Aquatic Citizen Science: A Sound Investment

Julie Vastine| Alliance for Aquatic Resource Monitoring

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Dickinson

About ALLARM

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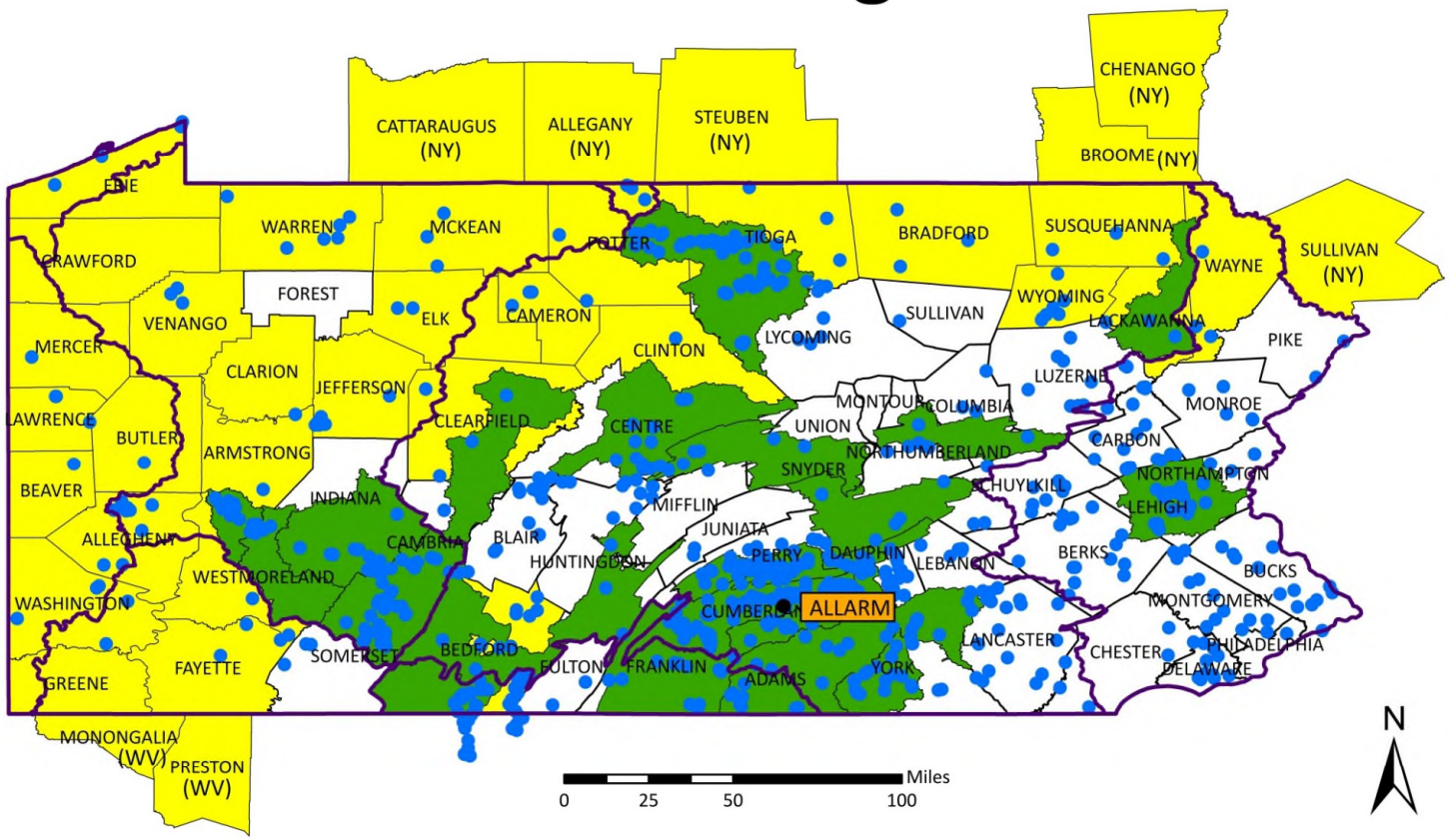
- Dickinson College Students
- Program of Dickinson College
- 40% supported by the college, 60% funded by federal, state, family foundation grants

ALLARM Monitoring Assistance



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Data Sources: ALLARM, NYS Office of Cyber Security, PA DOT, PSU, USGS, WVDEP

- Acid Rain Sites (734)
- Watershed Monitoring Groups (44)
- Shale Gas Monitoring Workshops (59)
- 6 Major PA Watersheds

“C” Science

- Citizen Science
- Community Science
- Civic Science
- Community-based research
- Informal Science

Table 1. Models for Public Participation in Scientific Research

Step in Scientific Process	Steps included in Contributory Projects	Steps included in Collaborative Projects	Steps included in Co-created Projects
Choose or define question(s) for study			X
Gather information and resources			X
Develop explanations (hypotheses)			X
Design data collection methodologies		(X)	X
Collect samples and/or record data	X	X	X
Analyze samples		X	X
Analyze data	(X)	X	X
Interpret data and draw conclusions		(X)	X
Disseminate conclusions/ translate results into action	(X)	(X)	X
Discuss results and ask new questions			X

X = public included in step; (X) = public sometimes included in step

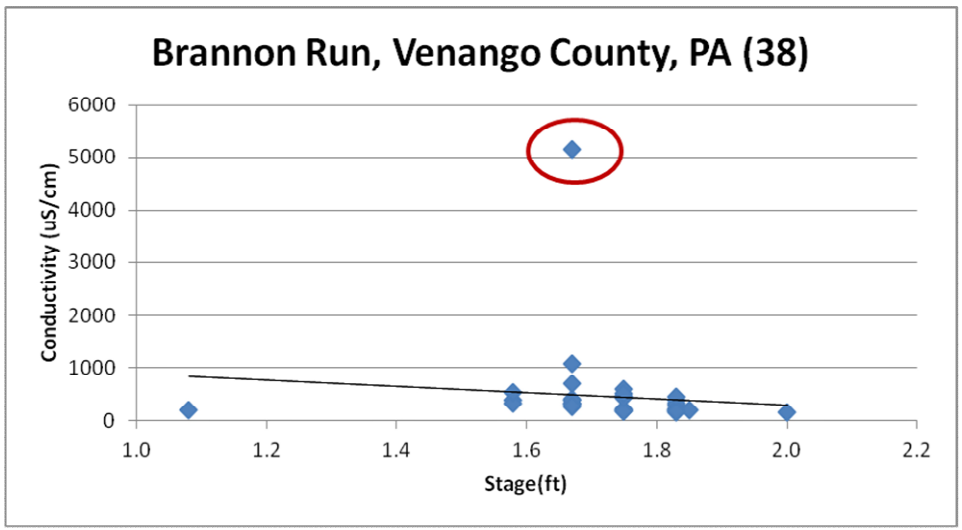
[2] The authors are not implying that all scientific research includes all of these steps or that there is a defined "order" to scientific investigation. Rather, we articulate these steps to outline a range of common research activities in which members of the public might participate.

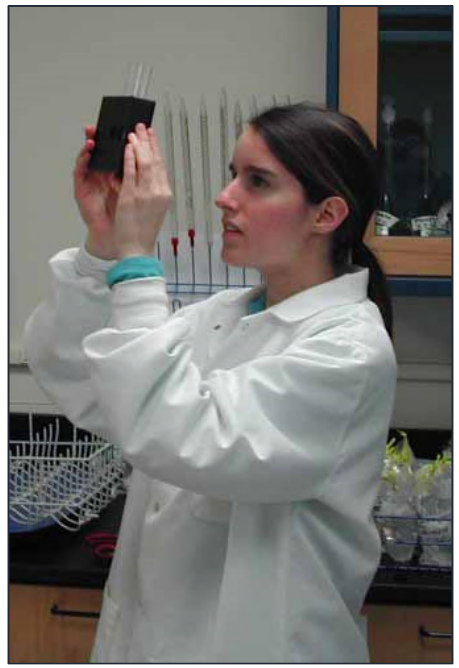
http://informalscience.org/images/research/PublicParticipationinScientificResearch.pdf

Where does aquatic citizen science or volunteer monitoring fit in?

Current research by Cornell Lab of Ornithology…

- Data use by many entities including the volunteers
- Strong quality assurance measures





Big picture – National Volunteer Monitoring

- Citizens involved in data collection
- US: 1970 – 2013
- 48 out of 50 states have active programs
- Over 1,700 programs

SURFRIDER FOUNDATION

HOOSIER RIVERWATCH

MISSOURI STREAM TEAM

Friends of Casco Bay Casco BAYKEEPER

Citizen Stewards Water Quality Monitoring Program

TEXAS STREAM TEAM

History of Volunteer Monitoring

- Oldest program (1968)
- Water Quality Act (1987) – emphasized public involvement
- 1990s & 2000s – federal funding to support
- Increase in past 20 years
  - 1994 – 517 programs
  - 1998 – 800 programs
  - 2009 – 900 programs
  - 2015 – 1675 programs

Models of Volunteer Monitoring – so much diversity!

Collectors Model

Combo field & lab approach

Cooperative Lakes Monitoring Program

Michigan Lakes – Ours to Protect

Michigan Clean Water Corps

Standardized Programs

Georgia Adopt-A-Stream

Community guided with TA

Alliance for Aquatic Resource Monitoring

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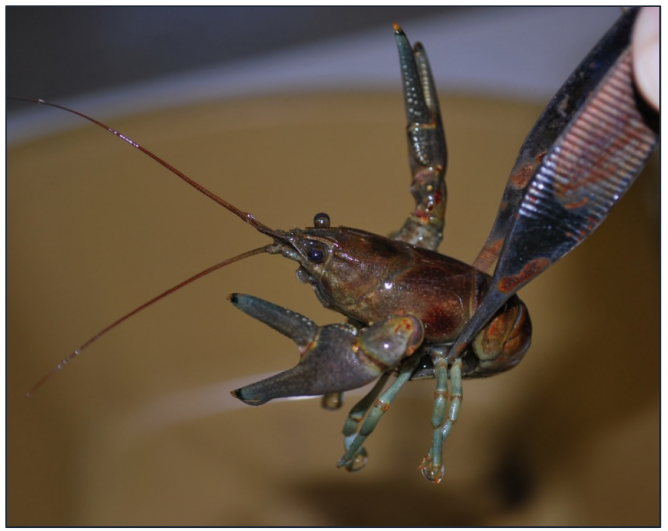
est. 1986

Lesson learned

- Cost effective not cost free
- Creative team, think outside of the box
- Invest in planning
- Maintain program funding
- Need a champion!

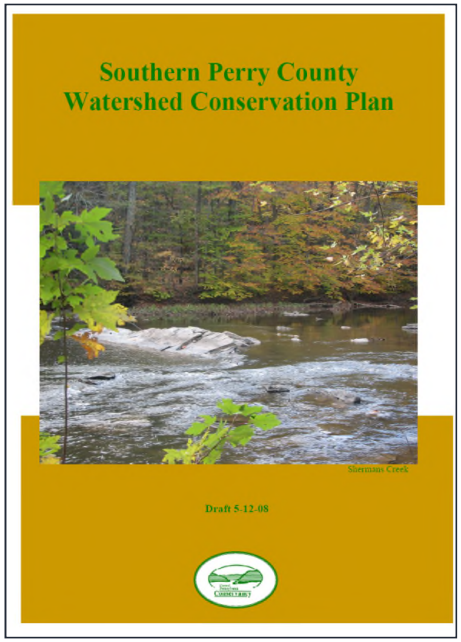
Upfront Investment

1. Data use
2. Coordinator positions
3. Protocol & equipment identification
4. Quality assurance/quality control
5. Data management



1. Data Use

Think through data use before starting a volunteer program

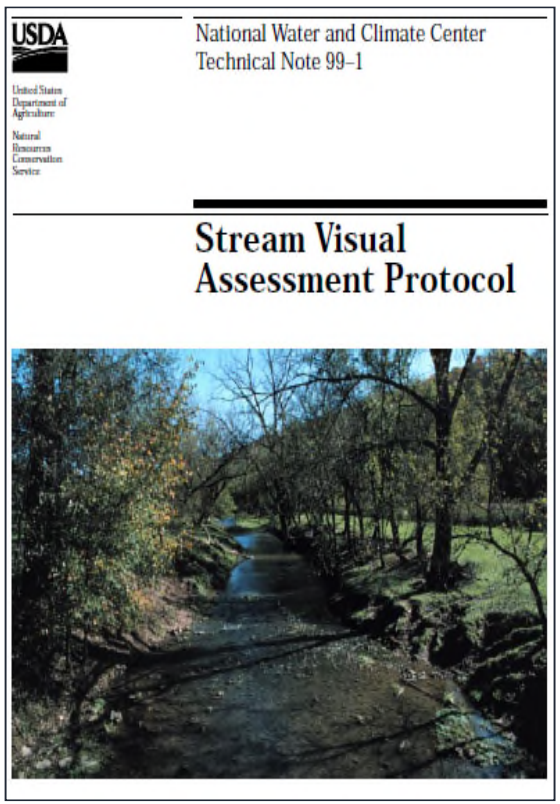


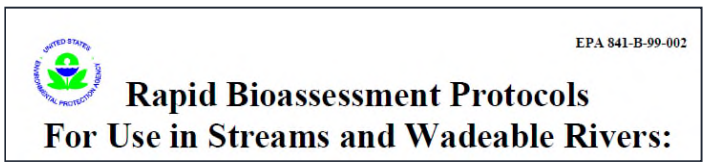
2. Coordinator positions

- Point person
- Big picture

3. Protocol & Equipment Identification

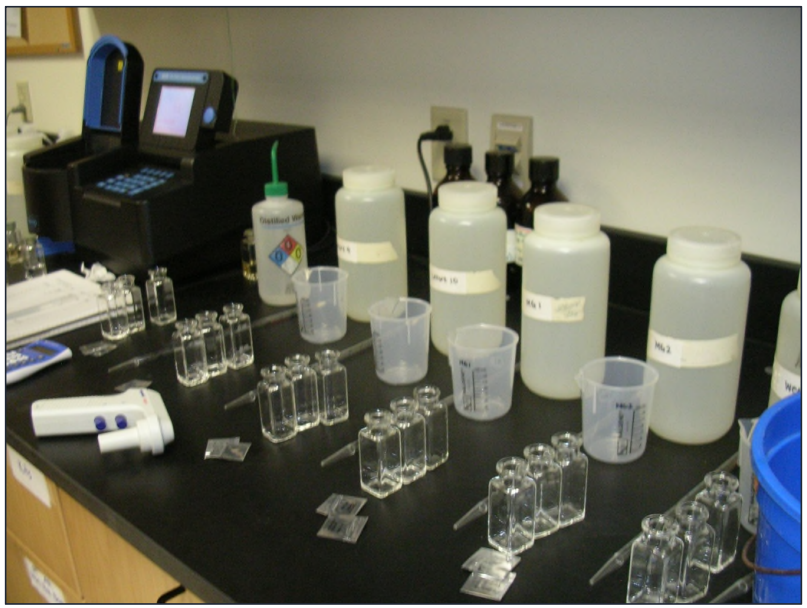
- Research appropriate protocols and equipment
- Comparability testing





4. Quality Assurance/Quality Control

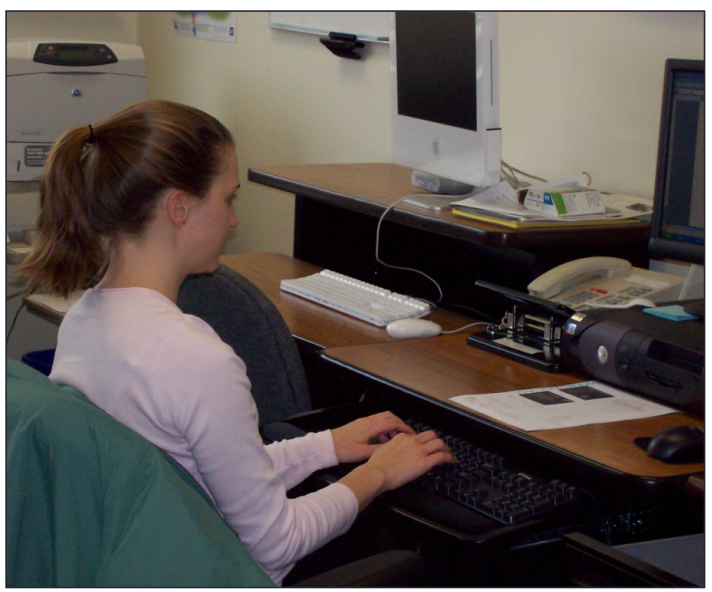
- Make sure volunteers are using equipment and protocols correctly and collecting credible data
- QAPPs
- Training



5. Data Management

- Think through at the beginning
- Clear protocols for data entry
- Metadata, metadata, metadata

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**Nitrate**												
2	Site	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
3	CR 0.35	7.25	7.15	6.90	6.00	7.05	7.95	8.85	7.30	#nd	6.10	4.25	#nd
4	SC 0.5	0.99	#nd	2.10	0.82	#nd	7.60	#nd	#nd	0.55	0.39	0.95	#nd
5	SC 1.5	0.92	#nd	0.92	1.10	#nd	0.91	#nd	#nd	0.81	0.35	0.77	#nd
6	SC 5.51	1.27	9.10	9.30	0.59	0.37	0.66	0.83	0.36	0.44	0.37	0.69	0.69
7	SC 7.27	10.00	8.80	10.00	7.50	5.00	6.50	7.80	3.70	6.40	2.70	3.15	9.90
8	SR 5.36	0.42	0.39	0.14	0.32	#nd	0.14	#nd	0.22	0.28	0.01	0.29	0.17
9	UNTSC 2.49	0.29	#nd	0.12	0.22	0.14	0.12	0.14	0.23	0.15	0.00	#nd	#nd
10													
11	**Nitrate - Annual Summary for Each Site**												
12	Site	Average	Min	25th	Median	75th	Max	Range	IQ Range	# of entries			
13	CR 0.35	6.88	4.25	6.30	7.10	7.29	8.85	4.60	0.99	10			
14	SC 0.5	1.91	0.39	0.69	0.95	1.55	7.60	7.21	0.86	7			
15	SC 1.5	0.83	0.35	0.79	0.91	0.92	1.10	0.75	0.13	7			
16	SC 5.51	2.06	0.36	0.42	0.68	0.94	9.30	8.94	0.52	12			
17	SC 7.27	6.79	2.70	4.68	7.00	9.08	10.00	7.30	4.40	12			
18	SR 5.36	0.24	0.01	0.15	0.25	0.31	0.42	0.41	0.16	10			
19	UNTSC 2.49	0.16	0.00	0.12	0.14	0.22	0.29	0.29	0.10	9			
20													
21	**Nitrate - Monthly Summary for All Sites**												
22		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
23	Average	3.02	6.36	4.21	2.36	3.14	3.41	4.41	2.36	1.44	1.42	1.68	3.59
24	Min	0.29	0.39	0.12	0.22	0.14	0.12	0.14	0.22	0.15	0.00	0.29	0.17
25	25th	0.67	5.46	0.53	0.46	0.31	0.40	0.66	0.23	0.32	0.18	0.71	0.43
26	Median	0.99	7.98	2.10	0.82	2.69	0.91	4.32	0.36	0.49	0.37	0.86	0.69
27	75th	4.26	8.88	8.10	3.55	5.51	7.05	8.06	3.70	0.75	1.55	2.60	5.30
28	Max	10.00	9.10	10.00	7.50	7.05	7.95	8.85	7.30	6.40	6.10	4.25	9.90



Continuous Investment

1. Training
2. QA/QC

Volunteer Appreciation

Key to retaining volunteers

Questions?

Alliance for Aquatic Resource Monitoring (ALLARM)

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