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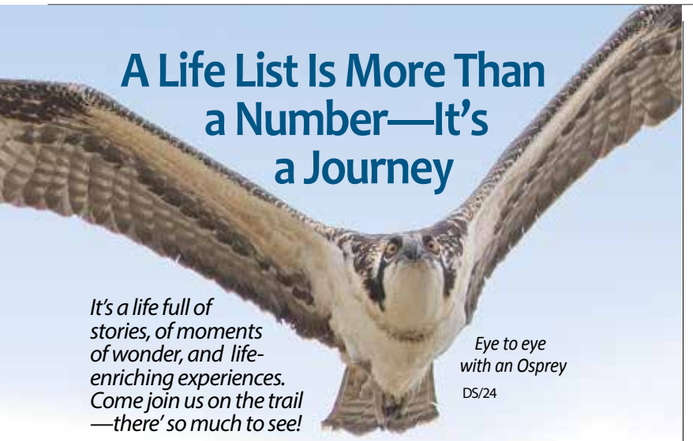

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Eye to eye with an Osprey
DS/24

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Sketches SAN DIEGO BIRD ALLIANCE

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Sketches
SAN DIEGO BIRD ALLIANCE

Celebrating More than 75 Years of Protecting Birds

WINTER 2025 • VOLUME 76 • NUMBER 2

BIRDSONG
Deciphering the Mystery of Bird Languages

Song Sparrow by Shea Vavra. The spectrogram of the species' song was recorded by Laura Stewart and posted to xeno-canto.com.

BIRDSONG *Deciphering the Mystery of Bird Languages*

by LaTresa Pearson, Sketches *Editor*

Hidden among the dense leaves and branches of the shrubs next to my patio, a small bird is quietly jabbering to himself. I recognize some of the sounds as those of a Song Sparrow, but it isn't the series of crisp notes followed by a buzz or a trill that I normally hear Song Sparrows belt out from the tops of the shrubs in my yard each spring. Instead, his "song" sounds more like gibberish. Much like a toddler learning to speak, this young Song Sparrow is practicing the sounds that will eventually become his song. He began this process at just a few weeks old, at first memorizing and imitating the notes, buzzes, and trills of his father and then switching his focus to the songs of the adult males neighboring the area where he hopes to settle and spend the rest of his life. He will not finalize his song until the spring when he must use it to find a mate and secure a territory.

This Song Sparrow is demonstrating *vocal learning*—an ability shared only by humans, whales (including toothed whales such as dolphins), seals and sea lions, elephants, bats, and some species of birds. As different as these species appear on the surface, they all have similar brain pathways—one for learning sounds and one for producing sounds. Also, like us, they acquire their vocalizations through listening, imitating, and practicing, and then they pass on their vocal repertoires culturally, from one generation to the next, according to Erich Jarvis, a professor in the Laboratory of Neurogenetics of Language at Rockefeller University.

The only bird families known to be vocal learners are parrots, songbirds, and hummingbirds (yes, hummingbirds!). Jarvis believes that each of these species evolved this ability independently, rather than from a common ancestor. In 2014, he co-led a consortium that sequenced the genomes of 48 bird species representing nearly all bird orders. The evolutionary tree they created revealed that parrots, songbirds, and hummingbirds are so distantly related that you would have to go all the way back to the mass extinction of the dinosaurs to find a common origin for their vocal learning circuits.

Northern Mockingbird by Tim Pagaard

How Birds Vocalize

All birds with vocal learning abilities have specialized brains that guide them in learning sounds and unique, highly sophisticated voice boxes that enable them to produce intricate sounds. A songbird's brain, for example, contains unique clusters of neurons that function as *song control centers* and two distinct neuronal pathways that allow songbirds to learn and produce songs. One pathway guides song learning and enables fine listening and processing. The other pathway guides the voice box to produce the intended song. Songbirds with large repertoires of unique songs, such as the Brown Thrasher and our California Thrasher, have larger song control centers in their brains than songbirds with smaller repertoires. The Brown Thrasher, for example, has the largest known song repertoire of any songbird, with more than 2,000 different songs. (The extent of the California Thrasher's song repertoire is unknown.)

While birds have a larynx like we do, they don't use it for vocalizing. Instead, they evolved a *syrinx*, a special organ not found in any other animal. It wasn't until 2013 that scientists were able to produce a high-resolution three-dimensional image of a syrinx in action, using a combination of magnetic resonance imaging (MRI) and microcomputed tomography (CT). What the imagery revealed is extraordinary. The syrinx, made of thin cartilage, sits deep in a bird's chest on top of its two bronchial tubes. As air flows through, two membranes, one on either side of the syrinx, vibrate at breathtaking speeds to create two independent sources of sound. Some songbirds, such as the Northern Mockingbird, can sing rising and falling notes simultaneously, shifting the volume and *frequency* (high/low pitch) of each note with lightning speed. This is accomplished through tiny powerful syringeal muscles that relax and contract within fractions of a millisecond—the fastest contracting muscles of any vertebrate! Birds with more complex syringeal muscles tend to have more complex songs. Mockingbirds, for example, have seven pairs of syringeal muscles, allowing them to sing nearly 20 songs per minute.

What Birds Hear

The impressive and intricate vocalizations of birds require equally impressive and intricate hearing, both for learning vocalizations and for processing their meaning. Robert Dooling (of the University of Maryland) couldn't find a difference between the hearing of birds and that of humans until he decided to test their ability to hear a sound's *fine structure*—how the sound changes in frequency and amplitude at the millisecond level. This fine structure isn't readily visible on *spectrograms* (graphs used to visualize bird sounds). Only by zooming in on the waveform of an individual song syllable can these fine acoustic details be revealed, explains Adam Fishbein (formerly one of Dooling's graduate students and now a science journalist), who discusses the fine structure studies in an article published in *Scientific American*, "What Birds Really Listen for in Birdsong (It's Not What You Think)."

Published in 2002, Dooling and his colleagues' groundbreaking study found that all the bird species they tested—Zebra Finches, Domestic Canaries, and Budgerigars—were able to hear minute differences in fine structure, two to three times smaller than those the human subjects could detect. Then, in 2018, Dooling's colleagues, led by Nora Prior, found that when Zebra Finches listen to one another's *calls*, they can hear tiny differences in the fine structure that could reveal information about sex and individual identity. That same year, Fishbein and his colleagues found that Zebra Finches can also hear tiny differences in the fine structure of one another's *songs*. "This result means that although

A wide range of Passerines (plus one hummingbird) singing their distinctive songs. Photos by Sandeep Dhar, Rich Durham, Gerry Tietje, Karen Straus, Ed Henry, and David Stump.

to us the Zebra Finch song sounds like the same motif on repeat, to the birds it does not," writes Fishbein. "We suspect that instead they could be perceiving a rich trove of information about emotion, health, age, individual identity, and more in the fine structure of song beyond what our ears can detect. It is reasonable to expect that other birds with songs that sound repetitive to human ears share the Zebra Finch's powers of perception." (In a separate but related study, Fishbein discovered another surprise—Zebra Finches don't seem to care about the melody of their songs, despite spending a lot of time and energy practicing and perfecting it. It's the fine acoustic details that matter to them.)

In his book, *An Immense World*, which focuses on sensory perception in animals, Ed Yong writes about another study, which found that birds' hearing can change with the seasons. In 2002, Jeffrey Lucas and his colleagues were conducting tests on six North American bird species to try to determine what they could hear. In a happy accident, they happened to do the tests in two waves—one in the winter and one in the spring. When Lucas compared the two, he was surprised to find that they were very different in terms of *temporal resolution* and *pitch sensitivity*. Temporal resolution is the ability to detect and differentiate between two sounds that occur in close succession; it's particularly important for understanding vocalizations in noisy environments. Pitch sensitivity is the ability to detect even the smallest change in the frequency of a sound. Ears can have either exceptional temporal resolution or exceptional pitch sensitivity, but not both simultaneously. Lucas found that birds can switch between the two abilities from season to season.

The Carolina Chickadee's signature *chick-a-dee-dee* call, for example, rapidly changes in pitch and volume. The call can be heard year-round, but it's especially important in the fall, when chickadees form large flocks. At that time, the birds need to pick up all the information encoded within the fine structure of their calls, so their hearing needs to have speedy temporal resolution. Lucas found that their temporal resolution goes up in the fall, but their pitch sensitivity goes down. In the spring, the flocks break up and males and females pair up to establish breeding territories. Researchers believe the male's attractiveness depends on how consistently he can sing the notes in his courtship song, so in spring, pitch sensitivity increases and temporal resolution decreases.

The hearing of the White-breasted Nuthatch changes in the opposite direction. Its courtship song is a nasal, fast-paced *wha-wha-wha*, with a fine structure that includes fast changes in volume. As a result, its hearing becomes faster during the breeding season and less sensitive to pitch. "Both bird species retune their sense of hearing from one season to the next to process the information that matters most in that season," writes Yong. These changes are thought to be driven by sex hormones such as estrogen, which can directly influence the hair cells in songbird ears. In some species, the hearing of males and females changes in different ways. Lucas and his colleague Megan Gall showed that female House Sparrows are better at handling pitch in the spring, while male hearing remains the same year-round.

(Continued on page 4)

(Continued from page 3)

What Birds Are Saying and Why

While researchers have discovered a great deal over the past 25 years about how birds sing and what they are able to hear, they can really only theorize about what birds are saying and why. Songs, both simple and elaborate, seem to focus on attracting a mate and establishing or protecting territory. Males are most frequently the singers, but female songbirds also sing, especially in the tropics, where females sing to defend their territories and their mates. Even in our area, however, many female birds sing. In his book, *Birdsong for the Curious Naturalist*, Donald Kroodsma points out that our Pacific Coast male and female Wrentits both sing. The male's bouncing-ball song is unmistakable, *pit-pit-pit-pit tr-r-r-r-r-r-r-r-r-r-r-r-r-r-r,* says Kroodsma. If you listen carefully, however, you may occasionally hear the female respond with a simpler *pit-pit-pit-pit-pit-pit-pit*, without the trill at the end. Female singing is thought to reinforce the pair bond.

Wrentit by Tim Pagaard

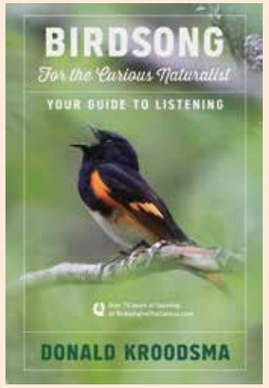
Even a Brown Thrasher's prodigious repertoire appears to be aimed at one thing—finding a mate to share his territory with, says Kroodsma. An unpaired Brown Thrasher will sing from the treetops all day long, but as soon as a female joins him in his territory, he abruptly stops. Mission accomplished. But why so many songs? Does the female care how many songs he can sing? Does she count them? Is it the ingenuity required to create so many songs that impresses her, or how long he can sing, or how well he sings? What is he conveying about his fitness as a mate in the fine acoustic details of his song? These are unanswered questions.

"When you are studying bird sounds, you are standing right on the edge of human knowledge," Nathan Pieplow tells an audience at the Aspen Center for Environmental Studies during his presentation, "The Language of Birds." Author of the *Peterson Field Guide to Bird Sounds of Western North America*, Pieplow says it is much easier to go out into your backyard and record a bird sound that has never been heard before than to go anywhere in the world and photograph a bird that has never been photographed before. "We just don't know that much about bird sounds, even the common bird sounds around us. If those of us in this room start making more recordings with our phones and start uploading recordings of bird sounds to the internet, we can actually help researchers start to solve some of these mysteries."

Sitting in my backyard listening to the overlapping songs of a Bewick's Wren and a Song Sparrow, I find myself paying attention to the intricate details of each with renewed awe, and a renewed sense of purpose. I feel inspired not only to listen more carefully to the bird sounds around me, but also to help solve the many mysteries that remain about the language of birds. I hope you will join me.

Exploring Birdsong

In his book, *Birdsong for the Curious Naturalist*, Donald Kroodsma, one of the world's leading authorities on birdsong, not only teaches you how to listen to bird sounds, but he also teaches you how to explore them through interactive listening sessions and suggested projects. Each chapter of this highly engaging and approachable book features colorful photos of the more than 200 species of North American birds he discusses, as well as QR codes, which take you directly to the appropriate spot on the accompanying website to listen to Kroodsma's own field recordings. For each recording (or series), Kroodsma walks you through what to listen for based on his experience making the recording. The website has 734 recordings, with more than 75 hours of bird sounds, which you can listen to or download for further study. In addition, Kroodsma suggests 77 different projects, enabling you to deepen your exploration of bird sounds, as well as to contribute to science. One project, for example, is to explore the extent of the California Thrasher's song repertoire. Kroodsma suggests finding a location where a California Thrasher awakes each morning and then listen and record everything it sings over multiple mornings. These are the questions he posits based on his own experience recording a California Thrasher over three mornings in 2017: "Would he ever return to something he had sung before? If so, how many days of listening would it take to hear some repetition? If never, does he compose original songs each day, settling on some theme that most satisfies him, or has he a seemingly infinite store of set themes to choose from?" Are you up for the challenge?



Recording Bird Sounds *with Expert Recordist Bruce Rideout*

Interview by Sketches *Editor LaTresa Pearson*

Bruce Rideout has been studying and recording bird sounds for nearly 20 years. He is an eBird reviewer for the San Diego region, frequently serving as the go-to guy when there's a tough audio recording to review. He was also one of the early expert annotators involved in training Cornell Lab of Ornithology's Merlin Sound ID application.

Sketches: What led you to develop expertise in identifying and recording bird sounds?

Rideout: When I first started getting deep into it, I realized there really aren't that many experts out there in bird sounds, so I thought if I can really develop my expertise here, then I can contribute something. That is something that helps with eBird reviews. Very often, somebody will report a rare bird, and their documentation is a recording they uploaded. The other reviewers are also good at evaluating sound recordings, but they're happy to have me deal with most of them. It's nice to have enough background and know-how to delve deep into something and consider not just this species but also what are the alternatives that also have to be considered. Could it be another species? And I just love those kinds of investigations.

Sketches: How did you get started recording bird sounds?

Rideout: I had repeatedly run into birders in the field who were just amazing at birding by ear, and I was a knucklehead. I realized this was something that could really improve my ability to find rare birds and to identify everything I was seeing. That's when I first got a pocket recorder. The main goal was just to record everything I heard and go home and listen to the recordings and just by trial and error try to figure out what I was hearing. I got increasingly frustrated with the quality of my recordings, so I did Cornell Lab's weeklong sound recording workshop up in the Sierras. That was life-changing. It was just such an amazing experience. After that, I really improved my ability to get high-quality sound recordings. (Cornell Lab is not currently offering the workshop, but former Macaulay Library Audio Curator Greg Budney, who led the workshop Rideout attended, still offers it. For information about the Summer 2025 session, go to https://sierra.sfsu. edu/wildlife-sound-recording-workshop).

Sketches: What advice do you have for the beginner who wants to start recording bird sounds?

Rideout: Start with your phone. Almost everyone has a smartphone, and they have pretty good microphones. One of the strengths and weaknesses of smartphones as recorders is the microphones are designed to pick up noises at close range, like your voice, so they're not good at picking up distant quiet bird sounds, but they're also good at not picking up distant freeway sounds. They're actually pretty good in noisy suburban environments like so much of San Diego is. The basic things are: Hold your phone steady. Don't be shifting it around constantly because that creates terrible handling noise. Aim the microphone at the bird. Get as close as possible to the bird because that helps deal with that microphone problem. If you cut the distance between you and the bird in half, the sound goes up fourfold, so getting a little bit closer makes a huge difference. What they told us to do in the Cornell Lab workshop is if you suddenly hear an important bird sound you want to record, stop and start

(Continued on page 6)

Bruce Rideout, a local earbirding expert and wildlife sound recordist, demonstrates his recording equipment at Lake Murray, including a Sennheiser MKH60 shotgun microphone and a Zoom F3 recorder. Rideout is an eBird reviewer for the San Diego region and served as a spectrogram annotator during the early training sessions of the Merlin Sound ID application.

(Continued from page 5)

your recording, so you get something. Then you can stop or pause your recording and start walking closer to the bird, so you don't have foot noise. Keep repeating that process to see how close to the bird you can get.

Sketches: What ethical considerations should people be aware of when it comes to recording bird sounds?

Rideout: I take kind of a strong view. I'm not a big fan of doing playbacks in the field. We fail to appreciate how degraded a lot of the habitat is in San Diego County and how stressed our local birds may be. Why should we be adding to it by going off trail and doing playbacks to try to get a bird to vocalize or come closer? We should never use playbacks during the breeding season unless we have a permit, and we're doing a legitimate research study because it takes energy for a bird to respond to playback. If there's a male defending a territory, and I play that species' song, that male is going to stop what it's doing and come over to threaten me because it doesn't want me in its territory. That takes time and energy away from other activities. I also think we should stay away from nests. People might hear birds chirping in a nest and think, oh great, there's some nestlings,

There are still massive gaps in our knowledge of bird sounds, but there aren't many gaps in our knowledge of bird plumage, so if your choice is between photographing birds or recording bird sounds, go all in on recording because you can really contribute important data to our knowledge base.

I want to get a photo or a recording of that. What they might not realize, with species like crows, for example, they're very intelligent. They will watch what we're doing. If we go off trail and start investigating in the bushes or in a tree, when we leave, they'll go in and find that nest and eat the nestlings. We have to be aware of the impacts of simple actions. Avoid doing playback. Stay on trails. Stay away from nests.

Sketches: What role do you see Merlin Sound ID playing in terms of getting people interested in learning about bird sounds and recording them?

Rideout: People can get really excited when they realize the number of birds that are out there. Most people don't have any idea of what they are hearing. If they're not serious birders, they may be making the false assumption that they only have one or two species of birds in their backyard. If they start running Merlin, they may realize they have a dozen or twenty species. That can get them excited about birds and conservation. When they can start putting names on birds, they become real, and when they know that a particular species is declining, then they care because it's not some nameless thing flying around.

Sketches: Are there any caveats you want people to be aware of when using Merlin Sound ID?

Rideout: If they're submitting eBird checklists, the thing to avoid is just running Merlin and then putting in everything Merlin told them because eBird is for human observation of birds. eBird doesn't want data from trail cameras or autonomous recorders. The gray zone is people who go out for a walk and are just chatting with their friends and not paying much attention, but they're running Merlin, and then they submit that as a checklist. The fact is, they didn't see any of those birds. They didn't really hear them either because they weren't paying attention, and that's not what eBird is for. You can still do that for fun, but don't submit that as data to eBird. The other caveat is that Merlin is still learning, so if it tells you something, even if it's a common bird, it might be wrong. As eBird reviewers, we have the ability to flag a record as a mistake Merlin made, and that goes back to eBird Central. They'll investigate it and figure out why Merlin failed, so they can do additional training. *(See "Teaching Merlin to See Bird Sounds" on pages 10–11.)*

Sketches: What smartphone app do you recommend people use for recording birds in the field?

Rideout: You can record through Merlin. The downside is Merlin, for whatever reason, sets your smartphone microphone sensitivity lower than some of the other apps do. So, I use an app called *Song Meter Touch*. It's a free app, and it will show you the spectrogram that you're recording as well as the sound waveform, which shows you the signal-to-noise ratio. If you understand what those two things are showing you, it's extremely helpful. One of the other advantages of an app like Song Meter Touch is it has a prerecord button, so when you have it running on your phone, it's doing a continuous three-second loop. When you hear a bird that you want to record, stop and hit the record button, and you've already recorded the previous three seconds. What that does for you is if you hear a bird singing and you press the record button, you haven't cut off the beginning of the song. It won't tell you what you're hearing, but it will set your microphone to be really sensitive, and it works really well.

Sketches: How long should a recording be to submit it to eBird for documentation?

Rideout: I would recommend at least a minute. I say that because there are species that have very similar songs and calls. Cassin's and Plumbeous Vireos have very similar songs—a lot of vireos sound similar. The way you tell some of them apart is some of them don't have very many buzzy notes and others have a lot of buzzy notes, but you need a long recording to say okay, there's almost no buzzy notes in here. This must have been a Blue-headed not a Cassin's Vireo. You need long recordings to distinguish between species.

Cassin's Vireo by Ed Henry

Sketches: How do you edit your recordings before submitting them?

Rideout: I mainly use a free application called *Audacity*. It's fairly intuitive and easy to use, and it's got a good filtering system. The editing involves filtering out some of the low-frequency noise but not eliminating it. If you eliminate all of it, then your recordings sound harsh and brittle. I boost the target bird's signal and do a fade in and a fade out. Those are really the main techniques I use to get a really nice professional recording. Then I upload them through an eBird checklist, so they become part of the collection at the Macaulay Library. For people using handheld recorders like smartphones, you want to eliminate any handling noise at the beginning and the end. What happens is they'll pull their phone out and start recording while they're still jostling it around, and then there's a lot of loud noises at the beginning and the end. [The Macaulay Library] wants those edited out. (For guidelines on submitting sound recordings, go to www.macaulaylibrary.org/resources/.)

Sketches: For those who might be interested in stepping up to more advanced recording equipment, can you talk about the equipment you use?

Rideout: A couple of years ago, I got a Zoom F3 recorder, and it's just a revolution in recording. It's about the size of my fist, and it cost me $300. The Zoom F3's sound quality is almost as good as my Sound Devices 702 recorder (which weighs about 8 pounds and cost about $2,000 when it was purchased 10–15 years ago). If you're going to use an external mic, there are two main categories. One is a shotgun mic. It quiets the sounds coming from the sides, so you mainly get the sounds right in front of the microphone. It's handy for recording in noisy environments, but it doesn't amplify the sound. I have a Sennheiser MKH60, which is not made anymore. The other kind of microphone is a parabolic microphone, which is a dish. The sound comes in and bounces off the dish and gets concentrated in the microphone at the center. Those things are like magic. You'll hear a distant sound and think, oh that's too far away to get a good recording, but you put the parabola on it, and it's like bingo. I have two dishes (22 and 32 inches). Parabolas are harder to use though. You need to use headphones, and they're exquisitely sensitive to positioning. You really need to keep the microphone and the parabola pointed directly at the bird, and if the bird is moving, that can be really difficult.

A pair of Cassin's Kingbirds in a noisy display. Photo by Karen Straus

Sketches: Why is it important for people to submit not just their observations and photos, but also sound recordings to eBird?

Rideout: One of the reasons I got into recording as seriously as I did is I read a really inspiring blog post that Nathan Pieplow posted on his website. He's the guy who wrote the first audio field guide (*Peterson Field Guide to Bird Sounds of Western North America*). What he pointed out was that there were still massive gaps in our knowledge of bird sounds, but there aren't many gaps in our knowledge of bird plumage, so if your choice is between photographing birds or recording bird sounds, he said go all in on recording because you can really contribute important data to our knowledge base. If you search through my contributed recordings, I try to target song development in birds. You don't have to have fancy equipment. Some of the most recent recordings I've uploaded, I just did with my iPhone in my backyard. A Bewick's Wren had fledged from a nest box in my yard, and I quickly realized it was a male fledgling because it started to sing about a month or so after fledging. But the songs at that stage are unrecognizable. It's just like soft mumbling. I didn't get recordings right then, but I got recordings in the next stage of development called *plastic song*, where you can just barely tell it's a Bewick's Wren, but he hasn't locked into his final adult song *(see spectrogram on page 11 for similar recording)*. Search for my recordings now, and you'll see a whole series of Bewick's Wren songs mostly recorded with my iPhone in my backyard of song development in that bird. I'm not aware of any other sequences like that in eBird. They may be out there. But that's the kind of thing you can contribute.

Bird Sounds

Songs: Songs tend to be longer and more complex than calls. They are most frequently used by males in the spring to attract a mate and defend territory, although some female birds also sing. Some birds learn their songs, while others have their songs encoded in their genes. Some songbirds exhibit regional dialects, and some can include imitations of other birds or mechanical sounds in their songs.

Calls: Usually shorter than songs, calls are used by males and females year-round to communicate context-specific information. Calls, even among songbirds, are thought to be innate and not learned.

Begging: Young birds in the nest use begging calls to tell their parents to feed them. Females may also use begging calls with their mates.

Contact: Foraging birds use contact calls to stay in touch with each other.

Flight: Birds in flight use calls to keep the flock together and communicate other important information.

Alarm: Birds use calls to signal the presence of a threat. Research suggests these calls can be quite nuanced—even some nestlings seem to respond to a particular call with a specific response, such as ducking from an overhead predator.

Drumming: Woodpeckers drum against hard surfaces to establish and defend territory, attract mates, and signal their readiness for breeding.

Bill Snapping: Species such as owls, flycatchers, and gnatcatchers snap their bills together in close-range aggressive displays.

Wing Clapping: Species such as the Short-eared Owl clap their wings together in courtship displays, territorial defense, and to warn off intruders.

Feather Movement: Some birds have specialized feathers that produce sounds, including the whistling sounds made by the feathers of Mourning Doves when flushing or the *chirp* made by the tail feathers of the male Anna's Hummingbird during flight displays.

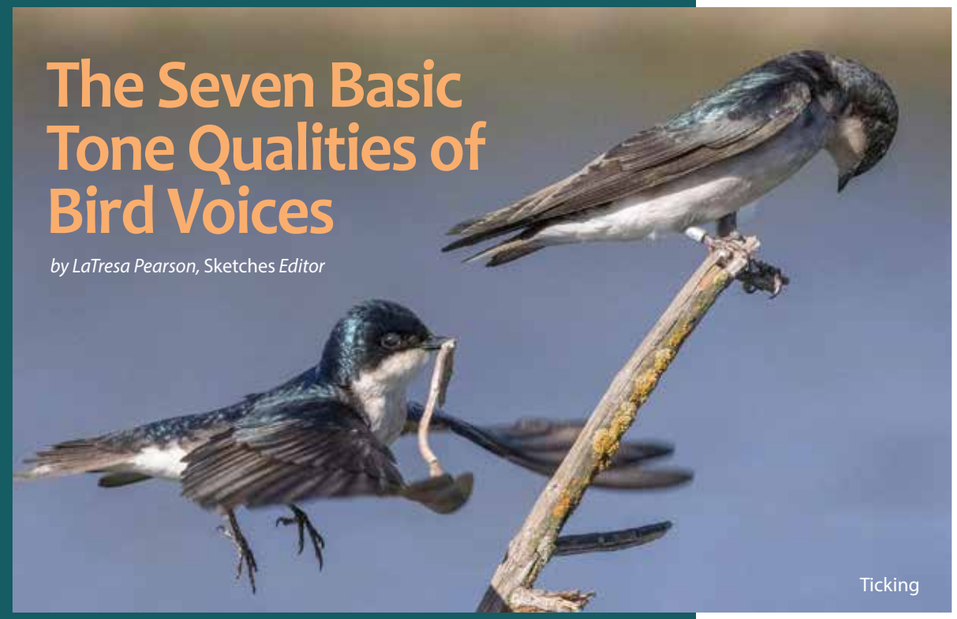

Whistled


Nasal


Hooting and Cooing

The Seven Basic Tone Qualities of Bird Voices

by LaTresa Pearson, Sketches *Editor*


Ticking

Top row: Say's Phoebe by DS; White-breasted Nuthatch by Richard Gleich. Second row: Mourning Dove by DS; Tree Swallows by Ed Henry. Bottom row, Lesser Goldfinch by Karen Straus; House Wren by LaTresa Pearson

In the introduction to the *Peterson Field Guide to Bird Sounds of Western North America*, Nathan Pieplow identifies seven basic tone qualities that compose all bird voices—whistled sounds; hooting and cooing sounds; ticking sounds; burry and buzzy sounds; noisy sounds; nasal sounds; and polyphonic sounds. While there are variations and combinations of each, learning to identify these tone qualities by ear as well as by their visual representation on a spectrogram can greatly increase your ability to identify birds in the field. Selected by local earbirding expert and recordist, Bruce Rideout, the seven birds shown on these two pages make sounds representing each of the seven basic tone qualities.


Polyphonic

Whistled: Say's Phoebe

The most basic bird sounds are whistled sounds. On a spectrogram, they show up as very simple nonvertical lines. The dawn song of a Say's Phoebe begins with a distinctively downslurred whistle, *Pi-deer,* followed by a two-note phrase *Pi-dweedy,* and then *Pi-dreep*. The dawn song transitions into just *Pi-deer* calls as the day goes on.

Nasal: White-breasted Nuthatch

Nasal sounds are combinations of multiple simultaneous whistles on different pitches that our brains perceive as a single sound. The individual whistles in a nasal sound are called partials and appear stacked vertically on a spectrogram. The *wha-wha-wha-wha-wha* or faster *whi-whi-whi-whi-whi-whi* song of the White-breasted Nuthatch is a good example of a nasal sound.

Hooting and Cooing: Mourning Dove

The hoots of owls and coos of doves are actually very low-pitched whistles, so they also appear as simple nonvertical lines on a spectrogram. Due to their low pitch, special spectrograms with a different scale are used to depict these sounds. The Mourning Dove has a sad, owl-like song, *Hoo-WOW, hoo, hoo, hoo*.

Ticking: Tree Swallow

Ticking sounds come in bursts and appear as vertical lines on a spectrogram. During courtship, the male Tree Swallow can be heard making soft ticking sounds as it swoops low over the female. The female may also make ticking sounds, indicating she is willing to mate. This sound may also be used while swooping over predators.

Noisy: Black-crowned Night Heron


Noisy

Black-crowned Night Heron by Tim Pagaard

Noisy sounds are made up of random sounds at multiple intervals. They sound like static and actually look like static on a spectrogram. When comparing noisy sounds and buzzy sounds visually, noisy sounds tend to have faded, blurry edges and stretch from the top to the bottom of a spectrogram. They can have a harsh quality like the snarl of a Black-crowned Night Heron.

Polyphonic: Lesser Goldfinch

Birds have the ability to make two whistled or nasal sounds at the same time—one from each lung—creating a distinctive sound. While they can look similar to nasal sounds on a spectrogram, the telltale signs of polyphonic sounds are partials (individual whistles) that are dissimilar in shape, irregularly spaced, or simultaneously rising and falling. These sounds are distinctively metallic or whiny. The song of the Lesser Goldfinch features whistles and polyphonic phrases, and many of their sounds are imitations of other birds.


Burry and Buzzy

Burry and Buzzy: House Wren

Sounds that rise and fall in pitch very rapidly are burry or buzzy sounds. They form a squiggly line on a spectrogram and sound trilled. Fast, tall squiggles sound less musical and more buzzy. All burry and buzzy sounds have very rapid repeated elements—often so rapid, they are not individually visible on a spectrogram. These look like thick lines on a spectrogram, compared to the thin lines of a whistle. The House Wren's energetic, bubbling song is a good example of burry and buzzy sounds. It starts off as a complex chattering warble that is softer and less musical, and is followed by one to three musical trills that are highest and loudest in the middle.

To learn how to visualize bird sounds and describe them with words, go to the free interactive version of the *introduction to the Peterson Field Guide to Bird Sounds* at https://earbirding.com/blog/specs. You can also access recordings of all of the bird sounds discussed in the book at petersonbirdsounds.com.

Teaching Merlin to See Bird Sounds

by LaTresa Pearson, Sketches *Editor*

In 2010, when Grant Van Horn joined Serge Belongie's machine-learning lab at the University of California San Diego (UCSD), the lab was just beginning a fine-grained computer vision project. These projects involve teaching a computer how to distinguish between subtle visual differences, such as in facial recognition. However, working with human faces can bring up all kinds of issues with privacy and other considerations. Seeking a less problematic subject, Belongie's students discovered that the internet is loaded with images of birds, making them a convenient choice for their project, and a fortuitous choice for birders.

That same year, Apple introduced the iPad, which gave Van Horn an idea. "It's difficult for undergrads to contribute to graduate-level research, and I was pretty eager to do stuff," he tells me over Zoom. "So, I thought I can take some of the algorithms they were developing and reimplement them on the iPad as a demo." His initiative paid off when Deborah Estrin, a professor of computer science at Cornell Tech, saw the demo and suggested that Belongie reach out to the Cornell Lab of Ornithology, where researchers were in the early stages of developing the Merlin Bird ID application. "Cornell saw it, and they were super excited about it," says Van Horn, who is now a Visiting Scientist at Cornell Lab and an Assistant Professor at the University of Massachusetts Amherst. "It's not like [Merlin] was a direct spawn off of Serge's research, but they absolutely didn't have machine-learning AI type of stuff on their radar," he says.

By 2011, Van Horn was on a plane to Ithaca, New York, to meet with Jessie Barry, Program Manager for Merlin. In addition to discussing how to incorporate artificial intelligence into Merlin, Barry took Van Horn birding for the first time. Although he had grown up spending time outdoors, hiking, mountain biking, and rock climbing in the Southern Sierras near his home in Bakersfield, Van Horn had never been birding or even given birds much thought beyond their use as data for the project. But that all changed. "It was like 0 to 100 how cool birding was," he says. "Jessie and her husband are both amazing birders. They're not only great at identification, but they're also great at sharing their excitement."

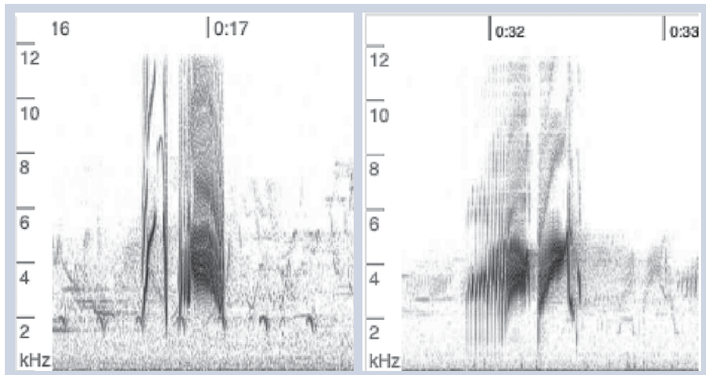
Ever since that trip, Van Horn has maintained strong ties with Barry, working with her on what machine learning can do for the birding community and how they can get some of the expertise of a few dedicated, passionate birders into everybody's pocket through the Merlin app. "Jessie Barry can't take everybody out on a bird walk, but if we can put some of Jessie's identification skills into a phone and lots of people have phones, then that's one way we can share that expertise," Van Horn says. "It's not the same, obviously. I would never claim that a machine-learning tool is as useful as that human connection, but until we have lots of people who know their birds, this is one avenue where we can look to improve."

Merlin launched with its initial five-question identification workflow in 2014 and then incorporated the AI-driven photo ID component in 2017. But from the start, Barry really wanted Merlin to be able to identify bird sounds, something Van Horn didn't initially think was in his wheelhouse as a computer vision specialist. After completing his BS and MS degrees in computer science at UCSD, and then his PhD at the California Institute of Technology, Van Horn joined Cornell Lab. It was 2019, and one of the first things he did was attend a workshop with Barry on machine learning applied to audio. "I can distinctly remember being in the audience and just being flabbergasted that all I was seeing all day long were pictures of sounds," says Van Horn. "I'm a vision researcher, not an acoustics researcher, but that was the first time it quickly clicked, we can do this."

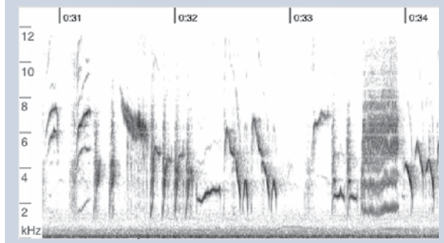
The "pictures of sounds" Van Horn saw at the workshop were *spectrograms*. Also called *sonagrams*, spectrograms are computer-generated graphs of sound frequencies across time that enable people (and machines) to visualize characteristics of bird sounds, including pitch pattern, speed, repetition, pauses, and tone quality—all of which are key to identifying a bird by its sounds.

Grant Van Horn

After realizing that he could apply computer vision techniques to identify bird sounds, Van Horn went back to the Lab of Ornithology and started working with Tayler Brooks, one of the curatorial assistants. They decided to initially focus on two species that are difficult to differentiate visually but easy to differentiate acoustically, the Alder and Willow Flycatcher. Brooks brought up spectrograms of the two species and showed Van Horn how different the sounds look. After that, he says he generated a bunch of spectrograms, isolating their vocalizations as much as he could, and then he trained a computer vision model to see how well it could differentiate the two. "The accuracy was basically perfect," says Van Horn. "And I was like, whoa, okay, that's super encouraging. That was the start." He went back to Brooks to begin building a proof of concept. They chose 59 species of backyard birds from the Eastern United States and ran more experiments. When they saw the results, Van Horn says they knew it was going to work, and they ramped the project up from there.



(Left) A Willow Flycatcher, recorded by Wil Hershberger at Stauffer's Marsh, West Virginia in 2012. The Alder Flycatcher (right) was recorded by Mike Anderson at Delta Junction, Alaska, in 2006. The birds are almost indistinguishable in appearance but revealed in their songs.



This spectrogram by Bruce Rideout is from a young Bewick's Wren just learning to sing, recorded at Mission Trails Regional Park. The spectrogram shows two or three song phrases that are run together. In this stage of song development, they often have these long stretches of random song phrases that they're practicing.

Willow Flycatcher by Ed Henry

To figure out how to create a computer model to train Merlin to identify birds by their sounds, Van Horn filmed biologists and ornithologists using sound editing software to see how they worked with bird sound recordings. "I just watched them work with the data, and then I tried to replicate that same process with the machines," he says.

The training process begins with collecting audio recordings of bird sounds from the Lab's Macaulay Library. "We try to get at least a hundred recordings of a bird before we seriously consider working to teach Merlin about it, but a hundred is a drop in the bucket," says Van Horn. "I imagine there are very few species where a hundred recordings really do it justice in terms of all the different environments we'd find it in, all the different vocalization types it could make, all the different situations of the background species that might be present. A hundred gets us started, but we want just a huge library of these things to really train these models to be as useful as going out with a seasoned expert."

After collecting audio recordings, they use software to generate spectrograms, which then go out to more than 200 human experts around the world, who annotate them, isolating each bird species and providing feedback such as where a vocalization starts and stops, as well as what its frequency bounds are. During the training process, Merlin learns to associate a bird species with its spectrogram. This teaching phase is followed by a testing phase, which once again relies on human experts to determine whether Merlin is accurately identifying the birds in a recording based on spectrogram analysis.

The first version of Merlin Sound ID came out in 2021 and included about 450 species from the United States and Canada. The current version can now identify about 1,400 species, but there is still much to be done. Van Horn says their guiding goal is to make Merlin work for anyone, anywhere—and that's a pretty tall order. Even here in the U.S., Merlin Sound ID performs better on the East Coast than the West Coast. "Part of this is the data bias of Cornell," he says. "We have a lot more data from the Eastern United States. It can also be that sound travels differently in Eastern forests than the open landscapes of the West, so I'm always just trying to get the system to work as well as it does in Massachusetts and New York, in Colorado and Nevada and California." Van Horn says Merlin also performs better in the spring than in the fall. "These short little phrases that birds switch over to in the fall, they're a bit more confusing and a bit more similar," he says.

So, how do they get Merlin Sound ID to work for anyone, anywhere? By having lots and lots of audio recordings to use for training, says Van Horn. They run Merlin Sound ID on every audio file that comes into the Macaulay Library through eBird to see if it can identify the species that the recordist entered as the target species. "We use these recordings both for teaching Merlin, as well as for trying to identify problems and areas of improvement," he says. "I'm always surprised to hear that eBirders think we don't need any more recordings from the United States. Obviously, we need recordings from other parts of the world, but we still absolutely need coverage in the United States under all these different recording conditions."

Van Horn says you don't need to buy a lot of expensive equipment to submit useful audio recordings through eBird. "I always encourage people to start simple. Just use your cellphone," he says. "If I'm working on a checklist, and there's a bird I want to record, I'll just get 15 to 30 seconds of audio. That's a nice-sized file for us to teach Merlin with. We have some tips and suggestions for how to normalize the audio, but they're not required. (https://www.macaulaylibrary.org/resources/). We definitely appreciate it when you do it, but just getting in the habit of making that recording and adding it to your checklist—just like your photos—is a huge help for the project." *(For more tips on recording and submitting bird sounds, see "Recording Bird Sounds with Expert Recordist Bruce Rideout" beginning on page 5.)*

Tuning in to the Languages of Birds

by LaTresa Pearson, Sketches *Editor*

While I'm focused on the familiar song of a White-crowned Sparrow, my birding companion for the morning, Sandy Kuntz, has homed in on another sound nearby. "That's the song of the California Towhee, or more likely the pair talking to one another," she tells me. We stop and listen for a moment, and then I hear, *tseet*, followed by some quiet chattering. "There," she says, pointing to a towhee perched in a sycamore tree. A skilled earbirder, Kuntz leads occasional birding-by-ear walks for San Diego Bird Alliance, as well as regular bird walks at Mission Trails Regional Park, including this one at Lake Kumeyaay. "They have the really loud metallic *chink* call, and then in the spring, they have a little tiny song that can be confused with the Orange-crowned Warbler, but this is something different," she explains. "This is more of a contact call. California Towhees are very monogamous, and they like to talk to one another to keep in contact."

This *reunion duet* between California Towhees is commonly heard wherever you find the species, Bruce Rideout tells me in a separate conversation. "The fascinating thing is the actual song of the California Towhee you almost never hear because they mate for life. It's only young males entering their first breeding season that sing, or males that have lost their mate, but you'll hear the mate reunion call all the time," he says. "When a male and a female split apart and go foraging, you'll hear that *chink* call constantly as they keep contact, and when they come back together, they give this tumbling, interesting complex song duet that the two of them do to reinforce their pair bond. Once you know that, it's like, wow!"

Learning to identify bird sounds not only can help us to more accurately identify birds in the field, but it can also unlock a whole new dimension for understanding bird behavior. "In fact, some say that experienced birders detect and identify ten times as many birds with their ears as with their eyes," Nathan Pieplow writes in the introduction to the *Peterson Field Guide to Bird Sounds of Western North Americ*a. "But listening to a bird can reveal far more than simply the identity of the singer. It can also reveal what the bird is doing and why, what it is communicating and to whom."

California Towhee by Ed Henry

While identifying bird sounds has traditionally focused on using language and mnemonic devices to describe a song or call, which often vary from birder to birder, Pieplow's approach is based on visualizing sounds and using universal terminology to describe them, much like birders use for describing plumage. *(See "The Seven Basic Tone Qualities of Bird Voices" on pages 8–9.)*

The best way to visualize a sound is through a *spectrogram*, a computer-generated graph of sound frequencies across time. Reading a spectrogram is a bit like reading music. The sounds move from left to right, with high notes near the top and low notes near the bottom. The vertical part of the chart is measured in kilohertz (kHz), and the horizontal part is measured in intervals of one second. The top of the chart usually goes up to 10 kHz, which is near the upper limit of hearing for most adults. Separate spectrograms are used for birds such as Great Horned Owls and Mourning Doves, who have low-frequency sounds. There are real spectrograms that are computer-generated from audio recordings, such as the ones you see when you use Merlin Sound ID, and there are also spectrogram symbols that can be used to illustrate patterns. These symbols can come in handy if you keep a field journal and want to describe the sounds you hear. *(Merlin Sound ID uses spectrograms to identify bird sounds. See "Teaching Merlin to See Bird Sounds" on pages 10–11)* .

While spectrograms can be intimidating, Rideout says learning to read them can markedly improve your ability to accurately identify birds. "It's really easy to read them, and it can be fun when you start getting into it," he says. "Learning to read spectrograms helps you to expand your hearing capabilities because you can see much more than you would normally hear." He gives the example of a Green-tailed Towhee, which has a *mew* call that is characteristic of only that species. While Red-naped and Red-breasted Sapsuckers have a similar *mew* call, only the Green-tailed Towhee has a sharp consonant sound at the very beginning of the call note, which makes a spike on the spectrogram. While it is difficult for us to parse out that sound in the field, it's easy to see it on a spectrogram. "If you see that on the spectrogram, it's diagnostic of a Green-tailed Towhee," he says. "They're the only ones that have a *mew* call with that spike at the beginning."

Rideout also recommends using Pieplow's book and the accompanying website www.petersonbirdsounds.com when trying to identify bird sounds. What he finds particularly useful is the "Index to Bird Sounds" toward the back of the book. When you hear a bird sound, you can go to the inside back cover of the book and check each of the four columns to find the description of the sound you heard. Once you find a similar sound to the one you heard, you can turn to the pages in the index to narrow down the list of species that make that sound and then go to the species account in the book. You can also go to the website to listen to different sounds made by that species. "I strongly encourage people to take advantage of the website," says Rideout. "What's there are high-quality recordings of essentially the entire repertoire of all of our North American birds. You can go to petersonbirdsounds.com, you can use the algorithm in the back of Nathan's book, and you can really start getting better at identifying things on your own and not relying so much on Merlin."

Kuntz encourages people to start learning bird sounds by getting to know the birds they can hear from their patio or yard. When you hear something different, she says try to find the bird because seeing it helps you to remember and associate it with its sound. When you're in the field, she recommends stopping frequently to listen. "When I lead an earbirding walk, we'll all stop, take a moment, and just really listen," she says. "I think that's one of the keys. People are busy walking on the trail, and they're not used to being tuned in." Once you tune in, she says you'll be surprised by how much you hear.

The Scented Signals *Of Avian Aromas*

by Shari Dorantes Hatch

Few of us realize how much we use smells to learn about one another. In her book, *The Secret Perfume of Birds: Uncovering the Science of Avian Scent*, Danielle Whittaker points out that we humans "unconsciously smell our hands after shaking hands with a stranger." Someone's scent can invite or repel us, even without our awareness. (Now that you're aware, have fun noticing this behavior.)

Scents powerfully affect bird interactions, too. Birds can smell one another, and they release odors that other birds can detect. In his book *Nose Dive: A Field Guide to the World's Smells*, Harold McGee writes, "Creatures on the move need to be able to find and be found by others of their species. They can do so . . . by purposefully emitting volatiles as signals"—that is, birds can seek and be sought by one another by emitting and detecting scents.

Nuzzling Crested Auklets by Cornelius Nelo, USFWS.

How Birds Detect Smells

Myriad sensory receptors (like tiny locks) line each bird's nostrils. When the bird inhales, particular inhaled chemicals act as tiny keys, unlocking particular receptors. These chemicals bind to the receptors, activating them. When activated (unlocked), the receptors send sensory information to neurons in the olfactory bulb, just above the nostrils. The bulb processes that information and sends it to particular areas of the brain. The brain further processes the various chemical signals into distinct identifiable odors. The brain either links the odors to previous experiences or flags the odors as novel, linked to this particular context. Birds who have a greater number and variety of smell receptors can more easily detect more odors.

Chemical Signals

To communicate with each other through scent, birds produce *semiochemicals*, which convey information between organisms. Some semiochemicals can be found in feces or on skin or feathers. Chiefly, however, semiochemicals are secreted in preen oil, exuded from a bird's *uropygial gland*, on its rump. Birds use their bills to liberally smear the preen oil on all their reachable feathers. This oil not only protects their feathers from degrading, but also communicates information to other birds. In social interactions, these chemicals might reveal something about mating, finding food, warding off rivals, or warning about predators. Some semiochemicals also convey unique information about the communicator, including:

- **Genetics**—Would this bird be a good father to my young? If he's not of my species, has poor-quality genes, or is too closely related, probably not.
- **Immune function**—Does this bird have a disease?
- **Hormone status**—Is this female ready to breed and likely to defend her territory?
- **Presence of microbes**—Does this bird have friendly or harmful microbes, which I might directly contact?

Courtship, Mating, and Raising Young

During courtship, males and females release distinctive *pheromones*, semiochemicals that signal when a bird is physiologically ready to mate. If a potential mate isn't ready to breed, why risk catching a predator's attention by dancing and singing? Odors may help to choose potential mates, too. High-testosterone male smells appeal more to females, and potent female smells attract more males. Both sexes prefer the odors of healthy mates whose high-quality genes differ from their own genes. Scent also appears to enhance pair bonding in numerous species of birds, according to *Birds of the World* (https://birdsoftheworld.org). For example, Crested Auklet pairs strengthen their bond by nuzzling each other's tangerine-scented napes.

In many species, the potent odors of courtship subside—potentially helping to hide the nest from predators. Nonetheless, scent continues to play a role in the brooding family's communication. Soon after being laid, embryo aromas may signal that they're alive, so their parents will know to incubate them. By the time embryos hatch, they can identify their parents' odors. Likewise, brooding parents recognize their nestlings' scents, and parents and young soon smell similar to one another and to their nest, which reeks of preen oil, feces, and saliva.

Ornithology has come a long way since the time when observers falsely opined that birds either lacked a sense of smell or profited little from smelling. We have better sense (scents?) now.

An Immense World *by Ed Yong*

One of the major benfits of science is its capacity to greatly extend our own senses, helping us perceive realities that we might otherwise have never imagined. We are living through a golden age of scientific discovery, and the knowledge gained can help us in our efforts to protect our biosphere. Pultizer Prize winner Ed Yong's book, *An Immense World*, describes the cutting-edge science that is transforming our understanding of the the hidden realms around us—and mapping the newfound complexities of our immense world.

Introducing Our New Director of Education

by Rebecca Kennedy, Communications Manager

Thanks to your generous donations, we were able to hire a new Director of Education, Sandy McCann.

With more than a decade of experience in San Diego's top cultural and conservation institutions, including the San Diego Natural History Museum (The Nat) and the San Diego Zoo Wildlife Alliance, Sandy is passionate about fostering conservation action and developing inclusive programming. She developed content for the Zoo and Safari Park, which highlighted conservation initiatives and nurtured a love of nature. At The Nat, she worked with a talented team to take the museum's award-winning exhibition, Coast to Cactus in Southern California, from concept to completion. It was only a matter of time, however, before Sandy found her way to San Diego Bird Alliance. While in college, she was the official penguin mascot for a local bank.

Sandy holds a degree in Sociocultural Anthropology and Biology from the University of California San Diego, as well as a master's degree from Johns Hopkins University in Museum Studies, focusing on content development. She looks forward to creating engaging educational experiences that nurture a love of nature and a commitment to conservation right here in our own backyard.

Be sure to say hi to Sandy at our next event!

The Anstine-Audubon restored coastal sage habitat in full spring bloom by Rebekah Angona.

Silverwood and Anstine
Are Open for the Season With New Hours

Silverwood and Anstine are free and open to the public. At both properties you can park in the dirt lot, grab a map, and hit the trail! Come explore, relax, and make unforgettable memories with us. We hope to see you soon!

Anstine-Audubon Nature Preserve in Vista is now open Saturdays from 9 A.M. to 4 P.M. Come enjoy our moderate loop trail and the abundant birdlife here at Anstine-Audubon.

Silverwood Wildlife Sanctuary in Lakeside is now open Saturdays from 9 A.M. to 4 P.M. and Wednesdays from 8 A.M. to 12 P.M. In addition to enjoying the stunning birding observation area and 5 miles of trails, we also encourage you to explore the displays in the **Frank Gander Education Center,** where you'll learn more about Silverwood's amazing flora and fauna.

A stroll through a Coast Live Oak grove on one of Silverwood's scenic trails. By DS.

San Diego Bird Festival 2025 *Discover the Wonder of Birds*

by Jen Hajj, Public Programs Manager

Birdwatchers, nature lovers, and environmental enthusiasts alike are eagerly awaiting the 2025 San Diego Bird Festival. This annual celebration, hosted by the San Diego Bird Alliance, promises an unforgettable experience for all attendees, showcasing the region's diverse avian population and its beautiful natural habitats.

Keynote Speakers & Lectures

The festival will feature prominent keynote speakers and engaging lectures designed to inspire and educate. These thought-provoking presentations will cover a wide range of topics, from bird conservation and climate change to the fascinating birds of the world. Attendees will hear from experts in the field, gaining insights that will deepen their appreciation of the bird species that grace San Diego and the broader environment.

Field Trips & Outdoor Adventures

One of the festival's highlights is the opportunity to join guided field trips. Whether you're a seasoned birder or a beginner, these trips are an excellent way to explore local habitats and observe birds in their natural environments. From coastal wetlands to urban parks, the San Diego region offers a rich diversity of birdlife, and these excursions provide a chance to see everything from shorebirds and songbirds to raptors and waterfowl.

Exhibit Hall & Silent Auction

The festival's expanded exhibit hall will be brimming with interactive displays, birding gear, and conservation-focused organizations. Attendees can shop for everything from binoculars to bird-friendly plants while learning about the latest conservation efforts. Don't miss the silent auction, where you can bid on unique birding experiences, artwork, and more, all in support of local conservation projects. The silent auction is currently available to view, and bidding opens on February 1, 2025.

Social Activities

While the festival is a hub of educational experiences, it's also a chance to meet and connect with like-minded individuals. With social activities throughout the weekend, you'll have plenty of opportunities to share stories and make lasting connections with fellow bird lovers. Whether you're attending the opening reception or enjoying a casual bird-themed gathering, there's always a sense of camaraderie and community.

The 2025 San Diego Bird Festival is not just an event—it's a celebration of our shared love for birds and the environment. Whether you're here for the birds, the lectures, or the chance to connect with fellow nature enthusiasts, you're sure to leave with new knowledge, lasting memories, and a deeper commitment to the protection of our feathered friends. Mark your calendars and join us for this incredible event in one of the nation's birdiest cities!

2025 San Diego Bird Festival
February 26–March 2
at Marina Village, Mission Bay
Register online at **sandiegobirdfestival.org**

February 26: Alvaro Jaramillo Opening Keynote, Marina Village Conference Center
Biologist, researcher, conservationist, and guide, Alvaro began birding at 11 years old. Born in Chile, he started guiding local trips as a teenager and is the owner of the international birding tour company, Alvaro's Adventures.

February 28: Juliana Soto-Patino "In the Footsteps of a Forgotten Female Ornithologist: Inspiring an All-Female Expedition and Rethinking Inclusion in Ornithology with Juliana Soto Patiño"—San Diego Natural History Museum
Juliana is currently a graduate student in the Program in Ecology, Evolution and Conservation Biology at the University of Illinois, where she is researching host–parasite systems at the Illinois Natural History Survey. She has been working on several research projects involving survey expeditions and community science on the Neotropics. She is passionate about biodiversity and science communication and is always excited to teach and communicate science in creative and inclusive ways to diverse audiences.

Photo by Kim Newmoney

March 1: Amy Tan "A Conversation with Amy Tan"—University of San Diego Shiley Theater
Born in the U.S. to immigrant parents from China, Amy Tan rejected her mother's expectations that she become a doctor and a concert pianist. She chose to write fiction instead. Her novels are *The Joy Luck Club, The Kitchen God's Wife, The Hundred Secret Senses, The Bonesetter's Daughter, Saving Fish from Drowning, and The Valley of Amazement*, all *New York Times* bestsellers. Her new book, *The Backyard Bird Chronicles* (Knopf, April 23, 2024), debuted at #1 on both the *New York Times* and the *Indie* bestseller list.