

NATIONAL GEOGRAPHIC

Merging Man and Machine

THE BIONIC AGE

Sublime
Scottish Islands 54

TRAFFICKING
IN WILDLIFE 78

CHINA'S SPIRIT
WORSHIP 108

CLOWNFISH:
THE COST
OF STARDOM 120

TOUGH LOVE
IN SINGAPORE 132





2010 Toyota Camry LE

MPG: 32 - EPA est hwy

Five-Star Crash Safety Rating: yes*

Powertrain Warranty: 60,000 miles/5 years**

Automatic Crash Response: not available

Turn-by-Turn Navigation: optional



2010 Chevy Malibu LTZ

MPG: 33 - EPA est hwy

Five-Star Crash Safety Rating: yes*

Powertrain Warranty: 100,000 miles/5 years**

Automatic Crash Response: OnStar®/1 year standard†

Turn-by-Turn Navigation: OnStar/1 year standard



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Macaroni Penguin (*Eudyptes chrysolophus*)

Size: Head and body length, 65 - 75 cm (25.6 - 29.5 inches); wingspan, approx. 70 cm (28 inches)

Weight: 3.1 - 6.6 kg (6.8 - 14.6 lbs) **Habitat:** Found mainly in the southern Atlantic; nests on rocky slopes, often amid tussock grass **Surviving number:** Estimated at 18,000,000 - 22,000,000



Photographed by Art Wolfe

WILDLIFE AS CANON SEES IT

Clean and preened. The macaroni penguin spends a great deal of time caring for its plumage, even making trips to the sea expressly to wash off dirt and parasites. Mates preen each other, too, which helps strengthen pair bonds. Despite all this effort, every year it must still replace its feathers in order to remain properly insulated and waterproof. During the molt, the penguin can't forage and, as a result, it can lose up to 40% of its body weight. Packing

weight back on depends on an ample supply of marine life, which is being disrupted by commercial fishing and climate change. The question is: How much longer will the penguin preen?

As we see it, we can help make the world a better place. Raising awareness of endangered species is just one of the ways we at Canon are taking action—for the good of the planet we call home. Visit canon.com/environment to learn more.

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"REINA DOESN'T RISK
HER LIFE FOR A PAYCHECK.
SHE DOES IT FOR ME.

THAT'S WHY I FEED
HER EUKANUBA."

Gregor Dekleva

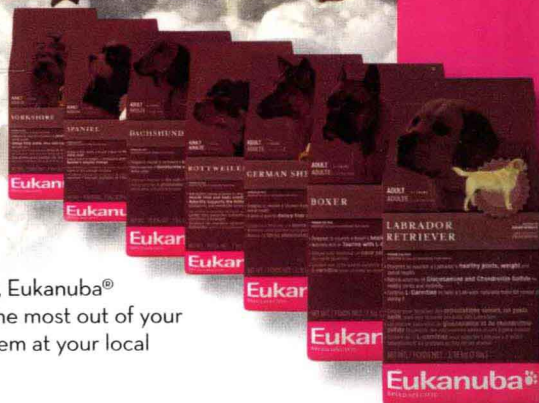
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Aspen/Snowmass K-9 Patrol

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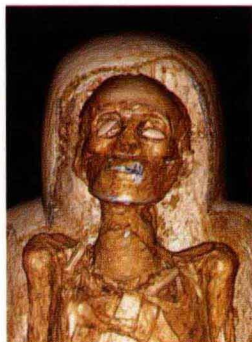
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CONSERVATION

Backing Big Cats

The NGS Big Cats Initiative aims to keep top felines from sliding toward extinction.

SPACE

Wanted: Moon Rocks

NASA has a cache. Samples are sold on eBay. Then there's the black market.

HEALTH

The Cost of Care

Which country leads the world in health care spending per person?

TECHNOLOGY

Mummies Bare All

Lady Hor was really a sir. That's one of many surprises from high-tech scans.

ENVIRONMENT

Quashing Kudzu

The vine covers eight million U.S. acres—and sponging. A killer fungus aims to take it down.

THE BIG IDEA

Hitting Viruses Where They Live 30

A radical new strategy could outwit the wily, ever mutating parasites.

Inside Geographic 150

Flashback

GeoPuzzle



On the Cover

This revolutionary prosthetic limb can match the real thing. With 20 motors, it is nearly as strong and dexterous.

Photo by Mark Thiessen



ngm.com



Replacing Your Parts

Maybe you need an artificial retina or a "spring ankle with regenerative kinetics." Our interactive illustration shows the latest in substitute devices.

ART: BRYAN CHRISTIE

NATIONAL GEOGRAPHIC

JANUARY 2010 • VOL. 217 • NO. 1

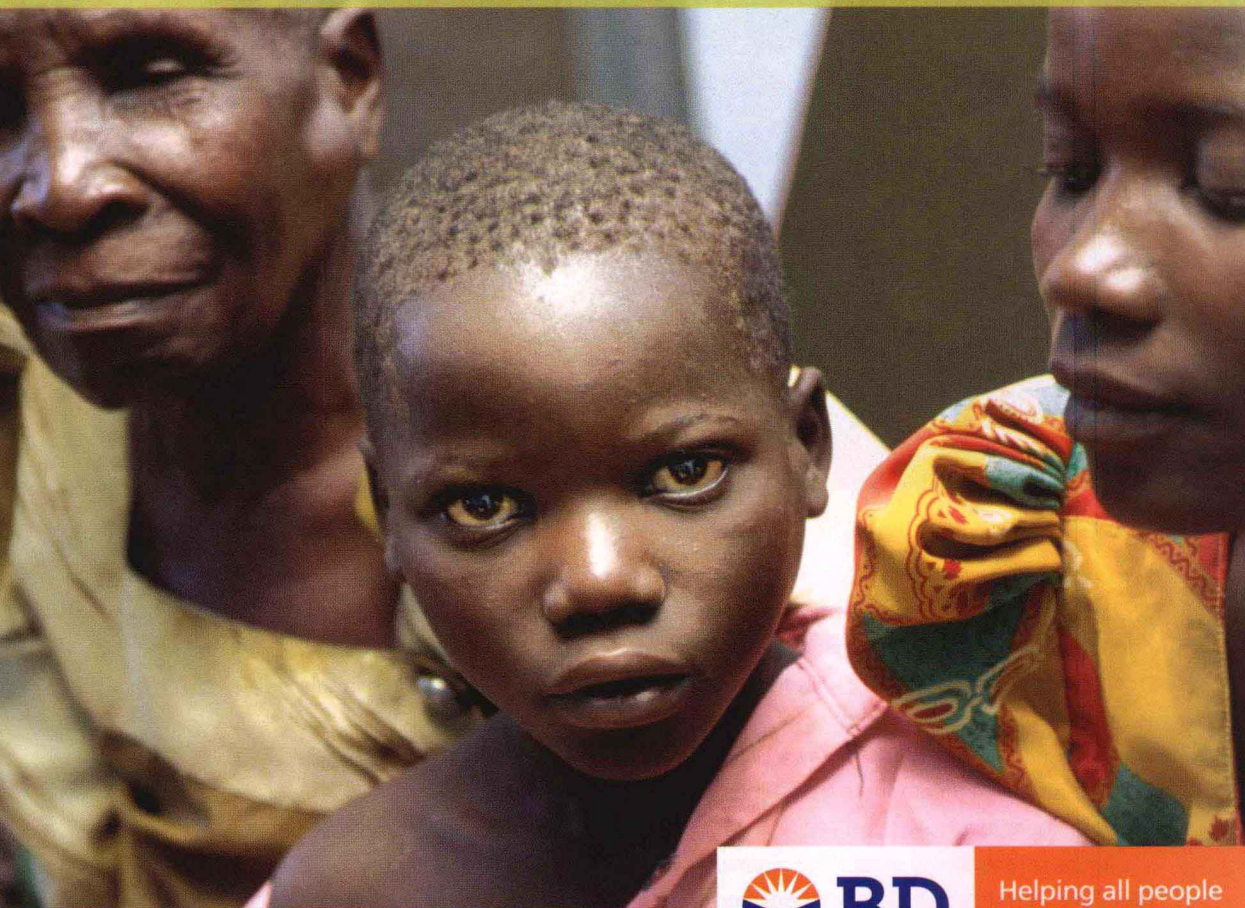
- A Better Life With Bionics** 34 The blind can see, a one-armed woman can fold her shirts.
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- Sublime Scottish Islands** 54 Some call the Hebrides bleak. They're not paying attention.
By Lynne Warren Photographs by Jim Richardson
- Asia's Wildlife Trade** 78 Demand for pets and medicines drives illegal trafficking.
By Bryan Christy Photographs by Mark Leong
- Restless Spirits** 108 In modern-day China, the dead still make demands.
By Peter Hessler Photographs by Ira Block
- Befriending Nemo** 120 Clownfish captivate moviegoers, scientists—and anemones.
By James Prosek Photographs by David Doubilet
- The Singapore Solution** 132 The "minister mentor" wields a big carrot and a big stick.
By Mark Jacobson Photographs by David McLain



Clownfish can't flourish without a host anemone, whose stinging tentacles keep predators away. Story on page 120.

DAVID DOUBILET

The International AIDS Vaccine Initiative (IAVI) is a global nonprofit organization searching for safe, effective, preventive and accessible HIV vaccines for use throughout the world. IAVI evaluates vaccines through its network of state-of-the-art laboratories and clinical research centers globally. To learn more, visit www.iavi.org.



Partners offering hope

The statistics are staggering. Over 33 million people are estimated to be living with HIV. Last year alone there were 2.5 million new infections, and another 2 million died as the result of AIDS.¹

Vaccines, like those developed to eradicate some of the worst diseases of the 20th century, offer the best hope to end the devastation of HIV and AIDS. Protecting the global community from infection before it strikes can potentially save millions of lives.

BD's renewed commitment of cash and product donations to IAVI will increase IAVI's access to



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live healthy lives

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EDITOR'S NOTE



Amanda Kitts tests a bionic arm in the prosthetics lab at the Rehabilitation Institute of Chicago.

Four years ago an automobile accident robbed Amanda Kitts of her arm and the ability to do things most of us take for granted, like making a sandwich. "I felt lost," the teacher from Knoxville, Tennessee, tells writer Josh Fischman in this month's cover story on bionics.

Then Amanda met Todd Kuiken, a physician and biomedical engineer who knew that the nerves in an amputee's stump can still telegraph brain signals. He fitted her with a bionic arm.

Bionics is technology at its most ingenious and humane. Most of us first encountered the word in science fiction books or television shows like *The Six Million Dollar Man*. In that 1970s series, pilot Steve Austin is injured in a crash. His rebuilt body, which includes a bionic arm, eye, and legs, is nothing short of superhuman. But the bionics of modern medical engineering has little to do with enabling someone to run at 60 miles an hour or use an eye like a zoom lens. It is more about the quiet miracle of holding a fork or seeing the silhouette of a tree. It's about allowing people like Amanda to reclaim what they've lost.

A year ago Ray Edwards, a quadruple amputee, was one of the first people in the United Kingdom to be fitted with a bionic hand. When he flexed his new hand for the first time, he cried. "It made me feel I was just Ray again," he said. The restoration of one's normal self is a powerful gift.

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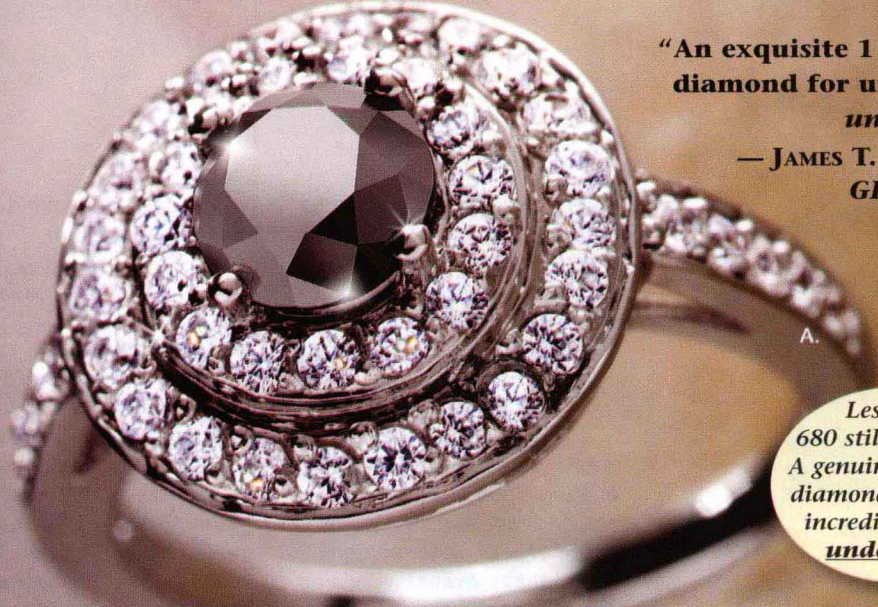
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When I strolled into the palatial lobby of the Grand Casino in Monte-Carlo, I headed straight for the roulette table to place my one bet for the evening. Of course, I bet it all on black. Black diamonds that is. I met our Belgian diamond dealer in the casino here and he pulled out a black suede pouch. He had almost 900 carats of rose cut black diamonds with him. When he told me the terrific price, I said that I'll take them all. Faceted one carat diamonds for under \$200 a carat—maybe this is one time you can leave a casino with a winning hand.

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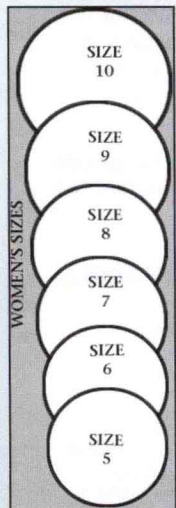
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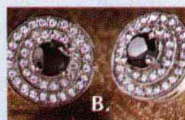
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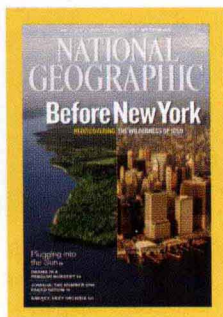


USING THE RING SIZE CHART

Place one of her rings on top of one of the circle diagrams. Her ring size is the circle that matches the inside diameter of the ring diagram. If her ring falls between sizes, order the next larger size.



Smart Luxuries—Surprising Prices



September 2009

Plugging Into the Sun

While the pessimists are saying of solar energy, we've heard it all before, the optimists are busy taking advantage of free energy. I installed solar thermal and solar electric on my home. My utility bills have dropped by more than two-thirds, my home value has increased substantially, and after subsidies, my systems will pay for themselves in less than four years at current utility rates. I'll get free energy for the remainder of the system's 25-year (minimum) life span. Solar is not only inevitable, it's a no-brainer.

WILLIAM SAROKIN
Mount Kisco, New York

Last year I looked into installing a photovoltaic system on my house here in southern California. Then I found out that I would have to sell any excess power back to Southern California Edison for less than Southern California Edison sells it to me. Plus I would have to use a special meter, I would not be permitted to install the equipment myself (although I'm an industrial electrician with more than 20 years of experience), and I would have to pay

an approved contractor for the system installation. Lastly, if there is a power credit at the end of the year (if I produce more power than I use), the credit is forfeited! Why bother?

KENNETH JOHNSON
Beaumont, California

Your coverage of solar energy omitted Israel's solar achievements. Israel leads the world in use of solar water heaters. Use of these devices, visible on virtually every building in the country, has been law since the early 1990s. Israel is a leader in solar technology as well. In fact, an Israeli company has been contracted to build in California's Mojave Desert what will become the world's largest solar-collection facility in both capacity and land size. Israel deserves credit for its leadership in solar energy development and generation.

ZVI HOLLAND
Phoenix, Arizona

There is a piece missing from your article, and that is that North America's electrical system is able to provide for today's requirements. The generation and delivery systems are dated but adequate. Updating and improvements always need to be continued, as is the case with any mechanical system. However, the main thrust does not have to be "Big Electric." What we need is self-sufficiency at the point of consumption. Your article's coverage on Germany shows what can happen when individual homes and businesses each produce power. We all live under roofs. If each user produces only 50 percent of what he or she consumes, already we have

off-loaded the demand on the generating system.

PETER VANDERBURG
Ottawa, Ontario

Before New York

You can go back to 1609 to rediscover the wilderness sacrificed to create an urban center, or you can go to photos taken in 2005 of wilderness raped to create one-acre, landscaped plots with five-bedroom monstrosities to house couples who don't even have children yet.

CHRISTINA SORMANI
New York, New York

José the beaver was right to come to the Bronx. The New York Botanical Garden, just north of the Bronx Zoo, has the largest stand of original forest left in New York City, about 50 acres. The Bronx is also home to the largest city-run park in New York City, Pelham Bay Park, which is three times the size of Central Park. I live just outside the park's border and from my kitchen window can see snowy egrets and herons picking their way through the tidal flats of the Hutchinson River. The park is also home to rabbit, raccoon, skunks, turkeys, hawks, and the occasional coyote.

PETER A. GEIGER
New York, New York

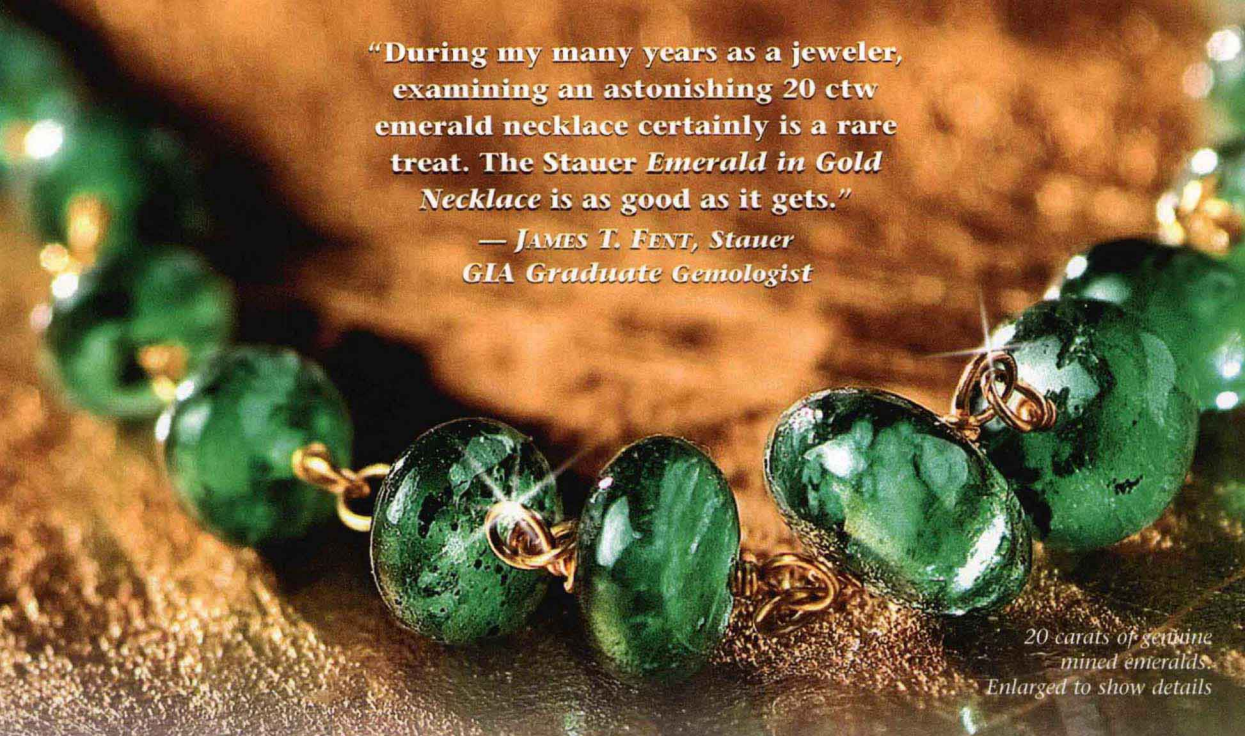
Corrections, Clarifications

September 2009:
Science: Who's Number Two?
São Paulo was misspelled.
We regret the error.

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20090-8199. Include name, address,
and daytime telephone. Letters may
be edited for clarity and length.

"During my many years as a jeweler, examining an astonishing 20 ctw emerald necklace certainly is a rare treat. The Stauer Emerald in Gold Necklace is as good as it gets."

**— JAMES T. FENT, Stauer
GIA Graduate Gemologist**



20 carats of genuine
mined emeralds.
Enlarged to show details

The Curse of the Perfect Gift

20 carats of polished natural emeralds linked with 14K gold for under \$200!

It happened on our last trip to South America. After visiting the "Lost City" of Machu Picchu in Peru, we ventured through the mountains and down the Amazon into Brazil. In an old village we met a merchant with an impressive collection of spectacular, iridescent emeralds. Each gem was tumbled smooth and glistened like a perfect rain forest dew drop. But the price was so unbelievable, I was sure our interpreter had made a mistake.

But there was no mistake. And after returning home, I had 20 carats of these exquisite emeralds strung up in 14k gold and wrapped as a gift for my wife's birthday. That's when my trouble began. She loved it. Absolutely adored it. In fact, she rarely goes anywhere without the necklace and has basked in compliments from total strangers for months now.

So what's the problem? I'm never going to find an emerald deal this good again. In giving her such a perfect gift, I've made it impossible to top myself.

To make matters worse, my wife's become obsessed with emeralds. She can't stop sharing stories about how Cleopatra cherished the green gem above all others and how emeralds were worshiped by the Incas and Mayans and prized by Spanish conquistadors and Indian maharajahs. She's even buying into ancient beliefs that emeralds bring intelligence, well-being and good luck to anyone who wears them. I don't have the heart to tell her that I'm never going to find another deal this lucky.



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in 14K Gold Earrings.*

Our elegant Emeralds in 14K Gold Necklace features 20 carats of smooth, round emerald beads, hand-wired together with delicate 14K gold links. Each bead is unique in both size and color, ranging from transparent to translucent. The 18" necklace fastens with a spring ring clasp. If you are not thrilled at this rare find, send it back within 30 days for a full refund of the purchase price. But remember, we have only found enough emeralds to make a small limited number of necklaces and earrings at this low price.

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LETTERS

I wish you had devoted a couple of paragraphs to the broader role of the beaver, a species that moved onto the rocky, partially barren island that would someday be Manhattan soon after the retreat of the glaciers about 11,000 years ago. Layer upon layer, it was the beaver-dam silting process that would ultimately create the marshes and meadows that support such a rich assortment of vertebrate life identified in the Muir web.

RAY PAWLEY
Arabela, New Mexico

It's unfortunate that your foldout map cropped out one of the only swaths of Manhattan that still resembles the island in its natural state. Inwood Hill Park, 196 forested acres at the

northern end of Manhattan, contains native flora and fauna not found elsewhere on the island. Inattention to this special, timeless place, which contains huge cliffs, caves, freshwater springs, and one of Manhattan's only salt marshes, has contributed to its disrepair. Its absence from the article is a missed opportunity to educate the public about this last Manhattan wilderness.

GABE KIRCHHEIMER
New York, New York

Sea levels around Manhattan Island have risen by one to two feet since the 1780s, when the "British Headquarters Map" was drawn. One would expect that large areas of the late 1700s-era shoreline would have been gradually submerged by now.

However, the overlaid maps of ancient and current areas clearly show that there are now high-rise buildings sitting on land that was then off the shoreline of Manhattan. This says volumes about how humans, using the technologies of the 19th and 20th centuries, were able to withstand over 18 inches of sea level rise—which is approximately the amount that sea levels are projected to increase over the next century.

CHRIS WALCEK
Albany, New York

Shattered Somalia

I was twice deployed to Somalia while serving in the U.S. Marine Corps in the early 1990s. The parts of your article most relevant to my observations of the country were the passages



LONG

that relay the hope that exists in Somalia. It has been ravaged by power struggles and inter-clan rivalries. Yet its people are as proud of their land and heritage and are as optimistic as any on the planet. A number of lessons can be learned from Somalia, including the human capacity for hope.

MICHAEL R. PICK, JR.
Arroyo Grande, California

The people of Somaliland have set a wonderful example. They are the best chance for Somalia and other nearby countries. They deserve some support from the international community to bolster their stability so that in time they can reach out to Somalia.

J. MCFARLAND
Stanfield, Oregon

Orchids

Michael Pollan's review of the orchid family's deviant deceptions was delightfully written, and I will never view their blossoms in the same way again. My wife loves orchids, and when an appropriate response to a holiday, birthday, or anniversary is warranted, I visit our local orchid shop for a sure thing. I am eager to see the shop's reaction when I request a "prostitute orchid." Or perhaps, a "whorchid"?

TOM BULLOCH
Woodland Park, Colorado

Culture: Facing Beggars

Buskers also feel the burn of anti-begging laws. In many countries great artists stay off the street for fear of being

fined or arrested. Luckily there are still places where street entertainers are supported—if not by the government, then at least by the people.

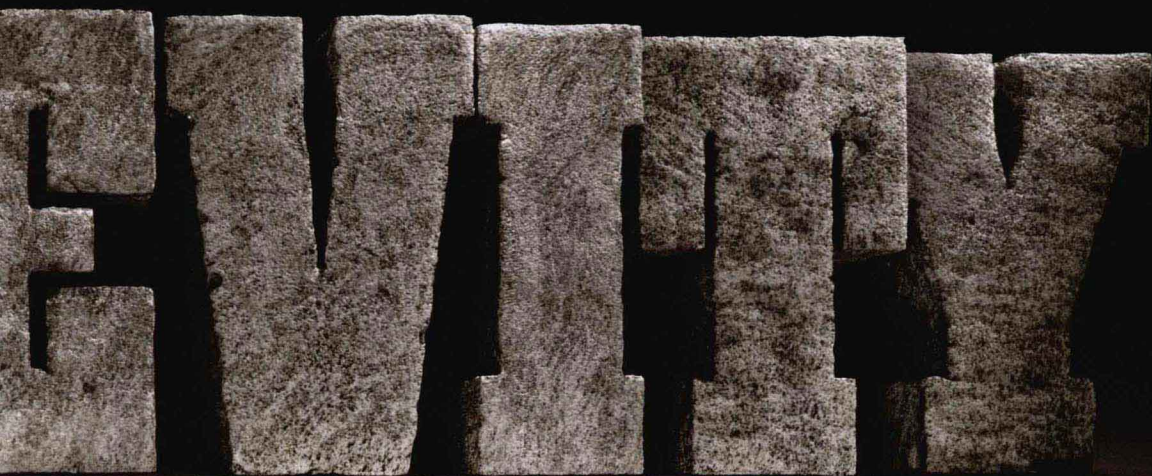
JEDEDIAH CALLEN
Manitoba, Canada

History: Saved By the Belt

I was very surprised at the omission of the 1903 invention of laminated glass by French chemist Édouard Bénédictus. Horrific disfigurements and deaths from broken windshields were common in early automotive history.

WILLIAM B. HARBERT
Spokane, Washington

Automobile windshields were just being introduced in 1903, but safety glass was not employed in them until the 1920s.



80% of Toyotas sold in the last 20 years are still on the road today.*

toyota.com/longevity

Rare Air They fall and soar at different altitudes, one slicing into water, the other carving air. But a diver and a jet have something in common: Both present amazing picture possibilities. So take your best shot and send it to us—the sky's the limit for how far it'll go. Every month this page features two photographs: one chosen by our editors, one chosen by our readers via online voting. For more information, go to ngm.com/yourshot.



EDITORS' CHOICE

Erik Guzowski New York, New York

A wedding photographer in Manhattan, Guzowski, 38, took a different kind of picture in Tempe, Arizona. Perched atop a 33-foot platform, he captured two high schoolers warming up on springboards before a state diving competition.

Kirk McMenamin Grosse Ile, Michigan

The back of an F/A-18F Super Hornet is consumed by a vapor cone during an exhibition. McMenamin, 38, a quality and engineering manager, says, "It had been raining that morning, so the air was filled with moisture. Conditions were perfect."



READERS' CHOICE