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Citizen Science and Wildlife Conservation:

Lessons from 34 Years of the Maine Loon Count

by Sally Stockwell and Susan Gallo

Abstract

Since the early 1980s—long before the term citizen science was widely adopted—Maine Audubon has engaged thousands of dedicated volunteers in myriad wildlife surveys and studies, from bat colony monitoring to spring amphibian surveys to loon counts. In this article, the authors describe some of those citizen science projects and use the longest-running program, the Maine Loon Project and its annual Loon Count, to showcase what it takes to run a successful program. They also review key lessons learned from these projects over the last three decades.

MAINE AUDUBON AND CITIZEN SCIENCE

Maine Audubon has worked with a variety of partners over more than three decades to develop and lead numerous citizen science projects. Each addresses an important conservation need, and all collect information that helps conservation biologists, state and local governments, and citizens to take action to help conserve the target species and habitats. Importantly, they also engage volunteers in science, the outdoors, and activities that foster appreciation of wildlife and wildlife habitat throughout the state.

Major Current and Recent Past Projects

Bat maternal colony and audio surveys

Maine Audubon worked with the Maine Department of Inland Fisheries and Wildlife (MDIFW) to develop a survey protocol for citizen scientists to estimate productivity of Maine's bats. Unfortunately, due to the sudden onset of white nose syndrome in Maine, over 100 volunteers who were set to locate and survey colonies found mostly abandoned sites. Of the more than 40 colonies initially identified, only one showed production of bat pups. More recently, in 2015 and 2016, Maine Audubon worked with Erik Blomberg at the University of Maine on the BatME Project to recruit and train volunteers to survey bats

throughout Maine using an innovative iPad audio-recording program (EchoMeter Touch, Wildlife Acoustics). The long-term goal of BatME, which is ongoing but currently lacks funding, is to document changes in occurrence and relative abundance of eight bat species across the state as a way of documenting the impacts of white nose syndrome and other sources of mortality on our native bat popula-

tions (Blomberg, Morano, and Mosby 2016).

Surveys of brook trout ponds and coastal streams

Maine is the last stronghold for wild brook trout in the eastern United States. Pond and lake populations are intact in 185 subwatersheds (compared to only six total intact subwatersheds among the 16 other eastern states), and stream populations are intact in as many Maine subwatersheds as in all other eastern states combined (TU 2006). Even so, some waters have not yet been surveyed, so volunteer anglers were recruited to find previously undocumented wild brook trout populations in remote ponds and coastal streams. After six years, volunteers have successfully surveyed more than 425 remote Maine ponds for which no data were previously available. In the three years since the Coastal Stream Survey was included, volunteers have successfully evaluated 137 coastal streams. Working with our primary partners of MDIFW and Trout Unlimited, these volunteers have donated over 7,990 hours to the project and found trout or signs of trout in 145 ponds and 65 streams (MA, MDIFW, and TU 2016). The long-term goal of this project is to protect priority ponds by adding them to the State Heritage Fish Waters list, which does not allow stocking or the use of live fish as bait, and to develop new strategies for protecting sea-run brook trout in Maine's coastal streams, ultimately ensuring the future success of the last, best remaining wild brook trout in the East.

Wildlife road watch

Roads and traffic can make it difficult or impossible for wildlife to move safely across the landscape. Wildlife populations may decline or become locally extinct as a result of vehicle collisions or the inability to move across different vital habitats during their life cycles. Wildlife movement has become even more important for population survival as habitats shift due to climate change and animals adapt by moving to find more suitable habitat. Additionally, vehicle collisions are an ongoing safety concern for Maine drivers. For this project, volunteers watch for and record wildlife (live or dead) on roads throughout the state to document wildlife movement and road mortality. Between July 2010 and December 2014, over 460 volunteers submitted more than 4,800 observations via a web-based reporting program. This includes 6,000 individual animals (60 percent dead on the road) and 153 different species (Charry 2015). This project is in collaboration with the UC Davis Road Ecology Center and is a model for other states and countries around the world. Next year, we will be initiating a new program tracking turtle movement in an effort to reduce road mortality that threatens local extinction of several endangered and threatened species. Additional partners include MDIFW, Maine Department of Transportation, and US Fish and Wildlife Service. The long-term goal is to identify areas with concentrations of wildlife road crossings, improve safe passage of wildlife across our roads, and reduce wildlife-vehicle collisions.

[Maine Audubon's citizen science programs] engage volunteers in science, the outdoors, and activities that foster appreciation of wildlife and wildlife habitat throughout the state.

Maine amphibian monitoring

Suspected long-term declines in worldwide amphibian populations led to an increasing interest in documenting frog and toad population trends in Maine. This project, led by Maine Audubon in partnership with

MDIFW, started in 1997. Volunteers collected information about the abundance of calling amphibians on 61 roadside survey routes across the state three times every spring. Maine was one of the first states to develop an amphibian survey protocol. Eventually that protocol was modified and adapted to a national standard by the US Geological Survey (USGS), which oversaw similar programs for more than 20 other states. The long-term goal of the amphibian-monitoring project was to document changes in the presence and relative abundance of amphibians. Based on Maine data from 2001 to 2011, six species of toads and frogs showed steady significant declines in occurrence, and one (pickrel frog) showed a significant increase (Weir et al. 2014). No longer supported by USGS as of 2016, the future of the program in Maine is uncertain.

Owl monitoring

Owls are missed by most volunteer survey protocols (Breeding Bird Survey, Christmas Bird Count), so the status of Maine's owl populations is unclear. In a span of years from 2002 to 2005, over 100 volunteers ventured out on cold nights from February to April to play calls (on audiocassette tapes!) and listen for responding owls. They conducted more than 6,000 surveys and heard more than 2,000 owl calls. The main goal of the project was to create a manageable protocol for surveying owls. Determining which owl species to play on the tapes, in what order, at what time of night to get the most detections, and what volunteers can tolerate in a protocol were all questions explored by the project. At the end of the project, a recommended protocol was developed, but a lack of funding thwarted attempts to continue long-term monitoring efforts. Partners for this project included MDIFW and Unity College.

Vernal pool surveys

Vernal pools are small seasonal wetlands that provide breeding habitat for several amphibians and which previously had no regulatory protections. For the first phase of this project, volunteers surveyed pools in the spring to record egg-mass numbers for vernal pool specialists (wood frogs, spotted salamanders, and blue-spotted salamanders) and to document other pool characteristics that might help identify the most productive or significant pools. Legislation protecting significant vernal pools was subsequently passed in 2006, with vernal pool citizen scientists helping raise awareness of the importance of this habitat among legislators and

within their communities. Starting in 2008, additional volunteers were recruited and trained to survey all potential vernal pools mapped in 12 towns to determine which ones were significant and therefore subject to special protection measures. Partners include the University of Maine, MDIFW, local municipalities, and local land trusts. The long-term goal is to help towns and developers proactively plan which pools to protect and where to steer new development.

A CASE STUDY FOR LONG-TERM SUCCESS: MAINE AUDUBON'S ANNUAL LOON COUNT

Background

In the late 1970s, as environmental activism and awareness of the importance of clean water was growing, concerns emerged that Maine's common loon population might be dwindling. Maine Audubon created a partnership with MDIFW to develop a protocol for volunteer loon surveys. That protocol for the annual Loon Count has been in place since 1983 (Lee and Arbuckle 1988) and has involved many thousands of volunteers over the course of 34 years. The count is held annually on the third Saturday of July from 7:00 to 7:30 a.m., a time of day before loons start moving around lakes and a time of year when most loon eggs have hatched but before chicks have been lost to predators. A sample of counts from different-sized lakes is used to create a reliable estimate of the population in the southern half of the state from year to year.

The Survey

The count uses paper forms, requiring substantial work to organize, photocopy, and mail maps and count forms to more than 900 volunteers. A small group of 45 to 50 people act as regional coordinators. These super-volunteers distribute and then collect all the count forms from individual counters in their regions, paying for postage and sometimes printing, and also making themselves available to answer questions counters may have before or after the count. Some coordinators even prepare their own newsletters or emails to share information and keep in touch with counters not just for count day but also throughout the season. Many have been coordinators for decades. Using regional coordinators gives the program a more personal and local touch than if everything was sent from the main office. It also significantly reduces administrative time (and postage costs) for Maine Audubon. Additional

volunteers in the office help check and enter count data into a database and update addresses and contact information for loon counters. These volunteers are truly indispensable for this project.

Volunteers

Volunteers for the Loon Count embody the characteristics essential for successful citizen science projects. They are a community of extremely dedicated individuals, with participation lasting on average more than 10 years. A surprising number (more than 30) have counted for 30 years or more. Many bring children—even grandchildren—along, and it is not uncommon for these younger participants to take over count-day responsibilities in time. For many, the Loon Count is a family tradition.

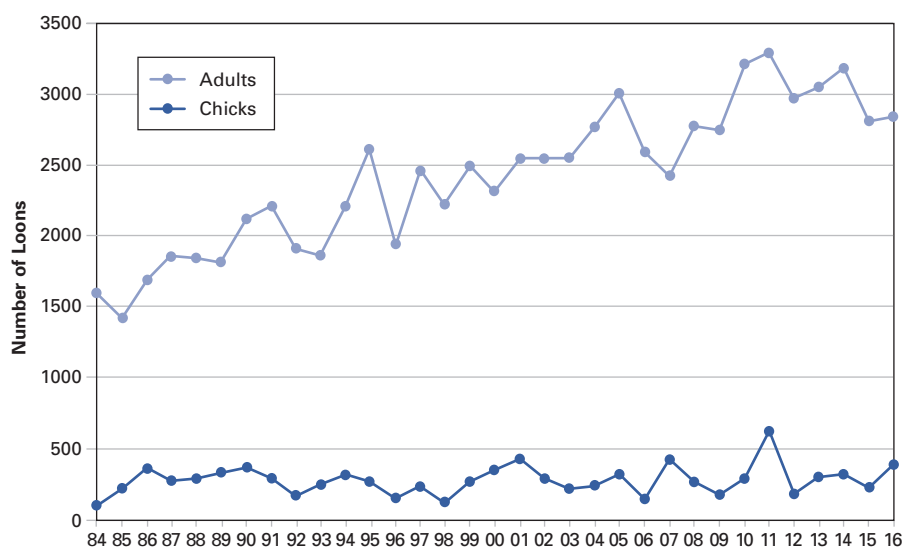
The simplicity of the protocol and the limited time required (a half hour per year to count, plus a few additional minutes to turn in data) likely contribute to this dedication. It is, of course, compounded by the charisma of common loons and the passion that loon counters have for them. Counters watch for their nesting pair to return each spring and wait anxiously for any chicks that might hatch. They watch the chicks disappear or grow up, and they wish the loons bon voyage as they fly off to the ocean in the fall. They love to share stories about territorial battles between neighboring pairs, successful nests, attempts at predation by eagles, and songs and calls they have heard.

Most importantly, counters have learned not only to count but also to help their loons. They find out that close disturbances from people in boats or on land can cause a nesting loon to abandon the nest either temporarily (exposing it to predators) or permanently. They understand that high wakes from passing boats will wash over a nest and wash out eggs and that lead sinkers and jigs can be ingested and are a leading cause of fatal lead poisoning. They know that good water quality is essential for loons to find food and raise their young.

Results

Over 34 years of the project, there has been a slow, steady rise in the adult loon population. As of 2016, we have twice as many adult loons in the southern half of the state (2,848) as we did when we started counting (1,416) (Figure 1). Chick numbers have stayed consistent, rising and falling markedly from one year to the next. The highest chick estimate was in 2011 (619), and the lowest was in 1984 (100). The most recent count of

FIGURE 1: **Estimated Size of Loon Population (Adults and Chicks) in the Southern Half of Maine (South of the 45th Parallel), from 1984 to 2016**



384 chicks is one of the highest recorded, yet unlikely to indicate a significant trend over time from the first estimate of chicks in 1983 (176) due to the year-to-year variability in count estimates.

SUCCESSFUL CITIZEN SCIENCE: LESSONS LEARNED

Based on our experience with the annual Loon Count, as well as with the many other citizen science programs Maine Audubon has undertaken over the years, here are six lessons we think could be useful to others embarking on citizen science projects.

Lesson 1: Be Realistic

Volunteers are at the core of citizen science. Citizen science volunteers are often passionate about the subject and generous with their time, but it is important to remember that they are not paid staff. Be sure you are asking volunteers to do something they can successfully complete and sustain over time with minimum oversight and maximum confidence and accuracy.

If you ask too much of volunteers, they may not follow through. If the instructions are too long or complicated, they'll likely give up before they even try. If you ask them to go out too many times in a season, there's a good chance life will intervene and they won't

be able to complete all the surveys. If there's a lot of specialized equipment needed, the number of people who can participate is likely to shrink rapidly.

In this way, the Loon Count is perfect in its scope: it is only once a year; it lasts only half an hour; it can be done from shore, kayak, canoe, or small motorboat; it requires only simple observation and counting skills; and data sheets are easy to submit. As a result, the barriers to entry are low, and the project draws volunteers from a wide array of ages and backgrounds. Although we do have occasional issues, for the most part, volunteers follow directions and report data in a timely way.

In contrast, participation in the Maine Amphibian Monitoring Program was more difficult to sustain over time. It required three after-dark surveys per year during specific windows of time over two months; it often proved difficult for volunteers to complete all three surveys year after year; some survey routes were remote and hard to get to, sometimes requiring overnight stays after the surveys were complete. Nevertheless, we had many individuals who surveyed the same routes for 10 years or more. In fact, out of all 11 northeastern states with similar monitoring programs, Mainers hold the record for the most observations, with a total of 1,097 records, or nearly 21 percent of all surveys in the Northeast (Weir et al. 2014)! This may be in part because many Mainers feel connected to their natural environment and are eager to participate in such a study. But we also consistently promoted participation and actively recruited new volunteers each year.

Lesson 2: Longevity Is Key

If you look at the graph of the results of the Loon Count from 1984 to 2016, you can see that if you were to count only the population for any three-year period, you would get a very different picture of the population trend than if you look at the long-term changes over 33 years. There is a lot of variation over time; only by counting over a long period can you see the overall trend, which in this case is clearly positive.

To avoid high rates of turnover among volunteers—which can be time consuming and costly for staff who then have to spend additional time recruiting new volunteers—we try to create a sense of community among counters. We send regular emails, newsletters, and reports with updates and summary information to volunteers, so they can see their results in action and feel connected to the project and to each other. We also focus on consistently recruiting small numbers of new volunteers each year for lakes that have lost counters and occasionally recognizing the generous contributions volunteers make (see Lesson 6).

Keeping volunteers engaged in the annual Loon Count year after year has also allowed us to make significant progress with public outreach. Sharing publications like *Living in Loon Territory*, offering *Look Out for Loons* signs, and delivering slide shows and multimedia presentations have helped raise awareness about the life cycle of loons, where they nest and where they raise their chicks, how to live near loons without disturbing them, and how to protect their lake habitat and water quality. Building a team of knowledgeable and caring loon counters has led to better stewardship of both loons and lakes, both in their communities and in the state legislature. Even better, that culture of stewardship is now being passed on to new generations.

Lesson 3: Longevity Is Hard to Sustain

Supporting citizen science programs takes a surprising amount of staff time and expertise. At a minimum, staff need to develop scientifically sound survey methods and clear protocols that are easy to understand and follow; develop informative but concise outreach and training materials; recruit volunteers who are generally busy and already committed to many other projects and causes; collect, enter, and store data; be available to support volunteers when they write or call with questions; be patient and attentive as volunteers share their stories; and then analyze data and report out results in a meaningful way. For some programs, staff also need to develop and host training workshops or spend time in the field with volunteers to ensure they understand and implement protocols.

With a long-term commitment comes a need to both honor the traditions developed over the span of a project and to introduce new twists to keep things fresh. For example, the Maine Loon Count has always been a paper survey, mailed out to regional coordinators and then counters in the weeks prior to the count and

returned by mail afterward. In 2018, we will introduce a new online data portal, allowing counters to enter their own count data. While the portal has the potential to greatly reduce resources and staff time committed to the project, it will not work for a significant portion of long-time loon counters who are not comfortable online. Maintaining the paper-based count for these long-time counters is critical to keeping the feeling of community and inclusiveness that the Loon Count has fostered in its three decades.

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Also with long-term commitment comes a constant need to raise funds to support staff time and other program expenses. Volunteers rightly do not want to pay for their citizen science experience as they feel they are already contributing their time, energy, and expertise. Foundations frequently cover initial start-up costs for new citizen science programs, but rarely sustain them over the long term. Host organizations might want, but not be able, to cover costs indefinitely. It can be challenging to sustain long-term programs.

Occasionally we have tried new approaches to reduce costs or raise funds for the annual Loon Count. At one point, we considered spacing the count to every other year or even every five years, which would still give us reliable long-term data, but potentially reduce some costs. The volunteers revolted! They really look forward to their annual count and wanted a yearly record of results for their lakes. In reality, the costs saved from a more periodic count would likely be lost as people would drift away from the project and recruitment costs for a count every other or every five years would be quite high. Another time, we tried to introduce a small fee (\$5) that counters would pay to participate. This is not uncommon in citizen science projects, but it was flatly rejected by loon counters. Despite our best attempts to explain the need for funds to cover expenses, angry counters left the project, and it took several years for the

project to recover. Aside from occasional grants and gifts from donors, which are essential, Maine Audubon supports the majority of the expenses for the Maine Loon Project from membership and annual fund donations because it closely aligns with our mission of engaging people to conserve Maine’s wildlife and habitat. Over time, a number of loyal loon counters have also become donors and important financial supporters of the program—another benefit of its longevity.

Lesson 4: Partnerships Are Essential

We rely on many different partners to ensure the success of our citizen science programs. We collaborate with state and federal agencies, academic institutions, businesses, sporting groups, civic groups, land trusts, and other nonprofits to accomplish our goals. Partners improve the quality of the program, the data collection and analysis, the public reach, and the likelihood of success. But coordinating with others also requires patience, persistence, sensitivity to differing viewpoints and approaches, and sometimes results in time lapses and delays. Clarifying the specific roles of each partner at the start of the program is critical, as is having one point person to shepherd the partnership and keep people moving along the timeline.

Examples of some of our partnerships include the following:

- UC Davis Road Ecology Center built our Wildlife Road Watch web program and guided us through the process of analyzing data to identify hot spots and high-density crossing areas. Currently, they are building a new mobile app that we will be beta testing soon (<https://roadecology.ucdavis.edu/>).
- Twelve towns in southern Maine contributed extensive staff time to map potential vernal pools, train volunteers, reach out to private landowners for permission for volunteers to survey pools on their property, and produce final maps of pools where egg masses were found (<http://www.vernalpools.me/>).
- Maine BASS Nation invited us to distribute Fish Lead-Free posters, stickers, and lead-free tackle at several fishing derbies around the state (<https://fishleadfree.org/me/>).
- Maine Lakes Volunteer Monitoring Program is currently collaborating with us to create a new online data portal that will build a loon count

database at the Lakes of Maine website (<http://www.lakesofmaine.org/>).

- US Geological Survey supported Maine’s amphibian-monitoring effort for 18 years, providing maps of amphibian survey routes, audio tests for volunteers, and long-term population trend data analysis. The partnership ended in 2016 when USGS dropped the program, which at the time was operating in 22 states.
- University of Maine Professor Aram Calhoun and her assistants provided professional expertise for vernal pool survey projects and guidebooks. The university also hosts the Maine Vernal Pools website, with publications and results from previous citizen science projects and information about current research and public policy initiatives (<http://www.vernalpools.me/>).
- UMaine Cooperative Extension serves as lead for the Signs of the Seasons program, which has incorporated a common loon phenology protocol into their program and into their online data entry portal Nature’s Notebook (<https://extension.umaine.edu/signs-of-the-seasons/>).
- Maine Lakes Society hosts the Lake Smart program, which now includes both a Loon Smart and Stream Smart component. Counters can be Loon Smart if they not only meet Lake Smart standards for their houses and yards that protect water quality, but also protect loon habitat, reduce disturbance, and share information with friends and neighbors. In just two years of the program, more than 100 camps and camp owners in Maine have been certified as Loon Smart (<http://mainelakessociety.org/>).

Lesson 5: Celebrate Your Volunteers!

Volunteers don’t want organizations to waste their money on gifts for them, but they do appreciate useful tools and recognition. Following are some of our more successful efforts to make volunteers feel special:

- A vernal pool–monitoring Frisbee. Perfect for dipping under salamander and frog eggs to help with counting, we gave one to all vernal pool survey volunteers.
- A published list of Loon Count volunteers and volunteer coordinators that have served for 20 years or more in our member magazine *Habitat*.
- Certificates of achievement mailed to individual volunteers for long-time or outstanding service.

- Personalized thank-you cards with hand-tied flies mailed to all active angler volunteers.
- Periodic feature stories about volunteers in *Habitat*.

We can always do more. With all the work our citizen science volunteers have done over decades, and all they have contributed to scientific understanding and conservation in Maine, they deserve all the recognition we can give them.

Lesson 6: Move People to Action

Once volunteers are invested in their program and understand the ecology of the species or habitats with which they are working and the potential threats to those species and habitats, they are often motivated to go a step further and help protect them. For us, this is one of the most important reasons for doing citizen science programs: We hope our programs will motivate people to care about wildlife and habitat enough to get involved and become better stewards. Often, they need to be asked and given the tools to do so.

Loon counters provide an excellent example of what a group of motivated individuals can accomplish with a little support and guidance. They post *Living in Loon Territory* brochures in their camps with a list of things to do to help loons, including how to reduce boating impacts and hazards from fishing. They post *Look Out for Loons* signs near nests to deter people from getting too close. They exchange their lead fishing tackle for lead-free replacements. They invite Maine Audubon to speak about loons and loon conservation at their annual lake association meetings. They borrow our traveling loon kit to bring to schools and youth groups to show them what real loons, feet, wings, bones, and eggs look like up close. They sign up to have their property inspected by the Lake Smart program to see what else they can do to help protect water quality and loon habitat, such as planting shrubs along the shoreline and reducing runoff from roofs and driveways. And sometimes, they come to Augusta, Maine, to testify at public hearings.

This last step—getting involved in citizen advocacy in support of conservation issues—is the step we would ultimately like to see all citizen science volunteers take. Having informed local voices contact their representatives is far more powerful than anything Maine Audubon staff can do alone. Responding to our action alerts, numerous Loon Count volunteers have written letters to

the editor, called or written letters to their state or local officials and legislators, or otherwise spoken out about an important proposed rule or bill that will affect loons or lakes. Many have even showed up at the state capitol to testify. A small sample of legislation that loon counters have helped pass over the years includes

- allowing municipalities to adopt special boating restrictions on certain portions of (or entire) lakes if the boating activity is deemed to threaten the success of loons and other wildlife;
- banning certain sizes of lead sinkers and jigs to reduce loon mortality from lead poisoning;
- protecting lake water quality by limiting development and timber harvesting in the Shoreland Zone;
- providing funding for boat inspections at public boat launches to minimize the transport and introduction of nonnative invasive aquatic plants.

Once volunteers are invested in their program and understand the ecology...and the potential threats...they are often motivated to go a step further and help protect them.

The Fish Lead-Free program is a particularly instructive case. First, volunteers helped us collect dead loons, which were sent to Tufts School of Veterinary Medicine for necropsies to determine the cause of death (the leading cause for adult loons in Maine being lead poisoning from the ingestion of lead sinkers and jigs). The data were summarized into a report for legislators, and Maine Audubon worked with legislative allies to introduce a bill banning the sale and use of certain-sized lead sinkers and jigs. Volunteers called their legislators and spoke at hearings asking them to support the ban, with the bill amended to ban only the sale of some of the tackle in question. After several years, more data on dead loons were collected that determined loons were still dying after ingesting certain-sized lead tackle that had not been included in the first ban. Finally, a ban on

both the sale and use of a wider size range of sinkers and jigs was passed into law.

The success of this advocacy effort owes much to the help of loon counters all along the way. Following each ban, Maine Audubon mounted an educational campaign to encourage anglers to switch from lead to lead-free sinkers and jigs, along with lead tackle collections and exchange programs. This was all undertaken with assistance from loon count volunteers, lake associations, and others across the state.

Legislators repeatedly comment on the number of calls they receive on bills related to loons and lake water quality. We know definitively that our Loon-Count-volunteers-turned-citizen-activists have played a substantive role in determining the outcome of these bills and the future of loon and lake conservation in Maine.

CONCLUSION

“Let’s all keep up the good work,” says Carol Gestwicki, a 30-year Loon Count veteran. “When we work to protect the loons, we also protect the lakes and ponds, the mountains, and our entire state. Being aware makes all the difference.”

Given the right support, tools, and training, citizen scientists can provide an invaluable service to wildlife professionals and conservation efforts. They allow us to collect data, identify issues, and demonstrate trends that we could never possibly do alone. Their work can and does lead to better stewardship and protection of our wildlife and habitat through public awareness, community action, and local, state, and federal policy making.

Understanding how to cultivate a community of volunteer citizen scientists is key to helping an organization leverage this incredible resource into a successful citizen science project. We have been doing this for over three decades, and we learn new lessons each time. We are lucky to live and work in a state with so many volunteers who are passionate about conservation and willing to donate their time and energy as Maine Audubon citizen scientists. 🐾

REFERENCES

- Blomberg, Eric, Sabrina Morano, and Cory Mosby. 2016. *BatME: Monitoring Distribution and Trends of Bats in Maine Using Outreach-based Citizen Science: Year 1 Report*. Department of Wildlife, Fisheries, and Conservation Biology, University of Maine, Orono. <https://batmedotorg.files.wordpress.com/2016/03/batme-year-1-report1.pdf>
- Charry, B. 2015. *Wildlife Roadwatch Citizen Scientist Observations 2010–2014*. Maine Audubon, Falmouth. <http://www.maineaudubon.org/wp-content/uploads/2017/03/WRW-ReportREV.pdf>
- Lee, M., and J. Arbuckle. 1988. “Maine Common Loons: A Glance Back and an Eye toward the Future.” In *Papers from the 1987 Conference on Loon Research and Management*, edited by P. Strong, 167–176. North American Loon Fund, Meredith, NH.
- MA (Maine Audubon), MDIFW (Maine Department of Inland Fisheries and Wildlife), TU (Trout Unlimited). 2016. *2016 Brook Trout Survey Project: Remote Ponds and Coastal Streams Volunteer Angler Survey Results*. <http://www.maineaudubon.org/wp-content/uploads/2017/03/2016-Final-Report-for-Public.pdf>
- TU (Trout Unlimited). 2006. *Eastern Brook Trout: Status and Threats*. Produced by Trout Unlimited for the Eastern Brook Trout Joint Venture. TU, Arlington, VA. <http://easternbrooktrout.org/reports/eastern-brook-trout-status-and-threats/view>
- Weir, Linda A., Andy Royle, Kimberly D. Gazenski, and Oswaldo Villena Carpio. 2014. “Northeast Regional and State Trends in Anuran Occupancy from Calling Survey Data (2001–2011) from the North American Amphibian Monitoring Program.” *Herpetological Conservation and Biology* 9(2): 223–245.



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Susan Gallo is a wildlife biologist with over 20 years of experience in citizen science, wildlife monitoring, conservation policy, and land/forest management. In her current position at Maine Audubon, she has worked with thousands of citizen scientists monitoring bats, owls, loons,

songbirds and amphibians across the state of Maine.