



# *bird* Radio

Employing cutting-edge technology, a new program aims to help improve bird point counting through a novel approach. *Written by Clyde Sorenson*

## *Tawee tawee tawee teo!*

The song of a hooded warbler rings out maybe 30 meters from where I'm standing. Is that another, 100 meters to the right? Did I really just hear a black-and-white warbler? What the heck was that call? I think my head is starting to hurt.

It's a bright, brisk, calm morning in late October, and seven experienced birders and I are standing in the piney woods of Johnston County, straining to hear the breeding songs of scarlet tanagers, black-throated blue warblers, hooded warblers and wood thrushes. And hear them we do, in spite of the fact that all these birds have already journeyed hundreds or thousands of miles away to the south for the winter. The bird-songs we're listening for are coming from little plastic boxes scattered through this forest at Howell Woods in Johnston County, and the fake birds we're tuned in to could help save real birds.

One of the most daunting challenges in bird conservation is simply knowing how many individuals of a given species exist, and whether the populations are changing over time. Birds are highly mobile, often



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Through the use of this new system, observers' accuracy during point counts of birds such as the scarlet tanager (preceding page), black-and-white warbler (top) and black-throated blue warbler (above) can be more accurately gauged.

well camouflaged and sometimes very secretive, so counting birds is a tough chore. One of the tools that ornithologists and conservation biologists have come to rely on for this difficult task is the point count. In a point count, an observer stops at a particular, predetermined point in a predetermined route, records the birds he sees and hears for a fixed period of time and then moves on to the next point.

Perhaps the most famous of these point count systems is the Breeding Bird Survey (BBS), a continent-wide network of 25-mile survey routes run since the mid-1960s. An army of expert volunteers runs the 4,100 or so routes every spring, stopping at exactly the same 50 spots on each route for exactly three minutes each, looking, listening and recording. The BBS is probably the best generator of regional bird population data in existence. The data from this program have helped us recognize the decline of the bobwhite quail and other grassland birds and have shown us the expansion of southeastern species into northern areas. But the BBS and other point count surveys do have problems.

### *The Blinded Me with Science*

First, not all observers are created equal. Older birders, though often possessing years of experience and tremendous skill, frequently have lost some hearing, and younger birders have less experience but much better hearing. Throughout the vast forested areas of the continent, hearing is a far more important sense than sight in counting birds. Second, not all birds are created equal. Some have loud, ringing songs that can be heard by most everyone from great distances, but others have thin, very high-pitched songs that only some people can hear, and then from rather short distances. Third, not all habitats are created equal. Songs travel much greater distances over open ground than they do through dense broadleaf forests. If point count data are to be trusted, and if sound management decisions are going to be made based on them, we need to understand the effects of such sources of variation—which is where the electronic birds we listened for that cold October morning come in.

Ted Simons, an ornithologist at N.C. State University, had been concerned with the potential problems in point counts for several years when it occurred to him that

technology could help address these possible shortcomings. He reasoned that, with the availability of wireless computer technology and high-quality digital audio recordings of birdsongs, it should be possible to create experimental simulations to answer some of the questions about the accuracy of point counts. Hence, Bird Radio was born. Over the last several years, Simons, an outstanding crew of graduate students and Ken Pollock, a biostatistician at NCSU who specializes in animal sampling problems, have used their little green boxes, computers and curious-looking antennae to address a host of point count issues.

The heart of the Bird Radio system is a laptop computer with recordings of birdsongs and programs to play them. The volume of the playback is carefully controlled so that all songs play at the same level. The computer is hooked up to a radio transmitter that communicates with the MP3 players in the green army-surplus ammo boxes. Each box has a speaker at each end so that the operator can have a "bird" call facing either toward or away from the observers. The numbered boxes are placed at various distances that are generally known to the Bird Radio crew but not to the observers. The computer programs are set up to deliver a predetermined number of songs from a set of bird species.

### *Sounding Board*

My first exposure to Bird Radio took place on a crisp March day four years ago, on the first day of the studies. Participating seemed like a good idea—at first. I'd get to spend a pleasant day outside with some good friends, and we'd be contributing to the advancement of science. However, the day got off to a bit of a rocky start as the crew worked the bugs out of the system. But, after resolving a few dead-battery issues, we started.

Fifteen of us were lined up along the edge of an open field, with an array of speaker boxes scattered out randomly in a semi-circular area in front of us from 5 to 200 or so yards away. The plan was for us to listen for three minutes, recording all the birds and their approximate locations on a field map (using a different color ink for each minute of the sample) and then go on to the next three-minute "point." It sounded simple enough—until the first point. We were

barraged by about 40 songs from 18 different species from all distances, and keeping up with just the pen colors became daunting.

After about five points, I began to have the suspicion that the friendly student running the computer might actually have a bit of a sadistic streak. It seemed the birdsongs kept coming faster and faster, and songs that I thought were coming from my left were actually coming from my right. A couple of my colleagues rapidly decided that their hearing had degraded to the point that they weren't qualified to continue with the work.

I found it extremely difficult to both identify and simultaneously pinpoint the location of each calling "bird," especially when "singers" were close. So, it was pretty much like doing a real point count. Just as with a real count, it took tremendous concentration, and though it looked like we were just standing around, it was actually an exhausting process. Over the course of the day, we did 20 unlimited-distance points and 20 points in which all the "birds" were within 50 meters.

### *Lessons Learned*

Even though that first day was a pilot run, Simons and his students learned some

valuable things. Importantly, and not unexpectedly, my 14 companion counters and I missed some birds on every point. We consistently undercounted black-and-white warbler calls; the black-and-white has a thin, high-pitched call that many folks can't hear under the best of conditions. But we also undercounted hooded warblers, which have a loud, ringing call.

Simons and his students have since used the Bird Radio system to study the effects of vegetation, distance, background noise and, importantly, characteristics of the observer that can have a big impact on the ability to detect birds. These are not trivial questions; point counts may be our only way to assess some bird populations, and important management decisions may be based on these data. If bird populations are changing but we can't detect those changes, we have a problem. But if populations aren't changing but our ability to assess them is changing, we still have a problem. Simons' research is attempting to describe these potential problems so we can make adjustments for them.

Distance is, of course, an important factor in hearing birds. Not surprisingly, the farther away a bird is, the harder it is to hear, and high-pitched songs fade fastest. So, again



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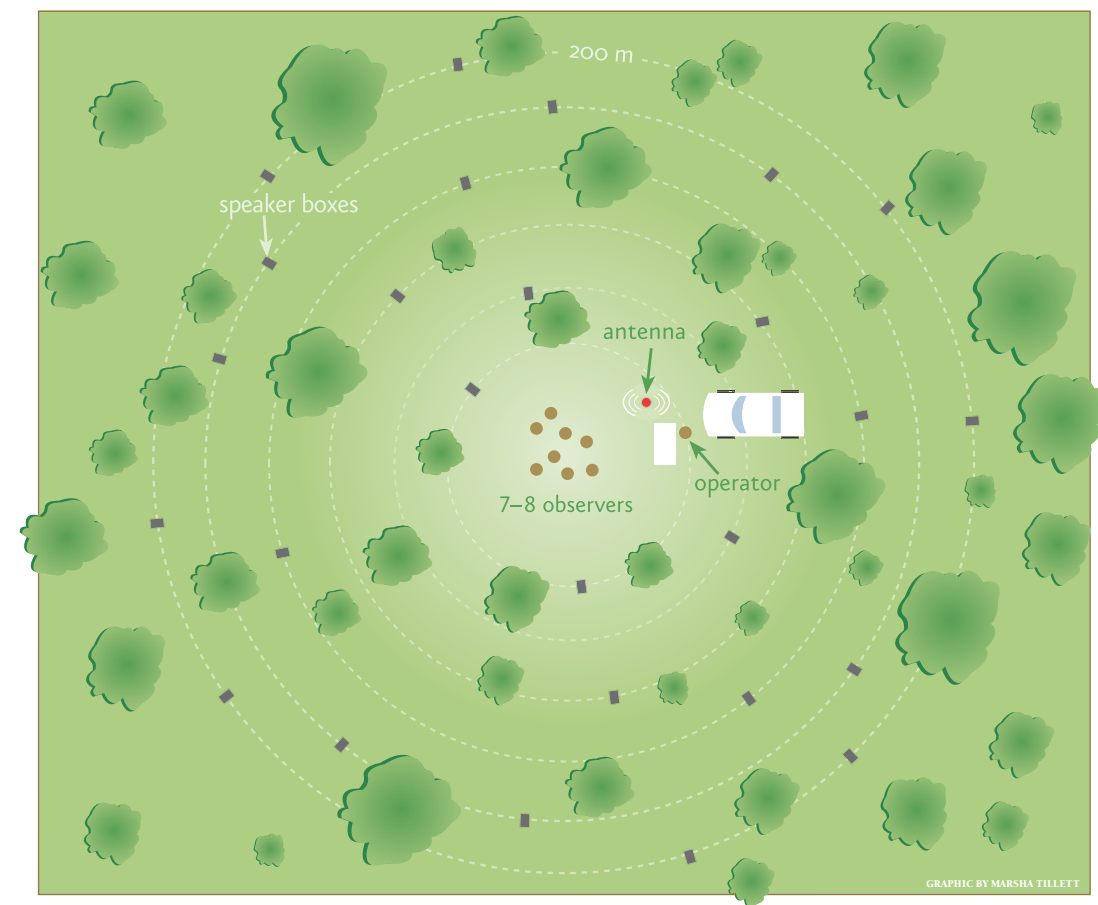


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### *The Ears Have It*

Developed by Ted Simons, an ornithologist at N.C. State University, the Bird Radio system was developed to help ornithologists and conservation biologists gauge how accurately observers can count birds in the field.

Using digital recordings of bird songs transmitted from a laptop computer, an operator sends random selections of samples to speaker boxes that are set up in concentric rings around a group of observers out to a distance of 200 meters. Each speaker box features two speakers, one facing toward the observers and another facing away. Observers make determinations of the distance and type of bird song, with the operator gauging their accuracy.



GRAPHIC BY MARSHA TILLET



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percentage of BBS volunteers, though extremely experienced and knowledgeable, are “seasoned,” and it is reasonable to expect that many of these older volunteers have experienced some degree of hearing loss. In the Bird Radio studies, fairly dramatic differences were detected among observers, with some of this variation tied to suspected hearing loss. Even though it is valuable to have experienced people run the same routes year after year, hearing loss in an aging observer, confounded by increasing ambient noise, could reduce the quality of data collected. These observers could be underestimating actual populations because they can’t hear them as they once could.

### *Whispers in the Wind*

On many routes, background noise is a big factor. I’ve run BBS routes for almost 20 years in three states. Over three years running my route in northern Nevada, a grand total of four cars or trucks passed me on my stops. During an average run of my North Carolina route, which winds through rural Wayne and Sampson counties, however, I’ll typically be passed by 20 to 30 vehicles, ranging from passenger cars to semis to even the odd farm tractor. On the other hand, it’s hard to find a day in the Nevada desert when the wind doesn’t eventually pick up to 15 or 20 miles per hour, but dead-calm days aren’t that unusual in North Carolina in the early summer. Clearly, ambient noise in these two environments differs. More important, the ambient noise on my North Carolina route is likely to continue to increase as the area develops. That’s not likely to be the case

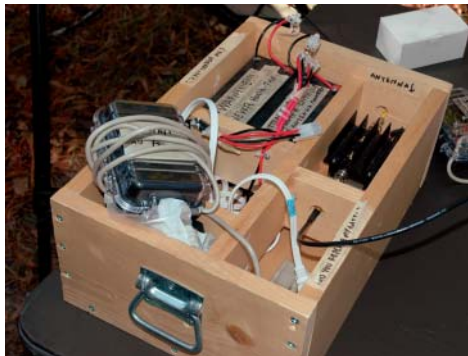
not surprisingly, distant birds get undercounted. Oddly, though, when Simons’ gang restricted birds to a 50-meter radius, we tended consistently to overcount birds! At close range, particularly in heavy woods, loud calls tend to echo, perhaps causing us to hear birds where they aren’t.

Still another, increasingly important (at least for the BBS), issue is the variation in individual counters, particularly that variation related to the age of the observer. The hair cells in our inner ear are responsible for catching the vibrations caused by sounds and converting them to neural impulses that we recognize. As we get older, we lose some of these hair cells. Frequent exposure to very loud noises exacerbates this loss. A high



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Armed with a laptop computer, an operator (top) sends out recordings of songs from birds such as the black-and-white warbler (right), hooded warbler (facing page, center) and wood thrush (facing page, right). These signals are transmitted to speakers housed within surplus military boxes (above left).



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in the Nevada desert. So, it is conceivable that as traffic increases on my North Carolina route, I’ll detect fewer birds even though populations of given species may not change — so I’ll be underestimating the true populations.

Understanding the impacts of background noise is crucial to effective surveys. The Bird Radio team used a white-noise generator to discover the impact of background noise on bird detection. Not surprisingly, the ability to hear birds drops dramatically with increased background noise. Even light breezes can reduce a listener’s ability to hear birds by as much as 25 percent, and just 10 decibels of white noise (far less racket than that caused by a pickup truck motoring by) reduces detection by almost 50 percent. Again, it’s the high-pitched, “thin” songs that drop out most rapidly. Simons’ crew has since been collecting data on actual ambient noise on North Carolina BBS routes to help clarify the impact of this noise on real-world counts.

There are also other factors that affect the precision of point counts — things like how frequently a bird sings, which way a bird is facing when it calls and how many different species are singing at the same time. As it turns out, birds that call very frequently are often overcounted, and, as you might expect, birds that call infrequently are often not recorded at all. A frequently calling bird that is some distance from an observer might be counted twice if it turns around between calls. And when many birds are calling, some inevitably get lost, particularly if they are calling infrequently or have those dangled high-pitched songs. Bird Radio gives Simons and his students the ability to assess these kinds



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of variations, so they can be accommodated when point count data are analyzed.

Although it’s not directly related to phenomena associated with our ability to hear birds, even global warming could have an impact on surveys such as the BBS. Each BBS route is given a window in early summer during which the singing activity of resident birds is expected to be highest. However, those windows were established almost 40 years ago. Since then, many phenomena associated with the arrival of spring, such as the dates certain flowers start blooming, bud break in deciduous trees and, yes, the arrival of some migrant birds, are now occurring as much as two weeks earlier than they did 40 years ago. We may soon have to adjust the BBS windows to insure that we don’t bias our counts and potentially underestimate populations, because our samples are now falling in the quieter time after the heat of the breeding season.

### *A Sound Future*

Point counts will undoubtedly continue to be extremely valuable tools in our bird study toolbox. Indeed, they will become even more critical as our human populations continue to grow and we continue to convert natural habitats to our own uses. But thanks to Bird Radio, the information we gain from those surveys will be of higher quality — and the birds will be the ultimate beneficiaries. ♦

Clyde E. Sorenson is an associate professor of entomology at N.C. State University and a regular contributor to WINC.



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## BBS founder inspires Bird Radio crew

*In March 2005, I invited several scientists from the U.S. Geological Survey’s Patuxent Wildlife Research Center to participate in three days of experiments at Howell Woods.*

*We were pleased to learn that coming down were not only former and current heads of the BBS Bruce Peterjohn and Keith Pardieck, and longtime contributors to the program Deanna Dawson, Barbara Dowell and Dan Boone, but also Chan Robbins, who, at age 89, is widely regarded as one of the fathers of modern ornithology.*

*I wondered if Robbins, who started the BBS in 1966 ([www.pwrc.usgs.gov/whats\\_new/events/robbins/](http://www.pwrc.usgs.gov/whats_new/events/robbins/)), would think our simulated point counts were realistic enough to learn something useful about counting birds. I had my answer soon enough. Over the next two and a half days Chan filled our conversations with stimulating questions, suggestions for additional experiments and offers to share data he had collected in the 1960s when he was writing the “Golden Field Guide to the Birds of North America.” Even after a professional career spanning 60 years of bird study, Robbins’ energy and enthusiasm inspired us all.*

— Ted Simons