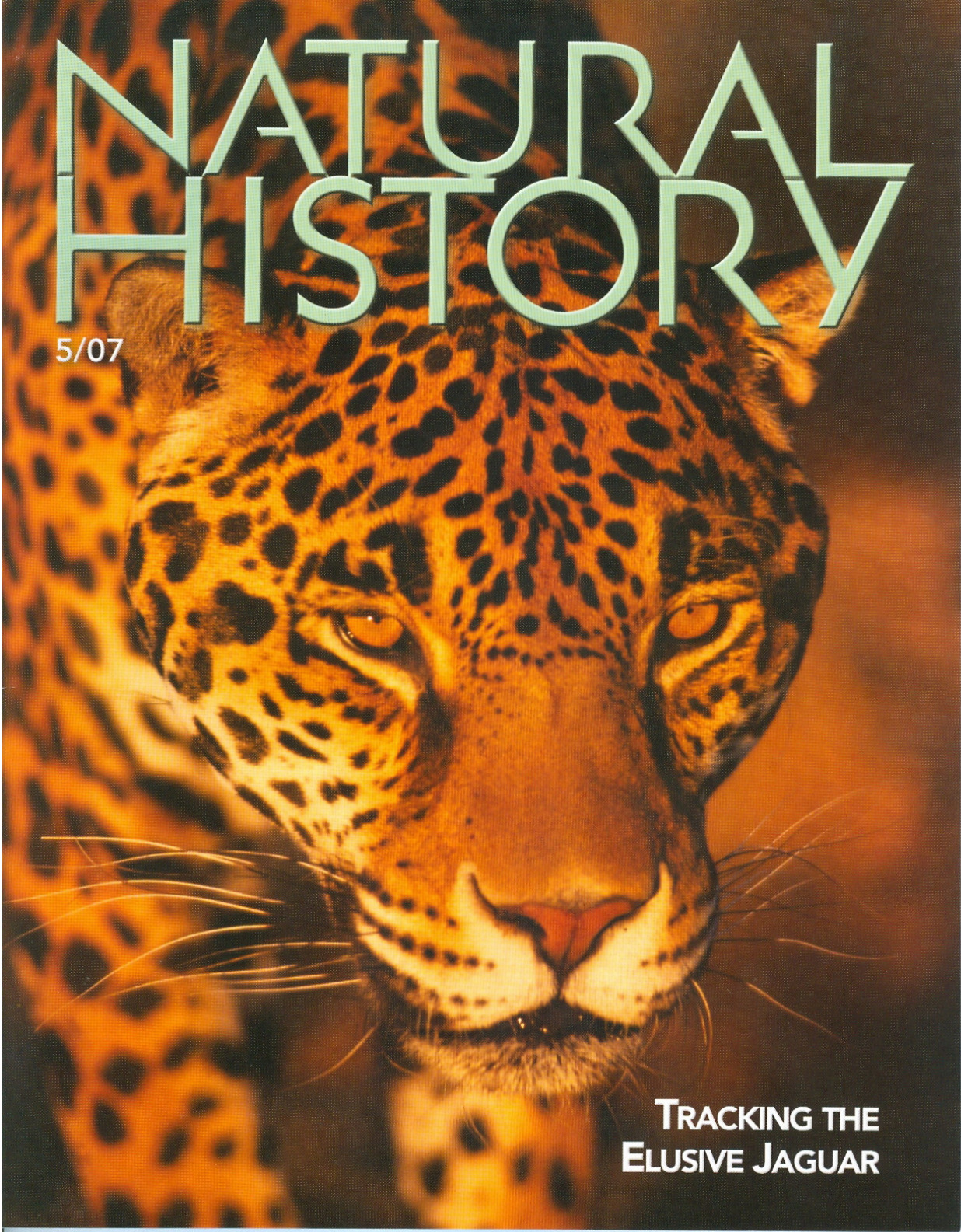


# NATURAL HISTORY



5/07

TRACKING THE  
ELUSIVE JAGUAR



## CONTRIBUTORS



images, visit [www.education.denniskunkel.com](http://www.education.denniskunkel.com).

Formally a microscopist, **DENNIS KUNKEL** ("The Natural Moment," page 4), specializes in photographing what can't be seen with the naked eye. Neurons, spider silk, anthrax cells—all of them have become subjects of his images. Kunkel earned his doctorate in botany from the University of Washington in Seattle, then pursued an academic career at that university and at the University of Hawai'i in Honolulu. For more of Kunkel's



When **EDUARDO CARRILLO** ("Tracking the Elusive Jaguar," page 30) was growing up in San José, Costa Rica, in the early 1970s, he often visited the country's newly created national parks. There, he became enthralled with the wildlife, and went on to work as a field assistant in the parks, studying deer, peccaries, and small felines. Jaguars didn't formally enter Carrillo's studies until he won a Fulbright scholarship to pursue his doctorate at the University of Massachusetts, Amherst. Carrillo has since taught at the Tropical Agricultural Research and Higher Education Center, in Turrialba, Costa Rica, and at the National University in Heredia, Costa Rica.

**GIL MOR** ("Pregnancy Reconceived," page 36) is an associate professor of obstetrics and gynecology at the Yale University School of Medicine. He is also the director of the Reproductive Immunology Unit and the Discovery to Cure Translational Research program at Yale. Mor's research focuses on the immunology of implantation, the role of apoptosis in tissue remodeling and reproductive cancer, and the role of inflammation in cancer formation and progression. He earned his doctorate in immunoendocrinology from the Weizmann Institute of Science in Rehovot, Israel, and his M.S. and M.D. degrees from Hebrew University in Jerusalem. Mor is the editor of a recent book, *Immunology of Pregnancy* (Springer, April 2006).



A student of early civilizations and the way their rural and urban sectors interrelated, **GLENN M. SCHWARTZ** ("Hidden Tombs of Ancient Syria," page 42) has concentrated on the rise and fall of early complex societies in Syria. With a colleague, he is codirecting excavations at Umm el-Marra. Schwartz is Whiting Professor of Archaeology at the Johns Hopkins University. His books include *The Archaeology of Syria: From Complex Hunter-Gatherers to Early Urban Societies (ca. 16,000–300 B.C.)*, coauthored with Peter M.M.G. Akkermans (Cambridge University Press, 2003), and *After Collapse: The Regeneration of Complex Societies*, coedited with John J. Nichols (University of Arizona Press, 2006). Schwartz's article in this issue is based on work supported in part by the National Science Foundation (see grant credit in Picture Credits, below).

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Natural History  
P.O. Box 5000, Harlan, IA 51593-0257.

Natural History (ISSN 0028-0712) is published monthly, except for combined  
issues in July/August and December/January, by Natural History Magazine,  
Inc., in affiliation with the American Museum of Natural History, Central  
Park West at 79th Street, New York, NY 10024. E-mail: [nhmag@naturalhistorymag.com](mailto:nhmag@naturalhistorymag.com). Natural History Magazine, Inc., is solely responsible for  
editorial content and publishing practices. Subscriptions: \$30.00 a year; for  
Canada and all other countries: \$40.00 a year. Periodicals postage paid at New  
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# Tracking the Elusive Jaguar

*When you're following one of the biggest cats in the Western Hemisphere, be aware that one might also be following you.*

By Eduardo Carrillo

**O**n a fresh May morning sixteen years ago, I was walking with ten of my students along a beach in Costa Rica's Corcovado National Park, when we came across the tracks of a sea turtle, leading out of the water and into the thick jungle beyond. A female turtle, we assumed, had come ashore to lay her eggs the night before. But no tracks led back to the water; instead, a set of jaguar paw prints crisscrossed the turtle's flippered swipes in the sand. Sure enough, we found the turtle in the woods, partly eaten. It was a seventy-five-pound olive ridley, which the jaguar had dragged about 300 feet into the forest. After taking a few pictures to document our find, we returned to the beach. Minutes later we spotted two animals about a mile away, loping in our direction. We promptly hid behind a fallen tree. All eleven of us watched in awe as a female jaguar and her cub approached, then passed within twenty feet of us.

That lucky sighting was my first encounter with a jaguar in the wild. I wasn't looking to spot one, let alone study the big cats. In fact, few people were studying them in the early 1990s, because they are so hard to find and follow. Jaguar field biologists often go several months without catching a glimpse of

one. Yet no radio collars, no traps, no rigged cameras had been necessary for my first sighting, which profoundly marked me, both as a professional biologist and as a human being. I wanted to know more about their ecology, to study the factors that have made them endangered, and to track them in their natural setting.

**I**t would be three years before I saw my next wild jaguar. By then, my colleague Joel C. Saenz, now at the National University of Costa Rica in Heredia, and I had resorted to pooling our own scant savings to study the jaguar and its primary prey, the white-lipped peccary (*Tayassu pecari*) in Corcovado, which has one of the highest concentrations of jaguars in Central America.





Jaguars populate a snaking strip of land from southern Arizona and New Mexico southward to northern Argentina. Hunting pressures on both jaguars and their primary prey, plus deforestation, have caused the species, *Panthera onca*, to disappear from several areas within that stretch, including the whole of El Salvador and historically extensive ranges north of the Mexican border. In fact, sightings that mark the northern limit of the jaguar's range are recent; after decades of absence from the United States, the occasional jaguar was sighted in Arizona and New Mexico, beginning in 1996. In spite of its comeback, the jaguar is still considered in great danger of extinction. Needless to say, tracking the stealthy, solitary animals remains exceedingly difficult.

Our initial objective was to gather information about the peccaries' and jaguars' movement patterns. Was Corcovado large enough to maintain long-term populations of the two species? In spite of our limited resources, we determined that jaguars feed mainly on peccaries and marine turtles. The finding was surprising, because it is clear that a jaguar could eat any animal that crosses its path, including a human being. (There are no records, however, that jaguars have ever attacked people in the wild.) On reflection, though, opting for peccaries and sea turtles makes sense for the jaguars: adults of both

kinds of prey are easy targets and weigh between eighty and ninety pounds, so they provide a good deal of energy in one fell swoop [see photographs at bottom left of next page].

We also realized that jaguars are active hunters by day as much as by night. Although they are skillful tree climbers and excellent swimmers, they travel mainly on the ground, walking along man-made trails. According to our findings, male jaguars require at least ten square miles of territory to support their energy needs; females require about four square miles. The ranges of individuals, however, can overlap.

Those early observations of ours secured funding from the Wildlife Conservation Society (WCS), the National Geographic Society, and Idea Wild. Soon we were tracking more jaguars and more of their prey. On one memorable occasion Saenz and I had followed a group of peccaries across the jungle and shot a big one with a dart, hoping to collar it. But because the tranquilizer needs about ten minutes to take effect, we had to pursue the peccaries. Off we ran, jumping through the forest, across a dry, sandy streambed, through more forest, and across







Jaguar pelts, along with those of ocelots, are stacked high in a Brazilian poacher's store. In spite of international efforts to ban the sale of jaguar skins, the black market in them continues, and some of the cat's populations are still in decline.

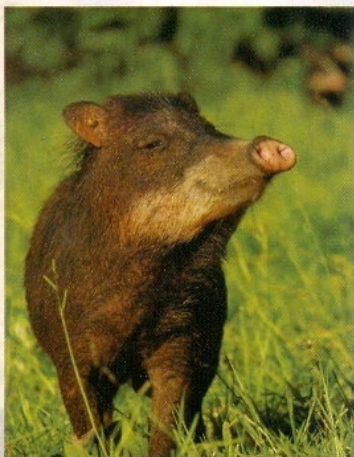
another streambed—where we saw our footprints in the sand. We were going in circles! But on top of our footprints were a set of paw prints from a big jaguar that had also been following the peccaries—or perhaps following us. Somehow it seemed as if the jaguars of Corcovado remained one step ahead of us. Or is that behind?

Individual jaguars' coats vary in color on their backs from stunning golden-yellow to sandy brown, dotted with black, rounded rosettes. The jaguar's belly is white with solid black spots. The top coats of the jaguars enabled us to differentiate

them, and like many field investigators, we gave our subjects names. Monster was the largest cat we saw in Corcovado, weighing in at about 220 pounds. Rosa had a spot in the shape of a rose on the left side of her body, and she searched for sea turtles on the beach at every new Moon. Negra was the curious one, eager to investigate and rub against the camera "traps" that we began setting up near the beach in 2003.

The camera traps have become essential to our research in Corcovado and Guanacaste national parks [see map on opposite page]. We place automatic cameras at sites we think are attractive to the jaguars. Each site has infrared sensors that activate the cameras when a passing animal triggers them. What we want, of course, is to capture enough of the animal on film to identify it by its coat pattern, but what we often get is a picture of its tracks or a stray tail. In any event, one of our most effective tricks for attracting jaguars to our camera stations turns out to be . . . men's cologne.

The idea came from a chat I had some years ago with a WCS colleague. Men's perfume had been useful, he told me, in attracting wild cats to scent stations elsewhere. With a little experimentation in Corcovado, we found out that jaguars cannot resist the smell of Calvin Klein cologne, specifically "Obsession." They seek out the fragrance from miles away—perhaps because of the civet scent in it. Regardless, the stuff works, and so all our stations are baited with the perfume. The photographs enable us to identify individuals by their unique pattern of spots, as well as to make general estimates of the kinds and numbers of prey that pass by the area.



Three favorite prey of the jaguar are pictured above. The white-lipped peccary (left) and sea turtle hatchlings (middle, with a jaguar print), as well as adult sea turtles, are the most hunted prey in Corcovado National Park. The squirrel monkey (right) often evades its feline nemesis, thanks in part to the vocal warnings of its fellow monkeys.



If you're lucky enough to see a wild jaguar in person, the observation is far more thrilling, and can be more informative, than a photograph. Once I went out to look for Jill (a female jaguar named in honor of my first field assistant), not long after putting a radio collar on her. I wanted to make sure her radio transmitter was working properly, and to check on her general well-being.

After about an hour of walking through the jungle with my radio antennas, I located Jill resting among the buttresses of a tree. She was only eighty feet or so from where I stood. On impulse, I decided to throw myself on the ground and try to slither toward her on the forest floor. I was making good progress on my stomach when a group of squirrel monkeys started calling from the trees above me. I recognized the particular call they were making—something like that of a barking dog—as their danger signal.

I looked up at them, but they weren't looking at me. I thought, "Hmmm, they usually make that sound when they see either a snake . . . or a feline." With that thought, I turned to my right and froze on the spot: just fifteen feet away was a male jaguar. Again a jaguar had been following my movements without my knowledge. Once this jaguar knew I had noticed him, he simply turned and walked casually into the thick woods. I was left puzzling over his behavior, but not fearful. Especially after that incident, fear was not a factor for me; the animals simply are not aggressive toward people.

In many ways, jaguars benefit from being non-confrontational. A stealthy, solitary animal can save itself the trauma of wounds from hunting prey, competing for potential mates, or fighting territorial battles. A wound in the jungle, after all, can mean a hasty death, since parasites abound.

Only in two-week-long mating encounters, and in the rearing of the young—a process that takes about eighteen months—do jaguars interact with one another. Most mothers bear two cubs, though litters of one cub or as many as four are not uncommon. In some cases a litter can include one spotted and one black cub; people once distinguished the black jaguars as "panthers." (The term is a general one, however, and it has also been applied to leopards and cougars with entirely black coats.)

Evolution has placed jaguars at the top of the food chain, but left them with one possible weakness: poor sprinting skills. Unlike the other big cats in the genus *Panthera*—including leopards, lions, and tigers—jaguars don't run much in pursuit of their prey. Instead, they track, and then pounce. Making incredibly silent approaches, the cats simply lunge from the shadows of the jungle and swiftly



Many national parks of Costa Rica (dark green) offer some protection for the country's threatened jaguars. The author has conducted extensive field studies in Corcovado National Park, in the southwest corner of the country.

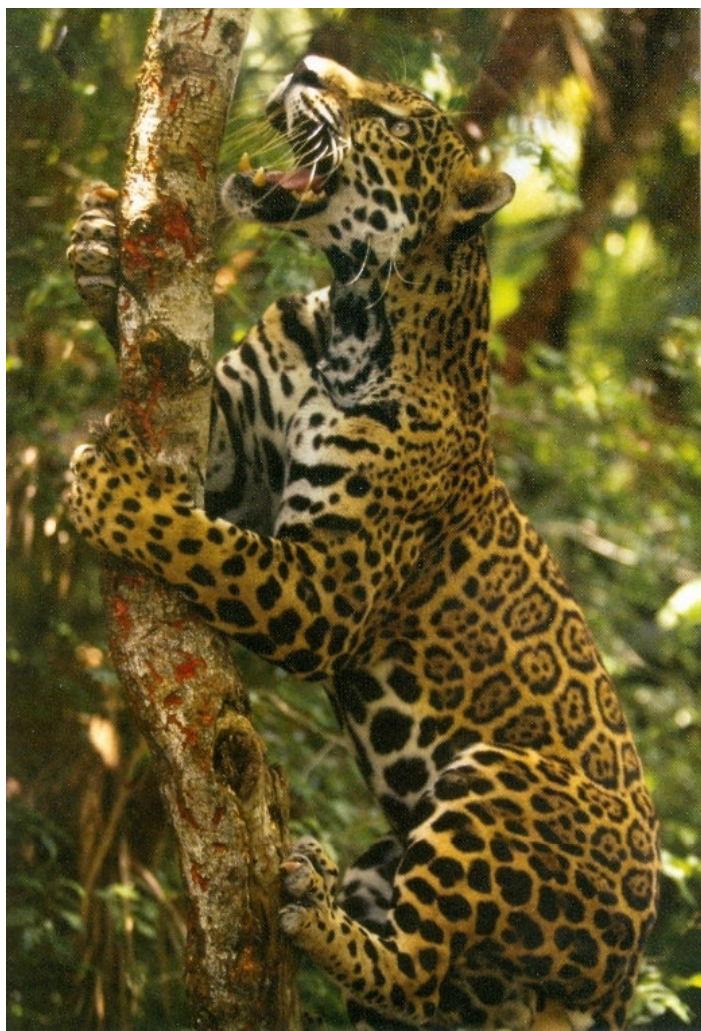
bite their prey in the neck. Why run when there's nothing worth running from and nobody knows you're coming?

In spite of their lack of aggression, jaguars are coming in closer contact with people as we encroach on their habitats. In Costa Rica, farmers have recently shot jaguars when the cats strayed from within national parks and raided pig farms or cattle ranches. Yet the jaguars have good reason for fanning out to seek alternative food sources. Three of their favorite prey species, the white-lipped peccary, the collared peccary, and the paca (a large rodent related to the common agouti), are all falling victim to massive hunting for their succulent meat.

Peccary or paca poaching often takes place on the edges of protected areas, or even inside the park boundaries if rangers aren't vigilant, since that's where more animals reside. In Corcovado, for instance, the peccary population has fallen by some 60 percent since 2000 because of hunting pressure. The hunters use high-caliber automatic rifles, such as AK-47s, which can kill as many as fifty animals in a few minutes. During the same six years, jaguar numbers in Corcovado dropped from about 150 animals to a mere thirty or forty.

When jaguars lose their food supply and face starvation, they naturally seek other means of survival. Farms become targets. And once they kill a domestic cow or pig, they learn that farm animals are easy prey. So hungry jaguars, in turn, become the targets of farmers' wrath. Fortunately, funding





Adult jaguars are excellent tree climbers, often using trees as resting spots, scratching posts, or caches for their prey. The author once found a marine turtle stashed ten feet above the ground in Costa Rica's Guanacaste National Park.

in 2005 from the Moore Foundation supported the hiring of fifty-three new park rangers for conservation areas on the Osa Peninsula. Our studies show that the peccary population has recuperated since then. But it will take some years before the jaguar population begins to make a noticeable recovery in Corcovado.

Efforts to stop deforestation in some areas and to support ecological restoration in parks such as Guanacaste are also helping support the jaguar populations. Still, three Costa Rican national parks, Tortuguero, La Amistad, and Braulio Carrillo, are suffering serious losses of their jaguars.

Another threat to the cats' safety comes from the fur trade, which underwent frenzied growth in the 1960s. In Brazil alone, 15,000 jaguars were being

killed every year. The year 1973 marked a change in the trade of jaguar pelts: the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) helped to cut down on the traffic in jaguar pelts. Yet in countries such as Nicaragua, a black market for pelts still exists [see photograph at top of page 32]. There you can buy a full pelt for about \$200, not to mention other products such as belts, shoes, and wallets.

Costa Rica depends ever more heavily on tourism and wildlife conservation for its income. People are beginning to understand the importance of protecting the country's living resources. Nevertheless, a single country cannot make much headway without the support of its neighbors. Alan Rabinowitz, a WCS biologist who has worked avidly to protect jaguars in Belize, has proposed establishing a multinational "Jaguar Corridor," which would run from the southwestern U.S. through to northern Argentina. Ideally, the corridor would include enough protected areas in every country along the way to sustain a healthy, contiguous jaguar population. Barriers, both physical and political, continue to prevent that kind of linkage. One case in point is the proposed "border fence" between the U.S. and Mexico.

Whether or not a Jaguar Corridor is established, new research must focus on mapping and understanding the distribution of jaguars across the countries that make up that corridor. In Costa Rica, my colleagues and I are making progress in determining how the parks' managers can best protect jaguars and their prey. We must continue that work—much about the jaguars has yet to be discovered—but, more urgently, we need to extend our existing collaborations to other research teams. The goal must be to ensure that populations of jaguars do not continue to disappear from any of our countries. Education and bans on hunting the jaguars' prey inside protected areas will help.

Human beings have to remember that we, too, belong to nature. What we do to nature, we do to ourselves. The linkages of cause and effect are circular, just as my chase of the peccaries was. Like the jaguar in the forest, what is lurking in our shaded future may be unrecognized and unknown, but it may also be ready to cover our heavy tracks with new and unexpected ones of an entirely different cast. □

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