

Strategies for Improving Participation in a Statewide Volunteer Monitoring Program for AIS

Angela De Palma-Dow and Jo A. Latimore

Introduction

Many invasive species prevention, monitoring, and management programs prioritize public involvement because of the role humans play in spreading invasive species and the impacts they have on public enjoyment and value of ecosystems. For example, the program we explore here is a volunteer monitoring program for aquatic invasive species (AIS) in lakes that takes a community science approach to early detection and monitoring.

Typically, plant identification, methods, and tools for monitoring are taught at mostly in-person workshops, trainings, or education and outreach events. During the COVID-19 pandemic, many volunteer-centric programs were reduced, modified, or temporarily cancelled, especially while state or local resources shifted to support public health sectors. Statewide and regional volunteer-led monitoring programs are no exception, and many were disrupted during the pandemic. Now that the pandemic is in decline, managers restarting or revitalizing community science volunteer programs might be looking for ideas to jumpstart participation or refreshers to improve methods and strategies for successfully engaging volunteers. Here we describe the lessons we learned while working to improve participation in a state-wide community science invasive plant volunteer monitoring program, before COVID, that may provide some valuable insights to those programs restarting or getting off the ground.

Community science is a powerful tool for conservation, education, and ecological management. Ecological community science programs connect the lay person to a resource of interest,

making these community members more connected to their environment and therefore more invested in the policies that regulate and influence these ecosystems. In fact, when community members participate in community science projects and efforts, they tend to share their learned ideas and values with others, expanding the significance of community science itself.

Well-designed AIS monitoring programs provide large scale bio-monitoring and high-quality data that can be used by state natural resource agencies, researchers and the public. Consistent monitoring of aquatic systems for invasive species facilitates early detection and eradication before invasions become unmanageable. Community members who live near or regularly visit an aquatic system can serve as the first line of defense against new AIS introductions. In terms of the number of aquatic systems monitored, as well as the frequency of monitoring, volunteer AIS monitoring represents a valuable asset especially considering the efforts of natural resource management agencies, which are limited by available funding and personnel resources.

History of Michigan's Cooperative Lakes Monitoring Program and the Exotic Aquatic Plant Watch

The Michigan Clean Water Corps (MiCorps) volunteer monitoring program is a partnership-based program involving state, academic, and regional organizations and local volunteers. Within MiCorps, the Cooperative Lakes Monitoring Program (CLMP) has been providing technical assistance, training, and other support to lake volunteers since 1974, making it the second-oldest lake monitoring program in the U.S. Hundreds

of volunteers monitor 250-300 lakes through MiCorps each year. CLMP volunteers can choose from a variety of limnological parameters to monitor throughout the ice-free season, including water clarity (Secchi disk depth), total phosphorus (TP), chlorophyll-*a*, dissolved oxygen and temperature, shoreline habitat quality, and aquatic plants. One purpose of the CLMP is to provide volunteers a standardized approach for monitoring the ecological status and trends in their lakes, with the support of CLMP staff biologists, so that the data generated are reliable and comparable through time and across the state.

The Exotic Aquatic Plant Watch (EAPW) is one of the newer components of the CLMP. This program provides valuable aquatic invasive species (AIS) data to community members, local decision-makers, and state managers. Michigan has approximately 11,000 lakes five acres or larger, and state agency funding and personnel constraints make it hard for them to consistently monitor for AIS. The engagement of volunteers in AIS monitoring using the pre-existing CLMP community monitoring network provided a feasible solution for establishing an early-detection and long-term monitoring network for AIS.

The purpose of the EAPW is to provide volunteers with a simplified protocol for detecting and monitoring invasive aquatic plants, increasing the probability of early detection while simultaneously providing education and outreach about the role of aquatic plants in lake ecosystems. The EAPW focuses on five species: Eurasian watermilfoil (*Myriophyllum spicatum*), curly-leaf pondweed (*Potamogeton crispus*), hydrilla (*Hydrilla verticillata*), starry stonewort (*Nitellopsis obtusa*), and European

frog-bit (*Hydrocharis morsus-ranae*). Only hydrilla is not currently established in Michigan.

Volunteer methods for EAPW monitoring

Before completing a survey, volunteers attend a required training session that covers the sampling protocol, plant identification, and the reporting process, followed by hands-on plant identification practice using dried and fresh specimens. In addition, volunteers learn to submit unknown plant samples to program staff for identification by placing plant samples between moist paper towels, placed in zip-top plastic baggies and sent through the mail. Plant sample photos are now permanent EAPW requirements as mobile phone camera technologies are more widespread and dependable.

When designing the EAPW methodology (www.MiCorps.net), we attempted to keep the protocol volunteer-friendly by intentionally focusing on a limited number of species, allowing low-tech alternatives options for recording and submitting data (i.e., allowing data to be submitted on paper rather than directly into the online MiCorps database) and making ourselves available to provide support.

During COVID, many educational efforts refrained from providing outreach and guidance face-to-face, and instead, many digital methods were developed to reflect the same information and could be easily accessed from a mobile phone or computer.

Challenges to enrollment and reporting

Although public interest in the EAPW has been great since it was launched in 2011, evidenced by high attendance at annual training sessions, volunteer enrollment and report completion rates were initially low. For example, in 2011, of all lakes enrolled in the CLMP, only 11 percent (23 of 211) chose to join the EAPW program. Of those that did join, less than half (43 percent) reported any results at the end of the monitoring season.

These trends led us to ask some important questions:

What motivates volunteers to enroll in this program?

What might discourage enrollment?

Why do many enrolled lakes not report any results?

What tools or strategies were helpful in increasing enrollment and reporting?

We used four approaches to answer our questions, including:

- Conducting a national program review by interviewing managers and coordinators of other statewide AIS volunteer monitoring programs to identify how they addressed challenges similar to ours.
- Conducting lake visits with volunteers during four field seasons (2013-2016) to identify technical challenges and gather volunteer feedback.
- Tracking participation, enrollment, and reporting trends and participant feedback to better guide improvements and implement strategies.
- Developing and evaluating new tools and strategies to help increase participation and reporting

AIS program review

In general, volunteer retention strategies in community science programs are well-researched and documented, but specifics pertaining to volunteer involvement in aquatic invasive plant monitoring programs are less known as evidenced by the limited number of comparable programs we were able to identify. At the time of our review, we were only able to identify 11 AIS monitoring state or regional programs in the U.S. that contained some component of AIS monitoring.

Program directors we interviewed identified keys to successful volunteer participation, including acknowledging volunteers' efforts, increasing online usability (e.g., ease of use when uploading and downloading data), and relying on multiple training events in locations around their state to minimize volunteers' need to travel long distances to attend. Of course, during the pandemic, traveling to in-person training events was no longer a viable option, and long-distance learning and remote trainings were established as the default. Many programs that existed through the pandemic probably now have a library of online training tools that can help to supplement and support the in-person requirements needed for

volunteers to participate in community science programs.

Lake visits

We conducted lake visits over four monitoring seasons (n=41, 2013-2016). A typical lake visit would start with a review of the major points covered during classroom training, including the overall goal of the program, with a strong emphasis on identifying and mapping only the four species on the EAPW (rather than a comprehensive plant inventory). During the visit we would provide guidance on the best places to survey such as boat ramps, public parks and beaches, and inlets and outlets that are high-risk locations for AIS introductions. We worked with the volunteers to identify any challenges they faced while completing the EAPW protocol (Figures 1 and 2). We observed the processes of plant surveys, plant identification, and reporting, and directly asked the volunteers about their concerns. We usually did not complete the entire lake survey during a lake visit. The intent was to identify the challenges volunteers encounter when executing the survey, identifying the AIS plants in their lake, and recording and uploading their data reports.

During the pandemic, some strategies were developed that remain useful today, including an online "mid-season check-in" event, to address questions and concerns and to provide tips and tricks to conducting surveys without in-person guidance. This tool is continued practice in the program today, for the entire CLMP not just the AIS monitoring portion.

We discovered four main challenges facing EAPW volunteers during our lake visits. First, many volunteers were unsure how to select sampling locations in their lake. Second, we learned that when surveys were completed and no AIS were found, many volunteers did not realize that they should submit this "negative data." Absence of AIS is important information, but without a report, these negative results were not included in EAPW database and we were led to assume that volunteers had not completed the survey. Third, many volunteers lacked confidence in their ability to accurately identify plants. Many were also unsure how to obtain help in confirming the identity of a possible AIS, although some



Figure 1. Volunteers in Gull Lake, MI, learning how to distinguish between native aquatic plants and invasive plants from CLMP EAPW Staff (Photo: Angela De Palma-Dow).



Figure 2. Volunteers learning how to enter data into EAPW datasheets in Lake Pleasant, Washtenaw County, MI (Photo: L. Nordeen).

volunteers were comfortable following program instructions to send specimen samples in the mail for staff verification. Finally, some volunteers reported feeling overwhelmed by their task, and pressured to complete the survey alone with little

support from others in their lake community.

Reporting rates for those lakes receiving a staff lake visit were higher each year than both the non-visited and overall reporting rate for that year (visited

lake reporting range: 70-100 percent; overall range: 63-79 percent; non-visited range: 10-58 percent). These differences were significant when using a Chi-square test of independence to compare reporting rates between visited and non-visited lakes ($\chi^2 = 33.3$, $p < 0.001$, $df=4$).

Clarifying program value and expectations

Based on the results of our investigations, we implemented several changes to the EAPW to increase enrollment and reporting by volunteers (Table 1). Uncertainty about program specifics that was likely limiting volunteer enrollment and success was addressed through the redesign and distribution of educational and promotional materials. These materials included an updated full-color program brochure and two newsletter articles that were distributed in hard copy and online, targeting the entire MiCorps CLMP community. The brochure and articles specifically emphasized (1) the importance of the program for protecting Michigan lakes, (2) the importance of regular monitoring for new invasions even where a lake management plan exists or a lake management company has been retained, (3) the time commitment needed to conduct a thorough EAPW survey, and (4) supporting resources for plant identification. All of these materials are available on the MiCorps website in the EAPW document section at: <https://micorps.net/lake-monitoring/clmp-documents/>.

Tools to boost volunteer capabilities and confidence

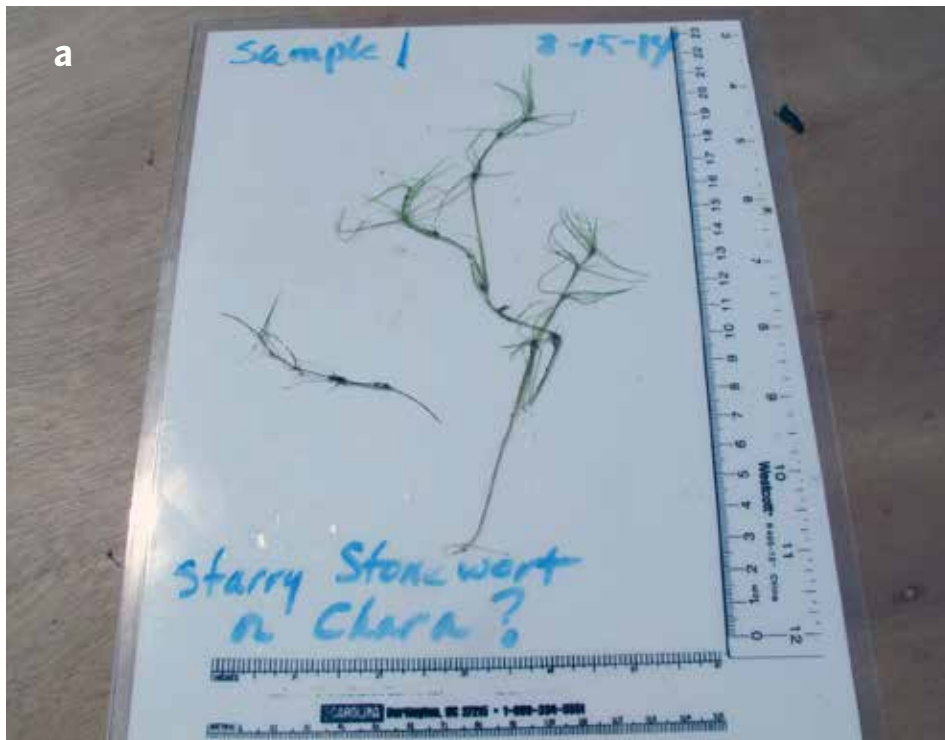
To improve volunteer confidence in plant identification, we provided a new waterproof field guide to selected invasive aquatic plants in Michigan. This guide, provided to all enrolled volunteers, contains large, colorful photos of 11 specific invasive species of concern, including the four EAPW focus species, as well as USDA location information and QR codes for quick, digital access for more information.

We also created and distributed a heavy-duty, waterproof, laminated photography card to make it easier for volunteers to submit field photos of plants for identification help (Figure 3, a and b).

Table 1. Summary of identified barriers to participation in EAPW program.

Barrier	Action(s) Implemented
1. While volunteers were aware of the program's existence, they were unclear about its important and necessary role in providing useful data and the realistic amount of time and effort it takes to complete.	i. Distribution of program brochure to educate volunteers about need to be active citizens when surveying for AIS. ii. Published newsletters and blog post on MiCorps web forums about the importance of collecting AIS data in lakes.
2. Volunteers expressed uncertainty and low confidence in correctly identifying plants when executing the EAPW	i. Maintained hands-on ID activities during annual training events ii. Creation and distribution of a Michigan-specific water-resistant, pocket-sized AIS plant field guide.
3. Volunteers were uncertain how to ask for help with plant identification	i. Encourage digital photographs and electronic correspondence of those photos with program staff ii. Creation and distribution of a laminated water-proof "scale-sheet" with pro tips about taking plant photos for ID and where to send them for fast confirmation response.
4. Volunteers felt unsure where to start survey and general uncertainty in following survey protocol	i. Improved clarity and step-by-step methods for survey protocol during annual training events. ii. Back side of laminated water-proof "scale-sheet" included abbreviated program protocols about where in the lake to prioritize sampling efforts.
5. Volunteers did not think they needed to submit reports when they did not find an AIS in their lake.	i. Update of survey data sheet with required section containing check box when no AIS were detected. ii. Emphasized the importance of submitting non-detect report.
6. Feelings of being overwhelmed with EAPW tasks or not having enough support from other lake residents / community to complete surveys and submit reports.	i. Created and implemented teamwork training modules during annual training events ii. Create and distribute "team work tips" factsheet to help volunteers identify what kinds of help they needed and where/how to ask for that help.
7. Need for more emphasis on award or acknowledgement system to successful lake and volunteers.	i. Encouraged veteran volunteers to write blog posts to share their experiences with EAPW. ii. Encouragement and registration of volunteers to present their lake's story at year-end conferences
8. More user-friendly web platform for training and protocol review / refreshers.	i. Increased advertisement and training of available online resources such as data sheets, updated methods documents, step-by-step mapping tutorials, and videos of example surveys. ii. Production and advertisement of 10-minute online EAPW training video published on YouTube and the program website.
9. Regional training and support was lacking.	i. Additional training opportunities to be offered in other parts of the state. For example, to date all EAPW annual training events have only been offered in the Lower Peninsula. Starting in 2017, trainings offered in the Upper Peninsula will provide volunteers in the far northern areas of the state an opportunity to get staff-led instruction and training. ii. Encouragement and instruction for volunteers to contact experienced, nearby EAPW volunteers or their local Cooperative Invasive Species Management Area (CISMA) for additional assistance.
10. Monitor enrollment, completion and reporting trends.	i. In order to identify if efforts are resulting in positive improvements in the program, yearly reports and analysis on enrollment and reporting rates between 2013 -2016 summer seasons were conducted to identify what aspects of the program were or were not improving so further action could be continues, eliminated, or improved.

Sources of barrier identification included pre-season questionnaires (n=36), staff lake visits (n=41), interviews with AIS monitoring program directors from other states (n=9), and casual conversation and discussions at annual conferences and training events.



a

Photo validation tools and electronic submission can ensure accurate identification of species and quality control because validation of the observation is recorded and because photos can be easily and quickly sent electronically to CLMP staff for confirmation, volunteer confidence in their identification skills is enhanced, and this positive feedback encourages improved monitoring.

To ensure the reporting of negative data, we promoted the idea that “the absence of data is data” and added a specific learning objective to EAPW training along with a prominent instruction and check box on the datasheet to encourage volunteers to take a positive action (i.e., checking a box) in the event no invasive plants were found. We also clarified protocols to include a report requirement, regardless of plant survey results.

b

TIPS FOR AQUATIC PLANT SAMPLING AND TAKING GREAT AQUATIC PLANT PICTURES!

- Take lots of pictures
- Check for and delete blurry photos
- Include size & scale in your pictures
- Record location where picture was taken

WHERE TO SAMPLE?
Get your map and start sampling in these locations first

- Boat Ramps
- Public Beaches / Parks
- Inlets (streams, creeks, canals)
- Quiet Bays and Coves

Then, fill in with...

- Areas not already sampled by the above

Equipment Checklist

- Boating safety equipment and anchor
- Depth map of lake
- GPS unit*
- Weighted sounding line
- Weighted rake and retrieving line
- Zip-lock bags
- Clipboard
 - Data forms/note paper
 - Monitoring procedures
- Pencil or indelible ink pen
- Camera
- This scale sheet for plant ID pics
- _____

COMMON NAME: _____

SCIENTIFIC NAME: _____

Lake: _____

County: _____


Location: _____

Water depth: _____

Date: _____


Collector: _____

Notes: _____



Michigan Clean Water Corps

Have a question? Contact:
Dr. Jo Latimore
MiCorps / Michigan State University
517-432-1491
latimor1@msu.edu



MICHIGAN STATE UNIVERSITY

Figure 3. (a): Submitted plant sample from EAPW volunteer on program-provided scale sheet, and (b): reverse side of scale sheet with steps to taking good digital photo tips and suggestions on where to sample for invasive plants.

Not going it alone

Volunteers' concern about the difficulty of completing plant surveys alone was substantial, and in response we focused on promoting a teamwork approach to lake volunteering. In addition to creating a more fun and welcoming experience for participants, the importance of increasing the teamwork training and opportunities for the EAPW volunteers is two-fold: to ensure both immediate (survey completion) and long-term (community understanding and engagement) goals of the program. To support a team approach to the EAPW, we developed a “Teamwork Tips!” (<https://micorps.net/wp-content/uploads/2017/12/CLMP-ExAqPlant-Teamwork.pdf>) handout that we provided to all CLMP volunteers, which formed the basis of a teamwork training module in 2015 and 2016. These tips are still provided to enrolled lakes and considered valuable by participants.

The goal of the teamwork training module was to provide guidance and resources on: (1) how to convince others that monitoring for AIS is important, (2) finding and recruiting local short-term or long-term help and, (3) demonstrating how fun and easy participation in the EAPW can be. The teamwork training and handout also included testimonials and advice from successful EAPW volunteers, which provided an opportunity to simultaneously acknowledge successful

EAPW volunteers as well as promote communal encouragement and guidance to newer or struggling volunteers. This strategy is probably the hardest to resurrect in a post-COVID volunteer science world, as working with a small or large group of people in a small space, such as a classroom or on a boat, can still be concerning for some due to risk of exposure. However, more and more people are willing to get outside and conduct monitoring, and the lack of partnerships, comradery, and assistance is a big motivator for participating and completing surveys, especially on larger water bodies.

Investigating participation trends

During 2011-2016, enrollment and reporting rates increased compared to 2011, with 76 unique lakes enrolled in the EAPW. In 2011, before any significant changes were incorporated into the program, there were 23 enrolled lakes and 43 percent submitted complete reports. After some tools and strategies were implemented, there was some improved participation and reporting. For example, 2014 saw the highest enrollment (32 lakes) and 20 lakes (63 percent) submitted reports (Figure 4). For reporting, 2015 was the most productive year with 23 out of 29 enrolled lakes (79 percent) submitting reports. While not every lake re-enrolls in this program every year, new lakes were enrolling in the program, as demonstrated by the accumulation of total unique lakes over time (Figure 5).

Based on 96 responses from volunteer evaluations, awareness of the EAPW program, was slightly higher than in 2013 (87 percent in 2013, 93 percent in 2017). Volunteer confidence in their ability to identify AIS plants accurately increased by 8 percent between 2013 and 2017. Time commitment continued to be a concern for some volunteers, no change really from 13 percent in 2013, compared with 14 percent in 2017. However, respondents did indicate that alternatives to EAPW, such as paying an aquatic plant professional or participating in an advanced plant monitoring program offered through the CLMP, was a bigger influence for not enrolling in the EAPW in 2017 compared to 2013 (26 percent in 2013, 46 percent 2017). When asked if a site visit would encourage their enrollment in the program, only 14

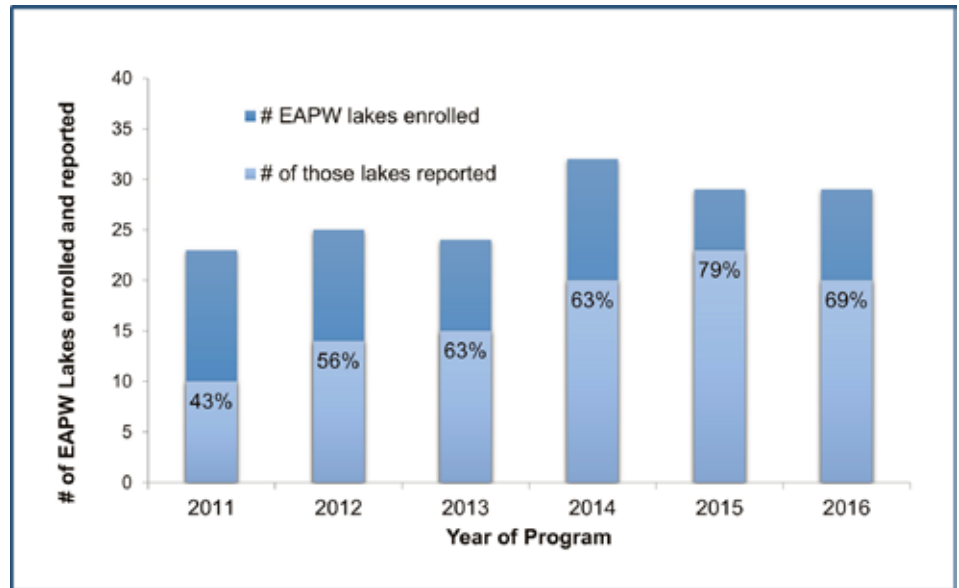


Figure 4. EAPW enrollment and reporting from 2011-2016, percentages within the light blue bars represent the percent of enrolled lakes that submitted reports at the end of that season.

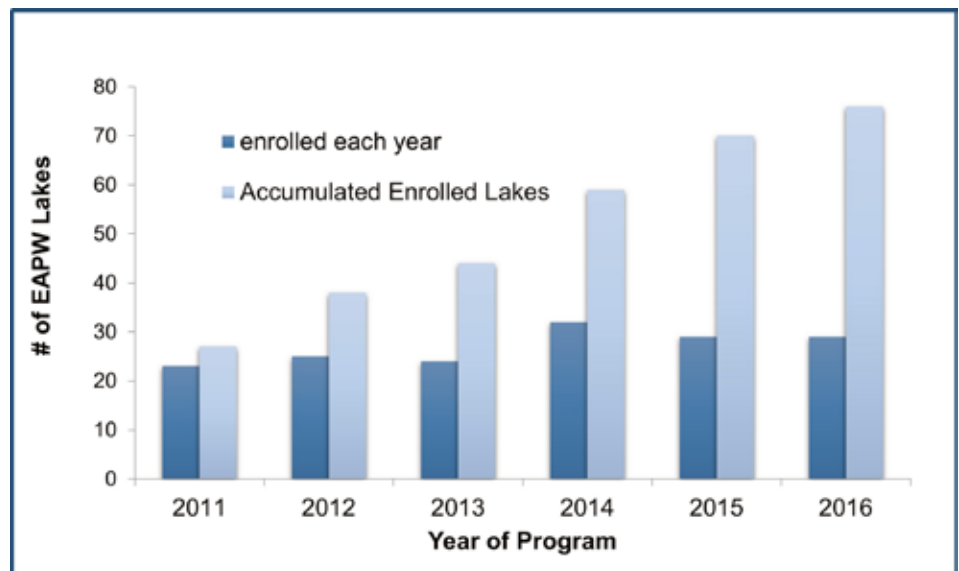


Figure 5. Lakes enrolled in EAPW from 2011-2016 with blue bars representing enrollment numbers for each year and light blue bars representing accumulated enrollment (i.e., total enrollment to date).

percent of respondents indicated that “Yes, absolutely!” it would, 43 percent responded “Maybe,” and 43 percent indicated that it would not impact their decision to enroll (n=96).

Outcomes and results

The new species identification guides and photography cards were used by EAPW volunteers, and are popular handouts at training events. We distributed a simple online questionnaire to volunteers who were provided the new guide to invasive aquatic plants of

Michigan. Responses indicated that 78 percent (n=12) of volunteers using the guide felt higher confidence in their ability to accurately identify invasive aquatic plants. While we did not collect quantitative data about use of the laminated photography cards, we observed that approximately 25-30 percent of reports submit photographs using the cards and we receive 3-5 plant identification questions each year where the plant is displayed using the photography card. We regularly observe volunteers using the photography cards

during lake visits, and volunteers have reported keeping the cards and identification guides in their boats so they are easily accessible and ready to use. More interestingly, the reports received from participants where no AIS species have been detected have increased (Figure 6) with the most species being detected in 2016 (20 AIS detected) and the most reports of no AIS detections occurring in 2015 (12 reports of no AIS detections). These results suggest two things, (1) the program is expanding to areas where AIS are not yet a large threat or presence on lakes and, (2) participants are submitting reports even if they do not find AIS, indicating that our efforts to increase awareness that the “presence of no data, is data” is successful.

Lessons Learned

The EAPW program is supporting an important effort to get more concerned community members trained and out monitoring their lakes for invasive species. The more informed people that are out on lakes searching for AIS, the higher the probability that an invasive species will be seen, identified, and reported along the proper channels. Compared to a researcher or government technician conducting a one-time plant survey, the exposure a volunteer has to their lake resource is greater, leading to greater chance of spotting AIS. The ability to access and collect this local knowledge through community collected data is extremely valuable for effective management and would not be possible otherwise. The future of AIS detection literally relies on community members and the volunteers, such as those participating in the EAPW, that are on the forefront.

Acknowledgements

We acknowledge the time, energy, and dedication of all volunteers who participated in the Exotic Aquatic Plant Watch and responded to our requests for input during the course of this project. This work was supported by a grant to JL from the Michigan Department of Environmental Quality (currently known as the Department of Environment, Great Lakes, and Energy), Project No. 2016-0100.

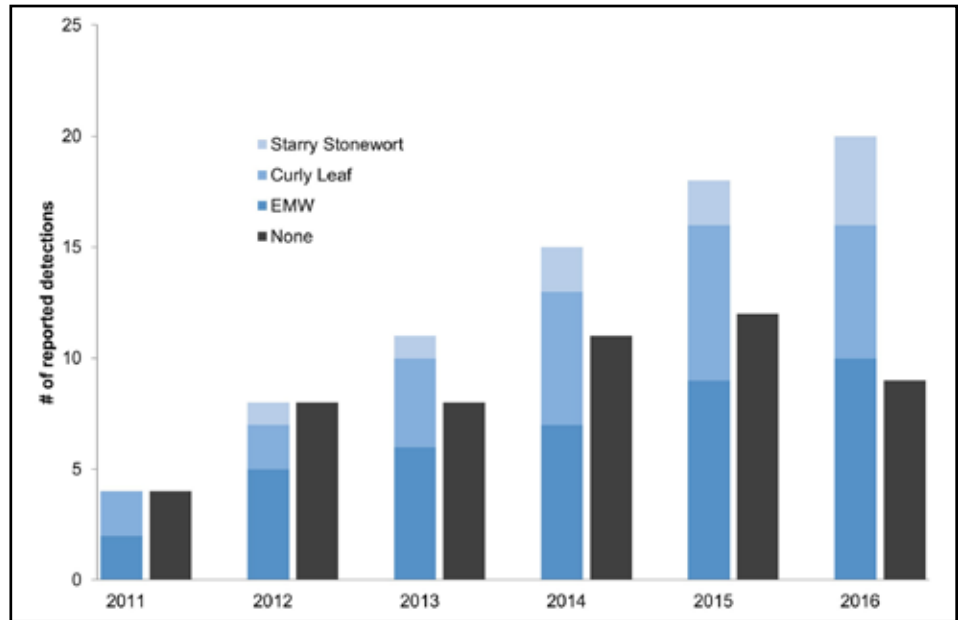


Figure 6. Number of invasive species detections by monitors, alongside number of reports from lakes.

References

Bednarz, R., H. Wandell, P. Steen, J. Latimore, and W. Dimond. 2015. Cooperative Lakes Monitoring Program manual. Report Number MI/DEQ/WRD-15/004. Lansing, MI: Michigan Department of Environmental Quality. Available at https://micorps.net/wp-content/uploads/CLMP_Manual.pdf [Last accessed 9 November 2019].

Gallo, T. and D. Waitt. 2011. Creating a successful citizen science model to detect and report invasive species. *BioScience* 61(6):459-465. DOI: <https://doi.org/10.1525/bio.2011.61.6.8>.

Latimore, J.A. and P.J. Steen. 2014. Integrating freshwater science and local management through volunteer monitoring partnerships: The Michigan Clean Water Corps. *Freshwater Science* 33(2):686-692. DOI: <https://doi.org/10.1086/676118>.

Poisson, A.C., I.M. McCullough, K.S. Cheruvellil, K.C. Elliott, J.A. Latimore and P.A. Soranno. 2019. Quantifying the contribution of citizen science to broad-scale ecological databases. *Frontiers in Ecology and Environment*. DOI: <https://doi.org/10.1002/fee.2128>.

West, S. and R. Pateman. 2016. Recruiting and retaining participants in citizen science: What can be learned from the volunteering literature? *Citizen Science: Theory and Practice* 1(2):15. DOI: <http://doi.org/10.5334/cstp.8>.

Angela De Palma-Dow

is a program coordinator with County of Lake Water Resources Department and helps manage Clear Lake in Lake County, CA. Angela coordinates a variety of programs including aquatic plant management, invasive mussel prevention, surface water quality monitoring, storm water management, and post-fire monitoring. Angela has an MS from Michigan State University and is a Certified Lake Manager through NALMS. You can reach Angela at Angela.Depalma-Dow@lakecountyca.gov.



Dr. Jo Latimore

is an aquatic ecologist and outreach specialist at Michigan State University and director of the Michigan Clean Water Corps (MiCorps), Michigan's volunteer lake and stream monitoring program. She collaborates with natural resource managers and communities to develop innovative solutions to complex challenges facing aquatic systems, including creative approaches to prevent the introduction and spread of aquatic invasive species. You can reach Jo at latimor1@msu.edu.

