Georgia Adopt-A-Stream

BACTERIAL MONITORING WORKSHOP
Georgia Adopt-A-Stream

A citizen science water quality monitoring program encouraging all Georgians to get familiar with their watersheds, monitor impacts, improve streams, rivers, wetlands, lakes, and estuaries, and inform others about their effect on water quality.

Increase public **awareness** of nonpoint source pollution & water quality issues

Collect baseline water quality **data** according to Adopt-A-Stream protocols

Take **observations** of sites to note water quality conditions

Seek **partnerships** with local gov'ts, nonprofits, & other organizations to share results & resources

Utilize **tools & training** provided by staff & local coordinators
TYPES OF POLLUTION

POINT SOURCE POLLUTION
• Easily identifiable pollutant source
• Regulated by GA EPD through NPDES permitting process

NONPOINT SOURCE POLLUTION
• Sources not easily distinguished/identified
• Everyone contributes
• Main cause of water quality problems in GA
WHAT IS A WATERSHED?

• A land area from which water, sediment, and dissolved materials drain to a common point along a stream, wetland, lake, or river.

• Its boundaries are defined by the highest points of land around the waterbody.

There is an unbreakable link between human health and wellbeing and ecosystems. -Walter Reid
WHERE IS YOUR WATERSHED?
VOLUNTEER NETWORK AND SUPPORT
Volunteer Network and Support

- State Staff: 2 to 4
- Board Members: 20
- Local Coordinators: 70
- Volunteers: 3,000 +
AAS VOLUNTEERS USE STANDARDIZED PROTOCOLS

- EPA Approved Quality Assurance Project Plan (QAPP)
- Quality Assurance/Quality Control (QA/QC)
  - Required to attend workshop(s) and pass certification test(s) to become certified
  - Only individuals are certified
  - Set monitoring protocol ensures all volunteers are collecting baseline data using standard methods
  - Only certified volunteers can enter data, but anyone can access the 20+ years of data in the online AAS database
EARNING YOUR QA/QC BACTERIAL CERTIFICATION

FIELD & LAB:
Volunteers must demonstrate how to properly collect and plate a sample

WRITTEN TEST:
Volunteers must pass a written evaluation with a score of at least 80% and must correctly identify E. coli colonies and calculate E. coli levels of example plates with accuracy of at least 90%
WHY IS BACTERIAL MONITORING IMPORTANT?

- **Monitor bacterial contamination of surface waters to assess if pathogens are present**
  - Human health is at risk when in contact with waters that contain harmful bacteria
  - Gaining a snapshot of surface water contamination (*E. coli* colonies), not long-term trends
ABOUT BACTERIA

• Single-celled, living microscopic organisms

• Pros:
  • Decomposition
  • Digestion
  • Nutrient Cycling
  • Pollution Control

• Risks:
  • Release Toxins
  • Cause Disease (Pathogens)
WHAT IS E. COLI?

- **Subgroup of fecal coliforms**
- **Coliforms**
  - Biological family of bacteria naturally found in the soil
- **Fecal Coliforms**
  - Subgroup of coliforms, found in intestinal tracts of warm-blooded animals
- **E. coli**
  - Subgroup of fecal coliforms

Subgroup of coliforms, found in intestinal tracts of warm-blooded animals
WHY MONITOR FOR E. COLI?

• High levels indicate the possible presence of pathogens
• Sources of E. coli in waterways:
  • Wildlife
  • Livestock
  • Urban storm runoff
  • Sewage
    • Leaking sewage pipes
    • Combined sewer overflow
    • Wastewater treatment plants
    • Failing septic systems
WHERE, WHEN, AND HOW OFTEN?

- Where to monitor:
  - Well mixed, flowing area of water
  - Same site location

- When to monitor:
  - Normal flow conditions
  - Same time of day

- How often to monitor:
  - Once a month
FACTORS INFLUENCING E. COLI COUNTS

• Weather:
  • Higher levels following a rainstorm or heavy runoff event
  • Avoid sampling during high flow

• Season/Temperature:
  • Warmer water temperature = higher E. coli replication rates
  • Colder water temperature = lower E. coli replication rates
HOW TO MONITOR FOR E. COLI
STEP 1: PREPARE THE BLANK/CONTROL

- Proves no contamination occurred during sample collection, transport, or plating
- How to prepare a blank:
  - Label Whirl-pak® bag as a blank
  - Put gloves on and remove perforated seal
  - Use small white tabs to open the bag
  - Fill the bag 2/3 up with DISTILLED WATER
  - Whirl!
  - Place in sanitized cooler with ice
STEP 2: COLLECTING A SAMPLE

• Label a Whirl-pak® bag with the location, date, and time
• Use same procedure as blank to open
• Fill Whirl-pak® 2/3 with stream water (collected upstream) and whirl!
• Place sample in cooler immediately after collection
  • Ice prevents E. coli from replicating
  • Lid prevents UV rays killing existing bacteria
• Plate within 24 hrs of collection
STEP 3: PLATING YOUR SAMPLE

- Clean area with disinfectant
- Invert Whirl-pak® to mix sample
- Label 3M Petrifilm plates
  - Date and time
  - Site name
  - Blank, Plate 1, Plate 2, Plate 3
- Use pipette to take one 1 mL sample from the blank, plus three 1 mL samples from the stream water (4 plates total)
STEP 4: INCUBATING YOUR SAMPLE

- 35°C ± 1°C for 24 hours ± 1 hour
- Check minimum and maximum temperatures after incubating
- Use AAS or EPA approved incubator
STEP 5: READING YOUR RESULTS

• Only count blue colonies with gas bubbles

• Do not count colonies growing more than halfway off the medium

• Units for bacteria: **Colony Forming Units (CFU)/100 mL**

Possible gas bubble patterns
There should not be any colonies (*E. coli* or general coliform) on the blank!
EXAMPLE

#1

How many *E. coli* colonies do you see?
How many *E. coli* colonies do you see?
EXAMPLE

#2

How many *E. coli* colonies do you see?
How many *E. coli* colonies do you see?
EXAMPLE

#3

How many *E. coli* colonies do you see?
How many *E. coli* colonies do you see?

Do not count blue colonies without bubbles.
EXAMPLE

How many *E. coli* colonies do you see?
How many *E. coli* colonies do you see?

Too Numerous To Count (TNTC)
EXAMPLE #5

How many *E. coli* colonies do you see?
How many *E. coli* colonies do you see?
How many *E. coli* colonies do you see?
How many *E. coli* colonies do you see?
EXAMPLE

#7

How many *E. coli* colonies do you see?
How many *E. coli* colonies do you see?

Too Numerous To Count (TNTC)
EXAMPLE #8

How many *E. coli* colonies do you see?

Would this be an acceptable blank?
How many *E. coli* colonies do you see?
How many *E. coli* colonies do you see?
How many *E. coli* colonies do you see?
EXAMPLE #11

How many *E. coli* colonies do you see?
How many *E. coli* colonies do you see?
How many *E. coli* colonies do you see?
How many *E. coli* colonies do you see?
STEP 6: CALCULATING YOUR RESULTS

<table>
<thead>
<tr>
<th></th>
<th>Plate 1</th>
<th>Plate 2</th>
<th>Plate 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. coli colonies</td>
<td>5</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>
Step 1: \[ \frac{(\text{Plate 1} + \text{Plate 2} + \text{Plate 3})}{3} = \text{Average CFU/1 mL} \]

Step 2: \[ \text{Average CFU/1 mL} \times 100 = \text{Average CFU/100 mL} \]
STEP 6: CALCULATING YOUR RESULTS

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>E. coli colonies</td>
<td>5</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Step 1: \[ \frac{(5 + 2 + 2)}{3} = 3.00 \text{ CFU/1 mL} \]

Step 2: \[ 3.00 \text{ CFU/1 mL} \times 100 = 300 \text{ CFU/100 mL} \]
## STEP 6: CALCULATING YOUR RESULTS

<table>
<thead>
<tr>
<th></th>
<th>Plate 1</th>
<th>Plate 2</th>
<th>Plate 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. coli colonies</td>
<td>TNTC</td>
<td>TNTC</td>
<td>TNTC</td>
</tr>
</tbody>
</table>
STEP 6: CALCULATING YOUR RESULTS

<table>
<thead>
<tr>
<th>E. coli colonies</th>
<th>Plate 1</th>
<th>Plate 2</th>
<th>Plate 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>TNTC</td>
<td>TNTC</td>
<td>TNTC</td>
<td>TNTC</td>
</tr>
</tbody>
</table>

\[
\frac{(\text{TNTC} + \text{TNTC} + \text{TNTC})}{3} = \text{TNTC}
\]
STEP 7: DISPOSAL AND CLEAN-UP

- Spray plates with disinfectant, seal in bag/used *Whirl-Pak*, and throw away
- Wipe down incubator & surrounding surfaces with disinfectant
- Wash hands!
HOW TO STORE PETRIFILM

- If using within one month, keep in the fridge
- If not, store in the freezer and thaw before use
REGULATORY STANDARDS

- State of GA regulatory data transitioned from fecal coliforms to *E. coli*
  - State standards reflect established EPA guidelines
  - Includes enterococci to indicate presence of pathogens in coastal waters

- Statistical Threshold Value (STV) - <10% of samples should exceed given level
  - Risk level of 36/1,000 people getting sick from primary contact activities
  - **Sample again if sample > STV**
  - **Report if samples are consistently > STV (2+ months out of the year)**

<table>
<thead>
<tr>
<th></th>
<th><em>E. coli</em> STV</th>
<th>Enterococci STV</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPA recommended level (CFU/100 mL)</td>
<td>&lt;410</td>
<td>&lt;130</td>
</tr>
</tbody>
</table>
HIGH E. COLI COUNTS

AAS Action Value: >1000 CFU/100 mL
If your count exceeds this value and you **did find** a source:

- NOTIFY local AAS coordinator and/or water authority
- INVESTIGATE site and identify possible sources
- I found a source!
HIGH E. COLI COUNTS

AAS Action Value: >1000 CFU/100 mL

If your count exceeds this value and you did not find a source:

- NOTIFY local AAS coordinator and/or water authority
- INVESTIGATE site and identify possible sources
- I did not find a source
  - Take another sample
  - Above threshold again
  - Below threshold
    - Monitor as usual
- Monitor as usual
SAFETY

• Try not to sample alone- take a monitoring buddy!
• Do not sample during high flows or after a heavy rain event
• Obtain permission if sampling on private property
• Wear PPE when sampling and plating
• Disinfect thoroughly before and after plating and counting
ONCE YOU’RE CERTIFIED

• You get an account to our online database!
• Only certified volunteers can submit data
• Certification is valid for one year
• Volunteers must attend an annual recertification workshop
HOW ARE YOUR DATA USED?

- Establish baseline conditions for waterbodies across the state
- Discover and report water quality issues
- Educate your community
- Help inform status of streams for 303d/305b list
From the AAS website’s homepage, hover over the My Profile tab and click Sign In
From the AAS website’s homepage, hover over the Data Entry tab and click Data Submission Form
# GEORGIA ADOPT-A-STREAM: Bacterial Form

To be conducted every month

<table>
<thead>
<tr>
<th>Site Information</th>
<th>WEATHER</th>
<th>OBSERVATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Name:</td>
<td>Present conditions (check all that apply)</td>
<td>Flow/Water Level:</td>
</tr>
<tr>
<td>Group ID: G-______ Site ID: S-______</td>
<td>Heavy Rain</td>
<td>Dry</td>
</tr>
<tr>
<td>Stream Name:</td>
<td>Steady Rain</td>
<td>Stagnant/Still</td>
</tr>
<tr>
<td>Monitor(s):</td>
<td>Intermittent Rain</td>
<td>Low</td>
</tr>
<tr>
<td>Number of Participants:</td>
<td>Overcast</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Partly Cloudy</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Clear/Sunny</td>
<td>Flow (over banks)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Amount of rain, if known?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount in Inches:_______ In Last Hours/Days:_______</td>
</tr>
</tbody>
</table>

*Refer to wunderground.com for rainfall data

<table>
<thead>
<tr>
<th>Water Clarity:</th>
<th>Water Color:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear/Transparent</td>
<td>No Color</td>
</tr>
<tr>
<td>Cloudy/Somewhat Turbid</td>
<td>Brown/Muddy</td>
</tr>
<tr>
<td>Opaque/Turbid</td>
<td>Green</td>
</tr>
<tr>
<td></td>
<td>Milky/White</td>
</tr>
<tr>
<td></td>
<td>Tannic</td>
</tr>
<tr>
<td></td>
<td>Other:______</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Water Surface:</th>
<th>Water Odor:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear</td>
<td>Natural/None</td>
</tr>
<tr>
<td>Greater than 3” high</td>
<td>Gasoline</td>
</tr>
<tr>
<td>It is white</td>
<td>Sewage</td>
</tr>
<tr>
<td></td>
<td>Rotten Egg</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Foam</th>
<th>Oily Sheen: does it break when disturbed? Yes/No (circle one)</th>
<th>Algae</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>-------</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Photos: Please take images to document your observations and changes in water quality conditions.</th>
</tr>
</thead>
</table>

Photo point directions can be found in the manuals. Send photos to AAS@gspd.org

<table>
<thead>
<tr>
<th>Trash:</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
# Bacterial Data

Submit data ASAP to online database

Access database via AdoptAStream.Georgia.gov

## Bacterial Data

<table>
<thead>
<tr>
<th>Plate</th>
<th>Colonies</th>
<th>Find AVG of Number of Colonies</th>
<th>cfu/100mL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blank</td>
<td></td>
<td>(total # colonies/total # of colonies (do not include blank)) x 100 =</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>Sample Holding Time (HH):</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Date START (MMDDYYYY):</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Date END (MMDDYYYY):</td>
<td></td>
</tr>
<tr>
<td>Total # Colonies</td>
<td>Time START (HHMM):</td>
<td>Time END (HHMM):</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MIN Temp (°C):</td>
<td>MAX Temp (°C):</td>
<td></td>
</tr>
</tbody>
</table>

Any changes since you last sampled at this site? If yes, please describe.

Please submit data to our online database at AdoptAStream.Georgia.gov
Fill out site data first, then navigate to the chemical tab to continue entering data.
After entering all of your data, click “Submit All” to submit your data to the database.
Use “Save as Draft” to finish submitting data at a later time. Data must be submitted within 7 days of saving as a draft.
FOLLOW AAS AND STAY CONNECTED

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@georgiaadoptastream

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TEST REVIEW