

Strengthening Citizen Science as a tool against Invasive Species in the NY Finger Lakes Region

Sydney VanWinkle, Robert Moakley, Zack Prokocki-Loomis, Tony Zhang



Partners

The project we are working on was developed in conjunction with our partners. They have been mentors for every step of this project

iMapInvasives:

Meg Wilkinson
Brittney Rogers



NYS Finger Lakes PRISM- Macrophyte Sampling Program:

Hilary Mosher
Patty Wakefield-Brown



Invasive Species

Invasive species cause ecological harm in a variety of ways, often causing a lack of balance in an ecosystem. We focused on NYS definition

Successful qualities:

- High adaptability
- Rapid reproduction
- Climate Change adaptability

Invasive species are typically introduced to an area through human intervention

- Intentional and unintentional

Invasive Species in the Finger Lakes

- There are at least 162 aquatic invasive species in the Great Lakes basin alone, and the estimated cost of the damages they cause the region is thought to be around \$5.7 billion per year
- High number of key economic drivers that are highly dependent on the local water quality in these regions



<http://www.visitfingerlakes.com/about-the-finger-lakes/finger-lakes-facts-information/>

Priority Species in the FL Region

Our clients, iMapInvasives and NYS Finger Lakes PRISM, work to monitor invasive species. The species of priority for NYS Finger Lakes PRISM include:

1. Hydrilla
2. Water Chestnut
3. Starry Stonewort
4. Hemlock Woolly Adelgid

Hydrilla (*Hydrilla verticillata*)

- Grows an inch a day
- Forms mats as it gets closer to surface
- Extremely tolerant
- Blocks sunlight and oxygen for natives
- Impacts recreational activities



Waterthyme, Hydrilla verticillata. Image from Evans (2018).

Water Chestnut (*Trapa natans* L.)

- Grows in rosettes
- Has spiny fruits that fall off
- Vines are a problem for swimmers



Water Chestnut, *Trapa natans*. Image from Mehrhoff (n.d.).

Starry Stonewort (*Nitellopsis obtusa*)

- Releases phytotoxins into the water
- Clusters can outcompete natives
- Dense mats can affect larger fish



Starry Stonewort, *Nitellopsis obtusa*. Image from Grazio (2015).

Hemlock Woolly Adelgid (*Adelges tsugae*)

- Hemlock Woolly Adelgid (HWA)
- Destroys needles, prevents new bud growth on infected branches
- Hemlocks are important to the Finger Lakes Region



USDA Forest Service - Region 8 - Southern , USDA Forest Service,
Bugwood.org

Limitations in management

- Difficult to detect which species are invasive
- Small window of detection time
- Combating invasive species is time and resource intensive
 - Limited management budgets



<http://nyis.info/blog/>

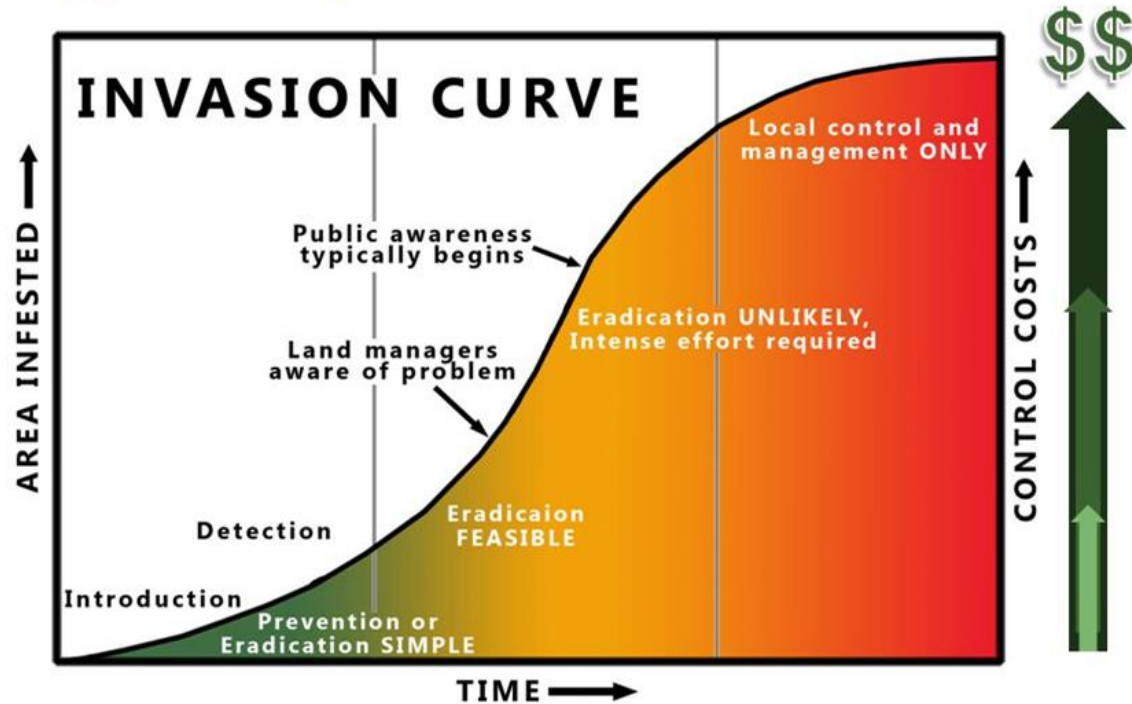
Early

Detection

Rapid

Response

Typical Species Invasion Curve



Source: <http://slideplayer.com/slide/3992588/>

- The most effective method in managing and removing invasive species
- Unfortunately, early detection requires a high number of trained individuals

Background Research

Hydrilla in Cayuga Lake:

- Cornell Cooperative Extension→ working for complete eradication due to finding it early enough on the invasion curve

So-Cal→ caulerpa taxifolia Early detection and eradication

- Southern California Caulerpa Action Team

Early detection is hard because it needs a lot of “eyes” so this shows the need for citizen science



Citizen science



the collection and analysis of data relating to the natural world by members of the general public, typically as part of a collaborative project with professional scientists.

- Used to accomplish a diverse set of goals
- Powerful tool that helps educate local communities on environmental concerns & stokes participation
 - Issues include quality of data, and recruitment
- 1 billion citizen scientists target goal set at UN Science-Policy-Business Forum for the Environment during December 2017

Research Continued



Case-Study Programs: ex. **Invaders of Texas**

Invaders of Texas was able to successfully increase citizen science engagement and legitimacy of reports

Impacts

- Prevented costs associated with late eradication
- Prevented costs associated with ecological damage
- Educated local citizens



<https://www.texasinvasives.org/invaders/>

The Gap

Previous RIT students:

- 5 years working with iMapInvasives
- High levels of awareness, low levels of reporting

Gap between knowledge and reporting, how to make long term engagement in these monitoring programs

- How can we increase participation in reporting?
- What are the reasons for a low level of participation in citizen science?

Main Project Goals

To improve citizen scientist involvement in invasive species management through early detection and long term monitoring.

Questions:

- 1) What are the characteristics of participants in citizen science programs?
- 2) How do people rate the trainings and features of the iMapInvasives app?
- 3) Does the type of training an individual receives influence future reporting?
- 4) Is there more reporting for terrestrial invasive species than aquatic invasive species why or why not?

Main Components

1. Literature Review:

- Research helping inform us of best practices for long term engagement that already exist for us to compare our findings to

2. Interviews (NYS Finger Lakes PRISM):

- Interviews we created for participants who were involved in the Macrophyte Sampling Program

3. Macrophyte Sampling Data (NYS Finger Lakes PRISM):

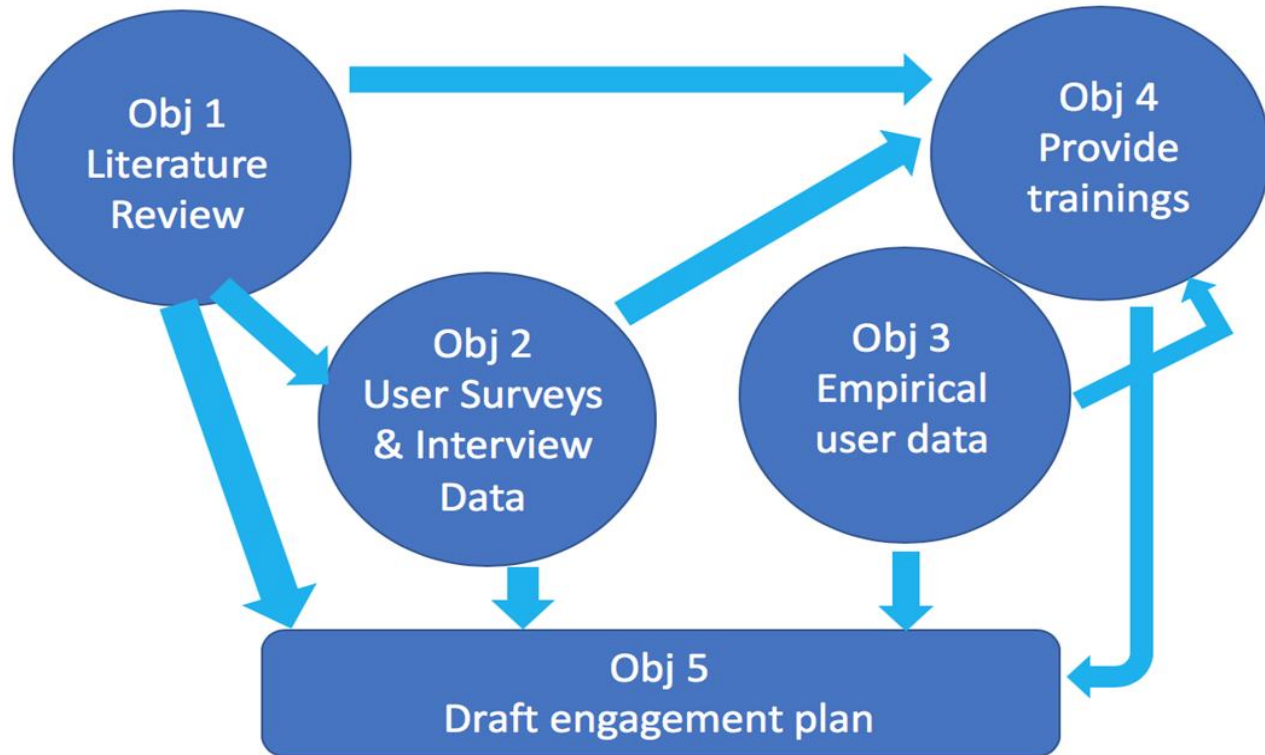
- Participants raw sampling/reporting data to cross compare with interviews findings

4. Data Mining (iMapInvasives):

- User associated data from iMap (types of trainings & reporting data)

5. Survey (iMapInvasives):

- Survey we created for all iMap users (ratings of app/background about them)



Interview Methods

Created semi-structured interviews to investigate:

- Participant characteristics
- Participant motivations



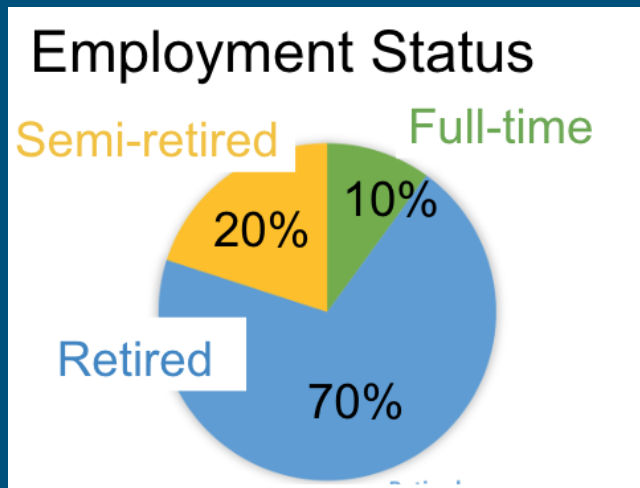
Your involvement in the sampling program:

- 1) How did you get into invasive species monitoring?
 - a) How did you get involved with/find PRISM?
- 2) How long have you been participating in this type of macrophyte, "hands on" monitoring?
- 3) How many times in 2018 did you sample for Macrophytes?
- 4) How motivated do you feel by this program? How inclined are you by this program to go outside and sample?
 - a) Rate from 1-7 (1 being very unmotivated, 7 being very motivated)
 - b) Why?

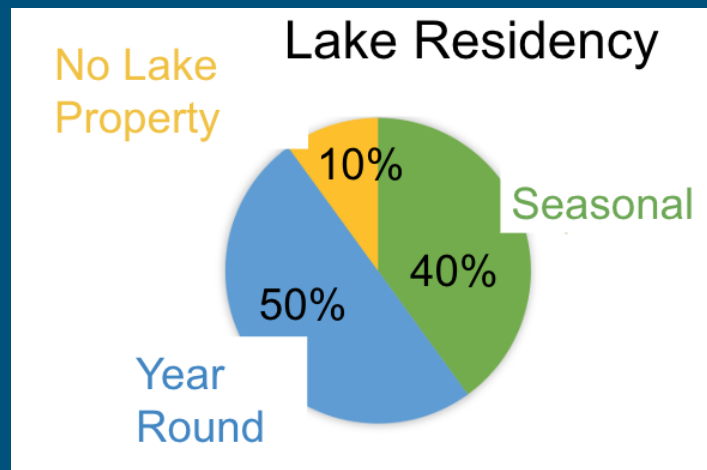
Perspectives on this sampling program and other programs:

- 5) Do you know about any other projects like this monitoring program (CSLAP, Angler Diaries, any citizen science initiatives)?
 - a) If yes, have you participated in any of them?
- 6) What did you like about the macrophyte monitoring you have participated in?
 - a) Will you stay involved next season?

Interview Findings



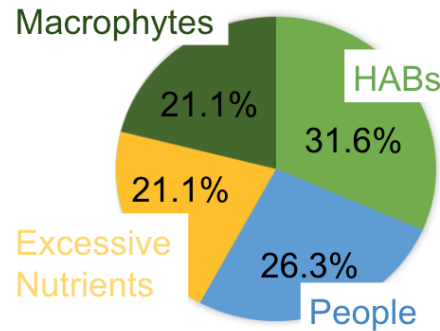
- Participants were more likely to be retired, year round residents of the lake they studied.



Interview Findings Continued

- Communication and flexibility were mentioned most often as favorable characteristics of programs/program managers.
- Those who were involved with the Finger Lakes Institute also reported being “very aware” of other citizen science programs, meaning they are involved in other programs as well.

“What is the biggest threat to your lake?”



60% of participants listed more than one “biggest threat”

“People” includes lake management conflicts, incoming boats from other lakes, politics such as private vs public access, overdevelopment & overpopulation.

Perception vs Reality- Macrophyte Sampling

- People reported doing the “recommended amount” when they actually sampled more or less than what they were instructed to do
- Those with environmentally related degrees sampled more consistently than other participants
- Communication
- Volunteer Responsibility

Finding groups who have a stake in the environment → 4/10 volunteers pointed out that they never had an interest in these programs prior to owning lake property, this was not something asked in the interview but was something these participants wanted to make clear

Data Mining Methods

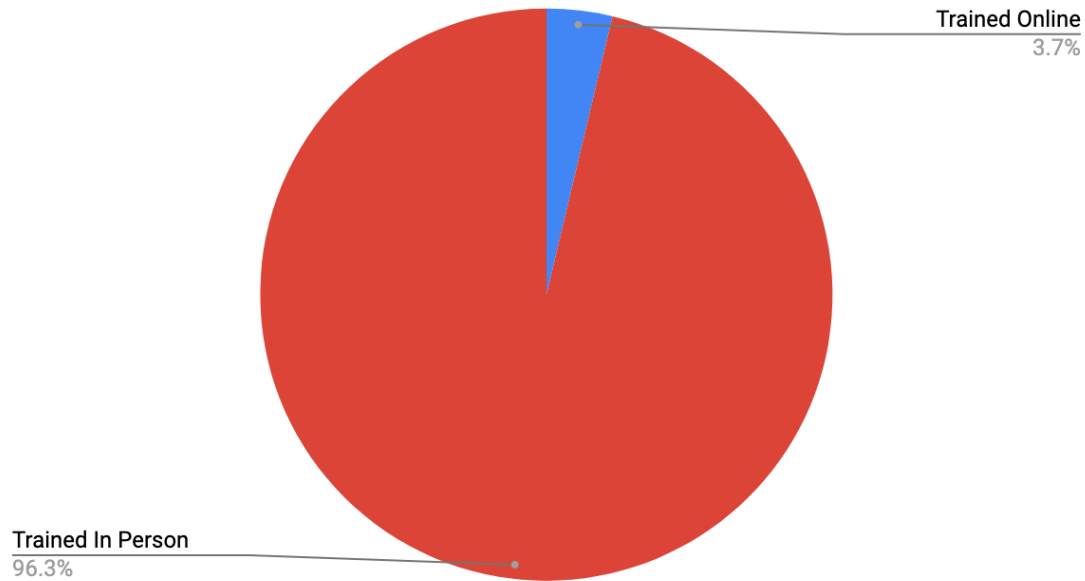
Questions:

1. Does type of training affect reporting behaviors?
2. What is the breakdown of training and reporting types?

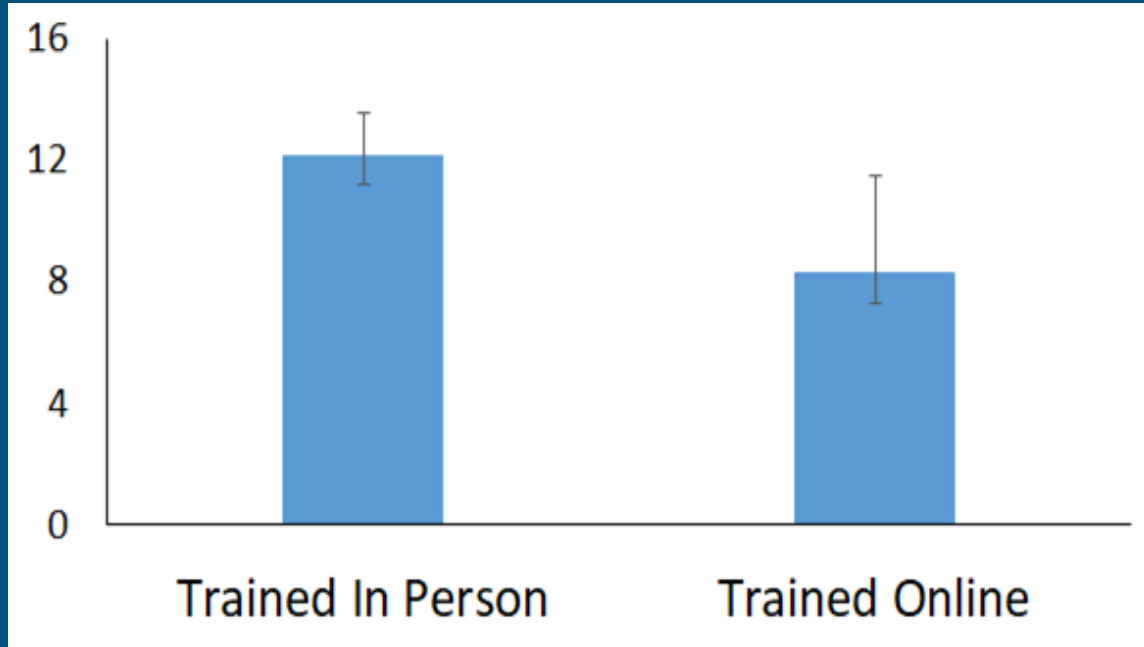
Assessment of iMapInvasives user report database including different sets of information

Data Mining Findings

Breakdown of Training Style



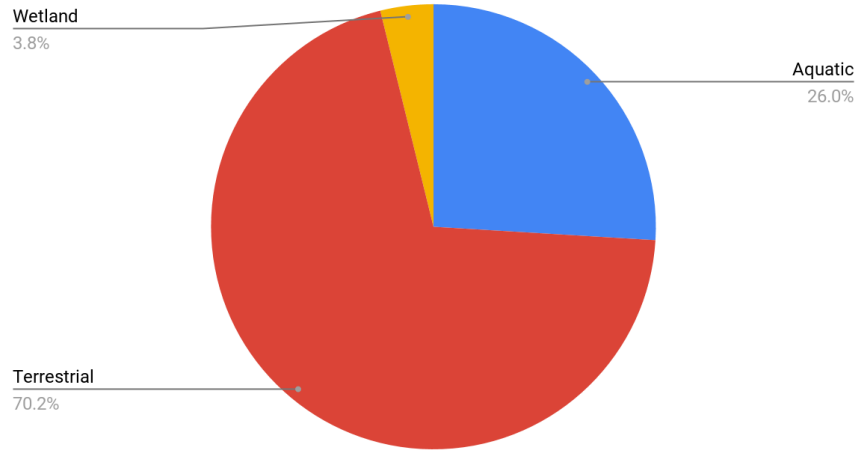
Data Mining Findings



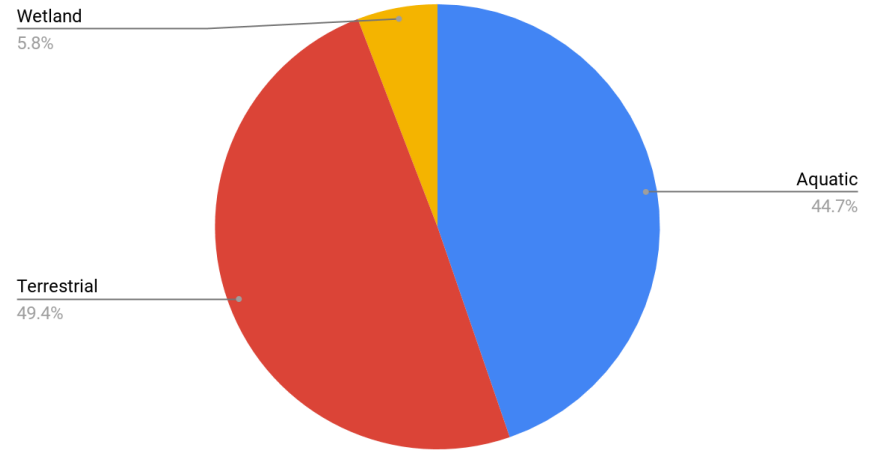
P Value: .61

Data Mining Findings

Unique species reported



Reports per species type



Questions

- ## Analyzing the data

- How did you hear about iMapInvasives?

Please Select all that apply

Friend

☐

Family Member

☐

Colleague/Co-worker

☐

Social Media

☐

Community/Lake Association

☐

Other

☐

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Please Select all that apply

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Colleague/Co-worker

☐

Social Media

☐

Community/Lake Association

☐

Age: P-value:	19-24 vs 24-34 0.837	vs 35-44 0.105	vs 45-54 0.007	vs 55-64 0.011	vs 65+ 0.018
Age: P-value:	25-34 vs 35-44 0.147	vs 45-54 0.012	vs 55-64 0.018	vs 65+ 0.027	
Age: P-value:	35-44 vs 45-54 0.303	vs 55-64 0.397	vs 65+ 0.496		
Age: P-value:	45-54 vs 55-64 0.832	vs 65+ 0.702			
Age: P-value:	55-64 vs 65+ 0.862				

Chi-Square Test for Association: Age, Worksheet columns				
Rows: Age	Columns: Worksheet columns			
	Yes	No	All	
19-24	51	7	58	
	44.85	13.15		
	0.8433	2.8761		
25-34	52	8	60	
	46.40	13.60		
	0.6767	2.3080		
35-44	27	9	36	
	27.84	8.16		
	0.0252	0.0861		
45-54	17	10	27	
	20.88	6.12		
	0.7205	2.4574		
55-64	21	11	32	
	24.74	7.26		
	0.5668	1.9331		
65+	23	11	34	
	26.29	7.71		
	0.4121	1.4055		
All	191	56	247	
Cells Contingency				
Chart				
Expected count				
Contribution to Chi-square				

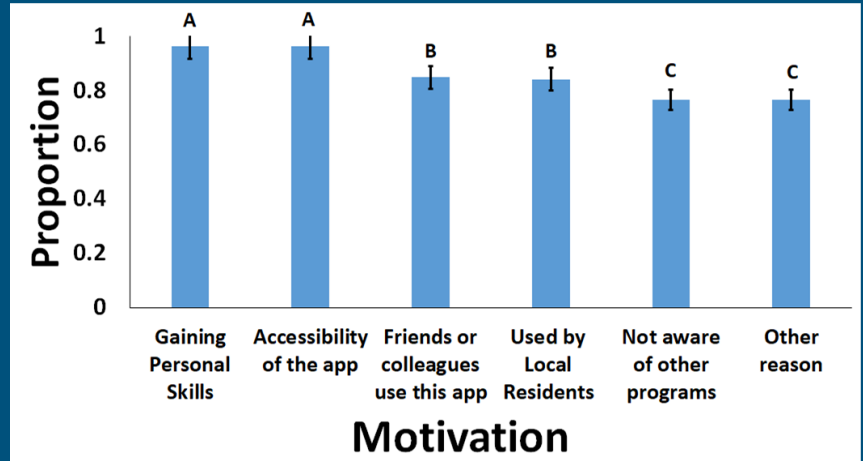
Chi-Square Test			
	Chi-Square	DF	P-Value
Pearson	14.311	5	0.014
Likelihood Ratio	14.515	5	0.013

Survey Findings

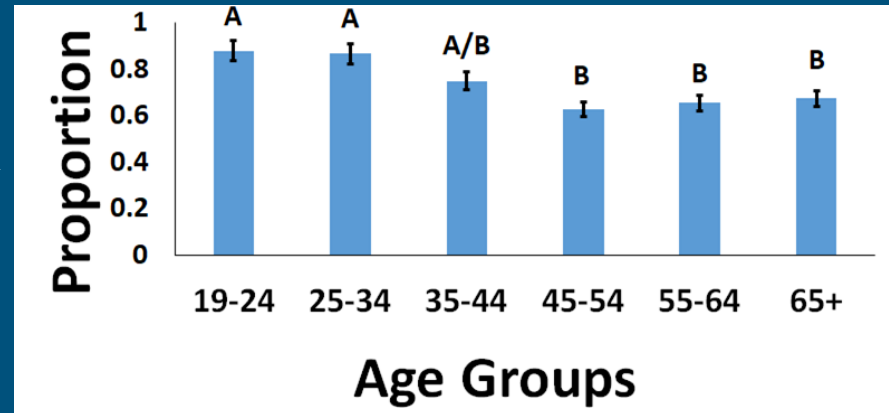
Main Motivators:

- gain personal skills
- accessibility of the app

Younger users are significantly more likely to be engaged with the app



*User-reported motivation for using the iMapInvasives mobile app. Unique letters above bars indicate a significant difference between responses ($p < 0.05$).



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Synthesis of findings

Interpreted the data through a lens of behavioral psychology

How do our findings from research, surveys, interviews and data mining synthesize to create recommendations?

CLOSING THE GAP BETWEEN KNOWLEDGE & BEHAVIOR

Essential to keeping people engaged in citizen science beyond initial education

RESEARCH

Through literature review, surveys and interviews, identify and remove barriers for involvement.



PROMOTE BEHAVIORS

Must be explicit in what behaviors you want people to follow. Appeal to reasons for involvement that resonate with your target community.

SECURE COMMITMENTS

In behavioral psychology, commitments are taken very seriously. This increases self-perception in being an active citizen scientist and further promoting behaviors. Written commitments are strongest.



SEND REMINDERS

When reminding your target community of behaviors, reminders must be close in time and space to when they could be active. Clear, simple visual reminders are most effective.

DEVELOP A CULTURE

Promoting participation and calling on others is critical to effectively engaging participants



PROCESS DEVELOPED BY KEN
DONNELLY OF BEYOND ATTITUDE

Engagement Recommendations

Factors affecting engagement

1. Roles of volunteers within project
2. Engaging in social aspects
3. Background/interests of Volunteers
4. Amount of commitment time/effort needed
5. Confidence of Volunteers in their ability to help
6. Age

Volunteer Roles

Literature:

- Options for how to complete work (Louv 2012)
- Unique roles can increase volunteer responsibility (Gallo 2011)

Our Findings:

- Options for sampling frequency→ ability to “move up” in roles and do more if they want to
- Areas of concern on lakes vs. sampling in convenient locations
- Peak growth times depending on species

Social Aspects

Literature:

- Bringing family/friends along (Louv 2012)
- Frequent administrator-volunteer communication (Nov 2011)

Our Findings:

- Many cited working with family/friends
- Open communication with program leader
- Wanted more volunteer communication mechanisms (web interface)

Volunteer Backgrounds/Interests

Literature:

- Science background may feel motivated due to contribution to science (Land-Zandstra 2012)
- Personal interest in helping oneself or contributing to a community effort (Land-Zandstra 2012)

Our Findings:

- Environmentally related backgrounds sampled more consistently
- But 4/10 participants pointed out their stake in the environment as a **major** motivator

Commitment and Effort

Literature:

- Most people want to participate at some level, not full time (Alexandria 2014)

Our Findings:

- Flexibility being cited as a favorable trait
- Combine with the ability for roles in projects for long term engagement

Confidence

Literature:

- Trainings, workshops and assigning specific jobs are keys to success for these programs (Louv 2012, Vickie 2015)

Our Findings:

- All participants reported being confident in sampling methods and most ID due to trainings and workshops
- 4/10 felt they needed additional training for invasive species & native (especially look-alikes)

Age

iMapInvasives users: Younger 19-34

Macrophyte sampling participants: Retired or Semi-retired (50-70)

- Provide more trainings to older populations for the app
- Promote hands on sampling to younger audiences
- Promote bringing younger family members to sample if possible

Overall Engagement

Creating these programs is hard

Many aspects to consider, objectives to reach, data to collect

Vital to protect our ecosystems

- Time & Cost

Important to understand all the relationships in these programs to help build on what we already have

Future for this project

Over the next 4 years RIT will continue with this project, finding new avenues to investigate the problem of knowledge vs participation

1. Focusing on HWA (MAC program → HWA Program)
2. MAC Sampling
3. Gather iMap 3.0 data (draw comparisons)
 - a. User data
 - b. Survey data

Acknowledgements

- iMapInvasives
 - **Meg Wilkinson**
 - **Brittney Rogers**→ Certified Trainers Network
- NYS FL PRISM-Macrophyte Sampling Program
 - **Patty Wakefield-Brown**
 - **Hilary Mosher**
- RIT **Gosnell School of Life Sciences** for funding our outreach activities
- **Dr. Christy Tyler** for guiding us through the creation and execution of this project



Questions?



References:

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