travel—how to drive dogsleds.

Facing Setbacks

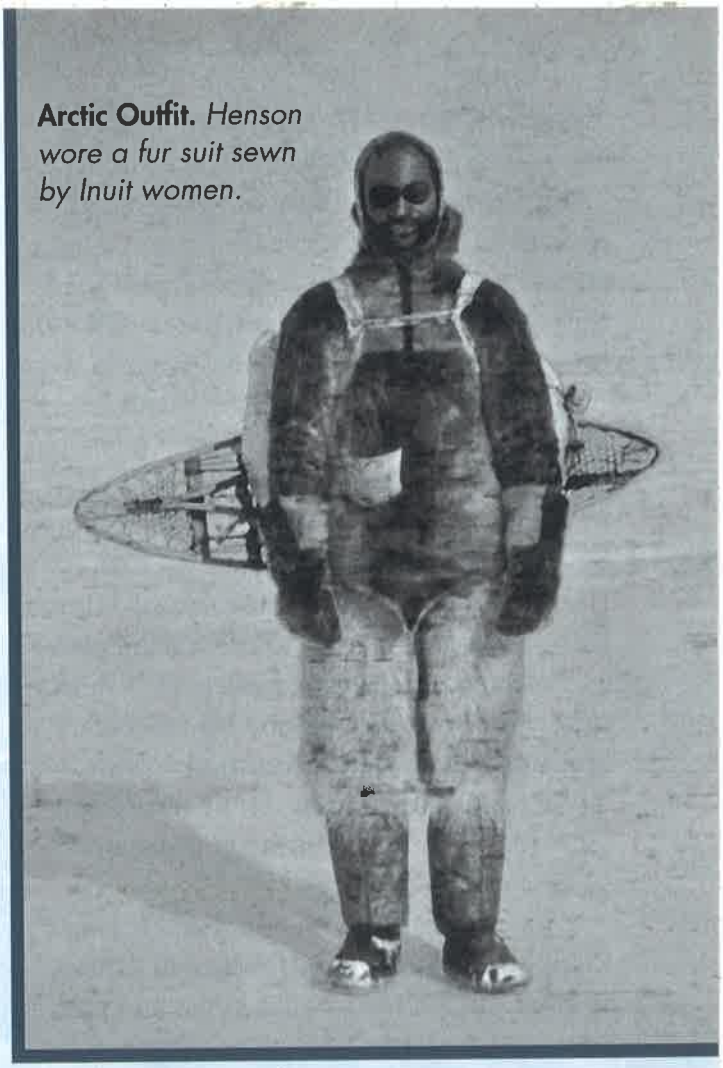
Between 1891 and 1906, Peary led seven trips to the Arctic. Each time, his team learned hard lessons about the dangers there. Sledges broke. Dogs weakened and died. Men got hurt. Peary even lost most of his toes to frostbite.

Ice floated on the ocean below the explorers' feet. It took them miles off course. The ice groaned and creaked. It split apart. They could not cross the watery leads until the ice refroze.

Each trip took Peary and Henson closer to the Pole. They tried reaching the Pole in 1906, but were forced to turn back. Two years later, they decided to try again. They were getting older. This expedition would likely be their last.

On July 6, 1908, Peary, Henson, and six other explorers sailed for Cape Sheridan, Canada. Their ship battered its way through an ocean clogged with icebergs. They landed 665 kilometers (413 miles) south of the North Pole.

The expedition had 19 sledges, 133 dogs, and 24 men, including 17 Inuit. They packed pemmican (sweetened ground meat and animal fat), biscuits, condensed milk, and tea for each man. They brought unsweetened pemmican for the dogs.



Arctic Outfit. *Henson wore a fur suit sewn by Inuit women.*

ROBERT E. PEARY COLLECTION, NATIONAL GEOGRAPHIC SOCIETY

Henson's 1908-1909 Expedition

NATIONAL GEOGRAPHIC MAPS

Tracing His Steps. *This map shows the route Henson followed to reach the North Pole.*

Final Assault on the Pole

The final expedition began in late February. "From now on, it was keep on going—and we kept on," Henson wrote. Peary sent a team ahead to carve the trail. They used axes to cut through giant pressure ridges. It was cold. "Our breath was frozen to our hoods," Henson wrote.

As the expedition neared the North Pole, Peary sent most of the teams back. Only a small group would make the final push. That way, there would be enough food and supplies. Finally, Peary had sent everyone back except Henson and four Inuit. Henson was overjoyed. He was going with Peary to the North Pole!

They had 214 more kilometers (133 miles) to go. Peary sent Henson and his team of Inuit ahead to break the final trail. Yelling, "Huk! Huk!" Henson urged his barking dogs forward. Each day, he drove his sledge up to 40 kilometers (25 miles).

All went well, until the moment Henson fell into the water. Henson struggled. Ootah, an Inuit, grabbed him by the collar and pulled him out. Ootah guided Henson's dog team to sturdier ice. Henson was wet and cold. But his dream was still alive.

Farthest North

On April 5, Peary looked through his sextant. The **navigation** tool showed him that the North Pole was only 56 kilometers (35 miles) away! On April 6, Peary once again asked Henson to carve the route north.

He only stopped when his instincts told him he had reached the North Pole. He and his team built igloos. When Peary arrived 45 minutes later, Henson said: "I think I am the first man to sit on top of the world."

Peary's sextant reading confirmed it. The expedition was within five kilometers (three miles) of the North Pole. That was close enough to claim success. Safe in their igloos, the men fell into an exhausted sleep.

The next day, Peary took his team of Inuit several miles beyond camp. He wanted to be sure they actually touched the North Pole.

Returning Home

Henson led the way south. After a 16-day dash across the ice, they reached their ship. As they sailed home, they got shocking news. Dr. Frederick Cook was an explorer who'd gone on earlier Peary expeditions. Cook now claimed he had reached the North Pole in 1908—almost a year before Peary and Henson.

Cook was a likable person. The American people believed him. Henson tried to defend the Peary expedition. People laughed at him. They called him ignorant. They didn't believe a black man had reached the North Pole.

An investigation found that Cook had lied. Peary won awards and a special place in history as the first person to reach the North Pole. He was a celebrated explorer.

Success! *At the North Pole, Henson (center) and four Inuit members of the expedition posed with flags.*

Honoring Henson

At first, Henson was remembered only as Peary's servant, not as a famous explorer. Back home, he worked as a messenger and as a clerk for the U.S. government.

At the end of his life, Henson's true role finally became widely known. He won a medal from Congress. He went to the White House. He was invited to join the famous Explorers Club. In 2000, after his death, the National Geographic Society gave Henson its highest honor, the gold Hubbard Medal.

Today, the two famous explorers are united forever. Peary and Henson are buried side by side. The words on Henson's tombstone read: "The lure of the Arctic is tugging at my heart. To me, the trail is calling."

Bundled Up. *Henson wore this fur suit on his travels. It kept him warm at the icy cold North Pole.*

PHOTO BY ART EVANS, COURTESY OF BERKSHIRE MUSEUM, COPYRIGHT 2008

WORDWISE

Arctic Circle: area surrounding the North Pole

expedition: long journey by a group of people to explore an area

navigation: helping by guiding one's way during travel

Reading Strategy: Preview the story. What does it remind you of? As you read, think about the author's purpose for writing.

The Invad

By Lana Costantini

Armies of creatures are on the move in places where they don't belong. They kill the animals and plants that get in their way. Is there any way to stop them?

CHRISTIAN ZEGERS/MINDEN PICTURES/NATIONAL GEOGRAPHIC STOCK

Imagine this: A crocodile and a toad the size of a dinner plate come face-to-face on a riverbank. The croc attacks the toad. Who will win? You might be surprised. Yes, the croc eats the toad. Yet within hours, the unlucky croc is dead, too. It met a deadly invader: the giant cane toad.

Cane toads are a huge problem in Australia—and not just for the crocs. People first brought the toads there in 1935. Farmers hoped the toads would prey on a sugarcane-eating beetle. Instead, they ate everything in sight. They feasted on insects, frogs, and even birds' eggs.

That was bad enough. But the cane toad also has a secret weapon: Warts on its skin ooze a milky white poison. The cane toad's toxic body kills larger animals that eat it, like the croc.

With few enemies to stop them, cane toads have invaded much of northeastern Australia. Scientists are worried. Unless the toads are stopped, many of Australia's native animals may disappear forever.

Aliens Among Us

An alien invasion is taking place on Earth. The aliens aren't creatures from outer space. They are animals and plants from our own planet! They hop, slither, swim, and are carried to places they don't belong.

In their own homes, or ecosystems, these animals fit right in. Ecosystems often have a natural balance of predator and prey. But if a new animal moves in, this balance can be upset.

Sometimes invaders travel thousands of miles to get to their new homes. How do they manage to go so far? Often, people move plants and animals on purpose, like the cane toad. That was a mistake! Other creatures hitch rides on ships and airplanes. Some people set pets free when the animals get too big or too dangerous to handle.

All invasive animals are alike in one way. They thrive in their new homes. Some have a lot of babies. For example, female cane toads can lay 30,000 eggs at a time! Others invaders have few or no predators. So their population grows quickly. Some invasive animals eat a lot of food. So they don't leave much for other animals to eat.

Potent Rodent

Imagine a rodent the size of a small dog. It has webbed feet and a rat-like tail. It is quicker in the water than on land. Meet the nutria. It is destroying wetlands in the United States, especially in the Southeast.

Nutria came from South America. People first brought them to the United States in the 1930s. Farmers bred them for their fur. Some nutria escaped into wild marshes. They thrived. They did not have to battle South America's severe dry periods and floods any more.

Now, millions of nutria munch on marsh grasses across the U.S. They rip out the plants by the roots. The soil washes away. New plants can't grow. So baby fish and crabs have fewer places to hide. Birds have fewer places to nest. Without the plants, it's much harder for all these creatures to survive.

Lion of the Sea

Along the Atlantic Ocean's coral reefs, red lionfish are on the hunt. These newcomers have long, graceful fins. They use their fins to herd fish into a small place. Then they gobble them up. Scientists once watched a lionfish eat 20 smaller fish in just 30 minutes.

That's a big problem. Lionfish live naturally in the South Pacific Ocean. There, many smaller fish have learned how to avoid lionfish. Some large fish in the Pacific even eat lionfish. Scientists think some pet owners set their lionfish loose in the Atlantic. Other lionfish may have traveled in the wastewater of giant ships.

In the Atlantic, lionfish have no natural enemies. They can kill as many as 80 percent of the native fish in a coral reef there. Human divers also better watch out. The lionfish's needle-shaped fins are full of poison. Ouch!

Killer Beetles

In Michigan and nearby states, bug traps hang in backyards and forests. They capture a small but deadly pest. It's the emerald ash borer. This bright green beetle is native to Asia. It was first seen in Michigan in 2002. It may have traveled there in firewood.

The adult beetle chews on the leaves of ash trees. Adults do little damage. It's the babies that are deadly. Adults lay eggs in the bark of ash trees. The worm-like larvae hatch under the bark. They eat the inner layer of the trees' bark. Without the inner bark, the tree can't get enough water and food. So far, the emerald ash borer has destroyed more than 30 million ash trees in Michigan alone!

Scientists Fight Back

What's the best way to stop an alien invasion? Prevent animals and plants from leaving their native homes in the first place, scientists say. That's because once invasive species move in, it's very hard to get rid of them.

People in Australia have spent more than $15 million fighting cane toads. Now, scientists may have a new weapon. They discovered the toads die after eating Australia's lavender beetles. They hope to find a way to use the beetle to fight the toad.

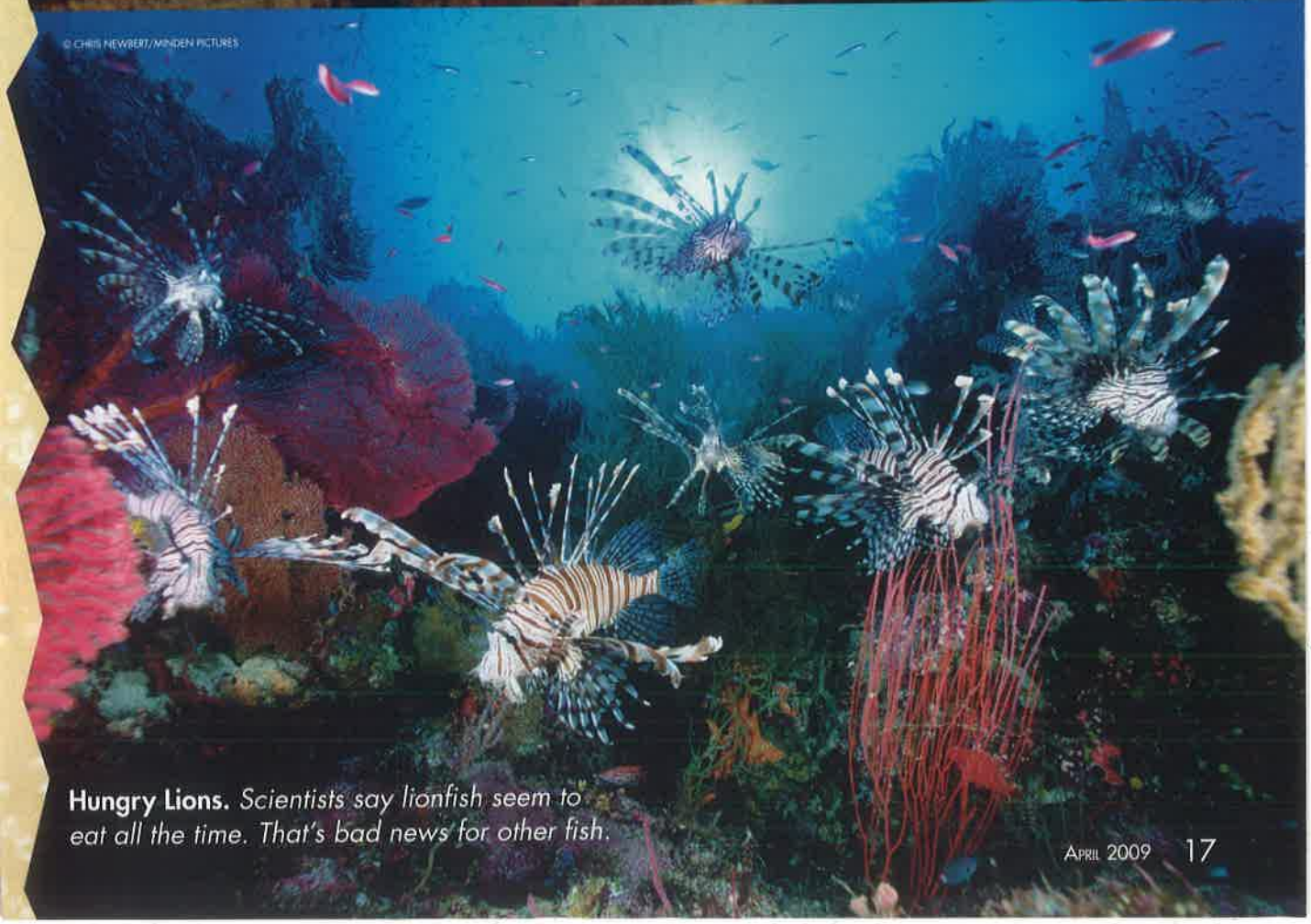
People set traps to catch some nutria and emerald ash borers. Lionfish pose a bigger challenge. No one knows exactly how to keep them from spreading in the open ocean.

Scientists won't give up, though. They can't. Already, too many species have become extinct or are at risk of dying out, thanks to these invaders. The U.S. is now home to 50,000 alien species. Some, but not all, cause problems. If they aren't stopped, what will happen?

Tree Pest. *The emerald ash borer came from Asia. It has spread to ten U.S. states and parts of Canada.*

Munch Break. *Up to 30 million nutria live in Louisiana's wetlands.*

JOHN EASTCOTT & YVA MOMATIUK/NATIONAL GEOGRAPHIC STOCK



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Hungry Lions. *Scientists say lionfish seem to eat all the time. That's bad news for other fish.*