

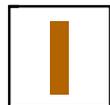
BIOLOGY

The New Flight of the Ibis

Ornithology: How a determined scientist taught an ancient species to migrate again.

BY CHELSEA WALD
PHOTO BY JOHANNES FRITZ

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In 2007, on a fine summer day in rural Austria, a flock of northern bald ibises followed two paraplanes, gondolas with prop engines, held aloft by yellow and blue parachutes. Although the ibises looked like vultures on the ground, the resemblance disappeared in the air. In flight their long, curved bills jutted forward, their black wings shimmered purple and green.

The scientist piloting one of the paraplanes was leading the ibises to a mountain pass in the Alps and a wintering ground in Tuscany. For centuries, ibises had been plentiful in Europe. They summered north of the Alps in today's Austria, Germany, and Switzerland, where they nested on cliffs and castle walls and fed from meadows. By the early 1600s, the sociable animals, vulnerable to hunting, had been wiped off the continent. If this group of 20 learned the route to Tuscany and returned on its own, it would be the first colony of northern bald ibises to migrate in Europe in 400 years.

But the birds were not sticking to the script of their historic mission. After shadowing the paraplanes for about five miles, they turned around and flew back to where they started that day. The birds landed in a field and started preening and making deep-throated squawks. They looked like an aging, addled punk band, rings of black feathers around receding red foreheads. "Scheisse," said Johannes Fritz, the scientist, cursing in German.

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For four years Fritz had been trying to do something he had never even heard of in zoology—teach an ancient bird to migrate. He had been a ^{ISSUES BLOG O}doctoral student in biology at the Konrad Lorenz Research Station in Austria, founded in the 1970s by Lorenz, the Austrian zoologist who demonstrated some types of young birds “imprint” on the people who raise them, accept them as foster parents, and follow them everywhere. Fritz got the idea to lead the birds in the air from the movie *Fly Away Home*, about a girl and her father who teach a wayward brood of Canada geese to migrate to a North Carolina bird sanctuary behind a “microlight,” or engine-powered hang glider. Fritz had worked with dozens of hand-raised ibises in captivity. But he knew that if the birds were to flourish in the wild, they would have to learn to migrate on their own.

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By 2007, his optimism was fading. Did he understand enough about migration to make the reintroduction work? Princeton University professor of ecology and evolutionary biology James Gould, co-author of *Nature's Compass*, has called animal migration “one of the greatest mysteries of science.” And no scientist had ever tracked a migration of the ibis in Europe. There was only one tiny, dying colony of migrating northern bald ibis left in the wild. And that was in Syria, where little was known about them.

For the past six years, Fritz has never stopped trying. Since 2003, he has led eight migrations with the ibises. In 2011, a female ibis flew the first new migratory route on her own, an extraordinary achievement. Subsequent migrations have brought surprising new insights that will help scientists work out how birds navigate, learn, and conserve energy during their journeys. Scientists marvel at the new migration of the ibis. Martin Wikelski of the Max Planck Institute of Ornithology said tracking the flights “is like following the walk of mankind out of Africa.”



In a recent evening at his ibis colony in Burghausen, Germany, Fritz, 46, who heads the “Waldrappteam” (Waldrapp is the German name for the species), explained that he never set out to be a flight instructor for the ibis. He arrived at the Lorenz station, a field station of the University of Vienna, in the '90s to study the social traditions of the greylag goose, a common European species. The northern bald ibis, he said, “dropped out of the air” into his life, his voice accented with the harsh but likable consonants of his native Austria. This May, the nonprofit Waldrappteam received its biggest donation: a grant worth more than 4 million euros from the European Commission and other sponsors.

By the 1990s the northern bald ibis was not only long gone from Europe but also critically endangered around the world, namely in the Middle East and North Africa, where it once flourished. In the 1950s, Turkey used DDT intensively, killing many hundreds of birds while also interfering with their reproduction. Conservationists caught more than 40 of the remaining wild birds in the '70s and '80s, preventing them from migrating but allowing them to breed on site. The hatchlings did well, but the wild flock continued to decline and was declared extinct in 1990. Their migration tradition died with them. Without experienced migrators to show them the way, the descendants of the captured birds remained in Turkey, cared for by humans, unaware of where their ancestors had spent their winters.

In the meantime, zoos figured out how to breed the northern bald ibis using descendants of a North African population. There were soon more than zoos could handle. Some conservationists experimented with releasing them into the wild to form colonies, but the young birds didn't cohere into a group and instead wandered off.

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In '97, Kurt Kotrschal, director of the Lorenz station (who had taken over the station's leadership from Lorenz, who died in 1989), acquired birds from the Alpenzoo in Innsbruck. He thought the station could establish a non-migratory colony by imprinting new ibis chicks. Just after hatching, the helpless chicks, kept from their natural mothers, bonded to human foster parents. (Students and young scientists usually take the role.) The chicks depended on their foster parents for food and protection and stuck close by them. So it was surprising that in August of the first year all but a handful of the birds suddenly flew off. Where had they gone? Luckily, Kotrschal said, people who see odd birds often try to find out where they came from. He got calls, mainly reporting dead birds, from as far away as the Netherlands, Lithuania, northern Germany, and Russia.

What compelled the birds to cut their ties with their foster parents and fly off? One likely possibility, which turned out to be the scientists' first key insight into the ibises' migratory habits, was *Zugunruhe*: Seasonal migratory restlessness caused by sudden physiological changes, such as an increase in the hormone corticosterone. This nervous energy convinces birds to leave their breeding grounds for warmer places that will provide them food for the winter. In the spring it pushes them north to breed, where predators are fewer thanks to harsher winters, and where the first flush will provide a dense food supply.

Some birds, like geese, are happy to give up their migratory traditions if the conditions are right, jaunting from pond to pond. But the ibises' extreme August journeys indicated that they were seized by an overwhelming drive to go, in spite of the fact that they didn't know their destination. This continued to be a problem for Kotrschal, who eventually succeeded in establishing a sedentary colony at the station. But it also represented an opportunity. If someone could harness the ibises' restlessness and teach them where to go, the species' lost migration traditions could be recreated.

Enter Fritz. He figured migration was a social tradition in the ibis, as it was in geese, cranes, and other water birds. Those types of birds followed adults on their first migration, and seemed to learn the route by memorizing visual landmarks in a sequence—a sort of mental photo album. That was different from many other birds, especially migratory songbirds, which are known to have a powerful innate migration vector that tells them which way to fly—no learning needed.

Although the ibises had an innate migratory impulse, their sense of direction was clearly lost. When they flew off their first year at the station, most of them flew roughly north, following the valley, when they should have flown south for the winter. Given the ibises fall “on the extreme side of the socially learned,” Fritz remembered thinking, he figured it would be relatively easy to teach them a new tradition. Knowing the imprinted birds would follow their foster parents anywhere, Fritz had the idea of having foster parents sit behind pilots in two-seat microlights, calling out to the birds, “Come! Come!” to fly with them.

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In 2001, Fritz got start-up funds from the Vienna zoo to buy his first “rather old microlight,” which, like the one in the movie *Fly Away Home*, had a rigid wing over the cab instead of a parachute. He enrolled in a pilot school in Spain but quickly discovered that flying made him queasy. His instructor warned him not to tell the doctor, since that would disqualify him. Fritz chewed motion-sickness gum, kept his lunch down and mouth shut, and went home with his license.

There were no historical records of where the species would have wintered in Europe, but Fritz guessed that Tuscany would be about right. He consulted with Italian ornithologists, who assured him many bird species winter in the famous Italian wine country. Fritz found a nature preserve in Tuscany, run by the Italian branch of the World Wildlife Fund, on the western coast of Italy. He was allowed to establish an aviary, which his team would use to care for and monitor the birds.

In August 2003 he mapped a 680-mile route through a pass in the Alps, down the Tagliamento River to the Adriatic Sea, along the coastline, then across the Apennine mountains to the nature preserve. He wanted to follow big landmarks the birds would remember.

The first flights didn’t go well. The old microlight was too fast for the ibises. Its slowest speed was 37 miles per hour, while the birds’ maximum speed was 27 miles per hour. Fritz had to keep circling around, waiting for them. But the biggest problem was that the imprinted ibises refused to fly much of the time. “We thought the birds have to follow when we want them to follow,” Fritz said. But it turned out that the ibises had different ideas. Even if they did agree to follow on any given day, they often gave up and landed before they reached the place the team had intended to spend the night. Fritz often had to beg landowners to let them set up camp.

“It was hilarious,” said Kotschal, who accompanied the migration on the ground. “In the morning you wouldn’t know where you would end up in the evening. Sometimes it was the middle of a field in northern Italy. One time it was the first international airport of Venice, at the Lido di Venezia. You wouldn’t know if you would leave the place the next day or only a week later.” But Fritz didn’t think it was so funny. He had no knowledge of how a northern bald ibis would naturally migrate, and it showed. He and the birds were simply out of sync.

The birds’ longest flight that year was about 19 miles in one day—a qualified success. On the other hand, the team was forced to load the birds in vans and drive them several stretches when they refused to fly. But the birds eventually got to Tuscany, one short segment at a time. The next years went better, as Fritz acquired slower microlights and allowed for more rest time. But getting the birds to fly over the Alps, the most direct route, was a struggle. He never made it

through a pass without taking the birds some of the way in a van. After 2007, he called it quits for the Alps. He figured the birds simply couldn't cross the range.

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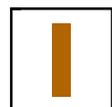
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Fritz also doubted his expertise as a pilot and enlisted Walter Holzmüller, an Austrian paraplane champion, as a second pilot. Holzmüller brought new paraplanes, the team's slowest aircraft yet, and finally a good fit for the birds' speed. Fritz hoped their new route would also be a better fit: The fastest way to the nature preserve without crossing the Alps was to the east through Slovenia.

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Those changes turned out to be the right decisions. All of a sudden the human-led migration started to click. Holzmüller noticed that the birds got bored if he just flew straight, so he wove to keep their attention. But what the birds really wanted was to soar in thermals. Studies had shown that large birds like storks and vultures conserve energy when they spiral up in hot air currents and glide down to the next one, barely moving a wing. But nobody had ever taught the ibises that soaring would be the best way to migrate. Wikelski of the Max Planck Institute of Ornithology marveled that the hand-raised birds “still have the ability and knowledge of how to fly in thermals and use streaming air efficiently.”

The new technique meant the paraplanes and the birds could go all day. One summer day in 2010, the birds flew almost six hours and more than 160 miles, similar to the distances that conservationists had observed the Syrian birds fly. (It was “by far the longest flight of an airplane in company of hand-raised birds,” Fritz would later boast in a press release.) Fourteen birds made it to Tuscany in only seven flight days. They stayed there for the winter, where the eating was good. Hopping from field to Tuscan field, they picked up grubs with the tips of their beaks and threw them into the back of their throats.



In July 2011, Fritz had the success he had long been waiting for: a lone bird named Goja returned on her own from Tuscany to the breeding grounds in Burghausen. Other birds arrived soon after. Global Positioning System trackers on the birds sent periodic locations to the scientists, showing that the ibises had taken shortcuts directly over the Alps.

The ibises had overturned Fritz's assumption that they would follow the route that he had taught them, having memorized a sequence of landmarks. They seemed to start out that way, following the learned route over the Apennines and up the Adriatic coast. But then they deviated. A statistical analysis showed that they chose straight-line paths through passes in the Alps. In short, they found completely new—and better—ways home via places they had never been before.

It seemed that all Fritz had to do was show them where the wintering area was. “Everything else is in their genetic background,” he said.

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Fritz started spreading the word to other researchers. They were amazed. “We know other animals do these things on a small scale,” said Wikelski. “Desert ants can go on a curly road trajectory, and then at some point when they decide to go back, they go straight back.” But Fritz’s birds, Wikelski said, were the first natural vertebrate population—at least one scientist had observed—to show that skill. Gould said the ibises’ migration was “certainly news.” It proved they were sophisticated navigators, more similar to migratory birds with no social tradition, which can find “a kind of planetary shortcut” with an internal, GPS-like map sense.

Because he tracked every single member of this new migrating population, Fritz knew that Goja, the trailblazer, didn’t learn the shortcut from another bald ibis but invented it herself. She also taught a new generation, leading a young male bird directly south to the wintering area. Fritz had done it. He had put the ancient ibis back in touch with its natural instinct. In 2012, Goja bred. Fritz was thrilled. “Goja is basically the first breeding migratory bald ibis in Europe in almost 400 years,” he said. “It’s a big success. It’s a concrete indication that we can give this bird a second chance in Europe so that it can return back to the wild.”

The ibis, however, remains susceptible to an ancient practice out of its control. During one of her migrations last year, Goja was shot and killed by hunters in Tuscany. Fritz’s team estimates that as many as 49 of the 102 ibises they have led to Tuscany have been killed by illegal hunters. The new European Commission grant includes money for an anti-hunting campaign, focused on ending illegal hunting in Europe.



In a summery day in May, the air still electric after a storm, Fritz drove up to the Burghausen colony to check on his brood of ibises. On the top ledge of a two-story aviary were seven nests, seven parents sitting on them. At the start of the breeding season a few weeks earlier, the birds quarreled, stealing each other’s nesting materials and sparring with their beaks. But now they seemed oddly peaceful.

Goja, the trailblazer, didn’t learn the shortcut from another bald ibis but invented it herself.

Fritz was proud the ibises were offering scientists new insights into avian migration. Franz Bairlein, director of the Institute of Avian Research in Germany, was studying the birds to learn about long-distance migration, how birds alternate quickly between two opposing physiological states: intensive energy use during flight and intensive energy storage during stopovers. He analyzed blood samples taken daily before the ibises’ takeoff and after landing, something that had never been possible before. By matching the ibises’ blood chemistry to their flight behavior, Bairlein hoped to learn how the birds regulate these physiological changes. Another group was

studying the aerodynamics of the ibises in flight. Their “V” formation was giving scientists new clues into how birds conserve energy over long hauls by “drafting,” or reducing the drag in front of them, by flying in a precise angle.

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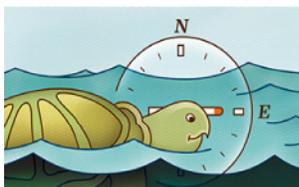
The results of these studies could help Fritz be a better leader, equipped with hard data instead of educated guesses, when he begins human-led migrations again in 2014 to increase the number of migrating birds in Europe to a sustainable number. He plans to try to go through the Alps again. But this time he will take routes that the birds have chosen themselves. He might also figure out the physiological underpinnings of why his birds need so much rest, a problem that’s plagued him since the very first migration. “They have food, they have a good body weight, they have everything, but sometimes they do not want to continue,” he said. “That’s still something we don’t understand.”

This year, seven new chicks were born at the Burghausen colony. Fritz made a prediction. In five years, he said with a grin, Europe could be home to more than 100 “free, wild” northern bald ibises, breeding north of the Alps and flying south for the winter.

Chelsea Wald is a freelance science writer who contributes to Science and New Scientist. She migrates between the United States and Austria.

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