



# ADVENTURE SCIENTISTS

EXPLORE. COLLECT. PROTECT.

## MICROPLASTICS TOOLKIT

# GALLATIN MICROPLASTICS INITIATIVE: TOOLKIT

A TOOLKIT FOR ASSESSING MICROPLASTIC POLLUTION  
THROUGH COMMUNITY VOLUNTEER ENGAGEMENT

## BACKGROUND

In response to the results from our Global Microplastics Initiative, Adventure Scientists formed the Gallatin Microplastic Coalition in 2015. The Coalition—comprised of community water leaders—designed a study for assessing microplastic pollution in the Gallatin River Watershed around the question of how microplastic pollution varies with hydrological flows at the headwaters of the largest watershed in the United States. The ensuing research project and data collection effort, the Gallatin Microplastics Initiative, spanned two years, during which 120 local volunteers collected over 750 samples from 72 predetermined sites within the watershed. Through partnerships and targeted results sharing, the data collected has spurred innovation and action in the greater Bozeman area and elsewhere towards addressing microplastic pollution.



**2 YEARS**

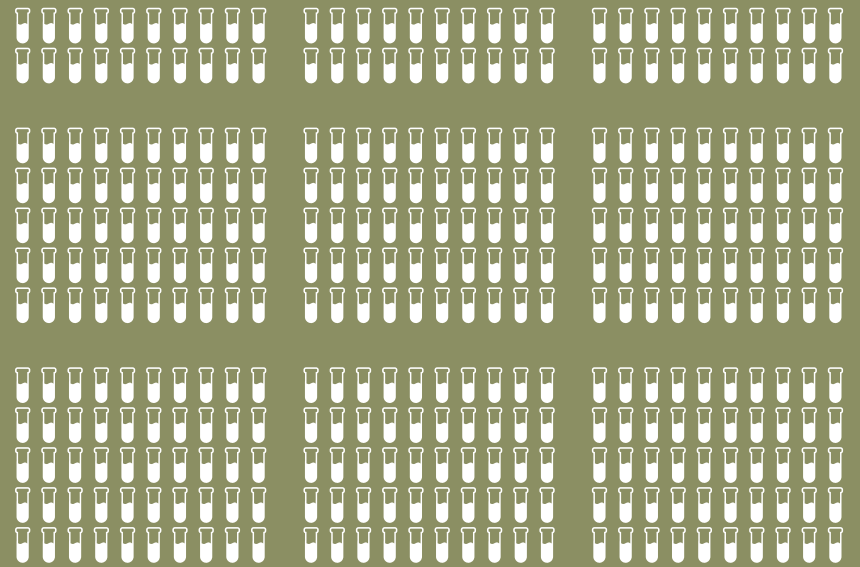


**120 VOLUNTEERS**

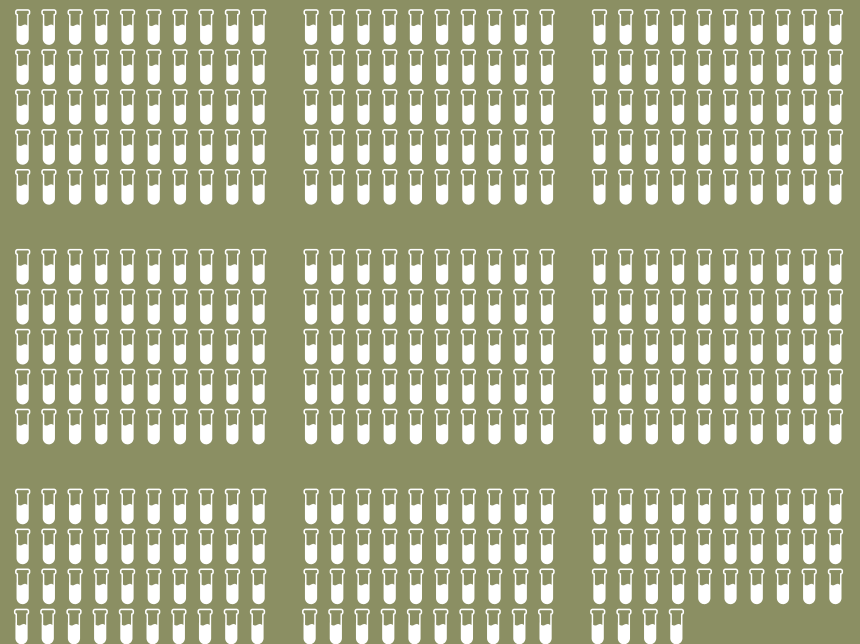




**72 SITES**



**774 SAMPLES**



# PURPOSE

This kit is intended to enable replication of our efforts in watersheds throughout the world. While this approach may not work in every jurisdiction, our intention is to provide a framework for others to get started on this important work. The methods and lessons presented here offer a glimpse into our project management process and should be considered against the local context of any potential site.

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# ABOUT

Adventure Scientists is a Bozeman-based nonprofit organization with a vision that by unleashing unprecedented scientific knowledge on our biggest problems, we can dramatically cut the time and expense required to address these issues. We have built a global network of highly-skilled and well-trained volunteers from the outdoor community and a platform that empowers them to collect otherwise unobtainable data on any scale, from anywhere. Adventure Scientists began working on the topic of microplastics in 2013, through the Global Microplastics

Initiative. During the four years of that project, thousands of volunteers were deployed to locations around the world where they collected water samples to be analyzed for microplastic pollution. In response to the rate of pollution discovered in worldwide samples, and the lack of data on freshwater river systems, Adventure Scientists launched the Gallatin Microplastics Initiative in 2015 in order to survey the headwaters of the largest watershed in the United States.

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## ENGAGING VOLUNTEERS WHILE CREATING CHANGE

- Our goal is to supply end-users (typically governments or corporations) with data that enables solutions to happen at scale. All of our energy goes to hitting this bullseye.
- Our volunteers tell us that they make behavioral changes after participating in our projects. They are advocating for the issues they have worked on and are more likely to pursue careers in conservation after their service.
- We have reached >150,000,000 people through popular and social media.





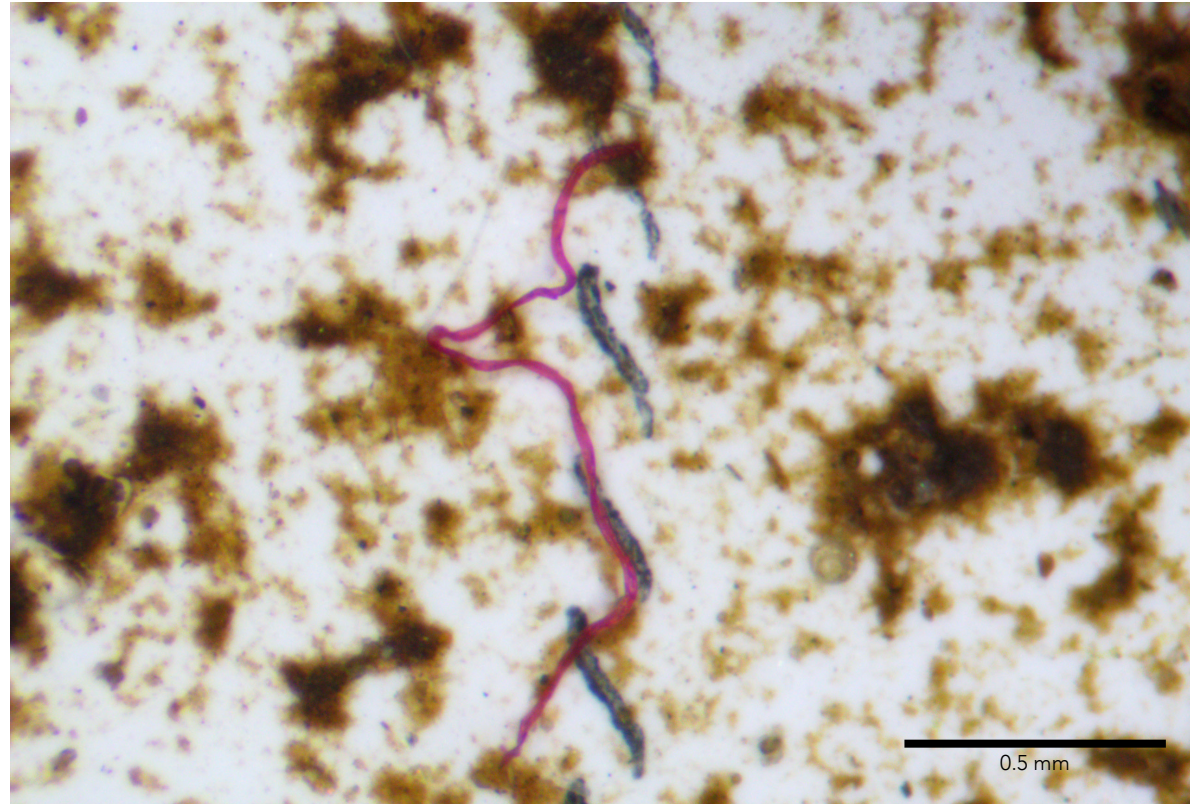
PETE OXFORD

# THE ISSUE

Microplastics, or tiny pieces of plastic, pose potentially detrimental effects to environmental and human health when they enter natural systems. These petroleum-based particles, like all plastics, are able to absorb and release toxins that once introduced into the food chain will bioaccumulate. Scientists are actively working to identify the full consequences of microplastic pollution, and early studies suggest the consequences are likely far reaching: in aquatic organisms they have been shown to affect feeding behavior and predator avoidance, and can interact with other pollutants to affect cell function in fish. Microplastics come from



several sources. They're laundered from synthetic clothing, they wash down the drain with many cosmetics and toothpastes, and they weather from larger plastic debris like bottles, bags, textiles, and tires.



**MICROSCOPE ANALYSIS OF A FILTERED WATER SAMPLE SHOWS MICROPLASTIC CONTAMINATION BY A PINK MICROFIBER.**



**A VOLUNTEER COLLECTS A WATER SAMPLE FROM A HIGH ALPINE LAKE IN MONTANA. LATER LABORATORY ANALYSIS REVEALED THE SAMPLE TO CONTAIN MICROPLASTIC POLLUTION.**

# THE ACTION

Microplastics is a global issue needing global action. Still, local action may offer grassroots momentum and a piece of the puzzle to this larger problem. Adventure Scientists undertook the Gallatin Microplastics Initiative to fill a data gap that was identified by local experts and ultimately to provide a foundation for local action if warranted by the data. The data were collected with a focus on quality assurance, thus supplying accurate results for use in decision making. Establishing and relying on key partnerships at project creation and throughout the study ensured that data would provide local decision makers with a scientific foundation from which they could take action.



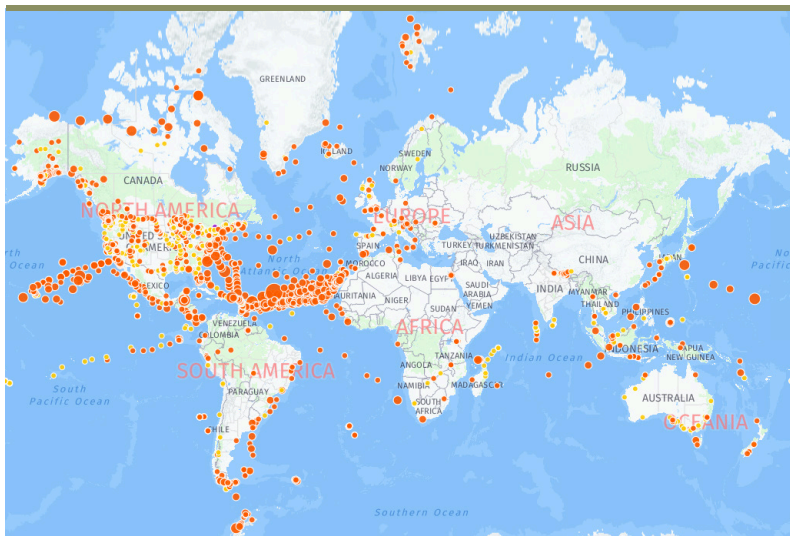
# THE PROCESS

## I. IDENTIFYING A NEED

Due to the relatively recent emergence of microplastics in the environment, there is likely to be a data gap around the extent of microplastic pollution on any local scale. Still, it's worth the time to ensure this information hasn't already been collected and that the data are needed. In the case of the Gallatin Initiative, data on local microplastic pollution was non-existent. The Gallatin Microplastics Coalition identified a need for this study.

# ACTION ITEMS

- Complete a detailed literature search and review to identify other studies exploring local, regional, or statewide microplastic pollution. Google Scholar is a helpful tool for this.
- Visit Adventure Scientists' Global Microplastics Initiative **INTERACTIVE DATA MAP** to see if samples have been collected near you.
- Reach out to local NGOs and decision makers (e.g. business and government) who work on local water issues and discuss the need for microplastics study in your area.



**FIGURE 1**

Sample locations from the Global Microplastics Initiative, showing distribution of sample sites around the world.

## II. IDENTIFYING END USERS

End users are those people and organizations with the position to effect change around local microplastic pollution. These may be conservation practitioners, land or wildlife managers, advocates, citizens, and/or agencies, who come together around a shared goal. They may be experts in education and outreach, policy, science, or communication. In short, end users are those who can make the data work for change. Adventure Scientists identified such water leaders in the community, who as subject experts and respected community members together formed the Gallatin Microplastics Coalition. The Gallatin Microplastics Coalition was composed of Guy Alsentzer (Upper Missouri Waterkeeper), Dr. Wyatt Cross (Montana State University, Montana Water Center), Dr. Kristin Gardner (Gallatin River Task Force), Dr. Timothy Hoellein (Loyola University), Tammy Swinney (Gallatin Local Water Quality District), and microplastics specialist Abigail Barrows (Ocean Analytics).

The Coalition actively participated in project conception and study design, ensuring that research questions and findings were relevant to themselves as end users. Some outcomes achieved by engaging end users throughout the lifetime of the project may include commitment by local government towards addressing microplastic pollution, local business championing of the issue by reducing their plastic usage, and increased local awareness leading to citizen action. During the lifetime of the project, Coalition members helped design the effort and their expert opinions were sought as needed. Developing relationships with end users is what lays the foundation for the ultimate reception of project results. It is a critical step that cannot be overlooked if the goal is to effect change around microplastic pollution.

# ACTION ITEMS

- Identify potential end users in your community representing diverse interests, sectors, and capabilities. Some general groups to consider: local or state government, water-focused NGOs, land managers, and education and outreach organizations.
- Explore interests and common goals of end users to inform research questions and study scope. It's important to work backwards from what information is needed and by whom before trying to figure out how to collect the data.
- Engage end users regularly throughout the process to ensure positive, action-oriented reception of data.

## QUESTIONS TO ASK OF END-USERS

1. What data do YOU need in order to inform your decisions on this issue? What actions might these data allow you to take or inform?
  2. Where within the region/watershed/river do you think data needs to be collected?
  3. Are there certain times of year or hydrological flows we should consider when establishing collection protocols?
  4. Have you been involved in any similar projects in which data has led to an outcome that we could use as a model?
  5. Who else should be involved? With whom else should we speak?
  6. What challenges do you foresee in addressing this issue locally? Do you have suggestions for how we might overcome those challenges?
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### III. RECRUITING VOLUNTEERS

The potential for study findings to effect change is contingent on assuring data quality. When working with volunteers as data collectors, this means taking steps to ensure volunteers are able to consistently follow established protocols. This complex yet critical component to any research endeavor begins with project choice and design—that is, identifying projects suitable for volunteer data collection and then specifically designing projects to be cooperative with such effort. Adventure Scientists, working in close partnership with the Gallatin Coalition, developed a replicable experimental design and data collection protocols (see Final Report Appendix A for details on study design and sampling protocols).

The next step is recruiting volunteers to complete the stated data collection. When recruiting volunteers for the Gallatin Microplastics Initiative, Adventure Scientists targeted members of the outdoor recreation community. Outdoor recreationists are particularly well suited for data collection efforts when sample sites include hard-to-reach locations. Members of this community are capable in the outdoors, are creative problem solvers who are used to finding a way, and they pay close

attention to detail. Adventure Scientists is also deeply familiar with and engaged in this community, and so we find it easy to establish rapport and mutual respect enabling both parties to communicate openly and with comprehension. Identifying a community from which selected members can be trusted to understand and follow directions is critical. Developing a profile of the kind of volunteers you will need based on the data you want to collect is an important step to take with your coalition.

Interested volunteers should be screened for their general ability to follow directions and to work safely in challenging environments. This application process improves the volunteers' adherence to protocols and their commitment to the project, and allows for maximizing incorporation of additional skills such as storytelling, if they are part of your project strategy. Adventure Scientists reached out to targeted networks and community groups about the volunteer opportunity, and those attracted to becoming volunteers were asked to submit an application to assess their basic abilities and interest. From there, top candidates were interviewed in person or via webinars so an Adventure Scientists staff member could assess fit and proficiency in direction-following and problem-solving. These traits have proven themselves as indicators of volunteer commitment, retention, and ability to adhere to protocols.



**IDENTIFY COMMUNITIES FROM WHICH TO RECRUIT VOLUNTEERS BASED ON SKILLS  
REQUIRED FOR DATA COLLECTION. | ADRIAN SANCHEZ-GONZALEZ**



# ACTION ITEMS

- Identify a community or communities from which to recruit volunteers based on a profile of skills required for data collection.
- Research values and interests of community in order to establish common understandings and basic connections. Consider conducting an informational interview with a representative member of the identified community to learn more about its membership.
- Use established networks to notify community members of volunteer opportunity.
- Create application for interested volunteers to complete.
- Screen applications for fit through interviews or via webinars.
- Evaluate candidates on ability to follow directions and solve problems.

## QUESTIONS TO ASK YOURSELF WHEN IDENTIFYING VOLUNTEER NEEDS

1. Where will data collection take place, and who is best suited to reach those places?
  2. What are the most cost and time effective ways to reach those locations with the determined frequency? How many people will I need?
  3. What are the safety risks that should be considered?
  4. What are the permitting issues that should be considered, who can we engage to help secure required permissions, and what processes will we need to follow?
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## IV. TRAIN VOLUNTEERS

Depending on the scale and complexity of the protocols as well as the locations of volunteers, training might take place in person and/or remotely. In-person trainings are ideal for locally-confined projects as they provide an opportunity to build community. In the case of the Gallatin Initiative, in-person trainings served as a first gathering of all project volunteers who, over the course of the project, together formed a community of microplastics-issue advocates within the larger local outdoor recreation community.

The most essential function of training is to ensure a uniform comprehension of collection protocols and thus consistent data quality. It also serves to establish relationships and expectations between volunteers and project staff. Adventure Scientists volunteers were divided into small groups led by Coalition members or staff. In small groups, the leader covered protocols step by step. Then volunteers were asked to repeat the protocols until successfully completing all steps with precision. Volunteers then navigated to their sites and repeated data collection in the presence of a trainer. This “test” of protocols should also be completed through online platforms if trainings are remote. Adventure Scientists makes protocols available in a variety of forms (written, videos, apps, etc.) to ensure ease of access, use, and adoption. In-person or remote trainings are complimented by handouts of printed protocols and the offering of a digital app that prompts users with protocol reminders.

Volunteers should leave trainings well-versed in protocols, with protocols printed in hand, and feeling inspired and committed to the important role they play in the project's success.

## ACTION ITEMS

- Assemble training leaders and ensure their competency with protocols. Host a train-the-trainer event with plenty of time for talking things through.
- Plan the event: identify a location suitable for the size of your group and with water access. Secure donations of food and beverages for participants (or purchase). Establish an emergency plan and convey expectations to trainers. Prepare materials (sampling equipment, protocol documents, sample site coordinates, etc.).
- Invite volunteers!
- Host training with primary goal of teaching protocols to volunteers and test their ability to accurately complete sample collection.

## V. MANAGE VOLUNTEERS

Successful volunteer management requires energy, compassion, consistency, adaptability, and leadership. Facilitating sample collection is an important component to volunteer management, but it is far from the only task. Managing volunteers is a fulfilling and energizing experience. It is also, at times, complex and frustrating. Adventure Scientists staffed a full-time project manager to oversee and coordinate all aspects of the Gallatin Microplastics Initiative, especially volunteer management. This full-time manager was supported by a volunteer communicator, tech manager, operations manager, and senior leadership team. While all of these individuals may not be available to you, just keep in mind that successful project management takes a lot of work. Proper management of volunteers can be the difference between a project experience that succeeds and one that fails.

Adventure Scientists' Initiative prioritized relationships with volunteers. This was demonstrated in voluntary, individual social meet-ups between a volunteer and Adventure Scientists staff member where volunteers could be individually thanked for their participation and reminded of the importance of their commitment. These took the form of hikes, skis, coffee meetings, happy hours, and/or phone calls with each volunteer. Volunteer engagement also happened in pre-sampling events, which served as refreshers on protocols prior to sampling efforts. Beyond



the reminder on protocols, these events served to continue to build camaraderie within the volunteer group, express gratitude, update volunteers on project results, and give a platform to sponsors and partners through giveaways and speaking opportunities. At all points of engagement, approaching volunteer management with a goal of high volunteer retention and positive volunteer experience will help in decision making, prioritization, and management.

## ACTION ITEMS

- Be prepared for dynamic relationships with volunteers that may require extensive time and energy investments.
- Offer opportunities beyond trainings for connecting with volunteers, and where volunteers may connect with each other.
- Consider swag or donated items like hats or shirts to build a sense of team identity.
- Have fun getting to know and building relationships with volunteers!

## VI. REQUEST FEEDBACK

At several points throughout the project, including at the conclusion, volunteer management should include requesting volunteer feedback. Feedback through formal surveys and/or informal conversations can lead to better, more efficient management. Early feedback requests are also an opportunity to address concerns before they may negatively affect a volunteer's participation. Using donations from project sponsors as raffle items may incentivize volunteers to complete surveys. Surveys might be offered on paper during pre-sampling events or online at anytime via email. Google Forms and other platforms provide easy-to-build, easy-to-use, and free tools for surveying volunteers and project partners.

### ACTION ITEMS

- Request feedback, both through formal and informal channels, that will be incorporated into project management strategy.
- Secure prizes to be used to incentivize participation in survey.
- Consider what specific information will assist you in improving the project.
- Respond to lessons learned as necessary.

## SAMPLE SURVEY QUESTIONS TO ASK

1. Were you aware of the issue of microplastics prior to volunteering with this project?
  2. Were you provided with adequate resources on the topic of microplastic pollution for your degree of interest?
  3. Were you provided with the necessary materials and training resources to be successful as a volunteer?
  4. Did you experience any confusion over the project protocols?
  5. Do you find the in-person pre-sampling events helpful and worthwhile?
  6. Were project staff members communicative and readily available to answer your questions?
  7. Do you have any memorable moments or experiences from your sampling expedition(s) that you wish to share with us? Adventure wins, mishaps, chance wildlife encounters, epiphanies...?
  8. Have you shared or used the project results?
  9. Have you taken any steps to address plastic pollution or microplastic pollution in your community?
  10. Would you consider participating in another volunteer data collection project?
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**VOLUNTEER CAMARADERIE IS FOSTERED THROUGH THOUGHTFUL, ENGAGING, AND FUN VOLUNTEER EVENTS. | JEFF MIESBAUER**

## VII. SHARING STORIES

The value of outreach and communication is particularly high when dealing with an emerging environmental pollutant like microplastics. Depending on the locale, the topic may be one that is largely unknown to the community. For end users to create change from the data, it may be critical to first establish a base of knowledge in the community from which action can take root. Completing a communications plan -- which should be done at project inception to align with project strategy -- is a good step towards ensuring that appropriate audiences and groups are engaged around the project. The plan should outline overall communication goals (e.g. raise awareness of this issue in order to enable policy action through an informed constituency) -- and individual communication objectives (e.g. reach 100,000 people in our municipality, gain earned media on the local news channel, etc.), which when combined will achieve the larger overarching goals. Free resources for developing a communications plan are readily found online. Working with colleagues who have expertise in communications will help you prioritize outreach efforts.

# ACTION ITEMS

- Define overarching communications goal(s) which will serve your project strategy.
- Determine specific steps for achieving individual objectives.
- Prioritize outreach efforts based on established communications plan.
- Get the word out! Reach out to local media outlets (newspapers, magazines, television news channels, etc.) about the project by checking their websites to identify the best way to connect. Offer the chance to meet in person. Tell the story about the project: engaging with local volunteers, building a coalition of stakeholders, and collectively working towards a shared vision in your community. Share the study findings widely via established networks. Invite press to your events. Connect gregarious volunteers with journalists to share their experiences with the project. Ask for photos and stories from volunteers and, with permission, share these through social media. Cast your storytelling net widely.



MICHAEL STONE

# CONCLUSION

Establishing and managing a local data collection effort to analyze microplastic pollution offers a tangible mechanism for addressing a global issue. The project management methods and lessons offered here were developed using best-known practices and have been tested and adapted based on on-the-ground functionality.

Successfully conducting a study of microplastic pollution by engaging trained volunteers will require a targeted, committed effort, but it is an effort well worth undertaking. We at Adventure Scientists hope this toolkit may offer the guiding

principles for initiating and effectively managing such a project, and we look forward to hearing of your successes!

For additional resources, see Final Report Appendix A. For assistance with volunteer recruiting, training, and management, please feel free to contact Adventure Scientists.

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# APPENDIX

## ADDITIONAL PROJECT RESOURCES

### **GALLATIN MICROPLASTICS INITIATIVE FINAL PROJECT REPORT**

This report contains in-depth background information on project design and volunteer management, including recruiting, training, and managing volunteers. The report discusses end use of study data and highlights successful partnerships. Appendix A contains sample collection protocols. Appendix B lists members of the Gallatin Microplastics Coalition. Citation: K. S. Christiansen, Global and Gallatin Microplastics Initiative Final Report. Adventure Scientists.

### **GALLATIN MICROPLASTICS INITIATIVE SCIENTIFIC JOURNAL ARTICLE**

This is the peer-reviewed publication that resulted from the Gallatin Microplastics Initiative, written collaboratively by partner scientists Abigail Barrows, Adventure Scientists Microplastics Project Manager Katie Christiansen, Gallatin Microplastics Coalition Member Timothy Hoellein, and Gallatin Microplastics Initiative volunteer and GIS expert Emma Bode. This paper details experimental design, laboratory methods and controls, data analysis, and project results. Citation: A. P. W. Barrows, T. Hoellein, E. Bode, K. S. Christiansen, A watershed-scale, citizen science approach to quantifying microplastic concentration in a mixed land-use river, (in prep).

### **MICROPLASTICS SAMPLING METHODOLOGY**

This article, written by Gallatin Microplastics Initiative Principal Investigator Abigail Barrows, compares options for microplastics sampling methodology. Citation: A. P. W. Barrows, C. A. Neumann, M. L. Berger, S. D. Shaw, Grab vs. neuston tow net: a microplastic sampling performance comparison and possible advances in the field. *Anal. Methods* 9, 1446-1453 (2017).



PROVIDING INTERACTIVE TOOLS LIKE THE GAIA GPS APPLICATION WILL ASSIST VOLUNTEERS WITH SUCCESSFUL DATA COLLECTION.





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