ARE WE CLEARING THE WAY TO FUTURE UNDERSTANDING THROUGH MONITORING?

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TRANSACTIONS OF THE WESTERN SECTION OF THE WILDLIFE SOCIETY 42:1–3; 2006

Key words: Breeding Bird Survey, monitoring, ornithology, wildlife management.

Good morning. I was surprised, delighted, and honored when 2005 Western Section President-Elect, Kevin Hunting, invited me to talk at this plenary session. This is very much a homecoming for me because I spent 22 years of my career here in California, much of that time measuring or monitoring some aspect of wildlife and its habitat (Howell et al. 1983; Howell and Shor 1985; J.A. Howell. 1986. Feral Pig Management Plan, National Park Service, San Francisco, California, USA; Howell and Pollak 1992; Howell and Bioret 1995; Howell 1997; Howell and Barrett 1998; Howell et al. 2002; Shideler et al. 2002; Semenoff-Irving and Howell 2005). The past 4 years as director of the Patuxent Wildlife Research Center have given me time to reflect on the subject at hand—monitoring—and a different point of view.

One of my greatest honors at Patuxent has been to work with Chandler Robbins, the lead editor of the *Birds of North America* (Robbins et al. 1983), which some of you may have used in your first ornithology class, whether you were giving it or taking it. He began his federal career in 1945 as an ornithologist and worked as a leader in the field for 60 years, until he retired in December 2005. He worked his entire career at Patuxent. Chan is a true field hand, spending untold hours surveying the eastern hardwood forests and riparian corridors for birds. From his experiences between the 1940s and early 1960s, he developed a monitoring protocol for birds. After several years of testing, Chan unveiled the Breeding Bird Survey (BBS) in 1966; this year is the 40th anniversary of the BBS.

The BBS protocol is fairly simple. Expert volunteer birders drive to a preselected route, stop at 50 points along that route, listen and observe for 3 min, and count as many bird species as possible (USGS 2001). This seems simple and straightforward. Like the Audubon Christmas Bird Count, the BBS caught on and was implemented across the U.S. and parts of Canada. There is even strong interest now to establish routes in Mexico, a partner with Canada and the U.S., through the Migratory Bird Treaty Act (1918). The BBS data are accessible on the web and analyses may be done in the same venue.

Currently, there are more than 5,000 BBS routes, and more than 700 bird species and nearly 67 million individual birds have been detected. Numerous analyses have been completed with this data set. The BBS was used as a major indicator of the decline of migratory birds across the continent, and federal and state agencies have used the results to guide policy for bird conservation in North America. It is an important tool for the states in developing their Comprehensive Wildlife Plans, which opens the door for them to successfully compete for federal funding. The BBS has become a well-respected, national monitoring program supported by bird management and conservation organizations across the continent. The BBS is the best we have to look at changes in bird abundance at an eco-regional scale.

This all sounds great, but there is a current of controversy underlying the BBS that threatens its future. There are some fundamental problems with BBS protocol and its power to detect change. Bird conservation groups are concerned that if the BBS is thrown out because of its flaws, the future of North American bird management and conservation efforts will be threatened. Because of these issues, there is a hot debate about the BBS and its future being played out in the peer-reviewed literature (Bart et al. 2004, Sauer et al. 2005). As with most

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debates, there are 2 camps of thought regarding the BBS.

One camp asserts that what needs to be done for the BBS is to increase the number of routes. The increased sample size increases statistical power, and life is good again. Intuitively, this has a lot of appeal, and many bird management and conservation organizations want to follow this recommendation. The other camp asserts that what needs to be done for the BBS is to assess and correct the roadside and habitat biases of the survey methods. As if that isn't enough, they also insist that observer bias must be accounted for. Not only that, they assert that for the amount of time, energy, and funding required to increase the sample size by 40–50%, as recommended by the other camp, the method's power is marginally increased and degree of bias remains unknown.

These are very difficult topics to address and get to the heart of the assumptions underlying BBS protocol. What do we do? Increase sample size or work on understanding the underlying biases so that they can be properly dealt with through changes in survey protocol? Ted Simons and Ken Pollock at North Carolina State University are tackling the question of observer bias. They have developed a method using randomly placed speakers at a BBS point-count site, known affectionately as "Bird Radio." The speakers are in known locations and, therefore, known distances and directions from the observers. Individual species' songs originate from one speaker, but multiple species' songs are from different locations during the trial period. Ted presented preliminary results at Patuxent in 2005 that indicated, even with "expert birders," they did not identify or properly locate birds in the field very well. Estimated distances were often off the mark and a little over half of the species were correctly identified. Three weeks ago, they returned to present results from refined "Bird Radio" experiments. Rather than using a multivariate approach, they simplified their experiments to begin teasing apart the aural detection process element by element. They reduced the number of birds to focus on 5 species with additional species in the background. They found that problems of detectability revolved around variables such as singing rate, ambient noise levels, and timing of surveys. In addition, problems with distance estimation remain. The ornithologists involved may have thought they were doing a good job but, in reality, may not be as good as they thought.

The exciting part of this is that you can look forward to a number of new publications on this topic in *Auk*, the *Journal of Wildlife Management*, *Biometrics*, and others. In addition, there are 2 dissertations and several articles currently in print (Farnsworth et al. 2002, Pollack et al. 2002, Alldredge 2004, Pollack et al. 2004, Webster 2005). Tackling these hard questions about bias is absolutely necessary if the BBS is to be taken to the next level so that the BBS will remain as a tool of choice in the 21st century as it was in the 20th century.

On the pragmatic side, if sample size is increased at some additional cost without a consummate increase in inferential power, then labor and capital are being wasted. The loss of our credibility as biologists is an even greater risk. In the current climate of scarce resources for wildlife conservation, biologists can ill afford to waste the public's or their clients' funds. As biologists, we cannot monitor for the sake of monitoring. In a soon-to-be-published paper by Jim Nichols, he states that monitoring should not be a stand-alone process. To maximize our understanding and get the biggest bang for our buck, we must put our monitoring in a greater scientific context. What are the questions critical to wildlife management that we need to answer? What are the tests of alternative management strategies that need to be done?

Many of us have all been involved in monitoring. We have results, and our intentions are certainly good. But are we getting the right results and are we answering those tough questions? If we are to take our profession to the next level in the 21st century, I suggest that we design our efforts using the scientific rigor described by Williams et al. (2002) in their book on wildlife population analysis and management. In the face of all the pressing conservation needs, we may not be able to do all of it, but we certainly must do our best science to accomplish what we can. Monitoring is a part of that process, and not the end. It is good to be home. Thank you.

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