

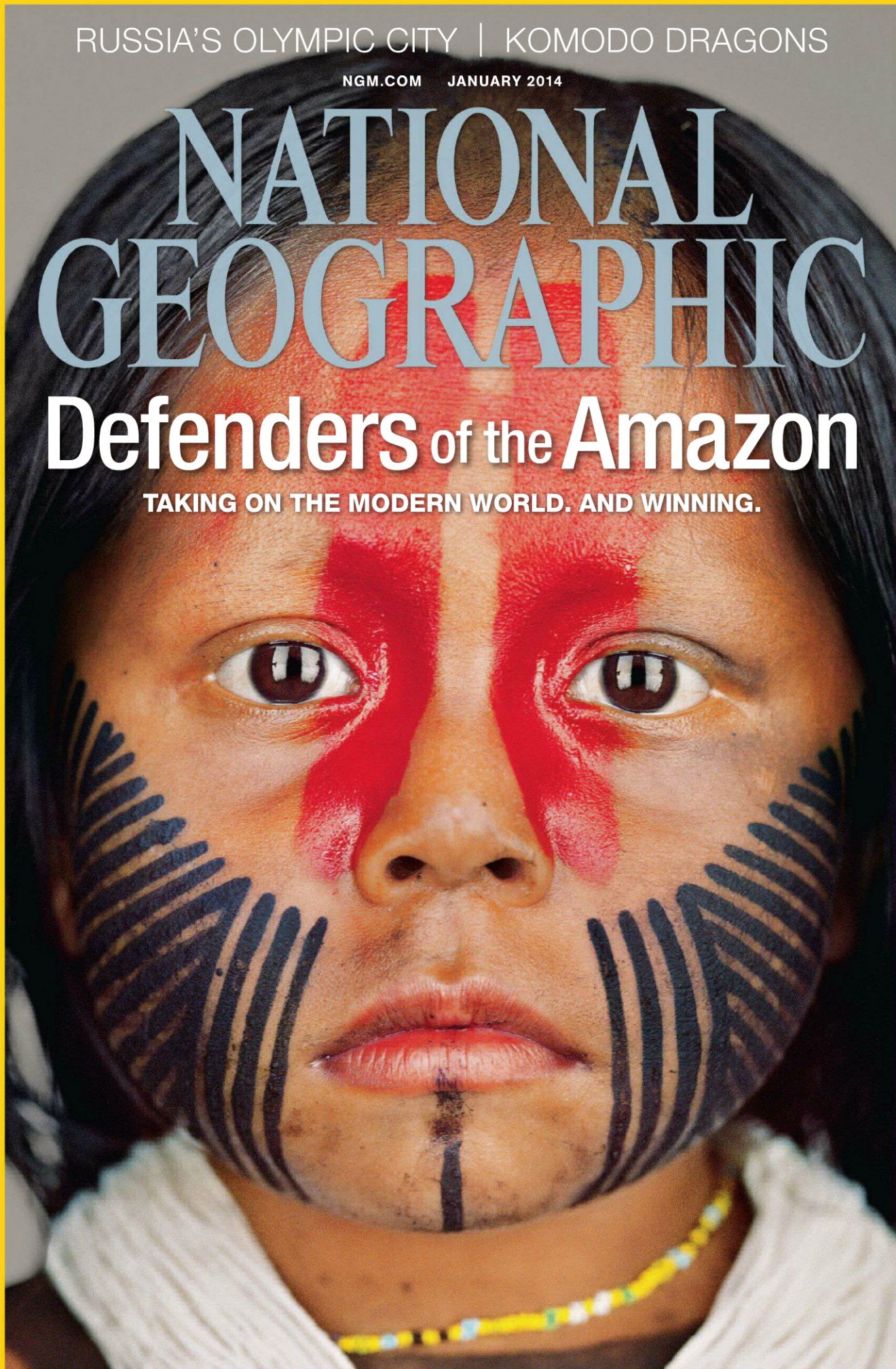
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*“I had heard that when you were in *Abroad*, you can buy anything.”*

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The methane gas alone could power one million homes for a year.

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Sand is covering up the Tunisian set for *The Phantom Menace*.

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On the Cover The crown of her head shaved, paint newly applied, hair slicked back with oil, a girl from Brazil's Kayapo tribe is ready for a ceremony. Her eyelashes and brows were plucked to meet local standards of beauty.
Photo by Martin Schoeller

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Staying True

We cover indigenous cultures all the time and have done so, you might say, ever since John Hyde, an early Editor of the magazine, ran a photograph of a Zulu bride and groom in 1896. It's part of our DNA, one of the many ways in which we show readers the great diversity of our world.

Often these are sad stories of dispossession and disappearing cultures, but this month's feature about the Kayapo, perhaps the richest, most powerful of Brazil's indigenous people, is different. Though the Kayapo follow a subsistence way of life, they have satellite dishes, disposable cigarette lighters, and boat motors. But the artifacts of modernity have been incorporated without compromising the tribe's identity. As Chip Brown reports, their language, ceremonies, and cultural systems remain intact. They have their land—an expanse of rain forest—and have been successful in protecting it. Most important: They know who they are.

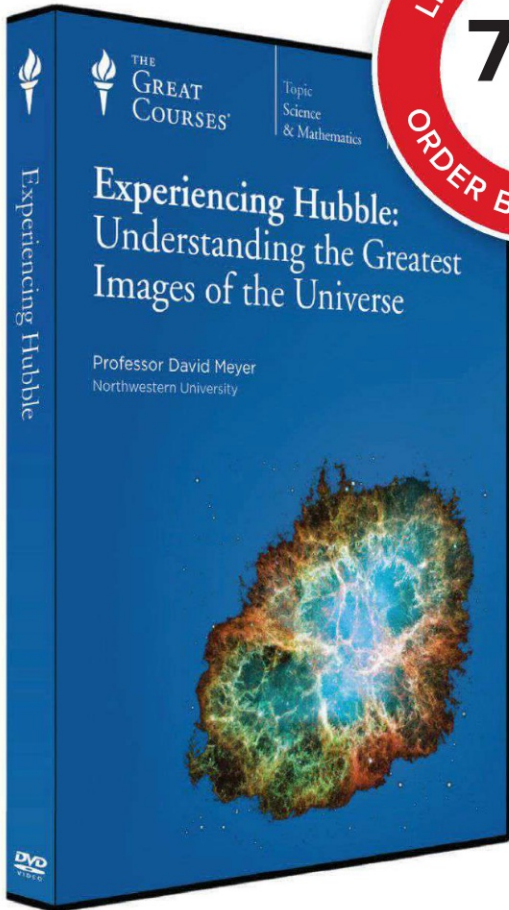
This certitude also shines through in Martin Schoeller's remarkable portraits. Schoeller, who made his career as a celebrity portraitist, has written that a photographic close-up creates "a confrontation between the viewer and the subject that daily interaction makes impossible." Through Schoeller's lens we see these remarkable men, women, and children as they are—ineffably human. We meet their gaze and connect across the distance of place and culture.

Feather head-dresses—here worn by Kayapo men Okêt (left) and Mryprire—are passed down in families.

A handwritten signature in black ink, which appears to read "Martin Schoeller".



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Rising Seas

The human race is facing a sort of problem it has never been up against before. Not only are the implications of climate change enormous, but the general public also seems unwilling to look the problem in the eye. Drastic action is going to have to be taken at some point in the future, but without public support governments will have a hard time being able to do anything significant. The first step should be to say, Hey, this is really happening. It is a whole lot easier to take action if everyone agrees there is actually something to take action about.

MCKAY JENSEN
Provo, Utah

When the overwhelming evidence is so compelling and the costs—even now—are so enormous and mounting, I commend the magazine for its courage and clarity. We are all part of the problem and must quickly act to become part of the solution.

MARTIN GOEBEL
Portland, Oregon

Though the charts and comments indicate that the ocean has been rising every year for some time now, a recent report from U.S. scientists shows that the ocean actually dropped in 2011. After heavy rains in Australia, the soil soaked up the moisture and therefore reduced the water level around the world. Why was this not mentioned in your story?

ROBERT WALTERS
Anaheim, California

According to one of the study's authors, John Fasullo: The interesting but temporary decline—which has already been offset by a faster rise in subsequent years—was reflected

in the article's chart on page 41, but the drop is so small compared to the long-term rising trend that the naked eye can't pick it out.

I have never seen anything on rising seas that explains the effects on nuclear power plants. Most plants around the world have been built on the seacoast or on rivers at sea level. As I understand it, a nuclear power plant cannot be used forever. At some point the plant has to be shut down and then monitored for potential leaks indefinitely. I would like to know how the nuclear industry will approach the potential problem of nuclear plants being underwater.

JIM KINGSBURY
Yorktown Heights, New York

Corrections

SEPTEMBER 2013, EXPLORERS QUIZ ANSWERS
The *T. rex* fossil "Sue" was found near Faith, South Dakota, not in the Black Hills.

RISING SEAS The credit for the image on page 35 should have read William Putman. On page 55 the name of the Verrazano-Narrows Bridge was incorrectly applied to the strait it spans. The strait is "The Narrows."

FEEDBACK

Readers offered their thoughts on the effects of rising seas.

"The effects on vast areas of critically important **LOW-LYING HABITATS** will be tremendous."

"Higher sea level coupled with less protection from reefs could accelerate **COASTAL EROSION.**"

"Any thought of change in **OCEAN SALINITY** or its effect on aquatic life?"

"With the loss of the weight of ice and permafrost on the land surfaces... are we not in for a great increase in major **EARTHQUAKES** and **VOLCANISM?**"



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Who should use Humalog?

Humalog is used to treat people with diabetes for the control of high blood sugar.

IMPORTANT SAFETY INFORMATION FOR HUMALOG

What is the most important information I should know about Humalog?

- Do not change the insulin you use without talking to your healthcare provider. Doses of oral antidiabetic medicines may also need to change if your insulin is changed.
- Test your blood sugar levels as your healthcare provider instructs.
- When used in a pump, do not mix Humalog with any other insulin or liquid.

Who should not take Humalog?

- Do not take Humalog if your blood sugar is too low (hypoglycemia) or if you are allergic to insulin lispro or any of the ingredients in Humalog.

Before using Humalog, what should I tell my healthcare providers?

Tell your healthcare providers:

- About all of your medical conditions, including liver, kidney, or heart problems.
- If you are pregnant or breastfeeding.
- About all the medicines you take, including prescription (especially ones commonly called TZDs [thiazolidinediones]) and non-prescription medicines, vitamins, and herbal supplements.

How should I use Humalog?

- Humalog is a rapid-acting insulin. Take Humalog within fifteen minutes before eating or right after eating a meal.
- Always make sure you receive the correct type of Humalog from the pharmacy.
- Do not use Humalog if it is cloudy, colored, or has solid particles or clumps in it.
- Do not mix Humalog with insulin other than NPH when using a syringe. Do not mix or dilute Humalog when used in a pump.
- Inject Humalog under your skin (subcutaneously). Never inject into a vein or muscle. Change (rotate) your injection site with each dose. Make sure you inject the correct insulin and dose.
- Depending on the type of diabetes you have, you may need to take Humalog with a longer-acting insulin or with oral antidiabetic medicines.
- If you forget to take your dose of Humalog, your blood sugar may go too high (hyperglycemia), which can lead to serious problems like loss of consciousness (passing out), coma, or even death.
- Your insulin dose may need to change because of illness, stress, other medicines you take, change in diet, or change in physical activity or exercise.

What are the possible side effects of Humalog?

- Low blood sugar is the most common side effect. There are many causes of low blood sugar, including taking too much Humalog. It is important to treat it quickly. You can treat mild to moderate low blood sugar by drinking or eating a quick source of sugar right away. If severe, low blood sugar can cause unconsciousness

(passing out), seizures, and death. Symptoms may be different for each person. Be sure to talk to your healthcare provider about low blood sugar symptoms and treatment.

- Severe life-threatening allergic reactions (whole-body reactions) can happen. Get medical help right away if you develop a rash over your whole body, have trouble breathing, have a fast heartbeat, or are sweating.
- Reactions at the injection site (local allergic reaction) such as redness, swelling, and itching can happen. If you keep having skin reactions or they are serious, talk to your healthcare provider. Do not inject insulin into a skin area that is red, swollen, or itchy.
- Skin may thicken or pit at the injection site (lipodystrophy). Do not inject insulin into skin with these types of changes.
- Other side effects include low potassium in your blood (hypokalemia), and weight gain.
- Serious side effects can include:
 - swelling of your hands and feet
 - heart failure when taking certain pills called thiazolidinediones or "TZDs" with Humalog. This may occur in some people even if they have not had heart problems before. Tell your healthcare provider if you have shortness of breath, swelling of your ankles or feet, or sudden weight gain, which may be symptoms of heart failure. Your healthcare provider may need to adjust or stop your treatment with TZDs or Humalog.
- These are not all of the possible side effects. Ask your healthcare providers for more information or for medical advice about side effects.

You are encouraged to report negative side effects of prescription drugs to the FDA. Visit www.fda.gov/medwatch or call 1-800-FDA-1088.

How should I store Humalog?

- Unopened Humalog should be stored in a refrigerator and can be used until the expiration date on the carton or label.
- Humalog should be stored away from light and heat. Do not use insulin if it has been frozen.
- Opened vials should be kept at room temperature or in a refrigerator. Opened cartridges or prefilled pens should be kept at room temperature.
- Once opened, Humalog vials, prefilled pens, and cartridges should be thrown away after 28 days.

Humalog is available by prescription only.

For additional information, talk to your healthcare providers and please see Information for Patients on following pages. Please see Instructions for Use that accompany your pen.

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Information for Patients about Humalog® (insulin lispro injection, USP [rDNA origin])

Read the "Patient Information" that comes with Humalog (HU-ma-log) before you start using it and each time you get a refill. There may be new information. This leaflet does not take the place of talking with your healthcare provider about your diabetes or treatment. If you have questions about Humalog or diabetes, talk with your healthcare provider.

What is Humalog?

Humalog is an injectable, rapid-acting, man-made insulin. It is used to treat people with diabetes for the control of high blood sugar. You should take Humalog within fifteen minutes before eating or right after eating a meal.

What is the most important information I should know about Humalog?

- Do not change the insulin you use without talking to your healthcare provider. Doses of oral diabetes medicines may also need to change if your insulin is changed.
- You must test your blood sugar levels as your healthcare provider instructs.
- If you forget to take your dose of Humalog, your blood sugar may go too high (hyperglycemia). If high blood sugar is not treated it can lead to serious problems like loss of consciousness (passing out), coma, or even death.
- Always make sure you receive the correct type of Humalog from the pharmacy. Do not use Humalog if it is cloudy, colored, or has solid particles or clumps in it.
- Do not mix Humalog with insulin other than NPH when using a syringe.
- Inject Humalog under your skin (subcutaneously). Never inject into a vein or muscle. Change (rotate) your injection site with each dose. Make sure you inject the correct insulin and dose.
- When used in a pump, do not mix Humalog with any other insulin or liquid. The infusion set should be changed at least every 3 days. The Humalog in the pump reservoir should be changed at least every 7 days even if you have not used all of the Humalog.
- Taking other medicines known as TZDs (thiazolidinediones) with Humalog may cause heart failure. Tell your healthcare provider if you have any new or worse symptoms of heart failure, such as shortness of breath, swelling of your ankles or feet, or sudden weight gain.

Who should NOT take Humalog?

Do not take Humalog:

- if your blood sugar is too low (hypoglycemia).
- before checking with your healthcare provider regarding any allergies you may have to its ingredients.

What are the possible side effects of Humalog?

- Low blood sugar (hypoglycemia). There are many causes of low blood sugar, including taking too much Humalog. It is important to treat it quickly. You can treat mild to moderate low blood sugar by drinking or eating a quick source of sugar right away. Low blood sugar may affect your ability to drive or operate machinery. Severe low blood sugar can cause unconsciousness (passing out), seizures, and death. Symptoms may be different for each person. Be sure to talk to your healthcare provider about low blood sugar symptoms and treatment.

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- Severe life-threatening allergic reactions. Get medical help right away if you develop a rash over your whole body, have trouble breathing, have a fast heartbeat, or are sweating.
- Reactions at the injection site such as redness, swelling, and itching. If you keep having skin reactions or they are serious, talk to your healthcare provider. Do not inject insulin into a skin area that is red, swollen, or itchy.
- Skin may thicken or pit at the injection site (lipodystrophy). Do not inject insulin into this type of skin.
- Other side effects include swelling of your hands and feet, low potassium in your blood (hypokalemia), and weight gain.
- Taking other medicines known as TZDs (thiazolidinediones) with Humalog may cause heart failure in some people.
- These are not all of the possible side effects. Ask your healthcare providers for more information.

You are encouraged to report negative side effects of prescription drugs to the FDA. Visit www.fda.gov/medwatch or call 1-800-FDA-1088.

What should I tell my doctor before using Humalog?

- About all of your medical conditions, including liver, kidney, or heart problems.
- About all the medicines you take, including prescription (especially ones commonly called TZDs [thiazolidinediones]) and non-prescription medicines, vitamins, and herbal supplements.
- If you are pregnant or breastfeeding.

How should I store HUMALOG?

- Unopened Humalog should be stored in a refrigerator and can be used until the expiration date.
- Humalog should be stored away from heat and light. Do not use insulin if it has been frozen.
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- Once opened, Humalog vials, prefilled pens, and cartridges should be thrown away after 28 days.

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Additional information can be found at www.Humalog.com

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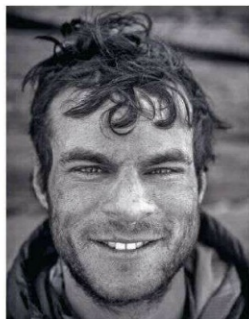
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EXPERTISE
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Cold Crossing My partner and I were walking from the Equator to the southern tip of South America, trying to learn the secrets of sustainability from people who had lived on the land for generations. Just south of Santiago, Chile, there were giant snowfields. We had to cross them if we were going to continue.

We walked for a week across the snow's crust, often falling through because it was melting. When we came out on the other side, the snow gave way to fine ash. When a sudden wind kicked up, we had to wrap our shirts around our faces to avoid breathing it.

Finally we made it to Laguna de la Invernada. According to the map and some locals we'd met, there should've been walking trails circling the lake. But the water level had risen, covering them, so the lake was surrounded by cliffs. Rock climbing was too difficult. We went back to flat ground, waterproofed our gear, and jumped in.

We pulled ourselves along the cliff face in 34°F water. Within minutes numbness set in. After a blind corner we got lucky—on the other side was a rockslide that gave us some relief from the water. The wind was blowing 20 miles an hour, and the air was about 50°F. I started shivering uncontrollably—probably hypothermic. To warm up, we stayed in our sleeping bags for two hours and made tea from the lake water. All we'd had to eat was a can of tuna between us. We turned our walkie-talkies on and asked for help on every channel. No one answered.

We had to keep going. It became a pattern: in the water for five to ten minutes at a time, then out for a couple of hours to get warm on the rocks. Thirty-six hours later, we made it to the other side—a distance of less than a mile.





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Go
Places

VISIONS


A person in silhouette is walking away from the viewer through a field of intense, orange and yellow flames. The background shows a vast landscape of rolling hills and mountains under a dramatic, orange-hued sky at sunset or sunrise. The sun is a bright, glowing orb on the right side of the frame, casting a long, golden light across the scene. The overall mood is one of awe and the power of nature.



United Kingdom

Heather fires smoke during a controlled burn in West Burrafirth in Shetland. This form of management, known as muirburn, clears old brush to improve both grazing conditions and wildlife habitat.

PHOTO: CHARLIE HAMILTON JAMES



South Africa

Through the dust of a dry riverbed in Kgalagadi Transfrontier Park, an African white-backed vulture advances on an antelope carcass. The bird's outstretched wings help it look larger and more threatening to rival vultures.

PHOTO: PETER DELANEY





Ukraine

Men in masks and costumes travel from house to house—playing jokes on whoever answers the door—during Melanka, a folk holiday celebrated on January 13, the Julian calendar's New Year's Eve. These revelers live in Kosmach, a Hutsul village in the Carpathian highlands.

PHOTO: GERA ARTEMOVA, ANZENBERGER

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**EDITORS' CHOICE****Giséle Teixeira**

Richmond, California

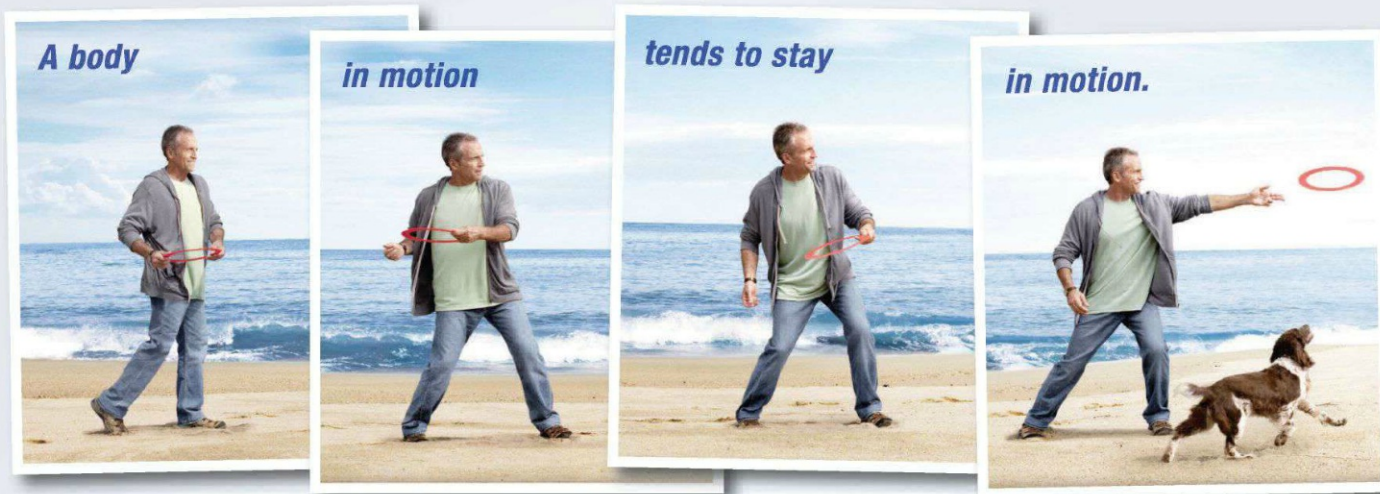
While cleaning her house, Teixeira, a third-grade teacher, came across an old pin-box toy. Lying on her bed, she envisioned a creative self-portrait. As she held her breath for each take, she experimented to find the best distance and angle at which to hold the camera.

READERS' CHOICE**Bridgena Barnard**

Cape Town, South Africa

Barnard hoped to photograph a cheetah kill during a trip to South Africa's Kgalagadi Transfrontier Park. When her daughter spotted a group of cheetahs on a dune surveying a group of springbok antelopes, Barnard found the perfect position to capture the pursuit of a fawn.





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*Individual results may vary. **Clinical studies with osteoarthritis patients.

You are encouraged to report negative side effects of prescription drugs to the FDA. Visit www.fda.gov/medwatch or call 1-800-FDA-1088.

Important Safety Information:

All prescription NSAIDs, like CELEBREX, ibuprofen, naproxen and meloxicam have the same cardiovascular warning. They may all increase the chance of heart attack or stroke, which can lead to death. This chance increases if you have heart disease or risk factors for it, such as high blood pressure or when NSAIDs are taken for long periods.

CELEBREX should not be used right before or after certain heart surgeries.

Serious skin reactions, or stomach and intestine problems such as bleeding and ulcers, can occur without warning and may cause death. Patients taking aspirin and the elderly are at increased risk for stomach bleeding and ulcers.

Tell your doctor if you have: a history of ulcers or bleeding in the stomach or intestines; high blood pressure or heart failure; or kidney or liver problems.

CELEBREX should not be taken in late pregnancy.

Life-threatening allergic reactions can occur with CELEBREX. Get help right away if you've had swelling of the face or throat or trouble breathing. Do not take it if you have bleeding in the stomach or intestine, or you've had an asthma attack, hives, or other allergies to aspirin, other NSAIDs or certain drugs called sulfonamides.

Prescription CELEBREX should be used exactly as prescribed at the lowest dose possible and for the shortest time needed.

See the Medication Guide on the next page for important information about Celebrex and other prescription NSAIDs.



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Medication Guide
for
Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)
(See the end of this Medication Guide
for a list of prescription NSAID medicines.)

What is the most important information I should know about medicines called Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)?

NSAID medicines may increase the chance of a heart attack or stroke that can lead to death.

This chance increases:

- with longer use of NSAID medicines
- in people who have heart disease

NSAID medicines should never be used right before or after a heart surgery called a “coronary artery bypass graft (CABG).”

NSAID medicines can cause ulcers and bleeding in the stomach and intestines at any time during treatment. Ulcers and bleeding:

- can happen without warning symptoms
- may cause death

The chance of a person getting an ulcer or bleeding increases with:

- taking medicines called “corticosteroids” and “anticoagulants”
- longer use
- smoking
- drinking alcohol
- older age
- having poor health

NSAID medicines should only be used:

- exactly as prescribed
- at the lowest dose possible for your treatment
- for the shortest time needed

What are Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)?

NSAID medicines are used to treat pain and redness, swelling, and heat (inflammation) from medical conditions such as:

- different types of arthritis
- menstrual cramps and other types of short-term pain

Who should not take a Non-Steroidal Anti-Inflammatory Drug (NSAID)?

Do not take an NSAID medicine:

- if you had an asthma attack, hives, or other allergic reaction with aspirin or any other NSAID medicine
- for pain right before or after heart bypass surgery

Tell your healthcare provider:

- about all of your medical conditions.
- about all of the medicines you take. NSAIDs and some other medicines can interact with each other and cause serious side effects. **Keep a list of your medicines to show to your healthcare provider and pharmacist.**
- if you are pregnant. **NSAID medicines should not be used by pregnant women late in their pregnancy.**
- if you are breastfeeding. **Talk to your doctor.**

What are the possible side effects of Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)?

Serious side effects include:

- heart attack
- stroke
- high blood pressure
- heart failure from body swelling (fluid retention)
- kidney problems including kidney failure
- bleeding and ulcers in the stomach and intestine
- low red blood cells (anemia)
- life-threatening skin reactions
- life-threatening allergic reactions
- liver problems including liver failure
- asthma attacks in people who have asthma

Other side effects include:

- | | |
|----------------|-------------|
| • stomach pain | • heartburn |
| • constipation | • nausea |
| • diarrhea | • vomiting |
| • gas | • dizziness |

Get emergency help right away if you have any of the following symptoms:

- shortness of breath or trouble breathing
- chest pain
- weakness in one part or side of your body
- slurred speech
- swelling of the face or throat

Stop your NSAID medicine and call your healthcare provider right away if you have any of the following symptoms:

- nausea
- more tired or weaker than usual
- itching
- your skin or eyes look yellow
- stomach pain
- flu-like symptoms
- vomit blood
- there is blood in your bowel movement or it is black and sticky like tar
- skin rash or blisters with fever
- unusual weight gain
- swelling of the arms and legs, hands and feet

These are not all the side effects with NSAID medicines. Talk to your healthcare provider or pharmacist for more information about NSAID medicines.

Call your doctor for medical advice about side effects. You may report side effects to FDA at 1-800-FDA-1088.

Other information about Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)

- Aspirin is an NSAID medicine but it does not increase the chance of a heart attack. Aspirin can cause bleeding in the brain, stomach, and intestines. Aspirin can also cause ulcers in the stomach and intestines.
- Some of these NSAID medicines are sold in lower doses without a prescription (over-the-counter). Talk to your healthcare provider before using over-the-counter NSAIDs for more than 10 days.

NSAID medicines that need a prescription

| Generic Name | Tradename |
|----------------|---|
| Celecoxib | Celebrex |
| Diclofenac | Cataflam, Voltaren, Arthrotec (combined with misoprostol) |
| Diflunisal | Dolobid |
| Etodolac | Lodine, Lodine XL |
| Fenoprofen | Nalfon, Nalfon 200 |
| Flurbiprofen | Ansaid |
| Ibuprofen | Motrin, Tab-Profen, Vicoprofen* (combined with hydrocodone), Combunox (combined with oxycodone) |
| Indomethacin | Indocin, Indocin SR, Indo-Lemmon, Indomethagan |
| Ketoprofen | Oruvail |
| Ketorolac | Toradol |
| Mefenamic Acid | Ponstel |
| Meloxicam | Mobic |
| Nabumetone | Relafen |
| Naproxen | Naprosyn, Anaprox, Anaprox DS, EC-Naproxyn, Naprelan, Naprapac (copackaged with lansoprazole) |
| Oxaprozin | Daypro |
| Piroxicam | Feldene |
| Sulindac | Clinoril |
| Tolmetin | Tolectin, Tolectin DS, Tolectin 600 |

* Vicoprofen contains the same dose of ibuprofen as over-the-counter (OTC) NSAIDs, and is usually used for less than 10 days to treat pain. The OTC NSAID label warns that long term continuous use may increase the risk of heart attack or stroke.

Rare African Emerald Find Shocks Colombian Cartel

U.S. jeweler seizes more than 10,000 carats and makes history by releasing the One-Carat Pride of Zambia Emerald Ring for UNDER \$100!

LUSAKA, ZAMBIA - A recent find of high quality emeralds in this African republic has thrown the luxury gem world into tumult. For hundreds of years, Colombians have controlled the high-end emerald market and sent prices soaring to over \$15,000 per carat for top graded stones. But the history-making discovery of Zambian emeralds has revealed a green gemstone with mesmerizing clarity that simply changes everything.

This important find led Stauer, a major gem dealer and importer, to bid on over 10,000 carats. Stauer designed a classic 1-ctw ring for people who love the gem but don't love outrageously priced luxury. Because of their timely buy, Stauer is releasing this exclusive, natural emerald ring—aka "*The Pride of Zambia*"—to the public for under \$100!

Discover a Different Kind of Emerald

"For the price, these natural gemstones were the most magnificent emeralds that I've seen in 30 years," said Michael Bisceglia at Stauer. "The value of Colombian stones can't compare."

Industry experts back him up. Lab tests prove that Zambian emeralds are less porous and brittle than their Colombian brothers. And gem cutters have found Zambians so brilliant that they lend themselves more to high-luster cuts than traditional emerald designs.

Unfortunately, the window on this exciting emerald opportunity is closing fast. Not long after Stauer acquired their cache, a recent auction saw Zambian emerald prices hit a new record high. The time to act on this great gem value is now, before it's too late. Please call our U.S.-based client service team at 1-888-277-8375 or visit us online at www.stauer.com.

Emerald Is THE Gem of 2014

The rise of emeralds is more than just a passing trend. An article in the *Financial Times of London* from June of this year pointed to the reason. In "Emeralds: Shades of Green Start to Outshine Diamonds," the newspaper reported that emerald demand is soaring worldwide even as diamond demand softens. Rarity is key as fine emeralds are much rarer than diamonds.

"With wealthy Russian and Chinese demand for emeralds way up, we expect prices to continue to rise quickly," Bisceglia said. "That's why we're so happy to have found these beautiful stones at this price."

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SKYCAST
Overhead this month
in parts of the world

January 2-3
Quadrantids
meteor shower

January 5
Jupiter and its
moons visible



*Khat vendors
draw a crowd in
Harer, Ethiopia.*

Khat Conundrum Khat is controversial. People in the Horn of Africa have chewed it for centuries. Last July the plant (right) lost its last foothold in Europe when Britain declared cathinone—khat's active ingredient—illegal. It's been considered a nonmedical drug in the U.S. since 1993.

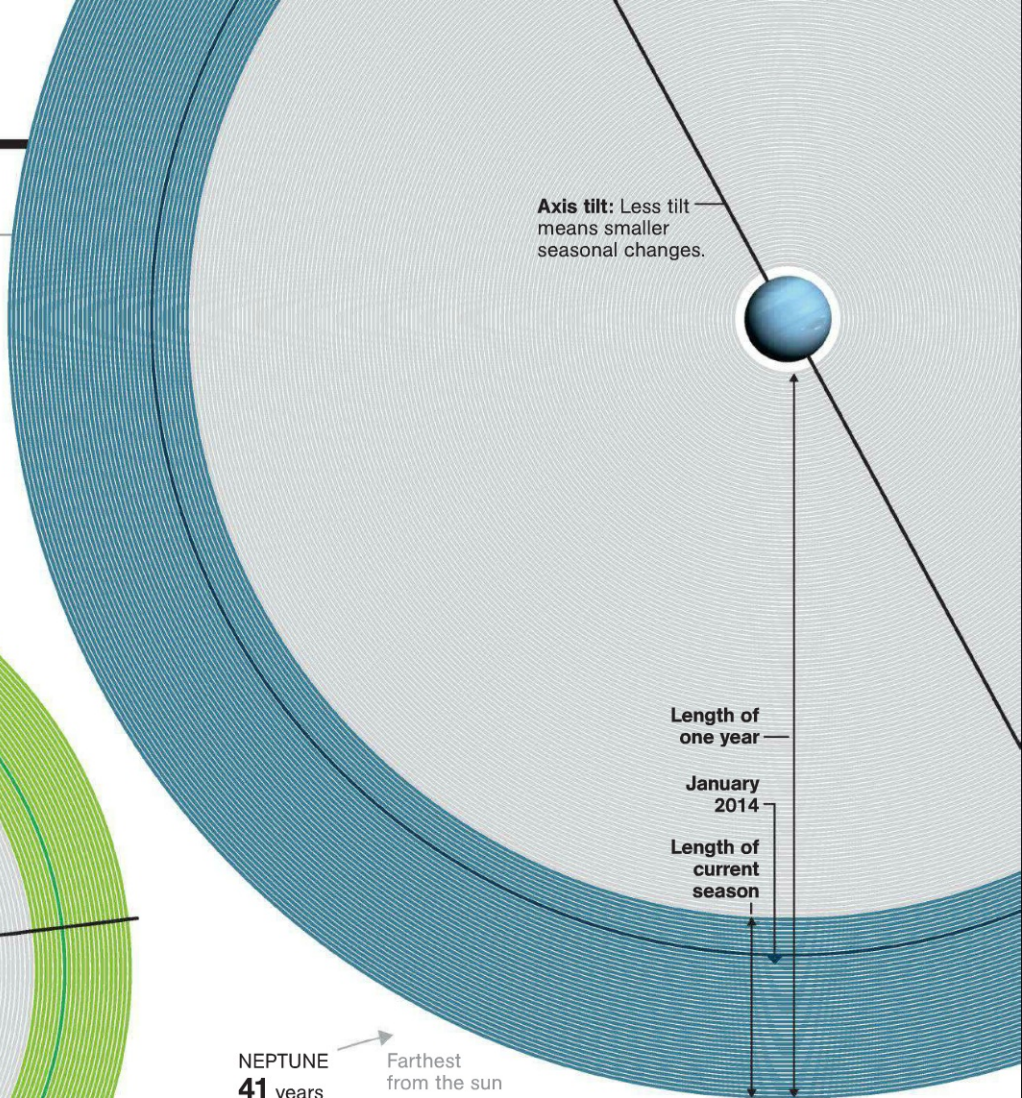
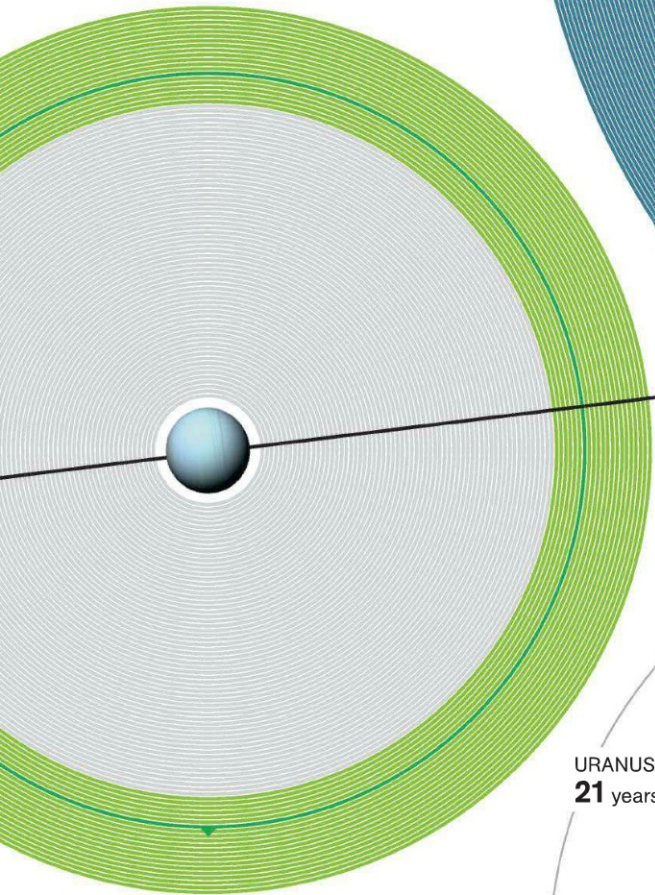
For growers looking to sell to the East African diaspora, losing Britain is a major blow. That country provided a substantial consumer base of Somali immigrants. Britain also provided a hub for quick dispersal, because of its centrality and numerous daily flights. That's important, since khat loses potency as it dries, usually within 48 hours. Kenyan farmers are protesting the loss of income from nearly 2,000 tons of khat exported to the U.K. a year, worth roughly \$70 million. —*Johnna Rizzo*



NEXT

Each ring = one Earth year

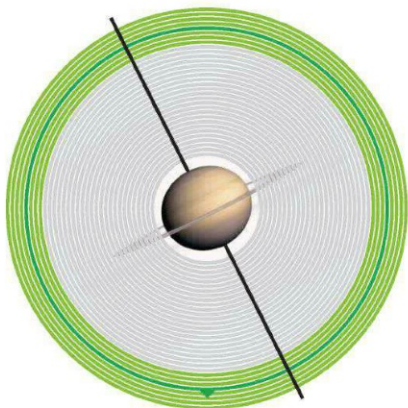
Outer rings = current season in Northern Hemisphere
 ■ Spring ■ Winter



NEPTUNE
41 years
 Length of one season*

URANUS
21 years

SATURN
8 years



JUPITER

MARS
7 months



EARTH
90 days



MERCURY



Closest to the sun

Jupiter, Venus, and Mercury have little seasonal variation.

Seasonal Flux It's not only Earth that has a winter, spring, summer, and fall. "Anything with an atmosphere has seasons," says NASA's Jim Green. They just look different on other celestial bodies.

Equinoxes and solstices mark the change in seasons, and rotation, orbit, distance from the sun, and axial tilt all play a role in how weather shifts play out. When Pluto is farthest from the sun—winter—its atmosphere collapses. Saturn's rings don't cast shadows during equinoxes. On its moon Titan, spring showers are made of methane and can last for several Earth years. Winter on Mars brings carbon dioxide snow. Mercury, notably, remains nearly seasonless—due to a thin atmosphere and a rotation so slow that one of its days is equal to the length of two of its years. —Johnna Rizzo

*Length of each season varies slightly.

PHOTOS: NASA. ART: LAWSON PARKER, NGM STAFF. SOURCE: NASA

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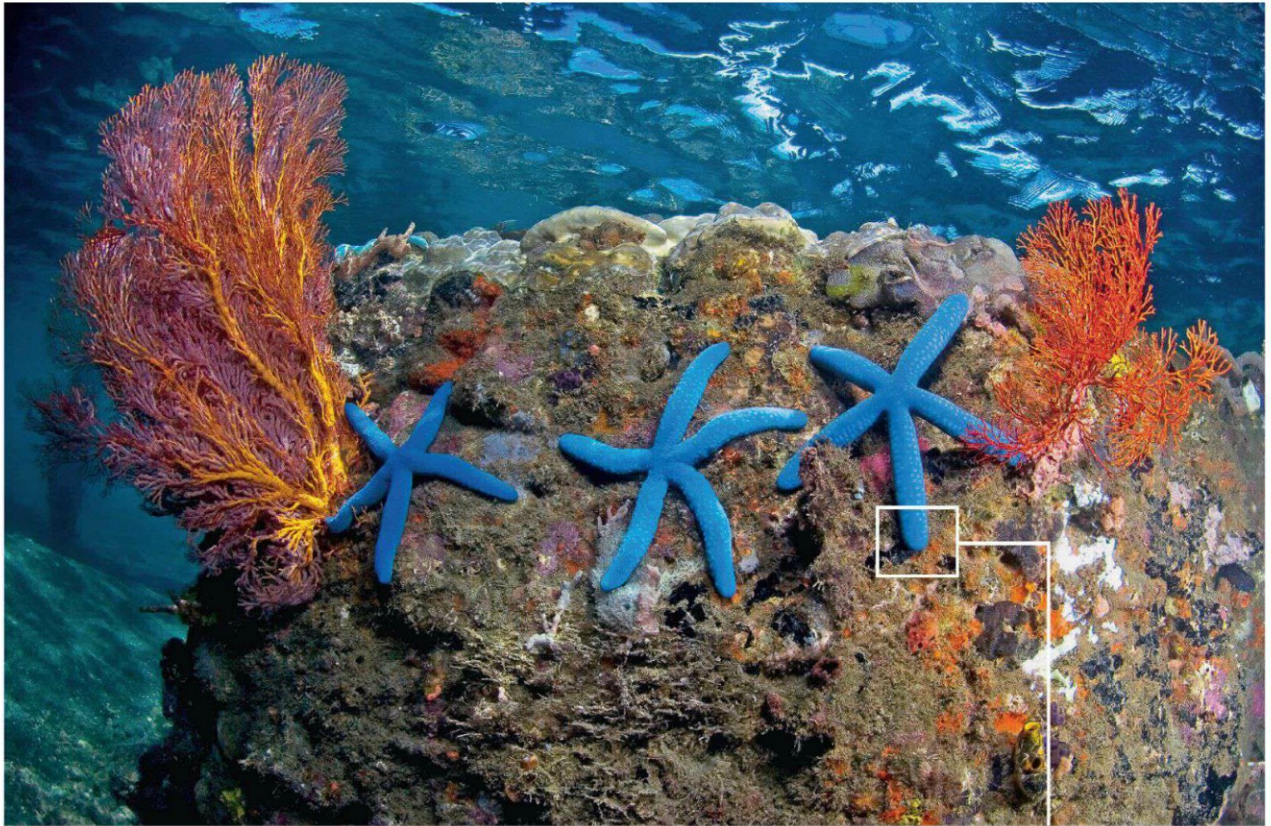
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Places

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Wandering Eyes Scientists have long known that sea stars have eyes. New research on *Linckia laevigata* (above)—one of the most common sea stars found on coral worldwide—illuminates how those eyes work.

Located at the tips of the arms, the eyes don't function like human eyes. "We think they can only see the difference between light and dark in low resolution," says neurobiologist Anders Garm. The difference has to do with brain size. Human vision evolved to process more input as the human brain grew bigger and increasingly complex. Sea stars, by comparison, have only a small collection of nerve cells that interpret visual information. Even primitive eyesight, Garm says, is sufficient for the animal's needs. —Daniel Stone



The red eyes (above) of a blue sea star can regenerate when arms are severed.



Odd Couple The rock hyrax (left) is the size of a groundhog, yet it's a close genetic relative of the towering African elephant. "What unites them is a common ancestor," says biologist Arik Kershenbaum. The two species, along with manatees, are part of a taxonomic group called Paenungulata, which diverged from other mammals 65 million years ago during climate shifts. They later began to diverge from each other to adapt in different habitats. Although they look nothing alike, hyraxes and elephants share some physical similarities, including spongy pads under their feet. —DS

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DIABETIC
NERVE PAIN...
IT'S A WONDERFUL
FEELING."**

**—PHYLLIS, RETIRED SCHOOL BUS DRIVER
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Prescription Lyrica is not for everyone. Tell your doctor right away about any serious allergic reaction that causes swelling of the face, mouth, lips, gums, tongue, throat, or neck or any trouble breathing, rash, hives or blisters. Lyrica may cause suicidal thoughts or actions in a very small number of people. Patients, family members or caregivers should call the doctor right away if they notice suicidal thoughts or actions, thoughts of self harm, or any unusual changes in mood or behavior. These changes may include new or worsening depression, anxiety, restlessness, trouble sleeping, panic attacks, anger, irritability, agitation, aggression, dangerous impulses or violence, or extreme increases in activity or talking. If you have suicidal thoughts or actions, do not stop Lyrica without first talking to your doctor. Lyrica may cause swelling of your hands, legs and feet. Some of the most common side effects of Lyrica are dizziness and sleepiness. Do not drive or work with machines until you know how Lyrica affects you. Other common side effects are blurry vision, weight gain, trouble concentrating, dry mouth, and feeling "high." Also, tell your doctor right away about muscle pain along with feeling sick and feverish, or any changes in your eyesight including blurry vision or any skin sores if you have diabetes. You may have a higher chance of swelling, hives or gaining weight if you are also taking certain diabetes or high blood pressure medicines. Do not drink alcohol while taking Lyrica. You may have more dizziness and sleepiness if you take Lyrica with alcohol, narcotic pain medicines, or medicines for anxiety. If you have had a drug or alcohol problem, you may be more likely to misuse Lyrica. Tell your doctor if you are planning to father a child. Talk with your doctor before you stop taking Lyrica or any other prescription medication.

Please see Important Risk Information for Lyrica on the following page.

To learn more visit www.lyrica.com or call toll-free 1-888-9-LYRICA (1-888-959-7422).

You are encouraged to report negative side effects of prescription drugs to the FDA.

Visit www.FDA.gov/medwatch or call 1-800-FDA-1088.

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IMPORTANT FACTS



(LEER-i-kah)

IMPORTANT SAFETY INFORMATION ABOUT LYRICA

LYRICA may cause serious, even life threatening, allergic reactions. Stop taking LYRICA and call your doctor right away if you have any signs of a serious allergic reaction:

- Swelling of your face, mouth, lips, gums, tongue, throat or neck
- Have any trouble breathing
- Rash, hives (raised bumps) or blisters

Like other antiepileptic drugs, LYRICA may cause suicidal thoughts or actions in a very small number of people, about 1 in 500.

Call your doctor right away if you have any symptoms, especially if they are new, worse or worry you, including:

- suicidal thoughts or actions
- new or worse depression
- new or worse anxiety
- feeling agitated or restless
- panic attacks
- trouble sleeping
- new or worse irritability
- acting aggressive, being angry, or violent
- acting on dangerous impulses
- an extreme increase in activity and talking
- other unusual changes in behavior or mood

If you have suicidal thoughts or actions, do not stop LYRICA without first talking to your doctor.

LYRICA may cause swelling of your hands, legs and feet.

This swelling can be a serious problem with people with heart problems.

LYRICA may cause dizziness or sleepiness.

Do not drive a car, work with machines, or do other dangerous things until you know how LYRICA affects you. Ask your doctor when it is okay to do these things.

ABOUT LYRICA

LYRICA is a prescription medicine used in adults 18 years and older to treat:

- Pain from damaged nerves that happens with diabetes or that follows healing of shingles, or spinal cord injury
- Partial seizures when taken together with other seizure medicines
- Fibromyalgia (pain all over your body)

Who should NOT take LYRICA:

- Anyone who is allergic to anything in LYRICA

BEFORE STARTING LYRICA

Tell your doctor about all your medical conditions, including if you:

- Have had depression, mood problems or suicidal thoughts or behavior
- Have or had kidney problems or dialysis
- Have heart problems, including heart failure
- Have a bleeding problem or a low blood platelet count
- Have abused prescription medicines, street drugs or alcohol in the past
- Have ever had swelling of your face, mouth, tongue, lips, gums, neck, or throat (angioedema)
- Plan to father a child. It is not known if problems seen in animal studies can happen in humans.
- Are pregnant, plan to become pregnant or are breastfeeding. It is not known if LYRICA will harm your unborn baby. You and your doctor should decide whether you should take LYRICA or breast-feed, but you should not do both.

Tell your doctor about all your medicines. Include over-the-counter medicines, vitamins, and herbal supplements. LYRICA and other medicines may affect each other causing side effects. Especially tell your doctor if you take:

BEFORE STARTING LYRICA, continued

- Angiotensin converting enzyme (ACE) inhibitors. You may have a higher chance for swelling and hives.
- Avandia® (rosiglitazone)*, Avandamet® (rosiglitazone and metformin)* or Actos® (pioglitazone)** for diabetes. You may have a higher chance of weight gain or swelling of your hands or feet.
- Narcotic pain medicines (such as oxycodone), tranquilizers or medicines for anxiety (such as lorazepam). You may have a higher chance for dizziness and sleepiness.
- Any medicines that make you sleepy.

POSSIBLE SIDE EFFECTS OF LYRICA

LYRICA may cause serious side effects, including:

- See “Important Safety Information About LYRICA.”
- Muscle problems, pain, soreness or weakness along with feeling sick and fever
- Eyesight problems including blurry vision
- Weight gain. Weight gain may affect control of diabetes and can be serious for people with heart problems.
- Feeling “high”

If you have any of these symptoms, tell your doctor right away.

The most common side effects of LYRICA are:

- Dizziness
- Blurry vision
- Weight gain
- Sleepiness
- Trouble concentrating
- Swelling of hands and feet
- Dry mouth

If you have diabetes, you should pay extra attention to your skin while taking LYRICA.

HOW TO TAKE LYRICA

Do:

- Take LYRICA exactly as your doctor tells you. Your doctor will tell you how much to take and when to take it. Take LYRICA at the same times each day.
- Take LYRICA with or without food.

Don't:

- Drive a car or use machines if you feel dizzy or sleepy while taking LYRICA.
- Drink alcohol or use other medicines that make you sleepy while taking LYRICA.
- Change the dose or stop LYRICA suddenly. If you stop taking LYRICA suddenly, you may have headaches, nausea, diarrhea, trouble sleeping, increased sweating, or you may feel anxious. If you have epilepsy, you may have seizures more often.
- Start any new medicines without first talking to your doctor.

NEED MORE INFORMATION?

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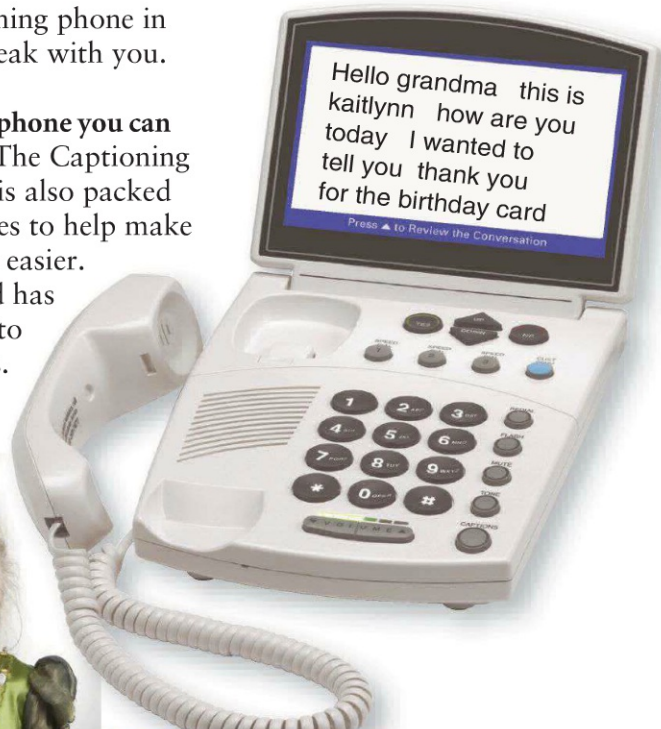


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The Afterlife of a Landfill

As the U.S. population has grown, so too has its collective output of waste—a quantity that last year topped 250 million tons. At modern landfills, waste managers compress and sculpt rising heaps of garbage in order to maximize capacity.

With the dirty work also comes an opportunity. As garbage breaks down, the organic material produces carbon dioxide and methane, a potent gas that can be burned to produce large amounts of energy. At existing landfill plants, that method has been used to create nearly 15 billion kilowatt-hours, enough to power roughly one million homes for a year. More than 600 energy projects at landfills pipe the gases to the surface, in every U.S. state except Alaska and Hawaii. California has the most, with 75. The Environmental Protection Agency has categorized landfill gas alongside wind and solar as an environmentally efficient way to produce power.

Seeking new revenue sources, some states and private companies have invested in technologies to turn garbage into other valuable substances, like crude oil or ethanol. “The goal is to extract the maximum value from everything that passes through these facilities,” says waste company executive Lynn Brown. Other countries are testing similar strategies. A partnership in Belgium plans to harness gases from a landfill dating from the 1960s. Proving that garbage can be valuable, Sweden has already begun importing waste from Norway for incineration to feed a growing energy demand. —Daniel Stone

CRUSHING THE HEAP

To minimize a landfill's volume, vehicles with steel wheels spread waste evenly and then compact it. Maintaining the structural integrity of the pile can prevent unexpected landslides and cave-ins.

SORTING RAW TRASH

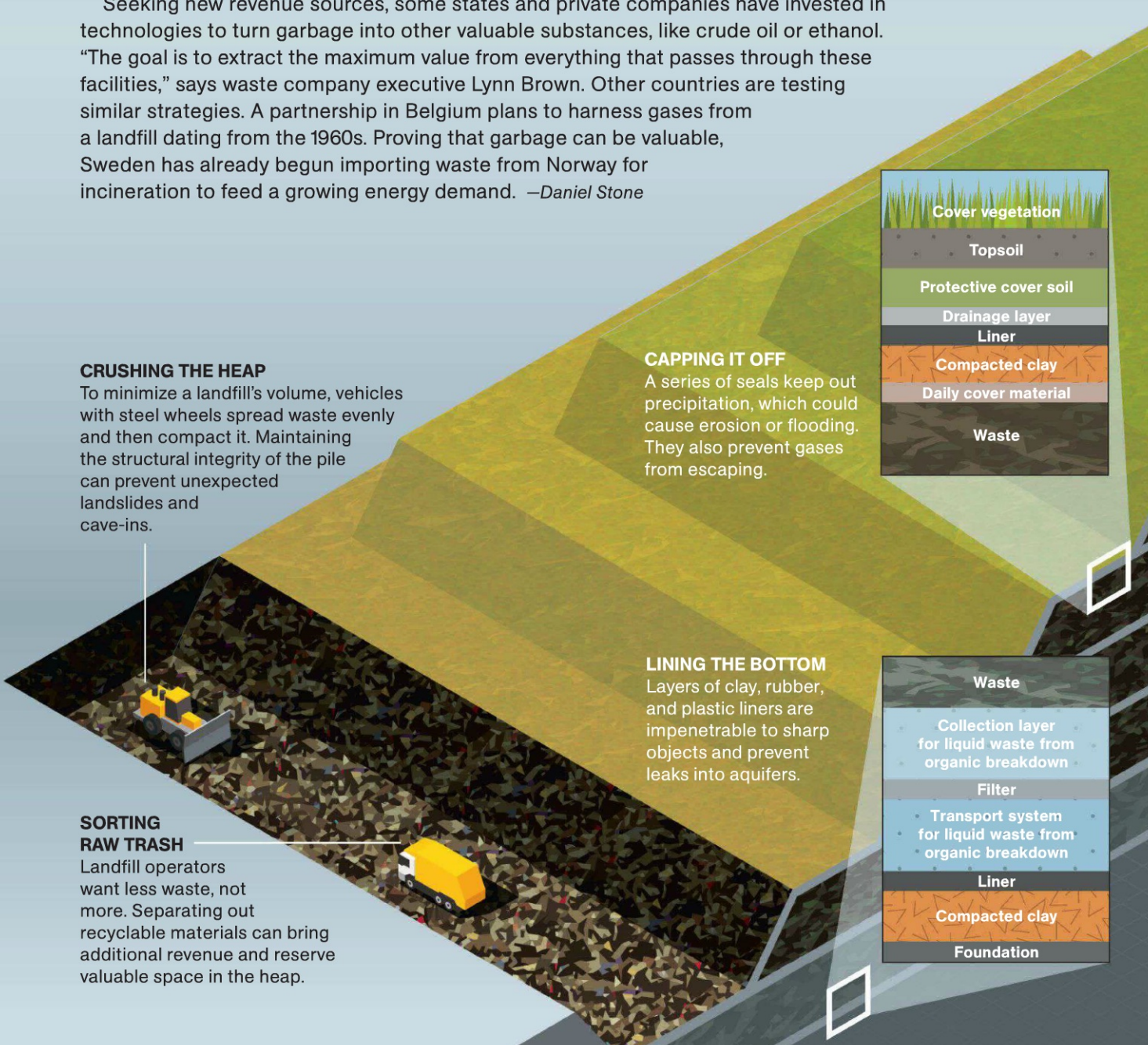
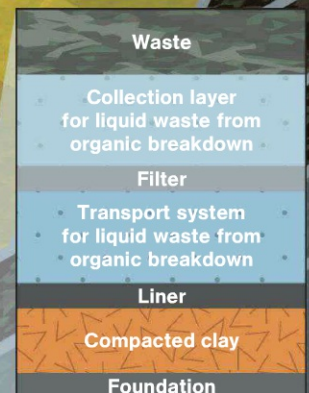
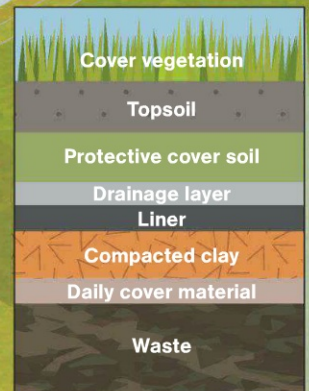
Landfill operators want less waste, not more. Separating out recyclable materials can bring additional revenue and reserve valuable space in the heap.

CAPPING IT OFF

A series of seals keep out precipitation, which could cause erosion or flooding. They also prevent gases from escaping.

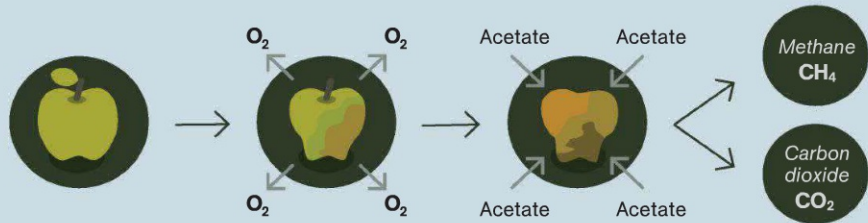
LINING THE BOTTOM

Layers of clay, rubber, and plastic liners are impenetrable to sharp objects and prevent leaks into aquifers.



TURNING WASTE INTO ENERGY

Trash isn't worthless. When it decomposes, it produces methane, which can be converted into electricity.



As it mixes with trash and air, organic waste begins to decompose.

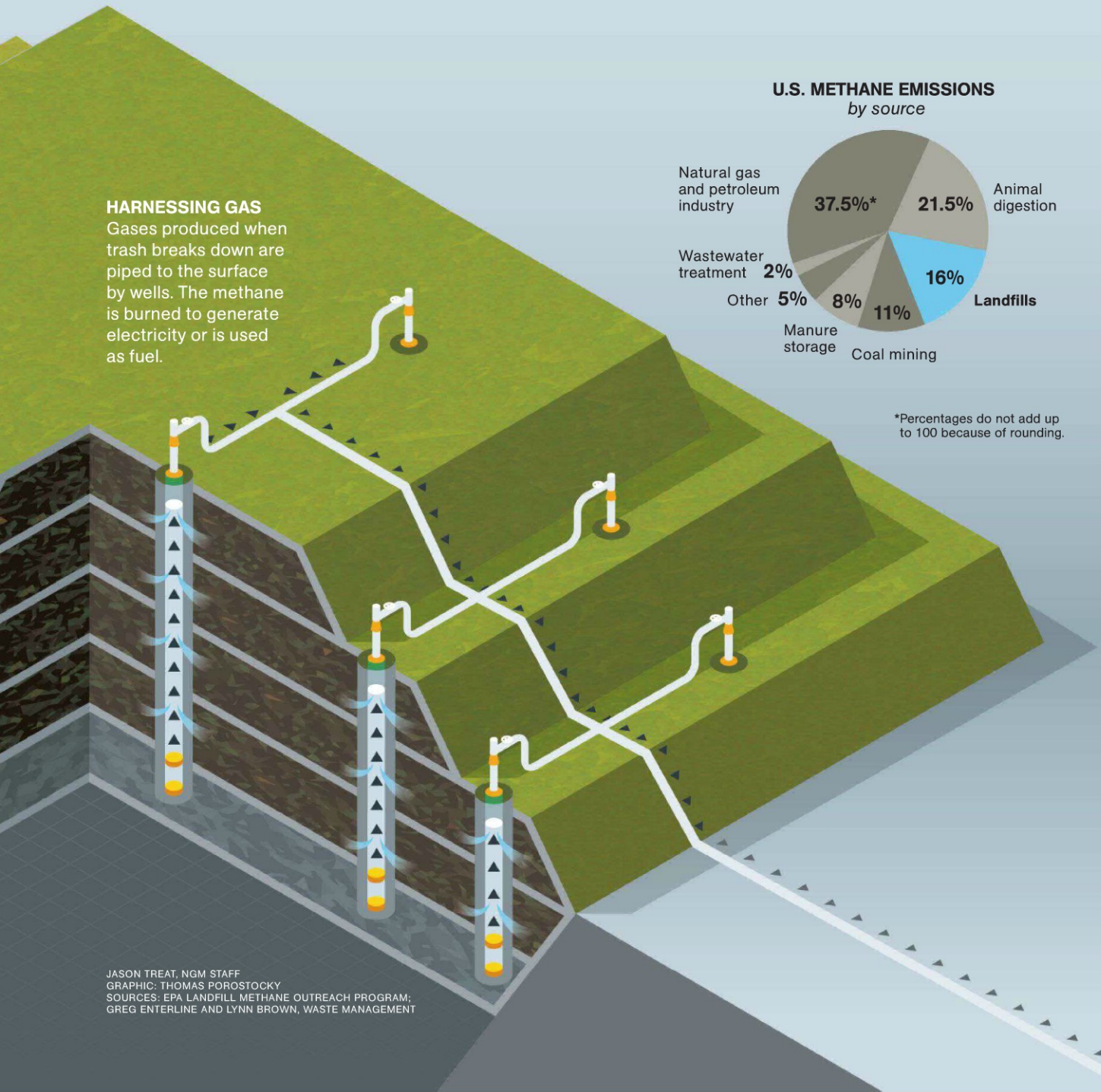
As the waste breaks down, bacteria remove oxygen.

Other bacteria that thrive without oxygen produce acetate, a relative of the acid in vinegar.

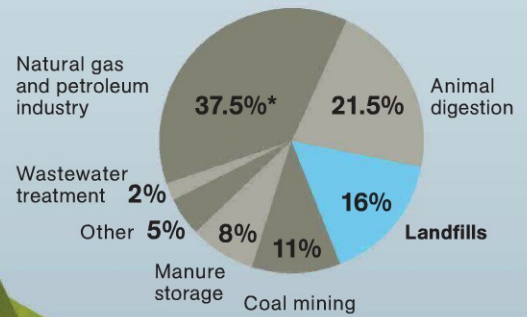
Additional bacteria convert acetate to carbon dioxide and methane.

HARNESSING GAS

Gases produced when trash breaks down are piped to the surface by wells. The methane is burned to generate electricity or is used as fuel.



U.S. METHANE EMISSIONS by source



*Percentages do not add up to 100 because of rounding.



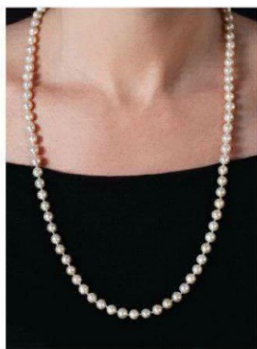
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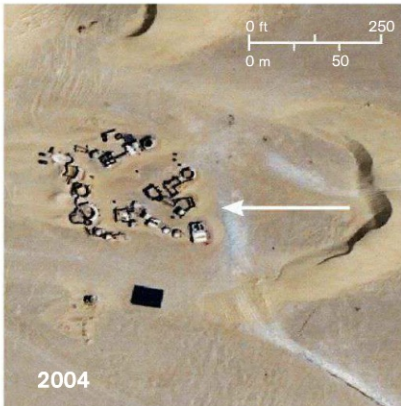
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Sand Story Tatooine—where Luke Skywalker grew up and his father, Anakin, pod raced in the *Star Wars* movies—is being swallowed by the Tunisian desert. A 300-foot-wide, crescent-shaped sand dune called a barchan (above) is bearing down on the set of 1999's *The Phantom Menace* (top). Most of the original *Star Wars* Tatooine set was already engulfed by the early 2000s.

Those who would preserve the fictional planet are short on time. Geologically speaking, only lava flows and mudslides move faster than sand, says the team of planetary scientists studying the dune's activity. This particular barchan has been slowed just slightly by airflow around the set's buildings and the estimated 100,000 tourists annually tromping through. It's marching forward about 45 feet a year, says Johns Hopkins University's Ralph Lorenz. He expects the *Menace* set to be fully covered in five years. Fans aren't completely powerless, though: Tourist photos can let researchers track exactly when the site gets overrun and whether it is unearthed again. —*Johnna Rizzo*

A Question of Taste

Where would dessert tables be without vanilla? It's a key ingredient in countless confections and is the number one ice-cream choice in America, according to the International Dairy Foods Association.

Vanilla's essence lies in a chemical called vanillin—the dominant flavor compound among hundreds found in the vanilla bean (below).

Frequently, though, vanillin has nothing to do with the bean. Notes vanilla historian Tim Ecott, most store-bought sweets are flavored with a synthetic version derived from other plants, wood, or even coal tar. Chefs prefer natural extracts, says Ecott, but people don't seem to care. "Using vanillin from other sources isn't fraud exactly," he adds, "but it is a bit of smoke and mirrors."

—*Catherine Zuckerman*





Kayapo Courage

The Amazon tribe has beaten back ranchers and gold miners and famously stopped a dam. Now its leaders must fight again or risk losing a way of life.

With an orphaned spider monkey on her shoulders, Nhàktàt, a young Kayapo woman, strolls in Kendjam, a village in northern Brazil. Kayapo sometimes raise infant monkeys and other stranded offspring of animals they hunt.



Women from Kendjam haul aluminum skiffs up the gentle, dry-season rapids of the Iriri River on a trip to harvest acai berries and coumarou beans. Men come along to hunt and to protect them from jaguars and other wild animals.



By Chip Brown

Photographs by Martin Schoeller

It was tempting to think we were going back in time, slipping the bonds of the modern world for tribal life in one of the last great bastions of indigenous culture, chronically jeopardized but still vital, intact, unvanquished.

The outsiders who first ventured into the southeast Amazon Basin centuries ago—missionaries, El Dorado seekers, slave traders, jaguar-skin hunters, rubber tappers,

wilderness explorers known as *sertanistas*—traveled by river on laborious boat journeys. We had a single-engine Cessna and good weather on a September morning late in the dry season.

The plane clawed through the haze of forest fires around the Brazilian frontier town of Tucumã. After half an hour heading south and west at a hundred knots, we crossed the twisting course of the muddy Rio Branco, and suddenly there were no more fires, no more roads, no more ragged clear-cut pastures stippled with herds of white cattle, nothing but trackless forest wreathed in mist. Below us lay Kayapo Indian country, five officially demarcated tracts of contiguous land that in sum make up an area about the size of Kentucky. The reserve, which is among the largest protected expanses of tropical rain forest in the world, is controlled by 9,000 indigenous people, most of whom can't read or write and who still follow a largely subsistence

way of life in 44 villages linked only by rivers and all-but-invisible trails. Our *National Geographic* crew was headed to one of the most remote, the village of Kendjam, which means “standing stone” and which took its name from a dark gray mountain that now appeared before us, arcing some 800 feet above the green canopy like a breaching whale. A little past the mountain lay the glittering braids of the Iri River, the largest tributary of the Xingu, itself a major tributary of the Amazon. The Cessna swerved down on a dirt airstrip slashed through the forest between the rock and the river and taxied past small garden plots and thatch houses arranged in a circle around a sandy plaza.

When we got out, a dozen or so kids wearing only shorts or nothing at all swarmed around, crouching in the shade of the wings. If you caught their eye, they giggled, glanced away, then peeked to see if you were still looking. The

ears of the youngest among them were pierced with conical wooden plugs as thick as a Magic Marker. Kayapo pierce their infants' earlobes as a way of symbolically expanding a baby's capacity to understand language and the social dimension of existence; their phrase for "stupid" is *ama kre ket*, or "no ear hole."

The kids watched closely as we unloaded our gear, including some gifts for our hosts: fish-hooks, tobacco, 22 pounds of high-quality beads made in the Czech Republic.

Barbara Zimmerman, the director of the Kayapo Project for the International Conservation Fund of Canada and the United States-based Environmental Defense Fund, introduced us to the village chief, Pukatire, a middle-aged man wearing glasses, shorts, and flip-flops. "*Akate-mai*," he said, shaking hands, and adding the bit of English he'd picked up on a trip to North America: "Hello! How are you?"

Kendjam looks timeless, but it was established only in 1998, when Chief Pukatire and his followers split off from the village of Pukanu, farther up the Iriki River, after a dispute about logging. "Fissioning," as anthropologists call it, is often the way Kayapo resolve disagreements or relieve the strain on resources in a particular area. The village's population is now 187, and for all its classic appearance there are additions that would have boggled the minds of Pukatire's ancestors: a generator in a government-built nurses' station; a solar panel array enclosed in a barbed wire fence; satellite dishes mounted on truncated palm trees. A few families have TVs in their thatch houses and enjoy watching videos of their own ceremonies, along with Brazilian soap operas. Pukatire showed us to a two-room schoolhouse built a few years ago by the Brazilian government—a pistachio-colored concrete structure with a tile roof and shutters and the luxe marvel of a flush toilet fed by well water. We pitched our tents on the veranda.

The heat of the day began to build, and a drowsy peace settled over the village, broken now and then by squabbling dogs and operatic roosters rehearsing for tomorrow's sunrise. The *ngobe*, or men's house, was deserted. At the edge of the central

plaza, or *kapôt*, women sat in the shade of mango and palm trees, shelling nuts and cooking fish wrapped in leaves and buried in coals. Some headed out to the charred earth of their swidden gardens to tend crops of manioc, bananas, and sweet potatoes. A tortoise hunter returned from the forest, loudly singing in the Kayapo custom to announce his successful quest for the land turtles that are a vital part of the village diet. Toward evening the heat ebbed. A group of young warriors skirmished over a soccer ball. About 20 women with loops of colored beads around their necks and babies on their hips gathered in the *kapôt* and began to march around in step, chanting songs. Boys with slingshots fired rocks at lapwings and swallows; one stunned a white-throated kingbird and clutched it in his hand—the yellow-breasted bird glaring defiantly like the peasant unafraid of the firing squad in the famous Goya painting. Families filtered down to the Iriki for their regular evening baths, but there were caimans in the river, and they did not linger as darkness fell. Eight degrees south of the Equator, the blood orange sun sank quickly. Howler monkeys roared over the dial-tone drone of the cicadas, and earthy odors eddied onto the night air.

AT FIRST GLANCE, Kendjam seems a kind of Eden. And perhaps it is. But that's hardly to say the history of the Kayapo people is a pastoral idyll exempt from the persecution and disease that have ravaged nearly every indigenous tribe in North and South America. In 1900, 11 years after the founding of the Brazilian Republic, the Kayapo population was about 4,000. As miners, loggers, rubber tappers, and ranchers poured into the Brazilian frontier, missionary organizations and government agencies launched efforts to "pacify" aboriginal tribes, wooing them with trade goods such as cloth, metal pots, machetes, and axes. Contact often had the unintended effect of introducing measles and other diseases to people who had no natural immunity. By the

Chip Brown's most recent story profiled climber Gerlinde Kaltenbrunner. Martin Schoeller's portraits appeared in the October 2013 photography issue.



YNHIRE expresses his identity as a warrior with a headdress of parrot feathers.



PUKATIRE, the powerful chief of Kendjam, wears body paint made from fruits, nuts, and charcoal.



The village of Kendjam, which in Kayapo means “standing stone,” is named for Kendjam Mountain—a precipitous formation that provides a rare overview of the tribe’s territory. The Kayapo often go to the highlands in search of medicinal plants.



late 1970s, following the construction of the Trans-Amazon Highway, the population had dwindled to about 1,300.

But if they were battered, they were never broken. In the 1980s and '90s the Kayapo rallied, led by a legendary generation of chiefs who harnessed their warrior culture to achieve their political goals. Leaders like Ropni and Mekaron-Ti organized protests with military precision, began to apply pressure, and, as I learned from Zimmerman, who has been working with the Kayapo for more than 20 years, would even kill people caught trespassing on their land. Kayapo war parties evicted illegal ranchers and gold miners, sometimes offering them the choice of leaving Indian land in two hours or being killed on the spot. Warriors took control of strategic river crossings and patrolled borders; they seized hostages; they sent captured trespassers back to town without their clothes.

In their struggle for autonomy and control over their land, the chiefs of that era learned Portuguese and were able to enlist the help of conservation organizations and celebrities such as the rock star Sting, who traveled with Chief Ropni (also known as Raoni). In 1988 the Kayapo helped get indigenous rights written into the new Brazilian Constitution, and eventually they secured legal recognition of their territory. In 1989 they protested the construction of the Kararaô Dam project on the Xingu River, which would have flooded parts of their land. The original plan calling for six dams in the basin was dropped after large demonstrations in which conservation groups joined the Kayapo for what is known today as the Altamira Gathering. "At the 1989 rally at Altamira, Kayapo leaders made a brilliant translation of the Kayapo warrior tradition to the tradition of the 20th-century media spectacle," says anthropologist Stephan Schwartzman of the Environmental Defense Fund. "They changed the terms of the discussion."

The Kayapo population is now rapidly growing. From shotguns and motorized aluminum boats to Facebook pages, they have shown a canny ability to adopt technologies and practices of the cash-based society at their borders without

compromising the essence of their culture. With the help of noted anthropologist and Kayapo expert Terence Turner of Cornell University, they have embraced video cameras to record their ceremonies and dances and to log interactions with government officials. One small example of their ability to incorporate elements of the outside world into their culture is a pattern now fashionable with Kayapo bead workers: It is based on the logo of the Bank of Brazil. Much to the dismay of some conservationists, several village chiefs formed partnerships with gold mining companies in the 1980s and in the 1990s sold mahogany logging concessions—alliances they came to regret and now have largely ended.

Mostly the Kayapo learned to organize and to put aside their sometimes fractious relations to cultivate unity of purpose among themselves. As a result, they are perhaps the richest and most powerful of around 240 indigenous tribes remaining in Brazil. Their ceremonies, their kinship systems, their Gê language, and their knowledge of the forest and conception of the continuum between humans and the natural world are intact. What may be the most crucial of all, they have their land. "The Kayapo aren't entering the 21st century as a defeated people. They aren't degrading themselves," Zimmerman told me. "They haven't lost a sense of who they are."

At least for the moment. It's one thing to teach the skills and ceremonies of traditional culture; it's another to inspire a sense of why knowledge of how to make arrow-tip poison (from herbs and snake venom with beeswax as an adhesive) or stack tortoises or stun fish using oxygen-depriving timbo vines might be valuable to a generation beguiled by iPhones and the convenience of store-bought food. Interest in traditional dress, beadwork, and ancestral practices is still strong in Kendjam, but it's not uniform, and even if it were, the threats from outside are daunting.

"The Brazilian government is trying to pass laws saying indigenous people don't need to be consulted for their rivers to be used for electricity or mining or even if the boundaries of their lands need to be redrawn," said Adriano "Pingo" Jerolimski, the director of a nonprofit Kayapo

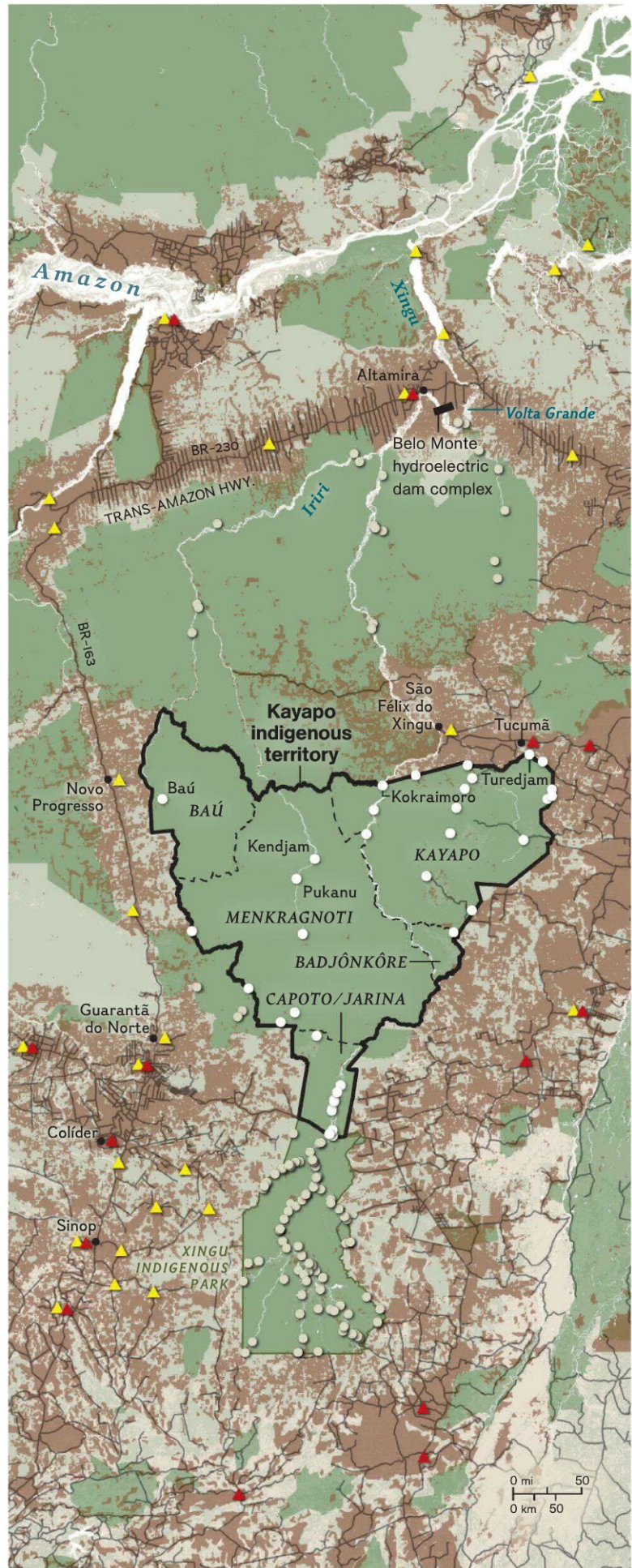
Reserves of Green

Comprising an area the size of Kentucky, Kayapo territory is one of the largest tracts of intact tropical rain forest in the world. The five contiguous reserves of the Kayapo nation are ringed on all sides by roads, cattle farms, gold mines, and Brazilian frontier settlements.



- Protected forest
- Forest
- Deforested area
- Kayapo indigenous village
- Other indigenous village
- Sawmill
- Cattle slaughterhouse
- Road

RYAN MORRIS, NGM STAFF
 SOURCES: SOCIO-ENVIRONMENTAL INSTITUTE; NATIONAL INSTITUTE FOR SPACE RESEARCH (BRAZIL); AMAZON; BRAZILIAN INSTITUTE OF GEOGRAPHY AND STATISTICS; AMAZONIAN NETWORK OF GEOREFERENCED SOCIO-ENVIRONMENTAL INFORMATION; WORLD DATABASE ON PROTECTED AREAS





BEPRAN-TI wears an impressive display of feathers for his betrothal ceremony, a Kayapo rite of passage.



BEPRÔ wears the beads and cotton-wrapped earrings that boys receive as part of their naming ceremony.



organization that represents about 22 Kayapo villages. Last June in the village of Kokraimoro, 400 Kayapo chiefs avowed their opposition to a raft of decrees, ordinances, and proposed laws and constitutional amendments that would gut their ability to control their land and prevent them, and any other indigenous group, from adding to their territory. The measures, which echo the dismal history of betrayal and dispossession in North America, are widely seen as part of a campaign to enable mining, logging, and agricultural interests to circumvent indigenous rights, now inconveniently guaranteed by the Brazilian Constitution. Among the many facets of this political struggle, perhaps the most wrenching at the moment is the effort to stop a project the Kayapo thought they had scotched more than two decades ago. The Kararaô project is back under a new name: the Belo Monte hydroelectric complex.

ON OUR SECOND DAY in Kendjam we went down the Iriri River with two Kayapo marksmen: Okêt, a 25-year-old with three daughters and four sons; and Meikâre, a 38-year-old with two boys and five girls. (In Kayapo villages the division of labor falls along traditional lines. The men hunt and fish; the women cook, garden, and gather fruits and nuts.) Meikâre wore

yellow-green beaded armbands and a long blue feather tied to a headband. We pulled away on two aluminum skiffs powered by Rabeta motors that enable shallow-water travel during the dry season. In places the river was black and still as a midnight mirror; in others it looked like tea flowing over the brown Brazilian shield rock, purling through gentle rapids or weaving among gardens of granitic Precambrian boulders.

When we reached a wide, bay-like stretch, Okêt steered for an open area on the west side of the Iriri and cut the engine. We clambered ashore. Okêt and Meikâre slipped into the forest gracefully; Meikâre had a bow and arrows over his shoulders, Okêt a shotgun. After five minutes of ducking and twisting and wriggling past a riot of thorny ferns and fallen limbs, stopping constantly to unhook myself from vines and to disabuse my adrenal glands of the conviction that venomous pit vipers lurked under every pile of leaves, I had no idea which way was east or west, no sense of where the river was, no hope of getting back to the boat on my own.

We picked up a faint game trail. Meikâre pointed to the scat of a collared peccary, a small wild swine, and then just off the trail, a trampled area where the peccary had slept. It was as obvious to Meikâre as the meat department of a



Stop & Shop would be to me. He and Okêt darted ahead. Fifteen minutes later a shot rang out, then two more.

When I caught up, a collared peccary lay dead on a bed of leaves. Meikâre fashioned some twine from a swatch of bark and bound the animal's feet. He cut another belt-shaped length of bark and lashed it to the fore and hind legs. He slung the load over his shoulder, moving with 30 pounds of peccary on his back as if it were no heavier than a cashmere shawl.

The Kayapo we'd left behind had been busy fishing. First they had plugged the escape holes of a mole cricket nest in a sandbank and then had dug up and captured a batch of mole crickets, which they used to bait fishhooks and catch piranha. They chopped up the piranha on a mahogany canoe paddle and used the pieces as bait to catch peacock bass and *piabanha*. They started a tidy wood fire on the riverbank with Bic lighters and cooked the lunch on freshly whittled skewers.

In midafternoon we motored on toward Kendjam against the light current. Meikâre reclined in the bow, back propped against a mahogany paddle, feet up, hands laced behind his head, gazing out at the hypnotic water like a commuter heading home on the train after a long day.

Two Kayapo warriors dine on a peacock bass they've just caught in the river. By contrast, Kayapo who live near border towns supplement their subsistence diet with trips to the supermarket, like this one in Tucumã.

That night Chief Pukatire wandered over to our camp with a flashlight. "The only things we need from the white culture are flip-flops, flashlights, and glasses," he said amiably. I wondered if he'd heard how skillfully I'd negotiated the forest that afternoon, because he said he had a new name for me: "Rop-krore," the Kayapo word for spotted jaguar. He had a good humor about him; you never would have guessed that two of his children had died of malaria not long after the founding of Kendjam.

The village census lists the year of Pukatire's birth as 1953, and notes the names of his wife, their 38-year-old daughter, and their three grandchildren. He said he was born near the town of Novo Progresso, west of Kendjam, in the time before contact. When Pukatire's village was attacked by Kayapo from the village of Baú, his mother and his baby sister were killed; Pukatire



NGREIKATĀRĀ wears the long strands of colorful glass beads popular with Kayapo women.



PHNH-ÔTI has an inverted V shaved into her scalp, a ceremonial female practice.

From shotguns and motorized aluminum a canny ability to adopt technologies and practices

and his brother were taken away and raised in Baú. Pukatire was around 6 or 7 at the time, he said, and it was not until he was 12 or 13 that he was reunited with his father. “We were happy. We cried,” he said.

Pukatire learned some Portuguese from missionaries and was recruited to help with the program of pacification by the Indian Protection Service, a forerunner of the National Indian Foundation, or FUNAI, the government agency that today represents the interests of Brazil’s aboriginal people. “Before contact we were clubbing each other to death, and everybody lived in fear,” he said. “Without a doubt things are much better today because people aren’t hitting each other over the head with war clubs.”

But Pukatire sounded a lament I heard over and over: “I am worried about our young people who are imitating whites, cutting their hair and wearing stupid little earrings like you see in town. None of the young people know how to make poison for arrows. In Brasília the Kayapo are always told they are going to lose their culture and they might as well get it over with. The elders have to speak up and say to our young people, ‘You can’t use the white man’s stuff. Let the white people have their culture, we have ours.’ If we start copying white people too much, they won’t be afraid of us, and they will come and take everything we have. But as long as we maintain our traditions, we will be different, and as long as we are different, they will be a little afraid of us.”

It was late; Pukatire got up and said good night. Tomorrow would be a big day. The Kayapo leader Mekaron-Ti and the great Ropni, who’d traveled the world in defense of the forest decades ago, were coming to Kendjam to resume the battle against the dam that wouldn’t die.

AFTER FOUR DECADES of plans dating back to Brazil’s military dictatorship, four decades of studies, protests, revised plans, court rulings, court reversals, blockades, international appeals, a film by *Avatar* director James Cameron, and lawsuits, construction finally began in 2011 on the \$14 billion Belo Monte. The complex of

canals, reservoirs, dikes, and two dams is located some 300 miles north of Kendjam on the Xingu, where the river makes a giant U-turn called the Volta Grande. The project, which will have a maximum generating capacity of 11,233 megawatts and is slated to come on line in 2015, has divided the country. Its supporters defend it as a way of delivering needed electricity, while environmentalists have condemned it as a social, environmental, and financial disaster.

In 2005 the Brazilian Congress voted to revive the dam on the grounds that its energy was essential to the security of the rapidly growing nation. The Kayapo and other tribes affected by the plans reassembled in Altamira in 2008. A project engineer from Eletrobras, the state-owned power company, was mobbed and suffered a “deep, bloody gash on his shoulder,” according to news accounts at the time. Claiming that the project’s environmental impact statements were defective and that the region’s indigenous people were not adequately consulted, Brazil’s federal Public Prosecutor’s Office filed a series of lawsuits to stop the complex, essentially pitting one branch of the government against another. The cases went to the country’s Supreme Court, but judgments have been deferred, and construction of Belo Monte has been allowed to proceed.

Even a complex consisting of just two dams will have an enormous impact on the Xingu Basin, thanks to roads and the influx of an estimated 100,000 workers and migrants. The dams will flood an area the size of Chicago. Official estimates project that 20,000 people will be displaced; independent estimates suggest the number may be twice as high. The dams will generate methane from inundated vegetation in quantities that rival the greenhouse gas emissions of coal-fired power plants. The diversion of some 80 percent of the water along a 62-mile stretch of the Xingu will dry up areas that depend on seasonal floodwaters and are home to endangered species.

“The key now is what comes after this,” says Schwartzman. “The government has said only the Belo Monte project will be built, but the original proposal was for five other dams, and

boats to Facebook pages, they have shown without compromising the essence of their culture.

there are questions whether Belo Monte alone will be cost-effective or whether the government will come back later and say we need to build these other dams.”

THE MORNING OF the great chiefs' arrival in Kendjam, two dozen Kayapo women, bare-breasted in black underwear and ropes of colored beads, went through what seemed like a dress rehearsal, chanting and marching around the kapôt. Around 4 p.m. the sound of a plane drew a crowd to the airstrip.

Ropni and Mekaron-Ti disembarked with a third chief from the south named Yte-i. Ropni is one of five elder Kayapo who still wear the lip disk—a mahogany puck the size of a small pancake that extends the lower lip. He carried a wooden war club, shaped like a medieval sword. As he stood by the plane, a woman approached, held his hand, and began to sob. In a different culture bodyguards might have hustled her away, but Ropni seemed unfazed and in fact began sobbing as well. The anguished weeping was not the result of some fresh catastrophe but a form of ritual Kayapo mourning for departed mutual friends.

That evening in the men's house, Ropni addressed the Kendjam villagers, vaulting across octaves with the glissading intonation of Kayapo speech. He stabbed the air with his hands and thumped his club: “I don't like Kayapo imitating white culture. I don't like gold miners. I don't like loggers. I don't like the dam!”

One of his purposes in coming to Kendjam was to find out why the chiefs of the eastern part of the territory had been accepting money from Eletrobras. Boxes of brand-new 25-horsepower boat motors were stacked on the porch of the Protected Forest Association headquarters. Ropni's village and other villages in the south had steadfastly refused money from Eletrobras, money that activists said was an attempt to dampen indignant opposition to Belo Monte. The consortium building the dam was investing in wells, clinics, and roads in the area and was paying a dozen villages nearby an allowance of 30,000 reais a month (roughly \$15,000) for food and supplies, which Schwartzman describes as “hush money.”

The first Kayapo encounters with the grimy Brazilian banknotes led to the coining of their evocative word for money: *pe-o caprin*, or “sad leaves.” More and more sad leaves were a part of Kayapo life, especially in villages close to towns on the Brazilian frontier. In the Kayapo village of Turedjam, near Tucumã, pollution from clear-cutting and cattle ranching had wrecked the fishing grounds, and it was not uncommon to see Kayapo shopping in supermarkets for soap and frozen chicken.

FOR THREE NIGHTS Pukatire led Ropni and Mekaron-Ti and Yte-i to our camp, where they would sit on the schoolhouse veranda, lighting their pipes and drinking coffee and telling stories while vampire bats veered through the wan aura of a fluorescent bulb. “In the old days men were men,” Ropni said. “They were raised to be warriors; they weren't afraid to die. They weren't afraid to back up their words with action. They met guns with bows and arrows. A lot of Indians died, but a lot of whites died too. That's what formed me: the warrior tradition. I have never been afraid to say what I believed. I have never felt humiliated in front of the whites. They need to respect us, but we need to respect them too. I still think that warrior tradition survives. The Kayapo will fight again if threatened, but I have counseled my people not to go looking for fights.”

He barked for more coffee, and then, seemingly agitated, took his cup to the edge of the veranda, away from the circle of schoolhouse chairs. For a long while, he stared into the darkness.

On the day the chiefs left, there were letters they needed to sign—FUNAI paperwork authorizing various matters they had discussed. Mekaron-Ti, who was fluent in the Western world as well as the forest world, signed his name quickly like someone who had written a thousand letters. But Ropni held the pen awkwardly. It was striking to see him struggle with the letters of his name, knowing what esoteric expertise was otherwise in his hands, how deftly he could fasten a palm nut belt, or insert a lip plate, or whittle a stingray tail into an arrowhead, or underscore the oratory that had helped



MEKARON-TI, the great chief, speaks Portuguese and is a powerful advocate for his people.



ROPNI, an internationally known chief, is one of the few Kayapo who still wear the mahogany lip plate.



secure a future for his people. In the Xingu Valley there had hardly ever been a more able pair of hands. But in the realm that required penmanship, the great chief was like a child.

Six months later, 26 eastern Kayapo leaders met in Tucumã and signed a letter rejecting further money from the dambuilding consortium: “We, the Mebengôkre Kayapo people, have decided that we do not want a single penny of your dirty money. We do not accept Belo Monte or any other dam on the Xingu. Our river does not have a price, our fish that we eat does not have a price, and the happiness of our grandchildren does not have a price. We will never stop fighting... The Xingu is our home and you are not welcome here.”

SOMEHOW WORD had gotten out. The paleface with no holes in his ears was heading up Kendjam Mountain. It was 2:30 in the afternoon, and before our hiking group was halfway down the airstrip, we’d picked up a tail of kids, 15 or so, a cluster of teen and preteen girls and boys with painted faces carrying water in old soda bottles, and even one ebullient little fellow who couldn’t have been more than four: barefoot and unsupervised with no parent hovering about to make sure he didn’t get lost or eaten

by a jaguar or poisoned by a pit viper or pierced by the thorns and spines on every other plant.

He was wearing just a pair of shorts—in contrast to me, in boots, hat, shirt, long pants, sunglasses, SPF three million sunblock, and three bandannas to mop up biblical torrents of sweat. We walked single file for a while, and then the kids rushed past, swarming around some tall shrubs; they pulled the branches down and chopped off seedpods of the wild inga fruit.

After 45 minutes the trail began to rise. The gray stone of the mountain loomed above: vertical walls, no fissures or obvious cracks. North, south, and west, its sides were seemingly unclimbable, but the eastern end sloped into the forest. The teenagers laughed and chattered up the steep grade, vaulting logs and swinging on vines. A narrow trail zigzagged up the side and cut through a cleft where you had to haul yourself with sweaty hands over a large boulder.

A long ramp led up to the summit dome. All the kids were sitting on the summit, backlit by a milky blue sky. I wheezed up after them. Brown-gray lizards scuttled around. The children scuttled around too, fearlessly flirting with the void where the rock fell precipitously for five or six hundred feet, maybe more. No handrails. No liability advisories. No adult supervision.



The four-year-old boy capered at the edge of the abyss, laughing and exulting as if it was the most marvelous day of the year.

When we all started down, he ran on ahead, and I found myself thinking about the night after the big chiefs had gone, when one of our guides, Djyti, came to visit, and we asked him a crucial question. “Can you be a Kayapo and not live in the forest?” Djyti thought for a while, then shook his head and said no. Then, as if contemplating something unthinkable, he added: “You are still a Kayapo, but you don’t have your culture.”

In the past some anthropologists have fetishized cultural purity, fretting over the introduction of modern technology. But cultures evolve opportunistically like species—the Plains Indians of North America picked up their iconic horses from the Spanish—and strong traditional cultures will privilege themselves, making the accommodations they think will ensure their futures. We can question whether a man dressed in a parrot feather headdress and penis sheath is more valuable than one in a Batman T-shirt and gym shorts. But who can be blind to their knowledge of forest plants and animals or to the preeminent values of clean water, untainted air, and the genetic and cultural treasure of diversity itself?

It is one of the richest ironies of the Amazon

A band of Kayapo warriors (left) moves through the forest with shotguns and axes in search of fresh game. In a more leisurely posture, a festively dressed father waits for his baby’s name-giving ceremony to begin.

that the supposedly civilized outsiders who spent five centuries evangelizing, exploiting, and exterminating aboriginal people are now turning to those first inhabitants to save ecosystems recognized as critical to the health of the planet—to defend essential tracts of undeveloped land from the developed world’s insatiable appetites.

My four-year-old friend—I never did learn his name—had run all the way home long before I staggered back to the easy walking of the airstrip. It was nearly dark. Maybe his mom had plunked him in front of a TV to watch a video of a Kayapo ceremony or a Brazilian soap opera. And maybe to him the day was no great lark either, nothing memorably distinct from all the other days. Still, it seemed hard to imagine a more perfect life for a kid his age than to be a free and footloose Kayapo at home in the forest. Long may he run. □





*Headdress and glasses on a rock,
Chief Pukatire immerses himself in
the Iri River for his nightly bath.
Pukatire is a pivotal figure for
negotiating Kayapo rights. He has
mobilized his people before to protect
their land, and he will do it again.*





“Every specimen has a story,” says retired Smithsonian entomologist Gary Hevel. But not all of them end well. Carl von Hagen, the naturalist who collected these paradise bird-wing butterflies (left) in Papua New Guinea around 1900, was captured and eaten by cannibals.

Japan was closed to most Western travelers in 1829, when Philipp Franz von Siebold, a visiting German physician and natural history collector, somehow managed to export samples of flora and fauna—including a Japanese macaque (above, at right)—to his fellow Europeans.

PARADISE BIRD-WING BUTTERFLY (ORNITHOPTERA PARADISEA), MUSEUM OF COMPARATIVE ZOOLOGY, HARVARD UNIVERSITY; JAPANESE MACAQUE (MACACA FUSCATA) AND UNIDENTIFIED MONKEY, NATURALIS BIODIVERSITY CENTER, LEIDEN, NETHERLANDS

THE
THINGS
THEY
BROUGHT
BACK

*Hidden in the back rooms of museums,
specimens collected by scientists and explorers
are both beautiful and enlightening.*

BY JEREMY BERLIN

PHOTOGRAPHS BY ROSAMOND PURCELL





Living in the Dutch countryside during the last century, Willem Cornelis van Heurn collected European moles in his neighborhood. A sea of their skins reveals subtle variations of size, shape, and sheen.

EUROPEAN MOLE (*TALPA EUROPAEA*), NATURALIS BIODIVERSITY CENTER, LEIDEN, NETHERLANDS

W ALTER LOOKS COMFORTABLE. Dead for 50 years, the giant Pacific octopus is resting in a ten-gallon tank of ethanol solution, six-foot arms folded in cephalopod repose. His next-door neighbors hail from the

Atlantic: a jarred colony of sea squirts, their blue-green bioluminescence long extinguished. Corals and algae bloom on a shelf. Leis of Tahitian snails dangle from hooks. Pearly shelled mussels from the Mississippi River, source of a once profitable button industry, glisten under glass.

And then there are the cabinets, all 230 of them: airtight, custom-made, climate-controlled homes to ten million mollusk specimens. Many were gathered on far-flung expeditions led by the likes of Ernest Shackleton, Meriwether Lewis and William Clark, Gifford Pinchot, and William Bartram.

Where is this storehouse of wonders? And how did we get here? The short answer first: We're at the Academy of Natural Sciences in Philadelphia. We reached this collection via two others, up a half flight of stairs from entomology, with its teeming drawers of scarab beetles and four million other bugs culled from every country on Earth, and past a choice paleo trove—limbed fish from the Devonian period, mastodon teeth owned by Thomas Jefferson, slabs of ichthyosaur skeletons from England.

But this is no closet they're kept in. It's a eureka factory. When we think of discovery, explorations tend to hog the glory. Yet finding a specimen in the field is just the first step. The rest happens here, in the hidden depths of a museum, amid the meticulously cared-for collections. This is where species are described, named, labeled, and cataloged, often decades after they were gathered. Where scientists coax new secrets from old plants and animals, each dead specimen uniquely alive with physical, molecular, and isotopic data on

everything from evolution to ecology, medicine to migration. Where our planet's life is reckoned.

The academy was founded in 1812 by amateur naturalists, says its senior fellow and "resident humanist," the author and historian Robert McCracken Peck. That makes it the oldest natural history museum in the Western Hemisphere, and among the first to foster an egalitarian pursuit of knowledge. So it's the perfect place to start our search for the longer answer.

People have always collected things. Whether a vestige of our hunter-gatherer days, a need to forge order amid chaos, or a simple desire to have and to hold, the urge to possess is a hallmark of the human psyche. Yet pathology is a danger. Compulsive hoarders find value in everything. Others fixate on a single thing, succumbing to what author Nicholas Basbanes calls "a gentle madness." In 1869 the bibliophile Sir Thomas Phillipps said he needed "to have one copy of every book in the world." His final tally (50,000 books, perhaps 100,000 manuscripts) wasn't bad. Or close. For zealots, wrote the evolutionary theorist Stephen Jay Gould, "the passion for collecting is a full-time job, a kind of blessed obsession."

That obsession seeds our story. In the 16th century, with Renaissance Europe awake to the wider world, status-conscious royals and nobles (think Habsburgs and the Medici), as well as physicians and apothecaries, began assembling eclectic objects in a single room. Called *Wunderkammern*, or cabinets of curiosity, they broadly expressed the beautiful, the monstrous, and the exotic: preserved flora and fauna, scientific instruments, objets d'art, genetic mutations.

"A good Wunderkammer would have a stuffed crocodile, a decent mummy, a fetus in a bottle (preferably with two heads), gems and minerals and fossils, Aztec headdresses or Japanese ceremonial swords, oil paintings, and antique sculptures," says the scholar Terry Belanger,

catalog co-author for a recent Manhattan exhibit curated by collector Florence Fearington.

In other words, these ancestors of modern museums (and P. T. Barnum's freak shows) were odes to idiosyncrasy, not science. Enter Carl Linnaeus, a Swedish botanist with an ardor for order. "The first step in wisdom is to know the things themselves," he wrote. To do so in a "simple, beautiful, and instructive" way, he devised a system of classification for all living things: two-word names in Latin identifying first the genus, then the species. Since 1753 his universal taxonomy "has been to scientists what the Dewey decimal system is to librarians," says Ted Daeschler, paleontologist and vice president of collections at the academy.

Linnaeus and the Enlightenment paved the way for proper scientific collecting, says Peck, as well as for the 19th-century transition from private to public collections. Naturalists began to prepare specimens with care and rigor. But early preservation techniques could do more harm than good: Insects might be pickled in spirits, snakes crammed with straw, shells boiled and shipped in sawdust. They could also be toxic. "It is a very Arsenicy job," wrote ornithologist John Cassin in an 1848 letter. "I labeled about half the [owl] collection... and was taken with congestion of the lungs and most violent head ache and fever."

Nowadays, Peck says, specimens are no longer burned clean of bugs; they're frozen. X-rays and micro-CT scans peer inside samples without damaging them. Institutions are kept at a constant climate. "Temperatures 65 to 70 degrees and relative humidity around 40 percent are ideal for natural history collections," says Smithsonian Institution bird specialist Christopher Milensky.

This is "where our culture keeps its three-dimensional knowledge of the natural world," says Kirk Johnson, director of the Smithsonian's National Museum of Natural History and its 126 million specimens. "People call this place

America's Attic. But it's more like Fort Knox—a place where we keep treasures, not the crap you don't want to deal with. It's a vault, a temple."

And a time machine. Using data from bird fossils, Smithsonian ornithologist Helen James is discovering now extinct island species; to date she's described nearly 40 from Hawaii alone. Karin Bruwelheide, her colleague in forensic anthropology, is investigating the mysterious death of a 19th-century naturalist named Robert Kennicott. Since opening his iron coffin 12 years ago, her team has deduced that he died at 31 of a heart attack, his short life of cricket frog collecting plagued by poor health and bad teeth.

Johnson says cutting-edge work like that is becoming increasingly collaborative thanks to the digitization of collections, which allows museums to catalog specimens, scientists to exchange information, and the public to access that information remotely. "Now," he says, "you can be a Maasai warrior with an iPhone and look at a collection."

Not that it's a replacement for the real thing. "You need both physical and digital collections," says Daeschler. "The latter augments the former. A digital sample is just a voucher. Each specimen is the definition of that organism at that time in that place. You can't represent it with just words or images." Or as Peck puts it, "If we didn't have 18 million specimens here but had 18 million pictures of those specimens, I'm not sure anyone would really care."

Johnson agrees. "Darwin's big insight is that all living things are related to each other," he says. "And that story is manifestly told by museum collections. Some of these species are extinct. But we've got their DNA right here. We're the keepers of the planet's knowledge." □

Jeremy Berlin is an editor at the magazine. Rosamond Purcell's most recent photographic books are A Glorious Enterprise and Egg and Nest.



Sand Crab (Birgus latro)
From Flint Island,
South Pacific
(C. D. Voy!)

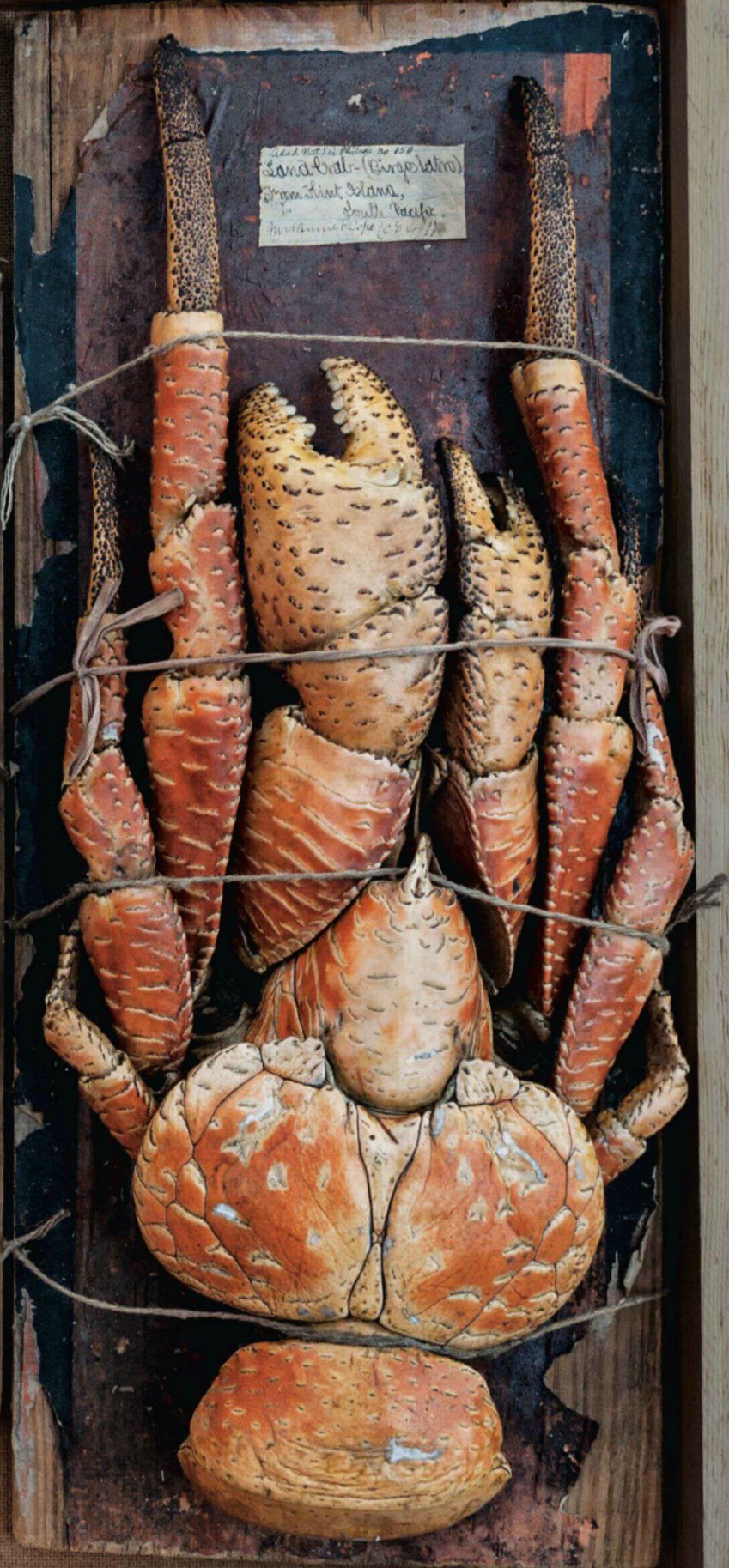
(Birgus latro)
South Pacific
(C. D. Voy!)

California naturalist C. D. Voy's handwritten notes still label three coconut crabs he collected in 1875 on Flint Island, an uninhabited coral atoll in the central Pacific Ocean.

COCONUT CRAB (BIRGUS LATRO); ACADEMY OF NATURAL SCIENCES OF DREXEL UNIVERSITY, PHILADELPHIA



LAND CRAB
From Flint Is.
SOUTH PACIFIC
Cape (C. S. V. 11)



LAND CRAB (Girardinus)
From Flint Islands,
South Pacific
Cape (C. S. V. 11)



“Beautiful things”—such as this bird wing-shaped piece of hematite, an iron oxide—“tend to be collected and studied first and most,” says Robert McCracken Peck of the Academy of Natural Sciences. “Birds, butterflies, shells, and minerals are the big four.”





Resting on a shipping trunk, two gorilla skulls offer tangible proof of a 1934-35 expedition to West Africa. "There's nothing like seeing the things themselves," says photographer Rosamond Purcell. "Nothing."

GORILLA (GORILLA GORILLA), ACADEMY OF NATURAL SCIENCES OF DREXEL UNIVERSITY



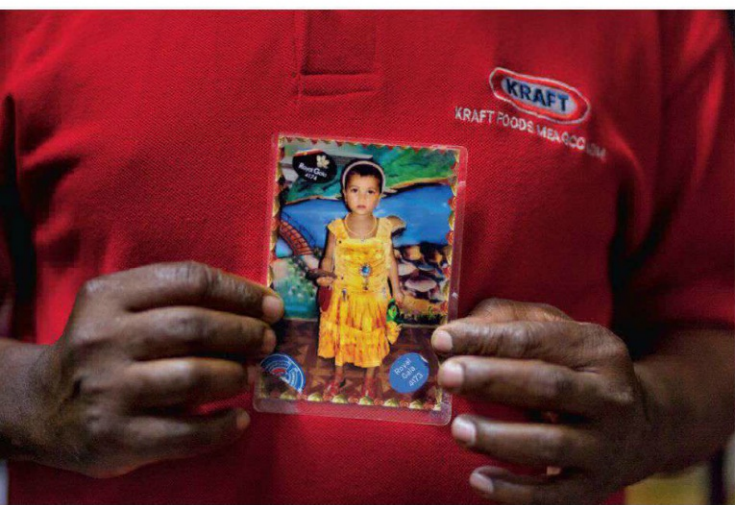
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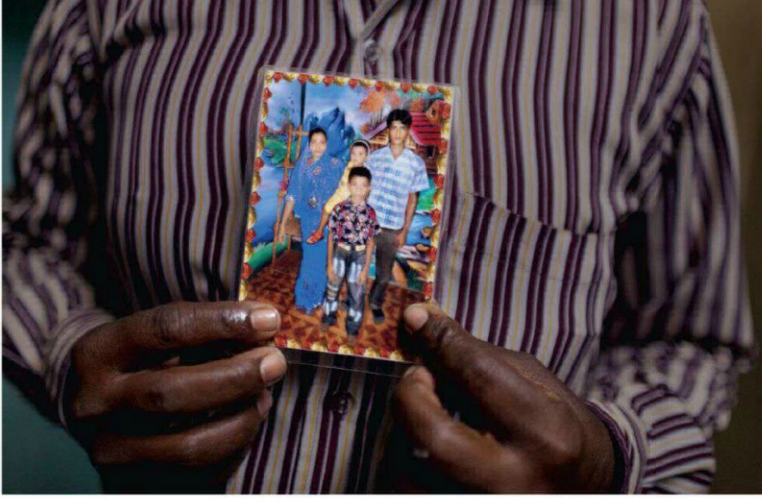
16891
Gorilla
Middle Congo, Kasai
No. 16891



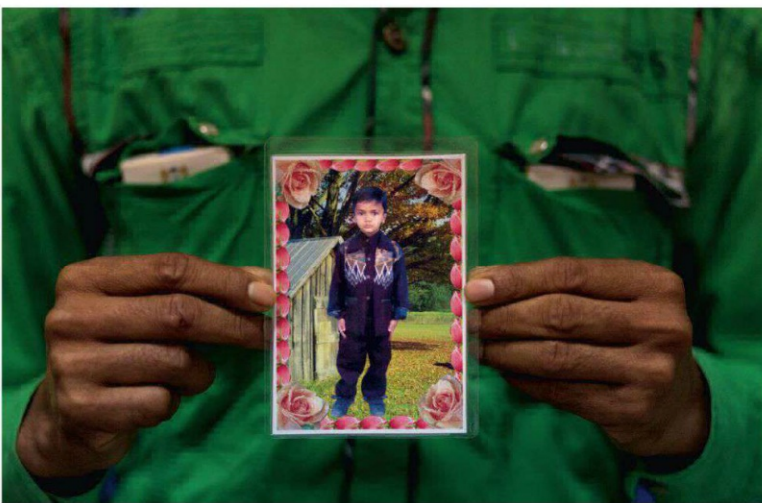
Far *from* Home

In today's hyperconnected world, many developing countries find that their most lucrative export is people. The foreign workers and their families must grapple with an inevitable trade-off: emotional loss for material gain.





GUEST WORKERS IN DUBAI HOLD PICTURES OF FAMILY MEMBERS BACK HOME.





The world's tallest building, the Burj Khalifa, looms like a distant bayonet over workers cleaning up a construction site in Dubai. The sweepers are mostly from Pakistan and India.





A newly arrived temporary worker from Ghana, on daily duty as “pool ambassador,” attends to thirsty swimmers at Dubai’s five-star Ritz-Carlton hotel.



By Cynthia Gorney

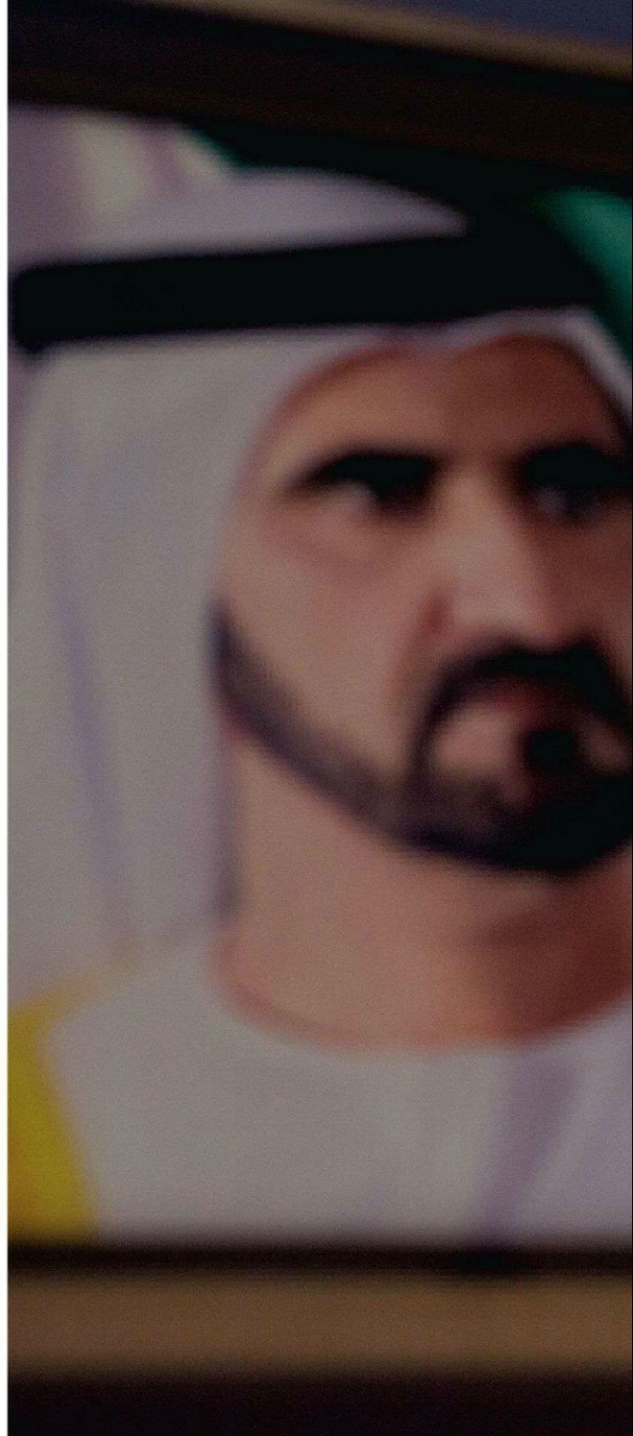
Photographs by Jonas Bendiksen

Noon in the United Arab Emirates is four in the afternoon in the Philippines,

which means that Teresa Cruz's two older children are supposed to be home from school and back inside the apartment of their aunt, who is raising them. Teresa lives in Dubai, the U.A.E.'s most populous city, 4,300 miles from the Philippines. She's a 39-year-old sales clerk at a clothing store in one wing of a shining multistory Dubai mall. Her job requires her to straighten clothes, ring up transactions, keep track of receipts, and smile whenever a customer walks in. She's on her feet six days a week, Fridays off.

So Friday midday is a scheduled time for Teresa to see her 11-year-old daughter and 8-year-old son, and because she's an overseas worker—one of many millions of adults who have traveled thousands of miles from home to take jobs that allow them to send money back to their families—she does this in the overseas worker's modern way: She pulls a low, plastic stool up to a computer set into a particleboard desk inside the bedroom she shares with four other people. She logs on to Facebook. She clicks a video-chat button, leans in close, and waits.

The first time I waited with her, Teresa was still in her pajamas and fuzzy-eared slippers at midday. She lives in the bedroom with her husband, Luis, who like Teresa left the Philippines years ago; their two youngest children, a baby and a three-year-old; and whomever the couple has persuaded to babysit while Teresa and Luis



An image of Dubai's hereditary ruler, Sheikh Mohammed bin Rashid Al Maktoum (often impertinently referred to as Sheikh Mo), is prominently displayed on the counter of a cupcake shop inside the vast Dubai Mall. With so many nationalities working, dining, and shopping here, the city's predominant language is English, not Arabic.



are at work. (Names have been changed to shield the family from potential repercussions.) This month it was a young Filipina who had run away from her job as an Emirati family's ill-treated maid and was now illicitly residing in a metal bunk wedged between the Cruz family mattress and the bedroom door. The baby was teething and cranky, and Teresa shushed him as she clasped him to one hip, her eyes fixed on the computer.

Finally a face materialized on the screen. But it was her sister, the children's aunt. The kids weren't home yet, she said. She didn't know where they were. "Call after dinner," she said in Tagalog, and signed off.

Teresa's shoulders sagged. She switched to

her daughter's Facebook page, where she was startled to read, "In a relationship." She stared at the screen. "Maybe she doesn't mean it," Teresa said. Justin Bieber was on her daughter's likes list, as was the television show *Glee*. As was a Facebook page with many followers who have one attribute in common: Someone in the family has decided that the only way to accomplish the things a responsible parent is supposed to—pay for schoolbooks, make sure the grandparents have enough to eat, prepare the children for college someday—is to leave family behind and find work a very long way away.

During the weeks I came to know her in Dubai, I saw Teresa lose her composure only once. She was talking about an evening in the

Nearly every Filipino in the U.A.E. has friends or relatives who manage long-distance marriages by taking lovers. “Don’t forget the people you left behind,” Father Tom preached. “Don’t forget the reason you’re here.”

Philippines more than a decade ago, when she stood outside her family’s home and saw that every house on the street had Christmas lights, every single one except hers. “For us,” she said, “nothing.” Her face suddenly crumpled, and she began to cry.

“I had heard a lot about ‘Abroad,’” Teresa told me. “I had heard that when you were in Abroad, you can buy anything.” Abroad was like a country of its own, the place from which impressive things emanated: gold bracelets, Colgate toothpaste, corned beef in cans. In the municipality where Teresa and her ten siblings grew up, an hour from Manila, houses of stone were made with Abroad money. “Our house was wood and very old,” Teresa said. One monsoon season, in the room where Teresa and her sister slept, a sodden wall collapsed. “Then when it’s Christmastime,” she said, “I was in front of my house. And I said, ‘The first salary, I will buy a Christmas light.’”

The first salary was from a local job selling sporty shoes. Teresa, just out of high school, could not afford to replace the house’s wooden walls with sturdier stone. But she could buy a string of colored lights. She nailed them up on her house in the shape of a Christmas tree. “I did it myself,” she said. “And I went out in front, and the light was there, and I said, *I can do this.*”

That was the night that Teresa decided she was tough enough for Abroad.

MIGRATION FOR BETTER OPPORTUNITY is as old as human history, but today it’s likely that more people are living outside their countries of birth than ever before. At every hour of every day masses of people and money are in motion, a global flux as complex and shifting as weather, with nations of fewer resources off-loading their ambitious working poor and relying on the money that comes back in their place. “Remittances” is what economists call these person-to-family transfers, whisked home by electronic

Cynthia Gorney wrote about Cuba for the November 2012 issue. Jonas Bendiksen is an award-winning photographer based in Oslo.

banking services or hand-delivered by couriers. Tiny in individual increments, aggregate remittances now constitute massive flows of capital into the world's developing countries. Of the many places from which this money is sent—the richest countries, where employers are willing to put needy foreigners to work—the United States tops the list.

No other city on Earth, though, packs 21st-century international workers into one showy space quite like Dubai. Arrive in the standard manner, disembarking into the sprawling international airport, and you will pass a hundred remittance workers like Teresa and Luis before you reach the curbside cabstand. The young woman pouring Starbucks espressos is from the Philippines, or maybe Nigeria. The restroom cleaner is from Nepal, or maybe Sudan. The cabdriver, gunning it up the freeway toward downtown Dubai, is from northern Pakistan or Sri Lanka or the southern Indian state of Kerala.

And the mad-looking, postmodernist skyscrapers outside the taxi windows? This building, the one like a massive hatchet blade, or the one that resembles a giant golf ball atop a 20-story pancake stack? All built by foreign laborers—South Asian men primarily, from India, Nepal, Pakistan, and Bangladesh. If it's daylight, empty buses will be parked in the shade beneath the skeletons of the skyscrapers still under construction. They're waiting to carry men back at dusk to group-housing units, crowded as prison barracks, where most of them are required to live.

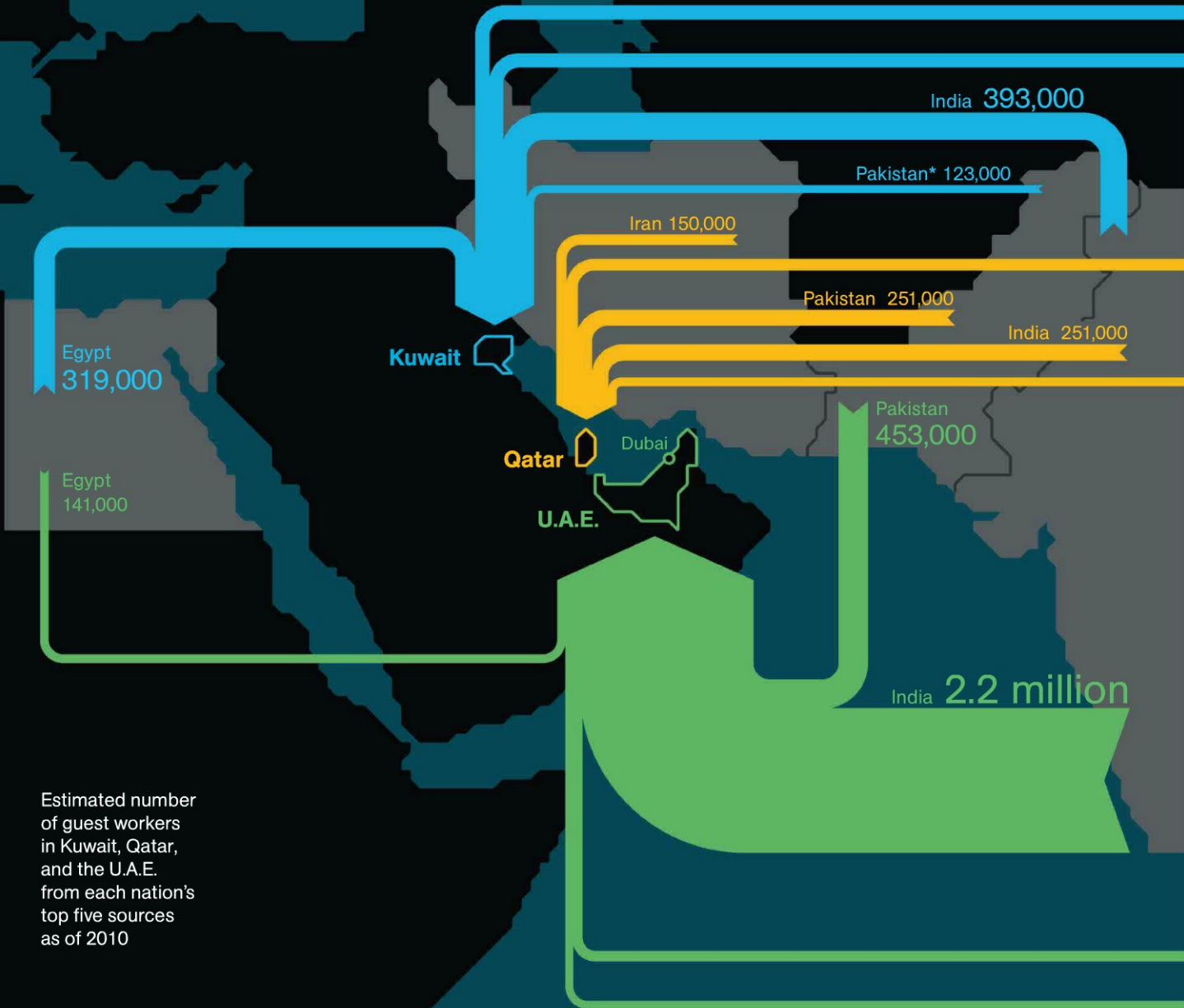
Difficult living conditions for foreign workers can be found everywhere in the world. But everything about Dubai is exaggerated. The city's modern history starts just over a half century ago, with the discovery of oil in nearby Abu Dhabi, then a separate and independent sheikhdom. The United Arab Emirates was founded in 1971 as a national federation encompassing six of these sheikhdoms—the seventh joined the following year—and since Dubai had comparatively little oil, the city's royal family used its portion of the country's new riches to transform the small trading city into a commercial capital to

dazzle the world. The famous indoor ski slope is only one wing of a Dubai shopping mall, which is not even the biggest of the city's many malls; that one contains a three-story aquarium and a full-size ice hockey rink. The tallest building on the planet is in Dubai; Tom Cruise was seen rappelling down its outer wall in one of the *Mission: Impossible* movies. Nearly everywhere the visitor looks, things are extravagant and new.

And because the men who conceived contemporary Dubai decided that their spectacular city would be assembled and serviced by workers from other countries—there were too few Emiratis to do it, and why would a newly wealthy nation expect its adults to wait tables or pour cement in 120-degree-Fahrenheit heat when it could afford to invite outsiders to perform these tasks?—they ended up doing this in exaggerated fashion too. Of the 2.1 million people in Dubai, only about one in ten is Emirati. The rest are the global economy's loaners, working on temporary contracts with the understanding that they will never be offered Emirati citizenship.

The society they live in, like most of the gulf countries now relying on foreign workers, is as rigidly layered as was 19th-century industrial America, and in many of the same ways: by race, gender, class, country of origin, English-language fluency. In Dubai the professionals and managers are largely Europeans, Americans, Australians, New Zealanders, and Canadians—white people who mostly make too much money to be thought of as remittance workers. Their salaries let them bring over their families, drive Range Rovers, and move into elegant high-rises or landscaped villas. It is remittance workers who cook for them too and look after their children, who clean the streets, staff the shopping malls, fill out the pharmacy prescriptions, run the hockey rink Zambonis, and build the skyscrapers in the scorching sun outside—who make Dubai function, in other words, while sending their wages a long way home.

At its heart, however, this isn't a story about work and wages and GDP. It's a love story: about family bonds, colliding duties and loyalties, and the immense barriers to providing for

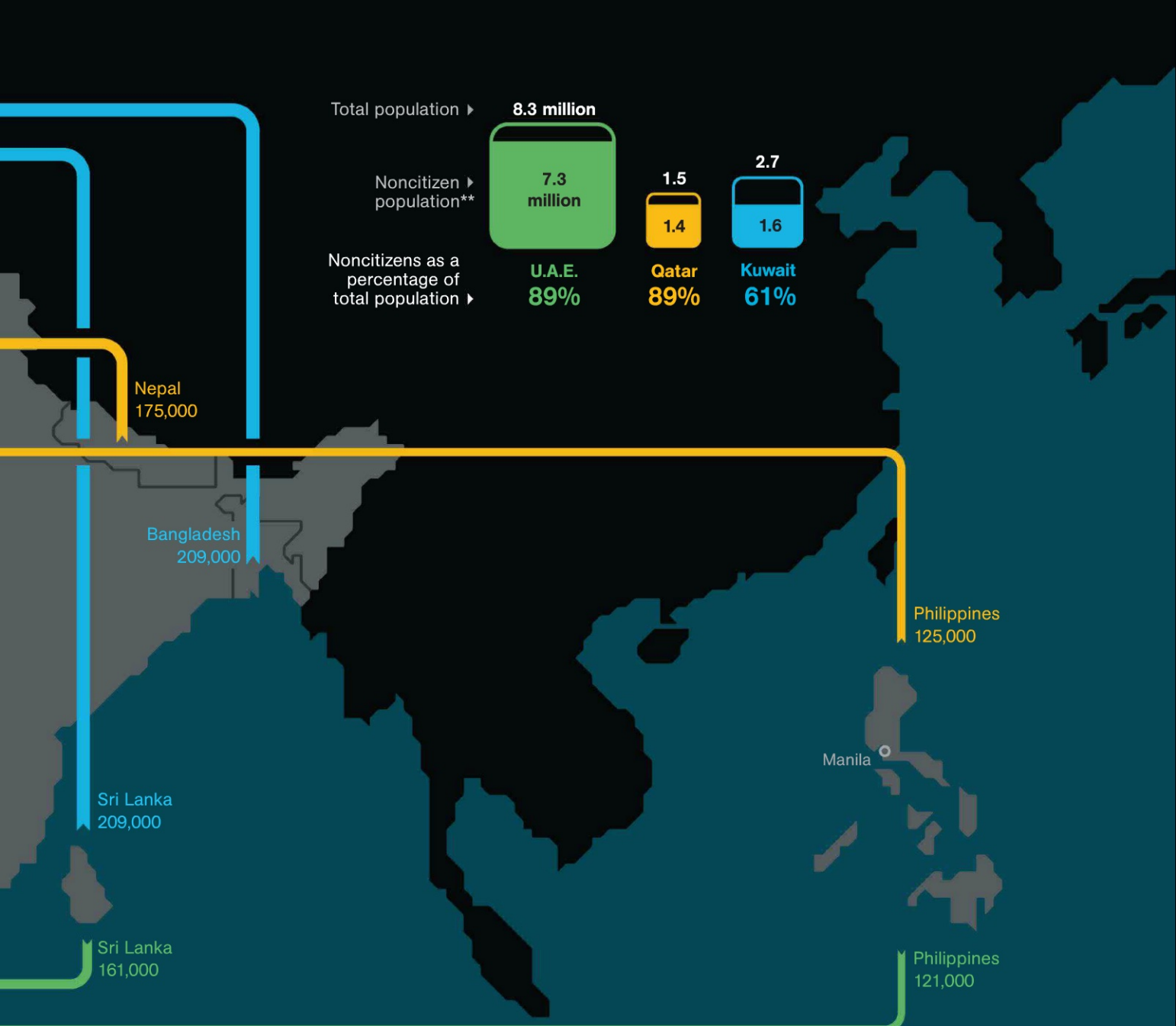


Estimated number of guest workers in Kuwait, Qatar, and the U.A.E. from each nation's top five sources as of 2010

Workers Flood in, Earnings Flow Home

Three oil-rich countries with small national populations—Kuwait, Qatar, and the United Arab Emirates (U.A.E.)—have the world's highest proportions of guest workers. The migrants, men and women largely from Asia and Egypt, fill unskilled or semiskilled jobs scorned by nationals. These workers, who rarely visit home, export billions in wages (right) to support their families. For many, including the children of guest workers and workers who've retired, the Gulf states become a permanent home, but one that offers no chance for citizenship.

JOHN TOMANIO, NGM STAFF; SHELLEY SPERRY
 SOURCES: DILIP RATHA, WORLD BANK (GUEST WORKERS AND REMITTANCE DATA); NOORA LORI, HARVARD ACADEMY (POPULATION AND NONCITIZEN DATA)



Total wages sent home in 2012 by guest workers in the three host countries.

BILLIONS OF U.S. DOLLARS

Kuwait
\$8.5 billion



Qatar
\$7.8 billion



U.A.E.
\$20.3 billion



*Pakistan sent the same number of guest workers to Kuwait as Syria did but sent home much higher remittances. **Guest workers are nearly the entire noncitizen population of Kuwait, Qatar, and the U.A.E. Percentages reflect rounding; 2010 data (latest available).





Starting at dawn, company buses haul foreign laborers between residential camps and work sites in Dubai. These workers are returning bleary-eyed to group dormitories.



loved ones' material and emotional needs in a global economy that sometimes seems perfectly structured to pull families apart. Most overseas workers are caught up in love stories of one kind or another, and in Dubai, which has one of the world's highest concentrations of foreign workers, the Cruzes appreciate the aspect of their daily lives that renders them unusually lucky: They are able to live together, husband and wife, in the same physical place. For a time they were together with all their children, a rare blessing for remittance workers. But the arrival of the fourth baby—the Cruzes are observant Roman Catholics—was more than they could manage. It was Luis, who had been married before and already had one child in the Philippines, who took the older children home. Whenever I asked Teresa about losing physical contact with her daughter and her oldest son, she went expressionless and still. "Very difficult," she said. And: "I think they have a good family with my sister." And: "There they will learn to be Filipino."

Inside the city's block-long St. Mary's Catholic Church the Friday afternoon mass is delivered in Tagalog. English masses are at other times of the week, as are the Sinhalese, the French, the Tamil, the Arabic, the Malayalam and Konkani. Those last two are languages of India. One Friday the pews overflowed with parishioners, and standing just outside St. Mary's doors, alongside others who had arrived too late for a seat, Teresa and Luis kept an eye on their wandering three-year-old while listening to the loudspeaker

STRANGERS IN A STRANGE LAND

In gulf countries most bottom-rung guest workers share company housing or improvise. In either case, the accommodations are utilitarian at best. A man carries a fish past dormitories provided by an employer in Qatar (top), and men from Uttar Pradesh, one of the poorest Indian states, use a patch of floor inside a Dubai rental apartment as a communal bed.

voice of Tomasito Veneracion, the priest who ministers to the congregation's Filipinos. He'd recently learned a new word, Father Tom was saying in Tagalog: "gamophobia," the fear of remaining in a committed relationship.

You must not be gamophobic, Father Tom preached. You must not allow yourself to say that the overseas worker's family is strong but that you, the actual overseas worker, are weak. Teresa and Luis exchanged glances; the priest was making no direct reference to adultery, but they understood what he meant. Nearly every Filipino in the U.A.E. has friends or relatives in the Philippines and in the gulf who manage long-distance marriages by taking lovers while the remittances flow. "Don't forget the people you left behind," Father Tom said. "Don't forget the reason you're here."

IN A CITY OF FOREIGN WORKERS these are the stories that predominate: the reasons you're here, the people you left behind. Frequently they turn out to be one and the same. My daughters, my husband, my parents, and my brother, who is still in the village and who I am now afraid is using drugs. Because I wanted that brother to go to high school. Because although we are eight men in a room meant for four and must soak our filthy work clothes in soapy buckets to remove the smell, the employer pays for my lodgings, leaving me more to send back. Because even though my employer does not pay for my lodgings, I can lower my rent by sharing not only a room but also a bunk, day-shift men and night-shift men taking turns lying down to sleep. Because my wife was pregnant and we were afraid for our baby's future, and now, by the way, I keep my wife's picture inside my suitcase, not on the bunkside wall, where the other men in my room might look at her while having private thoughts.

Because this is the way my own father taught me to provide—when he left us, 30 years ago, to quadruple his wages and send the money home.

In Manila there are blocks in which nearly every storefront window is plastered with inducements to leave. KINGDOM OF SAUDI ARABIA,

30 Sandwich Makers. HONG KONG, 150 Domestic Helpers. DUBAI, Play Area Attendant, Vegetable Packers. Tile Setter, Rice Specialist, Janitress (Good Looking), Ice/Fruit Carvers. Job offers luring Filipinos away name destinations all over the world. But the most prominent ads promise work in the Gulf states, especially for the minimally educated.

When Luis was a small boy, his father took just such a job, signing on as a welder in Dubai. He never moved back; Luis senior now returns home only on occasional leave, when he rejoins the woman to whom he is still married—Philippine law does not permit divorce. Luis and his four siblings grew up accustomed to their father's absence, and they hated it. "We would all take him back to the airport," Luis told me. "Everybody would have to hug and kiss him. That was the worst part. Everybody would cry."

Like many nations with persistent poverty, the Philippines has come to depend on these regular departures. A formal acronym is used, often accompanied by praise for heroic sacrifice to nation and family: OFWs, or overseas Filipino workers. A special OFW center takes up part of Manila's international airport, and multiple public agencies attend to their needs around the country—the Philippines Overseas Employment Administration, for example, and the Overseas Workers Welfare Administration, each with hundreds of employees.

By the time Luis was 22, he was married, with a child of his own, living in the gritty Philippine city in which he had been raised, south of Manila. He worked construction, making four dollars a day. It was enough to survive. But it was not enough to provide, not the way his father had. In Tagalog there's a phrase, "*katas ng Saudi*," that means "the juice extracted from Saudi." It was the title of a popular 2007 movie about the travails of a Filipino worker returning from Saudi Arabia, and Filipinos still use it to describe the bounty made possible by money from Abroad—the good shoes, the collapse-resistant walls—even when these things are technically *katas ng Dubai* or *katas ng Qatar*.

The Cruz family compound, entered through

a narrow passageway off a bustling commercial street that borders the water, is now a rich warren of *katas ng Saudi*: upholstered couches, spacious rooms, a DVD player in a polished bookcase, covered decks overlooking a cousin's permanent underwater fishnets. Two of Luis's sisters have gone to college. One is training to become a dentist.

It was Luis senior, studying his son's circumstances on a home visit and observing that the young man's first wife appeared to be losing interest in the marriage, who suggested his son find a better-paying job in Dubai. "He knew my situation," Luis said. "And my mother took me to the recruitment agency."

Luis still remembers the first sum he sent back to the Philippines, after a few weeks' work in Dubai: \$350, almost three months' wages under his old rate. He sent money straight to his mother, to support her, his daughter, and his sisters. He found he could earn more by working straight through the week, taking no rest days. His first job involved using a blowtorch in the desert. "You can't hold your own hat without gloves," he recalled. "It's too hot."

He was desperately lonely. But he was making very good money. He had his father for company. After a while his younger brother Tomas, who was also married, gave up on the Philippines and came to Dubai too, leaving his own wife and a daughter behind.

STILL, THIS IS A LOVE STORY, and it's sort of a happy one, as remittance-worker chronicles go. While Luis was working in the gulf, Teresa aced the Manila hiring-agency interviews. In Dubai, arriving at the malls to which she was first dispatched, she caught glimpses of hazy outdoor construction sites that helped keep her from feeling sorry for herself. She had air-conditioning at work and during her initial months, two-to-a-room ladies' housing, a special perk for many new female remittance workers. The dormitory was the nicest sleeping quarters she'd ever had.

She was glad not to be trapped in the lonesome exile of a domestic helper. Filipinas, with

their good English and their reputation for kindness and reliability, are in high demand as caretakers, and not just in the Gulf states; nearly half the remittance workers who leave the Philippines are women, often pulled away from their own families by the international demand for nannies, nurses, and assistants for the elderly. But Teresa had heard enough stories about domestics' lives overseas to know this was not for her. The lucky ones landed humane employers who treated them respectfully, but too often the accounts were grim: no time off, unyielding isolation, verbal abuse from the women in the household, sexual abuse from the men.

Teresa had her own cell phone too—another story often told about domestics is that employers confiscate phones to keep women more attentive and dependent. Every time she went to an exchange house for the gratifying transaction that made her Emirates wages reappear at home as Philippine pesos, she held back enough to buy food and other necessities, and eventually, on a few celebratory occasions, a little gold jewelry.

And because so many Filipinos of both genders wind up working in Dubai, Teresa found compatible friends, young people who, like her, had upgraded from worker dorms to jammed but congenial co-ed apartments. Romance was possible. It was messy romance, to be sure; most of the men were still legally bound to the people on whose behalf they had left.

When Teresa met Luis at a birthday party, he was still married. But he was handsome and tall, with a sweet smile and hair that fell into his eyes, and even though no divorce is permitted at home, there is annulment, for the determined. (When I asked Father Tom how many annulment requests he receives at St. Mary's, he sighed deeply. "I tell you, this is like a factory," he said.)

So it was that Teresa, four time zones from home so that her family might have a house that would stand up to rain, married a man who could tell her exactly what it felt like to see his own father only once every two years. But he was adaptable and tough, as was she, and now he has secured work indoors, at the industrial plant where he had been a welder. He likes to

The lucky ones landed humane employers, but too often the accounts were grim: no time off, unyielding isolation, verbal abuse from the women, sexual abuse from the men.



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In the Philippines a billboard offers a tantalizing vision. The website of the housing developer, which caters to returning workers, says it gives Filipinos “the best reason to come home.”



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cook, which both delights and embarrasses Teresa, since she is not much of a chef herself, and he knows which stores carry pork products, in special alcoves marked off for non-Muslims, as well as green mango and dried shrimp.

At work, moving quietly about the store aisles, Teresa has learned to spot unhappy Filipina domestics, minding other people's children while their imperious lady employers walk ahead examining clothes. Sometimes, risking much, she makes a whispered approach in Tagalog behind the employer's back: "Hi, *kabayan*. Hi, homeland friend." Are you all right? Is your job so difficult? Why don't you go home? "They say, 'I can't. My family needs.'"

Needs *what*, a less astute listener might wonder, and needs it more than your family needs you? But all remittance workers know that need is complicated and has ways of metastasizing. Food, schooling, medicine, and collapse-resistant walls are things families need; so is pride. The rebuilding of the family house is not a project to be stopped halfway through. A child placed in a costlier school at home will need tuition for years to come; a satisfactorily betrothed daughter or sister will next need money (and likely a dowry, if she is from India) for a proper wedding. In both Dubai and the Philippines I heard laments about spiraling cycles of expectation and dependency, the possessions that materialize as substitutes for the absent parent, the assumption that the overseas worker is a cash dispenser that cannot be unplugged.

PRACTICE MAKES A BETTER GUEST WORKER

Every year more than 100,000 additional Filipinas find jobs overseas as private domestics or hotel maids, often leaving behind their own families. Some aspiring workers learn the art of making beds at a government-sponsored facility (top); others practice on plastic dolls at a private agency in preparation for helping real children. They hope to get jobs in Singapore, Hong Kong, or the gulf.

Once, traveling with friends near Luis's home in the Philippines, I met an acquaintance of theirs who was on leave from his job in Najran, Saudi Arabia—a sweaty, monotonous restaurant kitchen job, where hardly anybody ever spoke to him except to shout orders. When I asked how it felt to rejoin his wife for a while, he shook his head. "Every week I am here means money is not coming," he said. "She wants me to go back."

Journalists and human rights groups periodically document remittance workers' grievances: unpaid wages, dangerous work sites, wretched living conditions, passports illegally confiscated. But the U.A.E. does not make that documentation easy. Some nongovernmental organizations are banned from working in the country, and the national press treads carefully to avoid offending Emirati officials, who are quick to snuff out any form of organized complaint. The U.A.E.'s defenders point out that it remains among the most welcoming of the Gulf states; women dress as they wish, non-Islamic houses of worship thrive, and the streets are safe for tourists and residents alike.

"All global cities have problems like this," retired Emirati political science professor Abdulkhaleq Abdulla told me. "All global cities are built on foreign workers and cheap labor. Dubai embodies the best and worst of globalization—the best because this is a very tolerant city, a very liberal and open city. But this city has a lot of misery in it and a lot of poor and a lot of exploitation. So which glasses do you want to wear? Optimistic or pessimistic? I tend to look at it from both sides."

The U.A.E.'s surest leverage for keeping its contracted workforce compliant is the threat of deportation: Stir up trouble here, ungrateful guest worker, and we will ship you right back to the less lucrative life you left at home. That is true of every labor-importing country in the world, including the United States, and in both Dubai and the Philippines people kept reminding me that remittance workers go abroad because they decide to—because they have weighed carefully their own possibilities, as they understand them, and the ways they

In a Qatar mall a nanny stares past her employer. Even when imported helpers are Muslim, cultural differences and separation from family and friends can make for a lonely life.





might contribute most to the people they love.

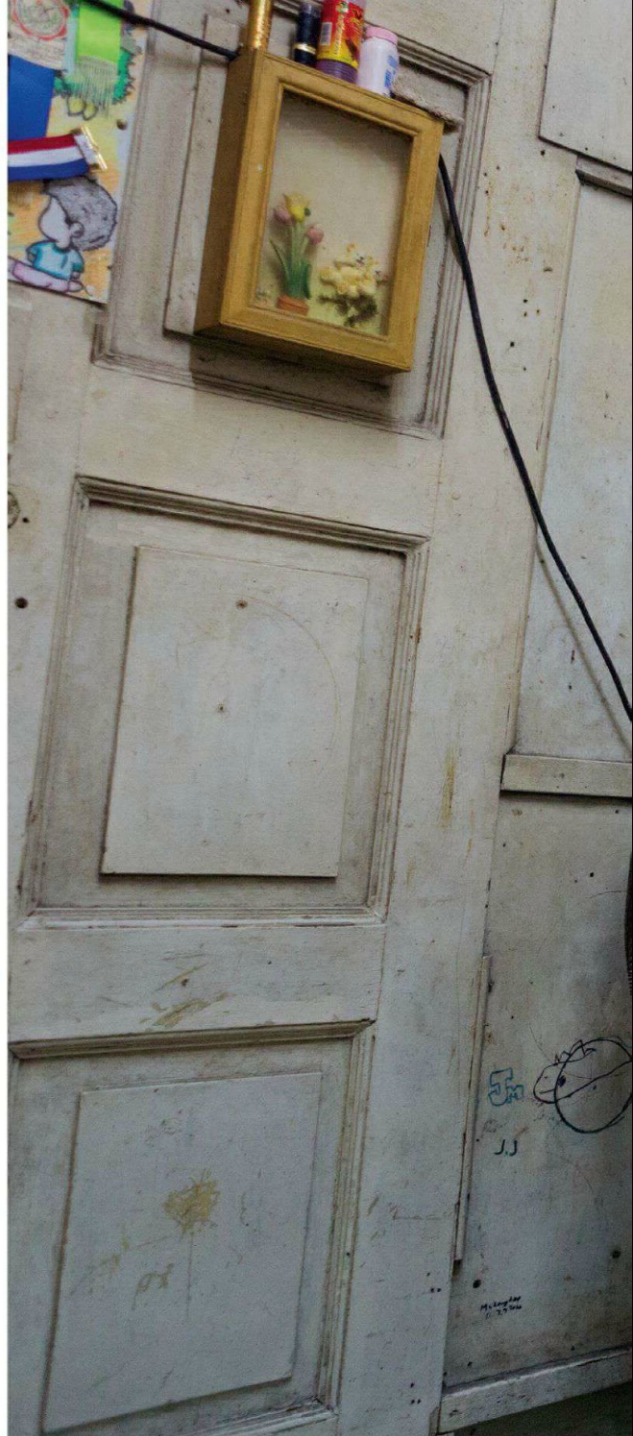
Picture this, at the Manila airport: A crowded reception terminal, scores of people just outside customs, all pressing and shoving for a glimpse of the first returning passengers to emerge. This was about 13 years ago, Teresa's initial visit home after a three-year absence. When she recognized one of her brothers and then another, and then a sister and some nephews, she was startled: Every one of the relatives who'd shrugged her off when she'd left the Philippines had crammed into borrowed cars to welcome her home. Atop the luggage cart she pushed toward them was a hefty cardboard box containing a new color television—a big one. "At home we had a small black and white," Teresa told me. "But I said, 'I want to buy a 25-inch TV.' I saw in their faces how happy they are to have this TV. Even now if there is no one watching, the TV is on."

The room in which the television stands—the sala, the big family room—has over the years been wholly reinforced. The construction was done bit by bit; Teresa's parents would tell her about it in long-distance conversations, how every few months a little more of the money Teresa wired was being funneled into repair. First the sala. Then the kitchen. Then the sleeping area, with the old bamboo mats on the floor. "Slowly by slowly," Teresa said, "they made it stones."

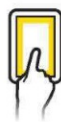
IN TAGALOG there's a popular song about a remittance worker, recorded a quarter century ago by Roel Cortez, called "Napakasakit Kuya Eddie." Teresa darted to her computer to call up YouTube when I told her I'd never heard it. On the screen appeared the silhouette of a small boat lashed to a buoy in a golden sea.

"I'll translate," Teresa said. Music swelled. The lyrics scrolled. "I'm here in the middle of Arab country and working so hard," Teresa said, as Cortez's rich voice rose. "In the very hot place... the hand will become hard, and your color become dark."

She was absorbed, singing and translating, working to catch up in English. "When he sleeps, he is always thinking to become past the time, so that he can go back home," she said. "And



Jesus Bautista appears on-screen from Sharjah, U.A.E., where he works as an electrician, while his son Jesus Julian (J.J.) speaks to him from a one-room apartment he shares with his mother and brother near Manila. For most of his nine years J.J. has known his father as a provider who lives 4,300 miles away.



Hear personal stories from current and aspiring guest workers on our digital editions.



he's so glad that his son write him a letter, but he become shocked, and his tears come out—'Dad! You go home, and make it fast! Mommy has another man!'"

By the last verse the song's narrator has returned to the Philippines to find his two children smoking marijuana and his wife having produced a third child, not his. "It's so difficult, brother Eddie," Teresa sang loudly, jouncing her own teething baby on her knee. "What happened to my life?"

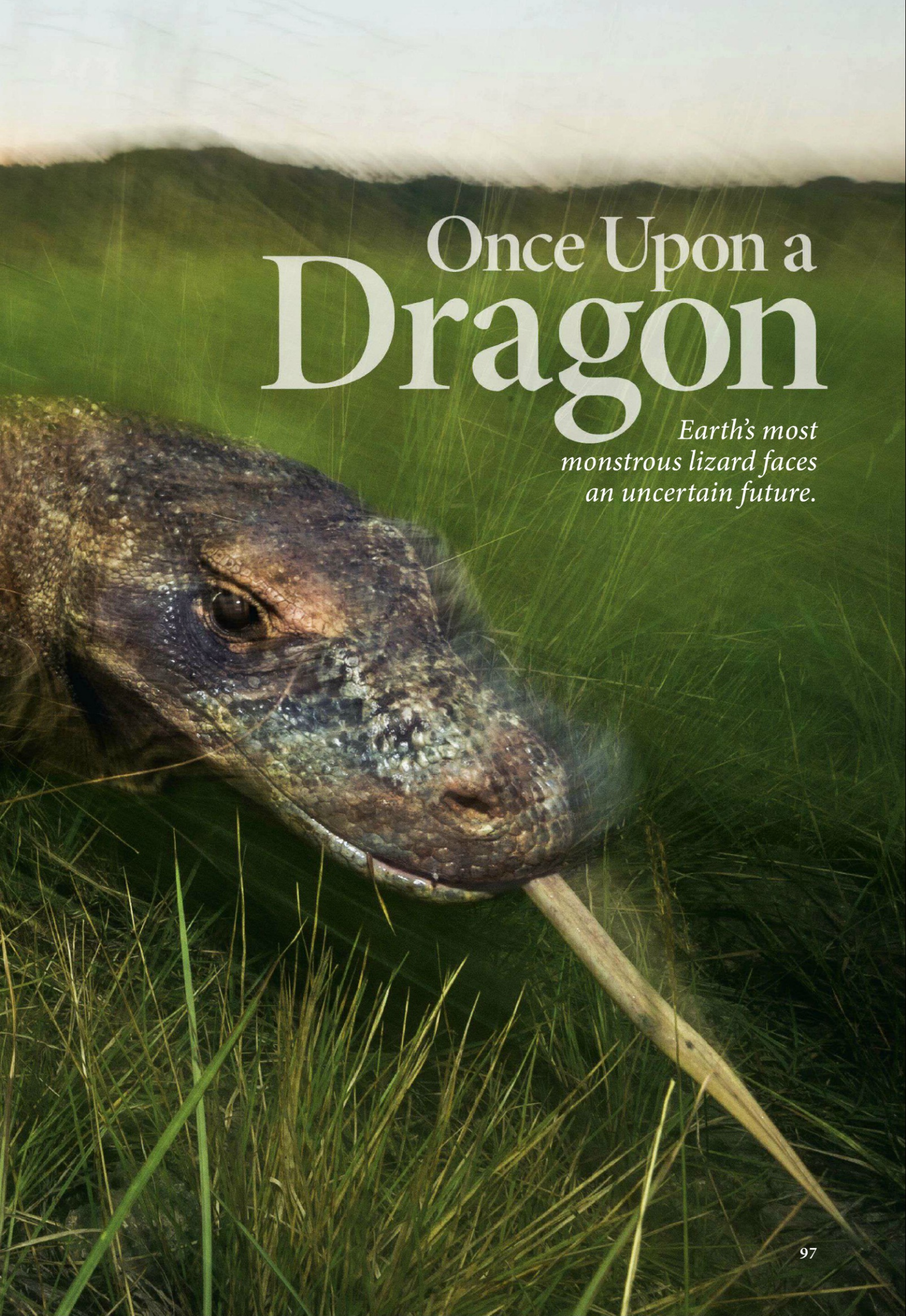
The baby had quieted, and Teresa passed him up to Luis. The three-year-old was sprawled on the family mattress, drowsily watching cartoons from the Filipino satellite station. In a few years, when they're too big for that mattress, they'll go

to the Philippines too. The Cruzes possess amazing communication devices that workers of their parents' generation did not have, of course: cell phones with instant messaging, Facebook, apps of international reach, and the computer near which Teresa and Luis now hovered, waiting, the baby in Luis's arms.

But on this Friday afternoon, as the Cruzes' daughter and big son finally appeared in a video window, mashed together on a couch and merrily punching each other in the arm, it seemed to me that it must have been a special comfort to their parents, amid all the laughing and pointing and waving, to have with them in their crowded quarters two small, needy bodies still close enough to embrace. □



A female dragon tastes the air on Rinca Island, part of Komodo National Park. Each tine of the forked tongue picks up molecules from prey or carrion to carry to a sensory organ in the mouth. A high concentration guides the way.

A close-up photograph of a Komodo dragon's head in profile, resting in a field of tall green grass. The dragon's tongue is extended, showing its forked tip. The background is a soft-focus landscape of rolling green hills under a pale sky. The text is overlaid on the upper right portion of the image.

Once Upon a Dragon

*Earth's most
monstrous lizard faces
an uncertain future.*





An adult dragon hangs out near Komodo village. With people living inside the island's dragon-protecting national park and poorly marked boundaries for wildlife habitat, encounters with lizards are inevitable. Most end without injury.

By Jennifer S. Holland

Photographs by Stefano Unterthiner

Here's what it takes to catch a dragon.

Slaughter a goat. Cut it up. Enlist a few strong friends to hoist three ten-foot-long steel traps, grab bags of goat meat, and trek a few miles up and down knee-punishing hills. Ignore the 90-plus-degree heat that wraps you up and steams you like a dumpling. Set up the first trap with hunks of flesh and hang a few meat bags in trees to “scent” the air. Hike another couple of miles. Lay another trap. Cover three or four more miles, repeat. Return to camp; fill a bucket with cold water and dump it over your head. Sleep. Revisit each trap in the morning and afternoon for the next two days. They'll likely be empty, but if you're lucky, you'll draw near, and there it will be: the world's biggest lizard, a grim-faced giant known as the Komodo dragon.

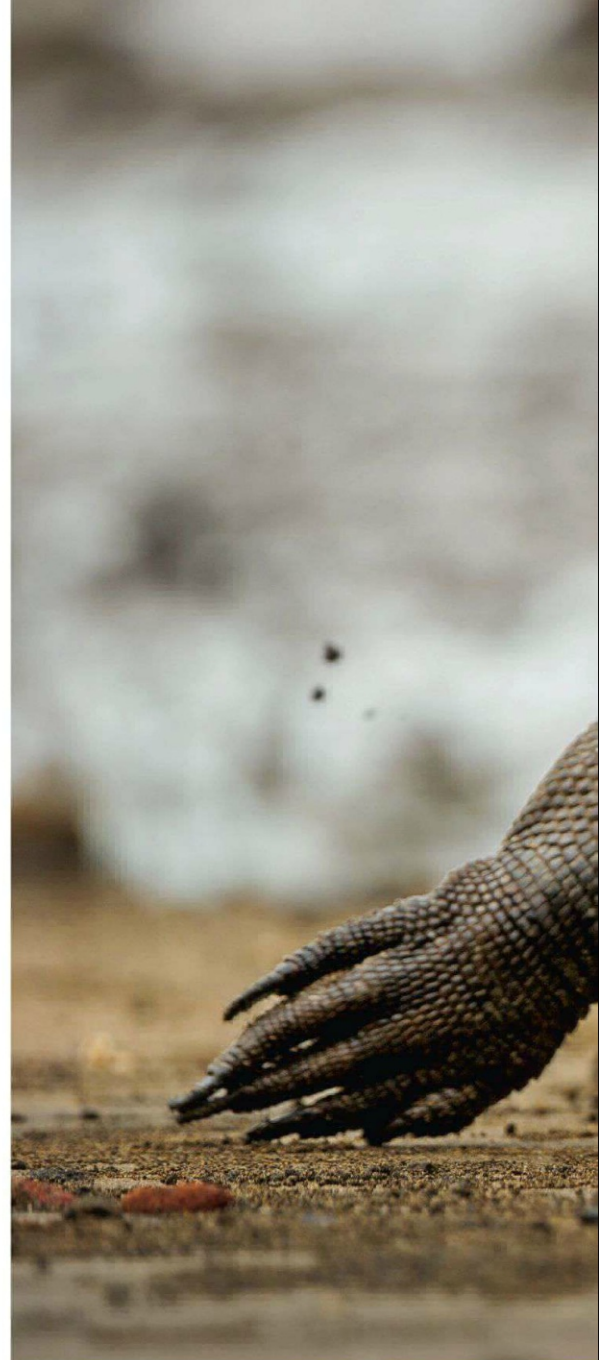
The man who devised this scheme is not your stereotypical dragon hunter. Claudio Ciofi, in his late 40s, a biologist and lecturer at the University of Florence, is mellow, slight of build, with kindly eyes. Tidy. He's the kind of guy who neatly folds his filthy field clothes when he packs to go home. He arrived in Indonesia in 1994 to complete a Ph.D. on dragon genetics. Then he saw the living relics up close. He was entranced. And other scientists weren't really paying attention to them. “I expected to find an organization studying dragons,” he recalls. “They are as charismatic and interesting as tigers and orangutans. But there was no one. Komodo dragons were all alone.”

So Ciofi expanded his research. He sought to understand every aspect of a dragon's life. With quiet persistence and top-notch Indonesian and Australian collaborators, he has given us much of our knowledge of the dragons and is working to improve their chances of surviving their

21st-century troubles. Even though they are dragons and can grow as long as 9.9 feet and weigh nearly 200 pounds, they are still vulnerable to the modern problems that afflict so many animals, from habitat loss to climate change.

Of course monitor lizards, as the dragon's family of animals is known, have survived many cycles of change. This particular species split off maybe five million years ago, but its genus goes back some 40 million, and its dinosaur ancestor lived 200 million years ago.

Varanus komodoensis has the lizard lifestyle down—basking in the sun, hunting and scavenging, laying and guarding eggs with no intention of being a parent after they hatch.





Saliva dangling, a dragon shows off its wide strut on Rinca at low tide. The lizard's spit is venomous, but prey usually die from being torn apart—or, if they are bitten but manage to escape, from infection of their wounds.

Dragons put in a good 30 to 50 years, most of the time solo. Meanwhile their window on the world is mighty small: They're found on just a few islands in Southeast Asia, all within the Indonesian archipelago. Jutting abruptly from the sea, these rugged volcanic lands have palm savannas and grasslands. Up higher are rings of forest. But much of the year the dragons' habitat is dragon brown, with monsoon season a brief green reprieve.

The earliest record of this extraordinary lizard is likely the three words “Here be dragons” emblazoned on ancient maps of the region. And surely the first humans who saw the animals would have added: Beware! An avid hunter, the Komodo dragon can hit 12 miles an hour in short bursts. The reptiles ambush their prey, ripping open the softest flesh, typically the belly, or maiming a leg. As a backup, dragons do, in a way, breathe fire. Their mouths drip with venomous saliva that keeps blood from clotting—so bite victims bleed out quickly. A wounded victim that gets away is likely to pick up pathogens from watering holes, resulting in infection. Either way, death is almost certain. And dragons can be very patient.

Last year a 6.5-foot-long monitor wandered into an open office in Komodo National Park and bit two rangers.

The lizards also scavenge—they're opportunists, always on the lookout for food, alive or dead. Scavenging takes less energy than hunting, and the dragons can detect the scent of a rotting carcass from miles away. Little is wasted: The big lizards aren't picky about which body parts they eat.

Despite the dragon's somewhat off-putting habits, islanders do not necessarily respond with fear and disgust. An Indonesian folk story tells of a prince about to slay a dragon. His mother, the Dragon Princess, appears and cries, "Do not kill this animal. She is your sister Orah. I bore you together. Consider her your equal, because you are *sebai*—twins."

Modern times have not entirely quashed this belief. In Komodo village I climb a crooked wooden ladder to the house on stilts of an elder named Caco, who guesses his age to be 85 years. My guide says this slight, bespectacled man is a dragon guru; the elder doesn't refute the title. I ask him how villagers feel about dragons and the danger they pose. "People here consider this animal our ancestor," he says. "It is sacred."

In years past when islanders would kill a deer, he said, they'd leave half the meat as an offering to their scaly relative.

Then things changed. Although no one has solid figures, the dragon population appears to have declined over the past 50 years. The government offered legal protection, responding

Jennifer S. Holland's new book is Unlikely Loves, about odd animal duos. Stefano Unterthiner covered leaping langur monkeys for our August 2011 issue.

to pressure from conservationists and also realizing the economic value of dragon-related tourism. In 1980 much of the dragon's habitat was turned into Komodo National Park (KNP), which encompasses all of Komodo, Rinca, and other smaller islands. Later three nature reserves were added, two of them on Flores Island.

Dragons are safeguarded from any human assault within KNP. What's more, dragon prey is also off-limits: Killing deer is forbidden. And thus villagers are no longer able to offer meat.

That, some say, has made the dragons more than a bit peeved.

Attacks aren't common, but recently a few have made the news. Last year a 6.5-foot-long monitor wandered into an open office in KNP and bit two rangers, each on the left leg. The men were flown to Bali for treatment to prevent infection. Both recovered. In another incident an 83-year-old woman fought off a six-plus-footer with a homemade broom and well-placed kicks. The dragon bit her hand, which needed 35 stitches.

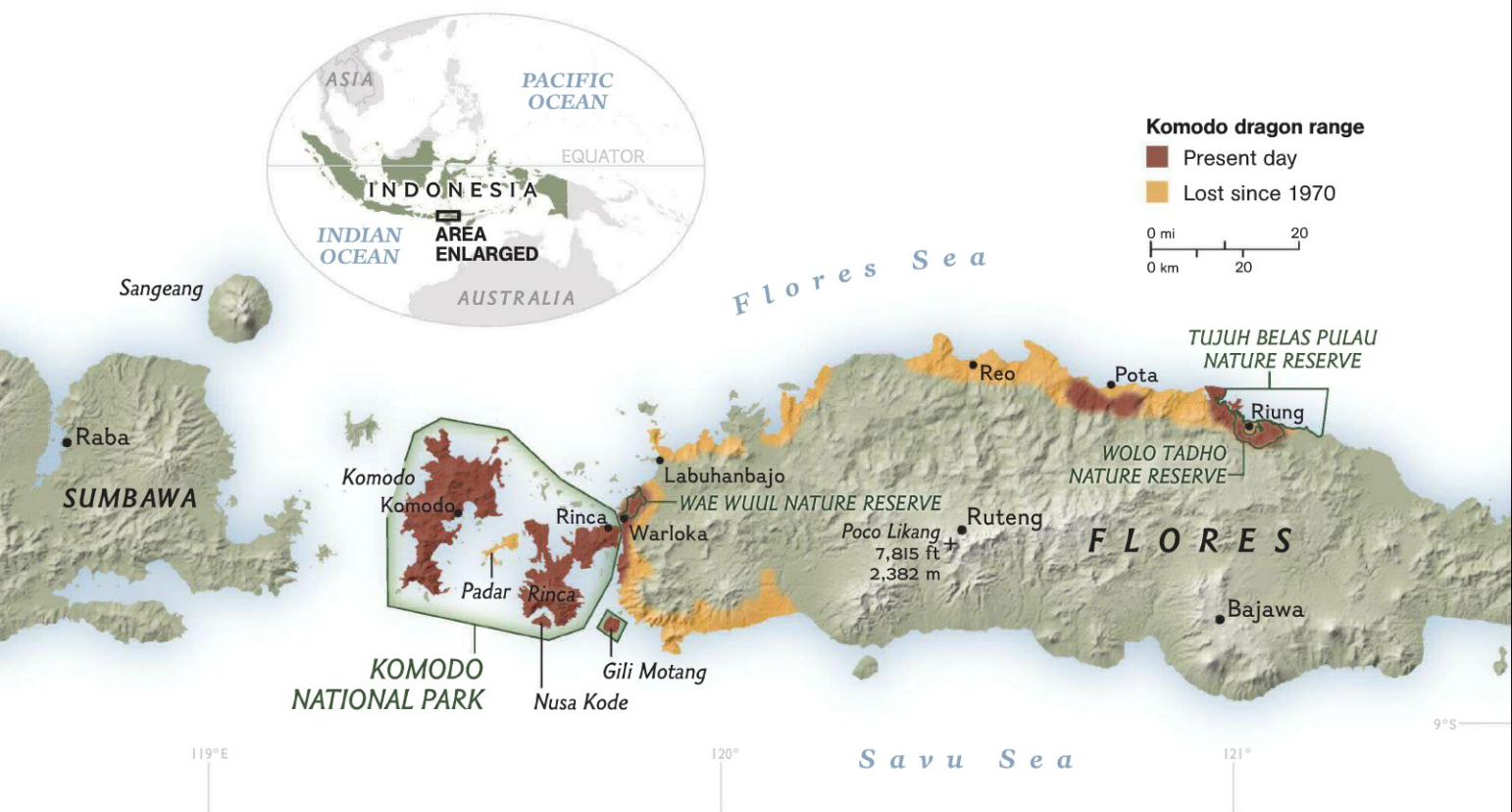
Other incidents have ended tragically. In 2007 a dragon attacked a village boy named Mansur, who had taken a break from a soccer game to relieve himself behind some trees. He died of blood loss.

TODAY VILLAGERS who see a dragon coming close or putting the move on livestock will typically yell and throw rocks. "People who live with dragons are used to living with dragons," Ciofi says. "You might shoo a squirrel away that comes to steal your lunch. They treat dragons like that."

As for dragons that attack, the government has moved offenders away from villages, but the animals usually return.

Not all encounters end badly. The first man to really sit with dragons for a spell was Walter Auffenberg, a curator at the Florida State Museum. In 1969 and '70 he and his family camped on Komodo Island for 13 months, recording detailed observations of the animals' every move. He authored an insightful book, *The Behavioral Ecology of the Komodo Monitor*.

Auffenberg's family was surprisingly relaxed about venturing afar to rough it among deadly



Komodo National Park, set up in 1980, and three reserves protect what scientists believe is a declining population of Komodo dragons. Their range has shrunk too, likely due to environmental changes as well as human encroachment.

animals. Packing up powdered milk and chocolate, his wife, Eleanor, told a local newspaper that her best friend thought she was crazy. “Crazy, maybe,” Eleanor replied. “Worried, no.” Life in a big city would be more terrifying, she said.

During the fieldwork Auffenberg wrote of curious dragons wandering into his blind. One tongue flicked his tape recorder, knife, and feet. To encourage the lizard to leave, he flicked back, tapping it on the head with his pencil. Apparently it worked. Another “stretched out in the shade... with his front leg draped over mine as he lay there half asleep.” Auffenberg was able to prod the animal to leave without incident.

Back in the '70s Auffenberg wasn't that worried about the survival of the Komodo monitors. Today scientists ask: Can these dragons carry on?

Dragon salvation relies heavily on the mundane issue of land management. On Flores, despite the nature reserves, locals set fires to clear land for gardens and pastures, breaking dragon habitat into small fragments. Also, some people still

hunt the deer and pigs that dragons like, as do feral dogs. And scientists suspect the dogs may chase—and even kill—young dragons, which spend their first year in the treetops but then come down to earth.

So the Flores dragons are boxed in: by villages, farmland, rice fields, the sea, and the dogs. That means less living space and a decline in prey. And ultimately fewer dragons.

If a changing climate affects the landscape, the dragons aren't well equipped to cope. Ciofi and ecologist Tim Jessop of the University of Melbourne, who's been researching dragons for the past decade, explain that with fewer than 5,000 animals scattered over a small number of islands, there's reduced genetic diversity, which limits their ability to adapt. The dragons could improve their genetic pool by swimming from island to island to mate. But while they're capable swimmers, strong currents and differences between island habitats discourage them. Besides, they're homebodies.

To learn more about dragons, Ciofi, Jessop, and their Indonesian colleagues have caught and tagged about a thousand and have DNA samples from 800. Their efforts have told them a lot about numbers, male-female ratios, survival rates, and





Adult males tear into a goat on Komodo Island. Dragons share prey if there's enough to go around but fight if food is scarce. Serious injuries are rare. Like all venomous animals, dragons are immune to their own toxic bite.





The smell of food drew a young dragon to an office kitchen in Komodo National Park. A fear of sticks will drive it out. Encounters rarely lead to injury; still, rangers relocate repeat offenders. They usually find their way back.



Storm clouds darken the Rinca sky during the wet season, from December to March. The months of rain are enough to sustain forests that provide a home to dragon prey. This elderly lizard is probably growing too weak to hunt.

breeding success—and how inbred the populations are. The genetic differences they find aren't the kinds of things that show up on the outside—bigger teeth or fatter tails. They're the seemingly innocent codes within that dictate who survives and who doesn't. Then comes the match game: figuring out how to shift animals from one group to another, making sure the newcomers aren't related to each other.

A more extreme approach, if numbers were

to plummet, would be to ship in zoo animals to bolster the gene pool. In Indonesia Komodo dragons have been breeding in captivity since 1965. In 1992 the first baby dragon was born outside the homeland, at the National Zoo in Washington, D.C. Since then, breeding efforts have gone like gangbusters. Today about 400 dragons live in zoos worldwide.

But playing God is controversial, Jessop notes: "We could be breaking the evolutionary integrity—messing with the natural path the animals are on. Some people are reluctant to do that." Besides, programs that relocate local animals only "work about half the time." Nor is the transition from zoo life to the wild an easy one. And there is



no guarantee that putting adult dragons together will yield offspring—or that the dragons can survive long term in such unevenly protected habitat.

Ciofi and his colleagues are respectfully pressing Indonesian officials and mustering support for dragon preservation. They speak to islanders on Flores of the danger to dragons from habitat loss and the poaching of prey. They hope to better monitor protected areas and train rangers in dragon biology so they can offer information to scientists about how the animals are faring.

Meanwhile tourists who come to see dragons—other than the lazy ones hanging around the ranger station—must be patient. The wilder animals don't like to be found. During my two

weeks on the islands I mostly chase after biologists on futile dragon hunts. Our hiking pace is set by young, fit Indonesians Deni Purwandana and Achmad Ariefiandy, who lead the Komodo Survival Program, established in 2007. Then comes Jessop, a giant of an Aussie whose single stride requires three of mine. A few nature reserve staffers and a couple of villagers, untroubled by heat and hills, round out the team.

When Ciofi and I arrive on Flores, the team's 26 traps have caught just four dragons (and many more dogs), down from 14 the same time the year before. But this may not indicate a reduced population. Cameras at the sites show the dragons sniffing traps, then deciding not to walk inside.

The elder I met, Caco, had told me villagers used to offer tree seeds, a local tree leaf, an egg, and the tobacco from one cigarette to lure dragons out of the hills. He presented me with seeds and a leaf. I am tempted to use them.

Then on my second to last day, the stars align. There are three traps to check. The first round—nothing. On the next circuit we see pebbly skin through the gaps of trap number three. It's just a little dragon, less than four feet nose to tail tip, perhaps three years old. Subtly pretty (if you keep an open mind), it has dark gray, yellow, and orange body scales and faded dark bands down the tail. I kneel for a better look through a hole in the metal; it peers back with one yellow-ringed eye. Then the dragon catchers remove it with hook and lasso, tape its mouth closed (for our protection), and gently but firmly tie its legs and arms to its body to keep it still.

Next comes a flurry of activity. The team quickly measures the captive, weighs it in a sling, and uses a microchip reader to search (in vain) for a tag beneath the skin that would represent a previous capture. Blood is drawn from the tail for genetic analysis; photos are snapped from every angle. The trappers who seek to preserve this ancient species speak matter-of-factly of the encounter: "It's our job." In less than 20 minutes off comes the mouth tape, and the animal is set free. It takes off like a shot into the woods, flinging dirt and rocks with madly scraping claws—the nonsense retreat of a real-life dragon. □



Putin's Party

For Russia, hosting the Winter Olympics could prove it has finally reemerged as a global power. But the beach resort of Sochi—a target for Islamist insurgents, on the site of an alleged genocide—is an unlikely place to stage the celebration.



A giant ad promotes a resort complex for the 2014 Olympics. Critics say it uses fascist-inspired imagery.

By Brett Forrest

Photographs by Thomas Dworzak

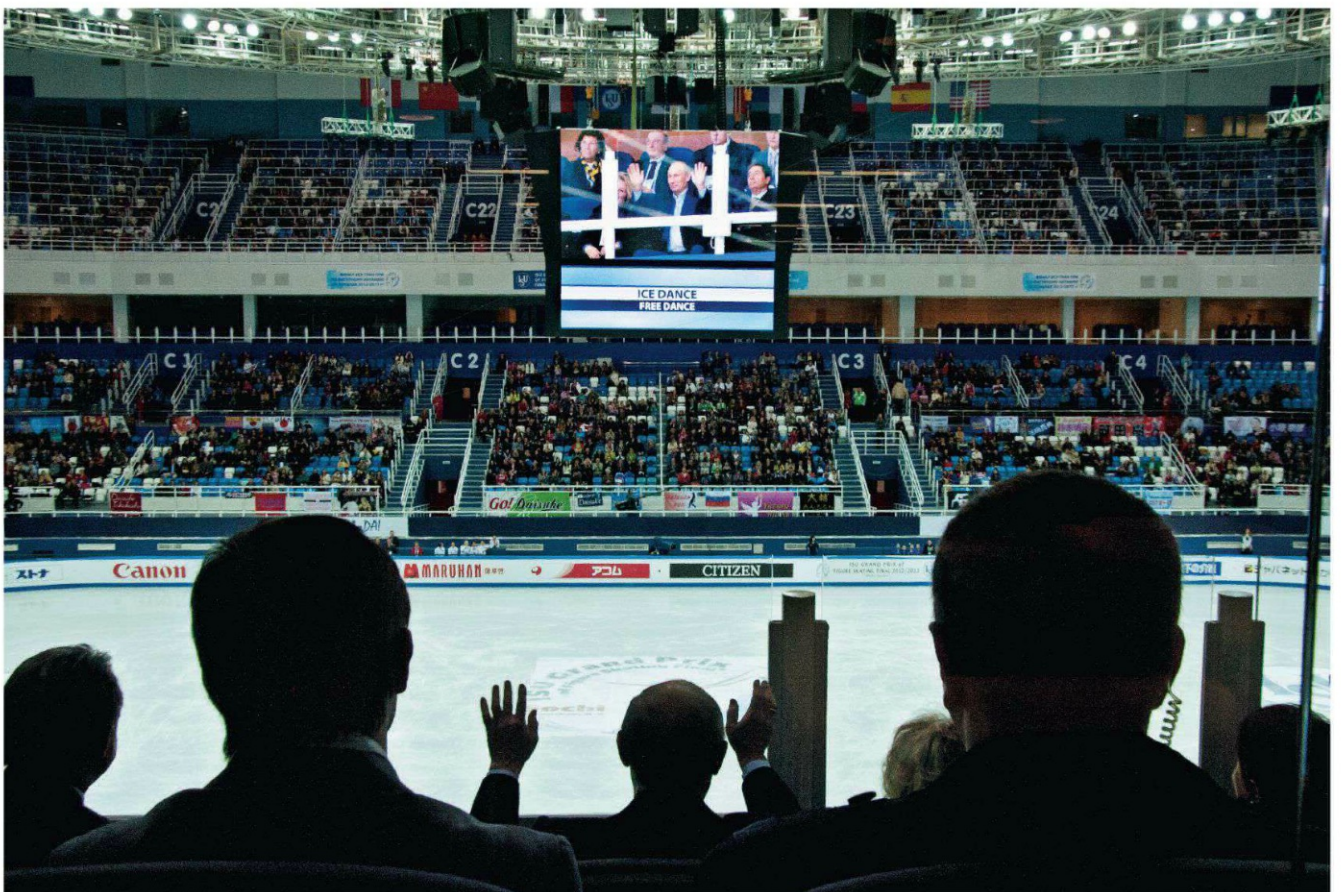
Valery Inozemtsev ascends a high mountain path through the churned mud of development. He climbs past an Olympics dormitory, past a Moscow bureaucrat's sprawling new dacha and trucks hauling gravel and steel beams—past all the things that were never here before. Inozemtsev has lived in this formerly sleepy village of Krasnaya Polyana in the Russian North Caucasus for a half century, since before it became a matter of urgent Kremlin concern. “This was the best place in the Soviet Union,” he says. “Virgin nature. And now...” His voice trails off in discontent.

Inozemtsev, 73, continues up the mountain in long, youthful strides. Reaching a wood of chestnut trees, he pauses to fling back his brown cape. He runs two fingers over his white, bushy mustache, then points down the mountainside to the cranes and the construction workers who are busy shredding Krasnaya Polyana, shaping it into Russian President Vladimir Putin's grand public achievement. “Sometimes I imagine that an earthquake will come and destroy it all,” Inozemtsev says. Through alpine mist, in the southern depths of a once powerful empire, the Olympics have nearly arrived.

Russia is an empire no more. Like other great and large nations, however, it still aches to be one. It must find an outlet for its urges, and over two weeks in February, it will have it. Through

force of Russian will, the Winter Olympics are coming to an unlikely location. The Sochi Games on the Black Sea coast will take place in the backyard of a recent war with Georgia, on the site of what many call the genocide of a people (the Circassians), and in the orbit of an Islamic insurgency (in Dagestan, Chechnya, Ingushetiya, and Kabardino-Balkariya). The state has resurrected a fearsome militia, the Cossacks, to help keep the peace that some might design to upend. Allegations of graft circulate widely, high temperatures threaten the snowfall necessary for competition, and activists have called for a boycott over antigay legislation enacted by the Russian parliament. In response Putin has banned protests and rallies in Sochi during the games.

A resort town along the Black Sea's beaches, Sochi drew the wealthy under Tsar Nicholas II, then Soviet leaders and communist workers, with a complex of sanatoriums built to soothe the ill effects of northern winters. These structures are now wan and disintegrating, the fronds of Slavic palm trees wafting over a more provincial clientele in one of Russia's few subtropical cities. Though Sochi is host to these Olympic games, however, the actual competitions will be staged elsewhere. The skating events will take place in Adler, 17 miles south along the coastline. Ski races will be in Krasnaya Polyana,



Rosa Khutor Alpine Resort (top) was constructed to help Russia win its bid for the Sochi Games. At a cost of more than \$50 billion, these Olympics will be the most expensive ever. Russian President Vladimir Putin, who often skis in the region, attends a figure skating competition at a new Olympic rink in Adler.



Circassians tour their ancestral homeland in the Caucasus, where the Russian Empire carried out a brutal military campaign in the 19th century.





Circassians celebrate their heritage at a festival northeast of Sochi (top); Russian soldiers expelled their ancestors 150 years ago, sending them to the Ottoman Empire. A memorial for Russian border guards who died in a 2002 helicopter crash is a reminder of a more recent conflict: the fighting with Chechnya.

29 miles east into the Caucasus range.

Nearly every venue for the games has been built from scratch—the ice rinks in Adler, the bobsled run and facsimile alpine villages of Krasnaya Polyana, the rail and infrastructure that connect and enable. The current official price tag, \$50 billion, is probably lowballed. Even so, the Sochi Olympics have cost more than any games before them. With many billions of dollars conjured up and carried away, this is not the tightest business plan ever designed. But this is not business.

Nor is it mainly a sporting matter. The event is intended to be the culmination of the achievements of Putin, a leader who many Russians believe was dispatched by God to guide Russia away from its defeats and ignominies. The seed of these games was planted in his mind more than a decade ago.

A SINGLE TWO-LANE ROAD runs through the valley formed by the many Caucasian peaks of Krasnaya Polyana. Just a few years ago this was a humble skiing village of a few thousand people, its innocence guarded by the local off-piste crowd, an insular place of insider's lingo and cyclical avalanche. That's all gone now with the mass construction and the 20,000 migrant workers who have arrived to remake the village. Further back in time, this valley bore witness to the destruction of a people who were all but forgotten by the outside world until the Olympics resurrected their memory.

Up a side road on a winter afternoon, Astemir Dzhantimirov sits at home, waiting for his boss to dispatch him on a job. Dzhantimirov works for the city's gas utility, Gorgaz, installing new canisters, fixing old ones. His profession is not his distinguishing feature, however, nor is his prominent nose or his forthright manner. Dzhantimirov, the Russified ending of his family name notwithstanding, is Russian only by

Brett Forrest wrote about a new Eurasian railroad in our August 2010 issue. Thomas Dworzak's most recent book, Kavkaz, showcases many years of work photographing in the Caucasus.

citizenship, but this is not what makes him stand out from the many laborers who have flooded the valley. He is Circassian, an ethnic group nearly eliminated from the area 150 years ago, when the tsar's army overran the mountain dwellers. He lives with his wife and three children on the second floor of a small house. The several interlocking rooms are in good order, quiet as the family tends to homework and chores.

Dzhantimirov describes how he learned the old Circassian stories when family would gather at funerals in the Cherkessk region, over the mountains northeast of here. "This was the time when my ears were on the top of my head," he says. Aunts and uncles told how the armies of the tsars arrived in the early 1800s, how the Caucasus War continued sporadically for decades, how the Circassians lost the land and much more.

When Russia gained the Caucasus, the tsars and their generals knew very little of the region, nor of the numerous tribes and tongues that dwelled within the rocky folds of the range. The Kuban Cossacks, vagabond warriors, patrollers of Russia's southerly margin, knew better than to penetrate the pined cliffs into which others had roamed to ultimate peril. The stray Russian soldier or wanderer routinely fell into bondage in this territory, bartered from tribe to tribe for goats and herbs and other captives. The Russians gained title to these tactical lands—fulfilling what they considered their expansionist destiny—by battling the sultan and the shah, but they also understood that a special effort would be required to make them their own.

The Circassians and other local peoples fought against the Russians in a determined guerrilla campaign, but not a winnable one. The Russians felt a special pull to the Caucasus—to the liveliness of frontier combat, to the forbidden romance of Circassian tribeswomen, to this precipitous place of emotional searching, where a St. Petersburg aristocrat could discard the rules that had molded him and become a new man altogether. In time these mountains would become the place of poets and writers, of Mikhail Lermontov and Leo Tolstoy. Ultimately, Russian military capability proved too much for the

warriors of the mountains, who refused to accept the tsar's offer to live in Siberia or emigrate to the Ottoman Empire.

The Circassians made their last stand in the small canyon that is now called Krasnaya Polyana, or red glade, a name some erroneously attribute to the bloodshed of the battle. After their surrender in 1864 the Circassians were expelled, and refugees died by the thousands on their way to Sochi. Survivors were shipped to various corners of the Ottoman Empire. Some of them died aboard the Turkish vessels, cast overboard into the Black Sea.

Since the announcement that Sochi would host the games, the Circassians' plight has made global headlines as activists in the diaspora have tried to shine a light on what they regard as genocide. Protests were held in cities around the world, in Istanbul and New York, Amman and Vancouver.

"We didn't go to Russia to fight. They came

After their surrender Circassian refugees died by the thousands on their way to Sochi. Survivors were shipped to various corners of the Ottoman Empire.

here to fight us. We lived here several ages," Dzhantimirov says. "The whole war was started for these beautiful lands." Dzhantimirov is not an activist. He voted for Putin in the 2012 election. "We have lived in Russia for years and years," he says. "We have lived side by side, and we have respected each other, and we will stay in Russia. But history is history, and there's nothing wrong with talking about it."

PYOTR FEDIN SITS AT his desk, a dissatisfied success, a mere landowner instead of the alpine entrepreneur he once was, and he tells the story of how government power made it so. The '90s had just begun, and Fedin did what every other shrewd Russian was doing: He opened a business. It was the start of free enterprise, the beginning of what contemporary capitalist Russia would become, a place of trial and error, of encouraging

successes and compounded failures. It was a time of pressing on, for there was no turning back to the way things were before.

Fedin and his partners surveyed the peaks of Krasnaya Polyana. They cleared the pines and erected metal towers in their place. The drive-shaft from a seafaring vessel powered the ski lift. Yet few came to ski Fedin's groomed run. Those wealthy enough to have such bourgeois interests chose the status resort of Courchevel, France, not provincial Krasnaya Polyana.

Things began to change one day in 2000, when the new president, Vladimir Putin, rode Fedin's lift to the top of the mountain, then capably navigated his way down. As Russians ascertained what this new leader could do, as he faced down his enemies and closed ranks with his allies, as Russia solidified, Putin returned to Fedin's slope time and again. Fedin's son, Dima, taught ministers and minders and oligarchs how

to carve a turn, how to stop, and how to save face while falling. The aspirants would not miss their chance to mix with the man who was becoming a type of ruler they recognized from Russia's long history.

Fedin weathered the inclemency of the Russian economy, while his partners fell out, sold out. Then, as the spoils of an oil-market boom filtered through Russian society, his resort became profitable. But only the naive enjoy success in Russia. Things you build attract the attention of those who can take them away.

The calendar turned to 2008, and a Gazprom plane arrived from Moscow. As Fedin recalls it, the men from Russia's largest company, the state-controlled gas monopoly, suggested that he join them for a ride. And in veiled language that anyone could understand, while the Gazprom plane flew north over Rostov, then Voronezh and Tula, the men looked at Fedin and said, "We respect you." They offered a figure to buy him out. Fedin knew there was nothing he could do. At the darkly prismatic Gazprom tower in Moscow, Fedin signed the papers placed before him. "I can see your face," the man with the contracts said



to Fedin. “You are sad. The money isn’t what’s interesting for you.” Fedin received fair value, he says, but the business he had built was no longer his. “Money is only paper,” Fedin said, spelling out his name on the contract. (A spokesperson for Gazprom said in an email that the company “was acquired on commercial terms.”)

From his office Fedin’s former resort can be seen through the window behind him. “It’s torture, looking at what they’re doing,” he says. “They came from Moscow and said, We know everything.” He speaks of landslides and mudslides and pollution, graft and political ambition.

Before the fired head of the ski jump development discovered elevated levels of mercury in his blood (from some mysterious source), before storm waves washed away the multimillion-dollar Sochi cargo port, before the minority group protested against holding the games on the site of an alleged genocide, before a helicopter delivering construction materials crashed in a nature preserve, before the Mzymta River jumped its banks, before antigay legislation caused international outrage—before all of that, the Sochi Olympics appeared to be a more promising idea. The Russian president traveled to Guatemala City in July 2007. He spoke the

adversary’s English before a gathering of the International Olympic Committee (IOC), stirring those in attendance, who marveled at his emergence from the thicket of Russian consonants. It is a testament to the attraction of power that even those whom Putin does not rule often seem dazzled in his presence.

And yet, when the IOC awarded the 2014 Winter Games to Sochi, granting Russia the right to host the world, the decision paradoxically heightened the state’s suspicion of foreigners and their motives.

THE COSSACK PATROLMAN keeps company with two policemen as they stroll past the few shops in the village of Krasnaya Polyana. In winter garb, the Cossack stands out: gray jodhpurs, tall black riding boots, brown leather suspenders crisscrossing over a soldier’s greatcoat. It is as though he has arrived from another time.

Cossacks founded Krasnodar, now the capital of the region in which Sochi finds itself, after Catherine the Great gave them her blessing in the 18th century. The Cossacks of Krasnodar distinguished themselves as the Kuban Cossacks, after the Kuban River, which flows northwesterly from Mount Elbrus and into the Sea of Azov.

Russian athletes watch the opening ceremonies of the 2012 London Olympics on an outdoor screen. Putin hopes Sochi will showcase a newly resurgent Russia.





They performed the violent and difficult work of defending Russia's outer domain against raiders who rose northward from the lands of Islam. The Kuban Cossacks existed beyond the law, under a code of their own.

After the communists came to power, the institution of the Cossacks was abolished, and for many decades this horseman sect was repressed. Yet by the time that Putin began skiing down Fedin's mountains, the Kuban Cossacks had regathered their numbers. They had not only survived but also constituted such a political force that the government recognized the wisdom of embracing their fatherland imagery. "We've always been patriots," Yevgeny Razumov says, his black Cossack uniform dotted with raindrops outside Krasnaya Polyana's redbrick police station. "And we're still here."

The Cossacks have returned to the streets—supplementing police foot patrols, breaking up

In winter garb, the Cossack stands out: gray jodhpurs, tall black riding boots, brown leather suspenders. It is as though he has arrived from another time.

brawls, occasionally starting them, profiling the ethnically non-Russian, looking the part, reviving old rites. There are 25 Cossacks on patrol in Krasnaya Polyana, another 25 in Sochi, and 15 each at the airport and train station. There are 1,500 total in the Krasnodar region.

Alexander Tkachev, the governor of the Krasnodar region and a Cossack himself, dresses in the Cossack uniform from time to time. He is a strong-handed leader, and he has bemoaned an increase in the local Caucasian Muslim population. In a speech in which he ushered the Cossacks back into service, Tkachev said that the neighboring Stavropol region had traditionally acted as an ethnic "filter" for the rest of Russia by assimilating its Caucasian migrants, but with growing minority populations, he feared that was no longer feasible. Recalling the old Cossack role, the sect's status outside of

the law, Tkachev said, suggestively, "What *you* cannot do, a Cossack can."

Critics complain that the Cossacks are a reactionary force. But the critic isn't responsible for the safety of others. The Islamist insurgency of the North Caucasus has persisted for 25 years, showing that Russia's subjugation of these lands remains elusive.

A drive to the confluence of the Achipse and Mzymta Rivers in Krasnaya Polyana reveals one more layer of doubt about the placement of these games. The road leads past excavators, trucks, and migrants in hard hats, through a tunnel that drips gray spittle onto the car windshield. At the end of the road two border guards man a checkpoint. In their friendly way they explain that access is prohibited. They point up to the mountain, saying, "Abkhazia is over there, three kilometers away." Abkhazia is a disputed territory that broke away from Georgia in the 1990s. After Russia won a war with Georgia in 2008, it recognized the sovereignty of Abkhazia. Only Nicaragua, Venezuela, Nauru, and Tuvalu likewise recognize the region's independence, a list that might elicit laughter, except that Abkhazia is no joke.

In May 2012 the Federal Security Service (FSB) discovered several caches of weapons in this territory just over the mountains from the great Olympics development. Explosives, grenade launchers, shoulder-mounted missiles. The FSB arrested three suspects, alleging that they belonged to a terrorist group called the Caucasus Emirate. In July 2013, Caucasus Emirate leader Doku Umarov urged his followers to prevent the Olympics from taking place. For those who make the North Caucasus one of the world's most volatile regions, disrupting the Olympics would be their own sort of gold medal.

With almost fortnightly occurrence, Russia's special forces and Muslim militants engage in murderous contact across Dagestan, Chechnya, Ingushetiya, and Kabardino-Balkariya. Each place is within a day's drive of Adler and Krasnaya Polyana, where it would not be difficult



Muslims attend prayers at the central mosque in Nalchik, Kabardino-Balkariya, a region east of Sochi where militants have attacked local security forces. At places like Sochi and Krasnodar (bottom), a historic base for defending imperial Russia, authorities have brought back the Cossacks to help maintain order.

Children in the breakaway region of Abkhazia stop play to watch a car pass by. Recognized by Russia but seen by most of the world as part of Georgia, Abkhazia borders the area containing the Olympic sites.







A young woman parties at a bubbly nightclub in Sochi, long a favorite destination for bone-chilled visitors from other parts of Russia.





Balmy weather makes the Black Sea coast a perfect setting for an elite youth camp (top). During February daily highs in the alpine areas can top 40°F, raising questions about the venue as a host for the Winter Games. In preparation Russia has built a massive snowmaking operation.



See our digital editions for an interactive map showing the Sochi area before and after Olympic construction.

to join the migrant army that is building the Olympic infrastructure.

In Krasnaya Polyana the workers huddle down a side street between shifts, slugging down warm Coke in a shack with greasy windows. They feed crumpled ruble bills into a machine, putting money on the phones they use to text home to Kyrgyzstan and Uzbekistan, telling their wives how they earn the money they send for the children. A group trudges up the mud path, reaching Defenders of the Caucasus Street, where they wait for the bus that will return them to the sound of scraping metal, the stink of smoldering solder.

Suddenly a Volvo sedan loses control on the road. It swerves across the lane divider and jumps the curb, hitting a man and knocking over a light pole. A crowd gathers. The man lies where he fell, on his back, and does not move. Someone throws a coat over the body, a worn and bloody hand sticking out from beneath it. A police car arrives, and three Cossacks emerge. They pull the driver through the window of the Volvo. He has black hair. He is thin. In his eyes you can see that he is lost, drunk. The Cossacks yell in his face, swear at him, saying that he has killed a man and that he deserves to die. They twist him facedown into the dirt and hold him there. They punch him in the kidneys. The man yells in pain. He submits. The Cossacks handcuff him. They place him in the backseat of their squad car. After the Cossacks drive away, the crowd disperses, as though nothing has happened. The corpse remains in the street. Emergency workers eventually arrive to take it to the morgue.

WHAT WILL BE LEFT BEHIND? That is a question many locals want answered—those who call Krasnaya Polyana home and have no hand in the muddy profits that have transformed their surroundings. The Olympics have become a prism through which Russia amplifies its message to the world, while downplaying the assaults on humanity, the environment, and the law that have become necessary to achieve the show everyone expects to see.

There is a thin line between pragmatism and cynicism, and in Russia you always ride it. This is

part of the country's special attraction. Down in the wine cellar of the Four Peaks Hotel in Krasnaya Polyana, Igor Zubkov uncorks a bottle of Merlot. The hotel belongs to him and his partner, as does the wine, 5,000 bottles of red and white produced with the grapes of Anapa, a town up the Black Sea coast. Zubkov holds a glass in his hand. "The government said that Russians spend four billion dollars a year on travel out of the country during the winter," Zubkov says. "Why waste four billion a year on a three-month winter season? Why not keep it for ourselves?"

State power has transformed Krasnaya Polyana from a sleepy village into a resort with the housing and infrastructure to support an annual winter migration of many thousands. Zubkov looks serious, but then he laughs. "So let's spend \$300 billion to build our own resort," he says. "That is 75 years' worth of expenditures." As with most Russians, it is difficult to tell when Zubkov is joking and when he is serious. As with most Russians, a friendship with Zubkov happens quickly, and could last forever.

The time of Putin, who could benefit from a change in the law to stay in office until 2024, might seem longer.

There is a hockey game, part of the World Junior Hockey Championship, and it convenes in the new Olympic rink in Adler. This is a teenage competition, Russia against the United States, and no pairing could be more apt given the message these games are meant to convey. As game time draws near, as the crowd mills about and the skaters glide along the glassy playing surface, a man of some recognition appears on the ice.

The loudspeaker announces Vladimir Putin. The Russian anthem plays over the arena speakers. As the song reaches its first crescendo, something interesting happens to Putin, a leader of superhuman composure. The music intensifies, and a ripple of energy rolls across Putin's face. His expression contorts into a smile. He has brought the Olympics to the Black Sea. He has conceived all this, and now it is really happening. As the look of satisfaction begins to overtake Putin's features, the Russian president regains himself. He stands firm. He returns his face to a frown. □



Impossible Rock

On the northern coast of Oman
a team of young climbers test themselves
against knife-edge seaside cliffs.

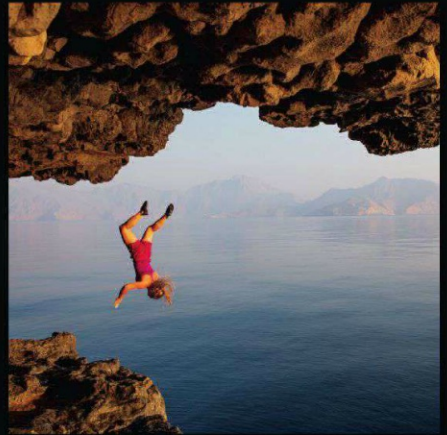


*From the top of Jabal Letub,
Renan Ozturk looks down on the
rocky strip of land that connects
Oman's Musandam Peninsula
to the Arabian mainland.*

PANORAMA COMPOSED OF THREE IMAGES.



British climber Hazel Findlay scales a cliff rising from the Gulf of Oman. Teammates wait below to fish her from the water if she falls—or decides to jump.



FINDLAY TAKES A PLUNGE WHILE DEEPWATER SOLOING.



A FISHERMAN UNLOADS HIS CATCH IN THE VILLAGE OF SHISAH.



MIKEY SCHAEFER HOLDS A CLIMBING ROPE SLICED IN TWO BY SHARP ROCK.

CLOCKWISE FROM TOP LEFT: JIMMY CHIN, RENAN OZTURK, MIKEY SCHAEFER, RENAN OZTURK, MI



AM'S CATAMARAN ALLOWED THEM TO EXPLORE THE PENINSULA.



ALEX HONNOLD AND FINDLAY CHECK ROPES BEFORE SCALING THE ROCKS.



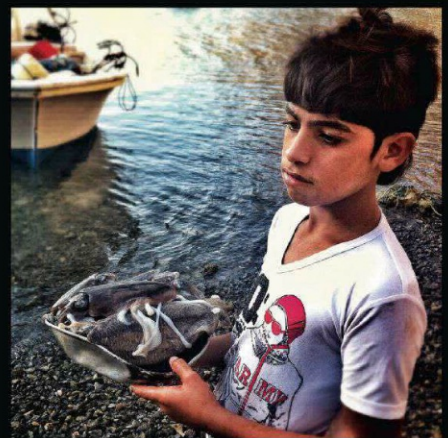
PHOTOGRAPHER JIMMY CHIN EYES THE TEAM'S BOAT IN THE LAGOON BELOW.



FISHERMEN DISPLAY SHARKS AND OTHER FISH FROM THEIR CATCH.



A BLIND, 90-YEAR-OLD FISHERMAN PULLS IN HIS CATCH.



IN THE VILLAGE OF SIBI A BOY OFFERS CLIMBERS CUTTLEFISH FOR DINNER.



SWEAT, AND TEARS SMEAR RENAN OZTURK'S FACE.

MIKEY SCHAEFER, JIMMY CHIN



HONNOLD INSPECTS A GASH IN OZTURK'S SCALP LEFT BY A ROCK.

CLOCKWISE FROM TOP LEFT: RENAN OZTURK (2), MIKEY SCHAEFER, JIMMY CHIN, RENAN OZTURK

Ups and Downs

Over the course of several weeks the six-person team searched the Musandam Peninsula in northern Oman for climbing opportunities amid sea cliffs and crags. They also visited fishing villages that have a hybrid Persian-Omani culture. The team documented the expedition on [Instagram@natgeo](#). A sliced rope and a head gash—both from razor-sharp loose rock—testify to hazardous conditions.



Determined to finish a new route, Honnold dangles from an overhang. After pushing as far as possible on the rock, a deepwater solo climber simply lets go.



By Mark Synnott

Photographs by Jimmy Chin

“Do you mind if I look around?” Alex asks the villagers.

We’re standing with a group of fishermen in front of a small mosque in northern Oman. A row of whitewashed buildings lines the pebbly beach. Behind the village rises a sheer 3,000-foot cliff that shimmers under a blistering midday sun.

“You can do as you please,” says Taha Abdullah Saif Althouri, speaking for the group.

There are no roads in the village, which lies at the head of a deep fjordlike waterway on the remote Musandam Peninsula. The only way to get here is by boat, which is how we arrived.

Jutting deep into the world’s busiest oil shipping channel, the peninsula lies only 24 miles from Iran and is one of the most strategic military locations in the world. Yet for centuries the peninsula was inaccessible, little known, and seldom visited by outsiders. The sultanate created a Ministry of Tourism in 2004 hoping to stimulate the economy, but so far it has had little effect in the region.

As Alex wanders off, we explain to the fishermen that we’re professional rock climbers on an exploratory visit. The men, dressed in white and tan dishdashas, puff on their pipes and nod. The mountainous peninsula on which they live is an intricate maze of bays and fjords, called



khors. Few climbers have ever touched its sheer limestone cliffs. We had learned of the area’s potential from some British climbers who visited in 2005.

There are six of us on our team, including two of the best young climbers in the world, Alex Honnold and Hazel Findlay. Alex, a 28-year-old from Sacramento, California, made headlines in 2008 when he scaled the 2,000-foot northwest face of Half Dome in Yosemite without a rope. Hazel, 24, who grew up climbing in Wales, in 2011 became the first British woman to free climb the 3,000-foot wall on Yosemite’s El Capitan.

This is Mark Synnott’s first story for the magazine. Jimmy Chin photographed rock climbing in Yosemite for our May 2011 issue.



Honnold and Findlay enjoy rare leisure time off the cliffs, while author Mark Synnott helms the catamaran that served as home—and commuting vessel—between climbs.

Taha tells us that this village, known as Sibi, is home to about a dozen families that all share the same last name, Althouri. Besides fishing, they make their living primarily as goat herders.

Suddenly one of the men stops in his tracks, points up at the towering cliff, and starts shouting. A thousand feet above us Alex is climbing, antlike, up the rock wall. The Althouris are beside themselves.

“What are they saying?” I ask our translator.

“It’s hard to explain,” he replies. “But essentially, they think Alex is a witch.”

I CAN UNDERSTAND WHY. Even for me, Alex’s skills are hard to grasp. But so is this landscape: In 28 years of climbing I’ve never seen rock formations as magical. In places the land rises straight from the ocean in knife-edged fins.

Proximity to the sea makes these cliffs perfect for deepwater soloing, a specialized type of

With Hazel cheering him on, Alex dangles his legs and swings like a chimp from one edge to the next.

climbing in which you push as far up a wall as you can, then simply tumble into the water. It sounds harmless enough, but an out-of-control fall can cause serious injury and even death.

We've rented a 44-foot catamaran to serve as our mobile base camp. Besides Alex and Hazel, our team includes photographer Jimmy Chin, filmmaker Renan Ozturk, and rigger Mikey Schaefer. One of the places we thought would be perfect for visiting by boat is As Salamah, an uninhabited island in the Strait of Hormuz.

"It's too close to Iran," says our guide, Abdullah Said al Busaidi, a veteran police officer from Muscat, Oman's capital. Peering through the thick haze, we see the hulking outlines of oil tankers in the strait. Nearby, dozens of speedboats cut back and forth, their decks piled high with crates.

"Smugglers," Abdullah says.

UN sanctions against Iran have created shortages of goods such as cigarettes, refrigerators, and flat-screen TVs, as well as supplies of food and medicine. With Khasab, the region's largest town, as little as an hour by speedboat from Iran, and 123 miles by highway from Dubai, a black market thrives here.

"We can't catch them all," Abdullah says, as an Iranian speedboat roars past.

We arrive at the island in early afternoon. As Salamah, we discover, is nothing more than a giant rock rising from the sea, and there is nowhere to anchor. So we drop the sails and

use the catamaran's twin engines to park the boat just offshore.

Wasting no time, Alex and Hazel lace up their climbing shoes, dive from the boat, and swim to a cliff where the ocean has carved out a cavern with an overarching 15-foot roof. Within minutes Alex has reached the cavern's ceiling, where he finds a series of tiny holds along a protruding rib of dark gray limestone. It's exactly the kind of challenge he and Hazel have been looking for, with every move more difficult than the one before. Hanging upside down, holding on to bumps in the rock no bigger than matchboxes, Alex hooks the heels of his sticky-soled shoes over a small protrusion. Defying gravity, he lets go with one hand and snatches for the next hold, reaching a spot about halfway across the roof. There the rock becomes too slick for a heel hook, so, with Hazel cheering him on, Alex dangles his legs and swings like a chimp from one tiny edge to the next.

At the lip of the roof Alex finds a way to hook his right foot over a sloping knob. Locking off with one arm, he gropes blindly over the lip with his other, feeling for a tiny crease into which he crushes his fingers. With nowhere to go from here, he looks down at the water 25 feet below. In other circumstances falling could have deadly consequences for a free soloist like Alex. With his arms failing, his survival instinct is kicking in.

"Come on, Alex!" Hazel screams, urging him to finish his new route. Alex lunges over the lip with a grunt, but his legs swing out, and he peels off the rock and leaps into the water.

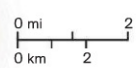
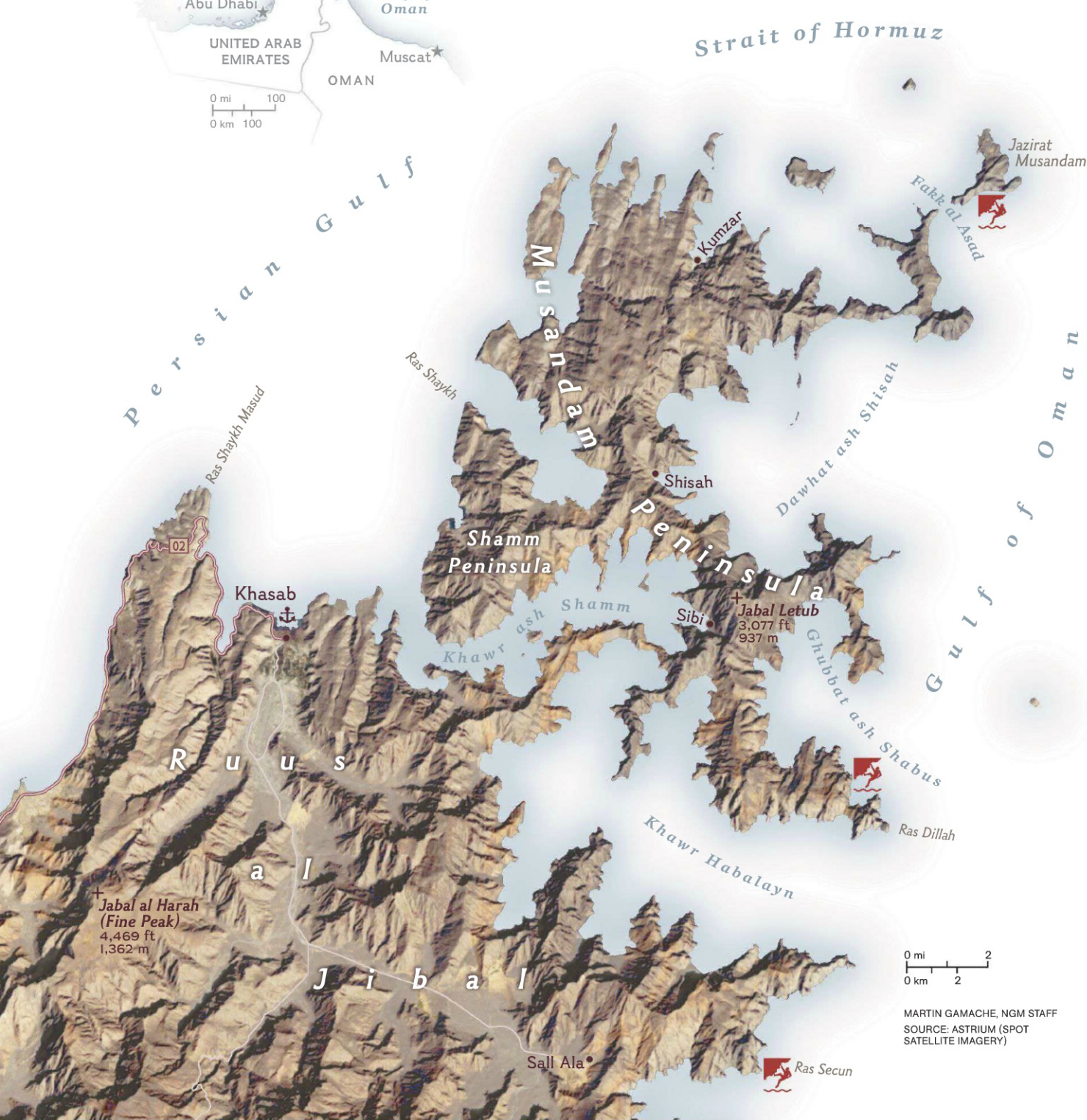
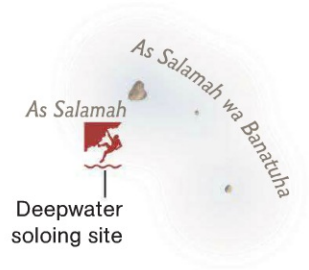
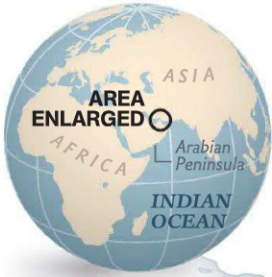
"I hate jumping off things," Alex says, swimming back to the wall for another try.

THAT NIGHT WE DOCK at Kumzar, a village on the northern edge of the peninsula. More than 2,000 people live here in one of the oldest settlements in the region. Their densely packed houses crowd a few acres of level ground at the foot of a soaring rock-walled ravine.

The morning call to prayer, broadcast from speakers mounted on a nearby mosque, awakens us at 5 a.m. Within half an hour a dozen fishermen appear at the wharf to collect the previous

Rock and Water

Long, bony fingers of limestone jab into the sea around Oman's Musandam Peninsula, forming steep, fjordlike inlets. Looking at a chart of these features, Synnott knew the climbing here would be unmatched.



MARTIN GAMACHE, NGM STAFF
SOURCE: ASTRUM (SPOT SATELLITE IMAGERY)



With no rope to protect him, Honnold reaches for a handhold on another deepwater solo. "He was climbing at a high level, really sick stuff," says the author.







day's catch, left on ice in old refrigerators. The variety of their haul is impressive: sharks, tuna, grouper, snapper, needlefish, and mackerel.

The Kumzaris are an extended family with their own language, a legacy of the cultural collision that has been going on here since ancient times. Linguists don't know exactly how Kumzari developed, but it's genetically related to Persian and Arabian languages, with words borrowed from Hindi, Portuguese, and even English. One theory is that the Kumzaris were originally from the mainland and were pushed out onto the tip of the peninsula by Bedouin Arab invaders in the seventh century. Another, more intriguing theory is that their ancestors had contact with shipwrecked sailors who washed ashore, perhaps as long ago as the Middle Ages.

From Kumzar we sail east toward the Fakk al Asad, or "lion's mouth," a narrow strait named for the fanglike red and orange limestone pillars that jut from overhangs at its entrance. Alex and Hazel spend the day working on a 200-foot route up one of the pillars.

That night we anchor in the bay at the base of a 500-foot Gothic tower we dub the "sand castle." Before joining Alex and Hazel for the climb the next morning, I suggest that we take along ropes and safety gear. As expedition leader, I'm responsible for keeping everyone out of harm's way. The young climbers scoff, saying that to them it's nothing more than a hike. I think of myself as a young 44-year-old, but trying to keep up with these two has made me feel old.

During a climb earlier in the trip Alex had scampered up a 1,500-foot wall with our rope in his pack.

"Hold on a second!" I'd yelled. What if the rest of us needed it?

"Don't worry," he'd replied. "I'll stop when I think it's appropriate for us to rope up."

Once again I'm slightly annoyed that neither of them seems to care whether I'm comfortable

I think of myself as a young 44-year-old, but trying to keep up with these two has made me feel old.

climbing without a rope. As a father of three, I have a healthy preoccupation with my well-being.

"You'll be fine," Alex calls down, as he and Hazel disappear from view.

The rock here is badly shattered, what climbers call choss. As I cling to the dead-vertical wall, I test the integrity of each hold by banging it with the heel of my hand. Sometimes the rock sounds hollow or even moves, and these places I avoid. Staring down between my legs, I see the catamaran bobbing in the bay far below. The last 20 feet turn out to be the hardest part, a steep, crumbling wall that leads to a tiny pinnacle so pointy we have to take turns climbing up onto it.

"You lived," Hazel says, slapping me a high five as I plop down on a ledge beside Alex and her, my nerves frazzled. Below us the clawlike fingers of the Musandam Peninsula glow orange with the setting sun. Looking down at the tortuous shoreline, which fans out in every direction, we're gazing at a lifetime's worth of climbing.

As I turn to my youthful partners for their thoughts, I see they've already packed up. For them the moment has passed. "Let's go," Alex says impatiently. "If we hustle, we can get in another climb before dark." □

To make this first ascent, Honnold not only scaled the towering, jagged pinnacle but also climbed back down the exact same way—an even more challenging task. PHOTO COMPOSED OF TWO IMAGES.



NATIONAL GEOGRAPHIC ON TV



Ultimate Survival Alaska

Armed with nothing more than their wits and their backpacks, eight survivalists are setting out on a mission: Stay alive in a race through the Alaska wilderness. Find out who has the strength, stamina, and nerve needed to overcome endless obstacles—from glacial ravines to wolves on the prowl—this month on the National Geographic Channel.

TRIP



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SPEAKER

MYSTERIES OF THE ANCIENT MAYA Archaeologist William Saturno has devoted his career to unraveling the history of the Maya culture. Hear him share tales of his most exciting finds at the Mesa Arts Center in Mesa, Arizona, on February 5. Tickets are at nglive.org/arizona.

TUMBLR

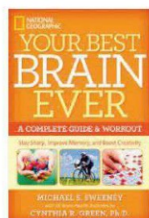
FOUND Photos from our vault of the Palace of Versailles in the 1980s, a 1940s drive-in theater, and more resurface at NatGeoFound.tumblr.com.

EXHIBIT

LIONS & TIGERS & BEARS Photographers Michael “Nick” Nichols, Steve Winter, and Paul Nicklen each spent years documenting wild animals. See the results—like this rare image of a tigress and her cub (right)—at the National Geographic Museum in Washington, D.C. For details go to ngmuseum.org.



Book of the Month



Your Best Brain Ever Michael S. Sweeney and Cynthia R. Green
Are you concerned about memory loss and “senior moments”? Give your brain a tune-up with word games, body stretches, and foods that help the mind stay sharp. This complete guide to brain health incorporates the latest neuroscience, case studies, and Alzheimer’s research. Available December 31 wherever books are sold (\$16.95).

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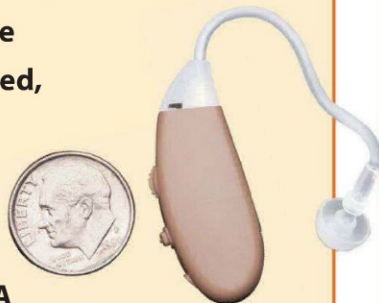
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Beached in Dubai “All these construction workers would come around and watch life at the beach, but none of them would sit on the sand,” says Jonas Bendiksen, who photographed this month’s story on guest workers in the Gulf states. “I think they felt somehow that they didn’t belong.”

Foreign laborers, like those shown below at Jumeirah Beach in Dubai, are doubly isolated. Their families are many hundreds of miles away in places like India and Vietnam, yet they’re also cut off from the people they serve. Even though foreign workers make up the vast majority of Dubai’s population, they’re housed mostly in residential camps on the city’s outskirts. Many work 12- to 15-hour shifts to maximize earnings, leaving little time for other activities.

To capture off-the-clock moments, Bendiksen wore a hard hat and boots to construction sites, then boarded a special bus that shuttled workers back to their camps. After a supervisor expelled him, the workers gave Bendiksen a tip: Come back between noon and 2 p.m., when the boss takes a nap. Bendiksen followed the advice and made intimate portraits of their home away from home. —Daniel Stone



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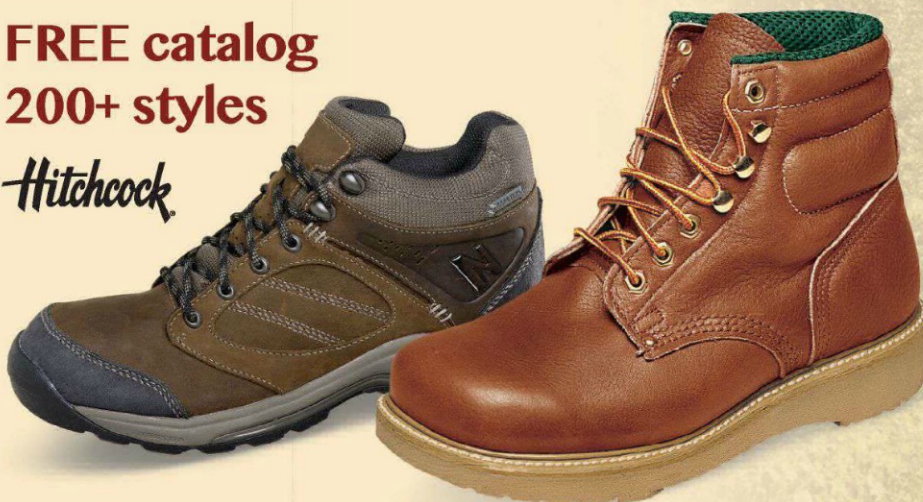
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Fish Stacks A wall of frozen walleyes testifies to a successful weekend of ice fishing on Minnesota’s Mille Lacs Lake. This photo first ran in the December 1958 issue of *National Geographic*. “Minneapolis people ... camped in comfort in their 42-foot trailer,” wrote staff member Thomas J. Abercrombie. “Driving onto the frozen lake, they heated their mobile home with a portable electric generator, dug holes in the ice, set their lines, and stood watch behind sealed windows. When a bobber jumped, all rushed out to see what they had caught.”

Mille Lacs has long been famous for its walleyes, but the lake’s population of the species is in decline. In 2013 Minnesota’s Department of Natural Resources increased restrictions for anglers, limiting size and number caught to help protect younger, smaller fish and breeding stock. —Margaret G. Zackowitz

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PHOTO: THOMAS J. ABERCROMBIE, NATIONAL GEOGRAPHIC CREATIVE

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Indian Skimmer (*Rynchops albicollis*)

Size: Body length, 40 - 43 cm (15.7 - 16.9 inches); wingspan, 102 - 114 cm (40.2 - 44.9 inches) **Weight:** Unknown **Habitat:** Wide lowland rivers, around lakes and marshes, and estuaries along marine coasts **Surviving number:** Estimated at 6,000 - 10,000



Photographed by Otto Plantema

WILDLIFE AS CANON SEES IT

Dinner to go. The Indian skimmer scoops up small fish, crustaceans and other arthropods while flying low over the surface of the water. This unusual mode of dining is facilitated by a long lower mandible, which allows the bird to snap up choice entrées. Uniquely adapted eyes help, too, handling both nocturnal conditions and dazzling daylight reflections. The skimmer is less successful

at dealing with habitat loss and predation. Its natural reaction when approached is to lie low, flying away only at the last moment. But how much longer can it escape the dangers it faces?

As Canon sees it, images have the power to raise awareness of the threats facing endangered species and the natural environment, helping us make the world a better place.



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