

# For the Love of Hummers

*Devoted citizen scientists help researchers understand the West's tiniest birds*

At 6:30 on a Wednesday morning, the early August sun creeps over a rocky ridge at Mesa Verde National Park in southwestern Colorado. Dense stands of Gambel oak, Utah serviceberry and rabbitbrush spring up from the grassy meadows around Morefield Campground. Birdsong and the whir of hummingbird wings mingle with human whispers in the chilly dawn air. Steve Somora, a retired electrical contractor, peers through the pale light at a hummingbird feeder, which hangs from a frame about 50 feet away. The frame supports a Hall trap, a cylindrical mesh curtain that can be raised and lowered from a distance. As Somora watches, a hummingbird hovers near the trap, then ventures below it, alighting on the feeder's rim. When the tiny creature lowers its head to sip the sugar water, Somora releases the trap, which drops to cover the feeder and the startled bird. He slides his hand inside the mesh and reaches for the bird, holding it gently in his hand; its little head sticks out between his first two fingers. Carefully placing it in a net bag, he carries it over to a picnic table, where it will be identified, measured and banded before it is released.

Like his six fellow volunteers, Somora got up hours before dawn to drive to Mesa Verde. They're all part of the Hummingbird Monitoring Network (HMN), a nonprofit organization dedicated to hummingbird conservation. Most of them have been doing this twice a month, May through September, for four years; 2011 marks the fifth year of monitoring at Mesa Verde. Their enthusiasm is palpable, their eyes as bright as the sheen on a hummingbird's feathers.

Lynn Udick, a research database designer, sits at the picnic table wearing a magnifying headlamp, with a hummingbird identification manual within reach and an array of small tools and supplies spread out before her, including those staples of volunteer gatherings everywhere, coffee and banana bread. She is the designated bander. Jane Pedersen, a semi-retired psychotherapist (and wife of Steve Somora) records the information on datasheets; another volunteer enters the data into a computer. Yet another sits next to Udick, ready to feed the hummingbird sugar water before it is released.

What brought this disparate group together at Mesa Verde, and at the many other sites maintained by the network, is a love for hummingbirds, those amazingly agile, brilliantly colored, blurred-winged little creatures that enliven our gardens every year, aggressively protecting their flowers — and feeders — and sometimes migrating thousands of miles to breed. The landscape of the West is changing rapidly, for many reasons, and hummingbirds face what could be a long and difficult period of adaptation. What keeps the volunteers returning is the knowledge that the work they do may contribute to scientific discoveries that help hummingbirds endure.

Despite their allure, hummingbird populations are not well

studied, and no one knows for sure whether their numbers are rising or falling overall. Federal scientists, though, agree that hummingbirds in the Western U.S. are threatened by the loss of their breeding, wintering and migratory stopover habitat, as well as by climate change, which, among other things, affects the availability of their primary food — flower nectar. In 2008, the U.S. Fish and Wildlife Service included seven hummingbird species in its list of highest-priority bird-conservation needs: Costa's, Calliope, Lucifer, rufous, Allen's, blue-throated and buff-bellied.

The information gathered around the West by the hundreds of HMN volunteers may be the best defense these hummingbirds have. And it's gathered one bird at a time. At the picnic table, Udick retrieves the net bag from the stand and begins the banding process. HMN protocol dictates that birds cannot hang on the stand for longer than 30 minutes. Once the number of birds in bags reaches the maximum Udick can band in 30 minutes, the trapping stops, and the trapper simply starts counting the hummers that enter the trap's perimeter. Banding provides information about a representative sample of the various local species, while counting gives an estimate of their relative abundance.

Udick checks to see if the bird has a band (it doesn't), and removes it from the bag, holding it in the palm of her hand. The bird doesn't struggle; instead, it seems to watch her intently. "Can everybody see his beautiful red gorget when the light hits it?" she says to the new recruits and other observers. "This guy's a broad-tailed male. They're the ones that make that really loud trilling sound when they're flying, and that's because of the special shape of their outer flight feathers."

Several other species occur at Mesa Verde, including the black-chinned, which breeds in the area, and Calliope and rufous, which both migrate through. Udick keeps track of all kinds of details, including the amount of fat in the bird's breast and other areas (fat helps sustain birds on long migrations), and the presence, or absence, of pollen on the head and bill, which shows whether there are nectar-producing plants nearby.

Udick is very careful not to injure the birds she bands. She has even made a model hummingbird out of little yarn pompoms in order to teach volunteers how to handle the tiny birds. She picks up a minuscule numbered band; 75 of them would fit on the surface of a penny. Volunteer Lee Rogers has customized tools for smoothing and shaping the bands, and has created a tool for measuring birds' legs to ensure a perfect fit. Udick reads out the number on the band so that Pedersen can record it, then closes the band around the hummingbird's tarsus. All of the data collected is sent to the Bird Banding Laboratory run by the U.S. Geological Survey and the Canadian Wildlife Service, which makes it available for use by scientists and the public.

An adult male black-chinned hummingbird approaches a sunflower. The species is found throughout the intermountain West. GEORGE C. WEST



A volunteer inspects the tiny coded band, after attaching it to the leg of a hummingbird at a Hummingbird Monitoring Network site in Madera Canyon, Arizona. Inset, from top: Cornering a hummingbird after it's caught in a feeder trap; inspecting a wing; measuring a beak; coded bands of various sizes; final inspection. JOE MESSINA



## Hummingbird range

Anna's



Broad-tailed



Rufous



SOURCE: CORNELL LABORATORY OF ORNITHOLOGY

“What has thrilled us the most this past year is the start of our Four-Year Club,” says Udick. “Those are the hummingbirds that we’ve trapped and banded every year of our four years of monitoring out here.” They’ve already seen some five-year hummingbirds this year: “We joke about how we should get them gold bands.”

**HUMMINGBIRDS ARE FASCINATING** creatures. They live only in the Western Hemisphere, with most of the approximately 340 species found in South America. Fifty-seven species live in North America; of these, 16 are migratory and breed in the U.S. They feed on nectar from flowers (and sugar water from feeders), which supply sucrose for energy. They also eat spiders and small insects, which provide protein for growth and

reproduction. Some species may travel close to 4,000 miles during annual migrations from winter ranges in Central America to breeding areas in the North-western U.S. and Canada. A few even fly as far north as Alaska. They are the principal pollinator for 130 plant species, mostly wildflowers, in the Western U.S. Despite their tiny size, they play a vital role in the region’s food chain — one reason why it’s important for officials to consider their needs when making land-management decisions.

The Hummingbird Monitoring Network is housed at the home of Susan Wethington and Lee Rogers in the Patagonia Mountains of southeastern Arizona. A tall woman with shoulder-length silvery hair and clear blue eyes, Wethington serves as the executive director and does it all — fundraising,

recruiting, training, monitoring, outreach. Before embarking on this mission, Wethington was an engineer with IBM, but she became fascinated by plants and birds during the four years she spent volunteering for the Arizona Sonoran Desert Museum in Tucson. By 1990, she was ready for a change. After applying for and receiving an educational leave from IBM, Wethington enrolled in the graduate program of the Department of Ecology and Evolutionary Biology at the University of Arizona. Her home was located in the path of migrating hummingbirds, so it seemed natural for her to focus on the little visitors. In 2000, she completed a Ph.D. on the interaction between hummingbirds and the plants they pollinate.

During her graduate work, Wethington realized how little was known about



the population dynamics of hummingbirds in North America, even though their physiology had been fairly well studied. Determining the status of hummingbird populations is next to impossible without baseline information on each species, the habitat important to their survival, and the specific factors that threaten them. Even if it were determined that hummingbird populations were at risk and needed federal protection, no species can be listed under the Endangered Species Act without solid data.

To address this "hole in hummingbird conservation," Wethington sought out George West, a retired ornithologist from the University of Alaska who now lives in Green Valley, Ariz., and Barbara Carlson, then the director of nature reserves for the University of California-Riverside. Both were already active in

hummingbird banding. In 2002, the trio founded the Hummingbird Monitoring Network.

They agreed from the start that the network would focus on setting up and running monitoring stations to collect data. That meant training and maintaining a small army of volunteers. In 2010, 1,500 retirees, college students, policemen, accountants and business owners monitored 32 sites across Arizona, California, British Columbia, Utah and Colorado. They donated 14,000 hours and drove 48,000 miles. The Hummingbird Monitoring Network runs on a shoestring: Its expenses were just \$66,617 in 2010, with funding coming from government agencies, private individuals and foundations.

"You can get a tremendous amount of data collected for a limited amount of resources," says West. "And the volunteers get the satisfaction of knowing that they're gathering information that will eventually end up protecting and preserving hummingbird populations." Citizen scientists are also more likely to weigh in on policy decisions about natural resources. "Polls say that 85 percent of the American public support conservation," West adds. "Citizen science helps to energize some of that base."

There are potential disadvantages, though, and one of them is attrition. Volunteers tend to get bored and move on to other activities. Fortunately, that doesn't seem to be a big problem for HMN. "Hummingbirds are truly unique," says Sarah Haas, biologist for Bryce Canyon National Park in southern Utah, "the way they fly, their association with flowers, their ability to convey personality in such a small package." For Jane Pederesen at the Mesa Verde site, it's all about migration. "To know that these tiny birds that weigh just a few grams fly as far north as Alaska and back to the same spot here at the park year after year is just incredible!" Her voice rises with excitement. "Yesterday, I was watching a rufous sitting in a tree outside my bedroom window, and a wasp flew up, and he ate it. I thought, 'Oh, my goodness!' I knew they ate bugs, but I didn't think this tiny little hummingbird could take a bug that large."

**WILL THE DATA** provided by the hummingbird network really contribute to conservation? It's probably too early to tell for sure, but already there are hints at the value of this effort. "In September 2010, the *Arizona Daily Star* published an article on hummingbirds," says Wethington. "The reporter had interviewed people who were monitoring hummingbirds in the area, particularly in the Huachuca and Santa Rita mountains, and they were saying that hummingbird populations were crashing. But when that reporter got to me, our data was able to tell us that, yes, in 2010 the numbers of birds at feeders were low. We could also see from our data that this

was likely part of the cycle of variability in hummingbird populations, because hummingbird numbers were low in 2005, and then rebounded from 2006 to 2009." Still, Wethington has no idea whether hummingbird populations will rebound this time. It'll take many years of collecting data, and many more monitoring sites, some of them likely covering much larger areas.

In the meantime, other scientists are beginning to tap into the network. Holly Ernest, a tall woman with short dark hair and a bright smile, is a professor in wildlife population health and ecological genetics at University of California at Davis. In Ernest's Wildlife and Ecological Genetics Lab, she and her graduate students apply DNA analysis and conservation ecology to the study of wild birds and mammals. Ernest became interested in hummingbirds in 2006, when she volunteered at a banding station at the McLaughlin Natural Reserve near Clear Lake, Calif. "I was just going to do it as a volunteer, to get out of the office and to learn a new skill," Ernest says. "And then, once I started, I saw all kinds of research questions that hadn't been addressed, and I was really excited, especially because some of the questions applied to my own work."

One of her lab's main interests is wildlife disease. Ernest noticed crusty, wart-like nodules appearing on the feet and legs and around the eyes and the base of the bill of one species in particular — the Anna's hummingbird. She wondered if the birds had a disease called avian pox, or whether it was something else. She began collecting specimens of the crusts, which often fall off afflicted birds when they're handled, and in 2010, enlisted HMN volunteers to send crusts and feathers to her lab. Now, the researchers are developing the laboratory tools to analyze the samples.

Ernest's lab is also studying population genetics, using genetic material to identify individuals and populations. HMN citizen scientists, following the protocol developed by Ernest, provide her lab with feathers from which DNA is extracted. The information gleaned will help the researchers understand the structure and genetic diversity of entire populations and species of hummingbirds.

Feathers collected by volunteers are also being used by another scientist, Jonathan Moran, an assistant professor in the School of Environment and Sustainability at Royal Roads University in British Columbia. He's measuring the amount of deuterium — a naturally occurring stable hydrogen isotope — in the feathers to help track down the nesting and wintering areas of rufous hummingbirds. Deuterium concentrations are found in a predictable gradient across the globe associated with latitude. Plants take up the isotope from precipitation, and then hummingbirds absorb it from the nectar they imbibe and the insects



### Incredible hummingbird facts

Hummingbirds are the smallest birds in the world and **the size of raisins when they hatch**. The tiniest species is Cuba's two-inch-long bee hummingbird.

They often **double their body weight** before migrating.

They can **fly backwards** and forwards, straight up and down, side-to-side, and are the only birds that truly hover.

They **convert nearly 100 percent** of the sugars they consume in nectar into energy — one of the highest use-ratios of any food by any animal.

They have the **largest heart and brain** of any animal on earth in proportion to their body weight.

During flight, their hearts can beat **1,200 times per minute**. The average human heart only beats 72 times per minute.

They fly at speeds up to **30 miles per hour**.

—Marian Lyman Kirst

SOURCES: FIELD GUIDE TO HUMMINGBIRDS OF NORTH AMERICA BY SHERI WILLIAMSON; ANIMAL DIVERSITY WEB, THE UNIVERSITY OF MICHIGAN MUSEUM OF ZOOLOGY; DO HUMMINGBIRDS HUM? BY DR. GEORGE WEST; DR. SUSAN WETHINGTON, EXECUTIVE DIRECTOR, HUMMINGBIRD MONITORING NETWORK  
HUMMINGBIRD FLIGHT ILLUSTRATION BY KARTA24, CC VIA WIKIPEDIA



ologist for the Dixie National Forest in Utah, noticed that an unusual number of hummingbirds were coming through the rugged plateaus and deep canyons of the Grand Staircase-Escalante National Monument. She contacted Wethington; they worked with Sarah Haas and Terry Tolbert, one of the monument's wildlife biologists, to add three new sites to the hummingbird network — one in a riparian area inside the national monument at 5,400 feet above sea level; another in the desert scrub at the Escalante Visitor Center, at 6,000 feet; and a third at 8,000 feet in Bryce Canyon's ponderosa pine forest. Interagency cooperation has provided benefits beyond the institutional support. "We're able to spread out the effort and look at different areas," says Haas. "Then we can look for patterns over a much larger region."

Hummingbird researchers are especially intrigued by landscape patterns, particularly the locations of the nectar plants the birds rely on. Biologists collect and identify the pollen of flowering plants in monitoring areas. By comparing pollen samples taken from the heads and beaks of hummingbirds with the pollen of various plants, they can identify the species on which the hummingbirds rely.

Young and her group also hope that hummingbirds can shed some light on how climate change might affect ecological systems. How, for example, will a warming climate affect the flowering time of nectar plants? How will that affect hummingbird migration and survival, and what can it tell us about other species with similar habitat needs?

that they eat. When the birds grow new feathers after hatching or molting, the feathers reflect the deuterium concentration of the foods the birds ate and thus the latitude at which those feathers grew. So, because hummingbirds molt in the winter, the feathers collected on their northbound migration will, theoretically, reveal the latitude of their wintering grounds at the southern end of their range. Moran discovered that male and female rufous hummingbirds appear to

winter in the mountains around Guadalajara, Mexico, but in different areas. More research is needed to pinpoint exact locations, he says, but the results suggest that protecting rufous hummingbirds in their wintering grounds means identifying the places that harbor each sex.

The hummingbird network has expanded over time and now monitors some sites managed by federal agencies. In the spring of 2009, Lisa Young, a bi-

## Citizen scientists to the rescue

The wildlife species about which we have little or no information far outnumber those that are thoroughly studied and documented. Basic population trends are missing for even some of the best-known species, such as the Mexican spotted owl and the northern leopard frog. Better coordination between state and federal agencies could ensure that researchers collect enough important data on a few species rather than a lot of scattered data on many species. But the biggest challenge to adequate monitoring is lack of funding — and that's where citizen science comes in.

These efforts train volunteers to go out in the field and collect accurate data on wildlife. The programs are generally inexpensive, gather a lot of information by involving large numbers of people, and foster a sense of stewardship. In the past, most citizen science efforts focused on

the more charismatic species, especially birds. Now, more and more researchers are realizing the value of having dedicated — and inexpensive — help with data collecting. Such volunteer-manned projects track a wide range of wildlife species, as shown in the following table. JEAN PALUMBO



**Citizen scientists are surveying mountain goats in Glacier National Park.** GLACIER NATIONAL PARK

Program	Location	Volunteer effort	Organization
Salmon and Trout Enhancement Program	Numerous locations throughout Oregon	In 2010, 537 volunteers put in 8,767 hours surveying 146 miles of streams	Oregon Dept. of Fish and Wildlife
Christmas Bird Count	U.S. and Canada, Central and South America, Bermuda, West Indies, and Pacific Islands	In 2010, about 60,000 volunteers completed 2,215 counts and reported 61,359,451 birds	Audubon Society
Monarch Larva Monitoring Project	36 states, including Calif. and Ariz., plus Canada and Jalisco, Mexico	Volunteers monitor 700 sites	University of Minnesota
Global Amphibian BioBlitz	So far, results have come from the U.S., Europe, Australia, Asia and Africa	Launched May 25, 2011. Total members: 288; total observations: 1,658	iNaturalist.org
Common Loon	Glacier National Park	105 citizen scientists conducted 220 loon surveys at 46 lakes	National Park Service
Mountain goats, High Country Citizen Science Project	Glacier National Park	For mountain goats and pikas: 143 volunteers contributed 2,900 hours and conducted 169 mountain goat and 45 pika surveys	National Park Service
American pikas, High Country Citizen Science Project	Glacier National Park		National Park Service

Ultimately, the information gathered could help public-land managers make more informed decisions. Hummingbirds rely on dense growths of shrubs, saplings and flowering plants, which typically emerge after wildfires. Post-burn logging or tree planting can reduce the diversity of this early successional vegetation. With knowledge gained from hummingbird monitoring, land managers may decide to forgo post-burn logging in important habitat, or at least include nectar-bearing plants in their restoration seed mix.

Recently, efforts to develop hummingbird conservation programs have gained momentum. In April 2009, scientists, land managers and nonprofit organizations, led by the U.S. Forest Service and the hummingbird network, convened in Tucson, Ariz., to discuss the conservation needs of North American hummingbirds. The meeting led to the formation of the Western Hummingbird Partnership. The organization has two main goals: to discover what hummingbirds need to successfully reproduce and survive, and to communicate those findings so that habitats can be managed in ways that support thriving hummingbird communities. Member organizations now include HMN, the U.S. Forest Service's Wings Across America program, Klamath Bird Observatory, Point Reyes Bird Observatory Conservation Science, Rocky Mountain Bird Observatory, and several universities in Canada and Mexico.

The Western Hummingbird Partnership works to coordinate its members' conservation and research

activities, so that results are shared and work isn't needlessly duplicated. "What we recognized was that, although many people were conducting their breeding bird survey routes ... or some other form of monitoring at the local level, the data wasn't being compiled or assessed uniquely for hummingbirds," says Cheryl Carrothers, a co-founder and wildlife program leader for the Forest Service in Alaska. "That information was just falling through the cracks." Early projects conducted by the partnership include studies of the distribution and abundance of nectar plants on pre- and post-fire landscapes and the effects of wildfire on hummingbird communities.

**ON A MISTY MORNING** in late April, at the Indian Peak Ranch in Mariposa, Calif., Barbara and Duane Robinson band hummingbirds with the help of volunteer Susan Robinson (no relation). The ranch sits in the foothills of the Sierra Nevada, 30 miles from Yosemite National Park. The damp morning air is filled with squeaks and the buzz of miniature wings. Hummers flit in and out of a large blue oak that rises above an expansive deck with a view of lush rolling hills of oak and pine woodland.

Indian Peak Ranch is on a migration route, and about four times more hummingbirds have been banded here than at any other HMN site. Barbara Robinson has banded seven species: Anna's and black-chinned, the most common locally along with rufous, Allen's, Calliope and Costa's, plus one broad-tailed hummingbird. Most of these species are

migrating through or breeding in the area, but the Anna's are a special case. Barbara believes that the ranch hosts four separate populations: one lives here year round, another breeds here, the third winters here and the last group is migrating through. Her hypothesis is based on recapture data. About 45 percent of the birds trapped here are recaptures, the highest rate in the HMN. Barbara has caught one female Anna's 35 times over eight years. Indian Peak Ranch is no longer an HMN site, but Barbara and scientist Holly Ernest are working together to determine if her hypothesis about the four populations of Anna's is correct.

As she examines a female Calliope hummingbird, Barbara recites the measurements and observations for Susan to record. She carefully pulls a feather from the breast, and Susan puts it in a small manila envelope. Barbara will send the feathers she collects today to Ernest for her genetic work. She wraps the bird in a cloth and places it on the scale, which registers 2.6 grams. "They weigh the same as a penny," Barbara says. "They're sooo little." Susan picks up the tiny bird, removes the wrap, and sticks its long bill into the feeder. The bird immediately starts to drink, its throat moving as it swallows the sweet liquid. She turns to an observer. "Do you want to release this one? Put your hand out flat." She gently lays the bird on the woman's palm; with a brush of wings, it's gone. □

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ROBIN E VALLENTYNE

Jean Palumbo is a technical writer and editor for the Southern Colorado Plateau Inventory and Monitoring Network of the National Park Service.

Species monitored	Information gathered	Overall goals	Notes
Salmon and trout	Fish population surveys determine species abundance and distribution	Restoring habitat and native trout and salmon populations, tracking population trends	Created by the Oregon Legislature in 1981. Volunteers work with Oregon Dept. of Fish and Wildlife biologists, freeing up agency time and dollars for other important work
Birds	Bird census (count birds, identify species)	Studying the long-term health and status of bird populations across North America	At 111 years old, it's the nation's longest-running citizen science project, occurring between Dec. 14 and Jan. 5 of each year
Monarch butterflies	Long-term data on larval monarch populations and milkweed habitat	Understanding variations in monarch populations over time, with a focus on the North American breeding season	Data is being used in a study of the effects of climate change on the monarchs' summer and stopover habitat
Amphibians	Photos and locations, identify species	Identifying distribution of amphibian species to determine which require special conservation attention	Recent estimates suggest that nearly one-third of the world's amphibians face extinction; 168 species have vanished in the last two decades
Common loon	Chick mortality, nest site locations, hatch and migration dates	Determining the number of loons in Glacier National Park, proportion of breeding pairs, number of successful nests	The common loon is a Montana species of concern; 20 percent of breeding population is found in Glacier National Park
Mountain goats	Estimate of relative abundance, map park-wide distribution	Determining current population and detecting changes	The number of mountain goats visiting a mineral lick in the park has declined; unclear whether overall population has dropped
American pikas	Location of talus habitat and pika signs, estimate number of pikas	Documenting locations of pika populations	Pikas have declined in the Sierra Nevada and Great Basin and have been extirpated in certain sites

Monarch butterfly larva. SIDPIX, CC VIA FLICKR



Hawk seen during Christmas Bird Count in Groveland, California. VELO STEVE, CC VIA FLICKR