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MASCOTS AT RISK

HOW SPORTS CAN HELP PROTECT THREATENED SPECIES

FOREWORD by George Schaller

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This report is dedicated with admiration and appreciation to the following officials in professional sports leagues and organizations who are invisibly but influentially leading the global sports industry towards the ecological protection of the children of all species:

Allan H. (Bud) Selig (MLB), Gary Bettman (NHL), David Stern (NBA), Adam Silver (NBA), Don Garber (MLS), Gordon A. Smith (USTA), Roger Goodell (NFL), Brian France (NASCAR), John McHale (MLB), Kathy Behrens (NBA), Craig Harnett (NHL), JoAnn Neale (MLS), Anna Isaacson (NFL), Lauren Kittlestad Tracy (USTA), Mike Lynch (NASCAR), Neil Boland (MLB), Omar Mitchell (NHL), Alex Townsend-Mitchell (NHL), Jan Greenberg (MLS), Jack Groh (NFL), Paul Hanlon (MLB), Lisa Quinn (NBA), Catherine Kummer (NASCAR), Deirdre Lafferty (NBA), Sarah Leer (MLB), Kate Gibson (MLB), Bernadette Mansur (NHL), Chris Ellis (MLB), Paul LaCaruba (NHL).

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About the Green Sports Alliance

The Green Sports Alliance is a nonprofit organization that leverages the cultural and market influence of sports to promote healthy, sustainable communities where we live and play. The Alliance does so by inspiring sports leagues, teams, venues, their partners and millions of fans to embrace renewable energy, healthy food, recycling, water efficiency, species preservation, safer chemicals and other environmentally preferable practices. Alliance members currently represent more than 300 sports teams and venues from 20 different sports leagues and 14 countries. Learn more at www.greensportsalliance.org and @SportsAlliance.

About 1% for the Planet

Started in 2002 by Yvon Chouinard, founder of Patagonia, and Craig Mathews, owner of Blue Ribbon Flies, 1% for the Planet is a platform of credibility and engagement for environmentally conscious brands that are truly committed to making a positive impact with their business. The more than 1200 member companies in this global movement in 48 countries donate one percent of annual sales directly to approved environmental organizations worldwide. To learn more go to: www.onepercentfortheplanet.org.

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FOREWORD

So many basic environmental problems affect our planet. Among these are an ever-increasing human population now exceeding 7 billion, the destruction of forests, shortages of fresh water and agricultural land, extinction of species, and pollution. Since the 1970s, a new factor of mass-destruction has become obvious, namely climate change with its increasing temperatures, melting glaciers, rising sea levels, and ever more violent and erratic weather patterns. Habitats throughout the planet are being transformed, and all species, including humans, must adapt, move, or perish.

We tend to forget or prefer to ignore the fact that the earth is a living organism with soil, water, air, life, and sunlight interacting to make us completely dependent on nature. Everything we make, buy, use, or want is wholly based on natural resources. Every personal act is an ecological act whether we flick on a light switch, drive a car, or make a cup of coffee. During the past half-century we have used up more of the earth's resources than in all previous human history. We are on a collision course with the biological limits of the earth. To resolve our conflicting demands for resources and protect the diversity of life are the major challenges facing us in this century. We do not have two planets, one to treasure and one to squander. Sometimes, when I note human attitudes, I wonder if there is intelligent life on earth. In brief, our survival—even if promoted by self-interest—seems like a good argument for leaving future generations with a habitable environment.

For the first time in our planet's long history, mass extinction of plants and animals is not being caused by meteorites, volcanic eruptions, or other cataclysmic events but solely by human-induced changes, by destroying the eternal for the expedient. To prevent the delicate web of life from tearing even more will depend on the efforts of every individual.

Our earth is sending us constant signals of a basic imbalance in nature. Songbirds are declining, frogs are disappearing worldwide, plant pollinators such as bees and other insects are crashing. The survival of some of our most iconic animals, those we have treasured since childhood, is now in chronic decline, including the tiger, elephant, polar bear, and shark. The flaming beauty of a tiger now graces just 7 percent of its former range and fewer than 3,500 persist in the wild. Thousands of elephants are poached annually for their ivory

tusks, which are carved and sold as trinkets. I doubt if future generations will ever forgive us if we have so little foresight and compassion that we deprive them of such wonders of creation. Extinction is not just the death of a species but the end of birth forever. If with all of our knowledge and wealth we can't offer a secure future to such species, what hope is there for our own?

A buffalo, jaguar, whale, or falcon is more than an animal: it is a symbol of a particular environment. By protecting such species in their habitat we can also save the thousands of others within their ecological community, each dependent on the other for its existence. For the past 60 years, I have gone about the world and watched wildlife disappear. I enjoy studying the natural history of animals, especially large and beautiful ones in remote places such as the mountain gorilla, tiger, and Tibetan antelope. However, the ecological crisis can be resolved neither by scientific work such as mine nor by technology. Conservation issues are mostly economic and social. Yet without good science, conservation is blind. Conservation basically comes from the heart. It is a moral issue of beauty, spiritual values, and ethics in that all species have as much right to exist as we do. Every person should learn to treat nature with responsibility and compassion. As Aldo Leopold wrote in his classic book A Sand County Almanac, "When we see land as a community to which we belong, we may begin to use it with love and respect." Everyone must in some way contribute to nature whatever his or her profession, whether farmer, teacher, truck driver, athlete, lawyer, soldier, scientist, politician, or businessman. Everyone.

We remain entranced by the size, rarity, and beauty of various species. Their dignity, power, vitality, speed, or other attributes touch our emotions, so much so that professional sport teams have adopted them as mascots, and commercial companies sponsor stadiums, teams, and individuals. Millions upon millions of fans are attracted to sports, and the mascots receive adulation by press and public. But a jaguar, grizzly bear, or dolphin is not just a stuffed toy far removed from the fate of the living animal. It is a live creature being pushed toward extinction.

Collegiate and professional sports have a huge cultural influence. By alerting its many fans to the actual plight of its mascot in nature, a sports team can have a decisive role in protecting it and its habitat—and really help the animal you love. I was delighted to hear about the creation of the Mascots Forever initiative, which is being developed by the Green Sports Alliance and 1% For the Planet. This is an impressive and innovative venture, which can become a major force for conservation.

As this Foreword attests, too many problems face our biodiversity. By contrast, good news of efforts to help threatened species is rare and thus much more treasured. We desperately need a clear agenda and vision for a new world, a new strategy for survival, one that includes unremitting devotion to the natural world. The The GSA's Mascots Forever initiative is a crucial step toward raising awareness and initiating action about our global responsibility to save the tiger and other living treasures in their wilderness home.

George B. Schaller
Panthera and Wildlife Conservation Society

PROFESSIONAL SPORTS HAVE A HUGE CULTURAL INFLUENCE. BY ALERTING ITS MANY FANS TO THE ACTUAL PLIGHT OF ITS MASCOT IN NATURE, A SPORTS TEAM CAN HAVE A DECISIVE ROLE IN PROTECTING IT AND ITS HABITAT—AND REALLY HELP THE ANIMAL YOU LOVE.

INTRODUCTION

OVERVIEW: SPORTS MASCOTS, THE ECOLOGICAL CRISIS AND THE POWER OF SPORTS

Animals have been used as symbols to inspire in myth, literature, and art for millennia. Although the use of animals as mascots for professional sports teams is a relatively recent phenomenon, dating from the early 20th century, their images have become entrenched in everyday modern life, an imaginative visual shorthand symbolizing the spirit of our favorite teams. The meaning of an animal mascot is self-evident. It reflects the attributes that teams want to be associated with: a fighting spirit, loyalty, perseverance, strength, courage, speed, intelligence, cunning, and predatory skills. Mascots communicate and inspire without words. On game day, they are magical, warding off a bad turn of play, inspiring success, motivating us to collective cheering, laughter, and ritual celebrations. They embody our beliefs about and desires for our team. And sometimes, increasingly, they assist in team advertising.

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Although teams' animal mascots have become familiar symbols, their plight in the wild goes largely unnoticed by sports leagues, fans, and the very teams that embrace animal mascots as a team emblem. This report is an attempt to change that, to remind sports fans of the inspirational debt we owe to the actual living animals that serve as the mascots representing our teams' ideals. And it is an attempt to marshal the growing interest in environmental stewardship that the sports world has recently embraced and help focus that interest on the urgent need to protect our planet's biodiversity, starting with the animals used as team mascots.

Building on our strong ongoing collaborations with sports leagues and teams, Green Sports Alliance, co-founded by the Natural Resources Defense Council (NRDC), is pleased to announce the Mascots Forever initiative, an action-oriented consciousness-raising effort to encourage the sports industry to play a uniquely influential role in reducing the urgent threats posed to at-risk animal species.

The sports industry can use its mascots to mobilize fans to protect or restore vital species and the habitats that sustain them. With its broad societal appeal and its unparalleled cultural and market influence, professional sports can help reverse the ecological pressures causing global biodiversity loss and take a leadership role to save at-risk species and their habitats.

"SPORT HAS THE POWER TO CHANGE THE WORLD. IT HAS THE POWER TO INSPIRE AND UNITE PEOPLE IN A WAY THAT LITTLE ELSE DOES."

NELSON MANDELA, LAUREUS LIFETIME ACHIEVEMENT AWARD SPEECH, 2000

‘THE SIXTH EXTINCTION’

In 1875 an Austrian geologist named Eduard Suess coined the term “biosphere”.[1] The biosphere is a 10-mile thin film of life that stretches from about five miles up from the surface of the earth to about five miles down, to the deepest depths of the oceans. Life is arguably the rarest phenomenon in the universe and it is known to exist only in the biosphere here on earth. Although homo sapiens comprise only a fraction of all the life forms on earth, humanity’s ecological impacts are immense and unprecedented.

Living organisms are spread throughout the entire surface, subsurface, and atmosphere of the earth. And yet, everywhere we reside human activities have been deliriously wiping out species that have existed for tens of thousands of years, often even before we know they exist at all. The unprecedented force, momentum, and range of human-induced ecological changes are doing nothing less than destabilizing the functional integrity of the biosphere. We are causing so many species to go extinct at such a rapid and widespread rate that this phenomenon has been given a name: “The Sixth Extinction.”[2]

For the sixth time in the history of our planet, species extinction has reached a scale that could wipe out a substantial fraction of life on earth if not reversed. “We are on the verge of the sixth extinction,” says Duke University’s Stuart Pimm. “Whether we avoid it or not will depend on our actions.”[3] Habitat destruction, deforestation, ocean acidification, poaching, pollution, invasive species, and climate change are creating a biodiversity disaster and posing increasing threats of extinction. All of these threats are human-induced, and only humans can reverse them. Extinction is a permanent disruption to the interdependent ecosystems on which life depends, and species loss continues to accelerate at an astounding rate. Whether it is the 4,000 to 6,000 annual extinctions estimated by E.O. Wilson, “10,000 times greater than the naturally occurring background rate,”[4] or a lesser rate of faunal extirpation (extinction), scientists agree that human-induced mass extinction now threatens a meaningful percentage of the planet’s animal species.[5] More than just cute creatures on a postage stamp or in a fundraising letter, animal species at risk are a pivotal indicator of the planet’s health and future survival.

THE POWER OF SPORTS

These emerging and increasing threats extend to the world of sports through its mascots. Of North America’s 153 major professional sports teams,[6] 90 teams share 50 animals as mascots or team names. A total of 31 of these animals—more than 60 percent—are at risk of going regionally or globally extinct in the wild. These species include 13 land mammals, four marine mammals, eight birds, four fish, one reptile, and one insect. Animal mascots connect fans with their favorite teams and the larger natural world. Thus, connecting sports fans with the fate of their favorite mascots in the wild can be a powerful tool in our fight to protect the animals they represent.

This report is an urgent plea to the sports industry to become a leader in protecting a multitude of endangered species. Sports unite and inspire our society, bringing us together around feats of courage, accomplishment, generosity, and cooperation. Both on the field and off, sports teams and athletes rise to the occasion with acts of heroism as well as compassion in times of need. Think of the New Orleans Pelicans and the New Orleans Saints helping to rebuild their city after Hurricane Katrina. Think of the Special Olympics. Think of the post-9/11 tributes at Yankee Stadium, which did so much to comfort a traumatized New York City.

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NEW ORLEANS PELICANS

The New Orleans Hornets NBA team returned to New Orleans in 2012 after being displaced by Hurricane Katrina. In 2013, the Hornets decided switched their team mascot to the pelican when the team owner Tom Benson realized that the nickname Hornets didn't mean anything to the New Orleans community. "The pelican represents New Orleans, just like the Saints. They have incredible resolve. If they can do that, the team can do the same," Benson told ESPN in January 2013. The brown pelican is Louisiana's state bird and has been connected to efforts to restore Louisiana's coast as images of the pelicans covered with oil were plentiful after the 2010 BP oil spill. The coast has been damaged extensively by the oil spill and erosion from Katrina and other storms.[7]

Over the past decade, because of the innovative work of the NRDC and the Green Sports Alliance, the sports industry has emerged as an environmental game-changer, launching inspiring initiatives to improve energy efficiency, use renewable energy, and promote recycling, composting, water conservation, safer use of chemicals, and healthier food options. Now, as we face a mass species extinction of such epic proportions that it threatens our own survival, the sports industry is in a unique position to help repair this ecological disaster. The sports industry can use its mascots to mobilize its fans to protect or restore vital species and the habitats that sustain them. With its broad societal appeal and its unparalleled cultural and market influence, professional sports can help reverse the ecological pressures causing global biodiversity loss and take a leadership role to save at-risk species and their habitats.

Driving more than $485 billion in annual economic activity within the United States and over $1.3 trillion globally, with billions of fans worldwide and a global supply chain that includes some of the most visible and influential corporations on earth, the sports industry represents a significant market and cultural platform that can be used to educate and mobilize fans throughout North America and the world about these important issues.

Indeed, few sectors are as influential or inspirational as the sports industry. Even a cursory review underscores how influential sports has been culturally: Jesse Owens in 1936, debunking the Aryan supremacy myth; Billie Jean King beating Bobby Riggs in the first female versus male professional tennis match, a big step toward pay equality; the passage of Title IX, leading to financing for women's athletics; Muhammad Ali's conscientious objection to the Vietnam War, and his role as a spokesman for civil rights; Magic Johnson's openness about his HIV/AIDS infection, which helped to destigmatize the illness; Jackie Robinson's role in breaking the race barrier within Major League Baseball; and most recently, pro-football star Michael Sam's announcement about his sexual orientation, helping to shatter myths about gay people.

Mascots, like players, have the ability to inspire, influence and educate. The Mascots Forever initiative can help channel fans' love of their mascots into preservation of endangered species. This campaign seeks to link sports leagues, teams, athletes, sponsors, and fans more closely to the species all around us, and seeks to boost international efforts to replenish biodiversity. Now these lovable mascots who dance around sports venues can help protect the species they represent.

ENDANGERED SPECIES AND MASCOTS

The "Sixth Extinction" is one of the most ruinous—and preventable —ecological events in the history of earth. According to science writer Elizabeth Kolbert, mass extinctions like this one are "a turning point in life's history—a moment when the rules of the game suddenly flipped, with consequences that, for all intents and purposes, will last forever."[8] Biologist E.O. Wilson has estimated that we are causing the extinction of species "on the order of 10,000 times greater than the naturally occurring background [extinction] rate...reducing biological diversity to its lowest level" [9] since dinosaurs became extinct abotu 65 million years ago.

The stakes of today's biodiversity crisis—what biologists are calling "defaunation"—could not be higher. The fate of all species is interconnected, and the acceleration of mass extinction is truly alarming:

- Since 2006, the overall number of critically endangered species globally has increased by nearly 15 percent, reaching 3,427 species in 2010.[10]
- Global species abundance is projected to decrease by 10 percent from 2000 to 2030.[11]
- A 2013 study by the U.S. Geological Survey found that frogs, toads, salamanders, and other amphibians are dying off at such rapid rates that "they could disappear from half of their habitats in the next 20 years."[12]

Before human impacts—essentially prior to 1800—the extinction rate for tropical birds was one for every 1 million species per year. Now, for all of the species throughout the world, there are 100 extinctions per million species annually. If current deforestation trends continue, the United Nations Environment Program (UNEP) estimates that we could reach 1,500 extinctions per million bird species a year by the end of this century.[13] If current trends continue, other species will meet a similar fate. If we continue on our current trajectory, in "the next 100 years half of all species will most likely have become extinct."[14]

Unlike the previous mass extinction events, the current extinction crisis is unique in that it has been caused by another species: humans. Engaging the sports industry in this battle offers us hope in this urgent battle for species survival. The sports greening movement demonstrates that leagues, teams, sponsors, fans, and mascots can help tackle the endangered species crisis. Humans are the greatest threat to

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earth's fragile balance of life—but we are also the only ones who can reverse the damage we've done. And the sports industry can lead the way.

Sports and the environment are inextricably linked. We are erasing the last of Earth's natural environments, threatening thousands of species and disrupting the natural systems that all aspects of our society depend on—including all agriculture, medicines, and of course sports and recreation. In fact, nature is the ultimate source of all economic value. No commerce or culture is possible without clean air and water; fertile topsoil; a chemically stable atmosphere; raw materials for food, energy and medicine; or the natural processing of waste by the millions of species inhabiting our soil, water and air. These species are essential to our survival and these wells of natural capital make sports and all other types of human activities possible.

SPORTS GREENING: RISING TO THE CHALLENGE

In the past eight years, all major professional sports leagues, as well as the U.S. Tennis Association (USTA) and NASCAR, have joined with NRDC and the Green Sports Alliance to implement influential initiatives promoting responsible environmental stewardship. This burgeoning "sports greening movement" has already produced wide-ranging and meaningful impacts:

- All Commissioners of professional sports leagues in the United States—as well as NASCAR and the USTA—actively encourage their teams to incorporate sustainable measures into their operations.
- Twenty professional North American stadiums or arenas have achieved LEED green building design certifications, and 24 have installed on-site solar arrays.
- Virtually all North American sports venues have developed or are developing recycling and/or composting programs, leading to huge reductions in waste.
- Of the 153 professional sports teams in the six major professional North American leagues, almost half have shifted to renewable energy or have an energy efficiency program.
- All of the large sports concessionaires that collectively feed tens of millions of people each year have developed environmentally preferable menus for at least some items.
- All sports industry Jewel events now incorporate greening initiatives into their planning and operations. These events include the World Series, the Super Bowl, the Stanley Cup playoffs, the NBA playoffs and finals, the MLS Cup, the U.S. Open, the Olympics, the World Cup, and all North American league All-Star Games.
- All leagues now educate their fans about environmental issues, in particular the need to recycle, compost, and reduce energy use.

By any measure, the sports greening movement has been a great success. It has eliminated millions of pounds of carbon emissions, saved millions of gallons of water, and reduced and recycled millions of pounds of paper products. We must build on this momentum to introduce new ways of doing business and producing and consuming goods and services. So far, this movement has focused primarily on ecologically beneficial venue operations and fan engagement. Now the sports world can build on this progress by teaming up with the Green Sports Alliance to address the ecological pressures threatening animals symbolized by team mascots. The Mascots Forever initiative aims to unite the sports world to raise awareness—and financial support—to protect species and habitats under threat.

The key objective of the Mascots Forever initiative is to encourage the influential world of professional sports to focus on reducing the threats posed to the at-risk animal species that serve as sports teams' mascots. Sports teams and leagues currently orient most of their ecological work towards reducing venue energy use and global warming pollution, increasing recycling and composting, providing healthier food,safer use of chemicals, and utilizing smarter transportation and on-site renewable energy. Now, the Green Sports Alliance will be asking sports leagues, teams, players, vendors, sponsors, and fans to broaden their focus and incorporate environmentally intelligent actions focused on protecting global biodiversity and use the plight of their animal mascots in the wild as motivation.

The importance of mobilizing professional and collegiate sports towards responsible environmental stewardship has never been greater. What we do, or don't do, to address biodiversity loss—and global climate disruption—will affect life on earth for thousands of generations after us. Along with our urgent need to shift away from a reliance on fossil fuels, perhaps no issue is more crucial than protecting the conditions that preserve biodiversity. Toxic wastes can be cleaned up. Coal-fired power plants can be retired and carbon emissions can be reduced. But extinction is forever. The potent threats destroying the earth's biodiversity reflect powerful global economic and cultural trends, and these trends are very difficult to reverse. What is certain is that all industries, indeed all consumers, need to recognize that a problem exists, and that we have a collective responsibility to address it.

With this report, the Green Sports Alliance is inviting sports leagues, vendors, sponsors, and fans to incorporate environmentally responsible actions that protect at-risk animal species. The focus of the GSA's Mascots Forever initiative will be to inspire leagues, teams, players, sponsors and vendors to incorporate mascot-driven fan engagement and sports sponsorship actions to protect at-risk species, including actions designed to protect some of the most iconic species on Earth such as elephants, sharks, rays, dolphins, tigers, lions, grizzly bears and gorillas, all of which serve as animal mascots for both professional and collegiate teams.

Our goal is nothing less than making the issue of species preservation as ubiquitous and visible in U.S. and global sports venues as advertisements are for beer and automobiles.

The GSA's campaign aims to raise awareness and funding for critical species and habitat protection. Teams will expand their merchandising opportunities, while raising valuable funds for environmental preservation. It's a perfect win-win.

The organizations focused on protecting biodiversity need help, and the sports industry can play a meaningful role in providing this vitally needed assistance. In joining this fight to save species, the sports world will join an esteemed yet chronically underfunded movement to protect biodiversity.

The single most important thing we can do to address the loss of biodiversity and the other urgent ecological challenges we face is change cultural attitudes and expectations about how we relate to the planet. To its credit, the sports industry is playing an extraordinarily useful role in bringing businesses and people together to solve our ecological problems. The greening of sports provides powerful examples of how small actions can ripple out and make big changes happen. The sports industry is working to assure the survival not only of our own children, but our children's children, our grandchildren's grandchildren, and beyond.

Now, as this report confirms, the sports industry would do well to broaden its already commendable environmental focus to include more attention on the preservation and protection of non-human species. Healing our increasingly damaged planet requires broad collective action, embracing all forms of cultural and economic diversity, and this is especially apparent in the strategic work needed to protect biodiversity. I am proud that the Green Sports Alliance and 1% for the Planet have played an important role in cultivating the green sports movement, and I hope that this report about the threats to animal mascots will lead to a redoubling of the sports industry's efforts to protect all of the earth's most biologically essential—and inspiring—living organisms.

Allen Hershkowitz, Ph.D.
President, *Green Sports Alliance*

THE SINGLE MOST IMPORTANT THING WE CAN DO TO ADDRESS THE LOSS OF BIODIVERSITY AND THE OTHER URGENT ECOLOGICAL CHALLENGES WE FACE IS CHANGE CULTURAL ATTITUDES AND EXPECTATIONS ABOUT HOW WE RELATE TO THE PLANET. TO ITS CREDIT, THE SPORTS INDUSTRY IS BRINGING BUSINESSES AND PEOPLE TOGETHER TO SOLVE OUR ECOLOGICAL PROBLEMS. THE GREENING OF SPORTS PROVIDES POWERFUL EXAMPLES OF HOW SMALL ACTIONS CAN RIPPLE OUT AND MAKE BIG CHANGES HAPPEN.

ENDANGERED ANIMAL SPORTS MASCOTS

Major professional sports teams began adopting mascots in the mid-20th century, although the Chicago Cubs had one of the earliest mascots, going back to 1908. Team mascots and team nicknames are sometimes confused; the two can be interchangeable but are not always the same. Mascots may take the form of a fantastical character, a person, an inanimate object, or a real animal.

Iconic wild animals are especially prevalent as mascots among the teams. The word "mascot" is believed to have originated in the Provence region of France and originally referred to things that brought household luck. The French word "mascotte" means "talisman" or "charm."

The Mascots Forever initiative focuses on the hundreds of mascots of professional and collegiate sports teams across the United States. This report spotlights the mascots used by the 153 major professional teams.

The major professional sports leagues mentioned in this report include Major League Baseball (MLB), the National Basketball Association (NBA), the Women's National Basketball Association (WNBA), the National Football League (NFL), Major League Soccer (MLS), and the National Hockey League (NHL).

Ninety teams have animals as their mascots or as team names. Out of the 50 species profiled here, 31 are considered endangered or at-risk species in the wild. In an effort to both promote awareness of endangered species, and prevent other species from meeting a similar fate, we have listed both endangered and non-endangered species in this report. Further, we have also included a handful of extinct species, in the hopes that through our efforts with the Mascots Forever campaign the animals portrayed by sports mascots will exist for future generations.

MORE THAN 60% OF ANIMAL MASCOTS ARE AT RISK OF GOING REGIONALLY OR GLOBALLY EXTINCT IN THE WILD

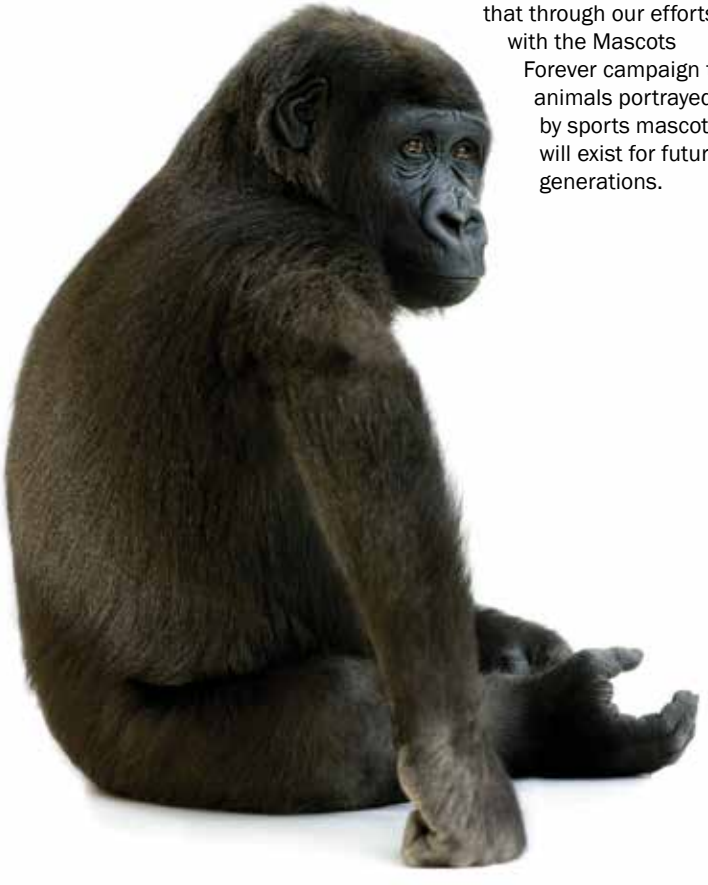
22% OF THE WORLD'S MAMMAL SPECIES ARE KNOWN TO BE GLOBALLY THREATENED OR EXTINCT*

15% HAVE INSUFFICIENT DATA TO DETERMINE THEIR THREAT STATUS*

Source: 2008 IUCN Red List mammal species data.

153 MAJOR PROFESSIONAL SPORTS TEAMS IN NORTH AMERICA

90 TEAMS SHARE 50 ANIMALS AS MASCOTS OR TEAM NAMES



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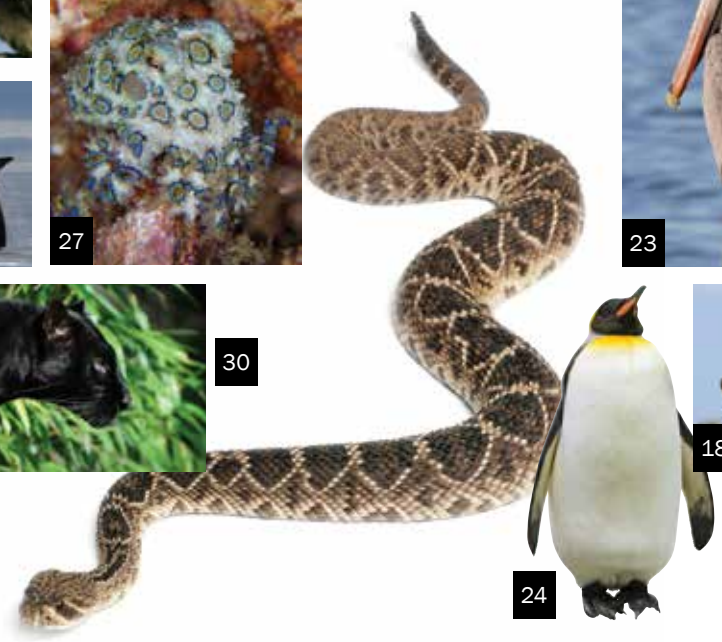


MAJOR PROFESSIONAL TEAMS WITH ENDANGERED ANIMAL MASCOTS BY LEAGUE

14 NHL (HOCKEY)

14 NBA/WNBA (BASKETBALL)

11 NFL (FOOTBALL)

11 MLB (BASEBALL)

4 MLS (SOCCER)

ENDANGERED/AT-RISK MAMMAL SPECIES
(AND THE TEAMS WHICH USE THEM AS A MASCOT)

1 BLACK PANTHER
NFL, Carolina Panthers

2 BOBCAT/LYNX
MLB, Arizona Diamondbacks
WNBA, Minnesota Lynx

3 BUFFALO/BISON
NFL, Buffalo Bills
NBA, Oklahoma City Thunder

4 ELEPHANT
MLB, Oakland Athletics

5 FLORIDA PANTHER
NHL, Florida Panthers

6 GORILLA
NBA Phoenix Suns

7 GRIZZLY BEAR
NBA, Memphis Grizzlies
NBA, Houston Rockets
NBA, Utah Jazz
NFL, Chicago Bears
MLB, Chicago Cubs
MLB, Minnesota Twins
NHL, Boston Bruins
NHL, Toronto Maple Leafs

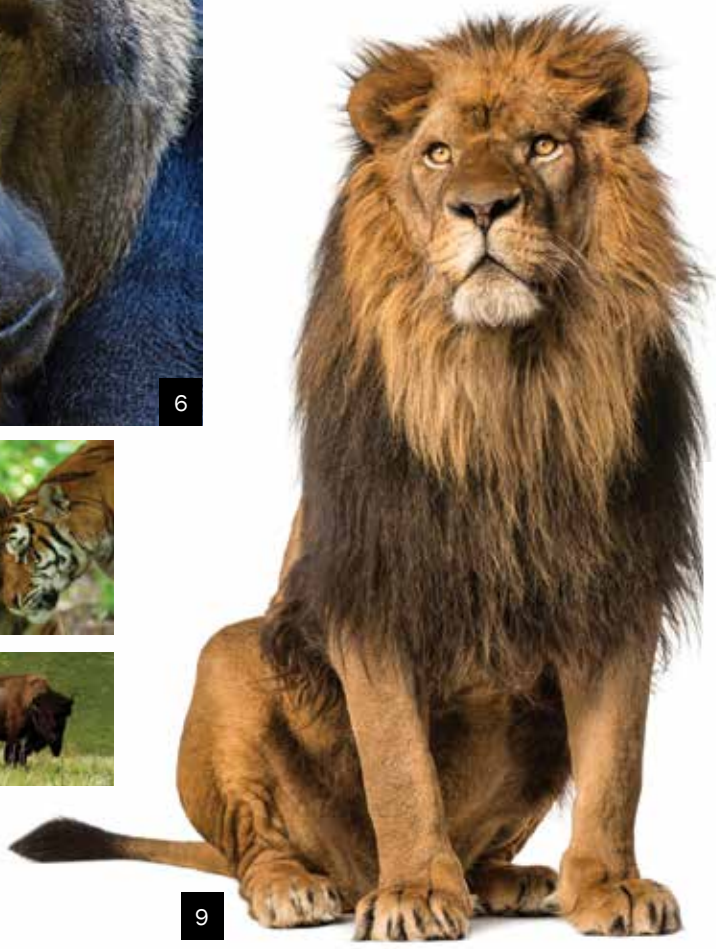
8 JAGUAR
NFL, Jacksonville Jaguars

9 LION
NFL, Detroit Lions
MLB, Kansas City Royals
NBA, Indiana Pacers
NBA, Sacramento Kings
NHL, Los Angeles Kings
NHL, Ottawa Senators
MLS, Orlando City SC
MLS, Real Salt Lake

10 MOUNTAIN LION
NBA, Denver Nuggets
NBA, Portland Trail Blazers

11 PANDA
WNBA, Washington Mystics

12 TIGER
NFL, Cincinnati Bengals
MLB, Detroit Tigers



13 WOLF
NFL, Kansas City Chiefs
NBA, Minnesota Timberwolves

ENDANGERED/AT-RISK MARINE MAMMAL SPECIES

14 DOLPHIN
NFL, Miami Dolphins

15 ORCA (KILLER WHALE)
NHL, Vancouver Canucks

16 POLAR BEAR
NHL, St. Louis Blues

17 SEAL
MLB, San Francisco Giants

ENDANGERED/AT-RISK BIRD SPECIES

18 DUCK
NHL, Anaheim Ducks

19 EAGLE
NFL, Philadelphia Eagles
NHL, Washington Capitals
MLS, D.C. United
MLS, Colorado Rapids

20 FALCON
NFL, Atlanta Falcons

21 HAWK
NBA, Atlanta Hawks
NHL, Chicago Blackhawks

22 PARROT
MLB, Pittsburgh Pirates

23 PELICAN
NBA, New Orleans Pelicans

24 PENGUIN
NHL, Pittsburgh Penguins

25 SEAHAWK (OSPREY)
NFL, Seattle Seahawks

ENDANGERED/AT-RISK FISH SPECIES

26 MARLIN
MLB, Miami Marlins

27 OCTOPUS, BLUE-RINGED
NHL, Detroit Red Wings

28 SHARK
NHL, San Jose Sharks

29 RAY
MLB, Tampa Bay Rays

ENDANGERED/AT-RISK REPTILE SPECIES

30 RATTLESNAKE
MLB, Arizona Diamondbacks

ENDANGERED/AT-RISK INSECT SPECIES

31 THUNDER BUG/ LIGHTING BUG/FIREFLY
NHL, Tampa Bay Lightning

10 NOTABLE ENDANGERED ANIMAL SPORTS MASCOTS

These are among the most endangered and beloved animals used as professional sports mascots. These animals all have endangered and some have critically endangered populations according to the U.S. Fish & Wildlife Service and the IUCN Red List of Threatened Species.

LION

- NFL's Detroit Lions
- MLB's Kansas City Royals
- NBA's Indiana Pacers
- NBA's Sacramento Kings
- NHL's Los Angeles Kings
- NHL's Ottawa Senators

You can hear a lion's **roar 5 miles away**

Since 1940 we've **lost 90%+** of Africa's lion population. Fewer than 21,000 remain

TIGER

- NFL's Cincinnati Bengals
- MLB's Detroit Tigers

Tigers can **jump over 16 feet**

We've **lost 97% of tigers** since 1900. Only 3,000 wild tigers left on Earth.

PENGUINS

- NHL's Pittsburgh Penguins

Penguins range from just **16 inches to 3.5 feet**

2/3 of penguin species are in decline

GORILLA

- NBA's Phoenix Suns

Gorillas **weigh up to 400 lbs** as the largest primates

We've **lost 50%** of gorillas in recent decades

PANDA

- WNBA's Washington Mystics

The giant panda is the rarest species of the bear family and is up to **6 feet long**

A few as 1,000 pandas in the wild

SHARK

NHL's San Jose Sharks

Sharks can **see nearly 360°**

100 million
sharks killed each year
(11,400 every hour) for their fins

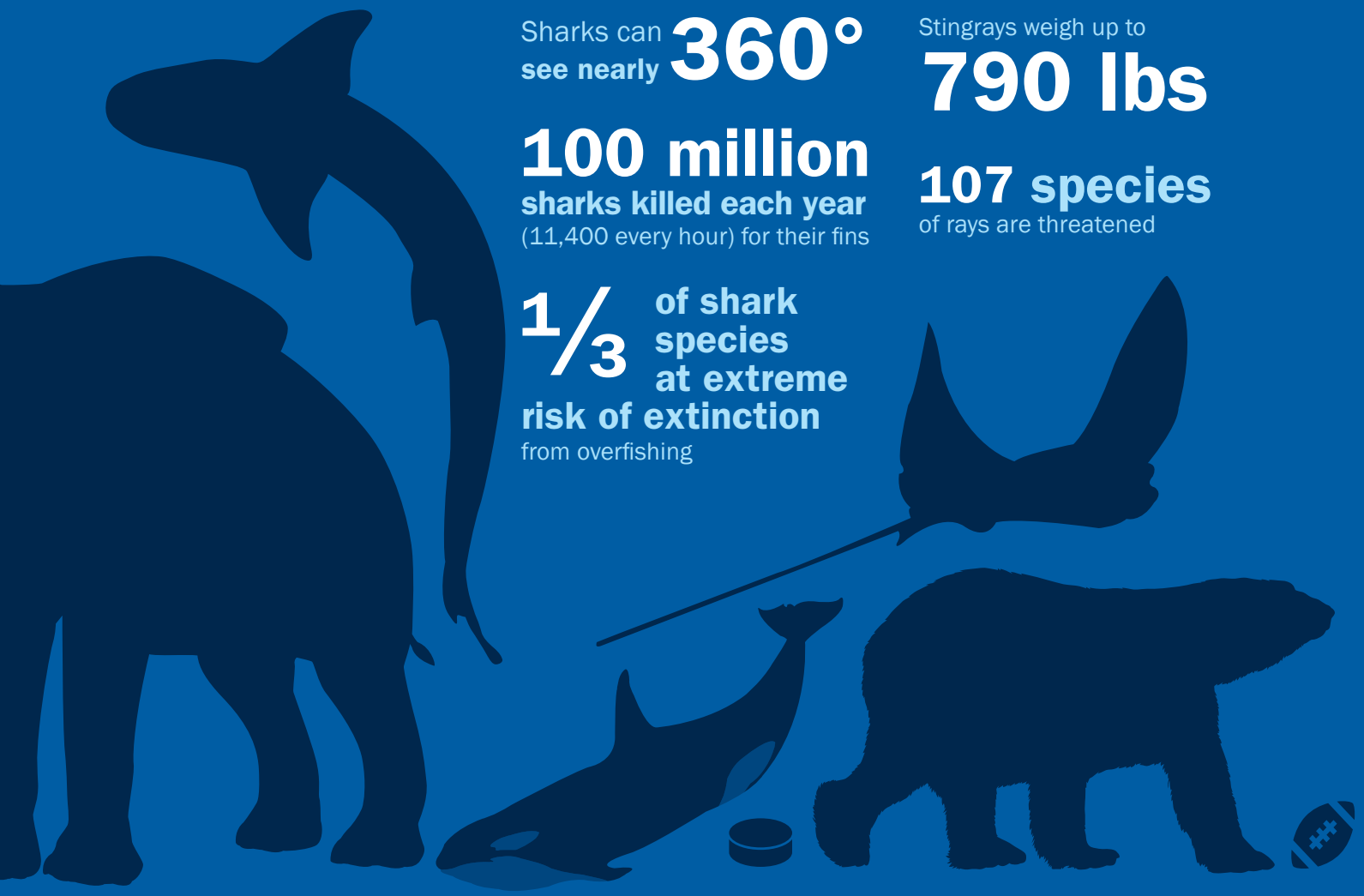
1/3 of shark species at extreme risk of extinction
from overfishing

RAY

MLB's Tampa Bay Rays

Stingrays weigh up to
790 lbs

107 species
of rays are threatened



ELEPHANT

MLB's Oakland Athletics

Elephant can **live to 70 years old** and **eat 400 pounds** of greenery daily

An elephant is **killed every 20 minutes**

KILLER WHALE

NHL's Vancouver Canucks

Female killer whales **live up to 90 years** (and males reach 60 years)

Only 50,000 left on earth due to serious threat from hunting, oil spills, and pollution

POLAR BEAR

NHL's St. Louis Blues

Polar bears can **swim 6 miles per hour**

As few as **20,000 polar bears left on Earth**

AFTERWORD

This year marks the centennial of the death of the last passenger pigeon, a species that once numbered in the billions and whose flocks were reported to have blackened the sky for days as they passed by. Meditating on a monument to the last passenger pigeon, erected some thirty years later, the philosopher and naturalist Aldo Leopold wrote: "For one species to mourn the death of another is a new thing under the sun" (Leopold, 1949).

Homo sapiens is not nearly as singular a species as we once supposed. We are, in a narrow and analytical sense, more intelligent than our fellow creatures, but we now know that many animals, from crows, to apes, to octopi, boast keen minds of their own. We've long known that humans are not the only animals to use tools; increasingly, we're also realizing that many creatures also have culture, syntax, and, perhaps, even language.

One thing that does set humanity apart, at last in this epoch, is our power to destroy. As George Schaller rightly notes in his Introduction, our influence on the planet is now so profound and ubiquitous that it can only be compared to a meteorite or similar cataclysmic events, which precipitated the last five "mass extinctions" in the history of the Earth (Raup & Sepkoski, 1982). In each of these extinction events, over seventy-five percent of all species were lost in a relatively short period of time (Barnosky, et al., 2011). There is every indication that a sixth such event is imminent.

A recent review of available scientific literature concluded that 33 percent of all vertebrate species (such as mammals, birds, and fish) are threatened with extinction and that total abundance, across all vertebrates, has dropped a shocking 28 percent. Invertebrates are faring no better. Forty percent of all identified invertebrate species are considered threatened.

Insects, too, are suffering widespread declines in abundance. Among the order *Orthoptera* (crickets, grasshoppers, and katydids) all species are now in decline (Dirzo, et al., 2014). For this reason, many scientists have concluded that the earth has entered a new geologic age—the anthropocene—literally, the age of man (Kobert, 2014).

There is another characteristic that sets humanity apart: our natural sympathy (that is, our sympathy for nature), something that Leopold was quick to recognize. "We, who have lost our pigeons, mourn the loss," he wrote. "Had the funeral been ours, the pigeons would hardly have mourned us." (Leopold, 1949).

Here, I believe, lies a central truth about our species; one that is far older than Leopold's observation. In the western religious tradition, the Bible is full of sympathy for nature and the acknowledgement not only of humanity's close relation to the natural world, but our obligation towards our fellow creatures. There is a reason, after all, that some have dubbed the United States' Endangered Species Act "Noah's Law" because of the attraction that the story of the Ark continues to hold. As Bill McKibben has pointed out (McKibben, 2005), who can read God's answer to Job without being struck by its ancient identification with the natural world?

> Do you hunt the prey for the lioness and satisfy the hunger of the lions when they crouch in their dens or lie in wait in a thicket? Who provides food for the raven when its young cry out to God and wander about for lack of food?

AS I WALK MY DAUGHTER TO SCHOOL IN THE MORNINGS, I OFTEN SEE LITTLE GIRLS AND BOYS WEARING SPORT-TEAM JERSEYS. SOMETIMES THEY REFER TO PROFESSIONAL TEAMS, SOMETIMES COLLEGIATE; REGARDLESS, MOST ARE EMBLAZONED WITH ANIMALS: A MOUNTAIN LION'S PAW PRINT, A TURQUOISE DOLPHIN. BEARS RUN BY, CHASING TIGERS. HOW WOULD THESE CHILDREN REACT IF THEY KNEW THAT MANY OF THESE EMBLEMATIC SPECIES COULD ONE DAY VANISH FROM THE EARTH FOREVER?

E.O. Wilson and Erich Fromm have named this sympathetic attraction biophilia (Wilson, 1984), and ancient western traditions are not the only place it can be found. The great religions of the East and, of course, the traditions of indigenous people around the world are full of similar examples.

As *Mascots at Risk* makes clear, in our adoption of animals as symbols, biophilia finds one of its most basic and potent forms. While the use of animal mascots for sports teams is a relatively new phenomenon, it should come as no surprise that it is now widespread. For millennia, after all, humans have adopted animals that we admire as our standard-bearers. Stags, eagles, bears, lions, and many others all have a long history of representing countries, tribes and clans. No wonder animal totems were eventually adopted by sports teams, which in the United States, at least, have come to serve similar iconic functions. As this report explains, today 90 professional teams in North America are represented by 50 different animal mascots.

Our laws have also come to reflect our sympathy for the natural world. The central purpose of the Endangered Species Act—one of the most powerful environmental statues ever written—is the conservation of species *without regard for their usefulness or economic utility* (Doremus, 1999). But the ESA is far from the only law to protect other living things. In the United States alone, we have enacted the Marine Mammal Protection Act, the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act, to name only a few. Other countries, such as Canada and Mexico, have passed legislation of their own. Internationally, almost all nations have signed on to treaties such as the Convention on the Trade in Endangered and Threated Species (Nash, 1989).

But laws alone cannot turn back the tide of extinction. To do that, we must also harness the energy of popular culture. There can be no better place to begin that task than with sport. This report, which reveals that 60 percent of the species representing North American sports mascots are at risk, will hopefully galvanize not just awareness, but action.

Adults, too, feel a special pull towards animals with which they identify. This report begins the process not only of educating sports fans to the real dangers wild animals face throughout the world but, through the launch of the Mascots Forever campaign, provides every sports fan with a list of concrete actions they can take to ensure our animal mascots' safety, so that they can continue to live, thrive, and inspire us—on the playing field and off.

Andrew Wetzler
Director, Wildlife Program,
Natural Resources Defense Council

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1 Smil, Vaclav, 2002. *The Earth's Biosphere: Evolution, Dynamics, and Change*. Cambridge, MA: The MIT Press, at p. 27.

2 For the most explicit and forceful explanation of this tragic phenomenon, see Elizabeth Kolbert, *The Sixth Extinction: An Unnatural History* (NewYork: Henry Holt and Company, 2014.

3 Seth Borenstein, "World on Brink of Sixth Great Extinction, Species Disappearing Faster Than Ever Before," *Huffington Post*, May 29, 2014, www.huffingtonpost.com/2014/05/29/sixth-great-extinction-species-disappearing_n_5412571.html (accessed July 21, 2014).

4 Edward O. Wilson, "Threats to Biodiversity," *Scientific American* 261, no. 3 (September 1989): 108–116, as quoted in Kolbert, The Sixth Extinction.

5 Kolbert, *The Sixth Extinction*.

6 Including teams for Major League Baseball (30 teams), the National Football League (32 teams), the National Basketball Association (30 teams), the National Hockey League (30 teams), Major League Soccer (19 teams), and the Women's National Basketball Association (12 teams).

7 ESPN, "Hornets to officially become Pelicans" http://espn.go.com/nba/story/_/id/8878315/new-orleans-hornets-announce-name-change-pelicans, January 24, 2013

8 Kolbert, at p. 97.

9 Wilson, "Threats to Biodiversity," as quoted in Kolbert, *The Sixth Extinction*, 186.

10 *IUCN Red List of Threatened Species*, International Union for Conservation of Nature (IUCN), version 2012.1, 2012, www.iucnredlist.org.

11 Organisation for Economic Co-operation and Development, *The OECD Environmental Outlook to 2030* (March 5, 2008).

12 John R. Platt, "Amphibians in U.S. Declining at 'Alarming and Rapid Rate,'" *Scientific American* blog, May 23, 2013, http://blogs.scientificamerican.com/extinction-countdown/2013/05/23/amphibians-declining-alarming/ (accessed July 30, 2014).

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RESOURCE GUIDE TO ENDANGERED/AT RISK ANIMALS USED AS PROFESSIONAL SPORTS MASCOTS

AUTHOR Michael Totten

BLACK PANTHER

Panthera

Sir Purr, Carolina Panthers (NFL)

FAST FACTS

Natively found in three continents: Africa, Asia, and South America.

Mostly nocturnal and can hunt without even seeing their prey.

THREATS

Habitat destruction

Toxic chemicals

Climate change

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Habitat preservation and protection

Toxic chemical use reduction

Climate remediation

Halting of illegal trade, trafficking, and poaching

The Black Panther is not a distinct species but a descriptive name referring to black felines of the big cat family. Wild black panthers include black jaguars (*Panthera onca*) in the Americas, black leopards (*Panthera pardus*) in Asia and Africa, and the very rare black tigers (*Panthera tigris*) in Asia. The melanism, or black color, is due to a dominant allele (group of genes) in the jaguar and by a recessive allele in the leopard.

Black panthers are stealth-hunting carnivores. Panthers are not the biggest cats, but they possess very muscular bodies, powerful jaws, and long, sharp canine teeth; they are considered superb athletes. Most of their hunting is done on the ground, although they also ambush prey by leaping from trees. Black panthers typically prey on medium to large herbivores including deer, warthogs, tapir, antelope, and wild boar, though their diet varies according to where they live.

Panthers are solitary animals, typically found in tropical and deciduous forests. They spend the daylight hours high in the trees, safely resting, and are active at night when they are almost invisible in the darkness as they track their prey.

RANGE

Panthers are natively found on three continents – Asia, Africa and Latin America. Jaguars and leopards share a common ancestor from 2 million years ago in Eurasia. The leopard migrated west into Europe and later Africa and Asia, while the jaguar migrated across the Bering Strait 500,000 years ago into North and South America.

BOBCAT/ LYNX

Lynx

D. Baxter the Bobcat, Arizona Diamondbacks (MLB)
Prowl, Minnesota Lynx (WNBA)

FAST FACTS

Native to North America.

Primary felid used in the skin trade and the United States is the dominant international trader.

THREATS

Habitat reduction

Climate change

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Habitat Preservation and Protection

Climate Remediation

Two of the world's four lynx species are native to North America: the bobcat (*Lynx rufus*) and the Canada Lynx (*Lynx canadensis*). The other two species include the Eurasian lynx, native to northern Europe and Siberia, and the Iberian lynx, which inhabits southern Europe. The bobcat is a carnivorous mammal, and it is capable of going without food for long periods. It normally preys on rabbits, rats, and other mammals smaller than 12 pounds, but during lean times it may prey on animals like deer that are up to eight times larger.

The bobcat has the broadest distribution of any of the half-dozen native (non-domesticated) cat species in North America. Like other lynxes, it has long legs relative to its body size, a small head, a spotted coat, and a ruff of fur that extends from the ears to the jowls. Bobcats are twice as large as domestic cats, although smaller than the Canada lynx. Their name is derived from their black-tipped, stubby tails. Bobcats are superior hunters, demonstrating stealth, strategy, and remarkable patience.

The bobcat is prominently featured in American national folklore and Native American myths. It represents fog in Amerindian folklore. The Mohave people believed dreaming of cougar and lynx, considered deities, would endow them with extraordinary hunting skills. The bobcat animal totem is a sign of patience among many North American native tribes.

RANGE

Bobcats live mainly in the United States but range from southern Canada to northern Mexico. With the clearing of northern Canadian forests, bobcats have been expanding northward. The slightly larger Canada lynx ranges across the tundra and boreal forests of Alaska and Canada.

ENVIRONMENTAL THREATS TODAY

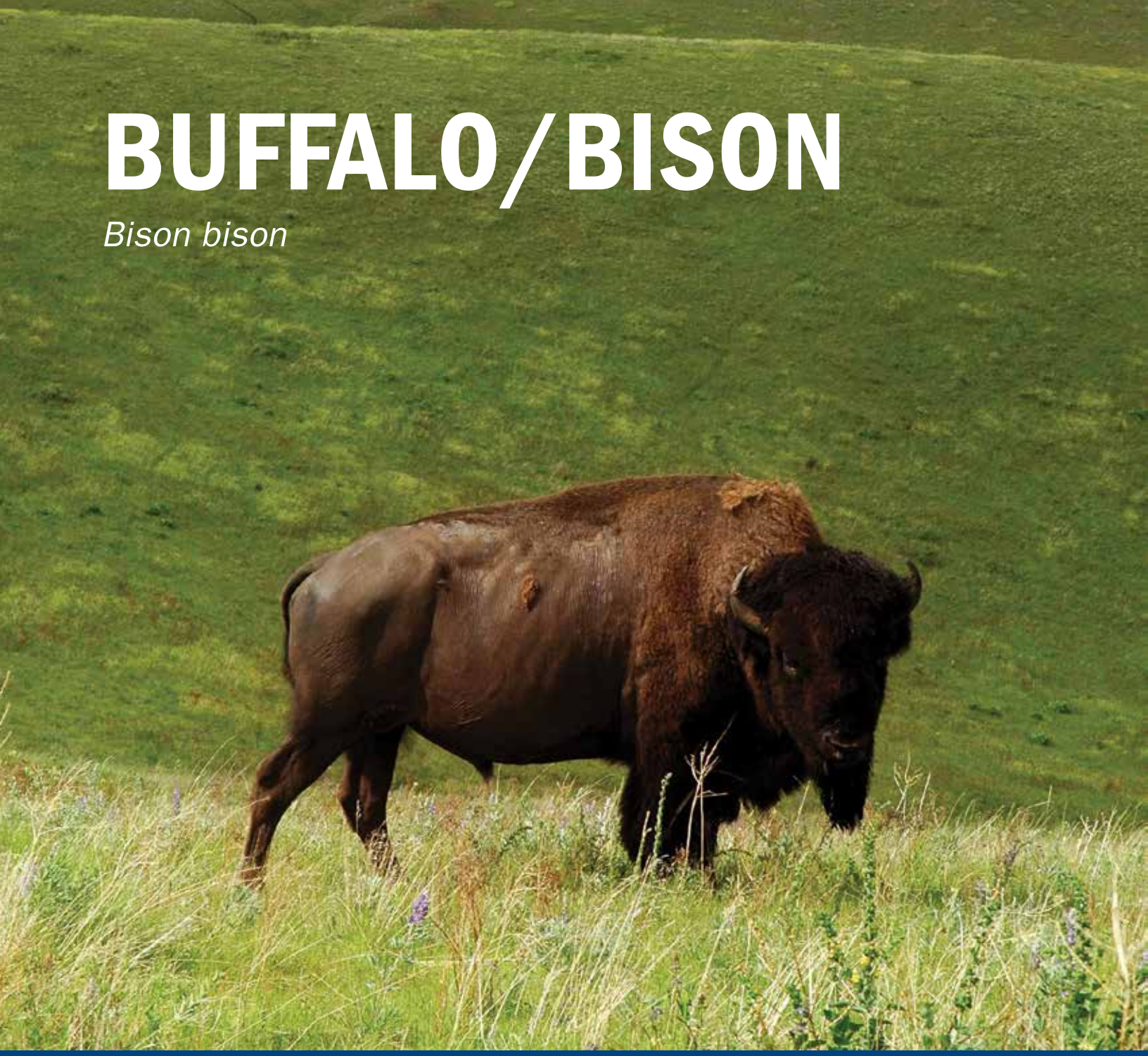
The most critically endangered cat species on the planet is the Iberian lynx. Hunting of the nearly extinct Iberian lynx has been unlawful since 1970. The Canadian lynx, whose habitat once spanned Canada, Alaska and the northern states, has been listed by the U.S. Fish & Wildlife Service as threatened in the continental U.S. since 2000. The Eurasian lynx, the third largest mammal in Europe after the grey wolf and brown bear, has suffered population losses and local extirpations (extinction) but is not considered endangered or threatened.

Jacqueline Kennedy unwittingly launched the fashion craze for spotted cat furs when she appeared in a leopard coat in the early 1960s. Today the bobcat is the primary felid used in the skin trade, and the United States is the dominant world exporter. The bobcat fur trade is legal in 38 states and seven Canadian provinces. Yearly exports of skins climbed from less than 14,000 in 1990 to more than 51,000 a year since 2006.

The U.S. bobcat population was estimated at 725,000 to 1 million at the last state wildlife assessment in the early 1980s. Since then it is believed that bobcats have been increasing in number throughout North America. Reviews by the U.S. Department of Interior indicate bobcat survival is well managed by state wildlife authorities. However, Ohio, Indiana, and New Jersey consider the bobcat endangered. Bobcats still face the primary threat of habitat loss, and they compete in some regions with coyotes for resources.

BUFFALO/BISON

Bison bison



Rumble the Bison, Oakland City Thunder (NBA)
William "Billy" Buffalo, Buffalo Bills (NFL)

FAST FACTS

Wild bison are slowly being restored in several states, including Montana and Alaska.

For some 12,000 years, bison provided the bedrock of subsistence economies in successive indigenous cultures of North America.

THREATS

Habitat destruction

Climate change

Hunting (at its peak in the 1800s)

WHAT NEEDS TO BE DONE

Habitat Preservation and Protection

Climate Remediation

The bison is the largest terrestrial animal in North America. It has existed for 2 million years in various forms, with more than 50 million once roaming North America.

Bison migrated from Asia across the Bering Land Bridge into Alaska 300,000 years ago. They moved south into the grasslands of central North America when the ice sheets retreated, 130,000 to 75,000 years ago. The North American region known as the great bison belt was a vast tract of fertile grassland around 9,000 B.C., emerging after the last ice retreat, running from the Gulf of Mexico to Alaska. Spring and early-summer rainfall there enabled short prairie grasses to thrive, and these deep-rooted grasses were moisture reservoirs, providing the grazing bison with high-quality, nutritious food in autumn.

Bison have played instrumental roles in the co-evolution of other plants and animals, including mutually beneficial and synergistic (enhanced) grazing adaptations in plants. They have functioned as a keystone species of the native biodiversity across vast areas of North America, greatly influencing the structure, patterns, composition, distribution, and stability of both plant and animal communities.

Scientists emphatically state, “No other wildlife species has exercised such a profound influence on the human history of a continent.” For some 12,000 years bison provided the bedrock of subsistence economies in successive indigenous cultures of North America.

RANGE

At one point the American bison had the largest range of any indigenous large herbivore in North America, running from coast to coast and from the floodplain meadows of interior Alaska to the desert grasslands of northern Mexico. Grasslands and meadows provide the bulk of the American bison’s diet.

ENVIRONMENTAL THREATS TODAY

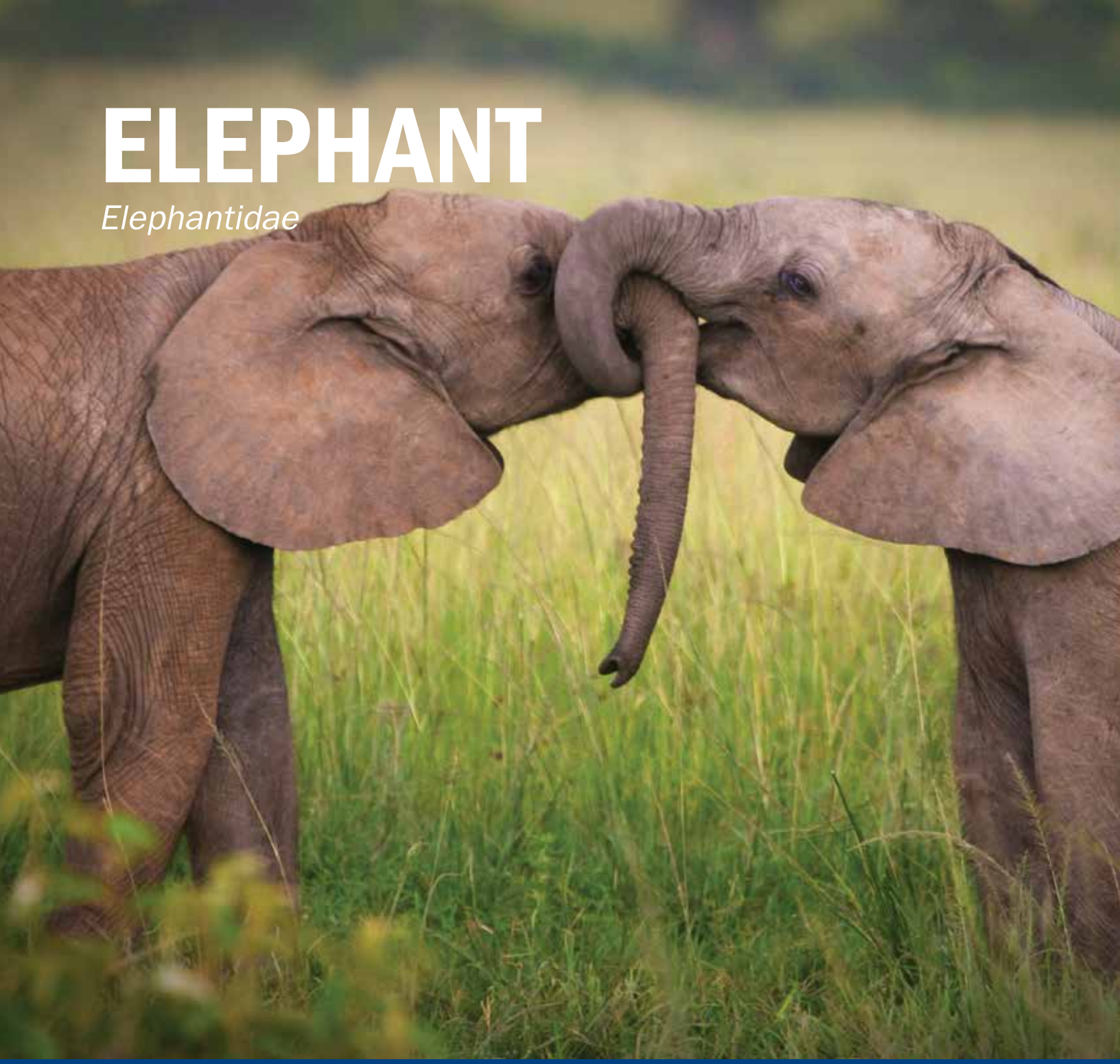
Bison were almost hunted to extinction in the 19th century, when nearly 300,000 were killed each year, and by the mid-1880s, formerly vast herds had been reduced to just a few hundred animals. In 1893 the first efforts were made to protect the animals. They are listed as threatened by the IUCN Red List of Threatened Species, given that there are fewer than 12,000. Only five geographically dispersed subpopulations have more than 1,000 members, the levels at which such populations are considered viable for the long term. Bison in conservation herds occupy less than 1 percent of their original range.

Restoring wild bison has been slowly occurring in several states. In 2012, 71 bison descended from one of Montana’s last wild herds were reintroduced to prairie grasslands of the Assiniboine and Sioux tribes in the Fort Peck Indian Reservation in northeastern Montana, and to lands belonging to the Assiniboine and Gros Ventre tribes in the Fort Belknap reservation in north-central Montana. Hunters and conservationists are now advocating expanding wild bison across a million-acre wildlife refuge.

Alaska, where wood bison disappeared more than a century ago, began reintroducing a small herd of wood bison from Canada back into the wild in 2013.

ELEPHANT

Elephantidae



Stomper, Oakland Athletics (MLB)

FAST FACTS

The African elephant is the largest living land mammal.

Elephants are highly intelligent with sophisticated communication mechanisms and complex social structures, including large families and elaborate mourning rituals.

THREATS

Habitat reduction

Climate change

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Habitat preservation and protection

Climate remediation

Halting of illegal trade, trafficking, and poaching

Asian and African elephants are the only two surviving elephant species, the latter being the largest living land mammal. Elephants weigh between 7,000 and 13,000 pounds and have a natural life span of 60 to 70 years.

Elephants are herbivores and eat 16 hours a day, consuming 400 pounds of grass, leaves, twigs, bark, fruit, and seedpods. Large volumes of food are required because less than half is digested.

Ivory tusks are their striking feature, and the market for ivory, based on the slaughter of elephants, is putting them at risk of extinction. These incisors once weighed 200 pounds or more and extended 10 feet. Poaching has eliminated the largest-tusked elephants—it is rare these days to find even a 100-pound example—and some populations of African elephants now have unnatural percentages of tusk-free animals among them.

The muscular trunk serves as a nose, an appendage that can reach out as much as 23 feet. It also serves as an extra foot, a signaling device, and a multifunctional tool for gathering food, siphoning water, dusting, digging, tearing down trees, fighting, and caressing a companion. African elephants' vein-rich ears are twice as large as those of their Asian counterparts and can cool the elephant's body by as much as 9 degrees Fahrenheit when flapped to increase blood circulation.

Elephants are highly intelligent and have sophisticated methods of communication and a complex social structure. They are gregarious, forming family groups of a dozen or more consisting of an elder matriarch and three or four of her offspring, along with their young.

RANGE

A century ago, several million elephants ranged across Africa, inhabiting tropical swamp forests, savannas, and deserts, often migrating over great distances. By 2007 their range had been reduced to just 15 percent of Africa's total land area and their numbers reduced to just 500,000. More than half of Africa's elephants live in Botswana, Tanzania, and Zimbabwe.

The Asian elephant has dramatically declined as well, with fewer than 30,000 estimated to be remaining in southeast Asia. Their habitat originally spanned from the Yellow River that crosses northern China to the Middle Eastern countries of Iraq and Syria. Today Asian elephants remain in Asia in an area from India to Vietnam, plus a small highly threatened remnant in Yunnan Province in southwest China.

ENVIRONMENTAL THREATS TODAY

A staggering 100,000 elephants were killed from 2010-2012. Poaching has tripled in recent years due to the increased global demand and higher prices paid for ivory, resulting in the killing of an elephant every 15 minutes. Two-thirds of the Congo Basin's forest elephants were killed for ivory in the past decade. In 2012, poachers killed some 35,000 African elephants for their tusks in the worst mass slaughter since the 1989 international ban on the ivory trade. If the poaching continues, African forest elephants face extinction in 10 years, with East Africa's savanna elephants not far behind.

Rising East Asian consumer wealth fuels the skyrocketing demand for ivory, most of which comes from African elephants, but Asian elephants are also being poached for their tusks and skins, and for use by circuses.

Compounding this threat is the ongoing loss of habitat and migratory range as a result of rapid human population growth and agricultural expansion. One-third of the existing elephant range is threatened by rapid urban and agricultural expansion. Nearly two-thirds of elephant habitat and range are at risk of being lost in the next four decades, especially in West, Central, and Eastern Africa. Extreme weather disasters triggered by climate destabilization are emerging as another serious threat to elephant survival in the face of declining habitat and range.

Elephants are listed as vulnerable on the IUCN Red List of Threatened Species. International efforts like Monitoring the Illegal Killing of Elephants (MIKE) program, the Elephant Trade Information System (ETIS), and the International Consortium on Combating Wildlife Crime (ICCWC) are working to reduce and prevent the spread of poaching.

FLORIDA PANTHER

Puma concolor coryi

Stanley C. Panther, Florida Panthers (NHL)

FAST FACTS

As far back as 1832, bounties were placed on Florida panthers, continuing to 1958 when it was listed as endangered.

The majority of panther deaths are caused by vehicle collisions.

Panthers are an umbrella species, meaning that protecting their habitat benefits other imperiled species, as well as land critical to preserving water quality.

THREATS

Toxic chemicals

Climate change

Habitat reduction

Vehicle collisions

WHAT NEEDS TO BE DONE

Habitat preservation and protection

Toxic chemical use reduction

Climate remediation

The word panther technically refers to the four large cats of the genus *Panthera*: tiger, lion, jaguar, and leopard. But it is also commonly used to specifically designate melanistic black jaguars (*Panthera onca*) in the Americas, which are a subspecies of cougar (*Puma concolor coryi*).

Unlike the four cats of the *Panthera* genus, Florida panthers lack the capacity to roar. Rather, they make sounds including whistles, chirps, growls, hisses, and purrs.

Florida panthers are smaller than other cougars in the United States and Canada, but larger than cougars from Mexico southward. A male can weigh up to 160 pounds and extend seven feet, with females one-third smaller in weight.

The Florida panther inhabits the forests and swamps of southern Florida, encompassing the Big Cypress National Preserve, Everglades National Park, and the Florida Panther National Wildlife Refuge.

RANGE

The historical range of the Florida panther used to span Florida, Alabama, Mississippi, Louisiana, Arkansas, and part of South Carolina. Even just a few decades ago it lived throughout Florida, including the Keys.

Today the panther resides mainly in the Fakahatchee Strand State Preserve, the Big Cypress National Preserve, Everglades National Park, and surrounding private lands, where cypress and mixed hardwood swamps are interspersed with freshwater marshes, old fields, and pine flat woods.

ENVIRONMENTAL THREATS TODAY

As far back as 1832, bounties were placed on panthers in Florida, with a panther scalp bringing $5 (about $120 in 2012 dollars) well into the late 1800s. The hunting of panthers continued until 1958, when the state listed the Florida panther as protected from hunters.

The Florida panther is the only *Puma* population east of the Mississippi River and remains a critically endangered subspecies of cougar. Today it occupies just 5 percent of its historic range. In the 1970s, there were only about 20 Florida panthers in the wild; their number increased to an estimated 100 to 160 as of 2011. The U.S. Fish and Wildlife Service listed as endangered in 1967, and Florida added it to the state's endangered species list in 1973.

The biggest threats to the Florida panther are ongoing loss of habitat and health problems. An abundance of deer was a habitat condition for panthers historically. But expansion of domestic cattle and swine operations and the spread of intensive agricultural practices have dramatically altered ecological conditions and reduced the Florida panther's prey. The majority of Florida panther deaths are caused by collisions with vehicles, including off-road vehicles.

Florida panthers' health problems are mainly connected to degraded habitat conditions. In the Everglades, mercury contamination is taking a toll on the panthers that ingest it by eating raccoons whose bodies are high in mercury. Mercury toxicosis causes neurological, gastrointestinal, and liver damage. Major sources of mercury emissions include fossil fuel combustion and waste incineration. A review of solid waste incinerators in Florida found that they released 18,000 pounds of mercury in 1989, and more incinerators have been installed since then. More than 4 million pounds of mercury emissions are released annually by human activity worldwide, causing serious health threats to people and wildlife.

In 2012, conservation groups joined with government agencies to protect 1,278 acres along the Caloosahatchee River west of Lake Okeechobee to provide a wildlife corridor for Florida panthers. The corridor allows the animals to migrate between the Everglades and central Florida, which they are doing with increasing frequency.

Currently, a broad coalition of leading conservation groups and small and large farmers and ranchers in eastern Collier County in southern Florida have proposed a Florida Panther Protection Program that would entail protection of as much as 2.5 million acres of public and private lands. The collaboration is committed to setting the endangered Florida panther on a path to recovery, which requires a significant, contiguous range of habitat to ensure success.

GORILLA

Gorilla gorilla and *gorilla beringei*

Phoenix Suns Gorilla, Phoenix Suns (NBA)

FAST FACTS

The gorilla is the largest living genus of primates.

Gorilla population has declined by 50 percent in recent decades.

THREATS

Habitat reduction

Climate change

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Habitat preservation and protection

Climate remediation

Halting of illegal trade, trafficking, and poaching

At 6 feet in height and weighing 480 pounds, the male gorilla is the largest living genus of primates. Females grow up to 5 feet in height and weigh up to 215 pounds. Gorillas have highly developed arm muscles and six times the upper-body strength of a human.

Gorillas live in groups of 6 to 12, led by the largest, oldest male silverback and including females, their young, and several younger males called blackbacks. The silverback makes all decisions, including when the group wakes and where it sleeps, forages, and migrates. As the group's protector, the silverback exhibits the most aggressive behavior.

The animals have an unusual upper body in that their stomachs are larger than their chests. This is due to their diet. Gorillas have enlarged intestines that are essential for digesting the immense quantity of bulky and fibrous vegetation they consume. Gorillas require up to 40 pounds of food per day due to the low nutritional value of the plant material. Gorillas have a natural life span of 35 to 50 years.

Gorillas nomadically wander throughout their range of 10 to 15 square miles. They forage, feed, and rest throughout the day. Gorillas are ground dwellers, but females and their young also nest in trees. Gorillas can be found both foraging and nesting 130 feet up in the tree canopy. In addition to human threats, gorillas face threats from leopards, and crocodiles also attack lowland gorillas.

Gorillas—like humans, chimpanzees, and bonobos—are all in the family *Hominidae*. Gorillas and humans diverged from a common ancestor about 10 million years ago.

RANGE

The Congo River and its tributaries in central Africa separate two gorilla species. The western gorilla lives in west central Africa, and the eastern gorilla lives in east central Africa. Gorilla habitat runs from moist, mountainous forests to lowland swamps.

Mountain gorillas live in the montane forests up to 13,000 feet in elevation, while eastern lowland gorillas live in submontane forests, montane bamboo forests, and lowland forests, ranging from 2,000 to 20,900 feet in elevation. Western gorillas live from lowland swamp forests on up to cloud rain forests, at elevations ranging from sea level to 5,300 feet.

ENVIRONMENTAL THREATS TODAY

In recent decades the world's gorilla populations have declined more than 50 percent. Humans are the primary threat and the leading cause of large-scale gorilla deaths. The animals are hunted for the bush meat trade, entire groups are killed in order to capture infant gorillas for zoos, and gorilla heads and hands are sold as trophies. Gorilla habitat is being fragmented and destroyed by legal and illegal logging, and human encroachment is leading to disease transmission.

All four gorilla subspecies are listed as threatened on the IUCN Red List of Threatened Species. The fewer than 300 Cross River gorillas along the Nigeria-Cameroon border are listed as critically endangered, as are the 700 mountain gorillas in parts of Rwanda, Uganda, and the Democratic Republic of Congo (DRC). Eastern lowland gorilla numbers in the DRC have rapidly plummeted by 70 percent to below 5,000. Only western lowland gorillas still have a healthy population, with 150,000 to 200,000 of the animals living in Angola, Cameroon, the Central African Republic, the DRC, Equatorial Guinea, and Gabon.

Laws to protect gorillas have been enacted by eight African nations, but illegal poaching and civil wars and conflicts cause continuous threats to their survival.

A changing climate poses additional threats to mountain gorillas living at higher elevations. In addition to directly altering their habitat, climate change may adversely impact nearby farmers' yields, driving them to convert more of the mountain gorillas' shrinking habitat for agricultural use.

GRIZZLY BEAR

Ursus arctos horribilis

- Clark, Chicago Cubs (MLB)
- T.C. Bear, Minnesota Twins (MLB)
- Clutch the Rockets Bear, Houston Rockets (NBA)
- Grizz, Memphis Grizzlies (NBA)
- Jazz Bear, Utah Jazz (NBA)
- Staley Da Bear, Chicago Bears (NBA)
- Blades, Boston Bruins (NHL)
- Carlton the Bear, Toronto Maple Leafs (NHL)

FAST FACTS

More than 30,000 grizzlies live in Alaska and 25,000 live in Canada, but fewer than 1,000 remain in the continental United States on less than 2 percent of their original habitat.

Grizzly bears have the slowest reproductive rate of any North American mammal.

THREATS

Habitat reduction

Toxic chemicals

Climate change

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Habitat preservation and protection

Toxic chemical use reduction

Climate remediation

Halting of illegal trade, trafficking, and poaching

Grizzly bears are among the largest terrestrial carnivores in the world. Depending on the location, male bears can weigh 300 to 800 pounds, while females are 40 percent smaller. Some grizzlies get much bigger: one was recorded at 1,500 pounds. They can reach speeds of 35 miles an hour, are excellent swimmers, and have an acute sense of smell over long distances. While grizzlies have fierce reputations as predators, about 80 percent of their food is made up of berries, nuts, roots, and insects.

These awesome animals are distinguished by a large hump of muscle and fat on their shoulders, which provides the force of their remarkable digging power for locating food and making dens. Bears are omnivorous, highly diverse and opportunistic eaters in each season. In addition to a range of plants, insects, fish, and animal carcasses, grizzlies may take 50 percent of newborn elk and 40 percent of moose calves. During the summer season, grizzly bears will spend up to 16 hours a day eating, putting on substantial weight. They may feed on up to 200,000 buffalo berries each day.

Another distinction is that their fur is tipped with gray. “Gray” in French and Spanish is “gris,” and it is speculated that in its translation to English it was mistaken as meaning “grisly,” hence the subspecies’ Latin name, *horribilis*. Although solitary, grizzlies gather when salmon run upstream for summer spawning on the western side of the Rockies. The fat-rich food source helps grizzlies hibernate over the winter, a five- to eight-month period during which their heart rate slows from 40 beats to 8 beats per minute.

RANGE

Eight bear species are found living on four continents – North and South America, Europe and Asia. The bear evolved 20 million years ago from a doglike animal, with brown and black bears emerging 1.5 million years ago. The grizzly bear is a North American subspecies of the brown bear, having crossed from eastern Russia to Alaska 100,000 years ago, and then into the continental United States 13,000 years ago.

There remain more than 30,000 grizzlies in Alaska and 25,000 in Canada, but less than 1,000 in the continental United States.

ENVIRONMENTAL THREATS TODAY

Some 100,000 grizzlies once roamed North America from the Pacific coast to the Great Plains and Mississippi River. Now, fewer than 1,000 grizzlies survive on less than 2 percent of their original habitat in the continental United States, decimated in the 1800s by advancing pioneers.

A thriving grizzly bear population reflects a healthy ecosystem: where there are grizzlies, there are elk, trout, and clean water. Grizzlies were among the first animals protected by the U.S. Endangered Species Act and are listed as threatened on the IUCN Red List of Threatened Species.

Grizzlies have the slowest reproductive rate of any mammal in North America and are especially vulnerable to development and industrialization of their habitat. Male grizzlies range across immense territories, up to 1,500 square miles, and given such low population densities, locating a female can be difficult. Grizzly bears take at least five years to reach sexual maturity.

Females typically bear two cubs per litter, but the mortality rate of grizzly cubs in the first year is about 50 percent due to disease, starvation, or attack by wolves, mountain lions, and male grizzlies. Females may go three or more years between litters, depending on food availability and other conditions.

Extreme weather triggered by climate destabilization is causing new threats to grizzlies. Warmer winters have led to an explosion in the mountain pine beetle population. These beetles are wiping out large tracts of whitebark pine, whose large, fat-rich nuts provide
a primary food source in spring and autumn for grizzly bears. Warmer rivers are also causing declines in cutthroat trout, another food source.

JAGUAR

Panthera onca

Jaxson de Ville, Jacksonville Jaguars (NFL)

FAST FACTS

Jaguars now occupy less than half of their original range, and nearly 90 percent of their remaining territory is in the Amazon.

Jaguars are the only roaring cat in North America.

More than 25 percent of the jaguar's natural prey has been exhausted by human expansion and land conversion.

THREATS

Habitat reduction

Climate change

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Habitat preservation and protection

Climate remediation

Halting of illegal trade, trafficking, and poaching

The South American Guaraní Indians called the jaguar "the beast that kills with one leap." A terrestrial, aerial, and aquatic apex predator, the 300-pound jaguar can cross 21 feet in a single bound. It has an unparalleled ability to climb trees, is a strong swimmer, has an acute sense of smell, and can chase down prey at a speed of 40 miles per hour.

The jaguar is superbly designed to be a super-carnivore. It has a huge head with daggerlike canine teeth that lock tightly onto prey, and its crushing, triangular cheek teeth can sever the prey's spine and rip its flesh into chunks small enough to swallow. With a biting pressure of 2,000 pounds of force, the jaguar has the second-strongest bite of all carnivores (after hyenas), twice as strong as a lion's.

Jaguars are readily identifiable by their camouflaging rosette patterns. Most are yellow with black spots, and some are black with black spots. Jaguars look very similar to leopards (which are found only in Africa and Asia) but can be distinguished in several ways. Jaguars have spots inside their rosettes and leopards do not, and the jaguar's legs and tail are shorter than the leopard's.

RANGE

The jaguar is the third-largest cat after the tiger and lion, and the only roaring feline in the Western Hemisphere. The jaguar traveled east across the Bering Strait 500,000 years ago into North and South America.

Until the early 20th century, the jaguar's range extended as far north as the Grand Canyon and as far west as California, but it is now considered locally extinct (extirpated) in North America. It now occupies an estimated 3.4 million square miles, less than half its historical range. Nearly 90 percent of the jaguar's range is in the Amazon Basin rain forest.

ENVIRONMENTAL THREATS TODAY

During the most precipitous decline of the species in the 1960s and 1970s, around 18,000 jaguars were killed every year for the fur coat trade. The jaguar is now extinct in El Salvador and Uruguay and is listed as near threatened on the IUCN Red List of Threatened Species.

The jaguar is protected under the U.S. Endangered Species Act, which has stopped the killing of the animal for its pelt. Deforestation remains a major threat to the animal's survival. It is estimated that around 15,000 jaguars remain in the Western Hemisphere. There are conservation efforts to set up protected areas, like the 150 square miles of rain forest in Belize's Cockscomb Basin Wildlife Preserve.

More than 25 percent of the wild prey base (notably tapirs, deer, sloths, and hoglike peccaries) in the jaguar range has been exhausted due to human expansion and land conversion.

LION

Panthera leo

- **Roary, Detroit Lions (NFL)**
- **Bailey, Los Angeles Kings (NHL)**
- **Spartacat, Ottawa Senators (NHL)**
- **Sluggerrr, Kansas City Royals (MLB)**
- **Boomer, Indiana Pacers (NBA)**
- **Slamson the Lion, Sacramento Kings (NBA)**
- **Kingston, Orlando City SC (MLS)**
- **Leo, Real Salt Lake (MLS)**

FAST FACTS

Lions once roamed through North and South America, Eurasia, and Africa, but are now mostly restricted to Africa.

Lions are the second-largest feline.

Safari hunters kill 600 lions per year, while poachers poison them for the bone trade, and local herders poison lions that attack their cattle.

THREATS

Habitat reduction

Climate change

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Habitat preservation and protection

Climate remediation

Halting of illegal trade, trafficking, and poaching

The lion is arguably the most iconic species of the animal kingdom. It is one of the four big cats in the genus *Panthera*, which also includes tigers, jaguars, and leopards. After tigers, lions are the largest felines, with the weight of some males surpassing 550 pounds. The largest lion recorded was nearly 700 pounds and 11 feet long. A lion's eyesight is five times better than human eyesight. It can hear prey a mile away, and its roar can be heard from five miles away.

The lion is a majestic animal that figures prominently throughout human history as a symbol of raw power, courage, and nobility. Lions are featured on the national flags of many countries, as well as on coats of arms and family crests.

While called the "king of the jungle," lions actually live in savannas, grasslands, and woodlands. They can run 50 miles per hour for short distances and are able to leap 36 feet. The survival rate of cubs is low, and female lions will copulate on average 3,000 times for each cub that survives for a year.

Most feline species lead solitary lives, but the lion is an exception. Lions live in prides of a dozen or more individuals, mostly females and their young, along with a couple of males, usually brothers. The pride is an extended, closed family unit that relies on teamwork and a division of labor. Females perform 85 to 90 percent of the pride's hunting, while males patrol the territory and protect the pride. Lions rest up to 20 hours a day while also engaged in plenty of licking, head rubbing, touching, and purring.

RANGE

New fossil DNA evidence discovered in 2013 indicates the *Pantherinae* subfamily of big cats (lions, tigers, leopards, and jaguars) diverged from their evolutionary cousins, the *Felinae* subfamily (bobcats, cheetahs, cougars, lynxes, mountain cats, and eventually domestic cats), between 6 and 9 million years ago. Lion-like cats appeared in eastern Africa about 3 million years ago.

It is thought that the lion migrated to Europe about 700,000 years ago, and to North and South America about 300,000 years ago, from Africa.

Apart from 350 Asian lions in Gir National Park and Wildlife Sanctuary, located near the central west coast of India, lions are now found only in the south Sahara desert and parts of southern and eastern Africa.

ENVIRONMENTAL THREATS TODAY

Lions once roamed throughout most of the world: Africa, Eurasia, and North and South America. Just 10,000 years ago the lion was the most numerous animal in the world, aside from humans. Today, apart from 350 lions living in an Indian nature reserve, all the world's remaining wild lions inhabit a small number of isolated parts of Africa. In 1800 there were 1.5 million lions roaming Africa. Since 1940 more than 90 percent of Africa's lion population has been lost, and fewer than 21,000 remain.

Lions are listed as vulnerable on the IUCN Red List of Threatened Species, and many experts see extinction potentially occurring within several decades unless there is a concerted effort to protect them.

The U.S. Fish and Wildlife Service is currently reviewing a petition to list the African lion on the Endangered Species list, which would result in a ban on trophy lion imports. The Asian lion has been listed since 1970.

Lions face multiple threats, including overhunting and poaching, habitat loss, diseases from domestic animals, and, increasingly, extreme weather events. Habitat destruction continues to be a primary cause of declining lion populations, including local extinctions. Humans have developed three-fourths of savanna Africa, driving off or killing lions in the process. Conservation ecologist Stuart Pimm summed up the unfolding process: "...As [people] moved in, lions have been hunted out."[4] The rapid rate of savanna loss exceeds that of tropical rain forests.

Hunters and poachers also pose a serious threat to lions. Safari hunters kill 600 lions a year, village herders poison lions that go after their cattle, and poachers use poison to kill lions for the bone trade. Their bones are falsely marketed as aphrodisiacs and medicinal potions, selling for several hundred dollars per pound. Poaching also puts lions at risk by reducing the populations of species lions typically rely on for food, such as zebras and buffalo.

Ongoing field research points to unsustainable overhunting in some African countries, due to high quotas or a failure to monitor how many lions have been killed. High hunting quotas are often set in regions where lion attacks on humans occur. Moreover, although some nations restrict the killing of females, others do not.

Import restrictions could prevent or reduce the number of lion kills and enable lion populations to recover in overhunted areas. However, this may prove to be only a temporary solution. With the loss of hunting revenues, there is the increased risk of developing the lions' habitat for agriculture and animal herding.

Wildlife managers and conservationists strongly recommend reducing quotas, establishing and enforcing age and sex hunting restrictions where not already adopted, and establishing ongoing monitoring of trophy hunting. Tanzania is the first nation to adopt an age limit for lion hunting, setting a six-year minimum age for trophy lions throughout the country. Mozambique also has set minimum age limits within the Niassa National Reserve.

MOUNTAIN LION

Puma concolor

- **SuperMascot Rocky, Denver Nuggets (NBA)**
- **Blaze the Trail Cat, Portland Trailblazers (NBA)**

FAST FACTS

Mountain lions hold the Guinness World Record for animals with the greatest number of names.

Less than 50,000 breeding mountain lions currently exist.

The mountain lion is protected in most of the United States and Central and South America.

THREATS

Habitat reduction

Climate change

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Habitat preservation and protection

Climate remediation

Halting of illegal trade, trafficking, and poaching

The mountain lion, native to the Americas, is the second-heaviest *felid* (cat) in the Western Hemisphere, after the jaguar. This multi-named cat was roaming the Americas millions of years before humans. It migrated across the Bering Land Bridge to North America 8 to 8.5 million years ago and advanced to South America 3 million years ago.

The *Puma concolor* species holds the Guinness World Record for the animal with the greatest number of names, most likely due to its vast distribution across North and South America. It has more than 40 names in English alone. The most common names used today in the western United States are cougar, mountain lion, and puma. East of the Mississippi River, more commonly heard names include panther, from the Greek word for "leopard" (a general term for cats that have solid-colored coats); painter, an American colloquialism; and catamount, used in New England and derived from "cat of the mountains."

Mountain lions are about the same size as an adult human. Adult males weigh 200 pounds and are around eight feet long from nose to tail. Females weigh less than 100 pounds and average 6.7 feet in length. Mountain lions have a short-sprint speed of up to 50 miles an hour. They can jump up to 18 feet vertically and as much as 45 feet horizontally. Thanks to their powerful neck and jaws and their large claws, they can clutch and hold very large prey, including deer.

Unlike other roaring "big cats," such as lions and jaguars, mountain lions are typically silent, with minimal vocalizations. Though they cannot roar, they do purr, hiss, spit, and growl.

RANGE

The mountain lion can be found from the Canadian Yukon near the Arctic Circle to the Strait of Magellan at the tip of South America—a range of more than 110 degrees of latitude— and from the Atlantic to the Pacific. The cougar once laid claim to more territory than any other land mammal in the Western Hemisphere.

ENVIRONMENTAL THREATS TODAY

As with many wild species, following European colonization of the Americas, excessive hunting and human conversion of the mountain lions' habitat resulted in dramatic drops in populations across most parts of the species' historical range. By the early 1900s, the mountain lion was extirpated (made locally extinct) in eastern North America, with the exception of the Florida panther, an isolated subpopulation (see the Florida Panther entry for more information).

Fewer than 50,000 breeding mountain lions currently exist in the United States, and that number continues to decline. In the United States, some state-level statistics appear more optimistic, indicating mountain lion populations are rebounding. A healthy population of 5,000 mountain lions was reported in Oregon in 2006. California has actively sought to protect mountain lions and now has a population of 4,000 to 6,000.

Other nations are also attempting to protect their remaining mountain lions. As of 1996, hunting of mountain lions was banned in Argentina, Brazil, Bolivia, Chile, Colombia, Costa Rica, French Guiana, Guatemala, Honduras, Nicaragua, Panama, Paraguay, Suriname, Venezuela, and Uruguay. In Central and South America, only

Ecuador, El Salvador, and Guyana still lack legal protection for mountain lions.

While there are localities in the United States that have taken steps to protect mountain lions, hunting is still permitted throughout the country, with the exception of California. Hunting is also allowed in Canada, except for the Yukon, where mountain lions are protected. Texas is the only state with a viable population of mountain lions, despite the fact that it provides them with no protection. In fact, they are listed as nuisance wildlife in Texas, and any citizen with a hunting or trapping permit can kill a mountain lion regardless of the season, number killed, sex, or age of the animal.

One of the main reasons why hunting is permitted in Texas is because mountain lions often hunt for and kill domestic animals, including cattle, sheep, and lambs. However, the total number of livestock killed by mountain lions is quite small. For example, in 1990, mountain lions killed 86 calves, or 0.0006 percent of the 13.4 million cattle and calves in the entire state.

In 2011 the U.S. Fish and Wildlife Service declared the eastern cougar (*Puma concolor couguar*) officially extinct. Saving other mountain lion populations from the same fate requires wildlife corridors with sufficient range for breeding. Research simulations indicate that corridors of 850 square miles or more are needed to prevent extinction.

PANDA

Ailuropoda melanoleuca

Pax the Panda, Washington Mystics (WNBA)

FAST FACTS

The giant panda is roughly the size of the American black bear, weighing several hundred pounds and measuring up to six feet long.

Unlike bears, giant pandas do not hibernate. Rather, they migrate during the winter to lower elevations, and will typically seek shelter in caves, rock crevices, or hollow trees.

THREATS

Habitat reduction

Toxic chemicals

Climate change

Illegal trade, trafficking and poaching

WHAT NEEDS TO BE DONE

Habitat preservation & protection

Toxic chemical use reduction

Climate remediation

Halt illegal trade, trafficking, and poaching

The giant panda, the rarest species of the bear family, has become the ambassador of protecting endangered animals around the world. Also known as the bamboo bear, white bear, and panda bear, the giant panda was long hunted for its fur, and there are now as few as 1,000 pandas in the wild. Poaching is now punishable with several years in prison, and in some cases, even penalty of death, for this symbol of global wildlife protection.

The giant panda is recognizable by the black fur patches covering its eyes, ears, snout, shoulders, and legs; the rest of the panda's coat is white. Some scientists speculate that the contrasting colors provide camouflage for the panda where it lives in the mixed forests of conifer, broadleaf, and bamboo, intermingled with snow, rocks, and shifting shade patterns.

The panda's diet is overwhelmingly concentrated on digesting bamboo; only one percent of its diet is other food. The panda's ancestors were carnivores or omnivores like other bear species, and three million years ago the panda had already developed powerful jaw muscles and big molar teeth for grinding the tough, fibrous bamboo found in the widespread bamboo forests it occupied. Unlike other bears, giant pandas do not hibernate. Rather, they migrate during winter to lower elevations, and will typically seek shelter in caves, rock crevices, or hollow trees.

Giant pandas inhabit elevations between 5,000 and 10,000 feet, in conditions characterized by heavy rains and a cloud forest of dense mist for much of the year, with about 30 to 40 inches of rain and snow falling each year. The giant panda is roughly the size of the American black bear, weighing several hundred pounds, and measuring up to six feet long. with shoulders two to three feet wide.

RANGE

The giant panda once ranged across most of southern and eastern China, as well as further south into northern Myanmar and northern Vietnam. Pandas also ranged as far north as Beijing.

Now, south-central China is the only remaining habitat of the great pandas, confined to just 20 remote patches of forest on six mountain ranges. Sichuan Province is home to three-fourths of the pandas.

ENVIRONMENTAL THREATS TODAY

The threats confronting giant pandas echo the key issues confronting wildlife preservation as a whole: the loss of habitat, forest fragmentation and land degradation, illegal poaching, and struggles between economic development and conservation.

The giant panda is one of the more endangered species in the world, with approximately 1,000 to 2,000 living in the wild. This low number is due in large part to the dramatic loss and fragmentation of their natural habitat. More than half of the bamboo forests in China were cleared for agriculture and tree harvesting between the mid-1970s and late-1980s.

Other ongoing factors causing the destruction or serious degradation of panda habitats are development projects like roads, hydropower dams, and mining operations. Illegal panda poaching and bamboo harvesting continues, and China's growing population is moving to higher elevations, further encroaching on the panda's habitat.

The Chinese government has taken some measures to protect pandas, but the results have been mixed. In 1963 the government recognized the importance of creating protective forest reserves, and since then 60 nature reserves have been established. However, the reserves stretch over six mountain ranges and are separated by farmland, human settlements, and monoculture forests (which lack bamboo) and the reserves only encompass two-thirds of the panda population. While the government is working to create connections between the reserves to make them more accessible, these efforts are being undermined by the expansion of large hydrodams, the construction of extensive road systems, and the spread of monoculture forest plantations.

Panda populations are also threatened by the decline in the diversity of bamboo species. To avoid starvation, the giant panda needs to have access to at least two different species of bamboo, since each bamboo species goes through a unique life cycle of flowering and regeneration, which can often take between 15 and 120 years. The different bamboo species also flourish at different elevations and seasons, historically enabling pandas to migrate to bamboo species in different phases of flowering for a steady source of food. However, human encroachment has prevented bamboo species from being able to regenerate, resulting in less bamboo and placing pandas in an even more precarious situation.

The Chinese government continues to take steps to protect giant pandas, and they are protected under the Chinese Wildlife Conservation Law of 1988. The giant panda is also listed as Endangered on the IUCN Red List of Threatened Species.

TIGER

Panthera tigris

Paws, Detroit Tigers (MLB)
Who Dey, Cincinnati Bengals (NFL)

FAST FACTS

Tigers are the world's largest feline species.

There are 3,000 wild tigers remaining, representing a 70 percent decline since 1900.

Though there is no pharmacological evidence of their effectiveness, tiger parts are used widely for traditional Asian medicines.

THREATS

Habitat reduction

Climate change

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Habitat preservation and protection

Climate remediation

Halting of illegal trade, trafficking, and poaching

The tiger is the world's largest feline species, reaching up to 11 feet in length and weighing up to 660 pounds. Tigers are adept swimmers, and when running, they can approach speeds of 40 miles per hour.

Subspecies of the tiger include the Sumatran, Siberian, Bengal, South China, Malayan, and Indochinese tiger. As a result of a rare gene, one in every 10,000 tigers is born white. The Siberian tiger is the largest subspecies, weighing up to 675 pounds. The smallest subspecies, the Sumatran, weighs 220 to 310 pounds.

Tigers are mostly active at night, and they rely on their stripes for camouflage while hunting for prey. Tigers mainly eat sambar deer, wild pigs, water buffalo, and antelope. Sambar deer, which can weigh between 200 and 1,200 pounds, make up 60 percent of the Bengal tiger's diet.

RANGE

Tigers once roamed across Asia from the eastern border of Russia to Turkey in the west. Tigers have lost 93 percent of their historical habitat, 50 percent in the last 30 years alone, and have suffered a 70 percent decline in population since 1900. They are now locally extinct (extirpated) in Southwest and Central Asia, from the Indonesian islands of Java and Bali, and throughout most of Southeast and East Asia.

Tigers still survive in 13 Asian nations. Subspecies range across the Siberian boreal forests, open grasslands, tropical mangrove swamps, tropical and evergreen woodlands, and rocky outcrops. With tigers now critically endangered, those 13 countries have come together in an unprecedented pledge to double the world's wild tiger population by 2022, the next Year of the Tiger on the Asian lunar calendar.

ENVIRONMENTAL THREATS TODAY

There are just 3,000 tigers left in the wild, due to human overhunting and destruction of habitat; three of nine subspecies are already extinct (Indonesia's Bali Tiger and Java Tiger, and the Caspian Tiger in Central and Western Asia). More tigers are privately owned as pets than exist in the wild.

Tigers are illegally killed for trade on the black market, and their body parts are sold for traditional Asian medicines. While there is no pharmacological evidence that any tiger part is an aphrodisiac, the animal's penis is used in medicines to treat impotence.

Other parts of the tiger are also used for ostensibly medicinal purposes, including: teeth to relieve fevers; fat to cure rheumatism; nose leather to heal bites; eyeballs to cure malaria; and whiskers to soothe toothaches.

In Taiwan, a bowl of tiger penis soup (to boost virility) goes for approximately $320, and a pair of eyes (to fight epilepsy and malaria) for $170. In Hong Kong, Taipei, or Seoul, powdered tiger humerus bone (for treating ulcers, rheumatism, and typhoid) costs up to $1,590 per pound.

Another threat to tigers is weather extremes caused by climate change. Rising ocean levels are causing saltwater intrusion into freshwater sources. As a result, in areas like India's Sundarban islands, rising sea levels are causing tigers to migrate northward toward areas heavily populated by humans, which will inevitably result in conflicts between tigers and humans.

WOLF

Canis lupus
and *Canis rufus*

Crunch the Wolf, Minnesota Timberwolves (NBA)
K.C. Wolf, Kansas City Chiefs (NFL)

FAST FACTS

Once the most broadly distributed mammal in the world, the gray wolf is now extinct in much of the United States, Mexico, and Western Europe.

When wolves howl together, they harmonize to create the impression that there are more wolves.

THREATS

Habitat reduction

Climate change

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Habitat preservation and protection

Climate remediation

Halting of illegal trade, trafficking, and poaching

In folk mythologies across North America and Eurasia, the wolf's predatory powers were strongly associated with the attributes of the warrior. Both the nomadic tribes of the Eurasian steppes and the natives of the American plains revered the wolf. Native American tribes honored the animal by performing wolf dances or ceremonies. Tribal members called upon the wolf's spirit to bless their hunts, and shamans invoked the wolf's power when healing people.

Wolves have three unique features: they can walk on their toes (digitigrade walking), making it easier to outrun predators or prey; they are *hyper*carnivores, feasting mostly on meat; and they have powerful jaws and canine teeth capable of bringing down prey 2 to 10 times their own weight.

The gray wolf is the apex predator throughout its habitat range, with the only threats posed by humans (and tigers in Asia). Wolves are social creatures, and travel as nuclear families. They can maintain a pace of 5 to 6 miles an hour over long distances and can achieve speeds of 30 to 37 miles an hour when attacking prey or escaping predators.

Wolves howl for a number of reasons: to assemble the pack, sound an alarm, and communicate across great distances. Howls can be heard by wolves over areas of up to 50 square miles—more than 50 times the range of a human scream. Wolves harmonize rather than hitting the same note when they howl together, which gives the impression that there are more wolves present than there actually are.

RANGE

Ancestors of the *canis* genus, which includes wolves, coyotes, jackals, and dogs, split off from foxes some 4.5 million to 9 million years ago. The modern gray wolf emerged in Asia about 1 million years ago, making its way to North America 300,000 years later.

There are numerous subspecies of wolves in North America, including the arctic wolf in Alaska, Canada, and northern Minnesota; the gray (or timber) wolf spanning the northern parts of North America; the red wolf in North Carolina; and the Mexican wolf, *el lobo*, found in the U.S. Southwest.

ENVIRONMENTAL THREATS TODAY

While some cultures have revered wolves for their predatory abilities, others, especially in Europe, have viewed these abilities in a negative light.

Originally the gray wolf (*Canis lupus*) was the most broadly distributed mammal worldwide. However, farmers came to view wolves as a threat to livestock, and the systematic extermination of wolves began in the Middle Ages (between A.D. 500 and 1000), first in Northern Europe but expanding throughout the wolf's global habitat in the ensuing centuries. The gray wolf is now extinct in much of the United States, Mexico, and Western Europe, and one-third of its original range has been lost due to humans' efforts to exterminate it.

Wolves worldwide were listed as vulnerable as recently as 1994, having disappeared in a dozen nations. But healthy growth throughout much of their remaining range over the past half-century has reduced the threat of global extinction. Gray wolf populations began to recover after the 1950s in Europe as a result of the decline in pastoral and rural economies. In the United States, legal protection under the Endangered Species Act of 1970, combined with land-use changes and human migration from rural to urban areas, has reversed the decline in the wolf population., .

Wolves have been reintroduced in parts of their historic U.S. range, and there are currently between 13,000 and 16,000 wolves in the United States, with the majority (7,700 to 11,000) in Alaska.

However, several wolf populations are still at risk. There are an estimated 100 red wolves living in the wild, and the red wolf (*Canis rufus*) is listed as critically endangered on the IUCN Red List of Threatened Species. Historically, these wolves ranged throughout the eastern United States from Florida to Pennsylvania and as far west as Texas. Today, the last refuge for the red wolf is North Carolina, where wild populations roam across some 1.7 million acres in the northeastern part of the state, including the Alligator River National Wildlife Refuge and the Pocosin Lakes National Wildlife Refuge.

The Mexican gray wolf was wiped out in the United States and nearly so in Mexico, but couples bred in captivity were reintroduced to the Arizona Apache National Forest beginning in 1998. The goal was for restoration of 100 or more wolves to the wild by 2006, but only 75 are currently known to exist. Like the red wolf, the Mexican wolf remains listed as an endangered species.

DOLPHIN

Tursiops truncatus

T.D., Miami Dolphins (NFL)

FAST FACTS

Dolphins are highly intelligent and social with a cerebral cortex (the seat of abstract information processing, communication, problem solving, and adaptation) 40 percent larger than a humans.

The increase of toxins in the ocean has caused a decline in dolphin immune and reproductive systems.

Due to increasing human activity in the ocean, including sonar blasts, dolphins have suffered from hearing loss and decompression sickness.

THREATS

Habitat reduction

Climate change

Toxic chemicals

Overconsumption

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Habitat preservation and protection

Toxic chemical use reduction

Climate remediation

Market shift to reduce consumption of ecologically damaging products

Among the 40 species of dolphin worldwide, the bottlenose is the most renowned for its exceptional intelligence, cleverness, and social communication. In fact, it is considered one of the most intelligent species on the planet. The bottlenose has the largest brain of any dolphin, and its brain-to-body mass ratio is greater than all that of all other mammals apart from humans. In fact, the bottlenose dolphin's cerebral cortex is 40 percent larger than a human's. The cerebral cortex is the seat of social communication, abstract information processing, problem solving, and aptitude to accept new things.

The bottlenose weighs 300 to 1,400 pounds and reaches 6 to 12.5 feet in length. The weight and length vary substantially, depending on the habitat. Dolphins living in shallow, warm seas typically are much smaller than dolphins living in the cool, pelagic (open) ocean. The dolphin's mouth line has a natural curve that suggests a smile, giving it the playful and friendly appearance for which it is known.

Scientists learned in 2013 that bottlenose dolphins have distinct "names"— sets of individualized, high-pitched whistles—with which they identify themselves. Each dolphin creates its unique set of whistles as it matures, acquiring a lifelong means of broadcasting its identity and location to other dolphins. Most dolphins have acute eyesight both above and below the water. They also have excellent hearing and are capable of discerning frequencies 10 times the upper limit of adult human hearing.

Dolphins have been a prominent part of human culture for millennia. They are portrayed throughout Greek mythology as agile, curious, magical beings. Ancient Greek coins displayed deities or men riding on their backs. Sailors delighted in spotting dolphins surfing in their ship's wake, considered a sign of good luck.

Dolphins are among the most playful species on earth. They can be seen pretend-fighting, tossing around seaweed, surfing shore waves or boats' bow waves as a group, or even swimming alongside human swimmers and surfers.

RANGE

There are an estimated 600,000 dolphins worldwide. Dolphins are nomads of the sea, found throughout the world although mainly occupying temperate and tropical waters. They are not found from 45 degrees latitude to the poles in both the Northern and Southern Hemispheres. The Atlantic bottlenose dolphin ranges from Cape Cod to the Gulf of Mexico.

Dolphin pods mostly travel along the shallow parts of the continental shelves, where they can find abundant sources of fish and squid.

Like whales and porpoises, dolphins are descendants of terrestrial mammals. The ancestors of the modern-day dolphin reentered the water roughly 50 million years ago.

ENVIRONMENTAL THREATS TODAY

The four river dolphin species—the Amazon, Ganges, Indus, and Yangtze River dolphins—are among the most threatened of all dolphin species. All are critically or seriously endangered, and the Yangtze Baiji dolphin is believed to have become extinct in the past decade. Hydro-dams, overfishing, and highly polluted waters have been the main threats driving river dolphins towards extinction.

Mediterranean sea dolphin populations have fallen by half in the past 50 years, principally due to mass extermination campaigns, which persisted until the 1960s, to reduce competition with commercial fisheries.

Bottlenose dolphins have suffered from the dramatic increases in marine discharge of pesticides, heavy metals, and other industrial and agricultural contaminants. These pollutants are extremely slow to disperse in the ocean, resulting in concentrated uptake by dolphins through the fish they eat.

The accumulation of toxins like PCBs and DDT in the bodies of bottlenose dolphins has caused decline in their immune systems and increased both disease and reproductive problems throughout many parts of their range. Along the Florida coast, males have PCB levels more than 10 times the threshold for adverse health effects. Dolphin meat is high in mercury, posing a health risks to humans if consumed.

Commercial fishing nets pose increasing threats to bottlenose dolphins. Purse-seine fishing, used for two-thirds of the global tuna catch (66 percent of the more than 4 million tons a year), uses vast walls of nets in which dolphins get caught and drown. Other fishing methods, like drift gillnets—mile-long nets called “curtains of death” by some ocean groups—also kill many dolphins, along with endangered species of whale, seal, sea lion, shark, turtle, the giant sunfish, and many other fish. Since 1990 tuna canneries have used dolphin-safe labels to reassure consumers the fish has been caught in gear that is unlikely to kill or harm dolphins. As it turns out, only about 5 percent of canned tuna comes from a fishery where dolphin mortality rates are strictly regulated. The remainder derives from fisheries lacking such regulations.

Dolphin species should not be confused with the non-mammal dolphinfish (*Coryphaena hippurus*). To prevent confusion, restaurants with dolphinfish on their menus refer to it as mahi-mahi. The dolphinfish, also known as dorado, is a surface-dwelling, ray-finned fish very popular among sport fishermen. *Mahi-mahi* is Hawaiian for “very strong.” The fish has an iridescent body, may reach 6 feet in length, and can swim at speeds up to 40 miles an hour.

Accumulating evidence indicates that, as with whales, dolphins can be stressed from the increasingly pervasive loud underwater noises like naval ship and submarine sonar and firing exercises, or certain offshore construction projects like air guns used during oil exploration. These sounds can be thousands of times more powerful than a jet engine impacting marine mammal ears, resulting in devastating, frequently deadly outcomes. Dolphins, and whales incur hearing damage and suffer decompression sickness (similar to divers suffering the bends).

Protecting dolphins from destructive fishing practices and poisoning from pollution is an immediate and ongoing need, but not sufficient to guarantee their survival. Another emerging threat to their long-term survival is the double risk caused by carbon dioxide (CO_2) emissions from fossil fuel combustion and the burning of tropical forests. The CO_2 is warming air and ocean temperatures and acidifying the ocean at a rate not experienced in 300 million years.

Already, with just a 1.3 degrees Farenheit increase in ocean temperature over the past 50 years, there has been a 40 percent loss in ocean phytoplankton, the base of the food chain for marine species upon which dolphins and other marine mammals depend for survival.

One-fifth of the world’s coral reefs are dead, including 50 percent of Caribbean corals, and most coral reefs are projected to die off within the next several decades as sea temperatures exceed an increase of 4 degrees Farenheit, combined with increasing acidification of the ocean. Rising sea temperatures combined with the discharge of nutrient-rich agricultural wastes into estuaries are producing dead zones in several hundred coastal locations around the world that are so huge they can be seen by satellites. Dead zones result from explosions of algae blooms that reduce oxygen levels, suffocating marine life. Coastal estuaries are the breeding, nursing and feeding grounds for many marine creatures. Dead zones transform these highly productive habitats into sterile graveyards.

Record high ocean surface temperatures during the summer of 2013 caused the die-off of thousands of small fish and 33 dolphins that washed ashore in Latin America. The dolphin deaths were attributed to a combination of suppressed immunity due to heat stress, an algal bloom, and a virus normally fought off by the dolphin’s immune system.

Climate change is expected to impact dolphins’ habitat as well. Most species are limited to specific ranges in sea temperature; the common bottlenose dolphin prefers surface water temperatures between 50 and 90 degrees Farenheit. Moreover, dolphins’ food resources may be reduced due to declines in the reproductive and survival rates of fish prey and shifts in timing and distribution of these resources. Ocean scientists are calling for a cap on global combustion of fossil fuels by 2015, and then steadily decreasing CO_2 emissions by 5 percent per year down to zero. If current trends continue, most of the ocean’s large species will be threatened with extinction by the end of the century.

KILLER WHALE

Orca

Fin, Vancouver Canucks (NHL)

FAST FACTS

Killer whales are known as the wolves of the sea because they hunt in packs.

Females' life span can reach 90 years while male life expectancy can reach 60 years.

There are estimated to be at only 50,000 orcas left on earth. Most threats come from hunting, oil spills, and pollution.

THREATS

Habitat reduction

Climate change

Toxic chemicals

Overconsumption

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Habitat preservation and protection

Curb and modify noise impacts

Toxic chemical use reduction

Climate remediation

Halting of illegal Trade, trafficking, and poaching

Orcas, or kiler whales, are one of 35 species in the oceanic dolphin family, with a lineage that goes back 11 million years. The genus name, *Orcinus*, in Latin means “of the kingdom of the dead” or “belonging to Orcus,” a mythological god of the underworld.

Orcas are prominently showcased in many indigenous cultures. They are included in spiritual and religious traditions, art, and history. The Haida people in the Pacific Northwest mythically described killer whales as living in undersea villages, taking on human form when underwater, with drowned humans joining their communities. The Tlingit people of southeastern Alaska recognized the killer whale as a guardian of the sea and a supporter of humans.

All cetaceans—whales, dolphins, and porpoises—descended from land-based mammals. They have retained key mammalian features and functions: They breathe air (through blowholes), nurse their offspring with milk from mammary glands, have body hair, and are warm-blooded.

Although all mammals sleep, whales have evolved to be conscious sleepers. Unconscious, deep sleep would result in drowning. Researchers on toothed cetaceans indicate they sleep with one side of their brain at a time. Presumably this is not only to breathe, but also to be ready to carry out other crucial functions such as swimming and avoiding predators.

Orcas have remarkably advanced echolocation abilities, emitting clicks and listening for echoes to detect the location and characteristics of prey and other objects in their surroundings.

RANGE

Orca whales are found in all oceans and most seas. They live most densely in the northeast Atlantic along the Norwegian coast, in the North Pacific around the Aleutian Islands, in the Gulf of Alaska, and in the Southern Ocean along the coast of Antarctica.

There are thought to be at least 50,000 orcas worldwide, although this estimate is uncertain. According to the most recent census, there are roughly 25,000 orcas in the Antarctic, 8,500 in the tropical Pacific, 2,500 around the cooler northeast Pacific, and 1,000 off Norway.

ENVIRONMENTAL THREATS TODAY

Commercial whalers targeted and killed thousands of killer whales around the mid-20th century, after having depleted the stocks of the larger baleen whale species. In the 1980s the International Whaling Commission (IWC) proposed a ban on commercial hunting of orcas, after more than 3,000 of them were slaughtered by Soviet whalers. Today no nation conducts a major orca hunt, although Greenland and Indonesia allow small subsistence hunts.

Killer whales worldwide are threatened in numerous ways, notably from large-scale oil spills, pollution, and other contaminants; from depletion of food sources; and from sonar testing and conflicts with ships. They are especially at risk of poisoning due to the accumulation of highly hazardous polychlorinated biphenyls (PCBs) and have been called the most contaminated wildlife on the planet. Puget Sound, in particular, is considered a hot spot for PCBs, dioxins, and chlorinated pesticides. Agricultural and industrial pollution and urban runoff taint the local waters; Chinook salmon become contaminated; and the orcas in turn are contaminated when they feast on the salmon, a main orca food source.

Killer whales are also threatened by reduced stocks of key food sources, such as salmon, seals, and sea lions. In the Pacific Northwest, wild salmon stocks have declined dramatically in recent years. On the west coast of Alaska and the Aleutian Islands, seal and sea lion populations have also declined substantially.

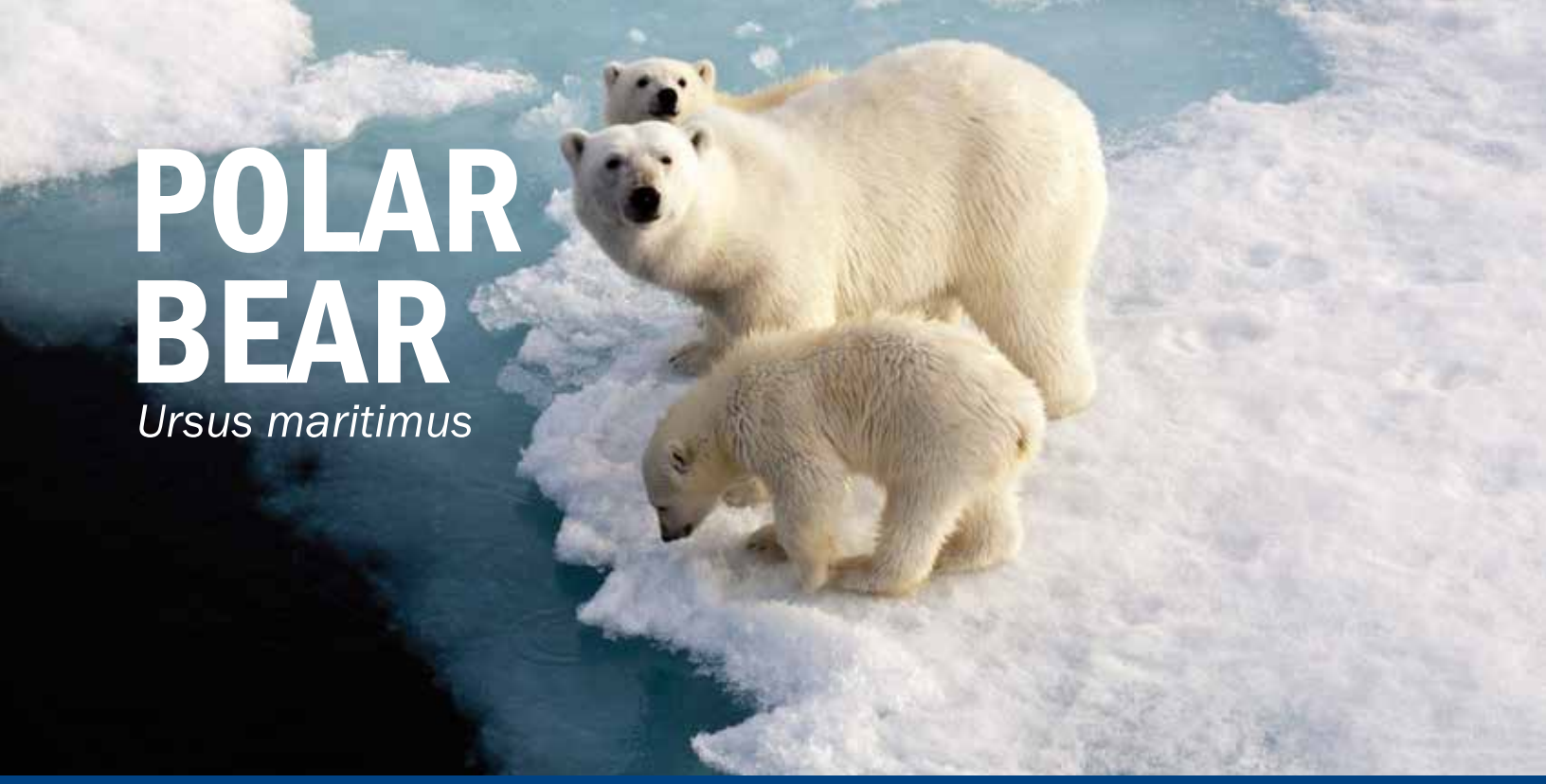
In 2005, the population of killer whales in British Columbia and Washington State waters, considered a distinct population group, was placed on the U.S. Endangered Species list. Once numbering several hundred, they have declined to just 83 individuals, due in large part to declines in Chinook (King) salmon.

In recent decades a new deadly threat to whales and other marine mammals has emerged. Imagine a noise as intense as 2,000 jet engines blasting through the water. That sound is the result of military ships and submarines pinging the ocean with active sonar in the deep ocean. It is proving devastating to whales and other marine mammals that depend on sound to communicate, navigate, find food and attract mates.

Evidence of the danger caused by these systems surfaced dramatically in 2000, when whales of four different species stranded themselves on beaches in the Bahamas. After the incident, the area’s population of Cuvier’s beaked whales nearly disappeared, leading researchers to conclude that they either abandoned their habitat or died at sea. Similar mass strandings have occurred in the Canary Islands, Greece, Madeira, the U.S. Virgin Islands, Hawaii and other sites around the globe.

Some of these sonar systems (as well as air guns used in marine oil exploration) operate at more than 235 decibels, producing sound waves that can travel across hundreds of miles of ocean. During testing off the California coast, noise from the Navy’s main low-frequency sonar system was detected across the breadth of the northern Pacific Ocean.

By the Navy’s own estimates, even 300 miles from the source, these lethal sonic waves can retain an intensity of 140 decibels—a hundred times more intense than the level known to alter the behavior of large whales. According to Navy impact reports, increased sonar training will significantly harm marine mammals by more than an estimated 10 million times during the next five years off the U.S. coast alone.



POLAR BEAR

Ursus maritimus

Louie, St. Louis Blues (NHL)

FAST FACTS

Polar bears are the world's largest bear.

Polar bears are considered one of the most contaminated Arctic mammals, due to excessive levels of pollutants, which they absorb from their prey.

Along with hunting, climate change is the largest threat to polar bears.

Polar bears hunt seals through sea ice. However, by 2020, the Arctic Ocean may be ice-free.

There are now only 20,000 to 25,000 polar bears left on Earth.

THREATS

Habitat reduction

Climate change

Toxic chemicals

Overconsumption

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Habitat preservation and protection

Toxic chemical use reduction

Climate remediation

Halting of illegal trade, trafficking, and poaching

Polar bears have sadly become the iconic symbol of the distressed Arctic ecosystem. Reaching 10 feet in length and weighing up to 1,500 pounds, the polar bear is the world's largest bear. Only the Kodiak bear (*Ursus arctos middendorffi*) rivals it in size. The largest recorded polar bear, shot in 1960, weighed 2,210 pounds and stood more than 11 feet tall. Archeologists say the polar bear's ancestors were even larger.

Because polar bears live most of their lives on the sea ice of the Arctic Ocean, they are classified as marine mammals. They have evolved a rich layer of body fat and a water-repellent fur coat that insulates them from cold water and air.

Polar bears are very buoyant and can maintain a swimming rate of six miles per hour, paddling with their forepaws and turning their hind legs flat to act like a rudder. Polar bears have been seen swimming several hundred miles from land. On land, they average 3.5 miles per hour but are capable of bursts of speed reaching 25 mph.

Polar bears spend half of their time hunting for food due to the fact that successful hunts occur only 2 percent of the time. Fat-rich ringed and bearded seals are their primary food sources. The polar bear has an acutely sharp sense of smell, capable of detecting seals underneath three feet of snow nearly a mile away.

Male polar bears do not hibernate like other bear species; only the females do. Polar bears have the ability to fast for several months during late summer and early fall, which is critically important given that the sea ice is unfrozen in those seasons and they cannot therefore prey on seals. Polar bears tend not to live as long as grizzly and black bears, and their life span rarely exceeds 25 years.

RANGE

Polar bears split off from brown bears 4 to 5 million years ago. The female ancestor of all living polar bears resided 20,000 to 50,000 years ago in what is present-day Britain and Ireland.

There are now 20,000 to 25,000 polar bears left on earth, according to biologists' estimates. Canada is home to about 60 percent of them. Polar bears are also found in Alaska, Russia, Greenland, and Norway's Svalbard archipelago.

Polar bear range is limited to environments with sea ice cover most of the year. Over much of their range, the bears remain on the sea ice year-round, spending only short periods of time on land.

ENVIRONMENTAL THREATS

Since 2005, the polar bear has been listed as vulnerable by the IUCN Polar Bear Specialist Group. Of the 19 subpopulations of polar bear, 8 are in decline. In 2008 the United States listed polar bears as a threatened species under the Endangered Species Act. In Canada, polar bears are listed as a Species of Special Concern. Russia too considers the polar bear a species of concern.

Polar bear decline is due in part to overhunting. Roughly 600 polar bears per year are hunted in Canada. The commercial demand for polar bear fur skins to use as rugs has been dramatically increasing since 2009. Prices for Canadian polar bear hides more than doubled between 2007 and 2012, exceeding $12,000 per fur, which tripled polar bear hides offered at auctions.

During this same period, quotas and harvests rose to unsustainable levels. For example, in 2011 hunters killed 100 polar bears in the Province of Quebec, 17 times the typical number killed in the southern Hudson Bay area. Joint jurisdictions that share the southern Hudson Bay population adopted a voluntary hunting quota of 60 bears per year, but most polar bear scientists find this to be unsustainable.

The United States proposed banning world commercial trade in polar bear parts (skins, skulls, claws, teeth) at the 2013 meeting of the Convention on International Trade in Endangered Species (CITES). The Parties to the Convention rejected the proposed ban. It was the second time in three years that the international community ignored the pressing threat of overhunting polar bears.

Polar bears are considered among the most contaminated of Arctic mammals, due to the accumulation of excessive levels of persistent organic pollutants (POPs), notably polychlorinated biphenyl (PCBs) and chlorinated pesticides. Being at the top of the food chain and consuming huge amounts of blubber, they absorb the concentrated toxins found in their prey.

Polar bears migrate as Arctic sea ice cover changes over the seasons, traveling as much as 600 miles. With the emergence of climate destabilization, polar bear populations now face a real threat of extinction. Sea ice cover is declining four times more quickly than forecast by scientists. Models done over the past decade—which assume far slower rates of sea ice decline than is now occurring—predicted that two-thirds of the world's polar bears would die off within 40 years and that the animal would entirely disappear in Alaska.

Polar bears rely on sea ice for hunting and breeding. In 2012, Arctic summer ice losses exceeded an area the size of the United States, falling 50 percent below sea ice coverage from 1979 to 2000.

Adverse impacts on polar bear populations have already been evident over the past several decades:

- Canada's western Hudson Bay polar bear population has declined 22 percent since the 1980s, a loss directly related to earlier ice break-up on Hudson Bay.
- The southern Beaufort Sea polar bear population along the northern coast of Alaska and western Canada has experienced a decline in cub survival rates and in the weight and skull size of adult males.
- The Baffin Bay polar bear population, shared by Greenland and Canada, has witnessed higher risk from both significant sea ice loss and substantial overhunting.
- The Chukchi Sea polar bear population, shared by Russia and the United States, is declining due to illegal hunting in Russia and one of the highest rates of sea ice loss in the Arctic.
- Given the accelerated loss of sea ice, some recent assessments indicate that the Arctic Ocean could be ice-free by the summer of 2020. Many polar bear populations already are suffering malnutrition or starvation from the rapid ice melt because there are fewer ice platforms from which they can hunt seals. This has required the bears to swim farther when hunting, which depletes their fat reserves, and their main food source, seals, is becoming scarcer. Moreover, there has been a decline in female reproductive rates and lower survival rates in cubs and juvenile bears.

The Arctic marine ecosystem's apex predator for millions of years now confronts its greatest threat, climate catastrophe. A large body of marine scientists and climatologists have called for reducing CO_2 emissions to zero within the next four decades—an essential action to ensure the long-term survival of the polar bear as well as many thousands of other marine, terrestrial, and freshwater species.

SEAL
Pinnipeds

Lou Seal, San Francisco Giants (MLB)

FAST FACTS

All seals are currently protected under the U.S. Marine Mammal Protection Act.

Human threats to seals include hunting, oil spills, and industrial chemicals.

THREATS

Habitat reduction

Climate

Toxic chemicals

Overconsumption

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Climate remediation

Habitat preservation and protection

Halting of illegal trade, trafficking, and poaching

Toxic chemical use reduction

Seals are part of the group known as pinnipeds: aquatic, fin-footed mammals. *Pinniped* means “fin foot” or “winged foot” in Latin. There are three families of pinnipeds: the earless or “true” seals, ranging from the small ringed seal to the mammoth southern elephant seal; the eared seals, including sea lions and fur seals; and the walrus.

All pinnipeds originated from a single ancestor 20 to 24 million years ago. They are possibly related to bears, having split from them 50 million years ago and then evolving from land back to the marine environment.

Among the pinnipeds there are 32 species of earless and eared (true) seals. The largest is the southern elephant seal, which can be as long as 16 feet and weigh more than 7,000 pounds. The smallest is the endangered Galapagos fur seal, with the 3-foot females weighing a mere 65 pounds.

Seals are remarkable deep divers, with different species able to descend 1,500 to 5,000 feet. They are capable of staying submerged for long periods, up to two hours in some species. This is possible because they have high concentrations of blood hemoglobin as well as large amounts of muscle myoglobin, both of which carry oxygen. Like whales and dolphins, seals conserve oxygen when diving by slowing down their heart rates by 50 to 80 percent while also restricting blood flow to vital organs.

Seals prey primarily on fish and squid and use their sensitive whiskers, called vibrissae, to detect prey vibrations. Natural predators of seals include sharks, orcas (killer whales), and polar bears. The common seal lives an average of 35 years for females and 25 years for males.

RANGE

Seals are found from polar to tropical waters. In the United States, the largest concentrations of seals are in California and New England. Seals spend 80 percent of their time in the water, and the rest on land for mating, birthing, and nursing their young.

ENVIRONMENTAL THREATS TODAY

Commercial hunters have long sought seals for their pelts, meat, and blubber, often overhunting populations. The Caribbean monk seal was hunted to extinction by 1950. All pinnipeds are currently protected under the U.S. Marine Mammal Protection Act (MMPA), and there are several species protected under the Endangered Species Act, including the Steller sea lion and the Hawaiian monk seal.

Overfishing has reduced the prey upon which harbor seals depend. In Norway, coastal marine reserves where commercial fishing is excluded have helped to reduce harbor seal mortality. Hunting of seals is now prohibited in the Wadden Sea area (Dutch, German, Danish, and Swedish waters). Licensed killing of seals is allowed in the United States, Canada, and the United Kingdom to protect fisheries.

One of the most widespread of the pinnipeds is the harbor seal. It resides primarily in the coastal waters of the Northern Hemisphere continental shelf and slope and is also often seen in bays, rivers, estuaries, and intertidal areas, from temperate to polar regions. Canadian harbor seal populations dropped by two-thirds during the 1970s, declining from 12,000 to 4,000. The populations began increasing again in the 1980s. Populations in western Greenland, Iceland, and Norway have not been so lucky, having been depleted from overhunting. Since the 1980s, after bounty hunting ceased, the eastern U.S. harbor seal population has been growing at 6 percent per year. Similarly, in the Gulf of Alaska, after 60 percent declines until the early 1990s, seal populations have recovered and stabilized, with slight increases since then.

Three widely separated but closely related species, the Caribbean monk seal (now extinct), the Mediterranean monk seal, and the Hawaiian monk seal, are recognized as the most primitive of living seals. Mediterranean monk seals are also the planet's most endangered seal species, with less than 600 still alive. Overhunting has severely diminished the species, and new threats, including coastal development and marine contamination, are, along with continued hunting, driving it toward extinction.

Hawaiian monk seals live primarily on or near islands, atolls, and reefs in the northwestern Hawaiian Islands in a region spanning 1,200 miles, although more have been seen recently on the Big Island of Hawaii. There are from 1,100 to 1,400 individuals, and the population is declining by 4 percent per year. The Hawaiian monk seal has been listed as endangered since 1976 under the U.S. Endangered Species Act, and it is protected against unpermitted taking under the U.S. Marine Mammal Protection Act of 1973. The IUCN Red List of Threatened Species lists it as critically endangered.

In 2000, President Clinton issued an executive order creating the largest marine reserve in the United States, the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve, which protects 70 percent of all U.S. coral reefs. The reserve encompasses 84 million acres of remote islands, atolls, reefs, and underwater habitat. The expanse is hoped to enable revitalization of the Hawaiian monk seal.

In the far north are the cold-weather harp seals, widely recognized as a conservation icon. Harp seals live in the Arctic and North Atlantic oceans. They use seasonal sea ice as their breeding area and have evolved specific traits to succeed in this harsh environment. However, these animals still confront a myriad of threats, notably hunting: The Canadian Department of Fisheries and Oceans set annual kill quotas of roughly 350,000 baby and adult harp seals. The seals are also victims of fishing by-catch, and they now face the impacts of global warming on their habitat and food sources as well.

Hooded seals are other ice-associated seals vulnerable to these combined effects. Their population in the northwest Atlantic is currently stable, but the northeast Atlantic stock has fallen by 90 percent over the past 60 years. This population breeds on ice off the east coast of Greenland and is now listed as vulnerable on the IUCN Red List of Threatened Species.

Other human threats to seals include pollution from oil spills and industrial chemicals. Thousands of Atlantic harbor seals have suffered mass die-offs from viral outbreaks. More than 20,000 European harbor seals died from a distemper virus epidemic in 1988, and a similar mass die-off of 30,000 occurred in 2002. It is thought that the seals were exposed to human waste and industrial and agricultural pollutants and that they came in contact with human pets and feral animals carrying communicable diseases. Exposures to high levels of some chemical contaminants are known to cause suppression of seals' immune systems.

DUCK

Anatidae family

Wild Wing, Anaheim Ducks (NHL)

FAST FACTS

Of the 130 species of ducks, many are suffering from the excelerating loss of wetland habitat.

In 2013, the North American duck population dropped by 6 percent

Only female dabbling ducks quack

THREATS

Habitat reduction

Toxic chemicals

Climate

WHAT NEEDS TO BE DONE

Habitat preservation and protection

Toxic chemical use reduction

Climate remediation

The word *duck* comes from Old English verb for “ducking” or “diving,” an allusion to the manner in which they feed.

In the 1992 Disney film *The Mighty Ducks*, misfit kids on a youth hockey team selected the duck as their mascot because it is a fierce fighter. The movie title later became the name of the National Hockey League team in Anaheim (“Mighty” was dropped in 2006).

The two main types of ducks are dabblers and divers. Diving ducks and sea ducks plunge deep underwater to forage. Dabbling ducks, when not on land, remain on the water’s surface and forage underwater without entirely submerging by upending their backsides.

Not surprisingly, the ducks’ body types correspond with their respective styles of foraging. Diving ducks, such as the harlequin and long-tailed duck, are heavier than dabbling ducks. They have shorter bills, shorter wings, and their legs are positioned toward the rear, which streamlines the body for swimming rapidly down to depths of as much as 200 feet.

Dabbling ducks limit their underwater foraging to as deep as they can reach—less than 2 feet—without completely submerging. Their legs are located mid-body, giving them better mobility when feeding on land.

There are more than 130 duck species in the world, including a few without "duck" in their name. In North America, the quintessential dabbling duck is the pervasive mallard. Other dabbler species include black ducks, northern pintails, gadwalls, wood ducks, green-winged teals, blue-winged teals, cinnamon teals, and wigeons.

Diving ducks prefer marine environments and are popularly called bay ducks or sea ducks. Bay ducks include the canvasback and scaup (or little bluebill), popular game birds found in the Northwest, more frequently in estuaries and tidal lagoons than on the open sea. Redhead ducks breed among marshes and prairie potholes in western North America. Because of a decline in their breeding habitat, they regularly lay eggs in the nests of canvasback ducks.

There are 20 species of sea duck, almost all located in far-northern latitudes, including the bufflehead, eider, goldeneye, merganser, scoter, and long-tailed duck. The arctic long-tailed duck (formerly called oldsquaw), is one of the deepest-diving types and spends three to four times longer foraging underwater than on the surface. The common eider forms large flocks that fly at speeds up to 70 miles per hour. The common goldeneye is one of the last ducks to migrate south in fall. It typically winters as far north as open water allows. The bufflehead (from "buffalo head") gets its name from the oddly bulbous shape of the male's head during the courting of females. The male swims in front of the female, puffing out its head feathers to exaggerated size, and rapidly bobs its head up and down.

There are diverse diving duck species known as stiff-tailed ducks. In Texas and the far south are the ruddy and masked ducks, both small, squat species with tails cocked upward. There are shelducks found in Eurasia and steamer ducks in South America. The steamer duck, mainly a flightless bird, derives its name from its resemblance to a paddle steamer when furiously flapping its wings and churning its feet to swim quickly.

Torrent ducks live as high as 5,000 feet in the Andes, live along swift-flowing mountain rivers, and are powerful swimmers and divers even in white water. They are a declining species due to competition for their food from introduced trout, increased pollution, widespread forest destruction, and blockage of mountain river flows by large hydrodams.

The 14 species of perching duck are found primarily in the tropics and subtropics, but also include the wood duck, the only perching duck native to the United States and Canada.

Bay ducks (including pochards or scaups) forage in open waters; the males can be identified by their conspicuous glossy red, purple, or green heads. Pochards, located in Europe and Asia, appear similar to the closely related North American redhead and canvasback. The greater scaup, or big bluebill, breeds across Eurasia and most of the Nearctic region (Arctic and temperate areas of North America and Greenland). The lesser scaup, or little bluebill, breeds in northwestern North America.

The saltwater- and freshwater-inhabiting mergansers have a long, narrow sawbill, serrated for seizing slippery fish. Mergansers are large, long-bodied, but streamlined ducks that can be seen floating elegantly along shallow shorelines and small rivers. The males are striking with clean white bodies, dark green heads, and slender, serrated red bills. The graceful, gray-bodied females have reddish-brown heads with a short crest.

RANGE

There were roughly 48 million wild ducks in North America in 2013, a decline of 6 percent from the previous year. In sharp contrast to wild duck populations, humans now domesticate more than 1 billion duck livestock worldwide.

Ducks are located across most of the world except for Antarctica. Some duck species are migratory, primarily those breeding in the Arctic northern and temperate hemisphere. Ducks located in the tropics do not typically migrate.

A close ancestor of modern ducks lived among the dinosaurs some 65 million years ago.

ENVIRONMENTAL THREATS TODAY

There are more than 130 duck species globally. Many are suffering from population declines caused principally by the loss of wetland habitat. The deep connection between birds and wetlands has been known for thousands of years. Birds and wetlands are depicted in cave wall paintings and inscribed on artifacts made by prehistoric tribes. Wetlands have been essential for bird breeding, nesting, rearing of young, and social interaction, as well as key sources of food and drink.

The conversion of grasslands and wetlands to croplands has caused dramatic declines in migratory bird species. Fortunately, millions of wetlands and large tracts of native prairie still remain. The prairie pothole region has been deeply altered, yet it remains the most important migratory bird habitat in the Western Hemisphere and has been called North America's "duck factory."

Through the leadership of Ducks Unlimited (DU) and its 600,000 members, some 13 million acres of natural habitat have been directly conserved, and an additional 110 million acres in North America have been restored and protected. The organization has been working on behalf of duck habitat since 1937, forming during the drought-plagued Dust Bowl years, when North America's waterfowl populations plunged to unprecedented lows.

The Great Plains prairies now face a new challenge caused by climate change: weather-triggered disasters, which are expected to significantly alter the wetland habitats of waterfowl. Fifty percent of North America's ducks breed in the prairie pothole region. Within the next four decades, upwards of 90 percent of the Great Plains wetlands will vanish if the global average temperature increases by 8 to 10 degrees Fahrenheit (as projected by current trends).

Continental waterfowl populations have historically experienced boom-and-bust cycles driven by regional wetland conditions. Populations commonly decline during drought, then rebound as water returns. However, the future will bring a permanently warmer and drier climate if fossil fuel emissions are not dramatically reduced. As a result, duck populations, as well as many other waterfowl and grassland bird populations, are expected to fall well below historical lows.

Until the end of the 1800s, California's Central Valley possessed one of the largest complexes of wetlands in the United States. Roughly 95 percent was eliminated as a result of agricultural expansion. Over the past few decades, many basins in the valley were restored. Along with large tracts of irrigated rice production, the wintering densities of waterfowl in California have become the highest in the United States – some five million a year. But this is again put at risk by the extreme weather triggered by climate change, already evident over the past decade with heat waves, droughts, wildfires, and flooding. California's current extreme drought has forced a 25% decline in irrigated rice fields, driving waterfowl to concentrate on less land area. This, in turn, has given rise to avian botulism.

According to long-term bird census counts, the population of the North American greater scaup species has declined by 75 percent, from 2 million to just 500,000, since 1980. Global warming is triggering dramatic changes in the duck's tundra breeding grounds, as permafrost melts and southern species invade. Invasive species like zebra mussels are also outcompeting the native shellfish species in the Great Lakes that the greater scaup relies on for food. Coastal oil spills and other water-quality issues impacting shellfish are also adversely affecting the greater scaup. Populations of the lesser scaup, or little bluebill, have been declining for nearly half a century; causes include a rise in chemical contaminants, the loss of breeding habitat and food sources, and lower female survival rates.

WILD NATURE FACTS

Ducks are toothless. A comb-like structure on the edge of the beak, called a pectin (Latin for "rake" or "comb"), strains food out of water that the duck takes into its mouth. Ducks also preen their feathers with the pectin, and it is useful in holding slippery food items.

Ducks exhibit a broad range of sounds and calls, including whistles, coos, yodels, and grunts. The scaup gets its name from the sound it makes. Despite widespread misconceptions, the only ducks that quack are the females of most dabbling species. Male dabbling ducks never quack.

Like many animal species, the males (drakes) have colorful plumage to attract mates, while the female ducks predominantly have nondescript brown feathers. The males' iridescent hues come from bending light (refraction) by microscopic crystalline structures in the feathers. Refraction by these feathers operates similarly to a prism, which divides light into diverse colors. During courtship in late fall and winter, hormones are triggered in male and female ducks that turn their feet bright orange or red.

Ducks waterproof their feathers with a coat of waxy gel they produce from a gland at the base of the tail.

EAGLE

Anatidae family

Swoop, Philadelphia Eagles (NFL)
Slapshot, Washington Capitals (NHL)
Talon the Eagle, D.C. United (MLS)
Edson, Colorado Rapids (MLS)

FAST FACTS

Nearly 85 percent of eagle species are located in Eurasia and Africa; only two species are found in North America.

A bald eagle was once witnessed flying with a 15-pound mule deer fawn, the heaviest load on record for a flying bird.

By the mid-20th century, there were only 412 nesting pairs of bald eagles in the continental United States. Today, there are estimated 100,000, making the bald eagle one of the most outstanding conservation stories.

THREATS

Habitat reduction

Toxic chemicals

Climate

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Habitat preservation and protection

Toxic chemical use reduction

Climate remediation

Halting of illegal trade, trafficking, and poaching

The bald eagle (*Haliaeetus leucocephalus*) and the golden eagle (*Aquila chrysaetos*) are the only two eagle species in North America, out of more than 60 that exist worldwide. Over 75 percent of the world's eagle species are located in Eurasia and Africa. Only 14 can be found elsewhere—the two North American species, nine in Central America and South America, and three in Australia.

The bald eagle is a sacred bird in some North American cultures, and its feathers, like those of the golden eagle, are central to many religious and spiritual customs among Native Americans. In some cultures eagles are respected spiritual messengers between gods and humans.

Bald eagles are not actually bald; their name derives from the Old English word for white, *balde*, and refers to the color of their heads. The adult is primarily brown with a white head and tail. Eagles are large, powerfully built birds of prey, with a heavy head and a very large, heavy hooked beak for tearing flesh from their prey, as well as strong muscular legs and powerful talons. Eagles' eyes are extremely powerful, enabling them to spot potential prey from a very long distance. Some, such as the martial eagle found in sub-Saharan Africa, have visual acuity up to 3.6 times that of humans.

Many eagle species lay two eggs, but the older, larger chick frequently kills the younger hatchling. The parents do not interfere with the killing.

Eagles are apex predators in the avian world. Bald eagles prefer to capture fish but also feed on other animals, especially other water birds, and are adept interceptors of other birds' prey. In some localities and depending on season, water birds can constitute up to 80 percent of the eagle's diet.

The bald eagle constructs the largest nest of any North American bird, and the largest tree nests ever recorded for any animal species. The nests may be up to 13 feet deep and 8 feet wide, and can weigh up to one metric ton.

A bald eagle was once spotted flying with the heaviest load ever witnessed for a flying bird: a 15-pound mule deer fawn. Golden eagles have killed prey seven to eight times their own weight, like 66-pound ungulates (hoofed animals), which they tear into pieces before returning to their nest.

The bald eagle is both the national bird and national animal of the United States. On June 20, 1782, the Continental Congress adopted the still-current design for the Great Seal, which includes a bald eagle grasping 13 arrows in one talon and a 13-leaf olive branch in the other, to symbolize the uniting of the 13 original colonies.

The body length of the bald eagle is 2.5 to 3.5 feet. Its wingspan is between 6 and 7.5 feet and it weighs 6 to 14 pounds.

RANGE

The bald eagle is the only sea eagle (fish-eating eagle) endemic to North America. It thrives in the continent's myriad ecosystem habitats—coastal swamps and bayous, deserts, the Great Plains grasslands, the Great Lakes region, the eastern deciduous forests of Quebec and New England, and the temperate rainforests of the Pacific Northwest.

Eagles in the northern part of North America are migratory, while eagles in the southern part are resident all year. From November until February, during the salmon spawning season, several thousand bald eagles winter in Squamish, British Columbia, along the Squamish and Cheakamus Rivers, for the winter feast.

ENVIRONMENTAL THREATS TODAY

The insecticide DDT, which was sprayed nationwide on farm crops from the early 1940s until the early 1970s, adversely impacted bald eagles and many other birds of prey. DDT itself was not lethal to the adult bird, but its accumulation in the eagle's body, via the ingestion of prey, interfered with the bird's calcium metabolism. This made the eagle either sterile or unable to lay healthy eggs. The eggs that were laid proved too brittle to withstand the weight of the brooding adult.

The U.S. bald eagle population in the early 1700s was 300,000 to 500,000. By the middle of the 20th century only 412 nesting pairs could be found in the continental United States. DDT was not the only cause of this decline; other factors included the vast loss of key habitat and overhunting. In a 12-year stretch starting in 1918, when Alaska established a bounty system to reward the killing of bald eagles (which were mistakenly accused of reducing fishermen's salmon take), hunters shot an estimated 70,000 of the birds. By the time the bounty system was discontinued in 1952 (based on research proving the eagles were not a salmon threat), upwards of 150,000 bald eagles had been killed.

Ironically, 1918 was also the year the United States and Canada signed the Migratory Bird Treaty, providing the first transboundary protection for the bald eagle. This was reinforced in 1940 with the passage of the U.S. Bald Eagle Protection Act, prohibiting commercial trapping and killing of the bald eagle and the golden eagle. In 1967 the bald eagle was declared an endangered species in the United States, and in 1972 increased penalties for violators were enacted, along with additional commercial restrictions. What proved especially beneficial for the eagles was the 1972 ban on DDT use in this country, followed by a comprehensive ban in Canada in 1989.

Near the close of the 20th century the bald eagle was on the verge of extirpation (local extinction) in the Continental United States. But the bird rebounded thanks to enforcement of the Endangered Species Act as well as the efforts of conservation organizations and wildlife agencies in carrying out captive-breeding programs and reintroductions. Broad citizen support for these initiatives contributed to a 400 percent increase in nesting populations between the mid-1970s and mid-1990s in the Continental United States.

Today there are an estimated 100,000 bald eagles in the United States and Canada, with half of them in Alaska and British Columbia. There were an estimated 11,000 breeding pairs in the Continental United States by 2007, with at least one pair found in every state and 100 or more breeding pairs found in nearly half the states. One-third of all breeding pairs live in Minnesota (1,312 pairs), Florida (1,166 pairs), and Wisconsin (1,065 pairs).

Bald eagles are also found in all the Canadian provinces, with most of the breeding population in British Columbia, mainly along the Pacific coast. There are also robust breeding populations in Canada's northernmost boreal forests of Alberta, Saskatchewan, Manitoba, and northwestern Ontario.

The bald eagle's spectacular return from 417 pairs in 1963 to the estimated 100,000 of today in North America is one of the planet's outstanding conservation success stories. In 2007 the bald eagle was removed from the List of Endangered and Threatened Wildlife in the lower 48 states (never required in Alaska, where bald eagles have always been abundant).

© Drew Reiter - Philadelphia Eagles

For some fish eagles and sea eagles, the future is uncertain. The enormous Steller's sea eagle, weighing some 20 pounds, is down to just 4,200 breeding pairs worldwide. It breeds in eastern Russia along the Kamchatka Peninsula and the Okhotsk Sea. Its coastal habitat is being cleared and displaced by giant hydropower projects, extensive forest logging, and other economic development. Steller's sea eagle populations are further threatened by declining salmon stocks. Rivers flowing from western Kamchatka were once abundant with Asian masu, Chinook, chum, coho, pink, and sockeye salmon. Biologists recognize these salmon runs as biological cornerstones of this vast ecosystem. Commercial overfishing is partly responsible for the decline. The billion-dollar illegal trade in adult salmon and salmon caviar (eggs) has further amplified the decline by doubling the take. News reports show MI8 helicopters flying tons of salmon caviar from protected biosphere and nature reserves in Russia.

Severe and widespread habitat destruction is occurring in the island nation of Madagascar off the east coast of Africa, threatening extinction of one of the planet's rarest birds, the Madagascar fish eagle. Just 40 breeding pairs survive in dry deciduous forests, which face constant threats of deforestation. The rare eagle is also hunted, mainly by fishermen who wrongly believe the fish eagle reduces their catch.

The Spanish imperial eagle is barely surviving after myriad adverse impacts to its habitat in central and southeastern Spain. The region's original ancient oak forest, which was rabbit-rich and largely left alone by humans, was clearcut by loggers, then replaced with farmland or reforested with animal-poor eucalyptus and pine plantations. Only 279 pairs of Spanish imperial eagle still exist.

WILD NATURE FACTS

The bald eagle typically soars on thermal convection currents. It is a powerful flier, reaching speeds of 35 to 43 miles per hour while gliding and about 30 miles per hour while carrying prey. It can reach speeds of 100 miles an hour during a dive, although it rarely dives vertically.

On the basis of their physical characteristics and behavior, scientists differentiate eagles into four groups: fish eagles, snake or serpent eagles, booted or true eagles, and harpy eagles. Eleven species of fish eagle live on the forested shores of lakes, rivers, and oceans from the Arctic Circle to the tropics, excluding South America.

Twelve species of snake and serpent eagles hunt the savannas and forests of tropical Europe, Asia, Australia, and Africa. This group includes the Madagascar serpent eagle, which inhabits dense, moist, tropical lowland forests. Massive deforestation has so reduced the eagle's habitat that it is now listed as one of the most threatened raptors in the world. Most snake and serpent eagles have a very limited range, which may be restricted to just one group of islands. Destruction or degradation of habitat presents a critical threat to their survival.

Booted eagles, so named because of the feathers covering their legs and ankles, are the largest group of eagles, with 36 species. They include some of the most beautifully marked eagles, such as the ornate hawk-eagle, the Spanish imperial eagle, and the crowned hawk-eagle. Several booted species, including the martial eagle, the wedge-tailed eagle, and Verreaux's eagle, are among the largest eagles in the world. The crowned hawk-eagle has been described as one of the most powerful eagles on earth; it routinely preys on mammals twice its weight.

Harpy eagles are found among the tropical forests of South America, Mexico, New Guinea, and the Philippines. The six species in this group include several of the world's most stunning eagles. The harpy eagle of South America is considered the planet's most powerful eagle. A female's thick legs and long, sharp talons allow her to seize large arboreal (tree dwelling) prey, including sloths and howler monkeys, from their branches. Swooping in at 30 to 40 miles per hour, the harpy eagle hits and stuns the prey with 13,500 foot-pounds of kinetic energy, greater than the muzzle energy of a 50-caliber machine-gun.

FALCON

Falco peregrinis

Freddie Falcon, Atlanta Falcons (NFL)

FAST FACTS

Falcons are the fastest animals on earth.

There are 3,900 nesting pairs estimated in North America today, compared to 324 in 1975.

Falconry sports in the Middle East are driving illegal poaching and trafficking.

THREATS

Habitat reduction

Toxic chemicals

Climate

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Climate remediation

Habitat preservation and protection

Halting of illegal trade, trafficking, and poaching

Toxic chemical use reduction

Falcons are powerful and fierce hunters, renowned for being the fastest species on the planet. Adult falcons possess thin, tapered wings that enable high-speed dives and rapid direction changes. Peregrine ("wandering") falcons have been recorded diving at speeds up to 240 miles per hour. Peregrines are fearless apex predators, fast and aggressive, and are seldom attacked by others. The peregrine has a distinct notched beak that allows it to rapidly kill its prey by severing the spinal column. With its high speed and agility, the peregrine is considered the perfect flying machine, the "master of the sky," whether diving for prey or engaged in aerial courting displays.

Worldwide there are 37 species of falcon, among them the gyrfalcon, the largest of the falcon species; the Lanner falcon, which lays its eggs in the nests of other birds of prey while they are gone; and the merlin, historically notable for being flown in stunning encircling flights pursuing skylarks during the Middle Ages. Some falcons hover 30 to 60 feet off the ground while hunting; these are kestrels, whose name derives from a French word meaning "rattle" or "crackle," like the bird's sounds.

Falcon is derived from the Latin word for "sickle," referring to the silhouette of the falcon's spread wings while flying.

ENVIRONMENTAL THREATS TODAY

Today, an estimated 3,900 nest pairs of peregrine falcons are located in North America. Like other raptors (eagles, ospreys, and condors), the American peregrine falcon suffered a population collapse between the 1940s and the early 1970s. Nearly 90 percent of the continent's peregrine falcons died off, due overwhelmingly to the intensive application of DDT. The pesticide would accumulate in the bodies of the small animals being eaten by the birds and would then contaminate the falcons. DDT prevents calcium uptake, causing eggshells to be thin and increasing mortality rates. In some areas, effective reproduction virtually halted.

By the time the peregrine falcon was added to the U.S. Endangered Species list in the 1970s, its eastern population was already gone and the western population had declined by some 90 percent. Only 324 nesting pairs were alive in North America in 1975. The American peregrine falcon has rebounded since then in Canada, Mexico, and the United States. In 1999 it was removed from the Endangered Species list.

© Atlanta Falcons

Falconry sports in the Middle East are driving criminal poaching and illegal trafficking of peregrine and Sakar falcons in Kazakhstan, causing catastrophic declines.

The emergence of global warming and climate-triggered weather extremes introduces news risks for the peregrine falcon, as well as many other bird species more broadly. Warmer winters, later snowfalls, prolonged and heavy rains, scorching summers, and spread of infectious diseases are all new threats to survival of avian populations.

Unusually long and frequent heavy rains in the Arctic are resulting in the deaths of peregrine chicks from hypothermia or drowning. The Arctic peregrine falcon is also facing food shortages because its normal prey, lemmings and ground squirrels, are also suffering higher mortality rates from the heavy Arctic rain.

Even prior to the threat of climate change, habitat loss and other risks put one out of every eight of the world's 10,000 known bird species at risk of extinction. This is roughly 1,000 times higher than the natural (preindustrial) background rate of extinction.

Climate change significantly increases the threat of extinction to half of all bird species, according to the IUCN Red List of Threatened Species 2013 assessment. Climate change already has impacted more than 600 bird species, according to research by Birdlife International. Increased temperatures are resulting in earlier arrival of springtime and later arrival of autumn. The migration and breeding of hundreds of bird species have shifted to an earlier timetable as well. However, such timing shifts have not coincided with shifts in the life cycles of plant and animal species upon which birds rely for food, causing "ecological mismatches" and impacting populations. For example, the Arctic tern in the United States has declined 40 percent over the past decade because of changes in its breeding habitat.

Some bird species may be able to cope with changes to their habitat. Others may be able to move to new areas, latitudes, or altitudes. But an enormous number will be lost, unless fossil fuel emissions are curtailed.

RANGE

Among the 37 species of falcons distributed worldwide, eight species live in North America. The peregrine falcon (once known as the duck hawk) and the prairie falcon are native to North America. Gyrfalcons are found in the northern regions of Canada and Alaska. The aplomado falcon (*aplomado*, Spanish for "lead," refers to the blue-gray in the bird's feathers) ranges from Texas and New Mexico all the way to the southern part of South America.

The American kestrel is the smallest raptor in North America. Also called the sparrow hawk, it is the only kestrel, as well as the most common falcon, in North America.

WILD NATURE FACTS

The peregrine falcon is the most widely distributed raptor species on the planet. It travels incredible distances during the spring and fall migrations to its nesting and wintering habitats.

Some falcons will cover nearly 16,000 miles a year, such as the Arctic peregrine falcon. In summer, the Arctic peregrine breeds on Alaska's north slope, as well as across northern Canada to Greenland. In the fall, it migrates all the way to the tip of South America, aided by uncanny homing instincts that return it each year to long-used nesting sites. Some sites have been used by successive generations of peregrines for hundreds of years.

Peregrines normally fly at 40 to 55 miles per hour, attaining speeds exceeding 200 miles per hour when diving for prey. Females are larger than males. Many falconers look upon the female peregrine as the quintessential falcon. Male peregrines, like all male hawks, are called tercels (British) or tiercels (American), their name thought to be based on the fact that males are one-third smaller than females, or on the belief that only one bird hatched in three eggs ends up being male.

Peregrine falcons feed primarily on other birds. They hunt and capture their prey in midair. The hunting is often performed in pairs, each falcon taking a turn diving on their prey until it is caught. It is estimated that all falcon species around the world prey upon some 2,000 different bird species.

Red-tailed hawks and raccoons occasionally prey upon peregrine nest eggs. Great horned owls and golden eagles sometimes kill fledgling peregrines. And foxes and grizzly bears prey upon the nestlings of ground-nesting Arctic peregrine falcons.

HAWK

Buteo species,
Buteogallus anthracinus
(black hawk)

- **SkyHawk, Atlanta Hawks (NBA)**
- **Blitz, Seattle Seahawks (NFL)**
- **Tommy Hawk, Chicago Blackhawks (NHL)**

FAST FACTS

There are 2 million black hawks in the world.

Largest threats include pesticides, which hawks ingest through the accumulation in their prey, and habitat reduction, which is increasing with agricultural expansion.

Known for their powerful eyesight; their eyes contain five times the photoreceptors of a human.

THREATS

Habitat reduction

Toxic chemicals

Climate

WHAT NEEDS TO BE DONE

Hawks rank among the most intelligent bird species. “Hawk” is derived from Old English and German root words meaning “to seize,” or highlighting both its skill as a predator and the central role its claws play in killing its prey. Unlike raptors such as the falcon, which kill with their beaks, the hawk kills with its strong claws.

The term *hawk* is somewhat confusing because it has multiple uses, ranging

from unique species to groups of raptors or other birds of prey. For example, ornithologists recognize 237 species of hawk in the group Accipitridae, which encompasses hawks, eagles, kites, Old World vultures, buzzards (buteos), and many others.

There is good reason why humans use the expression “hawk eye” to mean “sharp-sighted.” The hawk’s visual acuity greatly exceeds a human’s; compared to normal 20/20 human vision, hawks have 20/2 vision; in other words, what a human sees at 2 feet, a hawk can see at 20. A hawk’s eyes are huge in comparison to its body. Whereas human eyes represent less than 1 percent of the surface of the human body, the eyes of hawks and other raptors make up 15 percent of theirs.

The hawk’s eye also has five times as many photoreceptors in the retina as a human does, and twice the number of fovea, which are shaped to create powerful magnification in the central part of the retina’s visual field. This empowers the hawk to continue tracking moving prey while diving at great speed. The raptor has both eyes in the front of its head, similar to humans, which provides binocular vision that enables the hawk to continually evaluate changing distances when focusing on and pursuing prey. Songbird eyes, in contrast, are located on the sides of the head, providing monocular vision over a wide range, important for spotting predators from any direction.

ENVIRONMENTAL THREATS TODAY

In the United States, the common black hawk is protected under the Migratory Bird Treaty Act of 1918 in the far north of its range. The population is declining, but not at a rate that meets any of the three IUCN Red List of Threatened Species’ criteria for being listed as vulnerable (population declining more than 30 percent over a decade or for three generations, population of less than 10,000 mature individuals decreasing more than 10 percent per decade, and a range of less than 7,700 square miles). There are 2 million black hawks worldwide, roaming over a vast range of nearly 700,000 square miles.

There are several threatened and endangered hawks in the United States that are protected under the Endangered Species Act. These include the Hawaiian hawk, the Puerto Rican broad-winged hawk, and the Puerto Rican sharp-shinned hawk.

Pesticide use remains a constant threat to hawks. Worldwide, more than 6 billion pounds of pesticides and biocides are annually applied to farm fields, with the amount expected to double in the coming decades. The past 70 years have witnessed large-scale adoption of intensive chemical applications of pesticides in order to derive greater crop yields. They have also been used for habitat management and the control of diseases and pests. However, according to one conservative estimate, 670 million birds in the United States are directly exposed each year to pesticides on farmland, with 1 in 10 dying as a result. Roughly 50 pesticides used in this country cause die-offs of a wide range of bird populations, killing off hawks and other raptors as well as songbirds, game birds, shorebirds and seabirds.

In addition to introducing pesticides to the environment, where they bioaccumulate in the prey of hawks, agricultural expansion takes another toll by reducing bird habitat. A land area roughly the size of Iowa or England is cleared each year of meadows, grasslands, wetlands, woodlands, peatlands, forests, and mangroves.

The growing loss of bird habitat and increasing chemical residues are two of the biggest factors in currently driving nearly 200 bird species—1 out of every 50 bird species in the world—to extinction.

WILD NATURE FACTS

The common black hawk feeds mainly on crabs but will also eat small vertebrates and eggs. This species is often seen soaring, with occasional lazy flaps, and has a talon-touching aerial courtship display. The call of the common black hawk is a distinctive piping “spink-speenk-speenk-spink-spink-spink.”

It builds a platform nest of sticks 15 to 100 feet above the ground in a tree, often a mangrove. Nests are often reused and tend to grow bigger with each use.

The hawk’s preferred time for hunting is usually just before nightfall, at dusk.

Hawks have been known for their aerial mating rituals. The male and female fly in slow circles to 1000 feet or higher, with the male circling above the female. Once they get to a certain height, the male will dive toward the female, and then they will rise back to that height again. The two birds repeat this pattern until finally the male approaches the female from above, touching her briefly. This triggers a number of tumbles and dives approaching 100 miles per hour. The pair may lock talons or beaks in the fall, during which the female may receive food from the male. After separating, the female will land on a perch, with the male spiraling down to join and mate with her.

PARROT

Psittacine

Pirate Parrot, Pittsburgh Pirates (MLB)

FAST FACTS

More than one-third of the 372 parrot species are threatened with extinction today, with 19 species already extinct.

Parrots have been traded in larger numbers and over a longer period of time than any other bird.

More than 75 percent of all parrots captured for trade die during transportation.

THREATS

Habitat reduction

Climate

Overconsumption

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Climate remediation

Habitat preservation and protection

Halting of illegal trade, trafficking, and poaching

Parrots and pirates have a long history of association originating from pirates' trade in exotic animals, in which they actively engaged for centuries. The parrot's capacity for mimicking human words has long made it a prized pet and desired companion.

Unlike humans, parrots and other birds do not have vocal cords or a larynx. Instead, they have a syrinx (the Greek term for "panpipe"), which is a distended part of the trachea with two thin membranes that vibrate to create sound. The parrot can alter the depth and shape of its trachea to produce a range of sounds. The African gray parrot, native to the Congo Basin, is most renowned for its phenomenal ability to imitate sounds of birds and other animal species, including human speech.

Since ancient times, parrots have been accorded sacred status. In Buddhist scripture, the celestial Buddha transforms into a parrot to spread his teaching. The Moche people, who flourished in Peru nearly 2,000 years ago, worshiped birds and artistically depicted parrots in their cultural artifacts. Parrots are used by many nations as symbols, including the Caribbean nations of Dominica, and St. Vincent and the Grenadines.

Of the 372 parrot species worldwide, there is just one species native to the United States, the thick-billed parrot, with bright green plumage and a dark, heavy bill. There are between 500 and 2,000 pairs of thick-billed parrots living in pine forests in southern New Mexico and Arizona and northern Mexico. Thick-billed parrots feast on pine nuts, some acorns, and occasionally juniper berries, conifer buds, agave nectar, and insect larvae.

Thick-billed parrots thrive in mature pine forests and mountainous sky island habitats. The sky island region of southeastern Arizona is one of North America's most biologically diverse areas. Here, temperate and tropical zones meet at the Sierra Madre Occidental mountain range and converge with North America's two major deserts, the Sonoran and Chihuahuan. More species of mammals, birds, reptiles, bees, and ants are found here than in any other place in the nation. Thick-billed parrots live within this ecological richness, in high-elevation mountain habitats isolated by surrounding lowlands of a dramatically different environment.

RANGE

Modern parrots date back some 23 million years, and fossils of earlier ancestors go back 40 million years. The geographic origin of parrots was on the ancient supercontinent of Gondwana. This vast area consisted of most of the current landmasses in the Southern Hemisphere (Africa, Antarctica, Australia, India, Madagascar, New Zealand, South America). Around 200 million years ago Gondwana was connected with Laurasia (Asia, Europe, Greenland, and North America) in one continuous land mass. Plate tectonics

began separating the two supercontinents 160 million years ago, creating the continents in a process unfolding over the next 145 million years. Parrots were geographically distributed worldwide during this vast time period, remaining overwhelmingly concentrated in tropical latitudes, though there are several species inhabiting temperate regions in the Southern Hemisphere as well.

The greatest diversity of parrots is in South America and Australasia. The nations with the most parrot species are Brazil (82 species), Indonesia (77), Colombia (57), Australia (53), Peru (53), Bolivia (51), Venezuela (50), Ecuador (49), Papua New Guinea (48), Argentina (27), Guyana (24), and Mexico (23).

ENVIRONMENTAL THREATS TODAY

More than one-third of the 372 species of parrots in the family *Psittacine* is threatened with extinction, and 19 species already have gone extinct. Nine out of 10 threatened parrots are tropical forest species. In fact, parrots face one of the highest threats of extinction among the major families of birds.

Overhunting, illegal trade, destruction of habitat and nest sites, and the introduction of predators and competitors all pose enormous threats to parrots. Introduced predators include numerous snakes and lizards, possums, rats, and feral cats.

Trade in wild parrots remains highly profitable, with especially exquisite or rare species selling for $1,000 or more. Sadly, upwards of 75 percent of parrots captured for trade die during transport due to asphyxiation, crushing, dehydration, disease, rough handling, stress, or a combination of these. It is estimated that as many as 50,000 to 60,000 wild-captured parrots from Mexico die in transit each year.

Parrots have been traded in larger numbers and over a longer time than any other group of wild species. Tens of millions of wild parrots have been captured for international trade. One in every five birds subject to trade is a parrot. In the United States, of the 12 million birds owned as pets, three-fourths are parrots.

There have been efforts to halt illegal trade and regulate legal trade. The U.S. Exotic Wild Bird Conservation Act of 1992 and the 1975 Convention on International Trade in Endangered Species (CITES) have included 56 parrot species in their prohibitions on international trade. Indonesia, Australia, Brazil, the Philippines, Colombia, and Mexico are home to two-thirds of all threatened species and the source of most international trade activity.

The United States protects the native thick-billed parrot through the Endangered Species Act. After decades of advocacy by hundreds of conservation organizations as well as outbreaks of avian flu, the European Union halted importation of all wild birds in 2007. Prior to this permanent ban, the EU was responsible for buying 90 percent of the international trade. Hundreds of thousands of parrots were traded among the some 2 million live birds being imported each year.

Climate-triggered weather disasters and habitat change pose new threats to parrots, which are considered flagship or umbrella species, in the sense that protecting their habitat and nesting sites results in the protection of crucial ecosystems essential for the survival of many other animal and plant species. Climate change is increasing fire threats and outbreaks of insects that are killing the pine trees providing their food supply.

According to a 2013 assessment by the IUCN Red List of Threatened Species, climate destabilization puts half of the world's nearly 10,000 bird species at risk of extinction. These recent findings have many ornithologists calling for unprecedented conservation efforts if greenhouse gas emissions are not adequately curtailed. Many of these species are not currently classed as threatened. In fact, upwards of 40 percent of birds are highly vulnerable to climate change despite being considered safe by the Red List.

Scientists have documented more than 600 bird species in Europe and North America alone already being affected by the modest 1°F temperature increase experienced to date (with projected increases five to seven times higher in this century if fossil fuels are not phased out). Some species may be able to cope as their habitat changes; others species may simply move to new areas.

That does not appear to be the case with the United States' only native parrot species. The thick-billed parrot's ability to disperse is being limited by hotter, drier conditions in the desert surrounding its habitat.

WILD NATURE FACTS

Parrots feed on seeds, nuts, fruit, plant buds and other plant material. A few species sometimes eat animals and carrion. Lories and lorikeets have a specialized anatomy for feeding on floral nectar and soft fruits. Parrots use tree hollows for their nesting sites.

Parrots, like ravens, crows, and jays, are intelligent birds. Beyond mimicking human speech, species like the African gray parrot can form simple sentences. Other parrot species, like the kea, can solve puzzles and use tools. Parrots are very social, and much of their learning occurs early in life, beginning in nurseries that include several broods.

Male parrots exhibit elaborate breeding displays. They take slow, deliberate dancing steps and show an "eye-blaze," where the pupil of the eye constricts and the brightly colored iris expands in size.

Parrots come in many sizes. The world's largest is the hyacinth macaw, at 3½ feet in length with a 5-foot wingspan. The smallest parrot is the buff-faced pygmy parrot of Papua New Guinea, which grows to about 3 inches.

Large parrot species, like cockatoos and macaws, live for 80 years, with some surpassing a century. The smaller parrots, such as budgies, hanging parrots, and lovebirds, survive for 15 to 20 years.

PELICAN

Pelecanus occidentalis, Pelecanus

Pierre the Pelican, New Orleans Pelicans (NBA)

FAST FACTS

American white pelican is the largest bird native to North America.

Like many birds of prey, the pelican became at risk for extinction through the popular use of DDT, a pesticide, which they ingest through their prey. This chemical makes eggshells very frail, which significantly increases pelican mortality rates because they incubate their eggs by standing on them.

Three of the world's eight pelican species are at risk for extinction

THREATS

Habitat reduction

Toxic chemicals

Climate

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Climate remediation

Habitat preservation and protection

Halting of illegal trade, trafficking, and poaching

Toxic chemical use reduction

Pelican ancestors date back at least 30 million years. Their name derives from the ancient Greek word meaning "ax," which apparently referred to the shape of its bill.

Two of the world's eight pelican species live in North America. The American white pelican lives around freshwater and in the interior of North America, migrating to Mexico and Central America for the winter. The brown pelican lives along the Atlantic and Pacific coasts and on offshore islands and winters in northern South America. While they appear awkward walking on land, they are strong swimmers and masterful fliers.

The American white pelican has the distinction of being the largest bird (in body length) native to North America, rivaled only by the trumpeter swan. It is 6 feet in overall length, including its 15-inch beak. Its wingspan of 10 feet is the second widest in North America, exceeded only by that of the California condor.

Large as they are, American white pelicans are elegant fliers. Large flocks soar on thermal currents at altitudes as high as 10,000 feet; they can also perform precision turns and roll in unison.

Along the southern and western coasts of the United States, it is the brown pelican that is the most well-known and notable bird. It is strictly coastal, rarely living more than 20 miles inland. It has a 6½-foot wingspan and an enormous bill. Its pouch is dark gray-green most of the year, except during mating when the pouch turns a bright red.

The brown pelican is a comically elegant bird. Squadrons glide near the rolling surf, described by one ornithologist as “rising and falling in a graceful echo of the waves.” Gliding close to the water actually saves significant energy thanks to the so-called ground effect: as air flows between the birds’ rigid wings and the water surface, it is compressed and exerts a stronger upward force.

Brown pelicans hunt their prey by performing attack dives from as high as 65 feet, trapping fish in their large pouches. Brown pelicans prey on schools of small fish near the surface, including anchovies, herring, menhaden, mullet, and sailfin mollies. Brown pelicans also have been observed stealing fish from other pelicans as well as from seagulls and cormorants.

The pelican’s pouch is capable of gathering and holding fish in as much as three gallons of water, which the bird drains before swallowing, since its stomach can hold only one gallon. While the brown pelican is draining the water from its bill, seagulls may attempt to steal the fish straight from the pelican’s pouch. Incredibly, the gulls sometimes do this while perching on the pelican’s head.

While brown pelicans dive for their food, American white pelicans catch their prey while swimming.

RANGE

The planet’s pelicans span the globe from the tropics to the temperate zones. They are not found in the polar regions, the open ocean, or the interior of South America.

American white pelicans can be found throughout inland North America, mainly on islands located in brackish and freshwater lakes. They live in colonies of several hundred nesting pairs. They reach northward to islands in the Slave River of Canada’s Northwest Territories and southward to northeastern California, southwestern Ontario, and the Great Basin of the Great Salt Lake in Utah.

Brown pelicans span both coasts of the Western Hemisphere and can be found from Nova Scotia to the mouth of the Amazon River. Most of the population lives south of the Carolinas, particularly along the Gulf of Mexico. Along the Pacific Ocean the species ranges from British Columbia to southern Chile, as well as on the Galapagos Islands.

ENVIRONMENTAL THREATS TODAY

Pelicans and humans have had an antagonistic relationship over the centuries. Fishers have persecuted pelicans because they compete for fish. Their coastal habitat has also been disturbed or destroyed in many locations. Chemical contamination nearly drove several species to extinction, and chemical spills remain a constant threat.

Currently, three of the planet’s eight pelican species are vulnerable to extinction. These include the world’s largest pelican, the Dalmatian pelican, whose habitat extends from southeastern Europe to India and China; the Peruvian pelican, which spans the Pacific coast of South America from Ecuador and Peru all the way to southern Chile; and the spot-billed pelican, which ranges across southern Asia from southern Pakistan across India east to Indonesia. The populations of the spot-billed pelican in the Philippines and eastern China have already disappeared.

The American white pelican is listed as endangered in the state of Washington, and the California Department of Fish and Game provides it with protective status as a Species of Special Concern. Otherwise, it is thought to be abundant throughout the rest of North America. Both the American white and the brown pelican are protected under the U.S. Migratory Bird Treaty Act.

Worldwide, the two species are considered common enough to be listed as Species of Least Concern by the IUCN. This was not always the case. Brown pelicans suffered a population collapse in the 1950s and 1960s due to DDT pesticide poisoning. Agricultural runoff into both the Atlantic and Pacific Oceans released DDT, which became concentrated in anchovies and subsequently in the pelicans, where it caused thin eggshells. Because pelicans incubate their eggs with their feet, keeping them warm by standing on them, the shells were crushed, causing the deaths of the embryos.

On the East Coast, researchers discovered that DDT was also thinning eggshells around Tampa Bay and St. Petersburg. The widespread evidence of mass-scale bird deaths led to a ban on DDT use in Florida and California, and subsequently throughout the United States in 1972, bringing pelicans back from the brink of extinction. Brown pelicans have become a living symbol of how successful wildlife conservation can be. Sadly, an oil-soaked brown pelican also became an icon of the 2011 BP oil spill in the Gulf of Mexico, which killed some 6,000 birds in the spill zone.

WILD NATURE FACTS

The four white-feathered pelican species (Australian, Dalmatian, great white, and American white) prefer nesting on the ground. In contrast, three of the four brown or gray-feathered species (pink-backed, spot-billed, and brown) nest primarily in trees; the fourth (Peruvian) nests on sea rocks.

Red foxes and coyotes are the primary predators of pelicans.

There are more than 650,000 wild adult brown pelicans.

The “Pelican State,” Louisiana, has included the brown pelican as part of the official state flag and seal since 1902, and as a large visual part of the Louisiana state flag since 1912. The brown pelican is also Louisiana’s official state bird.

PENGUIN

Sphenicus species, *Eudyptes*

Iceburgh, Pittsburgh Penguins (NHL)

FAST FACTS

Two-thirds of penguin species are in decline.

Because penguin colonies take decades to form and penguins often remain attached to a location even if the environment becomes adverse, they are at particular risk for extinction from climate change.

All species are native to the Southern Hemisphere with very few living in the Northern Hemisphere. There are no penguins in the North Pole.

Penguin eggs are up to 50 percent thicker than those of other birds.

THREATS

Habitat reduction

Toxic chemicals

Climate

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Climate remediation

Habitat preservation and protection

Halting of illegal trade, trafficking, and poaching

Toxic chemical use reduction

Penguins are among the most adored wild animals in the world. People seem to love their unusually upright, humorous waddle and their absence of fear of humans. Penguins are seabirds, and when swimming they look quite similar to birds in flight. Diving penguins can reach a velocity of 17 miles per hour, although typically they stay below 7 miles an hour. The large emperor penguin has been recorded diving to a depth of 1,870 feet and remaining there for more than 20 minutes.

RANGE

All penguin species are native to the Southern Hemisphere, although only a few species of penguin live as far south as Antarctica. Surprisingly, not all species live in cold waters. A number of species are found in the temperate zone, and one species, the Galapagos penguin, lives near the equator. Contrary to popular image, there are no penguins anywhere the North Pole, and virtually none in the Northern Hemisphere.

The emperor penguin is the largest penguin species. Adults reach about 3.5 feet tall and can weigh more than 75 pounds. The little blue penguin (also called the fairy penguin) is the smallest species, reaching just 16 inches and weighing 2.2 pounds. It is the larger penguins that inhabit colder regions, while the smaller penguins inhabit temperate and tropical climates.

ENVIRONMENTAL THREATS TODAY

Two-thirds of penguin species are declining in population. Three of the 18 species have stable populations, and the populations of three other species are increasing. However, even the stable and increasing species face a potential loss of habitat and food sources as a result of the emerging threat of climate destabilization.

The emerging threat to penguins' long-term survival is the double risk caused by carbon dioxide (CO_2) emissions from fossil fuel combustion and the burning of tropical forests. CO_2 is heating up the atmosphere and sea temperatures to unprecedented levels and acidifying the ocean at a rate not experienced in 300 million years. The current trend is projected to raise the global average temperature 9° to 14°F towards the end of this century.

Already, with just a 1.3°F increase in ocean temperature over the past 50 years, there has been a 40 percent loss in ocean phytoplankton, the base of the food chain for marine species. One-fifth of the world's coral reefs are dead, including 50 percent of Caribbean corals, and most coral reefs are projected to die off within the next several decades, when sea temperatures increases by another 3.6°F (2°C). If current trends continue, most of the ocean's large species will be threatened with extinction by the end of the century. Ocean scientists are calling for a cap on global combustion of fossil fuels by 2015, and then steadily decreasing CO_2 emissions by 5 percent per year down to zero.

The specific traits of seabirds like penguins make them especially sensitive to climate destabilization. Ordinarily, penguins have very specific food requirements based on a limited number of prey species. Sudden ecological changes can radically disrupt the abundance and distribution of their food sources.

This can be compounded by penguins' behavioral patterns, which may constrain their adaptability. Penguin colonies can take decades to form, and many penguins remain attached to an area even if conditions become adverse. Species with exceedingly constrained geographical ranges, such as Galapagos penguins, face the most immediate risk of extinction.

WILD NATURE FACTS

Some 25 million years ago there were some penguin species that reached the size of an adult human. The common ancestor of penguins actually dates back some 70 million years.

All penguins evolved to have black backs and white fronts, a coloration which is highly effective in dealing with both predators and prey. A predator observing from below (such as an orca whale or a leopard seal) finds it hard to differentiate a white penguin belly from the reflective surface of the water. And penguins' black backs camouflage them from predators looking down from above.

Female emperor penguins in the Antarctic spend several months traveling up to 50 miles to access fishing spots, while leaving the males to weather the wind chills that reach –76°F. Males huddle together for warmth, rotating spots to ensure that each penguin gets time in the middle of the heat pack. Fish comprise 90 percent of the Emperor Penguin's diet. Diets vary among the 17 penguin species. Krill, a small shrimplike animal, comprise most of the diet for Adelie, Chinstrap and Macaroni penguins. Squid are favored when in season by Gentoo, Rockhopper and Emperor penguins, among others. Crustaceans and amphipods (which look like shrimp) are also favored. Adult penguins will dive as deep as 300 feet to locate crustaceans.

Penguins drink saltwater, which is filtered through nasal glands to remove excess salt from the bloodstream. The glands play a role comparable to kidneys, but are far more efficient at removing sodium chloride (salt) from the blood system.

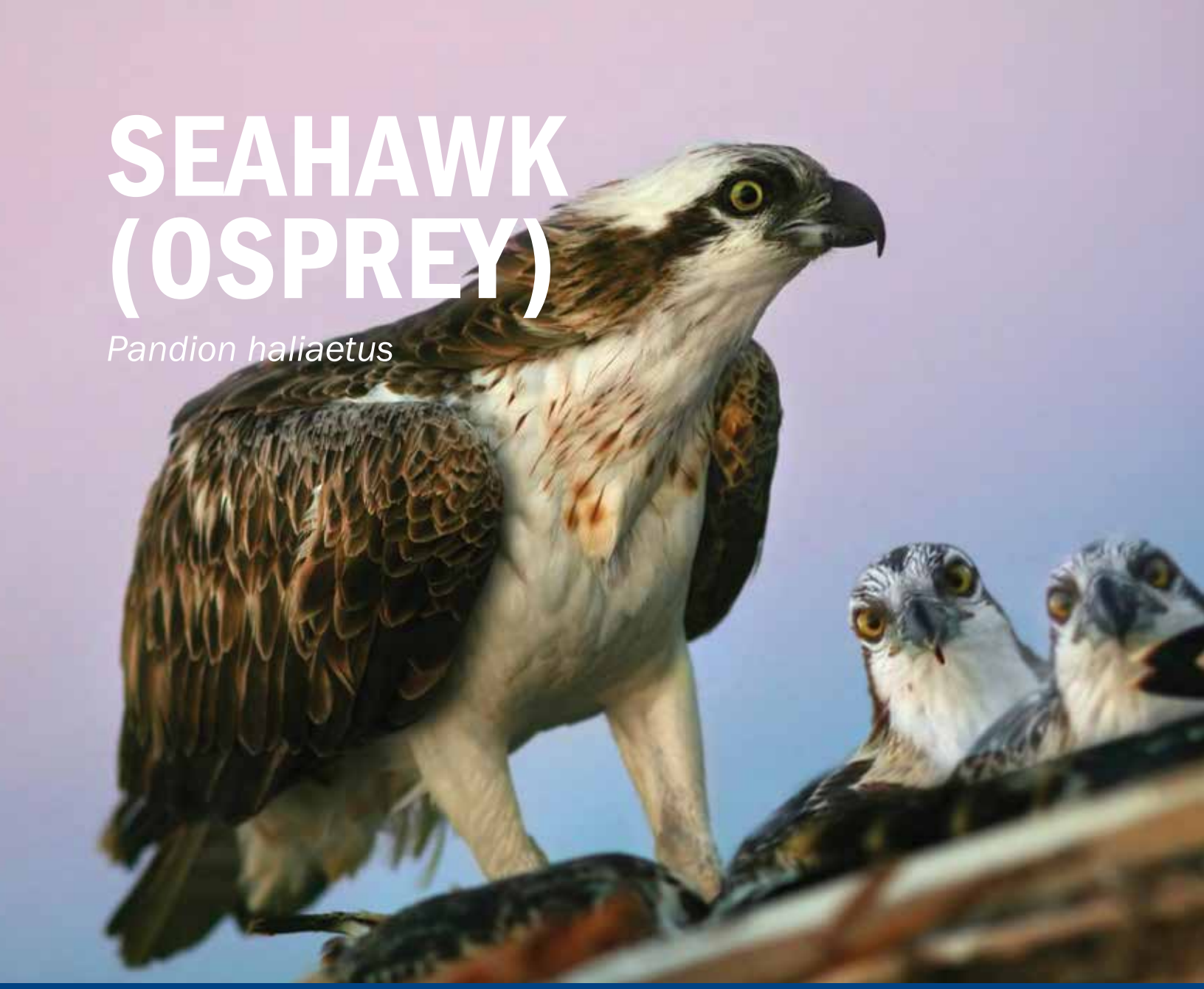
Female emperor and king penguins each lay one egg, while most other penguin species lay two eggs in a clutch. In all but one species, males and females share the task of incubating eggs. The one exception is the emperor penguin: the male is the sole incubator while the female hunts for food.

The penguin eggshell is up to 50 percent thicker than most bird eggs. The dense shell reduces the risk of cracking in the rough nesting environment. After hatching, the egg often has some yolk remaining, which helps nourish the new chick if the parents are delayed in arriving with food.

Penguins have no land predators in Antarctica or offshore islands, but at sea they face fierce predators like the leopard seal and killer whale.

SEAHAWK (OSPREY)

Pandion haliaetus



Blitz, Seattle Seahawks (NFL)

FAST FACTS

Seahawks, or ospreys, are found in every continent except Antartica.

Ospreys are neither hawks nor eagles; they are more closely related to the hawklike kite family.

Ospreys are considered sentinels of clean water and a key indicator species of forest ecosystem health

Osprey populations have gotten a boon from the erection of structures that allow them to build their large nests

THREATS

Habitat reduction

Toxic chemicals

Climate

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Climate remediation

Habitat preservation and protection

Halting of illegal trade, trafficking, and poaching

Toxic chemical use reduction

While commonly referred to as sea hawks, fish hawks, or fish eagles, ospreys are neither true hawks nor eagles. The species is most closely related to the hawklike kite family.

Ospreys are indomitable sea hunters. They have five times the visual acuity of humans and are able to spot an underwater fish from 200 feet. Ospreys are strong flyers, reaching speeds up to 25 miles per hour. A diving osprey will hit the water at 40 miles an hour and can grasp fish up to three feet underwater.

An osprey family with two young requires about five fish per day, which suggests up to 15 dives a day given their average success rate of one in three tries. Fish that are caught are sometimes carried to nests more than five miles away. Mistakes in fish selection are sometimes deadly, with osprey drowning by trying to carry fish too large for them to handle.

During hunting, ospreys slowly fly above the water, frequently hovering for a moment to scan intently for prey. If a fish is spied, wings are tucked and the dive begins. Unlike many seabirds that enter the water headfirst, ospreys go feet-first, with legs and needle-sharp talons fully extended. After seizing its prey, the osprey takes a moment on the surface to secure a tight grip. Once airborne, the osprey arranges the fish with its head facing forward to reduce wind resistance and places one foot in front of the other, using its swiveling outside toes to better clutch the fish.

Osprey is from the Latin word meaning “bone breaker,” indicating the strong grip of its talons. The bird is found on every continent but Antarctica and is viewed as a “cosmopolitan” raptor.

The osprey’s fishing skills and strength have been admired by various cultures for thousands of years. The ancient Greeks believed ospreys could foretell lightning. Osprey pictures were woven into the palace tapestries of Asian emperors. South American native tribes sought fishing success by incorporating osprey feathers and bones in ceremonies. Northwest Coast First Nation lore tells of the marriage between an osprey and a whale that gave rise to the orca.

RANGE

The osprey is among the most widely distributed raptor species, second only to the peregrine falcon. Ospreys span the globe and are recognized by ornithologists as “the natural citizen of the world.”

There are two subspecies of osprey located in North America; the North American osprey, found in temperate areas; and Ridgway’s osprey, found in the Caribbean. Ospreys have an ancient lineage, with fossils dating back 13 million years.

North American osprey species have experienced a 11-fold increase over the past four decades. There are an estimated 500,000 ospreys worldwide.

Ospreys in the northern latitudes of western North America migrate through California and sometimes through adjacent western states into Mexico. Northern mid-continent ospreys migrate via three routes: 1) through the central United States and along Mexico’s east coast, 2) down the Mississippi River and across the Gulf of Mexico, and 3) through the southeastern United States and across the Caribbean. Northern East Coast ospreys migrate along the Eastern seaboard, across Florida, and to the Caribbean.

ENVIRONMENTAL THREATS TODAY

Like a number of other animal species (notably eagles, falcons, condors, and other predatory birds), ospreys were dramatically impacted from the 1950s through the 1970s by organochlorine insecticides like DDT, as well as PCBs contained in cooling fluids. The pesticides caused thinner eggshells that led to fewer surviving offspring. Particularly hard hit were the osprey populations of the Great Lakes and Atlantic Coast regions. Prior to DDT use, breeding surveys along the coast from New York to Boston indicated 1,000 nesting pairs. By the end of the 1960s, the number of nest sites had declined by 98.5 percent.

Osprey populations have shown a steady increase since 1972, when the United States banned DDT and related chemicals. By 2001 there were 19,000 breeding pairs nationwide.

In the pre-DDT 1940s, ospreys nested all over California. Two decades later the osprey population had dramatically declined throughout much of the state. This was due not only to DDT but to loss of habitat due to human development and human persecution.

The California Board of Forestry lists the osprey as a sensitive species. The bird is also listed as sensitive by the U.S. Forest Service under the Federal Migratory Bird Treaty Act.

Ospreys are considered sentinels of clean water and a key indicator species of forest ecosystem health. Ospreys depend on fish for nourishment, and fish require clean water. Turbid and silt-laden waters reduce water quality and make it impossible for ospreys to spot fish.

A major help in reviving osprey populations has been the erection of structures upon which osprey can build their large nests. Nearly half the increase in the number of osprey nests along the Atlantic seaboard can be attributed to these human-made structures.

The emergence of climate destabilization introduces news risks for the osprey, as well as many other bird species. Even prior to

the threat of climate change, habitat loss and other risks put one out of every eight of the world's 10,000 known bird species at risk of extinction. Climate change increases the threat of extinction to half of all bird species, according to the IUCN Red List of Threatened Species 2013 assessment. Research indicates that climate change already has impacted more than 600 bird species. Some species may be able to cope with changes to their habitat. Others may move to new areas. But an enormous number will be irreversibly lost, unless fossil fuel emissions are curtailed.

WILD NATURE FACTS

Ospreys weigh between 2.5 and 4.5 pounds and have an impressive six-foot wingspan. People sometimes mistake the large, soaring osprey for an eagle. However, the osprey wing is narrower and curves backward at the wrist, like the wing of a gull. An eagle's wing plane is straight, whereas the osprey has a special joint that enables it to rise vertically out of water with a large fish. An osprey's forehead is smooth, unlike an eagle's. Because ospreys don't fly through trees and tall grass to catch prey, they lack the bony ridge above their eyes that other raptors need as a safeguard.

An osprey is outfitted with camouflaging feathers. White feathers on its chest appear like the sky to fish prey below, while dark feathers on its backside hide the osprey from overhead predators, like large owls. The evenly striped brown and white feathers on the underside of the osprey's wings and tail provide further disguise of its shape and flight pattern. Its head is concealed with dark spots plus a dark malar stripe across its eyes that look like wraparound sunglasses. The malar stripe is thought to reduce sun glare, similar to the black grease applied under athletes' eyes.

To avoid becoming water-soaked when diving for prey, ospreys have oily, fairly water-repellent feathers as well as long, unfeathered legs. In addition to their flexible outer toes, they have small, spiky scales on the soles of their feet for better gripping their prey.

Prior to females' arrival at breeding grounds during migratory periods, the males return to select the nest site. The males also begin performing aerial displays, even as the females are yet to arrive. With such displays, the males mark their territory and seek the arriving females' attention. These "sky dances" typically start and finish at the nest site. The male's display involves carrying a fish or nesting material while sounding repeatedly. During the sky dances the male may soar to 300 feet or more, performing an undulating flight. At the height of its flight the male briefly hovers, fanning its tail and dangling its legs, then retracts its wings and goes into a dive.

Ospreys build very large nests weighing up to 400 pounds. They are often five feet across and three feet deep when they are first built and are expanded annually thereafter.

Ospreys live an average of 15 years, although many survive as long as 20 to 30 years. During that time, an osprey may migrate more than 62,000 miles—equivalent to two and a half times around the world.

MARLIN

Makaira nigricans

Billy the Marlin, Miami Marlins (MLB)

FAST FACTS

Humans are the primary predator threat to the blue marlin.

Over the past two decades, the blue marlin population has declined by 40 percent.

3. Any billfish, which includes marlins, captured within 200 feet of the U.S. Coast must be released.

Marlins are at increased risk due to the rise of longline fishing, which catches many fish at a time.

THREATS

Habitat reduction

Toxic chemicals

Climate

Overconsumption

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Climate remediation

Habitat preservation and protection

Halting of illegal trade, trafficking, and poaching

Toxic chemical use reduction

The marlin's common name is derived from the similarity of its spearlike bill to a sailor's marlinspike, used in "marling," the winding of small-diameter twine (called marline) around larger ropes to form protective ends. These massive billfish use their several-foot-long bills to stun, injure, or kill while spearing through a school of prey. They then return to eat. The marlin is an exceptionally speedy swimmer, capable of exceeding 65 miles per hour.

The Atlantic blue marlin can reach a length greater than 16 feet and may weigh 1,800 pounds. The black marlin grows to 16 feet and 1,500 pounds. The female greatly outweighs the male, by a factor of as much as four to one.

Blue marlin, like other billfish, can suddenly change color. This is due to pigment-containing and light-reflecting organelles called iridophores in their cells.

RANGE

Blue marlin, which are the most tropical of billfish, range seasonally throughout the tropical and subtropical waters of the Atlantic, Indian, and Pacific Oceans. In the Pacific Ocean, blue marlin is found from California to Peru, including all of the Western Pacific islands. In the Atlantic Ocean, adults are commonly found in the tropics within a water temperature of 75°F.

ENVIRONMENTAL THREATS TODAY

Humans are the primary predator threat to adult blue marlin. Due to overfishing, the blue marlin is listed as vulnerable on the IUCN Red List of Threatened Species. Over the past two decades the blue marlin's global population has declined 40 percent. Even steeper declines have occurred regionally: there has been a two-thirds decline in Atlantic blue marlin and the Australian blue marlin, a 70 percent decline in the Indian Ocean, and an 80 percent decline around the Seychelles.

Large-scale longline commercial fishing has become a major threat to Atlantic blue marlin. Longline fishing involves a central line up to 50 miles long that has numerous dangling lines of baited hooks attached at spaced intervals. More than 1,000 tons of blue marlin is taken as bycatch each year in the Caribbean, primarily by Japanese and Cuban fishing vessels. Any billfish caught within 200 miles of the U.S. coast must be released. Unfortunately, these fish are so damaged during capture that survival rates are low.

Sport fishermen have been at the forefront of efforts to conserve blue marlin populations. The initial efforts to develop electronic tags for tracking highly migratory fish were carried out on marlin in Hawaii, in collaboration with anglers in the Hawaiian International Billfish Tournament. Tags aid marine scientists in understanding the biology of highly migratory fishes, and the retrieved data help them formulate better conservation initiatives, provide useful evidence for developing more effective fisheries policy, and enhance the marine spatial planning process.

In parts of the Atlantic, there are longlining restrictions to protect fish stocks for sport fishing. Measures have been introduced, such as limiting catch sizes, promoting catch-and-release, and encouraging use of circle hooks instead of J-hooks, to increase survival in sport fishing. Circle hooks reduce deep hooking and promote the live release of species. Circle hooks could also be highly effective in reducing the mortality of marlin species in the bycatch of tuna longline fisheries, where the mortality rate for marlin exceeds 90 percent. J hooks cause more body tears and injuries compared to circle hooks.

Meanwhile, longline fishing fleets continue to haul in vast catches of blue marlin in both the Pacific and Atlantic Oceans. With the introduction of deeper longline gear in recent years, the prospects for blue marlin have declined further.

Protecting marlin from overfishing is an immediate and ongoing need, but not sufficient. Another emerging threat to their long-term survival is the double risk caused by CO_2 emissions from fossil fuel combustion and the burning of tropical forests. CO2 is heating up the atmosphere and sea temperatures to unprecedented levels and acidifying the ocean at a rate not experienced in 300 million years. The current trend is projected to raise the global average temperature 9° to 14°F towards the end of this century.

Already, with just a 1.3°F increase in ocean temperatures over the past 50 years, there has been a 40 percent loss in ocean phytoplankton, the base of the food chain for marine species. One-fifth of the world's coral reefs are dead, including 50 percent of Caribbean corals, and most coral reefs are expected to die off within the next several decades as sea temperatures increase by another 2°C. Ocean scientists are calling for a cap on global combustion of fossil fuels by 2015, and then steadily decreasing CO2 emissions by five percent per year down to zero. If current trends continue, most of the ocean's large species, including the marlin, will be threatened with extinction by the end of the century. Marine ecologist Stephen Palumbi warns that failure to tackle the multiple threats to marine life could result in devastated oceans dominated by "bacteria, jellyfish and tar-like algae."

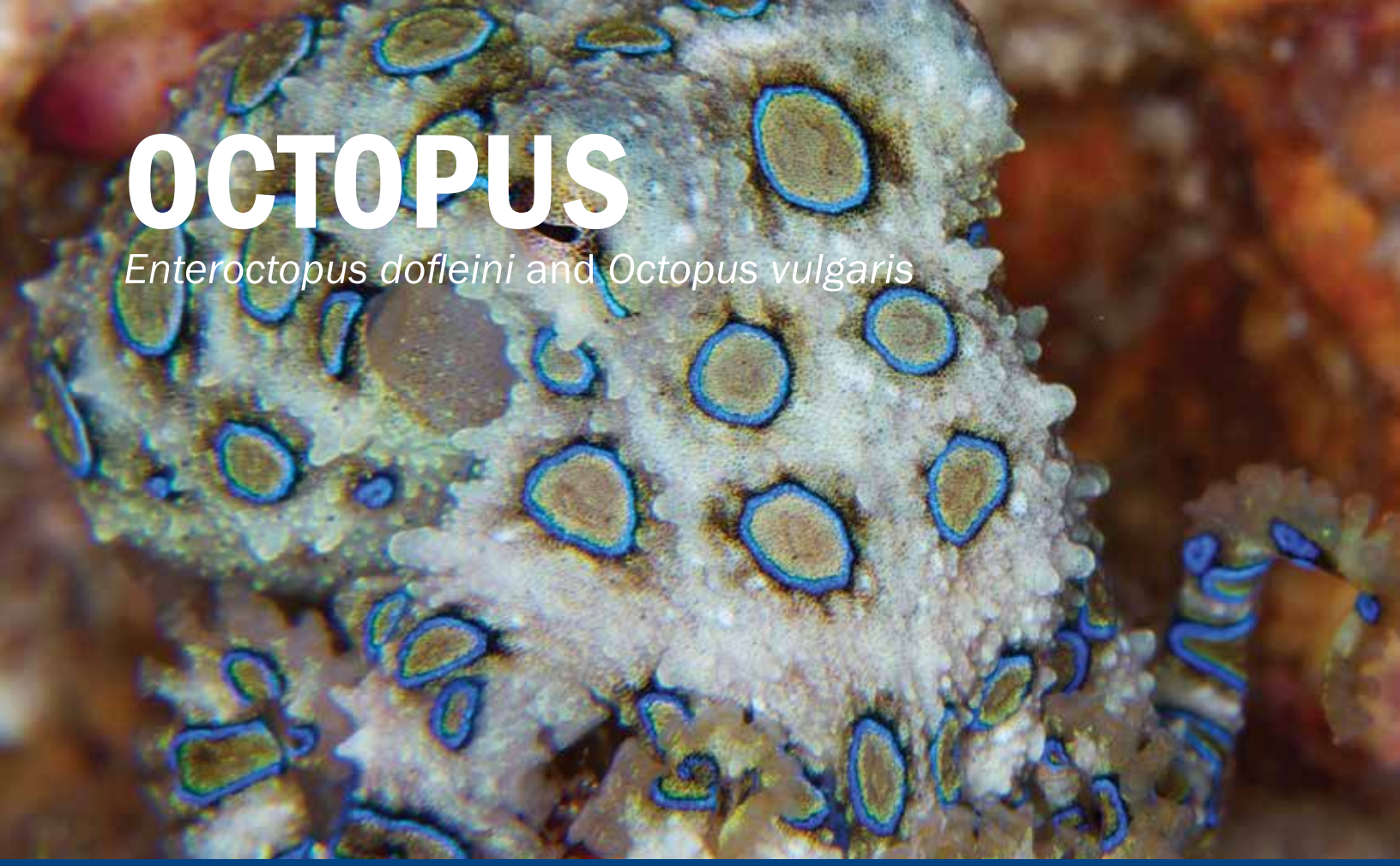
WILD NATURE FACTS

The blue marlin can dive to 3,000 feet, although it is commonly found within the upper 120 feet. Smaller individuals form schools of up to 10 members, whereas larger fish primarily swim alone.

Squids, tunalike fishes, and crustaceans are the principal foods of blue marlin. But they have been recorded taking prey in the 100-pound range, including white marlin, yellowfin tuna, and bigeye tuna.

Females spawn up to four times a season, releasing more than 7 million eggs at a time. However, very few of these eggs result in offspring that survive to sexual maturity. After hatching, the marlin larvae drift freely in the open sea, growing more than half an inch per day. They reach sexual maturity within two to four years.

The average life span of a male marlin is 18 years, and females live up to 27 years.



OCTOPUS

Enteroctopus dofleini and *Octopus vulgaris*

Al the Octopus, Detroit Red Wings (NHL)

FAST FACTS

Octopuses are the most neurologically advanced of all invertebrates.

It is difficult to monitor octopus populations because they do not travel in groups, but they are believed to be at risk due to the rapid deterioration of coral reefs and overfishing

Blue-ringed octopuses enhance the resilience, health, and ecological integrity of their environments by preying on invasive species.

THREATS

Habitat reduction

Toxic chemicals

Climate

Overconsumption

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Climate remediation

Habitat preservation and protection

Halting of illegal trade, trafficking, and poaching

Toxic chemical use reduction

Octopuses are cephalopod mollusks. They have four pairs of strong and dexterous arms covered with hundreds of circular sucker pads, a powerful beak similar to a parrot's, and specialized teeth and saliva capable of drilling into and corroding away the hard shells of prey. They are invertebrates and have no internal or external skeleton, enabling them to squeeze through what seem like impossibly tight spots.

Octopuses have excellent camouflage skills. Rather than trying to blend into the entire environment, which may include coral, sand, seaweed, and so on, they pick a specific feature and adapt to its color and texture. Octopuses are the most neurologically advanced and intelligent of all invertebrates. Their name is derived from Greek meaning "eight footed."

Fossil evidence of indicates cephalopods emerged 500 million to 600 million years ago. Octopus, squid, and cuttlefish are all cephalopods. The largest cephalopod is thought to be the colossal squid (*Mesonychoteuthis hamiltoni*), longer than a city bus; in stark contrast, the smallest cephalopod is the pygmy squid (*Idiosepius notoides*), the size of a fingernail. There are a number of distinctions between squids and octopuses.

A typical squid has:

- a streamlined body
- a clear internal shell known as a gladius or pen
- a head
- a mantle (which fits like a hat over the main part of the body)
- eight arms
- two tentacles with hooks, or sucker rings, or both
- two fins

A typical octopus has:

- a round, bulbous body
- no internal shell
- a head
- a mantle
- eight arms with suckers (never hooks)
- no tentacles and no fins.

The octopus has been one of the most rapidly evolving cephalopods over the past 300 million years. There are 300 species of octopus in the world. The giant Pacific octopus (*Enteroctopus dofleini)* is the largest octopus species in the world, as well as one of the largest invertebrates. It has a 14-foot arm span.

Females are typically larger than males. Although it is quite rare to find one over 100 pounds, a huge individual captured in 1967 near Victoria, British Columbia measured nearly 23 feet from arm tip to arm tip and weighed 156 pounds. Records indicate several individuals weighing 300 pounds have been found, as well as one that was more than 400 pounds.

The giant Pacific octopus does have several predators, including sperm whales, harbor seals, and sea otters. It typically feeds on bivalves, crabs, and lobsters. However, it is also opportunistic and has been seen eating fish, sharks, and even birds.

The tiniest octopus species is *Octopus wolfi*, found in the Indo-Pacific region. It is just half an inch long and ultra-lightweight at three-hundredths of an ounce.

ENVIRONMENTAL THREATS TODAY

No octopuses are currently protected by CITES or the IUCN Red List of Threatened Species, but this is due mainly to the fact that very little is actually known about octopus population levels. Unlike squid species, which typically swim in groups, most octopuses are solitary animals. This makes stock assessments time-consuming and costly.

Locally, concerns about overhunting the Giant Pacific Octopus has led the Washington State Fish and Wildlife Commission to protect seven popular Puget Sound dive spots from any hunting of Giant Pacific Octopus.

In other marine regions, concern has been raised about several potentially threatened octopus species, notably the four types of blue-ringed octopus (genus *Hapalochlaena*), considered to be among the most venomous marine animals on earth. Although small at just 7 inches, these octopuses have a supply of venom 1,200 times as toxic as cyanide, sufficient to kill two dozen human adults within minutes. The deadly species first came to public attention in the 1983 James Bond film *Octopussy*.

Blue-ringed octopuses inhabit coral reefs and tidal beds throughout the Pacific and Indian Oceans, enhancing the resilience, health, and ecological integrity of seashores, tidal zones, and reef marine ecosystems. Blue-ringed octopuses prey on invasive species of mollusks, which helps keep their numbers in check and makes marine biodiversity more robust in the face of more frequent weather extremes like typhoons, ocean acidification, and sea temperature rise. These benefits, in turn, assist in the balance of local marine food webs and restrain parasitic diseases.

Unfortunately, one-fifth of the world's coral reefs are dead, including 50 percent of Caribbean corals, and most coral reefs are projected to die off within the next several decades as sea temperatures increase by more than 3.6°F (2°C).

CO_2 emissions caused by human activity are to blame for driving marine acidification at a rate faster than has occurred in 300 million years. The 35 billion tons of CO_2 emitted each year is also raising sea temperatures at a rate that will exceed the corals' tolerance, leading to declining reproduction and rising extinction over the 21st century.

The notable exception for octopus stock assessments is the commercially important caught species, the tako, or common octopus. The tako constitutes the vast majority of octopus served by American sushi restaurants, with upwards of 100,000 tons caught per year. By comparison, the yearly worldwide catch of squid is 2.5 million tons. There are several key octopus-fishing locations: the Western Sahara coastal zone of Morocco, Mauritania, Spain, Japan, and Vietnam.

Takos have brief life spans of just 12 to 15 months, grow and mature rapidly, and spawn hundreds of thousands of offspring. These qualities help make the species resilient to fishing pressure. However, there are insufficient data to determine whether they are being overfished in some locations. Vietnam and Mauritania are known to be areas where octopuses are heavily fished.

The common octopus is typically caught in bottom trawl fisheries, which haul in bycatch and scrape the seafloor, heavily disrupting sensitive ecosystem habitat. The fishing methods in Morocco, Mauritania, and Vietnam are known to be poor, and there are little data on the effectiveness of the developing fishery-management programs in those countries.

Spain's octopus fisheries are better managed, and the species population is stable. Half of Spain's annual take relies on traditional pot fishing, which results in low bycatch levels.

Given these circumstances, Seafood Watch recommends that consumers avoid common octopus from Mauritania, Morocco, and Vietnam; the organization considers common octopus from Spain a "good alternative."

Bermuda has marine protected areas and "no collection zones" to protect the common octopus and its habitat. Bermuda also has a tariff subjecting all mollusk species in any form meant for human consumption to a tax of 10 percent per kilogram.

Octopuses are known to be sensitive to polluted water. Protecting them from threats is an immediate and ongoing need, but not sufficient. Also important is to maintain long-term preservation, which confronts the newest threat to long-term survival noted above: the double risk caused by CO_2 emissions from fossil fuel combustion and the burning of tropical forests. The current emissions growth trend is projected to cause a 9° to 14°F rise in the global average global temperature towards the end of this century.

Already, with just a 1.3°F increase in ocean temperatures over the past 50 years, there has been a 40 percent loss in ocean phytoplankton, the base of the food chain for marine species. Ocean scientists are calling for a cap on global combustion of fossil fuels by 2015, and then steadily decreasing CO2 emissions by 5 percent per year down to zero. If current trends continue, most of the ocean's large species will be threatened with extinction by the end of the century.

WILD NATURE FACTS

The hundreds of suction pads on octopuses' arms each contain thousands of chemical receptors. The chemoreceptors enable the octopus to taste whatever it is touching, useful when it is groping for prey in small, dark crevices.

Males possess a specialized sex arm that stores cords of sperm up to three feet long. When mating, the male inserts the cord of sperm into the female's oviduct. The female lays up to 100,000 eggs in several strings, which she drapes in her den. For the next seven months she watches over the brood, forgoing eating while obsessively cleaning and aerating the eggs until they hatch. The females die after the eggs hatch, and males die several months after mating.

Vertebrate animals, including humans, have one primary heart. Octopuses, as well as squid, have three hearts. In addition to the main, or systemic, heart, which pumps blood around the body, the octopus has two gill hearts, also called branchial hearts, which serve as booster pumps to circulate blood through the octopus's two gills. The octopus circulatory system transports oxygen via the copper-rich protein hemocyanin. This is not as efficient under normal conditions as the iron-rich hemoglobin of humans and other vertebrates. However, in low oxygen pressure and cold-water conditions, hemocyanin is far more efficient than hemoglobin for oxygen transport. The hemocyanin dissolves in the plasma, giving the blood a bluish color.

Octopuses are competent in performing maze and problem-solving experiments and show evidence of both short- and long-term memory.

Captured octopuses frequently escape from their aquariums and enter other aquariums in search of food. They have been discovered boarding fishing boats and opening holds to eat crabs. Among invertebrates the octopus is the only one to be observed using tools. For instance, octopuses that dwell in soft sediments create shelters out of coconut shell halves. The octopus will lug the shells around in an awkward "stilt-walk," and then assemble the halves as a shelter when necessary.

The octopus's main form of defense against predators is to avoid detection, whether by hiding out of sight or using its astounding camouflage and mimicry capabilities. If detected, its secondary defense is rapid escape, along with such distractive actions as squirting a cloud of dark ink or self-amputating a limb (which can be regenerated later). The still-moving limb can distract the predators long enough for the octopus to escape.

An octopus can change the color, reflectivity, and opaqueness of its skin. It does this through groups of pigment-containing sacs called chromatophores. They can contain yellow, orange, red, brown, or black pigments, with most species possessing three of these colors, others having two or four. Radial muscles around the pigment granules, controlled by the central nervous system, contract and expand to change the pigmentation colors. Some chromatophores can be expanding while others are contracting, enabling the octopus to instantaneously change color.

Other color-changing cells are light-bending (refraction) and -reflecting iridophores, which are iridescent, and leucophores, which are white. Iridophores are protein platelets that reflect specific parts of the light spectrum like a mirror; they usually appear pink, yellow, green, blue, or silver. Leucophores reflect white light, which is pervasive in the octopus's environment, and generate disruptive, light-scattering patterns by changing the skin surface from smooth to rough.

To achieve even greater camouflage, the octopus can use its skin muscles to change the texture of its mantle, the richly muscled structure where all of its organs are located. The mantle can take on the look of spiky seaweed or the craggy, rough texture of a rock, among many other disguises.

The master disguiser among cephalopods is the mimic octopus (*Thaumoctopus mimicus*), which has the uncanny ability to take on the look of dangerous animals, such as lionfish, sea snakes, and eels.

How octopuses translate information they see in their environment into rapid color, shape, and texture changes remains a puzzle to scientists. Remarkably, octopuses are thought to be colorblind, so they cannot visualize the colors they are mimicking. In any event, the octopus's camouflage abilities are especially valuable, given its lack of any external shell.

RAY

Manta

Tampa Bay Rays (MLB)

FAST FACTS

Anatomically, manta rays are a flattened form of shark.

Overfishing is the single greatest threat to manta rays, especially due to their low reproduction rates and because it takes them 15 years to reach sexual maturity.

Mantas are proving to be more valuable alive than dead due to the popularity of diving operations and snorkeling tours.

Due to the decreasing levels of plankton, which mantas eat, mantas have been observed choosing not to procreate.

THREATS

Habitat reduction

Toxic chemicals

Climate

Overconsumption

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Habitat preservation and protection

Toxic chemical use reduction

Climate remediation

Halting of illegal trade, trafficking, and poaching

Manta rays, like sharks (to which they are closely related), have skeletons made of tough cartilage (a strong, fibrous, elastic connective tissue) rather than bone. In fact, anatomically a ray is a flattened form of shark. Rays and sharks make up the subclass of cartilaginous fish known as elasmobranchs. Unlike fish that maintain buoyancy with swim bladders, elasmobranchs rely instead on large livers rich in oil to stay afloat.

Manta means “cloak” or “blanket” in Spanish, referring not to the manta ray’s broad, flat body but to the blanket-shaped trap traditionally used to catch them. The animal is also called the devilfish because of its cephalic (head) fins, which resemble the horns of a devil. Actually, the principal, and very benign, function of these cephalic fins is to channel planktonic organisms into the ray’s gaping mouth while it is feeding.

Mantas are found in tropical, subtropical, and warm temperate waters. They migrate across open oceans both solo and in groups. Mantas can reach huge sizes—3,000 pounds and 25 feet across, with some recorded weighing 5,000 pounds. Manta rays are renowned for leaping three feet into the air, momentarily appearing like a stealth bomber before crashing back into the water with a sound that can be heard for miles. Why they breach remains a mystery to scientists, but it is thought to be a display of fitness to attract mates, an effort to escape a predator, or a means of shaking off skin parasites. Rays are capable of swimming up to 25 miles per hour.

Divers and snorkelers are mesmerized by the intricate courtship behavior of mantas, which lasts days to weeks. Several dozen males compete to mate with the female, doggedly following her around in what is known as a mating train. The female leads the males as she twirls, whirls, speeds along, dives, twists and turns, her acrobatics testing the fitness and tenacity of the males as they jockey to keep up with her and gain her selection.

Manta rays have a life span as long as 50 years, if they do not succumb to the extensive overfishing that now threatens them.

ENVIRONMENTAL THREATS TODAY

Because rays and sharks are closely related, they are typically researched together. According to the IUCN's 2010 global report of vertebrates, one-third of the 1,041 species of ray and shark are threatened with extinction. A 2014 IUCN assessment concluded that just 37 percent of the 1,041 are considered to be safe.

Commercial fisheries are focused on harvesting the rays' gill plates, or gill rakers, the fingerlike projections the manta uses to filter zooplankton from the water. In recent years there has been an explosion of trade in these gill plates for the Chinese "medicine" market. This is a totally fabricated market; dried manta gills have never been used in traditional Chinese medicine, and there is no evidence that the gills possess any therapeutic value.

Still, every year thousands of manta rays are killed solely for gill rakers. This has driven some local populations to extinction. In fact, at most of the key aggregation sites around the world where huge numbers of manta rays have historically come to feed and mate, populations have already declined to fewer than 1,000 individuals.

Mantas are also at risk of becoming bycatch in the gill nets widely used by commercial fisheries. Mantas get oxygen by moving water through their gills as they swim. When they become entangled in gill nets they are unable to move, leading to suffocation and drowning.

Ironically, as mantas disappear, they are proving to be more valuable alive than dead. It is estimated that the direct income to diving operations from manta ray dives and snorkeling tours annually exceeds $73 million, and twice this amount when tourism-related revenues are included.

Protecting rays from overfishing and gill nets is an immediate and ongoing need, but not sufficient. A harbinger of another threat has been documented in the Maldives Islands in the Indian Ocean, where large aggregations of manta rays feed and mate. In recent years there has been a marked decline in mating. This has coincided with a dramatic change in monsoon weather patterns, a weakening of the winds normally relied upon to churn up the oceans and cause an upwelling of nutrients needed for plankton to bloom. Satellite measurements of chlorophyll in the Maldives region confirm extremely low levels of plankton.

Mantas have a very low rate of reproduction to begin with, typically producing just one offspring every several years. Now it appears the manta rays are deciding not to take the risk of breeding when food is scarce.

Such dramatic weather changes are part of the emerging threat to the ray's long-term survival, which is the double risk caused by CO2 emissions from fossil fuel combustion and the burning of tropical forests. CO2 is heating up the atmosphere and sea temperatures to unprecedented levels and acidifying the ocean at a rate not experienced in 300 million years. The current trend is projected to raise the global average temperature 9° to 14°F towards the end of the century.

Already, with just a 1.3°F increase in ocean temperatures over the past 50 years, there has been a 40 percent loss in ocean phytoplankton, the base of the food chain for marine species. One-fifth of the world's coral reefs are dead, including 50 percent of Caribbean corals, and most coral reefs are projected to die off within the next several decades as sea temperatures exceed a 3.6°F (2°C) increase. Ocean scientists are calling for a cap on global combustion of fossil fuels by 2015, and then a steady decrease in CO2 emissions by 5 percent per year down to zero. If current trends continue, most of the ocean's large species will be threatened with extinction by the end of the century.

RANGE

Mantas are found in tropical and subtropical waters in all of the world's major oceans. They also venture into warmer temperate seas where water temperatures remain above 68°F. Rays are open-ocean (pelagic) travelers, migrating with the currents to nutrient-rich upwellings where zooplankton is concentrated. Mantas will descend to 3,000 feet in search of prey.

WILD NATURE FACTS

Mantas travel solo as well as in groups of as many as 50 individuals. They also may interact with other fish species, marine mammals, and seabirds.

Manta rays engulf vast sums of plankton. Plankton is a rich diversity of organisms unable to swim against a current (plankton is derived from the Greek for "drifter" or "wanderer"). It includes shrimp, krill, planktonic larvae of crabs, clams, sea stars, barnacles, worms, and much more.

A single manta consumes about 13 percent of its body weight each week, or about 50 pounds a day for a large manta. Its unique style of foraging involves leisurely swimming around its concentrated prey, driving it into a tight bundle. It then rushes through the bundle of plankton, taking a large mass of it into its gaping mouth. If a ball is especially dense, a manta may somersault through it to break up the mass.

Mantas are preyed upon by the 16-foot, 1,500-pound warm water tiger shark, and by orca (killer) whales.

Like many large fish, mantas have their skin parasites scoured by visiting "cleaning stations" on coral reefs. The ray remains virtually still for several minutes near the coral surface while so-called cleaner fish—like wrasses, gobies, and cleaner shrimp—consume the parasites inside the ray's mouth and on its skin.

SHARK

Selachimorpha (Superorder)

SJ Sharkie, San Jose Sharks (NHL)

FAST FACTS

The great white shark can detect one drop of blood mixed in 10 billion drops of water.

Sharks have a sixth sense that scientists have variously termed a genetic GPS, a magnetic mental map or an internal cartography system.

Due to overfishing and shark finning, an estimated one-third of shark species are at serious risk for extinction.

Most—80 percent—of shark species are smaller than humans.

THREATS

Habitat reduction

Toxic chemicals

Climate

Overconsumption

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Climate remediation

Habitat preservation and protection

Halting of illegal trade, trafficking, and poaching

Toxic chemical use reduction

Say the word *shark* and the apex marine predator, the great white shark, comes to mind. This 5,000-pound, bus-sized ocean hunter has exceptional senses. With its acute sense of smell, it is capable of detecting a single drop of blood mixed in 10 billion drops of water.

Like humans' eyes, shark eyes contain both cones and rods, the former adapted for day vision, the latter for low light and night. Unlike humans and many terrestrial animals, which have trichromatic (three-color) cones, sharks are colorblind due to possessing monochromatic (one-color) cones, which enable them to perceive through visual contrast.

Sharks have a sixth sense that scientists have variously termed a genetic GPS, a magnetic mental map, or an internal cartography system. The shark's nose is filled with a network of jelly-filled cells (called the ampullae of Lorenzini) that are electroreceptors, sensing the power and direction of electrical currents and magnetic fields. It is thought that these electroreceptors serve two purposes: detecting prey through the weak magnetic fields they produce, and serving as a navigation device. Like many other migrating marine and avian species that travel long distances to specific locations, sharks take advantage of the geomagnetic fields crisscrossing Earth's crust. By detecting the inclination and intensity of the magnetic field, sharks (as well as manta rays, sea turtles, dolphins, whales, and many other marine species) can correct against strong currents pushing them off course.

The great white's torpedo shape allows it to reach speeds up to 35 miles an hour. Like other fierce sharks (tiger, bull, and mako) that prey on seals and marine mammals, the great white possesses several hundred razor-sharp, serrated cutting teeth for ripping chunks of flesh from its prey.

RANGE

Sharks are found in all the world's seas and are common to depths of 6,600 feet. The shark's ancestors go back nearly 300 million years. Some sharks, like the megatooth, which lived 20 million years ago, were giants 10 times the size of today's great whites. Surprisingly, 80 percent of shark species are smaller than humans.

Some sharks have already been fished to near-extinction in certain areas. In the Gulf of Mexico, 99 percent of the oceanic whitetip shark population has disappeared completely. Some 99 percent of all bull and tiger sharks in the northeast Atlantic are gone, as are 96 to 99 percent of all large sharks in the Mediterranean Sea.

ENVIRONMENTAL THREATS TODAY

Great whites are just one of more than 440 shark species. Sharks range from the 6-inch-long dwarf lantern shark to the 60-foot-long whale shark. Unfortunately, due to overfishing and shark finning, an estimated 100 species currently face an extremely high risk of extinction in the wild.

More than half of all pelagic (coastal and oceanic) shark species are listed as near threatened to critically endangered. Some 100 million sharks are killed each year (11,400 sharks killed every hour, 274,000 killed every day) primarily for their fins, which are considered a food delicacy in Asia, with the rest of the sharks' bodies typically discarded. Tens of thousands of sharks are also killed annually due to an irrational fear of shark attacks on humans. In contrast, sharks kill only half a dozen to a dozen humans a year. More people are killed every year by dogs and other domestic pets than by sharks.

Sharks are among the least resilient of fishes, highly vulnerable to exploitation because most species grow slowly, mature late, and produce few young. The IUCN Red List of Threatened Species names 64 species, one-third of all oceanic (deep ocean) shark species, at risk of extinction due to overfishing and shark finning.

The Monterey Bay Aquarium's Seafood Watch recommends that consumers not eat shark. In 2000, the United States passed the Shark Finning Prohibition Act. Also, nations like South Africa, Australia, New Zealand, and Israel protect great white sharks in their waters. The Convention on International Trade in Endangered Species (CITES) has banned international trade of products from great white sharks.

Protecting sharks from overfishing and shark finning is an immediate and ongoing need, but not sufficient. Another emerging threat to their long-term survival is the double risk caused by CO_2 emissions from fossil fuel combustion and the burning of tropical forests. CO_2 is heating up the atmosphere and sea temperatures to unprecedented levels and acidifying the ocean at a rate not experienced in 300 million years. The current trend is projected to raise the global average temperature 9° to 14°F towards the end of this century.

Already, with just a 1.3°F increase in ocean temperatures over the past 50 years, there has been a 40 percent loss in ocean phytoplankton, the base of the food chain for marine species. One-fifth of the world's coral reefs are dead, including 50 percent of Caribbean corals, and most coral reefs are projected to die off within the next several decades as sea temperatures exceed a 3.6°F (2°C) increase. Ocean scientists are calling for a cap on global combustion of fossil fuels by 2015, and then a steady decrease in CO2 emissions by 5 percent per year down to zero. If current trends continue, most of the ocean's large species will be threatened with extinction by the end of the century.

WILD NATURE FACTS

Sharks, like rays, are in the class of fish called chondrichthyes (Greek for "cartilage fish"). They come from an ancient vertebrate lineage dating back 420 million years. Unlike most fish with bony skeletons, a shark's skeleton is made of stiff, flexible, fibrous cartilage. Whereas most fish are covered in smooth, flat scales, a shark's sandpapery skin consists of millions of microscopic, sharp, toothlike scales called denticles. In addition to protecting the skin from damage and parasites, the tiny scales enhance thrust and reduce drag and friction as the shark swims through the water.

A shark has five to seven gill slits on each side of the body for breathing; most fish have just one per side.

Sharks can dislocate and protrude their upper jaw to grab and hang onto prey (in contrast to humans, whose upper jaw is a fixed part of the skull).

Most sharks have at least four rows of teeth. The back rows move forward as the first row wears out, and new teeth are always forming. Some sharks will go through more than 30,000 teeth during their lifetime.

Most sharks hunt in the evening and at night. Some have been tracked migrating over immense distances, entire ocean basins, to feed and breed.

RATTLESNAKE

Crotalus, Crotalus atrox

Arizona Diamondbacks (MLB)

FAST FACTS

Rattlesnakes have an infrared heat-sensing organ between each nostril and each eye, which allows them to locate prey and predators.

Arizona Diamondback accounts for most snakebite fatalities in Mexico and is second only to the eastern diamondback in the United States.

In the South and Midwest United States, rattlesnake rodeos have been common since the 1940's. At these events, snakes are killed for food, skins, and entertainment. The largest is held in Texas and attracts approximately 30,000 people.

Rattlesnake bites are rarely deadly to humans since their fangs do not fully inject the venom

THREATS

Habitat reduction

Climate

Overconsumption

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Habitat preservation and protection

Climate remediation

Halting of illegal trade, trafficking, and poaching

The Arizona diamondback rattlesnake (Crotalus atrox) is one of 32 species of venomous pit viper found only in North and South America, from northern Argentina to southern Canada. The Arizona diamondback is the largest rattlesnake in the American West. It is also known as the adobe snake, desert diamondback, desert diamond rattlesnake, fierce rattlesnake, spitting rattlesnake, Texan rattlesnake, Texas diamondback, and western diamondback or diamond-backed rattlesnake.

Rattlesnakes have an infrared heat–sensing organ called the loreal pit, situated between each nostril and eye, to help locate prey and potential predators. Just as people have glands that make saliva, rattlesnakes have glands that make venom. Although used occasionally in defense, the principal biological function of venom is to immobilize prey and assist in digestion.

Rattlesnakes use their heat-sensing facial pits, a chemically receptive tongue, and their eyes to locate their prey, then kill it with their fangs and venom. Snakes swallow their prey whole, since they are unable to chew or bite off pieces.

Ecologically, adult rattlesnakes are top carnivores. More than 90 percent of diamondback prey consists of small mammals including cotton rats, fox squirrels, ground squirrels, harvest mice, jackrabbits, kangaroo rats, moles, Old World rats and mice, pocket gophers, pocket mice, prairie dogs, rabbits, voles, white-footed mice, and wood rats. Birds and lizards are also preyed upon, the latter mostly by young snakes.

The Arizona diamondback is thought to account for most snakebite fatalities in northern Mexico and the second-greatest number of snakebites in the United States, after the eastern diamondback rattlesnake (Crotalus adamanteus). In the western states, although the Arizona diamondback produces more venom, the western rattlesnake (Crotalus oreganus) has venom twice as strong.

The eastern diamondback, found throughout the Southeast United States, is listed in Guinness World Records as the heaviest venomous snake. It is also the largest rattlesnake in the United States, reaching eight feet and more than 30 pounds. The eastern diamondback featured prominently in the American Revolution. The first U.S. flag, known as the Gadsden flag, bore the eastern diamondback as its symbol.

The Arizona diamondback is considered one of the more aggressive rattlesnake species found in North America, rarely backing away from confrontation. The diamondback reaches four to seven feet in length and 6 to 15 pounds in weight. It is a dusty gray-brown, although there can be various mixtures of pinkish-brown, brick red, and yellowish, pinkish, or chalky white.

Rattlesnakes have the remarkable ability to survive without food for up to two years. Studies have found that the snakes can reduce their energy use by 80 percent. Even more incredibly, rattlesnakes can continue growing during periods without food, feeding on its internal energy-rich lipid stores to grow skeletal muscles and bones, even while its overall mass is declining.

ENVIRONMENTAL THREATS TODAY

The Arizona diamondback is classified as a species of least concern on the IUCN Red List of Threatened Species. This status indicates that the species has a wide distribution and large population and is unlikely to decline quickly enough to qualify for listing in a more threatened category. Just one rattlesnake species appears on the U.S. Fish and Wildlife Service's list of endangered species: the New Mexican ridge-nosed rattlesnake (Crotalus willardi obscurus), found in mountainous areas of New Mexico and Arizona. However, even it has a sufficient population to be listed as a species of least concern on the IUCN Red List.

Rattlesnakes have long been hunted and killed. They are continually harvested from the wild, with hunters sometimes using gasoline to drive them out of their dens. Common in rural Midwest and Southern states since the 1940s are rattlesnake rodeos, or roundups, in which the snakes are killed for food, skins, and entertainment. Sweetwater, Texas, annually holds the largest rattlesnake rodeo in the nation, attended by some 30,000 people. It is estimated that 1 percent of the state's rattlesnakes are captured for the event. About 15 percent of the 125,000 rattlesnakes annually captured in the U.S. are intentionally killed at rattlesnake rodeos.

The American Society of Ichthyologists and Herpetologists (ASIH) strongly oppose traditional rattlesnake roundups. Roundups encourage overexploitation of wildlife populations, needless killing, inhumane treatment of individual animals, habitat destruction and degradation, and perpetuation of archaic attitudes toward important components of the nation's natural heritage. ASIH points to many communities that have opted to sustain the income generated from roundups by effectively converting roundups into other kinds of festivals. Further noting, "Our forefathers viewed the rattlesnake as a symbol of strength and independence, a perception that deserves to be encouraged once again."

Currently, four of the 32 rattlesnake species are listed on the IUCN Red List of Threatened Species: three in Mexico are listed as vulnerable (Crotalus stejnegeri), endangered (Crotalus pusillus) or critically endangered (Crotalus catalinensis), and one on Aruba island (Crotalus unicolor). Five other species face decreasing populations, but are still sufficiently large to remain Least Concern.

However, as seen with the Chytrid fungus plague over the past three decades that is driving most of the planet's 6,000 frog species to mass mortality and towards extinction, it is entirely possible for common and "secure" species to become rare, endangered or even "extinct" within a few short years. Many rattlesnake species are losing habitat due to conversion into agriculture and human settlements.

RANGE

There are 13 species of rattlesnake in Arizona, more than in any other state. The types most often encountered by people are the Arizona or western diamondback, western rattlesnake, Mohave, blacktail and sidewinder. The Mohave rattlesnake, often confused with the Arizona diamondback, has a deadly neurotoxic venom that makes it the most poisonous rattlesnake in America.

Four species of rattlesnake are protected in Arizona: the ridge-nosed, twin-spotted, rock, and massasauga. The first three are montane species, and the massasauga, the most primitive form of rattlesnake in the United States, inhabits grasslands. In Arizona it is found only in the extreme southeastern corner of the state, but it ranges all the way to Michigan and Ontario. Its name means "great river mouth" in the Chippewa language and was probably descriptive of grasslands surrounding river deltas in Chippewa country. It is illegal to collect or kill these four rattlesnakes in Arizona.

The Arizona ridge-nosed rattlesnake is the official state reptile, and gets its name from the raised ridge of scales around its snout.

The Arizona diamondback rattlesnake ranges across the U.S. Southwest from Texas to California, as well as parts of Arkansas, Oklahoma and Idaho. The diamondback also inhabits northern Mexico from the Pacific coast to the Gulf of Mexico.

From the perspective of deep history, snakes were "the first and most persistent predators" of early mammals, says professor Lynne Isbell, a behavioral ecologist at the University of California, Davis. She hypothesizes that the ever-present threat posed by snakes

helped shape the emergence and evolution of primates. The core argument is that successfully spotting camouflaged snakes lurking among leaves selectively advantaged primates with forward-facing eyes and enlarged specialized visual centers deep in the brain.

This snake-centric theory of primate evolution stands in sharp contrast to the more broadly accepted theory that it was the need for visually guided reaching and grasping for food that led to orbital eye convergence for stereoscopic vision, visual specialization, and brain expansion in primates. There is no neurological evidence confirming the orbital hypothesis. However, an October 2013 publication in the Proceedings of the National Academy of Sciences describes "the first neuroscientific support" for the snake-centric evolutionary theory. The findings focus on a cluster of neurons called the pulvinar, located in an ancient part of the brain called the thalamus. Pulvinar neurons are thought to assist in directing our focus to recognize potential threats, like hidden snakes. Primates, it turns out, have much larger pulvinars than other animals, and certain parts of the pulvinar are unique to primates.

WILD NATURE FACTS

The normal life expectancy of a rattlesnake averages more than 20 years. During the winter, rattlesnakes hibernate or bromate (remain dormant, but often wake up to drink water, then return to "sleep" with the ability to go for months without food). They seek caves or burrows and may share their space with many other snake species. Rattlesnakes use pre-established structures instead of digging their own dens. Unlike many snake species, Arizona diamondback rattlesnakes are poor climbers. Adults have no natural predators, but a number of animals, including hawks, eagles, coyotes, foxes, and other snakes, do prey on young snakes.

Rattlesnake venom serves two primary functions: It incapacitates the snake's prey so it cannot escape or cause retaliatory wounds, and it aids the snake's digestion. All rattlesnake venoms are complex mixtures of enzymes and other proteins. The composition and effects of venoms vary widely between species, as well as between different geographic populations of the same species. Most of the toxin released is proteolytic, meaning that it breaks down proteins. The venom's concentrated fluids essentially digest molecules, destroying cells and tissues.

The Arizona diamondback's venom is primarily hemotoxic (blood-destroying), affecting mainly the prey's blood vessels, blood cells, and heart. The venom causes profuse bleeding due to hemorrhagic components called zinc metalloproteinases. Cytotoxic (cell-destroying) and myotoxic (muscle-destroying) components are also part of the venomous cocktail. In addition to hemorrhage, venom metalloproteinases trigger skeletal muscle damage and myonecrosis (death of muscle). These latter impacts appear to occur as a result of the profuse bleeding, which restricts blood supply to the muscle tissue.

In most cases, the snake's bite does not result in full injection of the venom and therefore rarely proves lethal to humans. Venomous snakebites represent a minimal hazard to human health. The Centers for Disease Control and Prevention reports that about 15 people die from a venomous snakebite in this country each year. (By comparison, 12 people die from dog bites and 82 people die from lightning strikes annually.) If a snakebite is left untreated, the mortality rate is between 10 percent and 20 percent. In sharp contrast, injection of venom into small prey leads to certain death within minutes.

Recent DNA research indicates that when snakes first evolved, 100 million years ago, their venom genes were already 100 million years old. The common ancestor of snakes, living 200 million years ago, already possessed a complex arsenal of nine or more venoms.

Hollow fangs are the rattlesnake's means of efficiently delivering the deadly venom to its prey. Species of the Crotalus genus have the longest fangs among the nearly 3,000 snake species in the world. Fangs are individually hinged, enabling them to readily rotate from a resting, folded position in the hollow of the snake's jaw to an active striking position.

The fangs are replaced roughly every two months or sooner by a series of replacement fangs lining the upper jaw. Rattlesnakes can control the amount of venom they release from either fang by regulating the pressure on sphincter muscles adjacent to the venom glands.

Arizona diamondbacks breed twice a year, in spring and in late summer/fall. Other rattlesnake species have only a single breeding season. During such times, snake "dances" may occur when two males encounter each other. Both snakes raise the front half of their body off the ground to engage in combat, and the smaller male may be forcefully thrown to the ground by the larger male. If the two are the same size, the combat dance may last a long time. The winner gets breeding rights, while the loser experiences a physiological reaction that subdues its breeding urge.

Rattlesnake courtship is fairly subtle. The male sidles up to the female, sometimes coiling around her and usually laying his head on her. The male also exhibits "chin rubbing," which involves frequent twitching or jerking of the head. Females may respond and copulate or hide their head to display a lack of receptiveness.

Gestation lasts half a year, after which one to two dozen young are born. Within a few hours of birth, the foot-long young, fully capable of delivering a venomous bite, head off on their own, ready to hunt and find a den. The mortality rate is very high.

Rattlesnakes are not born with a rattle on their tail. The newborn begin with a small knob known as a prebutton. Then when the young snake sheds its skin, the prebutton is replaced with a button. Each subsequent shedding results in another segment added to the rattle. The rattle is made of keratin, the same material found in human hair and fingernails. Rattlesnakes shed several times a year. Because rattle segments occasionally break off, it is not true, as is generally believed, that a rattlesnake's rattle segments indicate its age.

THUNDER BUG/ LIGHTING BUG/ FIREFLY

Photinus species, Lampyridae family

ThunderBug, Tampa Bay Lightning (NHL)

FAST FACTS

There are 2,000 species of firefly worldwide, with 120 in North America.

Fireflies are not flies, but tiny beetles.

Fireflies are sentinel species, meaning that when they die out it is indicative of a major environmental degradation and deterioration.

Fireflies are largely under threat due to human expansion, which threatens their habitat, as well as pesticides and artificial light pollution.

THREATS

Habitat reduction

Toxic chemicals

Climate

Overconsumption

GMOs

WHAT NEEDS TO BE DONE

Climate Remediation

GMO Regulation

Habitat Preservation and Protection

Toxic Chemical Use Reduction

The thunderbug, lightning bug, or firefly is one of the planet's most amazing wonders. Flashing their twinkling lights like miniature Chinese lanterns, fireflies conjure up the mystery and beauty permeating nature. Naturalists and explorers of long ago recorded dense, immense, and brilliant lightning bug colonies that they compared to the star-studded Milky Way.

There are 2,000 species of lightning bug worldwide, including 120 species in North America. Each species synchronizes its light signals differently. Fireflies are not flies but tiny beetles in the family Lampyridae. Moreover, they don't produce fire but a cool green or yellow glow. North America's flashing fireflies are found mainly in the warmer and wetter states east of the Rocky Mountains. There are fireflies in the dry western states, but they are dark and nonluminescent.

North American fireflies spend two years as larvae underground, then spend two to three weeks alive as adults, flashing sexual signals, mating, avoiding being eaten by predators, and laying eggs. The larvae do virtually all the feeding, while adults ignore eating in preference of mating and laying eggs.

Fireflies have evolved a chemical protection system against predators. In a process known as reflex bleeding, they release drops of blood containing bitter and poisonous chemicals; this warns off many predator animals.

Botanists consider the firefly a symbol for the fertility and balance of nature, given how tightly connected their life cycle is to intact, healthy ecosystems.

Among the several thousand firefly species, there are adults that flash, other adults that only glow, and still others that produce no light, relying instead on chemical pheromones to do their signaling. Flashing males and females are essentially seeking mates with synchronizing signals. They also use their light signals to defend their territory and warn off predators. All firefly larvae glow, which helps ward off potential predators. Like the adults, the larvae's bodies contain bitter chemicals.

Flashing males parade in the air while the females view from the ground or in trees, carefully selecting the fittest mates. A female will initiate signal exchanges with as many as 10 males in a single evening, sustaining several ongoing conversations. In the end each female mates with only one male, usually the one she has signaled the most.

Female fireflies are fastidious "buy-wise" shoppers. Many male flashes get no response at all. Depending on the species, females may prefer rapid pulse rates while other species' females may prefer long-lasting pulses from the males. Researchers have found that female response to males signaling certain flash patterns results in more offspring, indicating it is an inherited preference.

Like many invertebrates, male fireflies come bearing nuptial gifts—packages of protein they insert along with their sperm. The protein greatly enhances the female's reproductive success, doubling the number of eggs a female can lay in her short lifetime.

Often found among the flashing fireflies signaling to potential mates is a great deceiver and nasty predator, the *Photuris versicolor*. It is a firefly that eats the smaller *Photinus* fireflies. *Photuris* males use aerial assaults to attack the males of flashing species. More frequently, *Photuris* females wait on a blade of grass, signaling to male fireflies with deceptive flashes. When the males leap at the opportunity to mate, the *Photuris* female cannibalizes them. The *Photuris* firefly is unfazed by the toxic chemicals the *Photinus* species produce to defend against predators. In fact, the *Photuris* firefly sucks in the foul-tasting chemical and deploys it to protect itself from predators.

As firefly biologist Sara Lewis observes, "Every single night, male fireflies are out there flying a fine line between sex and death. For us, it definitely rivals the most exciting television thriller! So, next time you're outside on a summer night, take a moment to admire the firefly romance and risk that's playing out all around you."

RANGE

The greatest diversity in lightning bug species is found in tropical Asia as well as Central and South America. North America's 120 species of firefly fauna migrated to the continent multiple times from multiple origins, notably Europe and Asia, over the past 5 million years.

Fireflies are drawn to warm, humid environments, thriving in tropical regions and moist, wet temperate zones. They appear in summertime on all continents except Antarctica, typically in forests and marshes and near lakes, rivers, streams, and vernal pools. A moist environment is imperative for survival. Some species of firefly larvae are aquatic, while others exist almost entirely in trees.

ENVIRONMENTAL THREATS TODAY

Once upon a time there were vast colonies of fireflies lighting up woodlands, meadows, mangroves, wetlands, riverbanks, ponds, and grasslands. Vietnamese fishermen would even read their newspapers by the glow of the firefly light at night. Unfortunately, there has been a dramatic collapse in these once-abundant species. Fireflies have become what ecologists call a sentinel species. When they die out, it signals that major degradation and deterioration are occurring throughout the habitat.

Human population growth and expansion have converted much of the firefly's habitats into paved roads, residential and commercial enclaves, industrial operations, and seemingly endless fields of agriculture and aquaculture. The widespread, heavy use of pesticides has polluted air, water, and soil. The spraying directly kills the fireflies and their larvae. The pesticides also kill off the larvae's food sources, putting the larvae at risk of dying from starvation. Artificial light pollution also adversely impacts fireflies. Bright lights from homes and businesses with landscaped lawns and lots of exterior lights can alter fireflies' synchronistic signaling systems.

The multiple threats of habitat loss, chemical contamination, and excessive night lighting are combining to drive massive populations of fireflies out of existence.

Fortunately there are initiatives like Firefly Watch, a research group hosted by the Boston Museum of Science that enlists "citizen scientists" in 40 states to voluntarily record firefly sightings each summer. Collecting this information helps build an understanding of how to help protect and restore firefly populations.

WILD NATURE FACTS

Fireflies are a nighttime (nocturnal) species, hidden away on the ground or in trees during the day. As night descends the females crawl to the tops of blades of grass and then fly into tree branches to signal for mates. Tall grass helps camouflage the fireflies while still enabling their signals to be seen by potential mates at night. So avoiding over-mowing lawns can aid in protecting firefly populations.

Firefly lights are the most efficient lights in the world. Nearly 100 percent of the released energy is emitted as light. By comparison, an incandescent bulb emits only 10 percent of its energy as light; the rest is heat. Scientists refer to firefly light as cold light because it produces near-zero heat.

The firefly's light organ is situated under the abdomen. Simply put, lightning bugs absorb oxygen inside special cells, where it is combined with a heat-resistant chemical compound called luciferin that generates light under certain conditions. A second chemical, an enzyme called luciferase, triggers the light emission.

Scientists have discovered beneficial uses for luciferase. It serves as a marker to detect blood clots, to tag tuberculosis virus cells, and to monitor hydrogen peroxide levels in living organisms. Hydrogen peroxide is thought to facilitate some diseases, like cancer and diabetes.

Firefly larvae prey on underground snails and slugs by injecting them with a numbing fluid. In contrast, adult fireflies prefer to feed on nectar or pollen, although many adults starve during the 14 to 21 days they are obsessed with mating and egg laying.

RESOURCE GUIDE TO NON-ENDANGERED ANIMALS USED AS PROFESSIONAL SPORTS MASCOTS

BULL

Bos taurus

Benny the Bull, Chicago Bulls (NBA)
Toro, Houston Texans (NFL)

FAST FACTS

Bull attacks account for more than 40 percent of livestock-related fatalities in Canada. Only about 1 in 20 victims of a bull attack survive.

Although cattle as a species are not threatened, about 500 cattle breeds are acutely threatened with extinction or loss by being blended into other breeds.

Given the need for only a few breeding bulls, most male cattle are castrated as calves to minimize aggressive threats and avoid mating. These bulls go to the slaughterhouse within 3 years.

THREATS

Habitat reduction

Toxic chemicals

Climate

Overconsumption

WHAT NEEDS TO BE DONE

Climate Remediation

Habitat Preservation and Protection

Toxic Chemical Use Reduction

Long before recorded history, the importance of the bull was recognized in cave paintings going back 17,000 years. The ancestral wild bull, a 3,300-pound charging aurochs (from the German term for “ox”), is an icon of strength and aggressive intimidation.

The bull is a mature adult male bovine of the species *Bos taurus*. It has intact testicles (castrated males are steers) and is used for breeding. Bulls are taller, heavier, and more muscular than female cows, with thicker bones, bigger feet, an enormous neck, a huge, bony head, and protective ridges over the eyes. These features aid bulls in competing for domination over a herd.

Almost all cattle bred worldwide have horns, both males and females. Horns grow in different ways depending on the breed. Texas longhorns, for example, have horns that grow outward and then curve up. English longhorns, in contrast, have horns growing downward.

Just how fierce and dangerous bulls can be is reflected in the fact that bull attacks account for more than 40 percent of livestock-related fatalities in Canada. Only about one victim out of 20 survives a bull attack. In the United States prior to 1940, the most frequent cause of death in the dairy industry was being gored, trampled, or otherwise crushed by a bull.

RANGE

A colder global climate that appeared some 2.5 to 5.3 million years ago resulted in the expansion of open grasslands. This, in turn, led to the evolution of large wild bovine grazers. About 2 million years ago the aurochs, the wild ancestor of today’s taurine and zebu domestic cattle, appeared in India. The species migrated east through Asia, and across western Asia to the Middle East. About 270,000 years ago cattle reached Europe.

Today more than 1 billion head of beef cattle are raised worldwide, 80 percent of which are located in Brazil, China, India, and the United States. Another 265 million animals are maintained as dairy herds.

ENVIRONMENTAL THREATS TODAY

As a species, cattle are not threatened. However, according to the U.N. Food and Agriculture Organization, 500 different cattle breeds are acutely threatened with extinction or loss from blending into other breeds. There are efforts to try and conserve these rapidly disappearing rare breeds, as well as breeds possessing desirable qualities, notably the Texas longhorn and a number of older European breeds.

Ranchers and farmers have been modifying the species for millennia, and there are now more than 800 cattle breeds worldwide. Breeds are derived from two primary subspecies, zebu and taurine. The zebu (*Bos taurus indicus*) is adapted to hot climates. Taurine cattle (*Bos taurus taurus*) are adapted to cooler weather, as is found in Europe and northeastern Asia.

WILD NATURE FACTS

Given the need for only a small number of breeding bulls, most male cattle are castrated as calves to minimize aggressive traits and avoid mating. These bulls go to the slaughterhouse within three years.

COYOTE

Canis latrans

The Coyote, San Antonio Spurs (NBA)
Howler, Phoenix Coyotes (NHL)

FAST FACTS

Coyotes are incredibly adaptable animals. In the eastern United States, when wolves were pushed out of the environment, coyotes took their place since they are better at coexisting with humans.

Coyotes range from Panama to Canada.

About 90,000 coyotes are killed each year by federal agencies to protect livestock.

THREATS

Habitat Reduction

Climate

WHAT NEEDS TO BE DONE

Climate Remediation

Habitat Preservation and Protection

The name *coyote* is derived from the Aztec word *cóyotl*, meaning "trickster." The animal is also known as the American jackal, brush wolf, or prairie wolf. It is a canine species native to North and Central America with a reputation for being clever, inventive, adaptable, and evasive.

The wily coyote pursues prey or escapes predators at speeds up to 43 miles per hour. It is also capable of 13-foot leaps.

Many Native American, First Nation, and aboriginal cultures include a deity or cultural hero in their creation mythologies whose name means "coyote" in English. The southwest Diné and Apache nations recount many tales of the coyote trickster figure.

RANGE

The coyote was mainly located in the western half of North America before the arrival of settlers but has been remarkably adept in steadily extending its range throughout the continent. It originally lived primarily in western grasslands and deserts but now lives throughout most of North America in diverse habitats. Coyotes are found roaming prairie, forest, desert, mountain, and tropical ecosystems. They range as far south as Panama to as far north as Canada and Alaska.

There are 19 subspecies across the continent, including three in Central America and 16 in North America. The coyote is thought to have evolved in North America about 1.8 million years ago alongside the dire wolf. Another related species, the gray wolf, originated in Eurasia.

ENVIRONMENTAL THREATS TODAY

There are no current threats to coyote populations throughout their range. They may experience temporary local reductions, but their range continues to expand. Conservation measures have not been needed to maintain viable populations. Coyotes adapt well to most habitats, including cities and suburbs.

About 90,000 coyotes each year are shot, poisoned, or trapped and killed by federal agencies to protect livestock. In spite of this extensive hunting, the coyote has been successful at enlarging its range since the beginning of human settlement.

WILD NATURE FACTS

Northern coyotes are bigger than southern subspecies, weighing as much as 75 pounds and measuring nearly 6 feet in length. Wild coyotes have a life span of about 10 years.

Coyotes hunt at night, primarily in pairs, but also occasionally in large packs. They flourish in habitat where wolves have been exterminated, apparently more adept at living among humans than with wolves. After New England became populated and settlers killed off the resident wolves, coyotes filled up the empty ecological niche.

In late winter, the female coyote comes into heat for one week. She will give birth to a litter with as many as 19 pups, although 6 is the average. The pups are born blind, each weighing about half a pound. Big litters compensate for high mortality rates among pups: some 50 to 70 percent fail to survive to maturity.

Coyotes are adaptable omnivores, eating what is readily available. Depending on the habitat, they will consume a variety of small mammals like voles, prairie dogs, cottontail rabbits, ground squirrels, mice, birds, snakes, lizards, deer, livestock, and birds, as well as insects and other invertebrates. Coyote packs will even pursue 600-pound adult elk. Throughout summer and fall they will also consume an abundance of fruits and vegetables.

Coyotes will persist for long periods in hunting down prey, more than 20 hours in some cases. Even unsuccessful hunts may go on for more than eight hours before being abandoned.

Gray wolves often prey on coyotes. Since coyotes can run uphill faster than wolves, they are more secure on steep terrain. They will run downhill from a pursuing wolf, then suddenly turn and run back uphill. Because the heavier wolf is not as agile in reversing direction, the coyote can gain a large lead.

Cougars and bears also kill coyotes, but coyote packs have also driven both cougars and bears away from downed prey.

A curious symbiotic hunting association sometimes occurs between coyotes and American badgers. The badger is adept at digging rodents out of their burrows but is a slow runner. Digging is difficult for coyotes, but they can chase a rodent down. Between the two, they make a successful hunting team. Sometimes the coyote chases a rodent that escapes down a hole that is caught by the badger, while at other times the burrowing badger will cause a rodent to escape from a hole into the clutches of the coyote. Coyotes also share ranges with bobcats, and the two same-size species tend to tolerate each other.

DEER

Cervidae family

Bango, Milwaukee Bucks (NBA)

FAST FACTS

Nearly 12 million U.S. sportsmen hunt deer and elk, bagging more than 6 million white-tail deer per year.

The concentration of deer is so high in certain areas that it has led to the spread of Lyme disease.

In 1900, overhunting had led to a population collapse of white-tailed deer, but this was reversed due to the implementation of wildlife management practices and conservation initiatives.

Deer are one among 160 species of ruminants, even-toed mammals with four-chamber stomachs that depend on bacteria to break down plants for digestion. Deer belong to the cervidae family (referring to animals with horns or antlers). There are more than 90 species of deer worldwide, but just five species in North America: elk, moose, caribou, and two native species, whitetail deer and mule deer.

All male deer species shed their old antlers and grow new ones each year; only among reindeer and caribou do females do the same thing. With their branching antlers, deer are distinct from the permanently horned (with no branching) animals of the bovine family, like antelope, bison, bighorn sheep, goats, and cattle.

Nearly 12 million U.S. sportsmen hunt deer and elk. Expenditures on big-game recreation amount to $17 billion a year, with deer the most popular pursued animal. Half of the nation's 22 million wildlife watchers predominantly observe and photograph deer, as well as other big game.

Nearly 90 percent of Wisconsin's hunters, about 800,000 sportsmen, are deer hunters.

This places Wisconsin third nationwide in the number of deer hunters, even though the state ranks 20th in population. More than 40 percent of Wisconsin residents observe or photograph wildlife. In addition, half a million out-of-state visitors come to Wisconsin for wildlife-related recreation, spending more than a billion dollars annually, and deer are the most favored wildlife, outranking even songbirds and bald eagles.

Deer are outstanding jumpers, able to leap10 feet high and cover a distance of 30 feet in a single bound. They are very good swimmers, and they can run at speeds of 35 to 40 miles per hour. They have an excellent sense of smell, which is their primary way of detecting potential predators. Their eyes are very sensitive to movement but lack sharp focus because they have no fovea. Deer see better at night because of their eyes' larger concentration of rods (which handle low light) than cones (which detect color).

The buck, or male deer, weighs up to 300 pounds. The doe, or female, weighs up to 200 pounds. Deer have always been a source of sustenance for humans, their flesh providing food and their skins providing leather. White-tailed deer meat, organs, and skins were integral parts of daily life in many Native American cultures when European explorers first arrived in the early 1500s. The deer proved vital for survival during Lewis and Clark's transcontinental expedition in the early 1800s.

Today's North American hunters bag more than 6 million white-tailed deer a year, out of a total population of more than 30 million. The concentration of deer in some localities is so high (over 100 per square mile) that it has led to several adverse consequences. An explosion of deer tick infestations is spreading Lyme disease, causing 300,000 new cases a year. Ninety-six percent of the cases occur in the 13 upper Midwest and Northeast states.

Negative impacts on songbird populations are also occurring as a result of deer over-browsing leaves, bark, and green stems from plants, shrubs, and certain young tree species that are important habitat for songbirds.

RANGE

White-tailed deer are among the most prevalent species found throughout North America; they range all the way to South America. Mule deer are located specifically in the Rocky Mountain region of western North America. In contrast to the 30 million white-tailed deer in North America, there are just several hundred thousand mule deer.

In North America the largest deer species—elk, moose, and caribou—are mainly concentrated in the Canadian Rocky Mountain and Columbia Mountain regions of western Canada and the United States, especially in and around national parks. These include Glacier National Park (in Montana and Alberta); Mount Revelstoke National Park, Yoho National Park, and Kootenay National Park in British Columbia; and Banff National Park and Jasper National Park in Alberta.

ENVIRONMENTAL THREATS TODAY

Prior to European settlement in North America there were an estimated 30 million deer. There would have been even more, but the population was held in check by competition for food and space from other herbivores, like elk, caribou, bison, and moose. Numerous predators, notably wolves, coyotes, and cougars—as well as Native Americans—also controlled deer populations. And the mature forests east of the Mississippi River, where most deer lived, restrained populations because of limited availability of browsing plants.

Deer prefer the transition areas between forests and open grasslands, prairies, or agriculture. Native Americans were the continent's first wildlife managers, deliberately setting forest fires to create browsing habitat for the whitetails.

By 1900, overhunting of white-tailed deer led to a population collapse that put it at risk of extinction. Introduction of wildlife management practices and conservation initiatives for protecting natural ecosystems throughout the 20th century led to a dramatic rebound of the deer population. Other factors for the recovery in the deer population over the past half-century have been the near-eradication of the deer's natural predators, as well as expansion of agriculture and open landscapes with abundant browsing plants.

Last century's wildlife management practices directly benefited deer, but they also gave rise to unintended consequences. Absent any biological control, whether through predation by reintroduced wolves, cougars, and coyotes, or through hunting, deer populations explode. For example, in the past 50 years the deer population in Wisconsin has increased 600 percent.

Wildlife managers now discourage the feeding of deer. This practice has been shown to artificially congregate the animals, which may lead to a more pronounced impact on the surrounding habitat.

WILD NATURE FACTS

Unlike many ruminants, such as sheep or cattle, which graze on large amounts of low-grade, fibrous plants, deer are selective eaters. They feed mainly on easily digestible shoots, young leaves, fresh grasses, soft twigs, fruit, fungi, and lichens. With their smaller and less specialized stomachs, they can't consume vast quantities of low-nutrition plants, and therefore they need more nutritious resources.

The male's antlers emerge each spring from the bony support structures on their foreheads called pedicles. The lengthening days in April trigger hormones from the testicular and pituitary glands that drive antler development. The antlers initially are a spongy mass composed of water and protein. As the antlers grow, they are covered by skin and soft hair called velvet, which has blood vessels and nerves.

Prior to mating season, the velvet cover is shed and the antlers become hard bone. After mating season, the shortening day triggers decreasing levels of hormones. This leads to calcium losses in the pedicle, softening the connection with the antlers until the antlers fall off.

Antlers range in size from tiny spikes protruding from the skin to large branching racks with numerous points. Mature bucks may have eight or more points, with antler sizes contingent on genetics, nutrition, and a buck's age. Some extinct deer had huge antlers, far larger than any today. The giant deer *Megaloceros*, for example, had antlers stretching 10.5 feet across.

At several places on their body, deer have glands that produce a musky-smelling scent. The tarsal gland at the hocks inside the hind legs is used primarily during rutting season. Bucks engage in "rub-urination," which involves urinating on their tarsal glands and rubbing the legs together as a signal of dominance to other deer in the area. Some bucks actually lick off the scent from their tarsal gland to reduce its strength if they find themselves confronting a more dominant deer.

Between the deer's toes are interdigital glands. Fawns rely on the scent they release to locate their mothers, and bucks use the scent to track does during breeding season.

The tear duct gland in the lower corner of the eye is rubbed against brush or trees for signaling. The doe also rubs this scent on her fawn for identification.

The forehead gland between a deer's eyes secretes an oily chemical that darkens the space between a buck's antlers. Mature dominant bucks have a visible orange color patch in this forehead area. Rubbing the gland on trees communicates the buck's dominant status in the herd.

DOG

Canis lupus familiaris

Harvey the Hound, Calgary Flames (NHL)
Bernie, Colorado Avalanche (NHL)
Maddie, New York Liberty (WNBA)

FAST FACTS

All domestic dogs are one subspecies of the gray wolf.

Dogs perform a diversity of functions, including herding, hunting, guarding and protection, companionship, aiding handicapped individuals, and assisting police and military.

Selective breeding to emphasize certain traits has led to more behavioral and morphological variation than any other mammal in the world.

There is an overabundance of abandoned and feral dogs. The largest number of feral dogs is in India, which has tens of millions.

THREATS

Overconsumption

All domestic dog breeds are one subspecies of the gray wolf. Around 100,000 years ago, the dog's lineage split off from the modern wolf's lineage in East Asia. When dogs were first domesticated remains uncertain; it could have occurred as early as 33,000 years ago or as recently as 8,500 years ago. Whenever it was, dogs proved so useful to hunters and gatherers that domesticated canines rapidly spread throughout the world. Dogs are believed to have reached North America about 12,000 years ago, perhaps brought by humans using them as sled dogs during their migration from Siberia over the ice-covered Bering Strait to North America. Some 1,400 years ago, dogs routinely pulled loads of belongings of many Native American tribes, like the Apache and Navajo, in their seasonal migrations.

The proverbial "man's best friend" has proved to be highly versatile. Dogs perform a diversity of functions, such as hunting, herding, guarding and protection, companionship, aiding handicapped individuals, and assisting police and military.

The sheer number of dogs worldwide—about half a billion—attests to their remarkable talents in interacting with humans, enabling them to become one of the most successful species on earth. Reflecting the socially complex and sophisticated behaviors displayed by their wolf ancestors, domesticated dogs are endowed with advanced forms of social cognition and communication. This is reflected in their sociability and playfulness in human situations, their capacity to be trained for various tasks, and their overall adaptability to a wide range of cultural situations.

The Swiss St. Bernard breed, mascot of the Colorado Avalanche of the NHL, is a case in point. Ancient Romans brought the St. Bernard's ancestors, molosser-type dogs, into the Alps several thousand years ago. Farmers and dairymen employed the large, 200-pound animals as livestock

guardians, herd dogs, draft animals, watchdogs, hunting companions, and search-and-rescue dogs.

The several hundred breeds of dog that now exist evolved mostly during the past few hundred years. Dogs have been artificially selected for a myriad of specific shapes, functions, and behaviors. This selective breeding has given dogs more behavioral and morphological variation than any other land mammal in the world.

For example, dogs range in weight from less than 1 pound to more than 250 pounds and in height from a few inches to 43 inches. They have life spans of 8 to 20 years. Dogs have been bred for a diversity of temperaments, including aggression, alertness, courage, independence, intelligence, loyalty, and ability to tolerate children. People have also bred dogs for specific grooming and fur-shedding characteristics.

Dogs have complemented and augmented human skills. They can detect sounds far above the upper limit of human hearing and from four times as distant, and are better at pinpointing exactly where a sound is coming from. Part of this comes from the 18 or more muscles that enable them to raise, lower, rotate and tilt their ears.

Dogs are also superior in sensing smells. The animal's brain is dominated by the olfactory bulb, which perceives odors. It is 40 times larger than the human olfactory bulb, relative to brain size. (In contrast, a human brain is dominated by a large visual cortex.) Whereas the human olfactory bulb has around 40 million smell-sensitive receptors, the bloodhound, bred for odor detection, has some 300 million receptors.

This breed's olfactory sense is estimated to be 100 million times more acute than a human's. Most dog breeds can smell 100,000 to 1 million times as well as a human. A dog's wet snout, called the rhinarium, performs the key function of ascertaining from the air the direction and location of a certain smell. The dog's remarkable sense of smell was instrumental to early human survival, both in tracking and hunting prey and in alerting humans of approaching predators.

RANGE

The global population of domestic pet and stray dogs is approaching 500 million, with three-quarters of the world's dogs thought to be free-roaming stray and feral animals. The largest number of pet dogs live in the United States (76 million), followed by Brazil (36 million), China (27 million), and Russia (15 million), Japan (12 million), the Philippines (11 million), India (10 million), Argentina (9 million), France (7 million) and Romania (4 million).

The United States also has the highest concentration of dogs per capita. One-quarter of U.S. households own one dog, 10 percent own two dogs, and nearly 4 percent own more than two dogs.

A recent global review of dog population growth between 2007 and 2012 found that India had the fastest growth rate during this period, with a 60 percent increase, followed by the Philippines at 40 percent, and Venezuela and Russia at 30 percent each. Countries including Switzerland, France, Japan, Romania, and Greece showed dog population declines of 3 percent to 10 percent.

ENVIRONMENTAL THREATS TODAY

People's love of pets has resulted in some unwanted consequences. The Humane Society of the United States estimates 4 million abandoned dogs and cats each year are put down because people no longer want to take care of them.

India has the highest population of stray and feral dogs in the world. Tens of millions of dogs roaming cities and villages bite millions of people every year. Dog bites result in some 20,000 Indian people per year dying from rabies.

WILD NATURE FACTS

Early human camps and settlements derived numerous benefits from the dog's presence. Dogs provided valuable sanitation services by devouring food scraps. They provided warmth during especially cold weather, as reflected in the Australian aboriginal expression "three-dog night."

Since antiquity, dog meat has been eaten in many East Asian countries, including China, Korea, and Vietnam. Roughly 16 million dogs are annually consumed in Asia. Koreans raise the Nureongi (meaning "yellow one") specifically for meat; it is distinct from pet breeds kept in homes.

It is uncanny how much variation in dogs' height, weight, and other characteristics emerged from the gray wolf. The smallest recorded dog was a Yorkshire terrier that was 2.5 inches in height and 3.7 inches in length and weighed a quarter-pound. In stark contrast, the largest recorded dog, an English mastiff, weighed 343 pounds and measured 98 inches from snout to tail. The Great Dane is the tallest dog breed, standing 43 inches at the shoulder.

A recent DNA analysis of 85 dog breeds found close genetic similarities that led scientists to suggest clustering the breeds into four broad categories:

Wolflike

With roots in Asia, Africa, and the Middle East, these breeds are genetically closest to wolves, suggesting they are the oldest domesticated breeds.

Herders

Familiar herding breeds, such as the Shetland sheepdog, are genetically related to breeds never known for herding: the greyhound, pug, and borzoi. This suggests those breeds either were used in the creation of classic herding dogs or descended from them.

Hunters

Most in this group were developed in recent centuries as hunting dogs. While the pharaoh hound and Ibizan hound are said to descend from dogs depicted on ancient Egyptian tombs, their placement here suggests they are re-creations bred to resemble ancient breeds.

Mastiff-like

The German shepherd's appearance in this cluster, anchored by the mastiff, bulldog, and boxer, likely reflects its breeding as a military and police dog.

HOG

Sus scrofa domesticus, Suidae family

Stormy The Ice Hog, Carolina Hurricanes (NHL)

FAST FACTS

There are approximately 1 billion domestic hogs in the world.

In the United States, there are roughly 6 million feral hogs located across 45 states.

Hogs are highly intelligent animals. Feral hogs avoid hunters and traps by studying them for days.

THREATS

Habitat reduction

Toxic chemicals

Climate

Overconsumption

GMOs

WHAT NEEDS TO BE DONE

Habitat Preservation and Protection

Climate Remediation

Domesticated and feral hogs, also commonly called pigs or swine, are among the most abundant large mammals in the world. They are descendants of the Eurasian wild boar. In Old English, *hog* originally referred to a castrated male pig, while *pig* was reserved for small, young animals. Today, male and female adults are called swine, hog typically refers to large swine or pigs, a castrated male is called a barrow, and an uncastrated one is a boar.

Hogs are even-toed, hoofed animals (ungulates) whose weight is supported about equally by the third and fourth toes. This is in contrast to odd-toed ungulates such as horses, rhinoceroses, tapirs and zebras, whose weight is borne primarily by the third toe. Other even-toed animals include antelope, camels, cattle, deer, giraffes, goats, hippopotamuses, llamas, pronghorn, and sheep.

There are roughly 1 billion domestic hogs in the world. Hogs are three to five feet in length, with adults weighing from 110 pounds to as much as 770 pounds.

Hogs are very intelligent animals. As veterinarian and New Mexico land commissioner Ray Powell once quipped, “If they had the dexterity, they’d be driving vehicles around. I mean, these guys are really smart.” Feral pigs will study traps for days before directing the lowest-ranking group member to probe for danger. Pigs can overcome even well-built traps by climbing on top of each other. Feral hogs are also aggressive—and dangerous, given their 300-pound weight, razor-sharp tusks, and strong jaws that can crack bones. They also can run at speeds up to 30 miles per hour.

With their aptitude for avoiding hunters and traps and their year-round mating, feral hogs have invaded most habitats from wetlands to prairies, from rugged deserts to mountain valleys.

RANGE

There are 16 species worldwide of hogs, boar, and warthogs that belong to the Suidae family. They all are native to the Old World, ranging from Asia to Europe and Africa. According to fossil evidence, the hog’s common ancestor dates back 33 million years.

Archaeological evidence indicates that humans first domesticated wild boar 15,000 years ago around the Tigris River Basin in the Middle East. Separately, the Chinese domesticated boar about 8,000 years ago.

It is thought that the wild boar’s adaptable nature and omnivorous diet enabled early humans to domesticate it with ease. In addition to using the animal as a food source, early cultures used its hides for shields, bones for tools and weapons, and bristles for brushes.

ENVIRONMENTAL THREATS TODAY

The domesticated hog species exists vast in numbers worldwide. That is not the case with four of the 16 species in the Suidae family. All four of these species, native to Indonesia and known as babirusas (“deer hogs”), are threatened with extinction by illegal hunting and habitat loss from the over-logging of rain forests.

The male babirusa is distinguished by its long upper canines that pierce though the skin and curve backward over the front of the face and toward the forehead. The four species are protected in Indonesia and are listed as endangered on the IUCN Red List of Threatened Species.

Feral hogs are not considered wild hogs, given that they are of the same species as domesticated hogs. Although these feral swine are the second-most popular large mammal among hunters in North America, next to white-tailed deer, their exploding population numbers are causing problems and costs that are exceeding their benefits. In fact, they have become the bane of ranchers and farmers. Feral hogs cause crop losses, spoil water systems, disperse invasive weeds, and perhaps most worrisome, spread myriad diseases.

WILD NATURE FACTS

Hogs have an excellent sense of smell, far superior to their sight or hearing. Feral hogs are capable of detecting some odors five to seven miles away. They can smell truffles three feet underground.

Unlike cows and other ruminants, which feed for a short time and then sleep for a short time, domesticated pigs tend to feed continuously for many hours and then sleep for many hours.

HORSE

Equus ferus caballus

Rangers Captain, Texas Rangers (MLB)
Miles, Denver Broncos (NFL)
Thunder, Denver Broncos (NFL)
Blue, Indianapolis Colts (NFL)

FAST FACTS

Horses were domesticated approximately 6,000 years ago.

There are now 60 million horses in the world now, with 10 million in the United States alone.

The last remaining wild horse is Przewalski's horse in Mongolia.

THREATS

Habitat Reduction

Overconsumption

WHAT NEEDS TO BE DONE

Habitat Preservation and Protection

Fifty million years ago, the horse was a tiny, multi-toed critter. Today it has evolved into a single-toed large animal. Humans domesticated the horse about 6,000 years ago, and there are now nearly 60 million of them in the world.

Very few horses are true wild horses. In fact, the threatened Przewalski's horse of Mongolia is considered the last true wild horse on earth. Most horses are domesticated, although there are large domesticated populations—technically known as feral horses—living in the wild in an untamed state. These animals descended from domesticated ancestors who escaped their owners. The herds of feral mustangs in the Americas, for example, descend from the Iberian horse brought to America by the Spanish in 1500.

Horses are highly admired for their tremendous sense of balance, which comes from their uncanny ability to keep their footing and an excellent sense of movement and spatial orientation.

Horses are described according to their temperament or disposition. Racehorses and thoroughbreds, for example, are known as "hot-bloods," high in energy, spirit, and boldness, and bred for speed and agility. Draft horses and other workhorses, in contrast, are "cold-bloods," known for being quieter and calmer. There are also "warm bloods," bred from crosses of hot and cold, particularly in Europe, and created for specific riding purposes. Over the centuries more than 300 horse breeds have been developed for many different uses.

ENVIRONMENTAL THREATS TODAY

The last true wild horse, Przewalski's horse, is also known as the Mongolian wild horse. Named after the19th-century Russian explorer Nikolai Przhevalsky, it is a rare animal, with a small population living in Mongolia.

Until 10,000 years ago there were wild horses in North America, but all went extinct prior to the arrival of Europeans. All horses and burros now living in North America are descendants of European domesticates, selectively bred over many generations before their introduction to the North American continent.

Some 40,000 feral herds of horses and burros range in herds across 10 western states and two Canadian provinces, encompassing some 45 million acres. Roughly half of them are located in Nevada. Herd sizes generally increase about 20 percent a year, resulting in the population's doubling every four years. Range ecologists estimate that Nevada's dry, water-stressed ecosystems can support fewer than 24,000 feral horses and burros.

RANGE

Of the 60 million horses worldwide, roughly 33 million inhabit North and South America, with close to 10 million in the United States alone. Some 14 million live in Asia, and more than 6 million are in Europe. The American Horse Council calculates that horse-related activities directly contribute nearly $40 billion to the United States economy, and more than $100 billion when indirect spending is included.

The modern horse evolved about 5 million years ago. One key transition was the emergence of equid teeth, which allowed the horse to move from eating the leaves of soft, tropical plants to browsing on drier plant material, and then to grazing on the tough, fibrous grasses of the plains.

Horses became extinct in North America roughly 10,000 years ago, and there are two theories why. One theory points to the arrival of humans, who killed off many large mammal species. The other theory suggests climate destabilization, given that some 12,500 years ago, a major landscape change occurred, with the grasses characteristic of a steppe ecosystem giving way to shrub tundra filled with plants that might have been unpalatable to horses.

WILD NATURE FACTS

Horses have a strong fight-or-flight response. Their anatomy combines a well-developed sense of balance with rapid reactions and speed to escape predators. Horses also have the unusual trait of being able to sleep either lying down or standing up, which aids in escaping wild predators.

Other horse features also help prevent predator attacks. Horses have the largest eyes of any land mammal, offering excellent vision day and night, with their eyes positioned on the sides of their heads. This provides the horse with a range of vision of more than 350 degrees. Roughly 65 degrees of this range is binocular vision. Horses also have good hearing. A horse can rotate each ear up to 180 degrees, enabling 360-degree hearing without moving the head.

Today's domestic horse has a life span of 25 to 30 years, depending on environment, breed, and management.

Horses vary widely in weight and size. The smaller ones weigh between 850 and 1,200 pounds and reach about five feet tall from hoof to shoulder; heavy draft horses weigh between 1,500 and 2,200 pounds and reach six feet. The record for largest horse was set by a Shire named Mammoth, which lived during the late 1800s in the United Kingdom. He reached seven and a quarter feet and a peak weight of 3,300 pounds.

Horses are herbivores. Compared with humans, they have small stomachs but very long intestines, which are essential to digest the continuous flow of nutrients from their immense intake of grasses. A 1,000-pound horse will consume up to 24 pounds of plant material and nearly 40 quarts of water per day. Unlike cows, with four stomachs to digest plant forage, horses are not ruminants. They have only one stomach yet are capable of digesting cellulose, the major component of grass.

All horses move naturally with four basic gaits: the four-beat walk, which averages 4 miles per hour; the two-beat trot or jog at 8 to 12 mph; a three-beat canter or lope at 12 to 15 mph; and the gallop at 25 to 30 mph. The world record for a galloping horse sprinting over a short distance is 55 mph.

MOOSE

Alces Alces

Mariner Moose, Seattle Mariners (MLB)
Mick E. Moose, Winnipeg Jets (NHL)

FAST FACTS

Moose range has dwindled since the 19th century due to human expansion.

Today, white-tailed deer are moving into moose range, bringing with them ticks and parasites that are increasing the mortality rates for moose.

In the 19th century, rancers shot moose to reduce competition with livestock for food.

THREATS

Habitat reduction

Climate

Illegal trafficking, trading, and poaching

WHAT NEEDS TO BE DONE

Climate Remediation

Habitat Preservation and Protection

Halting of Illegal Trade, Trafficking, and Poaching

Moose are the largest members of the deer family (cervids, also including elk and caribou). They are about the size of a horse. Males weigh 900 to 1,400 pounds and females 700 to 1,100 pounds. Moose are good swimmers and can move through the water at 6 miles per hour for as long as two hours at a time.

Of any living cervid, moose males have the largest antlers. The antlers, which sometimes weigh more than 77 pounds and spread 5 feet, are shed annually.

A large moose can kill its primary predators—American black bears, brown bears, grizzly bears, and gray wolves—in self-defense. Because of their small size, moose calves are most vulnerable to predation. When confronted with a predator, a moose may stand its ground and defend itself by flailing and kicking its legs, or it may flee and attempt to evade the predator by moving rapidly over obstacles or swimming into deep water. A moose may also flee to an area that provides better footing, such as areas with shallow snow, and maneuver to confront the predator.

RANGE

The moose species is believed to have arrived in North America from Asia about 11,000 to 14,000 years ago, shortly before the flooding of the Bering Land Bridge.

Moose range has decreased over the past century in the southern boreal forest regions in the eastern provinces of Canada, but it has expanded in other areas. Local populations in Nova Scotia have been declared endangered. In recent decades, moose have expanded their range westward into the coastal temperate rain forests of British Columbia and some coastal islands.

Moose are found in Canada, the U.S. (Alaska, North Dakota, Minnesota, Michigan, Rocky Mountains, and northeastern states), Scandinavia, and Russia. In Eurasia, moose are called elk, which is confusing since in North America *elk* refers to a different species, the wapiti (*Cervus canadensis*), which is a similar though slightly smaller species (the second-largest deer species).

ENVIRONMENTAL THREATS TODAY

Moose once lived throughout most of the United States and Canada, inhabiting spruce forests, swamps, and aspen and willow thickets throughout most of Canada, Maine, Minnesota, Alaska, and the Rocky Mountains in Utah and Colorado. But their range has dwindled because of uncontrolled hunting for sport and food and because of land development. In the 19th century, ranchers shot them to reduce competition with livestock for food.

Threats to the status of moose populations are primarily human-caused habitat alteration. In the species' southern range, the boreal forests of southern Canada, forestry and agricultural practices have caused extensive changes to and reductions in habitat. White-tailed deer have moved into these areas, which are increasingly open agricultural fields and deciduous forests. With the deer has come the brain worm, which attacks the membranes surrounding the brain and spinal cord and is a significant cause of mortality for moose. The parasite is not fatal to the white-tailed deer, however. The parasite passes from a deer through its feces,

which are then eaten by snails. Moose pick up the parasite by inadvertently ingesting snails when browsing on vegetation.

The expansion of white-tailed deer into moose habitat has also caused an explosion in deer ticks. Deer groom themselves so the ticks are a manageable nuisance. Moose do not groom, and as a consequence they are vulnerable to vast accumulations of ticks. Research in western Canada found *an average* of 33,000 ticks per moose, with some individuals having more than 100,000. The situation is being further aggravated by warmer winters that are enabling ticks to survive.

By early spring, tick-infested moose show big patches of missing hair where they have tried rubbing the insects away. Some moose will rub so hard that the white base of the hair shaft is all that remains over much of their body; these are sometimes described as "ghost" moose. The heavy mass of ticks is stressing moose and their calves to the point of premature mortality. And the situation is bound to get worse as climate change is bringing on warmer temperatures, enabling more ticks to thrive.

WILD NATURE FACTS

The word *moose* comes from Algonquian languages meaning "eater of twigs" and "one who strips the bark off of trees." Moose have a strong sense of smell and hearing, but their eyesight is poor. They are very fast runners, and have been clocked at 35 to 40 miles per hour.

Moose have been reintroduced to some of their former habitats. Their diet consists of both terrestrial and aquatic vegetation. Unlike most other deer species, moose are solitary animals and do not form herds.

Moose are active throughout the day and night, with peaks of activity often occurring around dusk and dawn. There is more activity at night during hot summer periods and less night activity during very cold winters.

RACCOON

Procyon lotor

T-Rac, Tennessee Titans (NFL)

FAST FACTS

Raccoons' brains are wired for tactile sensations more than any other animal.

Raccoons have such adept hearing that they can hear the vibrations from earthworms.

In the last 70 years, the raccoon population has increased 20 fold.

THREATS

Overconsumption

Habitat Reduction

WHAT NEEDS TO BE DONE

Habitat Preservation and Protection

Raccoons are intelligent, independent, adaptable, and determined tree-climbing mammals. They are located throughout the Western Hemisphere from Canada to Paraguay. The word *raccoon* is derived from a term of the Algonquian-speaking Powhatan, meaning "one who rubs, scrubs, and scratches with his hands."

Studies have found raccoons capable of remembering solutions to tasks for several years. Native Americans highly respected the raccoon's intelligence and looked upon the little masked animal as an icon of dexterity and disguise. The raccoon is known to be a cunning scavenger and an opportunistic omnivore.

Of the five senses, the sense of touch is the most important for the raccoon. Its front paws are hypersensitive, and its brain, more than any other animal's, is wired for tactile sensations. Two-thirds of the area that processes sensory perception is concentrated on interpreting tactile impulses. Vibrissae—stiff, whiskerlike hairs—located above the raccoon's sharp, non-retractable claws help it identify objects before touching them.

The ability of these animals to find food has been key to their surviving even amid urban sprawl. Native American tribes watched how raccoons would measure the risks and rewards while trying to secure food. They marveled at the raccoon's sophisticated capabilities, calculating strategies, and methods for breaking into food storage areas that were impossible for most scavenging animals to surmount. Native Americans also held the raccoon in high esteem because of its cagey qualities that helped it avoid becoming predators' food.

The playful, crafty raccoon figures in folktales of the Southern United States and in stories about American pioneers like Daniel Boone and Davy Crockett exploring the wilderness in their coonskin jackets and caps. The caps were fashioned with the animal's tail hanging down in the back.

People in Southern states have long hunted raccoons for food and for sport. Raccoons further north were valued for their thick fur, used in making cold-weather coats. In the 1920s the raccoon coat became immensely popular.

Raccoons take up residence in hollow trees, rocky dens, or burrows, typically near water. As omnivorous eaters, raccoons feast on the most abundant foods available in each season. Their spring and early summer diet consists of insects, worms, other invertebrates, and rodents. In late summer and autumn they eat fruits and nuts, such as acorns and walnuts, rich in calories for building up winter fat. Throughout the year raccoons will seek out other delicacies, including bird eggs, fish, amphibians, and occasionally birds and small mammals.

Raccoons have such good auditory range (between 100 and 40,000 hertz) that scientists report they can hear sound levels produced by earthworms underground.

RANGE

Fossil evidence indicates that the earliest ancestors of raccoons originated around France and Germany about 25 million years ago. Some 19 million years ago raccoons migrated into North America over the Bering Strait and kept moving until they reached Central America. While distant relatives of the raccoon remained in these tropical and subtropical regions, such as the crab-eating raccoon, the raccoon's ancestors migrated back north about 2.5 million years ago.

For long stretches of history modest raccoon populations lived along rivers and in the woodlands of the Southeastern United States. Since the 1940s, raccoon populations have exploded and expanded into many new habitats in addition to urban areas. They are now found in the western Rocky Mountains, prairies, and coastal marshes.

The raccoon population in the late 1980s was 20 times higher than it had been 50 years earlier, when the animals were considered comparatively rare. The causes for this increase in abundance and habitat range include urban and suburban growth, agriculture expansion, deliberate introductions, and the killing of the raccoon's natural predators.

ENVIRONMENTAL THREATS TODAY

The wily and adaptable raccoon has been able to thrive in many environments, particularly in urban and suburban habitats. Over the last 70 years there has been a twentyfold growth of raccoon populations in North American cities. There are so many living in Toronto that it has been called the raccoon capital of the world.

Life expectancy among wild raccoons is only two to three years. The causes of raccoon deaths vary by region. For example, up to 90 percent of adult raccoon deaths can occur in areas with heavy vehicular traffic and extensive hunting.

Raccoons have a number of natural predators that vary by habitat. The most notable ones in North America are bobcats, coyotes, foxes, and great horned owls. In Central America, jaguars are a common predator.

However, a far more frequent cause of death is distemper, especially in the Southeastern United States. Raccoons are susceptible to both canine and feline distemper, which is passed between animals but does not affect humans. Distemper epidemics are cyclical in nature, killing most of a local raccoon population when they occur.

Raccoons also can carry the rabies virus in their saliva and transmit it to humans, typically through bites. Of the 6,100 reported rabies cases in the United States in 2010, roughly 35 percent were due to raccoons. Medical treatment is now so effective that only one or two human deaths from all rabies cases occur each year.

WILD NATURE FACTS

Raccoons are not runners. They have short legs that make it difficult to run fast, cover long distances, or jump. In short bursts, their top speed is just 10 miles per hour. They enjoy the water and are good swimmers, traveling 3 miles an hour. Raccoons climb down trees headfirst, facilitated by their ability to rotate the hind feet so they are pointing backwards.

While they are the bane of gardeners and farmers, raccoons do perform some human-valued services like eating yellow jackets and preying on mice and rats.

RAM

Ovis canadensis

Rampage, St. Louis Rams (NFL)

FAST FACTS

A ram is an intact male sheep; a male castrated before maturity is called a "wether."

Due to overhunting and habitat conversion, by the beginning of the 1900s, there were 15,00 bighorn sheep, down from several million.

The conservation movement led by President Theodore Roosevelt led to animal reintroductions, creation of national parks, and the establishment of managed hunting. All of this contributed to a major turnaround for the bighorn sheep.

Two of the remaining key threats to bighorn sheep are domestic sheep (and the diseases they carry) and humans, who act as super-predators by killing the strongest and most virile sheep.

THREATS

Habitat reduction

Climate

Overconsumption

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Climate Remediation

Habitat Preservation and Protection

Halting of Illegal Trade, Trafficking, and Poaching

A ram is an intact male sheep. A male sheep castrated before maturity is called a wether. There are two species of wild sheep in North America, bighorn and thinhorn. The horns on bighorn sheep can weigh up to 10 percent of the body weight of these 300-pound animals.

Bighorns' ability to scamper up and down high, steep, rocky mountain slopes with the slightest of footholds is stunning to see. Naturalist John Muir looked upon the bighorn sheep as "the bravest of all the Sierra mountaineers." They have a wide arc of extraordinary vision, facilitated by wide-set eyes positioned far forward on their head. They also have keen hearing and smell that help them detect and avoid predators.

RANGE

Sheep originally crossed to North America from Siberia over the Bering Land Bridge. Two subspecies of thinhorn sheep are found in Alaska and Canada: Dall's sheep, which number about 100,000, and Stone's sheep, numbering about 18,500.

Bighorn sheep live in the western mountainous regions of North America, ranging from southern Canada to Mexico. The bighorns face many potential predators, including bears, bobcats, coyotes, golden eagles, mountain lions, and lynx, although they avoid harm most of the time. To protect themselves, bighorn groups face in different directions when grazing, in order to spot potential predators from every direction.

ENVIRONMENTAL THREATS TODAY

In the 1800s several million bighorn sheep spanned the American West. Overhunting and habitat conversion by settlers reduced the bighorn population to just 15,000 by the beginning of the 1900s. By 1920, bighorn sheep had been eliminated from Nebraska, North Dakota, Oregon, South Dakota, Texas, Washington, and part of Mexico.

The introduction of millions of disease-carrying domestic sheep turned out to be a key driver in the bighorn's near extinction. Rocky Mountain field research over a four-year period found that each domestic sheep wandering into bighorn winter range led to a die-off of more than 86 bighorns.

A turnaround for the nearly extinct bighorn began with the conservation movement advocated by President Theodore Roosevelt. This led to animal reintroductions, the creation of national parks, and the establishment of managed hunting. The Boy Scouts in Arizona took the conservation initiative very seriously, mounting a statewide campaign to save the bighorn sheep in 1936.

Within three years the effort had resulted in two protected bighorn areas in Arizona: the Kofa and the Cabeza Prieta National Wildlife Refuges. More than 1.5 million acres were set aside, and the desert bighorn sheep was adopted as the official mascot for the Boy Scouts of Arizona. The ongoing costs for the bighorn sheep conservation and restoration efforts have been covered by a sporting goods excise tax and income from the purchase of hunting licenses and tags.

National conservation initiatives beginning in the 1950s succeeded in increasing the population of bighorn sheep to 70,000. This involved a consortium of sports hunters and state wildlife agencies restricting hunting and the transplanting of sheep from healthy populations into empty habitats. The population increase, however, led to interactions with domestic sheep and transmission of their diseases.

Farmers and conservationists are working together to try out region-specific options for further shoring up wild sheep populations. For example, in Wyoming's Shoshone National Forest, adjacent to Yellowstone, conservation groups purchased land from domestic sheep ranchers to protect the forest's 4,000 bighorns. In other areas where bighorn numbers are modest, such as Bighorn National Forest east of Shoshone, domestic sheep take priority.

In addition to introducing domestic sheep, humans are hurting bighorn populations by acting as super-predators. Animal predators normally kill the smallest or weakest individuals in the target species. But human trophy-hunters seek the largest animals, and eliminating large numbers of the biggest reproductively mature individuals is rapidly skewing wild bighorn populations toward smaller animals that are reproducing at ever-younger ages. In Alberta, for example, where regulations limit hunters of bighorn sheep to large animals, both horn length and body mass are declining.

Hotter temperatures and droughts, indicators of climate change, are causing declines in some bighorn sheep subspecies populations. About one-third of California's populations of desert bighorn sheep have died off due to rising temperatures and less rain at lower elevations, resulting in less available water and fewer forage plants. More populations of desert bighorn sheep are at risk given the projections of a significantly hotter and dryer climate throughout the Southwest in the years ahead.

Five subspecies of bighorn sheep are recognized:

Rocky Mountain bighorn are the most abundant and widespread subspecies, numbering around 34,500. They are found in British Columbia, Alberta, Washington, Oregon, Idaho, Montana, Wyoming, South Dakota, Nebraska, Colorado, New Mexico, Utah, Nevada, and Arizona.

California bighorn number approximately 10,500. They are found in British Columbia, Washington, Oregon, Idaho, California, Nevada, Utah, and North Dakota. In 1999 the genetically distinct population of California bighorn inhabiting the Sierra Nevada was emergency listed as endangered by the U.S. Fish and Wildlife Service.

Nelson bighorn are the most abundant of the desert bighorn races and number approximately 13,000. These bighorn are found in California, Nevada, Utah, and Arizona.

Mexicana bighorn populations number roughly 6,000. They are distributed across Arizona, New Mexico, Texas, and the Mexican states of Sonora, Chihuahua, and Coahuila.

Peninsular bighorn inhabit the Peninsular Ranges of Southern California and Baja California. Only 950 remain in the United States, and less than 2,500 remain in Baja California, Mexico. These bighorn have been listed as threatened by the state of California since 1971 and federally as endangered since March 1998.

WILD NATURE FACTS

The bighorn sheep was one of the most-admired animals of the Apsaalooka people of the northern Great Plains. The Bighorn Mountain Range was central to their tribal lands.

Bighorn sheep group together in herds or bands of five to 15 ewes (mature females), lambs, yearlings, and two-year-olds. The mature males group together most of the year in bachelor flocks of two to five, separate from the females and young. During winter, many ewe herds come together, forming bands of as many as 100 animals.

The rams compete for ewes by having epic head-butting contests in the fall. Two charging rams will crash into each other at speeds of up to 40 miles per hour. The loud crack at impact can be heard more than a mile away. The charging rams may battle for as long as 24 hours. When one ram is physically hurt or too exhausted to continue he will back away, leaving the winner to claim his ewes.

A newborn lamb can be walking and climbing with its mother within a day of birth. Rams live for 8 to 10 years, and ewes for 9 to 12 years.

Bighorns are grass-eating ruminants. They eat very large quantities, grazing on grasses, clover, and sedges in warm months, and woody plants like willow and sage during winter months. They then swiftly retreat to steep cliffs or ledges, safe from predators. There they thoroughly re-chew and digest their food in their four-chambered stomach, aided by bacteria that break down the plant fibers. The sheep derive most of their water over long periods by absorbing the water content from the plants they consume.

SABER-TOOTHED CAT

Smilodon **species**

Sabretooth, Buffalo Sabres (NHL)
Gnash, Nashville Predators (NHL)

FAST FACTS

Saber-toothed cats became extinct approximately 10,000 years ago.

It is speculated that these apex-predators went extinct due to their reliance on large animals (megafauna) for prey. When these animals began to disappear, the saber-toothed cat could not adjust to smaller animals or a plant-based diet.

Different genera of saber-toothed cats ranged across Europe, Asia, Africa, and North and South America

Smilodon fatalis, the dominant saber-toothed cat in North America, was among the largest terrestrial carnivores during the past 2.5 million years. It went extinct 10,000 years ago. These 500-pound animals with canine teeth up to 19 inches long were excellent hunters, probably going after prey in social packs. Chemical analysis of proteins in fossil skulls revealed they preyed primarily on bison and horses, as well as ground sloths and mammoths.

RANGE

Long before saber-toothed cats, there existed five other major groups of saber-toothed predators, dating back 42 million years. They did not evolve from a single line; their saber-toothed canines were independently evolved.

The oldest saber-toothed predator, *synapsid*, was a mammal-like reptile. Different genera of saber-toothed cats ranged across Europe, Asia, Africa, and North and South America. A large concentration of saber-tooth cat fossils has been found in California, notably at the La Brea tar pits in Los Angeles.

ENVIRONMENTAL THREAT

It is speculated that what made saber-toothed cats successful also made these carnivores vulnerable to extinction. Their large size and evolved saber-toothed specialization limited them to preying exclusively on megafauna. When large prey became scarce or extinct, the saber-toothed cats may have been unable to adapt to smaller prey or to consume non-meat sources of food. Essentially their apex predator dominance led them into an evolutionary dead end.

WHAT NEEDS TO BE DONE

Habitat Preservation and Protection

Toxic Chemical Use Reduction

Climate Remediation

Halting of Illegal Trade, Trafficking, and Poaching

GMO Regulation

It is too late for the saber-toothed cats, but we can do something for the many species at risk today. Species extinction is happening up to 1,000 times faster than the natural “background” rate that occurs over geological time spans. It is due mainly to the explosion of the human population and global economic growth. Actions to reduce threats of extinction include:

WILD NATURE FACTS

There are more than half a dozen hypotheses as to why, and for what purpose, the long saber-toothed canines evolved. Unlike their portrayals in art, these were not daggers that, with one lunge, brought down 1,000-pound beasts. Abundant broken tooth fossils indicate otherwise.

Some archaeologists conjecture that they were used for attacking the soft tissue of the belly or throat. The long teeth would have struck major blood vessels, weakening the animal. However, this would also release the scent of the prey, drawing in competing predators. To date, the precise functional advantage of the saber-toothed cat’s bite remains a mystery.

BLUE JAY

Cyanocitta cristata

Ace, Toronto Blue Jays (MLB)

FAST FACTS

Blue jays are known to raid other bird's nests for eggs and fledglings and to take over the nests of other birds.

Blue jays have suffered increased mortality rates since the West Nile virus arrived in North America in 1999. Warmer temperatures are expected to increase the rate of infectious diseases like West Nile, avian pox, and malaria among birds. Although some local populations may face declines from climate-triggered weather extremes, the Blue Jay is among the half of bird species not threatened with extinction.

THREATS

Habitat Reduction

Climate

WHAT NEEDS TO BE DONE

Climate Remediation

Habitat Preservation and Protection

The blue jay is a perching songbird native to North America. It is one of only two jays on the continent, the other being the Steller's jay. Jays are part of the crow family. The blue jay is known for being noisy, daring, and aggressive. It is thought that the bird's name derived from the sound of its call, which typically sounds like a loud *jeer*. The jay is also known for its "whispering songs" lasting several minutes, filled with a mix that has been described as "clicks, chucks, whirs, whines, liquid notes, and elements of other calls."

The blue jay consumes acorns, beech nuts, seeds, soft fruits, grasshoppers, beetles, caterpillars, and other arthropods, as well as dead or injured tiny vertebrates. It has a powerful beak that it uses to hammer open nuts while holding the nut with its four-toed feet. The expansion of oak trees after the last ice age some 12,000 years ago resulted to a large degree from the blue jay's preference for acorns.

Nesting pairs of blue jays partner in constructing an open-cup nest in tree branches, where two to seven eggs are laid. They are also known to raid other birds' nests for eggs and fledglings and to take over the nests of other birds.

Blue jays, like many other songbird species, engage in a behavior called anting. The jay selects ant species that have a poisonous sack of formic acid near the abdomen, which they spray to ward off predators. The jay picks up the ant by the thorax and rubs it across its wings and tail. There are several interpretations of this behavior. Some researchers have shown that the jay's rubbing of the ant across its feathers releases the formic acid, thus allowing the bird to eat the ant—particularly the abdomen, where the most nutrition is located. Other researchers point to the diverse materials songbirds rub on their feathers and suggest they are trying to soothe their skin or get rid of mites and parasites. For example, some birds do anting with millipedes and bombardier beetles, which each emit insecticidal chemicals. Some use marigold flowers, which contain pyrethrum, a natural insecticide. Even mothballs, which birds may find around the edges of gardens, and which contain the insecticide naphthalene, are used in anting.

RANGE

Blue jays live throughout southern Canada, and the eastern and central United States, down to Florida and across to West Texas. Some western populations are migratory.

The blue jay's range is vast, amounting to 2.6 million square miles. It thrives in a range of ecosystems including boreal, temperate, subtropical, and tropical forests. Worldwide, the blue jay population exceeds 22 million, and it appears to be expanding. While some local populations may face declines from climate-triggered weather extremes, the blue jay is among the half of bird species not threatened with extinction.

ENVIRONMENTAL THREATS TODAY

Since the arrival of West Nile virus in North America in 1999, species of the Corvid family, especially crows and blue jays, have suffered increasing rates of mortality from being infected with the virus. For a number of recent years, random blood tests of wild blue jays found many birds that carried the virus but appeared healthy. However, in 2012, the deadly virus hit hard in Texas after a warm winter and scorching summer. Scientists believe West Nile may have rapidly evolved into a more virulent form, because there was a sharp rise in blue jay deaths.

The emergence of global warming and weather extremes introduces new risks for the blue jay, as well as many other bird species more broadly. Warmer winters, scorching summers, and wider spread of infectious diseases like West Nile virus, avian pox, and malaria are all anticipated. Even prior to the threat of climate change, habitat loss and other risks put one out of every eight of the world's 10,000 known bird species at risk of extinction. This is roughly 1,000 times higher than the natural (preindustrial) background rate of extinction.

Climate change significantly increases the threat of extinction to half of all bird species, according to the IUCN Red List of Threatened Species 2013 assessment. Climate change already has impacted more than 600 bird species, according to research by Birdlife International. Increased temperatures are resulting in earlier arrival of springtime and later arrival

of autumn. The migration and breeding of hundreds of bird species have shifted to an earlier timetable as well. However, such timing shifts have not coincided with shifts in the life cycles of plant and animal species upon which birds rely for food, causing "ecological mismatches" and impacting populations. For example, the Arctic tern in the United States has declined 40 percent over the past decade because of changes in its breeding habitat.

Some bird species may be able to cope with changes to their habitat. Others may be able to move to new areas, latitudes, or altitudes. But an enormous number will be lost, unless fossil fuel emissions are curtailed.

WILD NATURE FACTS

As is the case with other blue birds, the blue jay does not get its hue from pigment, but rather from very fine, microscopic structures that selectively reflect blue from the feather surface. That is why, when the jay's blue feathers are crushed and the microstructures are destroyed, the blue disappears, unlike pigment-based feathers, which retain their color.

Blue jays have a tough life. Nearly all the predatory raptor species in the same landscape as blue jays feast upon them. The blue jay's nest eggs, hatchlings, and fledglings also face constant threat from predatory tree squirrels, cats, crows, raccoons, opossums, and snakes. Jays even prey on each other. The blue jay does fight back; it has been known to chase away even predatory birds like hawks and owls. It can impersonate the calls of raptors, particularly red-shouldered and red-tailed hawks—a valuable skill for scaring away potential predators and competitors. It can even mimic the sound of human speech.

Blue jays, like other crow family species, are quite curious and show considerable intelligence. Young jays exhibit playful behavior with a diversity of found materials.

Blue jays typically form monogamous pair bonds for life. Both sexes raise their young, with the male feeding the female while she is brooding the eggs.

CARDINAL

Cardinalidae family

Fredbird, St. Louis Cardinals (MLB)
Big Red, Arizona Cardinals (NFL)

FAST FACTS

In the 1800s, thousands of cardinals were captured for the caged bird market in the United States and Europe. In 1918, the United States enacted the Migratory Bird Treaty Act, which legally protects the northern cardinal and bans its sale as a cage bird. Trafficking cardinals is also illegal in Canada.

Cardinals are found over several million miles in the Western Hemisphere, encompassing southern Canada, the Eastern United States, and Mexico.

Most of the insect species that cardinals eat are crop pests.

THREATS

Habitat Reduction

Climate

WHAT NEEDS TO BE DONE

Climate Remediation

Habitat Preservation and Protection

The northern cardinal, vermilion cardinal, and desert cardinal are perching songbirds that share the same genus and are found only in North and South America. They are part of the *Cardinalidae* family, which comprises between 35 and 60 species, and are also known as cardinal grosbeaks and cardinal buntings.

The brilliant crimson male northern cardinal, with its crest and black mask, is one of the most familiar and popular birds in the United States. There are abundant populations of cardinals found throughout the eastern United States in a diversity of ecosystems, but mostly open woodland. Colonists named the species after the male's red plumage and crest, which reminded them of a Catholic cardinal's robe and miter.

In sharp contrast to the male, the female is brown-yellow in color with grayish-brown tones and slight tints of red. Males sing more frequently than do females, with songs described as a liquid, whistling *cheer-cheer-cheer* or *purty-purty-purty*. Actually there are many regional variations since northern cardinals learn their songs.

The northern cardinal is very territorial. The male defends its territory by singing from treetops in a loud, clear whistle. Other males coming into its territory will be chased away. It is not unusual to see the cardinal fiercely attacking reflective surfaces like windows because they mistake their own reflection for an invasive male. Both the males and females will spend hours relentlessly fighting intruders. During the winter, northern cardinals will gather in big flocks of about 70 birds.

The desert cardinal, also known as Pyrrhuloxia, is a year-round resident of Arizona, New Mexico, Texas, and northern Mexico. There are clear color differences between the male desert cardinal and the northern cardinal. The desert cardinal is mainly brownish-gray with a red breast, a red mask, and a yellow, parrot-like bill that is stout and rounded. Females are very similar except for their beaks; the desert cardinal has a downward-curved, thick, yellow-colored bill, whereas the northern cardinal female bill is straight, red and pointier. Cotton farmers find desert cardinals quite beneficial because they feast on harmful cotton worms and weevils.

The vermilion cardinal is the most southerly of the three cardinal species, as well as the most shockingly red. The male is rosy red with a prominent crest. The species resides along the Caribbean coasts of Colombia and Venezuela. Their preferred habitats are the coastal subtropical and tropical dry shrublands and deserts.

RANGE

Cardinals are found over several million square miles in the Western Hemisphere, encompassing southern Canada, the eastern United States from Maine to Texas, and northern Mexico. They thrive in a variety of habitats including gardens, shrublands, swamps, and woodlands.

ENVIRONMENTAL THREATS TODAY

Cardinals have a healthy population, numbering an estimated 100 million. In the 1800s they were popular as pets. Thousands were captured for the cage bird market in the United States and Europe. In 1918 the United States enacted the Migratory Bird Treaty Act, which provided legal protection for the northern cardinal and banned their sale as cage birds. The species also is protected by the Convention for the Protection of Migratory Birds in Canada. It is illegal to take, kill, or possess northern cardinals, and doing so is punishable with a fine of up to $15,000 and six months in prison.

The emergence of human-induced, climate-triggered weather extremes introduces news risks for some local populations of songbirds, as well as many bird species more broadly. Warmer winters, scorching summers, and wider spread of infectious diseases like West Nile Virus are all part of this anticipated pattern, which has been killing off crows and blue jays. Cardinals have been infected with the virus, but do not appear to die from the infection.

Even prior to the threat of climate change, habitat loss and other risks put one out of every eight of the world's 10,000 known bird species at risk of extinction. Climate change increases the threat of extinction to half of all bird species, according to the IUCN Red List of Threatened Species 2013 assessment. Increased temperatures are resulting in earlier arrival of springtime and later arrival of autumn. The migration and breeding of hundreds of bird species have shifted to an earlier timetable as well. However, such timing shifts have not coincided with shifts in the life cycles of plant and animal species upon which birds rely for food, causing "ecological mismatches" and impacting populations. For example, the Arctic tern in the United States has declined 40 percent over the past decade because of changes in its breeding habitat.

Some bird species may be able to cope with changes to their habitat. Others may be able to move to new areas, latitudes, or altitudes. But an enormous number will be lost, unless fossil fuel emissions are curtailed.

WILD NATURE FACTS

Male cardinals' crimson red plumage results from the red and yellow carotenoid pigments in the vegetable matter they consume, while the female's plumage is grayish-brown with slight reddish tint. These color differences are due to the sexual selection by females of males with the brightest red plumage, resulting in the evolutionary success of those males with the biochemical capability to absorb more of the red and yellow pigments into their plumage.

Northern cardinals maintain an alert eye and ear for lurking predators. A wide range of other birds, mammals, and reptiles prey upon them, including blue jays, falcons, hawks, owls, shrikes, milk snakes, black racer snakes, squirrels, chipmunks, and domestic cats.

The northern cardinal's food consists of a wide range of plants and insects, in varying percentages depending on local and seasonal availability. One examination of 500 cardinal stomachs found 70 percent plant parts and 30 percent insects. More than 50 species of beetle were identified, including bark beetles, billbugs, click beetles, fireflies, lamellicorn beetles, ground beetles, leaf beetles, long-horned beetles, snout beetles, and woodborers. Also found were centipedes, cicadas, crickets, grasshoppers, leafhoppers, plant lice, scale insects, slugs, snails, spiders, and treehoppers, as well as the larvae of ants, dragonflies, sawflies, and other flies. Among the plant materials were more than three dozen species of weed seed and some three dozen species of wild fruit. The waste grains from corn, oats, rice, and wheat made up a small percentage of the cardinals' stomach contents.

Cardinals clearly serve as pest-control agents for farmers and gardeners. Most of the insect species that cardinals eat are crop pests.

The cardinal is the state bird of more states than any other species, representing Illinois, Indiana, Kentucky, North Carolina, Ohio, Virginia, and West Virginia.

KINGFISHER

Megaceryle alcyon

Spike, Vancouver Whitecaps (MLS)

FAST FACTS

Kingfishers thrive in a variety of environments, including ponds, swamps, and oceans

Kingfishers have featured prominently in cultural folklore across the world.

Kingfisher fossils found in Wyoming and Germany date back 30 to 40 million years ago.

THREATS

Climate

Habitat Reduction

Illegal trade, trafficking, and poaching

WHAT NEEDS TO BE DONE

Climate Remediation
Habitat Preservation & Protection

Halt Illegal Trade, Trafficking and Poaching

Walk along the shores, coastal estuaries and streams of North America and one is likely to hear the loud, rattling call or warble of Belted Kingfishers. These small birds with large crested heads, and a blue stripe across their white breasts (females have blue and chestnut bands), patrol up and down

rivers, coastlines and other water bodies. Their vigorous flights to and fro are scanning for good nest sites and perches to catch aquatic prey, and to ward off competitors and predators.

Perching on branches or telephone wires unobstructed by surrounding foliage, and peering below into unclouded waters, the Belted Kingfisher rapidly dives when it spots a crayfish or fish, grabbing or spearing the prey with its solid, straight, dagger-like bill.

At different times of the year Belted Kingfishers may be spotted in a variety of habitats including streams, ponds, lakes, estuaries, and still marine waters. During the winter they will seek out mangroves, swamps and brackish lagoons in Central America. Breeding season will find Belted Kingfishers at elevations up to 9,000 feet throughout North America.

There are two other species of North American kingfishers. These are found only in the very far south of the United States. The tropical Ringed Kingfisher is seen in the Rio Grande Valley of Texas. It is the largest kingfisher in the western hemisphere, with an immense dagger-shaped bill. The dark, glossy-green Green Kingfisher, half the size of the Belted Kingfisher but with a longer bill, is also seen in south Texas and sometimes in Arizona.

Kingfishers tend to be shy birds, yet they feature prominently in some cultures. To one Borneo culture, the Dusun, the brilliant multi-colored, Oriental dwarf kingfisher, is considered a bad omen if spotted by warriors on the way to battle, warning them to turn around. In sharp contrast, another multi-colored kingfisher, the banded kingfisher, is considered a positive omen by a different Bornean tribe, the Kenyah people. And the ocean-going Polynesians revered the sacred kingfisher and other Pacific island kingfishers that were believed to control ocean waves.

RANGE

Belted Kingfishers live year round throughout the United States and coastal Canada. In summer they migrate north throughout Canada for breeding, and during the winter they migrate south throughout Mexico, Central America and the Caribbean. But the Belted Kingfisher is also known to turn up in far-flung places spanning a third of the planet; from the British Isles, Netherlands, and Azores, to the Galapagos Islands and Hawaii, as well as across Iceland and Greenland.

Fossils of kingfishers found in Wyoming and Germany date back 30 to 40 million years ago. Fossils of Belted Kingfishers dating back 600,000 years during the Pleistocene epoch have been discovered in various southeast states, including Florida, Tennessee, Texas and Virginia.

ENVIRONMENTAL THREATS TODAY

Ornithologists estimate the worldwide population of Belted Kingfishers at around 2 million birds. From this perspective they are considered prevalent and widely distributed, and are categorized as Least Concern on the IUCN Red List of Threatened Species. However, over the past half-century (1966–2011) the North American Breeding Bird Survey indicated a 1.4 percent per year decline was occurring to Belted Kingfisher populations, or nearly a 50 percent drop over that time period. This has led to them being listed as a Common Bird in Steep Decline.

Historically, kingfishers were shot and trapped to prevent them from taking fish from hatcheries and trout streams. With the passage of the Migratory Bird Treaty Act of 1918, hunting and trapping of native bird species was outlawed. The law was enacted mainly in response to the immense number of birds killed for use in the millinery (hat-making) trade. By some estimates 200 million wild birds were killed each year to accommodate the fashion of adorning hats with stuffed birds and feathers.

Curiously, Belted Kingfishers do not appear to be affected by environmental contaminants that cause illness in so many other bird species. It is speculated this may be due to the fact the Belted Kingfishers eat small prey that absorb very low levels of toxins.

Among the 90 species of kingfishers there are a number of species listed as threatened, endangered, and critically endangered. The Marquesan Kingfisher of French Polynesia is listed as critically endangered, while the Micronesian Kingfisher is listed as endangered, as is the Tasmanian Azure Kingfisher. Loss of habitat to ranching and dam construction, combined with predation by invasive species, is the principal causes of threats to these kingfisher species.

WILD NATURE FACTS

Ninety species of kingfisher are found worldwide, most of them living in the tropics, and most species live away from rivers, feasting on small invertebrates. All the kingfisher species have large heads with extended, sharp, pointed bills. Kingfishers all nest in burrowed cavities, although one-fourth of the kingfisher species reuse abandoned termite nests.

Belted Kingfishers build their nests by tunneling into the vertical earthen banks along rivers. Both sexes share in excavating a tunnel for their nest. Some birds have been observed flying at the selected site with such force that they have fatally injured themselves. Tunnel depths vary depending on how hard and compacted is the soil. The giant kingfisher holds the record for longest tunnel, discovered to be 28 feet in length. It typically takes the kingfisher pair a week or less to excavate and construct their nest, although hard soil can require up 3 weeks. Bits of bone, fish scales and arthropod shells are used in the nest for insulation.

Belted Kingfisher nestlings can digest bones, fish scales, and arthropod shells, since they are born with highly acidic stomachs. The stomach chemistry changes by the time they depart the nest, and they start expelling the inedible animal parts in the form of pellets.

During breeding season Belted Kingfishers pair up and remain monogamous until the end of the season. They form new pairs each year. Hawks, snakes and various mammals are the main predators that threaten kingfishers.

ORIOLE

Icterus galbula

The Oriole Bird, Baltimore Orioles (MLB)

FAST FACTS

There are an estimated 6 million Baltimore orioles that span an area of 3 million square miles across the eastern United States.

There are at least 8 other oriole species in the United States.

Orioles are at risk for the same environmental threats from climate change that affect most bird species: spread of disease and loss of habitat.

THREATS

Climate

Habitat Reduction

WHAT NEEDS TO BE DONE

Climate Remediation

Habitat Preservation and Protection

The Baltimore oriole is a perching songbird that populates eastern North America. It is a migratory breeding bird. The adult male is orange and black with one white bar on its black wings. Females are yellow-orange on the breast and grayish on the head and back, with two white wing bars. The bird's name derives from the male's colors, which resemble the coat of arms carried by Lord Baltimore in the 17th century.

Baltimore orioles sing from treetops, in what has been described as one of the flutiest sounds among songbirds. The oriole is part of the blackbird family. It is medium-sized with a thick neck, long legs, and a long, sharply pointed bill.

RANGE

There are an estimated 6 million Baltimore orioles that span an area of 3 million square miles across the eastern United States. They breed from Wisconsin to Maine and south to central Mississippi and Alabama and northern Georgia. Populations extend as far west as the Great Plains and eastern Dakotas, Nebraska, Kansas, Oklahoma, and Texas. They migrate to winter in the tropics, mostly in Central America and northern South America, but some winter in northern Mexico and the southern coast of the United States. Since the 1960s, when people started attracting orioles with bird feeders, there has been an increased population in Florida and other southern states where the orioles reside all winter.

There are at least eight other oriole species in North America in addition to the Baltimore oriole. The burnt-orange orchard oriole is found in the eastern regions, while the yellow Bullock's oriole and the Scott's oriole inhabit western regions. The bright orange spot-breasted oriole resides in central Florida. The Altamira oriole, Audubon's oriole, hooded oriole, and streak-backed oriole all live in southern states and Mexico.

ENVIRONMENTAL THREATS TODAY

The emergence of climate-triggered weather extremes introduces new risks for some local populations of songbird, as well as many bird species more broadly. Warmer winters, scorching summers, and wider spread of infectious diseases like West Nile virus are all part of this anticipated pattern now occurring. Since West Nile was discovered in the United States in 1999, it has been detected in more than 300 species of dead birds, including Baltimore orioles, out of the roughly 750 species of birds in North America. Crows, jays, and magpies suffer higher mortality rates from infection, but most infected birds to date have survived.

Even prior to the threat of climate change, habitat loss and other risks put one out of every eight of the world's 10,000 known bird species at risk of going extinct. Climate change increases the threat of extinction to half of all bird species, according to the IUCN Red List of Threatened Species 2013 assessment. Climate change already has impacted more than 600 bird species, according to research.

Some bird species may be able to cope with changes to their habitat. Others may be able to move to new areas, latitudes, or altitudes. But an enormous number will be lost, unless fossil fuel emissions are curtailed.

WILD NATURE FACTS

Outside of mating season, Baltimore orioles are essentially solitary birds.

The mating game begins in spring when the male stakes out a territory and begins displaying to females. This is done by hopping from perch to perch in front of her while singing and chattering. The male will also perform a bow display, bowing with lowered wings and fanned tail. The female may respond with her own display and calls. The female uses a wing-quiver display, bowing forward with tail partly fanned, then quivering or fluttering the lowered wings.

The females construct impressive, pouchlike hanging nests, woven together from slim fibers. It takes the female about a week to weave a 4-inch-deep and 4-inch-wide nest, with a small entrance at the top and a lower chamber for the eggs. The female anchors the nest high in a tree with a tangle of long, flexible fibers. She then adds to the outer nest bowl an inner bowl made with springy fibers that help retain the nest's baglike form. A soft lining of downy fibers and feathers cushions the egg chamber. Females frequently build new nests using the fibers from an old one.

While perched and singing, orioles are on constant alert for predators, which are the most common cause of death. Avian threats to themselves and their nest eggs, nestlings, and fledglings include common grackles, American crows, blue jays, black-billed magpies, eastern screech owls, and Cooper's and shark-skinned hawks. Tree squirrels and domestic cats are also constant threats.

Baltimore orioles feed primarily on insects, dark berries, and nectar. Forest tent caterpillar moths are among their favorites, particularly in the larval stage. The birds beat the caterpillar larva against a branch to remove its protective hairs before eating it. Baltimore orioles also have a definite preference

for ripe, dark-colored fruit. They will pass up green grapes or yellow cherries and search for the darkest mulberries, the reddest cherries, and grapes of the deepest purple.

The birds employ their beaks in a behavior called gaping. They stab their beaks into soft fruits and then forcibly open their beak to access and drink the fruit juices. Sugary foods are converted into and stored as fat, which helps prepare the oriole for its highly energy-consuming migration.

The instinct to migrate is overwhelming in most birds. A female oriole still sitting on eggs in the fall will abandon the nest to begin migrating. The oriole flies at about 20 miles per hour for seven to eight hours a night, resting during the day. By traveling at night, it can avoid raptor predators, take advantage of the cooler weather and lower winds, and navigate by the stars. With good weather the migration takes two to three weeks, depending on the starting point.

Orioles are not territorial during their winter migration. In fact, given the abundance of food sources, orioles become part of large mixed feeding flocks. Several dozen to hundreds of orioles can be found during migration concentrated in coastal brush like cattails and in flowering trees.

RAVEN

Corvus corax

Poe, Baltimore Ravens (NFL)

FAST FACTS

The common raven is the largest crow in the world, with a wider distribution and greater adaptability than any other bird in the world.

Ravens are one of the smartest animals in the world, with an advanced memory and ability to store and retrieve food throughout the year (even though they have no sense of smell)

By the early 1900s, ravens had been wiped out in Alabama, North Dakota, South Dakota, and the southern Great Lakes due to overhunting. In recent decades, however, they have been expanding back to their original territory.

Ravens have developed a workable hunting relationship with wolves. They alert the wolf to prey and then eat alongside them.

THREATS

Climate

Habitat Reduction

WHAT NEEDS TO BE DONE

Climate Remediation

Habitat Preservation and Protection

The common raven is the largest crow in the world, measuring up to several feet in size with a four-foot wingspan. Weighing up to four pounds, it is four times heavier than the American crow, with a larger and heavier black beak, shaggy feathers above the beak and around the throat, and a wedge-shaped tail.

Ravens are among the world's smartest animals. They engage in play, make and use tools, and perform a kind of midair jousting to create a pecking order. Ravens exhibit an advanced memory and an ability to hide, store, and retrieve food throughout the year (even though they have no sense of smell). The raven solves problems as they arise; it can even differentiate individual humans through facial recognition.

Ravens are opportunists. They may do some of their own hunting, but primarily they eat food that other animals have caught, sometimes stealing from the food caches of other ravens and coyotes. Ravens have evolved a workable relationship with wolves. They will alert wolves to large prey, and then the wolves will kill and dismember it.

Wolves could devour all the food and leave none for the birds, so ravens have learned to eat side-by-side with the carnivores. To avoid being killed themselves, the birds have acquired a good sense of the wolf's behavior, like when a wolf might attack, its jumping distance, and ways to distract it.

This learning process begins at an early age. Juvenile birds will interact with wolves to learn their reactions, flying up behind a wolf and nipping it. This is highly risky activity, but it enables the birds to gather critically valuable knowledge about the wolf's responses.

RANGE

There are more than 16 million ravens worldwide, divided into roughly 11 subspecies, including four in North America. No other bird in the world has a wider distribution or demonstrates greater adaptability.

Ravens occupy an extraordinarily wide geographical and ecological range, from the Arctic Circle, across temperate landscapes, in the highlands and mountains of Central America, to deserts in the U.S. Southwest. They also live across the deserts of North Africa, in Eurasian regions, and in the Pacific Islands. Ravens are also found around Tibet and at altitudes as high as 20,600 feet on Mount Everest. The birds tend to remain local residents, with the exception of those that visit the Arctic.

ENVIRONMENTAL THREATS TODAY

Ravens suffered precipitous declines over the past two centuries. This was caused by a combination of poisoning, overhunting, and the loss of habitat and food sources, including disappearance of bison on the Great Plains. Whereas indigenous peoples of the Americas held the raven in awe as a great deity, European settlers were repulsed by ravens, associating them with witchcraft, evil omens, and disaster.

By the early 1900s ravens had been locally wiped out in Alabama, North Dakota, South Dakota, and the southern Great Lakes and were considered endangered in Tennessee

and Kentucky, as wilderness was converted to farmland. Ravens prefer wilderness habitat and shun farmlands, unlike their smaller cousin the American crow.

In recent decades, raven populations have been expanding back into some of their former territory in parts of the East, around the Great Lakes, and in the northern Plains.

The majority of U.S. states and Canadian provinces are seeing an increase in West Nile virus infections in birds, as well as in cats, dogs, horses and humans. The virus, carried by mosquitoes, has been infecting ravens as well as other perching birds. The American crow has been hit particularly hard; because of the virus, since 1999 the American crow population has declined by nearly half. The birds typically die within a week of becoming infected.

The emergence of climate-triggered weather extremes introduces new risks for ravens and many other bird species. Warmer winters, intense rains and floods, and scorching summers will support the spread of infectious diseases like West Nile more widely. Most areas will see a longer mosquito season as temperatures increase and summers get wetter and longer. In 2012, the deadly virus hit hard in Texas after a warm winter and scorching summer. Scientists believe West Nile may have rapidly evolved into a more virulent form, because there was a sharp rise in bird deaths.

Even prior to the threat of climate change, habitat loss and other risks put one out of every eight of the world's 10,000 known bird species at risk of extinction. Climate change increases the threat of extinction to half of all bird species, according to the IUCN Red List of Threatened Species 2013 assessment. Climate change already has impacted more than 600 bird species. Some species may be able to cope with changes to their habitat or may simply move to new areas. But a large number will be lost unless fossil fuel emissions are curtailed.

WILD NATURE FACTS

Common ravens are devoted to their families, even though they can be quite quarrelsome with one another. They can live up to 21 years in the wild.

Ravens have been so successful in part because of their omnivorous and opportunistic feeding habits. They feed on dead animals and food wastes, as well as maggots and insects, berries and fruit, cereal grains and noxious weeds, and small animals.

The common raven has few natural predators, given its average two-foot size, its large family flock, and its protective, aggressive abilities. It will attack any predators by flying at them and attacking with its large beak. Predators like owls, martens, and other ravens will go after unprotected raven eggs.

Ravens are wonderful mimics. They vocalize sounds heard in their habitat and can do good imitations of other bird species, cows, and human speech. Scientific studies suggest their calls to one another express diverse emotions such as happiness, surprise, rage, or tenderness.

Given the raven's intelligence, it is not surprising that ornithologists have described considerable play occurring among juveniles. Young ravens will slide down snowbanks and play catch-me-if-you-can games with other species like wolves, otters, and dogs. Ravens are among the few animals that create their own toys.

They are superb aerobatic flyers, flying in loops, interlocking talons in flight, and flying together upside down.

Ravens have featured in mythology, folklore, art, and literature for centuries. They have been revered as spiritual figures or gods by many indigenous cultures in such places as ancient Ireland and Wales, Scandinavia, Siberia, the northwest coast of North America, Bhutan, and northeast Asia. And in the Judeo-Christian and Islamic traditions, the raven was the first animal off Noah's Ark.

RAPTOR/VELOCIRAPTOR

Velociraptor mongoliensis

The Raptor, Toronto Raptors (NBA)

FAST FACTS

Raptors were solitary hunters who lived in the Mongolian desert.

Raptors went extinct 65 million years ago when a comet hit the earth, along with all other dinosaurs and 70 percent of all other species.

Thanks to Hollywood, the velociraptor has become one of the world's most famous dinosaurs. The movie *Jurassic Park* took considerable artistic license with the fossil facts. The movie shows the "speedy thieves" (the meaning of *velociraptor*) in a rainforest, with scales, hunting in a pack. In fact, the movie actually portrays an entirely different species, *Deinonychus* (meaning "terrible claw"), some six times the weight and twice the size of the ancient velociraptor. Paleontologists say the 30-pound, two- to three-foot tall feathered velociraptor was actually a solitary hunter and lived in the Mongolian desert.

ENVIRONMENTAL THREAT

Some 65 million years ago, an asteroid or comet crashed into Earth, leading to dramatic long-term effects that resulted in the extinction of the velociraptor, along with almost all other dinosaurs, and some 70 percent of all other species.

RANGE

Dinosaur raptors roamed most of the earth, except Australia and southern Africa, during the latter half of the age of reptiles, the Cretaceous epoch, between 145 and 66 million years ago. This was a time when the continents were arrayed very differently from how they are today. The North American continent was not yet formed, India was an island far south of the equator near Antarctica, and the continents of South America and Africa were in the early phase of splitting apart.

WHAT NEEDS TO BE DONE

Habitat Preservation and Protection

Toxic Chemical Use Reduction

Climate Remediation

Halting of Illegal Trade, Trafficking, and Poaching

GMO Regulation

We cannot save the velociraptor, but we can do something for the many species at risk today. Species extinction is happening up to 1,000 times faster than the natural "background" rate that occurs over geological time spans. It is due mainly to the explosion of the human population and global economic growth. Actions to reduce threats of extinction include:

WILD NATURE FACTS

The prehistoric raptors (technically dromaeosaurs) were a diverse group of meat-eating, small to medium-size, birdlike dinosaurs. They ranged in weight from the few-pound microraptor to the one-ton Utahraptor. They lived during the 80-million-year span of the Cretaceous epoch.

The 200-pound deinonychus were ferocious predators that were similar to lions in the way they ambushed prey, using their razor-sharp claws to slash the underbellies of big, two-ton tenontosaurus. These raptors could have torn a human to shreds in less than 30 seconds. Most deinonychus fossils have been discovered in Montana over the past 50 years.

The biggest prehistoric raptor, the one-ton, 23-foot Utahraptor, had huge jaws with saw-edged teeth and foot-long claws similar to those of the saber-toothed cat. These were used to slash, rip, and puncture giant prey, causing them to bleed to death. Utahraptors were the earliest raptors and are thought to have preyed mostly on a relatively gentle plant-eating dinosaur, the 30-foot, three-ton iguanadon, which was twice the size of an elephant. The first Utahraptor fossils were discovered in Moab in 1991, and all the fossils since have been found around Arches National Park in Utah, which would have been highly wooded at the time the Utahraptor lived.

TRICERATOPS

Triceratops horridus

Dinger, Colorado Rockies (MLB)

FAST FACTS

It is now thought that the triceratops' large horns were less for fighting than for courtship and dominance displays, similar to the antlers of modern reindeer.

The first fossil remains of triceratops were discovered in Denver in the late 1800s.

Triceratops went extinct 65 million years ago when a meteor hit the earth.

ANIMAL

Triceratops is an extinct dinosaur that lived 68 million years ago in what is now North America. Its name literally means “three-horned face.” Triceratops lived during the same time as the fierce carnivore Tyrannosaurus rex.

These nearly 10-foot, 12-ton herbivores, with 7-foot skulls that took up one-third of their bodies and a three-foot horn above each eye, are often depicted in movies battling other dinosaurs. However, it is now thought the animal’s big horns were less for fighting than for use in courtship and dominance displays, similar to the antlers and horns of modern reindeer, mountain goats, or rhinoceros beetles.

RANGE

The first fossil remains of triceratops were discovered in Denver in the late 1800s. Subsequent fossils were found in Montana, South Dakota, Wyoming, and in the Canadian provinces of Saskatchewan and Alberta.

ENVIRONMENTAL THREATS TODAY

Some 65 million years ago, an asteroid or comet crashed into Earth, leading to dramatic long-term effects that resulted in the extinction of the triceratops, along with almost all other dinosaurs, and some 70 percent of all other species.

WHAT NEEDS TO BE DONE

Habitat Preservation and Protection

Toxic Chemical Use Reduction

Climate Remediation

Halting of Illegal Trade, Trafficking, and Poaching

GMO Regulation

Species extinction is happening up to 1,000 times faster than the natural “background” rate that occurs over geological time spans. It is due mainly to the explosion of the human population and global economic growth. Actions to reduce this mass extinction threat include:

WILD NATURE FACTS

Triceratops had 36 to 40 columns of teeth on each side of its top jaw and each side of its bottom jaw. There were three to five teeth stacked in each column for a total of up to 800 teeth. Just a fraction of the teeth were in use at any moment; most were in reserve for continuous tooth replacement during the dinosaur’s lifetime. The teeth functioned like shears oriented vertically. So many large teeth suggest the triceratops consumed immense amounts of fibrous plant material, perhaps palms, cycads, and ferns, which then grew on the prairies.

HORNET

Vespa crabro

Hugo, Charlotte Hornets (NBA)

FAST FACTS

In the United States, the only true hornet (meaning not a wasp or yellowjacket) is the European hornet.

Outside of their nest area, hornets never attack needlessly. Unlike bees, whose stingers are intended to attack vertebrates to protect their hives, hornets use their stingers to hunt insect prey.

China is experiencing an epidemic of Asian giant hornet attacks, which many believe to be the result of climate change. With warmer winters, more hornet colonies are able to survive the winter.

THREATS

Habitat Reduction

Toxic Chemicals

Climate

GMOs

WHAT NEEDS TO BE DONE

Climate Remediation

GMO Regulation

Habitat Preservation and Protection

Toxic Chemical Use Reduction

Hornets prey on a myriad of insects. They are the top predators of the insect world, comparable to the birds of prey in the avian realm, and have been called the eagles of the insects. Hornets' main food is flies, and occasionally they eat bees as well. A large hornet colony may catch thousands of insects a day.

Hornets and yellow jackets are close relatives. Both are in the wasp family Vespidae. They closely resemble each other, but the hornet has a larger head, is often black and white, and may reach 2.2 inches in length, while yellow jackets are black and bright yellow and are half the hornet's size. In the United States the only true hornet is the European hornet, which is roughly 1 inch long.

A few large yellow jacket species are sometimes called hornets, like the bald-faced hornet found in North America. The term *hornet* is used for this and related species mainly due to their custom of making tree nests, as do the true hornets, rather than subterranean nests like most yellow jackets.

Outside of the nest area, hornets never attack needlessly. Few people realize that hornets are peaceful animals, even more cautious than honeybees, which also prefer to avoid conflict. It has been demonstrated that hornet stings are not more dangerous than those of bees and wasps (although hornets, unlike honeybees, can sting repeatedly). It is their relatively larger size and louder flight noise that induce this fear. Individuals lashing out in alarm at the sight of a hornet are those most likely to be stung.

Unlike bees, the poison of hornets and wasps is not intended for use against vertebrates (like humans) alone. Bees are nectar-collecting animals, and the primary role of the bee sting is to defend the colony against honey-seeking vertebrates, whether they are mice, badgers, brown bears, humans, or other animals. This explains the honeybee's barbed stinger. A bee will lose its life within minutes if its stinger gets lodged in a vertebrate and is ripped from its abdomen. What the bee gains is the injection of more poison, which continues even after the stinger is detached from the bee.

In contrast, wasps and hornets are hunters of insect prey. They employ their non-barbed stinger repeatedly not only to defend their hives but to kill difficult prey. Being wasteful and losing their stingers is costly, since they need to sting in order to eat. The bottom line is that in North America there is a very low probability of being stung by a hornet, far less than the chance of being stung by a bee.

That is not proving to be the case in China, which is experiencing an epidemic of Asian giant hornet attacks around the city of Ankang, in Shaanxi Province. In 2013, 41 people died and nearly 1,700 were injured by swarm attacks. The Asian giant hornet is the world's largest hornet—around the size of a human thumb—and the most venomous. Also referred to as the yak-killer hornet, it is native to temperate and tropical Eastern Asia. One entomologist described its sting as feeling "like a hot nail being driven into my leg." The sting can dissolve human tissue as well as cause kidney failure. Some 30 to 40 Japanese die each year from being stung by the Asian giant hornet.

Ankang citizens blame the epidemic on climate change. Unusually warm weather allowed a high number of hornet colonies to survive the winter. In addition, the hornets may have been agitated by a dry spell, which was then compounded by forestry laborers' working deeper into the mountains, disturbing their nests.

Like many social wasps, hornets will mobilize the entire nest to sting in defense of the colony. An attack pheromone is released whenever there is a perceived threat to the nest. The Asian giant hornet also releases attack pheromones for mobilizing workers when preying on honeybee hives.

Hornets use their powerful mandibles to dismember their caught prey, removing the head, legs, wings, and abdomen. They are most interested in the thorax, which contains the protein-rich flight musculature. The hornet rolls it into a ball and then flies back to the nest to feed the larvae.

The queen needs more protein than the workers to sustain her egg-producing ovaries. Highly active workers, in contrast, primarily need carbohydrates. Sugary liquids from the sap of damaged oak and ash trees are good sources of carbohydrates, as are nectars and the juice from ripe fruits like apples, pears, and plums. Unlike yellow jackets, hornets don't plague picnic areas in the summer in search of food.

RANGE

There are 22 hornet species worldwide. Most are restricted to Asia, with the highest diversity found in northern Indo-Malaya (encompassing South and Southeast Asia and parts of East Asia).

One species, the European hornet, is found in Europe and around the Black Sea and the Caspian Sea. Another species, the Oriental hornet, similar in appearance to the European, thrives in the north of Africa, southern Mediterranean regions, across the Middle East, in India, and in Madagascar.

Hornets are found mainly in the Northern Hemisphere. The common European hornet was accidentally introduced to North America around the middle of the 19th century, becoming permanent at about the same latitudes as in Europe. However, it has never been found in western North America. Generally it is considered a forest species in the United States and is rarely found near human habitats.

ENVIRONMENTAL THREATS TODAY

Hornets, like other wasps, are immensely valuable to ecosystem health. They are part of farmers' and nature's tireless pollinator brigades. Hornets and other wasps and insects, including honeybees, beetles, butterflies, flies, and moths, pollinate nearly 90 percent of all the wild plants on earth, and two-thirds of the world's food crops. Their pollination services to the world economy are worth more than a quarter trillion dollars per year.

In addition to the important ecological service of pollination, hornets and wasps also provide pest control by preying on insects harmful to farmers' crops.

Research compiled by the National Academy of Sciences reveals steep declines in many pollinator groups. The causes are multiple, including habitat loss and widespread pesticide use. The World Conservation Union estimates 20,000 flowering plant species will disappear in the next few decades due to the decline in pollinator species.

The global agriculture industry, commercial landscapers, and homeowners apply more than 6 billion pounds of pesticides each year, posing continuous and persistent threats to pollinators. Unintentional poisonings directly occur from insecticides, while herbicides indirectly kill off forage and other wildflowers that are critical for sustaining pollinator populations. Hornets are protected animals in Germany.

WILD NATURE FACTS

New queens are born in the autumn. Rotten wood or soil protects them through harsh winter conditions, during which time their metabolism slows to a minimum. Their bodies are also capable of producing glycerol, which provides antifreeze protection.

Upon emerging in April, the queen immediately investigates suitable nesting places and food sources, particularly tree sap and insects. Having decided upon a nest spot, she constructs a short pedicel (stalk) that will hold the suspended nest, and then begins building out the first group of cells for laying unfertilized eggs, which will become the colony's workers. Within a week tiny larvae develop, transitioning through five larval stages over the subsequent two weeks.

Hornets expand their colony's comb cells by scraping tree bark and woody debris, mixing this with saliva and chewing it up into a ball with their mandibles. This makes the wood fiber extremely soft and moist. Once well chewed, the hornet plasters the paste onto the nest structure, spreading it out with its mandibles and legs. The characteristic striated pattern of a hornet colony's nest comes from pulp gathered from different trees.

The combs inside the hornet's nest are precise and intricate architectural wonders. The workers build spaces between floors of combs that provide ventilation and the removal of potentially poisonous carbon dioxide. The workers also function as a group like a thermostat, climate-controlling the hive's interior temperature through several measures. Throughout the hot summer, clusters of hornet workers will space themselves around the nest entrance and beat their wings like a fan. After several minutes another group takes over the fanning. If the temperature continues rising, then workers repeatedly fly to gather mouthfuls of water with which to soak the nest surface, generating evaporation that cools the hive.

The packing density of the hive's larvae in comb cells also helps to raise temperatures during the cooler springtime. Once larvae have gone through metamorphosis into workers, they remain in their cells for a while. The net effect of this is to increase the temperature of surrounding larvae cells from 70°F to 88°F within six minutes.

Hornet colony activity reaches its developmental peak by late summer, when some 400 to 700 hornets will be living in a two-foot-high nest. The queen lays fertilized eggs, which become males (called drones) and young queens. The colony's decline is signaled by the emergence of these first so-called sexuals. The workers gradually ignore the old queen; she finally departs the nest and, exhausted from laying eggs, dies.

The workers focus on feeding the new sexuals with protein and carbohydrates. This nourishes the young queens with essential reserves for surviving the long hibernation phase. All of the hive workers die off each season except for the young queen. Even many young hornet queens fail to survive through winter, succumbing to fungal attack or becoming the prey of insectivores.

It was recently discovered that the Oriental hornet has a most unusual body feature compared with other hornets. The yellow stripe on the hornet's abdomen converts sunlight into electrical energy. Indeed, the Oriental hornet's primary metabolic activity happens in that yellow pigment layer, suggesting the sun may be its major energy source. A crystalline solid pigment called xanthropterin enables the process.

YELLOW JACKET

Vespulus species

Stinger, Columbus Blue Jackets (NHL)

FAST FACTS

Yellow jacket colonies are seasonal. Except for the fertilized queen, the entire colony dies off in most North American winters.

Wasps and other insects (e.g., honeybees) pollinate nearly 90 percent of all food crops; their annual services are estimated to be about $200 billion.

Most wasp species do not defend their nests, although they may sting in defense against a personal attack.

THREATS

Habitat Reduction

Toxic Chemicals

Climate

GMOs

WHAT NEEDS TO BE DONE

Habitat Preservation and Protection

Toxic Chemical Use Reduction

Climate Remediation

GMO Regulation

Species extinction is happening up to 1,000 times faster than the natural "background" rate that occurs over geological time spans. It is due mainly to the explosion of the human population and global economic growth. Actions to reduce this mass extinction threat include:

Yellow jacket is the common name in North America for predatory wasps. In most other English-speaking nations they are simply called wasps. Yellow jackets are sometimes mistaken for bees, given that they are similar in size and appearance and both sting. However, honeybees are covered with dense tan-brown hair, carry pollen, and have flattened, hairy hind legs to carry the pollen, while the yellow jacket has none of these features. Yellow jackets also are often confused with other wasps, particularly hornets and paper wasps.

There are 17 species of yellow jacket in North America, including two native species, the western yellow jacket and the eastern yellow jacket, which have long been the types that people most often encounter. The eastern yellow jacket is found from the East Coast to the Great Plains. The western yellow jacket formerly lived only west of the 100th meridian, the dry half of the United States that receives less than 20 inches of rain a year. However, they have now colonized in cities across the country.

In the mid-1970s, the German yellow jacket, a species native to Europe, appeared in Ohio. It has since overtaken the eastern yellow jacket as the dominant species. It is very aggressive and, if provoked, will pursue and sting its target repeatedly.

Yellow jackets can be irritating pests around summer picnics and other outdoor events where food is present, but they are also beneficial. They are pollinators of crops and ornamental plants and prey on harmful insects such as caterpillars, flies, and beetle grubs.

Yellow jacket colonies are seasonal, dying off in the winter in most of North America. Only the newly inseminated, fertilized queen overwinters, emerging during warm days between February and April. She selects a nest site, either underground or concealed in tree branches or bushes. The queen then constructs a small, paperlike nest to begin laying eggs.

Within several months adult workers emerge and take over the myriad activities of expanding the nest, foraging for food, caring for the queen and larvae, and protecting the colony against predators. By the end of the summer the colony will have grown to between 4,000 and 5,000 workers, and the nest will contain 10,000 to 15,000 cells. At this peak, reproductive cells are constructed and new males and queens are produced.

Where warm winters allow year-round colonies, such as in the southeastern United States and in Hawaii, nests of the southern yellow jacket (*Vespula squamosa*) may include as many as 100,000 adult wasps. This is an opportunistic species, or what biologists call a facultative social parasite. The parasite queen usurps the nest from the host queen of another species, mainly the eastern yellow jacket (*V. maculifrons*), and takes control of the colony. The *V. maculifrons* host workers rear the first brood of *V. squamosa* workers, and over time the *V. squamosa* workers entirely replace the original host workers.

RANGE

Worldwide there are more than 200,000 species of wasp known to science, and potentially that many still to be identified. About 15,000 species are stinging wasps. The rest are solitary and nonaggressive species that use their stings mainly to overwhelm their prey. Most of these species do not defend their nest, although they may sting in defending against personal attack.

ENVIRONMENTAL THREATS TODAY

Wasps are immensely valuable to ecosystem health. They are part of farmers' and nature's tireless pollinator brigades. Wasps and other insects, including honeybees, beetles, butterflies, flies, and moths, pollinate nearly 90 percent of

global wild plants and two-thirds of the world's food crops. Their yearly services to the world economy are estimated to be worth more than $200 billion.

In addition to the important ecological service of pollination, wasps also provide pest control by preying on insects harmful to farmers' crops. Some wasp species are predaceous, using their powerful mandibles to chew up and feast on pests. Other species paralyze and parasitize pests by using their stingerlike ovipositor to insert eggs. When the eggs hatch they eat their way through the prey. Yellow jackets mostly scavenge dead insects to feed their offspring.

Research compiled by the National Academy of Sciences has found deep declines in many pollinator groups. The causes are multiple, including habitat loss and poisoning from widespread pesticide use. The World Conservation Union estimates 20,000 flowering plant species will disappear in the next few decades due to the decline in pollinator species.

The agriculture industry, commercial landscapers, and homeowners apply more than 6 billion pounds of pesticides each year, posing continuous and persistent threats to pollinators. Unintentional poisonings directly occur from insecticides, while herbicides indirectly kill off forage and other wildflowers that are critical for sustaining pollinator populations.

WILD NATURE FACTS

Come springtime, the fertilized queen emerges to begin building a colony nest. Well-sheltered spots like dark, hollow tree trunks are most preferred. The queen will gather scrapings of wood bark, which she lubricates with saliva until a round, moist ball of wood pulp is formed. She uses this paper-strength material to form cell walls. Her antennae serve as tools in placing the pulp like a master plasterer. The queen will construct up to 50 cells, depositing an egg in each one.

Within a week the larvae hatch; they then initiate the process of metamorphosis by spinning a silk cap over the cell's opening. They undergo five stages of growth over two more weeks, during which the queen provides them with protein-rich meals. The new adult then eats its way through the silk cap. These first workers, almost always females, begin performing nearly all the tasks being conducted by the queen. These include foraging, nest and cell expansion, caring for the brood, and other maintenance tasks. The sole exception is egg laying, which is the exclusive task of the queen.

The queen lays both fertilized and unfertilized eggs. Females,or gynes, hatch from fertilized eggs; males, or drones, from unfertilized eggs. Males are not involved in caretaking of the larvae, foraging, or nest maintenance. Rather, their function is to depart from the nest in early to mid-autumn and mate. The males die shortly after mating. The workers and queen also die off in autumn, except where the weather is sufficiently warm for them to survive year-round. Otherwise, the sole survivors are the newly fertilized queens that overwinter.

RESOURCES & FURTHER READING

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Jason Riggio et al., "The Size of Savannah Africa: A Lion's (Panthera leo) View," Biodiversity Conservation 22 (December 2, 2012): 17-35, afrpw.org/wp-content/uploads/2013/01/The-Size-of-Savannah-Africa.A-Lions-View.2012.pdf
Peter Andrew Lindsey et al., "The Trophy Hunting of African Lions: Scale, Current Management Practices and Factors Undermining Sustainability," PLoS ONE 8, No. 9 (September 13, 2013): e7380, www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0073808
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