Trafficking Jam: In Wildlife CSI, Scientists Become Nature's Detectives

By Michele Berger

Crimes against wildlife deplete animal populations and natural resources. Even more so when circumstances—weather, migration—make them vulnerable, particularly in the face of a changing climate. A handful of wildlife crime scene investigation labs around the country are tackling this problem, focusing on the evidence to stop these heinous acts.

There's a chill in the air, cool enough for a light jacket. It feels like autumn, and the calendar agrees, but most of the leaves outside the museum haven't let go of summer, clinging obstinately to the season's end by staying green. The pavement leading to the entrance is splotchy and dark, like it recently met water and hasn't fully dried. After a guard checks my bag ("You're not here for the symposium?" he asks), I wait for Carla at security.

Carla is Carla J. Dove, head of Smithsonian Institution's Feather Identification Lab in Washington, D.C. With her frosted blonde hair and affable nature, she's unassuming despite her advanced degrees and decades of experience. She offers a warm handshake, then leads me through the maze that is the behind-the-scenes part of the Smithsonian. I'm here to see wildlife CSI in action, to view the institution's massive collection of stuffed bird specimens and understand how Dove and her staff use them to parse evidence and identify the avian casualties of bird strikes, a $700 million a year problem that pits man against nature in the truest sense of the phrase, and one the Air Force, the Navy and the Federal Aviation Administration would love to make disappear.

Four people in the Feather Lab—five or more during busy season, which coincides with fall migration—work full-time on this puzzle, three of them trying to pinpoint species by feathers and feather structure, the fourth working solely on DNA. A contractor specializes in bird bones. In 2013, the lab handled more

than 8,000 cases. To the skeptic or an untrained eye, the job might seem futile or thankless, trying to glean something, anything, from DNA strands or dirt smudges or feather pieces. But over the years, the Feather Lab has identified the remains of more than 400 different bird species, helping aviation officials prevent crashes and save boatloads of money.

Though the Feather Lab is the only one in the United States focused specifically on bird strikes, it isn't the only animal forensics lab. A number of facilities across the U.S. specialize in this, a varied and complicated field loosely divided into those who expose the seedy underbelly of wildlife crimes and those who prevent the collision—both literal and figurative—of wildlife and humans. Smithsonian's lab doesn't typically collaborate with law enforcement, but the National Fish & Wildlife Forensics Laboratory in Oregon and the Forensic Unit at the Northwest Fisheries Science Center both do. So do more than half a dozen state labs. All told these institutions save countless lives and millions, maybe billions, of dollars annually.

I. The Letter of the Law

Before the notion of wildlife forensics existed, crimes against animals often went ignored; they simply didn't take precedence over wrongdoing against humans, according to Ken Goddard, who runs the National Fish & Wildlife Forensics Laboratory. Some animals went extinct. Other populations dipped perilously low.

American crocodiles, for instance, peaked at a few thousand individuals in the early 20th century, but the value of their skin, particularly following the rise of commercial tanning, kept growing. "This species was hunted and overexploited for its hides in the 1930s, until it was protected in the 1970s," according to the International Union for Conservation of Nature and Natural Resources. The original Federal Register notation for the crocodile, in 1979, called exploitation the "major factor" of the animal's decline. Today it's endangered everywhere but Florida, where it's threatened. That's in contrast to the American alligator, which faced similar dangers in the 1950s but rebounded fully in the late 1980s thanks largely to hunting bans.

Birds, particularly those with showy plumes like snowy and reddish egrets, also fell victim. “In 1886 [ornithologist] Frank Chapman hiked from his uptown Manhattan office to the heart of the women’s fashion district on 14th Street, to tally the stuffed birds on the hats of passing women,” writes *Audubon* magazine, which Chapman later founded. “In two afternoon trips he counted 174 birds and 40 species in all. America’s hat craze was in full swing.”

Feathers of these species became so fashionable as to almost wipe these birds from the Earth. Their populations plummeted and plume hunters turned vicious, prompting what *Audubon* describes as “outraged Americans” to “combat the feather trade and advocate bird protection.” This was the 1890s. Soon after, in 1900, the Lacey Act became law, making it illegal to “import, export, sell, acquire or purchase” certain fish, wildlife and plants (a list that continues to grow).

Today convictions under the Lacey Act carry with them stiff penalties. An individual can face $100,000 in fines and up to a year in prison for a misdemeanor, and $250,000 and up to five years in prison for a felony; corporations could be on the hook for $200,000 for a misdemeanor, half a million for a felony. Perpetrators—those who sold and those who purchased—must turn over the illegal items, any profits and any tools used to obtain them.

The Department of Justice calls prosecuting this particular crime type akin to going after drug traffickers by disrupting the supply chain and scaring consumers: *Wildlife investigators, particularly the special agents of the U.S. Fish and Wildlife Service and the National Oceanic and Atmospheric Administration, use techniques similar to those used in narcotics enforcement. In particular, controlled deliveries of contraband wildlife, followed by anticipatory warrants, often result in overwhelming evidence against consumers of illegal wildlife. With the evidence piled up against them, these defendants are sometimes willing to cooperate against their suppliers. When suppliers are convicted, the government sees the greatest deterrent effect.*

A host of U.S. laws in addition to the Lacey Act today aim to guard this country’s wildlife trove: The Endangered Species Act, the Migratory Bird Treaty Act, the Marine Mammal Protection Act, the Bald and Golden Eagle Protection Act. It’s an extensive set of regulations. As of December 2014, the ESA alone protected mammals from African antelopes to zebras and more than 375 in

between, plus 330 birds, 130 reptiles, 44 amphibians and scores of fish, clams, snails, insects and coral. There's also CITES, the Convention on International Trade in Endangered Species of Wild Fauna and Flora, a treaty that delineates crimes and punishments by how dire the species' situation. The United States is one of 180 CITES member countries party to the agreement, the aim of which is to protect 30,000 species by preventing their trade across borders.

With enough evidence, the government doesn't hesitate to pursue lawbreakers. In May 2009, a commercial fisherman caught falsifying catch records to illegally obtain additional permits was sentenced to 13 months in prison, two years of supervised release and a $75,000 fine. In a 2011 violation of both the Lacey Act and CITES, a corporation was fined $1.8 million for illegally importing and falsely labeling black coral, a rare species in demand because of the beautiful jewelry it makes.

The thing is, these criminals are persistent, and securing enough evidence to convict takes specialized labs and skilled scientists. What works for crimes against land mammals won't necessarily work for those from the ocean, and birds are a different story altogether.

II. In the Air

At a glance, there's nothing special about the office where Carla Dove, Marcy Heacker, Jim Whatton and Faridah Dahlan work—until you start really looking. There are desks with computers, filing cabinets and bookshelves. There's a makeshift kitchen tucked in the corner. But their file bins don't hold typical office papers; they contain unsolved cases, evidence and paper trails. On the bookcase are at least nine guides: *Sibley's Guide to Birds*, *Birds of the Horn of Africa*, *Birds of the Middle East*, *Peterson's Guide to the Birds of North America*, a *National Geographic* guide, *Birds of Pakistan*, *Birds of East Asia*, *A Field Guide to the Birds of Korea*, *Birds of Turkey*.

The books are nothing compared to what's just around the corner: Smithsonian's 620,000-item avian collection filled with stuffed birds, bird skins, skeletons, even pickled birds.

"Did you say pickled?" I ask.

"Yeah," Dove laughs. "They're pickled."

"Why? Why are they pickled?"

To explain, she points to a pileated woodpecker a la Woody that's not pickled, but rather stuffed, turned into what the lab calls a study skin. "This kind of specimen is prepared by making an incision and skinning out the bird," she notes. "All the feathers stay attached. But you clean out the skull and you clean the skin, and then you stuff it with cotton. So this doesn't have any internal organs except for a few that are left in the bird. The pickled birds are injected with formalin with all of their muscles and all of their insides, everything inside is still there; it's like embalming them. If somebody wants to look at muscle structure, a specialized muscle in a bird, or they want to look at stomach contents, that bird would be preserved."

Pickled birds. Okay. Dove continues showing me around what could be confused for a warehouse, using the stuffed specimens stored there as a 3-D field guide. They're for much more than impressing visitors, though. The collection has samples of 85 percent of the world's 10,000 identified bird species, with DNA for at least 3,500. It includes extinct birds like the passenger pigeon and the Carolina parakeet, as well as specimens reportedly collected by Teddy Roosevelt. The collection's oldest date back to the 18-teens.

Though Dove admits she sometimes peeks at her favorites simply because they're cool, she and Heacker, another of the lab's morphologists, depend on these examples for scientific comparison. When they get evidence in the mail—a torn feather or a piece of bird bill, for example—they can look at incident location, time of year and birds that fit the general profile, then pull out an actual individual of the suspected species. In conjunction with the DNA analysis by Dahlan, the Feather Lab makes some sort of ID on every case it gets.

It reports the finding to the FAA or clients in the branches of the military, who use it to figure out ways to keep away the birds. Most importantly, this knowledge saves human lives. But it doesn't hurt that when applied properly, it can also save millions—some sources say billions—of dollars annually. From 1990 through 2012, according to the FAA, bird strikes cost the American people $639 million per year. When adjusted for inflation and taking into account strikes not reported, that number could shoot up by half, to $957 million per year, the agency said.

That's why during that busy fall migration season, Dove's lab works about 400 cases every week. "We have DNA barcoding. We have the microscopic

structure and we have the whole feather. And that's how we do the work here," Dove says. "Sometimes we can only say it's a duck. But you know, if we have enough feathers or enough material we can get to species. Sometimes they're insects. Sometimes they're bats. The other day we had [DNA fragments of] a cow."

III. On Land

Ken Goddard is no stranger to seeing the strange and unexpected in his line of work. For the past three decades, this ex-deputy sheriff has run the National Fish & Wildlife Forensics Laboratory in Ashland, Oregon, a facility he was hired to launch.

The year was 1979 when Goddard saw an ad for the Fish & Wildlife Service job located in Washington, D.C. "My wife talked me into applying," says the 68-year-old. "I didn't think I knew enough about wildlife. I'm a writer.... That's probably why I was selected." The agency needed someone to create the crime scene procedure manuals.

The lab itself, in Oregon, opened eight years later, after the appropriate funding was secured, the right people convinced of the need for such a thing. To Goddard, it just made sense. "The underlying issue is if you have a whole elephant, it's pretty obvious to almost everyone that it's an elephant," he says. "It's not a hippopotamus, not a rhino. We don't get whole animals. We get pieces, parts, products. We might get a bunch of skins where the species-defining characteristics are gone. We had to come up with new ways of identifying pieces of skin that have been made into watchbands."

And purses and belts and boots. Goddard recalls once receiving as evidence 3,000 pairs of shoes. His lab had to determine the species of all 3,000 pairs (mostly sea turtle, some alligator). Without that information, it's unclear whether a crime has even been committed. "[Human] crime labs do two things: They identify evidence and they link suspect, victim and crime scene together with that evidence," he says. "Wildlife CSI is different: Our first job is to determine what the victim is, because it makes a great deal of difference."

To better explain, Goddard delves deeper into one, let's just call it unique, case. Hundreds of headless walrus were washing up on the Seward Peninsula in Alaska. Alaska Natives such as Inuits and Aleuts, can, by law, subsist hunt, taking

what they need to eat and to create clothing and artifacts. They cannot, however, waste the animals or kill them for illegal trade. So Goddard and two others were sent out to determine when the heads came off—before the animals drifted ashore or after. “We landed next to dozens of decomposed walrus. In doing so, we crashed an airplane,” he says. “We had to wade naked to get to another. It was a very memorable investigation.”

As it turns out, hunters decapitated the animals as they sat on off-shore ice floes, the rest of the carcasses tossed back into the sea until they eventually washed ashore, a determination Goddard and colleagues made by comparing neck bones to other skeleton bones; because the neck bones had been exposed to saltwater, the sun had bleached them differently. The animals hadn’t been hunted for food but rather for their tusks, making the acts illegal.

“Our job is to evaluate the evidence, speak for the evidence [in court],” Goddard explains. “What does it say?” The Ashland lab speaks for a whole lot of evidence. It’s nearly impossible to discuss wildlife forensics without hearing mention of Goddard or his lab. (“I love that man,” one woman in the field gushed.) Despite the adoration, the 32 people in that facility don’t have an easy job, slogging through roughly 1,000 cases a year and 15,000 individual pieces of evidence. The lab is also the official investigator for CITES member countries, meaning it could receive samples from 180 countries, though it routinely sees evidence from about half a dozen.

Generally speaking, the National Fish & Wildlife Forensics Laboratory handles any terrestrial—or land-dwelling—animal cases, as do labs in several states including Wyoming, Idaho, California, Texas and Maine. But the scope of the cases differs for the states, says Dee Dee Hawk, director of Wyoming’s Wildlife Forensic and Fish Health Lab and president of the Society for Wildlife Forensic Science. Nearly “90 percent of our work is matching individualization,” she says. In other words, “does that gut pile … match the meat in the freezer and the blood on the guy’s knife and the head hanging on the wall?”

The annual caseload for state labs is a lot smaller, too—for the Wyoming lab in Laramie, it’s about 100—but no less interesting, from the way Hawk tells it. In one of her all-time favorites, tissue from under a bear’s claw proved that hunters in Colorado had illegally shot a male elk in an area closed to hunting. The hunters brought their trophy into town, leaving it unattended in the back of

their truck. When a black bear took advantage of this ready-made meal, the hunters shot the bear (legally) and called the game warden to get it tagged (protocol). Suspicious of the elk and uncertain about the bear, the warden confiscated the latter. But without sufficient proof of wrongdoing, he had to let the hunters keep the elk.

The warden later found an elk gut pile in that closed off area of the woods. DNA comparison of those remains, the dead bear's claws and the elk's head—at that point, mounted on a wall in Louisiana—proved what the warden had guessed: All three a perfect match. "We ended up making of a case off tissue in the bear's claws," Hawk says, adding, "They lost their [hunting] privileges for quite a few years. They paid over $15,000 in fines," and had to return the elk head.

For most cases, jurisdiction is pretty cut and dried. But when it comes to certain animals, like sea turtles, it can get murky.

IV. In the Sea

In November 2013, a man by the name of Manuel Garcia-Figueroa pleaded guilty to illegally selling $350 worth of endangered sea turtle meat. He was sentenced to 15 days in jail and 150 hours of community service, plus three years of supervised release. By evaluating the evidence, Kathy Moore, a forensic biologist, helped the Department of Justice make its case.

What Dove's lab is to the air and Goddard's is to the land, Moore's is to the sea. Unlike the lab in Oregon, Moore's, the Forensic Unit at the Northwest Fisheries Science Center in Charleston, South Carolina, is small, just herself and one other scientist, plus two more in another lab in Seattle. The lab is part of the National Oceanic and Atmospheric Administration or NOAA. She and her coworker see just 40 cases per year. Moore focuses on sea turtles, marine mammals, some sharks; her colleague does the finfish.

Like the Fish & Wildlife lab, the NOAA lab typically gets "pieces, parts, products," as Goddard describes it. Rarely do whole animals come in, though they sometimes get shells. "If it's a frozen fish filet, it's pretty quick and easy because the tissue is in really good shape. The DNA is, too," Moore says. "If it's a piece of one which doesn't have a lot of DNA in it or a spear gun that maybe has blood on it, that can take longer."

Similar to those who work terrestrial animal cases, Moore's goal, first and foremost, is to determine species. She says she focuses on the marine creatures safeguarded by the Endangered Species Act, the Marine Mammal Protection Act and other laws.

Back for a minute to why turtles might get tricky: Sea turtles spend part of their lives on land and part of their lives in water. So cases surrounding them have split jurisdiction. "If they're in the sea, it belongs to NOAA," Goddard says. "If they're on land, we deal with it." Turtle eggs in the sand? Fish & Wildlife. Turtle meat? Maybe Fish & Wildlife, maybe NOAA. Illegal animal goods in port? Fish & Wildlife. Those same illegal goods at sea? NOAA. The line is typically black and white—but occasionally it blurs.

The case of Garcia-Figueroa was clearly NOAA. From photos and samples Moore received from law enforcement, she identified endangered hawksbill turtles and threatened green sea turtles. Not until she saw a DOJ-issued press release, however, did she know how well the work paid off. "Some of these people taking sea turtles, they know it's illegal," she says. "If they see enforcement on the ground or if they get probation or in the rare cases they get imprisoned, they're going to think twice before they do it again. And their friends are going to think twice. It's going to reduce recidivism and it's good for the sea turtles. That's the point. We don't want them to go extinct."

Moore says her lab typically identifies turtle eggs from Florida and South Carolina, and meat from Puerto Rico. "Every now and then we'll get them coming across the border," she says. People believe the eggs are aphrodisiacs, she adds, noting without a hint of irony, "There's a black market for almost everything."

V. Past, Present and Future

What's in vogue changes with the metaphorical season, on the whims of those doing the poaching, on the supply available, on those prosecuting cases. It also kind of depends on whom you ask.

According to Moore, trends in the labs often hinge on what law enforcement opts to concentrate on at any given moment. "They may hit one sector really hard with a lot of investigations and a sting operation to sort of clamp down on one part of the trade," she says. "When they feel like they've

prosecuted a lot of people, there may be another emerging market that they need to switch their focus to."

For a while, it was popular to masquerade Vietnamese catfish as grouper. Smuggle the former into the United States and sell it as the pricier latter option. A quick article search for "Vietnamese catfish" affirms Moore's memory: "Florida Restaurants Serve Vietnamese Catfish, Call It Grouper" from Bloomberg, "'Key West Grouper' in Name Only," from *The Boston Globe*. The most recent dates back to 2011.

Now totoaba is in fashion. "We hadn't seen a case in 10 years, until last year," Moore says.

Totoaba, or red drum on the East coast, is the largest fish in the *Sciaenidae* family. In 1979, the ESA listed it as endangered and the IUCN still considers its situation critical. Yet Moore's lab has started encountering the species. She says she guesses it's because when the population was low, poachers simply paid the fish no mind. As their numbers grew, they could be fished—and suddenly had real value, both to the people who make their living by illegally poaching and those trying to stop them.

"They've been on the Endangered Species list long enough [to let them rebound]. They are no longer commercially extinct," she says, of totoaba. Therefore, "there is new enforcement interest."

Trends, Goddard agrees, depend on the availability of the species, plus their perceived value in the marketplace. Before wearing fur became a faux pas, he says, the fur coat trade was "very active." Same goes for shoes and purses made of alligator and crocodile skin. Today, Goddard sees another growing trend, a whole new caseload for his lab. "Chemical analysis of wood," he explains. "We have to distinguish the species source." Though it may sound like a job for the U.S. Forest Service, trading of illegal timber falls under the Lacey Act, something only Fish & Wildlife Service agents can enforce, he says.

Much like with animals, rarely does the lab get enough of a tree's properties to tell the species by looking. Usually, he says, Fish & Wildlife receives two-by-fours, and after a scientist determines the tree's family via visual microscopic identification, Lab Deputy Director Ed Espinoza evaluates the wood's composition. "If we had the whole tree, it'd be pretty easy to identify,"

Goddard says, “but when it’s turned into lumber you’ve lost the species characteristics.”

In addition to upping the number of cases for Ashland—there are 150,000 tree species—analyzing a new set of illegal goods brings with it new challenges. The day we spoke, Goddard’s lab was “actively cutting up rosewood,” a genus that in Madagascar alone comprises more than 50 different species. Espinoza discovered, quite by accident, that the timber he was testing at that time—likely *Dalbergia nigra* or Brazilian rosewood—contains a natural insecticide, which is also toxic to humans. Contact irritates the eyes and the skin and can cause respiratory problems, side effects that worsen the greater the exposure. In fact, Espinoza required medical attention. “We have to be very careful when cutting up the wood,” Goddard says.

VI. The Next Generation

What would benefit the field immensely, most interviewed for this article agree, are more people trained to do this work and more places to do it, goals the Society for Wildlife Forensic Science and at least one university are (separately) working toward.

The Society, founded in 2009 by Hawk and Espinoza, was established to “give wildlife forensics a voice,” according to Hawk. “When you go into a human forensics lab, everyone is doing the exact same test in the exact same way. They have kits for everything,” she says. “There’s not a lot of standardization in wildlife forensics.”

It wouldn’t be cost-effective to create crime scene kits for every animal the labs might encounter, Hawk contends, so second to that, the field now aims to implement as much process standardization as possible. Two years ago, the Society created a Wildlife Forensic Scientist certification program that to date, 24 people have completed. Hawk says the governments of several countries have approached the Society about making certification mandatory for their scientists.

In 2014, the University of Florida began the country’s first Wildlife Forensic Sciences online certificate and continuing education program. Susan Underkoffler helped develop the curriculum, an online program open to wildlife officials across the country and the globe.

See, the problem isn't just a U.S. one, or even a North American one. These crimes worldwide are part of a multi-billion dollar industry. In 2010, illegal trafficking of timber alone totaled $3.5 billion, according to the U.N. Office on Drugs and Crime. Tack on another $75 million for poaching of ivory from elephants, tiger skins and rhino horns in Asia.

This past May Underkoffler traveled to Africa to meet with wildlife control officers from Botswana, Namibia, Seychelles and South Africa. "When you start talking about wildlife forensics and poaching, people are actually personally offended by what's going on in their countries and they want it to stop," she says. "They're willing to learn whatever it takes. It's actually a personal affront to them. I hadn't thought people would care all that much."

Often, she continues, wildlife officers in these countries find the poached animals but either don't know how to process the crime scene or collect the materials but have nowhere in country to send them for testing. Corruption happens, too—wildlife officials collaborate with rather than prosecute poachers. Worldwide efforts to crack down on poaching have been broadening to include wildlife forensics, in places like Taiwan and recently, with the opening of a lab in Malaysia in late 2013.

"There's been a little more of a push on an international scale just to get labs open in some of these other countries, which is fabulous so long as they understand that there's forensic rigor that needs to go along with it," Hawk says. "Wildlife forensics is a little bit different. You have to know a little bit about taxonomy. You can't just have a great scientist that's got great technical skills in the lab." Just how many more countries will start taking these crimes seriously remains to be seen.

As I wait to leave the Feather Lab at the Smithsonian, Marcy Heacker and Faridah Dahlan start discussing a case that just came in. A bald eagle and a Cessna plane up in Alaska collided. The strike apparently messed up the plane's landing gear. I imagine the bird didn't fare too well either, though neither scientist says as much.

"I've worked here since 2000 and I still find it fascinating," Dahlan had explained earlier. This despite the fact that for much of every day, she must tone down her extra-large personality and stare at the As and Cs and Ts and Gs of

DNA sequences on a computer screen. Her coworkers feel the same, passionate about what Carla Dove almost lovingly calls “snarge,” the goopy mix of tissues and feather and particulates they analyze. After a day watching the researchers in the Feather Lab—and hearing the passion in the voices of every person I spoke with—Dahlan’s sentiment doesn’t require much explanation.

They’re scientists and detectives in one, helping to solve crimes directed toward creatures they love. “It’s like solving a puzzle. Every piece of evidence we get is different than the one before, even though the species might be the same,” Dove says. “Today we might get tail feather or wing feather. Tomorrow we might get blood. Every case is different.”

The sun has come up in the hours since I arrived at the museum, warming the sidewalks and the air. I leave thinking about the sleuth work these scientists conduct, wondering about the next big case they’ll crack, and contemplating mysteries solved with a combination of smarts, science and some good old-fashioned evidence.

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