



AMERICAN MUSEUM OF NATURAL HISTORY

# ROTUNDA

Member Magazine  
Summer 2016 Vol. 41 No. 3

## NATIONAL TREASURES



SCIENCE IN  
ANTARCTICA



# From the President

Ellen V. Futter



Summer is a great time to go outside, shake off the winter doldrums, and renew the spirit of exploration. There’s no better place to do that than the American Museum of Natural History, where exploration imbues everything that we do. For our scientists, summer is high season for fieldwork, and this issue of *Rotunda* highlights some of the exciting projects our scientists carry out in such places as Antarctica and Cuba, both of which offer important frontiers for scientific research. While the Museum has worked with colleagues in Cuba for decades, the changing political climate deepens the potential for important scientific exchange, and the Museum’s Explore21 initiative is working extensively to study Cuba’s exceptional biodiversity and endemism. Stay tuned for more exciting programs related to our work in Cuba!

In the meantime, the current exhibition *Dinosaurs Among Us* and the massive new Titanosaur exhibit showcase the kinds of thrilling and important discoveries still being made today in expeditionary paleontology, a field that is seeing tremendous advancement. You need not be a scientist to explore, though. The Museum has many opportunities to expand your horizons this summer, including taking Bat Walks in Central Park or getting up close and personal with live crocodiles. You can stay cool indoors while viewing the magnificent *National Parks Adventure* in 3D in the LeFrak Theater, or venture out into the cosmos with the Hayden Planetarium’s *Dark Universe* Space Show. No matter what your style or preference, the Museum offers something for the explorer in each of us. Let’s get out there!

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## ROTUNDA

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ISSN 0194-6110  
USPS Permit #472-650  
Volume 41, No. 3, SUMMER 2016  
*Rotunda* is published quarterly by the Membership Office of the American Museum of Natural History, 15 West 77th Street, New York, NY 10024-5192. Phone: 212-769-5606. Website: [amnh.org](http://amnh.org). Museum membership of \$75 per year and higher includes a subscription to *Rotunda*. © 2016 American Museum of Natural History. Periodical postage paid at New York, NY and at additional mailing offices. Postmaster: please send address changes to *Rotunda*, Membership Office, AMNH, at the above address.

Please send questions, ideas, and feedback to [rotunda@amnh.org](mailto:rotunda@amnh.org).

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# 13-Million-Year-Old Fossil Sheds Light on Crocodile Evolution



The field team excavates a fossil mandible of *Gryposuchus pachakamue* from the Pebas Formation in Peru.

Fossils of an extinct crocodilian recovered from the Peruvian Amazon by a team of paleontologists including the Museum’s Frick Curator of Fossil Mammals John Flynn suggest that South American and Indian species of crocodiles evolved separately to acquire protruding eyes. Such “telescoped” eyes let crocs scan the banks of rivers and lakes for prey while remaining concealed underwater. Flynn has been co-leading prospecting and collecting expeditions in Peru’s Pebas Formation alongside Rodolfo Salas-Gismondi of the University of Montpellier in France and the Natural History Museum in Lima, Peru, for more than a decade. The team has uncovered mammal fossils and, recently, a diverse group of crocodilians. These include the newly described species *Gryposuchus pachakamue*, the oldest-known gavialoid crocodilian from the Amazon. Gavialoids, which are known for their elongated, narrow snouts, and sharp, piercing teeth, are one of three major types of crocodilians and are represented today by just one living species, the Indian gharial.

“This new gavialoid was the only long-snouted species within a hyper-diverse crocodile community dominated by blunt-snouted, clam-eating caimans,” said Dr. Salas-Gismondi, who was the lead author of the recent study about *Gryposuchus pachakamue*, published in the journal *PLOS ONE*. In the study, the research team provides a long-sought insight about gavialoids. New analysis suggests that the slight telescoping found in this fossil represents the ancestral condition from which the South American lineage evolved protruding eyes. This means that the distinctive, fully telescoped eyes of gavialoids evolved in parallel in South American and Indian groups. “The extraordinarily well-preserved fossils of this 13-million-year-old gharial document how independent, parallel evolution of long-snouted animals with specialized visual systems occurred across continents,” said Flynn.

Learn more about crocodile evolution in the Museum’s new exhibition *Crocs: Ancient Predators in a Modern World*, which is free for Members.

**Swab for Science**  
Since November, the special exhibition *The Secret World Inside You* has been introducing Museum visitors to the trillions of bacteria living inside us and on us—a vast community known as the microbiome. Now, Museum Members can do more than just learn about this fascinating new field. You can join a groundbreaking effort to help scientists understand what makes, and keeps, us healthy. This summer, the Museum is hosting the Healthy Microbiome Project, a first-of-its-kind study to learn more about the beneficial microbes that are an invisible part of our lives. The project, running in partnership with researchers from The Children’s Hospital of Philadelphia and Columbia University’s Mailman School of Public Health, began in mid-May and continues through July 31.

To participate, stop by the Sackler Educational Laboratory in the Spitzer Hall of Human Origins on Saturday and Sunday afternoons through July 31. Project staff will use cotton swabs to sample hands, mouths, and nostrils of adult participants while the whole family enjoys a host of educational activities. Collected samples will be anonymously processed to help researchers learn more about the populations of bacteria and viruses that are present in healthy humans from around the world.

Share a few of your microbes—for science—in the Sackler Educational Laboratory on weekends through July 31.



You can help researchers learn more about the bacteria in the human microbiome by sharing your microbes this summer.



DOOMED DUO

Even before the latest evidence that one animal might be a male and the other a female, paleontologists casually referred to this pair as Sid and Nancy, after the star-crossed punk-rock couple of the 1970s.

CRADLE OF EVOLUTION

This ill-fated dinosaur pair was discovered in 1995 at Ukhaa Tolgod in the Gobi Desert by a joint AMNH-Mongolian Academy of Sciences expedition. Museum Provost Michael J. Novacek, who has co-led expeditions to the site with Dr. Norell since 1990, has described the site as “a bounteous cradle of evolution” that continues to yield masses of dinosaur, mammal, and lizard fossils from the Late Cretaceous period.

HIGH HONOR

The fossil pair’s scientific name is a tribute to an esteemed paleontologist and Museum curator. *Khaan* means “lord” in the Mongolian language, and *mckennai* is derived from the last name of the late Malcolm McKenna, who was instrumental in securing the Museum’s return to the Gobi after a hiatus of 60 years.

HOME AWAY FROM HOME

The *Khaan mckennai* fossils have been housed at the Museum since their discovery and are on loan from the Paleontological Center of the Mongolian Academy of Sciences.

Cretaceous Captives

Some 75 million years ago, heavy rains in Mongolia’s Gobi Desert apparently triggered a sand dune collapse that froze two dinosaurs together forever. Today, they are two of the most spectacular fossils on display in the exhibition *Dinosaurs Among Us*—an exploration of the unbroken line between one group of ancient dinosaurs and modern birds.

Their species, *Khaan mckennai*, belongs to a group of theropod dinosaurs known as oviraptorids, relatively small dinosaurs with bird-like traits including toothless beaks, wishbones, and skulls filled with air pockets. Cousins of *Tyrannosaurus rex* and even closer cousins to today’s birds, some oviraptorids have even been found sitting on eggs, in a brooding posture similar to that of modern birds.

These two fossils are so exquisitely preserved, it’s likely the animals died suddenly where they were standing or sitting, only inches apart. Their proximity hints at interaction of some sort. Based on other fossils in the same group that were also found in pairs, paleontologists are beginning to suspect that oviraptorids were social animals.

Recent research offers more clues. A study published in *Nature* last year by Mark Norell, chair and Macaulay Curator of the Division of Paleontology, and three Canadian colleagues suggests that *Khaan mckennai* exhibited sexual dimorphism, differences in the appearance of males and females of the same species. Though the fossils are very similar, their tails vary in ways that indicate that one may have been a female, capable of laying eggs, and the other, a male, with a tail that could have supported muscles for spreading out feathers to attract a mate. Think peafowl, sage grouse, and other modern birds that put on dazzling displays during courtship. So, was their dying together in a long-ago rainstorm a case of fatal attraction? We will never know.

*Dinosaurs Among Us* is now on view and free for Members.

Catalog nos. IGM 100/1002 and IGM 100/1127



Catalog no. AMNH 42027

Exquisite Emerald

Gifted to the Museum by an anonymous donor in 1953, the Patricia Emerald is among the world’s most magnificent uncut emeralds. Measuring just over 2.5 inches tall, the 632-carat crystal group weighs about 4.4 ounces, and is the largest example recovered from the Chivor Mine in Colombia, one of the world’s most renowned emerald-producing countries.

Because of their value, most emerald crystals of comparable size have been cut into gems and sold commercially. “Only a small number of large emeralds have been saved, and we are indeed lucky to have one of the fabulous few,” says George Harlow, curator in the Department of Earth and Planetary Sciences.

Colombian emeralds are valued the world over for their superb color and relative clarity. The high quality of gems is due to the unique process by which the crystals take shape.

While emeralds from deposits in North Carolina and Russia occur in metamorphic rock, Colombian emeralds are formed in fissures in sedimentary rocks like limestone and black shale.

When hot, briny water passes over rocks and clays that contain chromium and beryllium, these elements are carried off in the flow, eventually coming together to form emerald crystals. Since they don’t form inside a rock containing other minerals, they have fewer inclusions, resulting in more transparent gems.

Historical sources say that the Patricia Emerald was part of a pocket that featured an even larger crystal. Unfortunately, miners attempted to extract the stones from the surrounding rock using TNT, and the resulting explosion blew the larger stone to smithereens. Somehow, the Patricia Emerald survived the blast intact.

It was a stroke of luck that miners found the Patricia Emerald when they did. A landslide engulfed the area of the mine where it was located shortly after this specimen was extracted in 1920.

See more unique specimens in the Guggenheim Hall of Minerals and Morgan Memorial Hall of Gems.

BY ANY OTHER NAME

It is thought that the Patricia Emerald was named after the daughter of an owner of the Chivor Mine. Just who that owner was, though, is unclear: a German owner, numerous American investors, and a Canadian corporation all held rights to the mine around this time.

FINDER’S FEE

Miner Justo Daza discovered the Patricia Emerald, and the remarkable find earned him a bonus of about \$10. When the gemstone was sold one year later, it commanded a higher price, selling for \$60,000.

TWICE AS NICE

Most emerald crystals have a hexagonal form, with six symmetrical sides. The Patricia Emerald, though, has 12 faces, a rare feature that makes this crystal even more special.

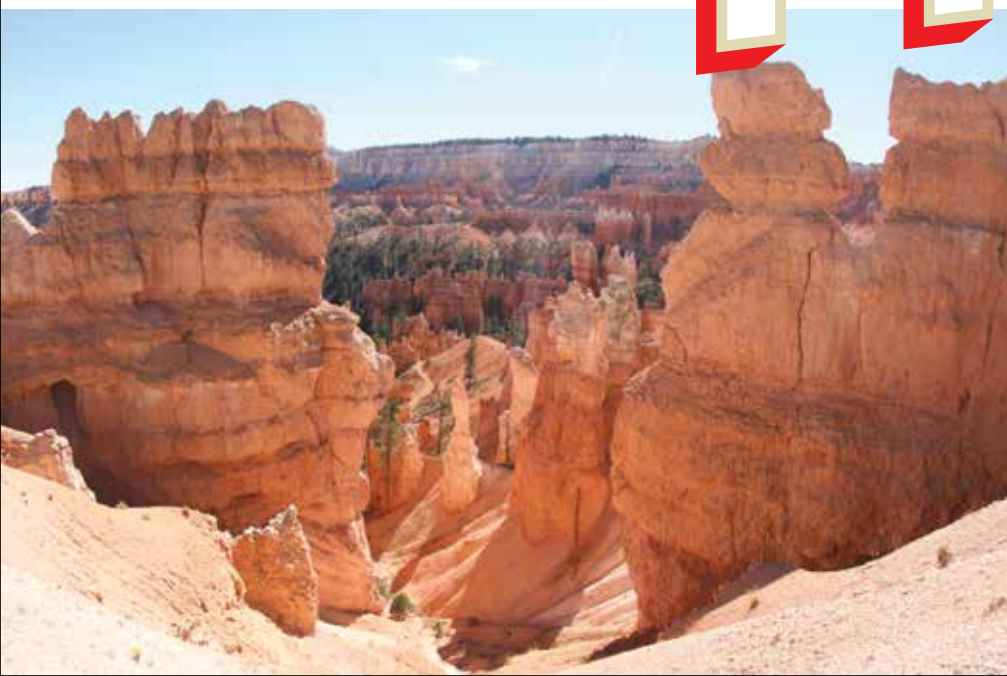
GREEN WITH...CHROMIUM?

Emeralds are a form of the mineral beryl and owe their green coloration to minor concentrations of the elements chromium and vanadium. Other types of gem beryls include aquamarine, which gets its blue color from iron, and morganite, which takes its pink and purple hues from manganese.





# NATIONAL TREASURES



*The National Park Service  
is turning 100 years old  
this summer, and we're  
all invited to celebrate.*



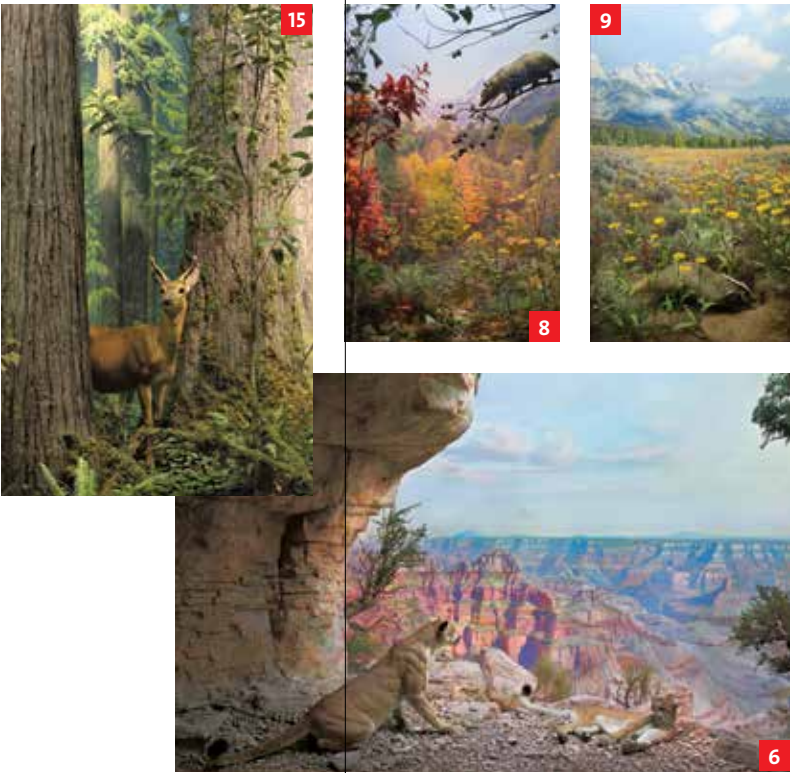
Will your summer vacation find you heading into the great outdoors on a trip to the more than 400 parks, monuments, and other sites in America’s national park system? If so, you’re in good company: the National Park Service, which turns 100 this summer, hosted 307.2 million visitors last year, an all-time record, at sites ranging from San Francisco’s Golden Gate National Recreation Area to the Blue Ridge Parkway. Of these, about 40 million tourists trekked to the most popular national parks—with the Great Smoky Mountains, the Grand Canyon, and Rocky Mountain National Park topping the list.

If you’re not national park-bound this summer, maybe you’ll find yourself sightseeing from the air-conditioned comfort of the Museum’s Bernard Family Hall of North American Mammals and Hall of North American Forests, where dioramas re-create some of the most picturesque vistas from national parks or monuments (see the sidebar for a full list). Several feature lands that were protected by President Theodore Roosevelt, whose passion for conservation was stoked by naturalist John Muir and Museum ornithologist Frank Chapman. Chapman, who had pioneered the use of “habitat groups” or dioramas to educate the public about threats to wildlife, helped persuade Roosevelt to establish the first Federal Bird Reserve on Florida’s Pelican Island in 1903. That same year, a camping trip with John Muir convinced Roosevelt that Yosemite Valley, depicted in the Museum’s coyote diorama, deserved federal protection as part of Yosemite National Park.

“When visited, national parks inspire an immense sense of gratitude for the bequests given to all of us by our forebears,” says Theodore Roosevelt IV, the president’s great-grandson and a Trustee of the Museum. “They make us realize that we have to act as responsible stewards to be able to pass on these lands to our children’s children unimpaired.”

His great-grandfather’s now-legendary trip is re-enacted in the giant-screen film *National Parks Adventure*, which is playing in 2D and 3D in the Museum’s LeFrak Theater. Narrated by Robert Redford, *Natural Parks Adventure* takes viewers to stunning locations in more than 30 national parks as it follows mountaineer Conrad Anker and his companions on adventures from Bryce Canyon in Utah to an ice cave at Pictured Rocks National Lakeshore in Michigan. In person, on the big screen, or through the glass of a diorama, wilderness has never looked more inviting—or more worthy of every effort to preserve it. 📺

*National Parks Adventure* screens daily until September 1. Member discounts are available, and the film is free for Voyager-level Members and above.



The Great Indoors: See the sights, without leaving New York.

Bernard Family Hall of North American Mammals

- 1 Yellowstone National Park, Wyoming: Grizzly Bear
- 2 Crater Lake National Park, Oregon: American Marten
- 3 Wind Cave National Park, South Dakota: Black-footed Ferret
- 4 Big Bend National Park, Texas: Collared Peccary
- 5 Yosemite National Park, California: Coyote
- 6 Grand Canyon National Park, Arizona: Cougar (Mountain Lion)
- 7 Denali National Park, Alaska: Dall Sheep
- 8 Great Smoky Mountains National Park, Tennessee: Gray Fox and Opossum
- 9 Grand Teton National Park, Wyoming: American Badger
- 10 Devils Tower National Monument: Mule Deer
- 11 Mount Rainier National Park, Washington: Sewellel (Mountain Beaver)

Hall of North American Forests

- 12 Saguaro National Monument, Arizona: Giant Cactus Forest
- 13 Inyo National Forest, California: Jeffrey Pine Forest
- 14 Great Smoky Mountains National Park, Tennessee: Mixed Deciduous Forest
- 15 Olympic National Forest, Washington: Olympic Rain Forest
- 16 Colorado National Monument, Colorado: Piñon-Juniper Forest
- 17 Glacier National Park, Montana: Timberline in the Northern Rocky Mountains

Drop in on a favorite park diorama whenever you like! Admission is free for Members at all levels.

FAVORITE PARKS from Museum scientists

We canvassed curators and collections managers from disciplines as varied as paleontology and astrophysics for their favorite national parks for fun and fieldwork.

BEST FOR FOSSIL FINDS

Death Valley National Park

CA NV

“Possibly more trilobites than any other national park. Also, the lowest point in North America is in Death Valley at Badwater Basin, which is pretty cool.”

**Melanie Hopkins**  
Assistant Curator, Division of Paleontology

BEST FOR BIODIVERSITY

Great Smoky Mountains

NC TN

“One of the most biodiverse places on the planet due to left-over tundra flora and fauna holding out in the high elevations, while subtropical species thrive in the moist lower elevation.”

**Susan Perkins**  
Curator, Division of Invertebrate Zoology

BEST FOR STARGAZING

Hawaii Volcanoes National Park

HI

“This is the location of Mauna Kea, an extinct volcano where many of the world’s largest optical and infrared telescopes are located, and where I often observe.”

**Michael Shara**  
Curator, Department of Astrophysics

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BEST FOR BATS

Carlsbad Caverns

NM

“Carlsbad Caverns is a classic. It’s a great place to see a lot of bats.”

**Nancy Simmons**  
Curator-in-Charge, Department of Mammalogy

BEST FOR BIRDS

Joshua Tree

CA

“An incredible spot. Great scenery, great plants, great birds.”

**Paul Sweet**  
Collections Manager, Department of Ornithology

BEST FOR ROCKS

Grand Canyon

AZ

“My favorite park, and pretty much favorite place on the planet, is the Grand Canyon. Amazing sedimentary and metamorphic rocks.”

**James Webster**  
Curator, Department of Earth and Planetary Sciences

BEST FOR INSPIRATION

Yosemite

CA

“Chaco [Culture National Historical Park] is a favorite. And Yosemite...I worked around there for six years before going to college, and it set the course for my future as an archaeologist and advocate for American Indians.”

**David Hurst Thomas**  
Curator, Division of Anthropology



F O S S I L H U N T I N G *at the*

B O T T O M  
*of the* W O R L D



**IT TAKES FIVE DAYS** to reach Antarctica from the tip of South America on board the *Nathaniel B. Palmer*, an icebreaker and research vessel named for the first American who sighted the frozen continent in 1820.

The toughest point, perhaps, is crossing the Drake Passage. This infamously turbulent stretch of sea had some members of a recent Museum expedition so green at the gills they were confined to their bunks.

Arriving on land improves the conditions, by a little. Even during its relatively mild summer, Antarctica's notoriously dry air and whiplike winds can cause exposed skin to chap and crack, driving some to bind their wounds with tape or even super glue. And there are more hazards than just dry skin in the winds, which regularly reach speeds of up to 50 miles per hour.

"If you're in a parka, you're catching a lot of that wind, like a sail," says Abagael West, a graduate student who spent seven weeks in the field in Antarctica earlier this year. "When it's really going, walking 100 yards can be a trip that takes 20 minutes."

The trip was still a dream come true for West, who studies South American mammals at Columbia University in a collaborative program with the Museum's Richard Gilder Graduate School (RGGS).

"I've wanted to go to Antarctica ever since I found out it was a place," she says.

Home to penguins, particularly hardy mosses, and the occasional seal paying a visit to dry land, the continent is a unique and uniquely harsh environment. Snow and ice cover 98 percent of the landmass, and with wind chill, temperatures in the center of the continent can plunge to 100 degrees below zero.

But it wasn't always this way. Tens of millions of years ago, Antarctica was the heart of the supercontinent known as Gondwana, pressed between would-be South American and Australian continents at first and then likely joined to each by land bridges for millions of years after they started to drift apart. Though it was still at Earth's southern pole, Antarctica was then much warmer. And, as fossils recovered there show, the continent was home to a diverse group of vertebrates,

including non-avian dinosaurs and, later, mammals during the Eocene period, about 45 million years ago.

Paleontologists think the continent still has more fossils to yield—remnants which could show the dinosaurs that roamed there 65 million years ago shared the continent with ancient mammals. In February, West joined Museum Curators Ross MacPhee and Jin Meng as they headed south on a seven-week expedition in search of the evidence.

### PALEONTOLOGY IN PARKAS

The trio were part of the Antarctic Peninsula Paleontology Project, known as AP3, a multi-year research initiative funded by the National Science Foundation that first sent scientists to the continent in 2007. (Dr. MacPhee was part of that original expedition, and both he and Dr. Meng went on a subsequent trip in 2011). This year, Museum scientists joined an international team of 12 researchers, including vertebrate paleontologists from Pittsburgh's Carnegie Natural History Museum, Ohio University, and University of Texas at Austin, as well as colleagues from Australia, the United Kingdom, and South Africa.

Their goal: to survey the James Ross Island group, off the northernmost tip of the Antarctic Peninsula, for fossils of backboned animals from the Late Cretaceous through the Paleogene, an interval spanning from 100 million to 40 million years ago. While not exactly inviting, these islands are temperate enough to be partly free of snow and ice during the Antarctic summer, which spans December to early March. When the snow recedes, researchers can get to the rock and dirt that may hold valuable fossils, which are

mostly unreachable elsewhere on the continent. MacPhee in particular was on the lookout for mammals.

"Towards the end of the Age of Dinosaurs, marsupials and early mammals likely came down from what is now South America, and traveled to what is now Australia," says MacPhee. "We should see fossil evidence of this trip in Antarctica."

### MISSING MAMMALS

The teams spent several weeks divided among field camps at four separate sites, with short trips to other locations by helicopter and Zodiac motorboat. The glamour of island-hopping by helicopter didn't diminish the grueling work of finding fossils, a down and dirty exercise pursued on all fours while searching through frigid, densely packed mud, sand, and gravel.

The odds of finding mammalian fossils were always low, in part because the islands are largely composed of shallow marine sediment, topped with volcanic deposits. That makes them a great place to find fish fossils like shark teeth, which the team discovered in abundance, but not ideal hunting grounds for mammal fossils.

"These islands are not where mammals would have been living, because they only uplifted a few million years ago," points out MacPhee. "The teeth and small fragments of land vertebrates would have come in from elsewhere, and would have been carried to sea by a river, swept out into shallow waters, and remained there."

That's certainly a possible course of events—fossils of Eocene mammals from about 45 million years ago were found on this and earlier expeditions. But it makes finding more ancient mammal specimens a very tall order, especially considering that such fossilized remains would be from species probably not much larger than a rat.

In the end, the team's efforts did not turn up the Cretaceous-era mammals MacPhee and his colleagues had hoped to uncover. But there were plenty of other collections made—many hundreds of fossils in total—as well as a few additional interesting and important findings.

Photos © J. Meng

### FOSSIL FINDS

One was a closer study of a layer of fish fossils on Seymour Island located just above the boundary layer that marks the impact that wiped out the dinosaurs. While this important marker, known as the K-Pg boundary, is well understood and identifiable at numerous sites around the world, places where mass die-offs are directly associated with the impact are rare.

"It's possible that the deaths of these fish and other organisms was caused by the impact," says Meng. "There's no direct evidence yet, but we're looking into whether we can establish that connection."

*The glamour of island-hopping by helicopter didn't diminish the grueling work of finding fossils.*

MacPhee and his colleagues also brought home a few fossils from a well-studied species of extinct Eocene penguin. These fossils are not destined for Museum collections but for so-called "destructive sampling." MacPhee hopes to extract collagen proteins, which can last millions of years longer than DNA, from these specimens. Collagen is produced by only a few genes and so cannot provide as much information as DNA sequences. However, recent work reveals that even a small amount of protein sequence information can shed light on evolutionary relationships.

Given the challenges implicit in finding bones that are millions of years old and the compounding difficulties of working in one of the world's most inhospitable environments, if there's anything that Antarctica rewards, it is the flexibility and willingness to embrace scientific work as it presents itself.

"In this kind of fieldwork, you have your reasons for wanting to go to a place, but you don't always get what you want," says MacPhee. "Sometimes, though, you end up finding something even more interesting." ①

This material is based upon research supported by the National Science Foundation under Grant Nos. ANT-1142052 and ANT-0636639.



Curator Jin Meng captured images from the AP3 expedition, such as scientists traveling by Zodiac boat and helicopter, fossil-containing rocks known as "concretions," local wildlife and much more.





# SURVEYING the SOUTHERN OCEAN

## Forests of Invertebrates in the Polar Seas



The waters around Antarctica teem with plant-like invertebrate animals, such as these anemones. Right, scientists including Associate Curator Estefanía Rodríguez (center, white helmet) sort specimens aboard the research vessel RRS James Clark Ross.



Antarctica's Southern Ocean is among the coldest and most remote marine ecosystems on the planet. It is also one of the most pristine.

But a steady increase in commercial fishing in these waters is putting pressure on biologists like Associate Curator Estefanía Rodríguez to understand what the populations of these polar waters look like and help to ensure their protection. In March, Dr. Rodríguez took part in the So-AntEco expedition, a British Antarctic Survey-led research cruise to the Southern Ocean, near the South Orkney Islands. This international expedition aimed to discover new species in the waters around Antarctica, learn more about their habitats, and report findings to policy makers considering protections for the region.

The same factors that have historically limited commercial activity in the Southern Ocean—cold climes, unpredictable weather, and general inaccessibility—have made it one of the least understood ecosystems on the planet. For more than 55 million years, it has developed in isolation from the rest of the world, rendering it one of the most stable environments on Earth as well.

“Other than the occasional iceberg scraping the bottom of

the seafloor, not much was changing in this environment for a long time,” says Rodríguez, who did her Ph.D. thesis work on Antarctic anemones but hadn't traveled to the waters of the continent since 2004. “Once a species has adapted to it, it is actually a pretty nice environment.”

The cold temperatures have not discouraged the development of flourishing marine life here. In fact, Rodríguez says the Southern Ocean is about as diverse in species as the world's warmer—and better studied—tropical waters. In addition to the anemones that Rodríguez studies, the Southern Ocean hosts species of crustaceans, echinoderms, sea worms, and more.

“The whole seafloor is thriving with forests of invertebrates,” says Rodríguez. “Basically every time you go down there, you're going to find something that is not yet described.”

To find new species and learn more about life in the Southern Ocean, the So-AntEco team used trawls and dredges to bring small samples of invertebrates from the ocean floor—anywhere from 500 to 2,000 meters below the surface—on board the research vessel *RRS James Clark Ross*.

Experts in a variety of ocean organisms then sorted through the specimens, identifying and preserving samples for further study. Rodríguez netted over 100 specimens of about 20 species of anemone for the Museum's collections. She suspects that as many as three of those species are new to science.

In addition to its biodiversity, the slower pace of life in these frigid waters leads to peculiar adaptations among its native species. For one thing, providing some parental care to young is a common trait among species in Antarctica, even in animals that aren't known to be particularly nurturing, such as sea spiders, urchins, and anemones like *Epiactis georgiana* (pictured above, far right). Young anemones of this species grow in a ring around their parent for several months, falling off to begin their own lives nearby only once they've grown large enough.

Such close cultivation is necessary in part because the colder temperatures of Antarctic waters mean that young animals take more time to mature, leaving them vulnerable to predators for longer periods than their warm-water counterparts. This slower pace is a general rule in Antarctic oceans—one

that makes these regions particularly susceptible to sudden changes in environmental conditions.

The steady expansion of fisheries into the region, coupled with ecosystem changes brought on by climate change, present just this kind of challenge for Antarctic ecosystems, adding a special urgency to efforts to learn more about these habitats before too much damage is done. The So-AntEco mission, for example, searched for so-called indicator species such as sponges and corals, which can give researchers clues about the general health of an ecosystem.

“These animals tend to take a long time to grow and provide habitats for other species,” Rodríguez says. “If you see them, you're looking at communities that have been around for a long time and could take a long time to recover from any damage. That makes those areas especially important to protect.”

Photos © E. Rodríguez, L. Robinson



Programs and Exhibits

For more programs and to purchase tickets, visit [amnh.org/calendar](http://amnh.org/calendar).

For updates and reminders, sign up for monthly Calendar Highlights for Members by sending your membership number and request to subscribe to [members@amnh.org](mailto:members@amnh.org). The Museum does not trade, rent, or sell this information.

Tickets

Tickets are available by phone at 212-769-5200, Monday–Friday, 9 am–5 pm, or by visiting [amnh.org](http://amnh.org). Please have your membership number ready.

Availability may be limited. Please purchase tickets in advance.

Please be aware that ticket sales are final for all Member programs. All programs go ahead rain or shine. There are no refunds unless the program is cancelled by the Museum.

Please check [amnh.org](http://amnh.org) for Member ticket prices for live-animal exhibits and giant-screen 2D and 3D films.

Information about programs is current as of June 1. Please check [amnh.org/calendar](http://amnh.org/calendar) for updates.



*This croc ate our credits! The Spring 2016 issue should have noted that Crocs: Ancient Predators in a Modern World was created by Peeling Productions at Clyde Peeling's REPTILAND. We regret the omission.*

EXHIBITIONS

Admission is by timed entry only.

Dinosaurs Among Us

Free for Members

Discover how one group of dinosaurs evolved into the fascinating creatures we call birds.

The Secret World Inside You: The Human Microbiome

Free for Members; closes August 14

Come explore the new world that's being discovered in human bodies, and discover why bacteria are key to our health.

Countdown to Zero

Free for Members

This exhibition, developed in collaboration with The Carter Center, highlights scientific innovations that are ridding the world of ancient afflictions.

Opulent Oceans

Free for Members

View large-scale prints featuring illustrations of sea creatures, drawn from rare scientific works.

Crocs: Ancient Predators in a Modern World

Explore the complex lives of crocodilians in this new exhibition featuring four live species.

LeFrak Theater National Parks Adventure

Closes September 1

Narrated by Academy Award winner Robert Redford, *National Parks Adventure* lets audiences soar over red rock canyons, hurtle down steep mountain peaks, and explore our country's most legendary spaces in giant-screen 2D or 3D.

Hayden Planetarium Space Show: Dark Universe

Narrated by Neil deGrasse Tyson, the Space Show celebrates pivotal discoveries and the cosmic mysteries that remain.

Credits

*The American Museum of Natural History gratefully acknowledges the Richard and Karen LeFrak Exhibition and Education Fund.*

*Dinosaurs Among Us is proudly supported by Chase Private Client.*

*Additional support is generously provided by Dana and Virginia Randt.*

*Generous support for The Secret World Inside You and its educational resources has been provided by the Paul and Irma Milstein Foundation and the Milstein Family.*

*The Secret World Inside You is proudly supported by the Janssen Pharmaceutical Companies of Johnson & Johnson.*

*The Secret World Inside You is supported by the Science Education Partnership Award (SEPA) program of the National Institutes of Health (NIH).*

*Countdown to Zero is presented by the American Museum of Natural History in collaboration with The Carter Center.*

*Credits continued on page 18*

Photo © McDonald Wildlife Photography

JULY

Evening Bat Walks in Central Park

Fridays, July 8, 15, 22, and 29

Rain Date: Saturday, July 30th 8 pm

\$25 children under 12; \$40 adults

Join **Bradley Klein, Danielle Gustafson**, and other members of the New York City Bat Group for a walk through Central Park, watching and cataloging the species that call the city home.

Hall Tour: Sharks

Sunday, July 10

10:30 am–noon, 1:30–3 pm

Free; registration required;

call 212-769-5200

Join a Museum tour guide and learn more about the evolution and diversity of sharks. Explore the Hall of Vertebrate Origins, Hall of Biodiversity, and the Milstein Hall of Ocean Life.

*This tour is appropriate for participants ages 12 and up.*

Manhattanhenge

Tuesday, July 12

7 pm

\$12 Members

As the Sun sets on July 12, it will be aligned with Manhattan's east-west numbered streets. Astrophysicist **Jackie Faherty** will guide you through the history and astronomy behind this fascinating phenomenon in a special presentation at the Hayden Planetarium.

Come Fly with The MARSBAND

Tuesday, July 19

7 pm

\$12

Join Director of Astrovisualization **Carter Emmart** and the musicians of **The MARSBAND**, including **Keith Patchel** and **Tenzin Kunsel**, for an immersive exploration of the Red Planet accompanied by a live performance.



Sail on the Clearwater

Wednesday, July 20

6–9 pm

\$95

Enjoy a Members-only sunset sail aboard the *Clearwater*, a wooden sloop modeled after 18th-century Dutch cargo ships. The crew will lead Members through activities like sailing and net-fishing and discuss topics including the history of the sloop and the ecology of the Hudson River.

Grand Tour of the Universe

Tuesday, July 26

7 pm

\$12

Join **Emily Rice** and **Irene Pease** to experience the entire observable universe and come to a cosmic understanding of where we are and how we came to be.

Journey to a Lost World

Saturday, July 30

9 am–4 pm

\$95

Pack your collecting bag, old sneakers, and lunch, and travel back in time with a Museum fossil expert **Paul Nascimbene** for an expedition to Big Brook in Monmouth County, New Jersey. The area offers a variety of invertebrate and vertebrate fossils. Feel free to bring your own collecting equipment; transportation provided.

AUGUST

The Grand Illusion: Celestial Motions

Tuesday, August 2

7 pm

\$12

Explore the night sky from different perspectives with **Ted Williams** and discover how patterns of celestial motion appear to change depending on your location.

Summer Star Sail

Friday, August 5

7:45–10 pm

\$95

Set sail in New York Harbor with astrophysicist **Charles Liu** and watch the Sun set while learning the science and star lore that surround the summer sky.

Our Cosmic Destiny

Tuesday, August 9

7 pm

\$12

Join **Brian Abbott** and **Alejandro Núñez** as they guide you through the history of the universe, then discover what will happen to stars and galaxies in the future, including our ultimate fate: the “Big Freeze.”

Hall Tour: Evolution

Saturday, August 13

2–3:30 pm

Free; registration required; call 212-769-5200

Tour the Halls of Biodiversity, Vertebrate Origins, Primates, and Human Origins to learn about the mechanisms of evolution. Along the way, we will review some of the major branching points in animal evolution.

Nature's Gate: Microscopy with Jay Holmes

Sunday, August 14

10:30 am–12:30 pm

\$25

Go on an exploration of the microscopic world in Central Park with **Jay Holmes**. Participants will learn how to study the world using microscopes and get a primer in collection techniques. Examples of microscopes from the 19th century will be on hand.

*This tour is appropriate for ages 8 and up.*



SEPTEMBER

**Signs Of The Sun**  
Tuesday, August 16  
7 pm  
\$12  
Irene Pease and Lydia Maria Petrosino share ancient myths as they guide you through the night sky to identify the constellations of the zodiac.

**Things That Go Bang In the Universe**  
Tuesday, August 23  
7 pm  
\$12  
Discover all the things that go BANG in the night on a tour of cosmic explosions with Jackie Faherty.

**Hall Tour: Conservation**  
Sunday, August 28  
10:30 am–noon  
Free; registration required; call 212-769-5200  
Tour dioramas throughout the Museum’s halls that serve as an archive of environmental change and educate researchers and visitors alike about how ecosystems have changed over time.

**Countdown To Totality**  
Tuesday, August 30  
7 pm  
\$12  
Get ready for the total solar eclipse on August 21, 2017, with Joe Rao and share a “sneak preview” of the experience in the immersive dome environment.

**Early-Morning Bird Walks in Central Park**  
Weekly sessions begin September 6  
\$85  
Observe the exciting fall migration of birds in Central Park with ornithologists Paul Sweet (Tuesdays, 7 am and Fridays, 9 am) and Joseph DiCostanzo (Wednesdays and Thursdays, 7 am).

**Lunchtime Bird Walks in Central Park**  
Weekly sessions begin September 6  
\$50  
Follow ornithologist Paul Sweet through three Central Park habitats to observe the varied bird species that make New York City their home.

**Family Bird Walks**  
See amnh.org for date  
9 am, 11:30 am, or 2 pm  
\$20  
Young explorers will learn observational skills, then head out to Central Park with Museum naturalist Noah Burg to identify bird species and habitats. Binoculars and bird guides are included. Recommended for families with children ages 4–10.

These programs include approximately 45 minutes of walking. Please wear comfortable shoes and clothing.

See amnh.org/calendar for more information about bird walks.

**Walking Tour: The New York City Water System**  
Saturday, September 17  
10:30 am-noon  
\$25  
Join Sidney Horenstein in Lower Manhattan to explore the construction, intricacies, and storied history of the New York City water system. This tour will focus on the transition from local water to that of the Croton watershed and reservoir.

**Behind the Scenes Tour: Mammalogy**  
Tuesday, September 27  
6:30, 7, 7:30 pm (hour-long tours)  
\$30  
The Museum’s mammal collection is among the Museum’s oldest, and the third largest collection of recent mammals in the world. Join a Museum expert in mammalogy to see some of the highlights that are not on public display.

This tour is appropriate for ages 10 and up.

**Animal Drawing**  
Eight Wednesdays, September 28–November 16  
7-9 pm  
\$160 (Materials not included)  
Join an intensive after-hours drawing course with illustrator and naturalist Patricia Wynne. All experience levels welcome.

Credits continued from page 16.

Countdown to Zero is proudly supported by Conrad N. Hilton Foundation, Lions Clubs International Foundation, Mectizan Donation Program, and Vestergaard.

This exhibition is made possible by the generosity of the Arthur Ross Foundation.

The presentation of Opulent Oceans: Extraordinary Rare Book Selections from the American Museum of Natural History is made possible through the generosity of the Arthur Ross Foundation.

Crocs: Ancient Predators in a Modern World was created by Peeling Productions at Clyde Peeling’s REPTILAND.

National Parks Adventure is a MacGillivray Freeman Films produced in association with Brand USA and presented by Expedia, Inc. and Subaru of America, Inc. with major support from the Giant Dome Theater Consortium.

Dark Universe was created by the American Museum of Natural History, the Frederick Phineas and Sandra Priest Rose Center for Earth and Space, and the Hayden Planetarium.

Made possible through the generous sponsorship of Accenture.

The Museum also gratefully acknowledges major funding from the Charles Hayden Foundation.

Presented with special thanks to NASA and the National Science Foundation.

Dark Universe was developed by the American Museum of Natural History, New York (www.amnh.org) in collaboration with the California Academy of Sciences, San Francisco, and GOTO INC, Tokyo, Japan.

JULY

8  
FRIDAY  
Bat Walk  
Nature Walk

10  
SUNDAY  
Hall Tour: Sharks  
Member Program

12  
TUESDAY  
Manhattanhenge  
Hayden Planetarium Program

15  
FRIDAY  
Bat Walk  
Nature Walk

19  
TUESDAY  
Come Fly with The MARSBAND  
Hayden Planetarium Program

20  
WEDNESDAY  
Sail on the Clearwater  
Member Program

22  
FRIDAY  
Bat Walk  
Nature Walk

26  
TUESDAY  
Grand Tour of the Universe  
Hayden Planetarium Program

29  
FRIDAY  
Bat Walk  
Nature Walk

30  
SATURDAY  
Journey to a Lost World  
Member Program

Bat Walk Rain Date  
Nature Walk

AUGUST

2  
TUESDAY  
The Grand Illusion: Celestial Motions  
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5  
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Summer Star Sail  
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9  
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13  
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14  
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16  
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23  
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Things That Go Bang in the Universe  
Hayden Planetarium Program

28  
SUNDAY  
Hall Tour: Conservation  
Member Program

30  
TUESDAY  
Countdown to Totality  
Hayden Planetarium Program

SEPTEMBER

6  
TUESDAY  
Early Morning Bird Walks in Central Park start  
Nature Walk

Lunchtime Bird Walks in Central Park start  
Nature Walk

7  
WEDNESDAY  
Early Morning Bird Walks in Central Park start  
Nature Walk

8  
THURSDAY  
Early Morning Bird Walks in Central Park start  
Nature Walk

9  
FRIDAY  
Early Morning Bird Walks in Central Park start  
Nature Walk

17  
SATURDAY  
Walking Tour: The New York City Water System  
Nature Walk

27  
TUESDAY  
Behind the Scenes Tour: Mammalogy  
Member Program

28  
WEDNESDAY  
Animal Drawing Class starts  
After-Hours Program



# The Crocodiles of Zapata Swamp



Cuban crocodiles are among the most rare and vulnerable croc species on Earth. Left, researchers are working to reintroduce captive- bred Cuban crocodiles to Zapata Swamp.

Located less than 100 miles from Cuba’s capital, Havana, Zapata Swamp is one of the island’s most treasured national parks.

A plethora of reptiles and amphibians, many of them found only in this part of the world, live in this 2,200-square-mile wetland, as well as roughly 200 species of birds. Some, like the Zapata rail, are full-time denizens, while others are just passing through. Researchers estimate that dozens of migratory birds, including ibis and flamingos, depend on this rest stop during their annual migrations. Several species of hutia, large rodents that are endemic to the Caribbean, are found there. Zapata Swamp is also home to some of the last remaining Cuban crocodiles in the wild.



Page 20 main photo: © iStockphoto/K. Aksenov; all others © G. Amato

The Cuban crocodile (*Crocodylus rhombifer*) is a big animal, reaching up to 12 feet in length. Males of this brightly colored freshwater species, which occurs only in the Cuban archipelago, are notable for the bony protrusions adorning the backs of their heads. In captivity these animals have developed a reputation among zookeepers for being too clever by half. Some have even suggested that the species displays pack-hunting instincts, a behavior that is otherwise unheard of in crocodiles.

“There’s an impression among researchers that Cuban crocodiles are notably curious and notably aggressive—two attributes that are not normally associated with crocodiles,” says George Amato, director of the Museum’s Sackler Institute for Comparative Genomics, who has been working with the species since the 1990s and has traveled to Zapata Swamp each year of the past three years.

Most recently, Dr. Amato and his colleagues, Dr. Roberto Ramos of the National Enterprise for the protection of Flora and Fauna and Dr. Yoamel Milian-Garcia of the University of Havana, have been helping scientists and veterinarians who study Cuban crocodiles develop their capacity for DNA testing and analysis, key tools in ensuring this charismatic species’ survival. While Zapata Swamp is home to the largest remaining wild population, an estimated 3,000 crocodiles, the species has vanished from other parts of the island due to habitat loss and is considered critically

“There’s an impression among researchers that Cuban crocodiles are notably curious and notably aggressive.”

— GEORGE AMATO

endangered. The crocodiles that remain are targeted by poachers. They also face a far more insidious problem: hybridization.

When they interbreed with larger, saltwater-dwelling American crocodiles—a process that has likely been going on for decades—the gene pool of pure Cuban crocodiles gets diluted. In a large population, hybridization is not much of an issue. But wild populations of Cuban crocodiles are now so small that the presence of hybrids has become a serious problem.

To combat hybridization and as a hedge against extinction, Zapata Swamp is also home to a Cuban crocodile farm, which has been raising the animals and studying them in captivity for decades. In recent years, the first captive-bred population of Cuban crocodiles was released into the wild. The release occurred deep in the interior of Zapata Swamp, where interbreeding with American crocodiles should not be possible. When they breed, these newly released Cuban crocodiles will reproduce only with other Cuban crocs, replenishing the numbers of pure Cuban crocodiles in the wild.

“The release of Cuban crocodiles from the managed population represents the success of many years of hard work by dedicated Cuban biologists,” says Amato. “More importantly, it’s a significant step to a more secure and hopeful future for the species.”

Learn more about crocodiles and alligators in *Crocs: Ancient Predators in a Modern World*, now on view in Gallery 77.

## Getting Swamped

What’s it like to study crocodiles in Zapata Swamp? Natalia Rossi, a herpetologist and doctoral student at Columbia University who collaborates with Dr. Amato, shares some hard-earned lessons from the field.

A baby Cuban crocodile



### Sleep With One Eye Open

Researchers studying Cuban crocodiles often secure their camps with fences made of netting before settling in for the night. This helps to keep out crocodiles, which have been known to wander into these sites for a closer look at the scientists.

### Mind the Mud (and the Mangroves)

Working in the wetlands means waiting for the rainy season, when the swamp is navigable by boat. Trying overland travel other times of the year is a perfect recipe for finding yourself stuck up to your waist in impassable muck. And even when they can get around by boat, researchers have to clear paths by cutting through thickets of mangrove.

### Prepare to be Bitten

Not by crocs, which can generally be kept at bay. But there’s no escaping Zapata Swamp’s other animal attackers—the omnipresent mosquitoes. “Any work you do in Zapata Swamp, you’re going to be doing with every bit of your body—your ears, your eyelids, your fingers—covered in mosquito bites,” Rossi says.

## Coming This Fall: ¡Cuba!

Glimpse a nation’s complex history, vibrant cultures, and extraordinary biodiversity in *¡Cuba!*, a new exhibition developed in collaboration with the National Museum of Natural History of Cuba opening on November 21. The unique and changing nature and culture that have shaped this Caribbean island nation will be showcased in an immersive exhibition, including a section devoted to Zapata Swamp and recent efforts to safeguard the threatened Cuban crocodile there.

See *¡Cuba!* before it opens to the public! Member Preview Days begin November 18, 19, 20.

Major funding for *¡Cuba!* has been provided by the Lila Wallace-Reader’s Digest Endowment Fund.

Generous support for *¡Cuba!* has been provided by the Dalio Ocean Initiative.



# New York Night Life

## Bat-Watching in Central Park



(Left to right) Hoary bats, Eastern red bats, and little brown bats are among the numerous bat species that can be seen during a summer evening in Central Park.

The old saw that New York is the city that never sleeps holds just as true for its animal denizens as for humans. This July, you can join guides on evening walks in Central Park to encounter some of the most famous nocturnal animals in the world.

The walks, led by members of the New York City Bat Group, begin near Balcony Bridge, a stone bridge near 77th Street and the Park’s West Drive overlooking the Lake. It’s a great place to see many of the bats of New York, all of which live on a diet of insects such as gnats and mosquitoes that are plentiful near water.

During the summer months, the park is home to numerous species, including little brown bats, ginger-furred Eastern red bats, and hoary bats,

Photo © M. Durham (Eastern red bat), iStockphoto/cheri31 (hoary bat, little brown bat)

which can be identified by the silvery tips of fur that give them a slightly frosted look. Some bats live in New York all year round, hibernating during the winter, while others are visiting during the warm weather. Some species make their homes under bridges or in caves, others live in trees, and some even roost in built spaces like attics.

“During the day, Eastern red bats look just like little red leaves hanging off of trees,” says Bradley Klein, a member of New York City Bat Group who has led bat walks for the Museum for more than 10 years. While they are most active at night, the early bat gets the bug. Plenty of bats can be spotted at dusk, before night has truly fallen. Eastern red bats can sometimes be found out hunting around dusk and dawn if it is particularly cloudy, says Klein, though you need to know where to look.

Appearing against the backdrop of the night sky, bats aren’t as easy to spot as some of the park’s other wildlife, so seasoned bat watchers employ a suite of specialized gear, starting with ultrasonic microphones that can pick up the high-pitched sounds bats use to hunt in darkness. When the calls, made mostly at frequencies too high for human ears, bounce back as echoes, they help bats to hunt and navigate at night.

Even if you can’t see a hunting bat, listening closely to these echolocation calls is a good way to determine what kinds of bats are in a given area. “Each bat species has a distinct echolocation call, and you can use these calls to distinguish between species,” says Klein.

### Bats aren’t as easy to spot as some of the park’s other wildlife.

In addition to the classic ultrasonic mics used by bat enthusiasts for years, there’s now a new tool: ultrasonic sound detectors that can plug into mobile devices. Paired with tablet computers, these detectors can not only pick up inaudible bat chirps but, thanks to an accompanying app, can also suggest which species it might be—a helpful assist for first-time bat watchers.

These swing-shift sojourns aren’t just for bat-lovers, either. All sorts of animals enjoy the nightlife in Manhattan’s most expansive green space. Insects like the swamp darter dragonfly can be found, as can fireflies lighting up the evening sky in early July. Birds like the fast-flying, insect-eating chimney swallow and the black-crowned night heron, which uses the lakes and wetlands of the park as a summer breeding ground, are also spotted regularly by bat walkers, showing a different side to even the best-trodden Central Park paths.

“The bat walks are a great way to introduce people to the natural history of night in New York City, and how it is different from the day,” says Klein. “They can help people see a new world in a familiar environment.”

Sign up for Evening Bat Walks on July 8, 15, 22, and 29 by calling 212-769-5200. Member tickets are \$40 for adults and \$25 for children under 12.



### Bat Spotting Tips from Curator Nancy Simmons

If you’re interested in seeing bats, Curator Nancy Simmons, the Museum’s resident authority on these small mammals, says you’re in luck: it’s likely you’ve been seeing them for years—you just haven’t recognized them.

“When you see an animal flying at dusk, that’s very often not a bird, but a bat,” Simmons says.



#### Pattern Recognition

One easy way to distinguish between the two is to examine the flight path. Birds at dusk tend to be flying in a direct line from one point to another. New York’s bats, which are hunting insects as night falls, instead fly in repeating patterns—from one end of a field to the other and back, or in a continuous loop over a pond—that researchers call “aerial hawking.”



#### Look for Bounce

Another telltale sign that you’re watching a bat is that the flight trajectory tends to be interrupted once in a while. That’s because bats often catch prey not in their mouths, but in their wings, or in the membranes of their tails, and then pause in midair to consume their prey. For bat watchers, these inflight meals are seen as shudders or bounces in the flight path.



#### Follow the Bugs

If you’re spending the summer someplace less bustling than New York City, there’s another tip for finding local bats, though it may seem counterintuitive: look for the brightest lights around.

“When you’re in a place where there’s not as much light pollution, the lights of a parking lot, for instance, attract a high density of insects,” says Simmons. “That makes them a great place to see bats, which are attracted to all the potential food.”



Central Park West at 79th Street  
New York, New York 10024-5192  
[amnh.org](http://amnh.org)



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Seen here in *National Parks Adventure*, Bryce Canyon National Park is home to awe-inspiring geological formations. See page 6 for more.

## General Information

### HOURS

Museum: Open daily, 10 am–5:45 pm;  
closed on Thanksgiving and Christmas.

### ENTRANCES

During Museum hours, Members may  
enter at Central Park West at 79th Street  
(second floor), the Rose Center/81st Street,  
and through the subway (lower level).

### RESTAURANTS

Museum Food Court, Café on One,  
Starlight Café, and Café on 4 offer  
Members a 15-percent discount.  
Hours are subject to change.




### MUSEUM SHOPS

The Museum Shop, Dino Store,  
Planetarium Shop, Cosmic Shop,  
The Secret World Inside You Shop,  
Dinosaurs Among Us Shop, and  
Online Shop ([amnhshop.com](http://amnhshop.com))  
offer Members a 10-percent discount.

### PHONE NUMBERS

Central Reservations 212-769-5200  
Membership Office 212-769-5606  
Museum Information 212-769-5100  
Development 212-769-5151

### TRANSPORTATION AND PARKING

Subway:  (weekdays) or  to 81st Street;  
 to 79th Street, walk east to Museum  
Bus: M7, M10, M11, or M104 to 79th Street;  
M79 to Central Park West  
Parking Garage: Open daily, 8 am–11 pm;  
enter from West 81st Street. Members can park  
for a flat fee of \$10 if entering after 4 pm.  
To receive this rate, show your membership card  
or event ticket when exiting the garage.

### ACCESSIBILITY



For information on accessibility at the  
Museum, email [accessibility@amnh.org](mailto:accessibility@amnh.org)  
or call 212-313-7565.