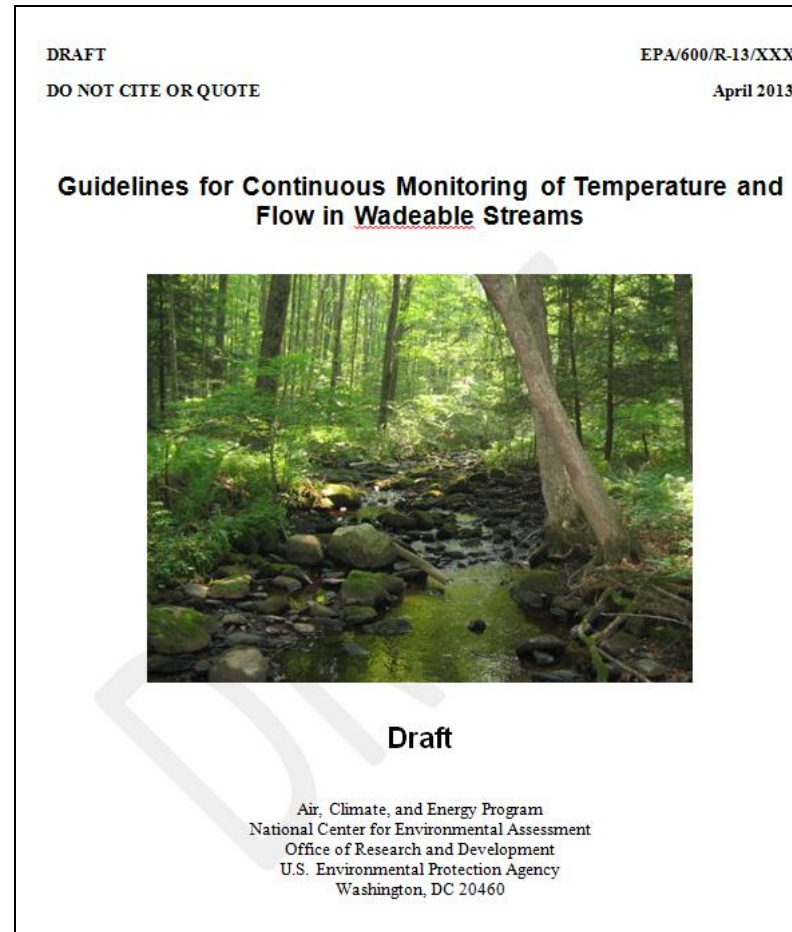


# GUIDANCE DOCUMENT ON CONTINUOUS MONITORING OF TEMPERATURE AND FLOW



*The views expressed in this talk are those of the author and they do not necessarily reflect the views or policies of the U.S. Environmental Protection Agency*

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# CONTINUOUS MONITORING OF TEMPERATURE AND FLOW



- GOAL - facilitate more **uniform and effective deployment of continuous temperature and flow sensors** at ungaged sites in wadeable streams
- Differs from existing standard operating procedures documents in that **both temperature and flow information are compiled into one place**, and deployment techniques specifically address challenges posed by **year-round deployment**.



# GUIDANCE ON WHAT EQUIPMENT TO USE & WHERE TO PUT IT



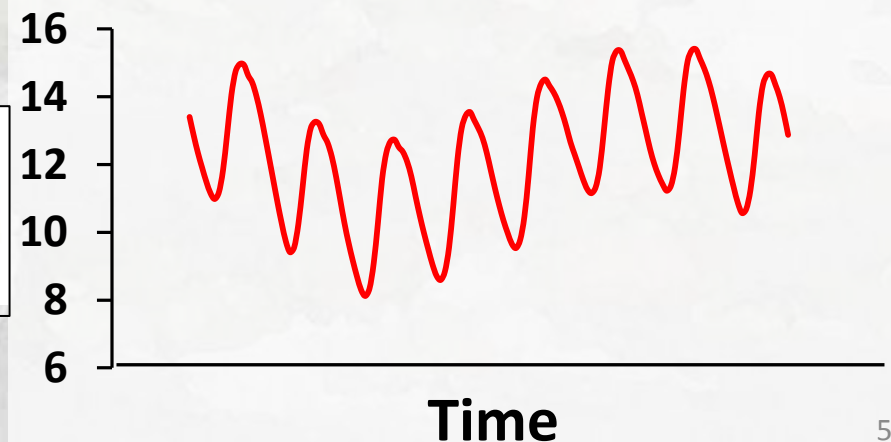
Plus sensor configuration, installation techniques, data retrieval, and data processing

# Full Year Monitoring of Stream Temperatures in Wadeable Streams

Dan Isaak and Zack Holden



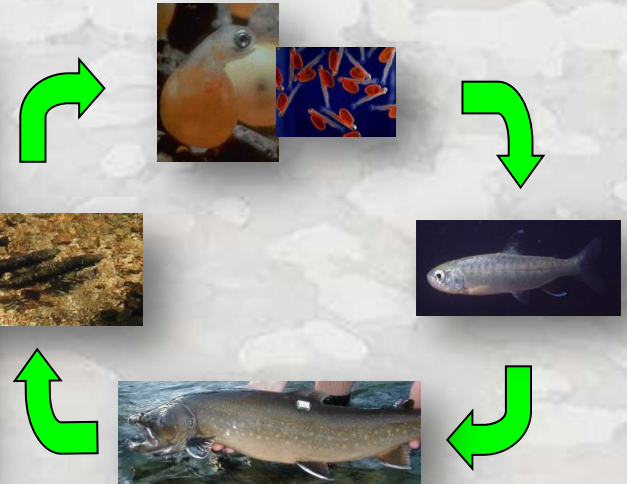
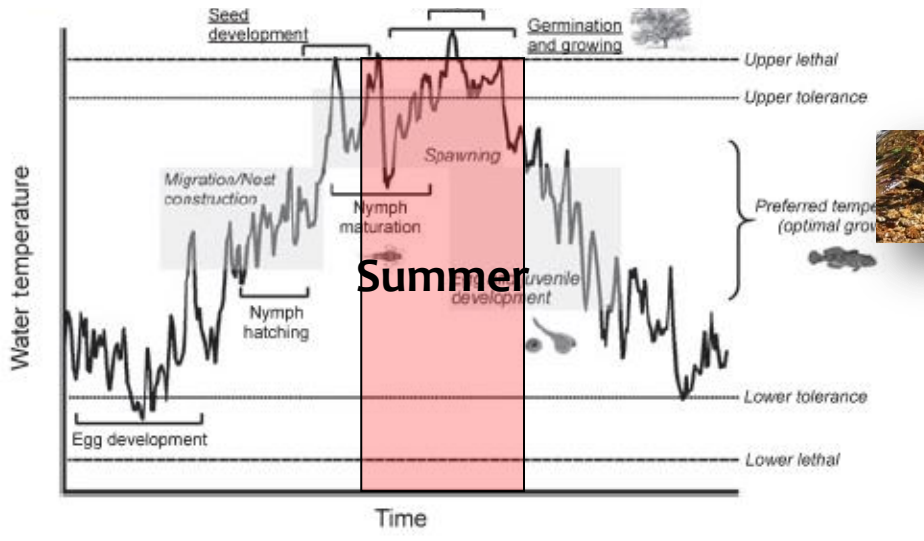
Stream Temperature ( $^{\circ}\text{C}$ )



# Summer is Not the Whole Story

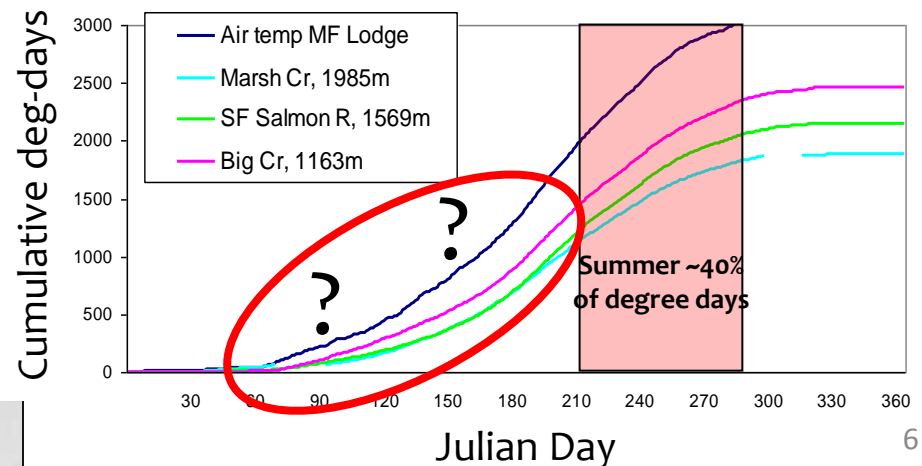
## Full year temperature data needed

### Annual Temperature Cycle



Olden and Naiman 2009

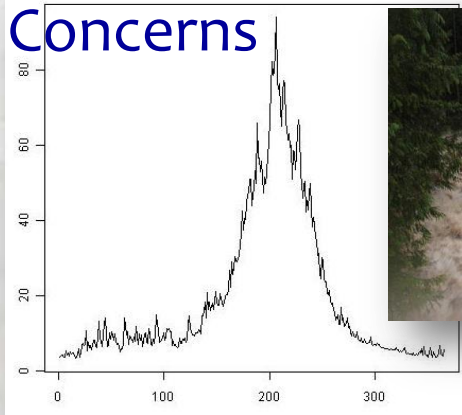
### Annual Accumulation of Thermal Units



# Easy Method for Full Year Monitoring

## Underwater Epoxy Protocol

Annual Flooding  
Concerns



Underwater epoxy



\$130 = 5 years of data

Data retrieval

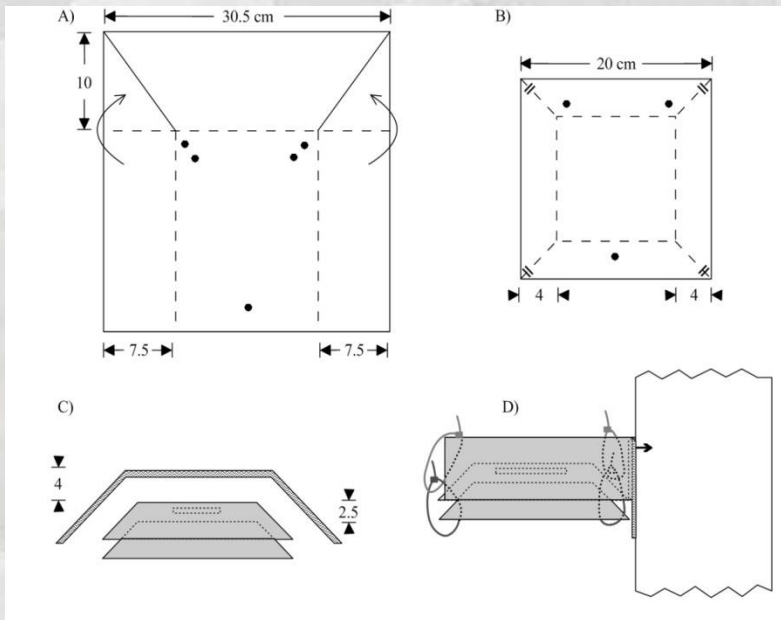


PVC housings glued to  
boulders or bridge pilings



# Pairing Air w/ Stream Sensors

## Well-ventilated radiation shield needed



### Materials:

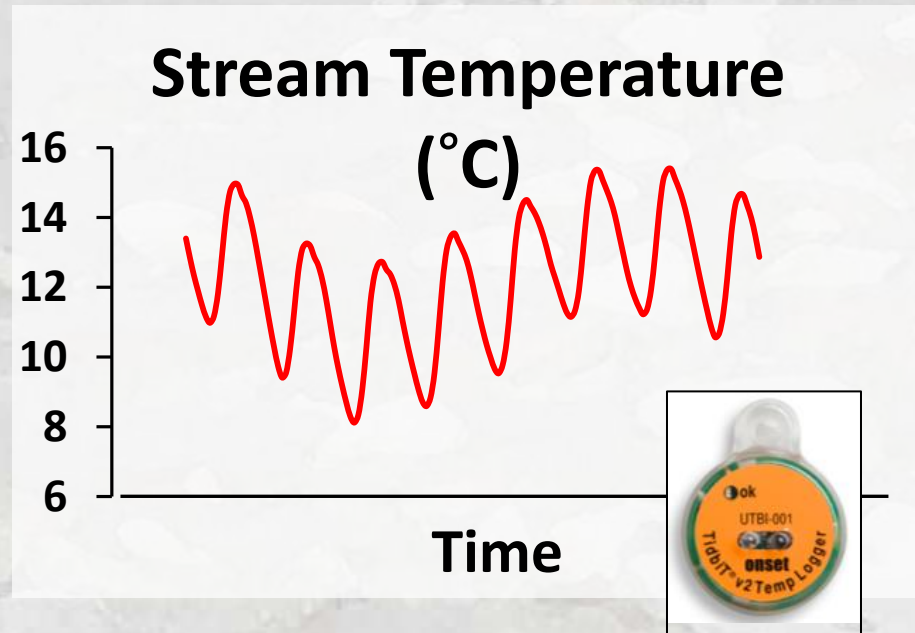
Corrugated plastic  
½ inch stapler  
Aluminum HVAC tape  
Plastic Zipties

Nails/Hammer for  
installation



# Key Points for Ensuring High Quality Full Year Stream Temperature Data

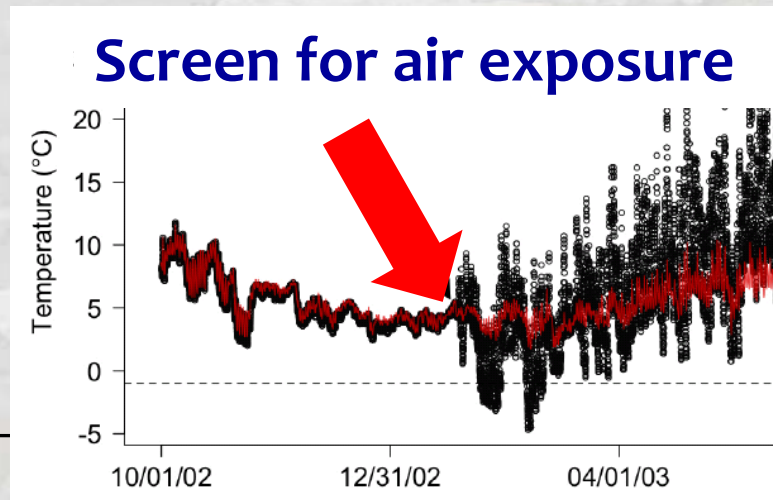
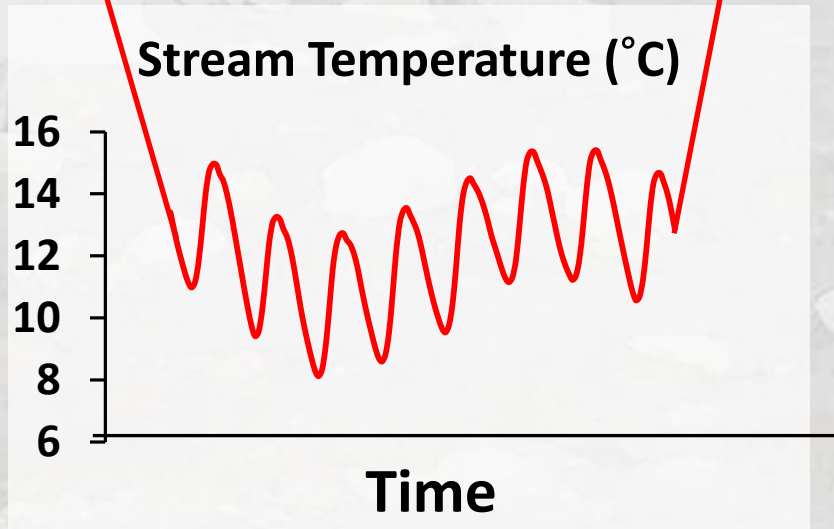
- 1) No sunlight
- 2) No sediment
- 3) No air
- 4) Flowing water
- 5) Accurate georeferencing/photo archiving



# QA/QC Checks & Database Archiving

Simple plots show a lot

← Trim the tags! →



Consistent units °F vs °C?  
Check date & time stamp

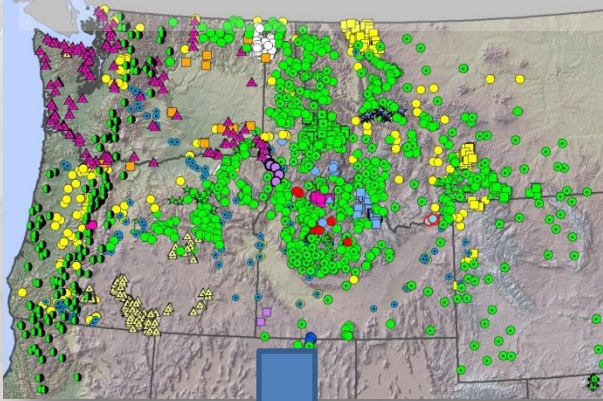
	A	B	C
1			
2	Stream:	Elk Creek	

Have a plan for data archiving. Don't fall behind...

10	7/15/2005	23:53	13.55
11	7/15/2005	23:53	13.55
12	7/16/2005	0:23	13.24

# A GoogleMap Tool for Dynamic Queries of Temperature Monitoring Sites

## Regional Sensor Network



### Site Information

- Stream name
- Data steward contact information
- Agency
- Site Initiation Date



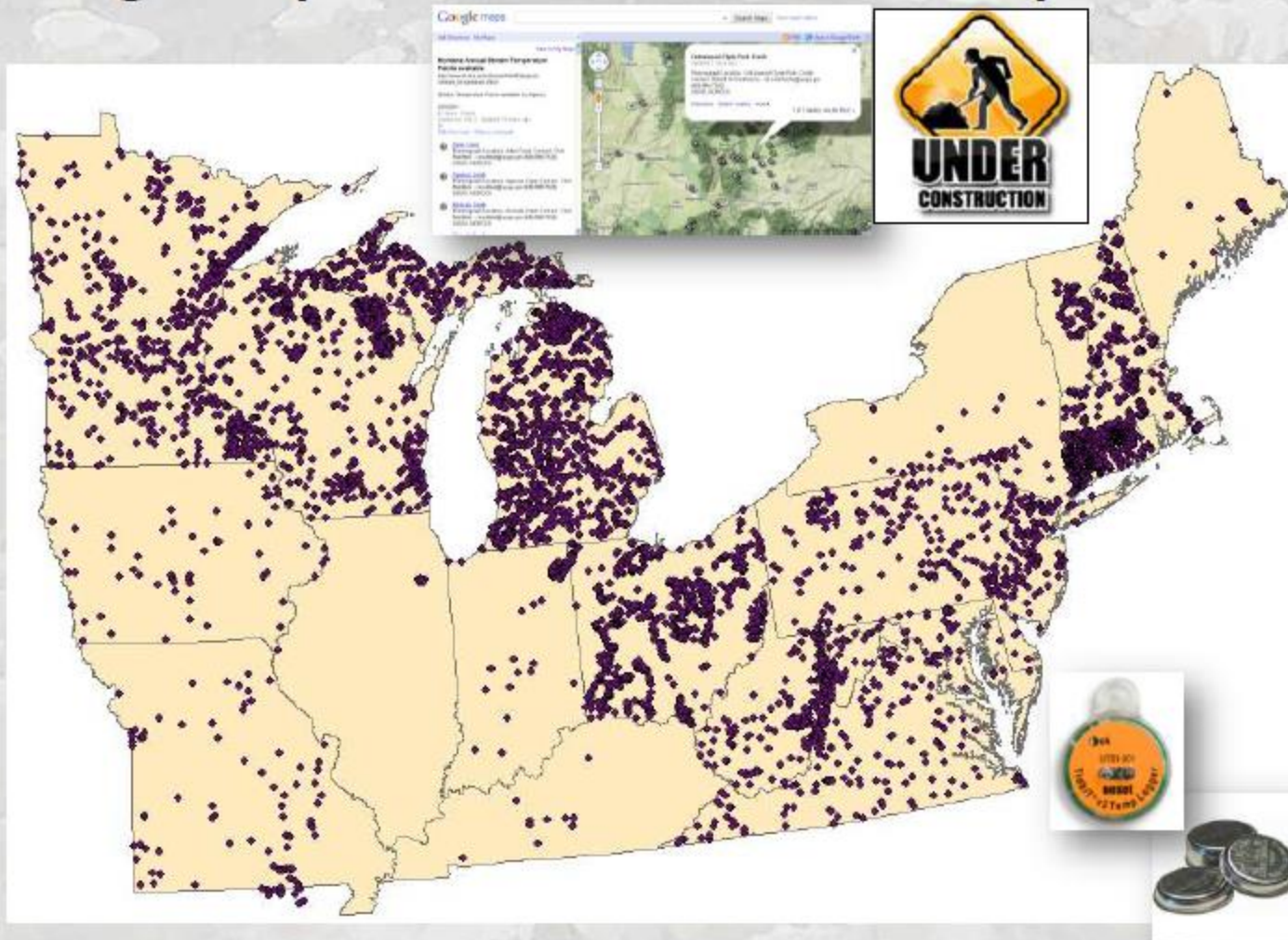
### Query Individual Sites

**Montana Annual Stream Temperature Points available**  
www.fs.fed.us/rm/boise/AWAE/projects/temperature.shtml  
Stream Temperature Points available by Agency  
2/02/2011  
62 views - Public  
Created on Feb 2 - Updated 13 hours ago  
By  
Rate this map - Write a comment

- **Adair Creek**  
Thermograph Location: Adair Creek Contact: Clint Muhlfeld - cmuhlfeld@usgs.gov (406-888-7926)  
USGS, NOROCK
- **Agassiz Creek**  
Thermograph Location: Agassiz Creek Contact: Clint Muhlfeld - cmuhlfeld@usgs.gov (406-888-7926)  
USGS, NOROCK
- **Akokala Creek**  
Thermograph Location: Akokala Creek Contact: Clint Muhlfeld - cmuhlfeld@usgs.gov (406-888-7926)  
USGS, NOROCK

**Cottonwood-Clyde Park- Creek**  
Updated 2 days ago  
Thermograph Location: Cottonwood-Clyde Park- Creek  
Contact: Robert Al-Chokhachy - ral-chokhachy@usgs.gov (406-994-7642)  
USGS, NOROCK  
Directions Search nearby more ▾  
1 of 2 nearby results Next >

# Google Map for Northeast Stream Temperature



Contact: Jana Stewart, 608-821-3855, [jsstewar@usgs.gov](mailto:jsstewar@usgs.gov)



# Water Level & Flow Measurements

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U.S. Geological Survey

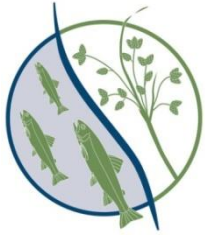
Massachusetts Cooperative Fish and Wildlife Research Unit

Department of Environmental Conservation

University of Massachusetts

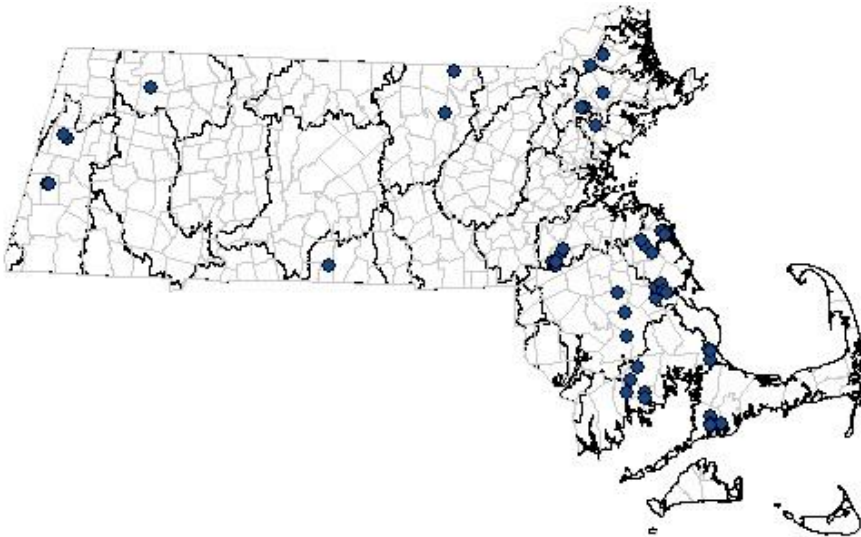
413-545-4895

aroy@eco.umass.edu



# Streamflow gaging in Massachusetts

- River Instream Flow Stewards
  - Started in 2002
  - Initial focus on low-flow conditions
  - In 2012, 41 RIFLS volunteers read 43 stream gages





# RIFLS – how it works

- Volunteers read staff gages, RIFLS staff build rating curves
- QAPP, USGS technical guidance
- [www.rifls.org](http://www.rifls.org)
- Two staff
- Major costs:
  - Travel
  - Equipment (now ~\$5k annually, but more upfront \$)



# Vented vs. non-vented pressure transducers

Non-vented



In water

On land

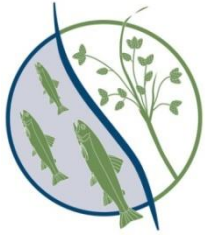
Vented





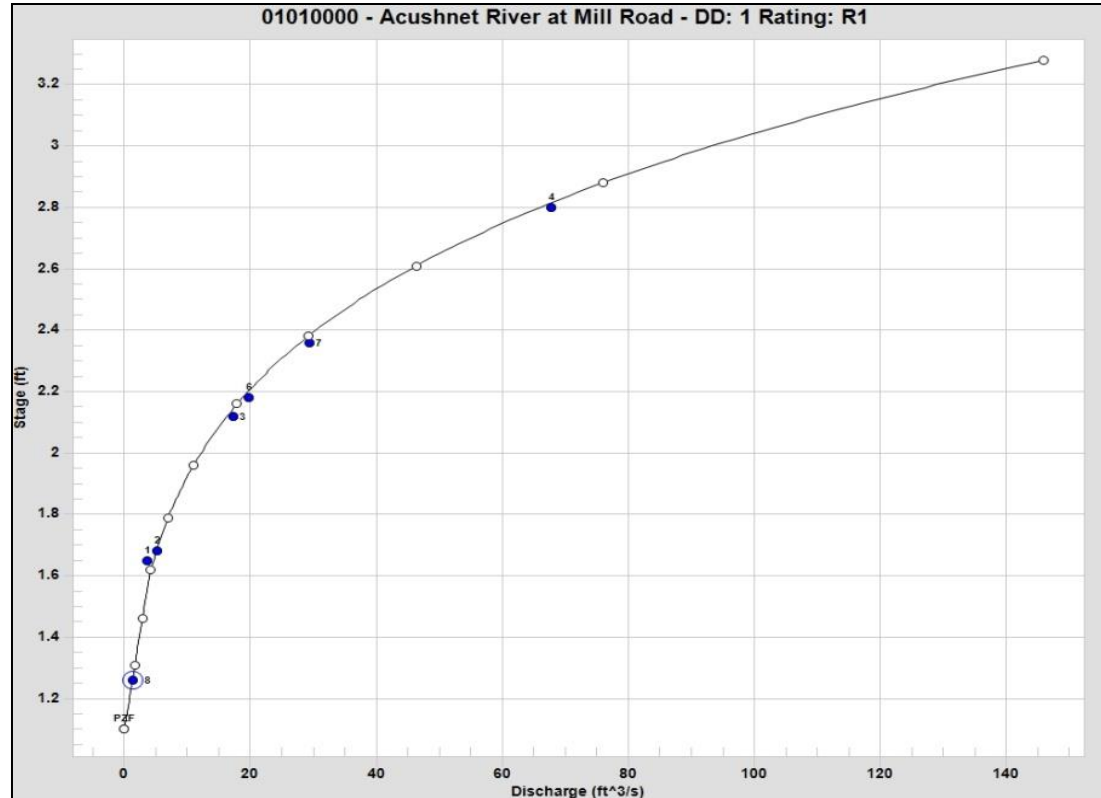
# RELATING DEPTH/STAGE TO DISCHARGE

- Stage data on its own does not give quantitative information about the magnitude of streamflows or flow volume
- Establishing a relationship between stage-discharge allows you to:
  - Compare data from year to year
  - Compare data from stream to stream
  - Know the magnitude of streamflow – key attribute that may change with changing climate



# Stage-discharge rating curve

- Need at least six streamflow (discharge) measurements at a variety of stages



# QUESTIONS? COMMENTS?



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