Georgia Adopt-A-Stream
Macroinvertebrate Training

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Georgia Adopt-A-Stream

• What is it?
  Georgia’s volunteer water quality monitoring program

• Program Goals
  A: Increase public **awareness**
  D: Collect quality baseline water quality **data**
  O: Gather **observations**
  P: Encourage **partnerships** between citizens & local government
  T: Provide **tools & training**
Macroinvertebrate Monitoring

Involves: collecting, identifying, and counting macros

Purpose: to quickly assess both water quality and habitat quality

Characterizes stream health by abundant and diverse macroinvertebrate populations (however our macro key places importance on diverse populations)
EPA Quality Assurance Project Plan

- Quality Assurance
  Quality Control (QA/QC)

- Only individuals are certified

- Certification is valid for one year

- Volunteers must attend an annual recertification workshop

- Only certified volunteers can submit data!
To Become a Certified QA/QC Volunteer…

- In the field, volunteers must demonstrate the ability to collect a macroinvertebrate sample
  - Volunteers must pass a written evaluation with a score of at least 80%
  - Must identify at least 20 macroinvertebrates with >90% accuracy
What is a Watershed?

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

- Its boundaries are marked by the highest points of land around the waterbody.
Where, When and How Often?

- **Where**: Same site location

- **When**: Same time of day and during normal flow conditions. Should take 1 ½ - 2 hours.

- **How often**: Once every 3 months or every season
Safety Considerations

If conditions are too dangerous to sample...

DON’T SAMPLE!

- Wait until storm has stopped and strong flow has subsided
- Never sample alone
- Remember to wear gloves and boots for protection at site
- Receive permission from land owner before going onto private property
What are Macroinvertebrates?

- Organisms that lack a backbone and can be seen with the naked eye such as aquatic insects, mollusks and crustaceans

- The organisms that we will be sampling for are benthic macroinvertebrates – macros that live in the substrate, or bottom, of a water body

- Macros live in various stream habitats and derive their oxygen from the water

- These organisms are impacted by all the stresses that occur in a stream environment, both man-made and naturally occurring
Macroinvertebrates as Indicators of Water Quality

- Not very mobile
- Present during ALL stream events
  - Recent heavy rains can affect results
- Relatively easy to catch, view and identify
- They are affected by the physical, chemical and biological conditions of the stream
- Values may differ in north and south Georgia
Stream Habitats

- **Vegetative margins** - area along the edge of water body consisting of overhanging bank vegetation

- **Substrate**
  - Sand/rock/gravel streambed - area of stream with coarse substrate
  - Riffles - shallow area of a stream in which water flows rapidly over a rocky or gravelly stream bed

- **Organic Matter**
  - Leaf packs – decomposing vegetation that is submerged in the water
  - Woody debris – decomposing trees, roots, or branches that are submerged in the water
Stream and Sampling Types

Rocky Bottom Streams
- Generally found in North GA and Piedmont Region
- Characterized by fast moving water flowing over large rocks and boulders
- Stream stretch consist of pool/riffle system

Muddy Bottom Streams
- Found mostly in South GA and urban environments due to erosion and sedimentation
- Slow moving water with little or no turbulence
- Substrate is generally composed of fine silt, sand or coarse gravel

*If your stream shows traits of both categories, do your best to CHOOSE ONE and proceed with that method!*
Rocky Bottom Sampling Method

Sample TWO different habitats using a kick seine

3 Substrate
Sample 2x2 foot area with kick seine net in riffle areas

4 Organic Matter
Using both hands, take 4 handfuls (1 square foot) of decayed, submerged leaf packs
Muddy Bottom Sampling Method

Sample THREE different habitats using a D-frame net

7 Vegetative Margins
7 scoops (1 square foot)

4 Organic Matter
4 scoops (1 square foot) in woody debris

3 Substrate
3 scoops (1 square foot) of sand/rock/gravel or coarsest area of streambed

Tip: Try to avoid collecting a lot of sand to save time
Pollution Sensitive Organisms
Require High Levels of Dissolved Oxygen
Found In Good Quality Water

Somewhat Pollution Tolerant Organisms
Require Moderate Levels of Dissolved Oxygen
Found In Good or Fair Quality Water

Pollution Tolerant Organisms
Can Survive in Low Levels of Dissolved Oxygen
Found In Any Quality Water
GEORGIA ADOPT-A-STREAM: Macroinvertebrate Form (page 1)

To be conducted quarterly

<table>
<thead>
<tr>
<th>Group Name: ___________________________</th>
<th>Event Date: ___________________________ (MMDDYYYY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group ID: G-________ Site ID: S-________</td>
<td>Time Sample Collected: ___________________________ (HHMM am/pm)</td>
</tr>
<tr>
<td>Stream Name: __________________________</td>
<td>Time Spent Sampling: _____________________________ (Min)</td>
</tr>
<tr>
<td>Monitor(s): ____________________________</td>
<td>Total Time Spent Traveling (optional): ___________ (Min)</td>
</tr>
<tr>
<td>Number of Participants: ________________</td>
<td>Furthest Distance Traveled (optional): ___________ (Miles)</td>
</tr>
</tbody>
</table>

**WEATHER**

Present conditions (check all that apply)
- [ ] Heavy Rain
- [ ] Steady Rain
- [ ] Intermittent Rain
- [ ] Overcast
- [ ] Partly Cloudy
- [ ] Clear/Sunny

Amount of rain, if known?
- [ ] Amount in Inches: ___________
- [ ] In Last Hours/Days: ___________

*Refer to wunderground.com for rainfall data*

**FLOW/WATER LEVEL**

(check all that apply)
- [ ] Dry
- [ ] Stagnant/Still
- [ ] Low
- [ ] Normal
- [ ] High
- [ ] Flood (over banks)

**WATER CLARITY**

- [ ] Clear/Transparent
- [ ] Cloudy/Somewhat Turbid
- [ ] Opaque/Turbid
- [ ] Other: ___________________________

**WATER COLOR**

- [ ] No Color
- [ ] Brown/Muddy
- [ ] Green
- [ ] Milky/White
- [ ] Tannic
- [ ] Other: ___________________________

**WATER SURFACE**

- [ ] Clear
- [ ] Oily sheen: Does it break when disturbed? Yes/No (circle one)
- [ ] Algae
  - [ ] Foam
  - [ ] Greater than 3" high
  - [ ] It is pure white
- [ ] Other: ___________________________

**WATER ODOR**

- [ ] Natural/None
- [ ] Gasoline
- [ ] Sewage
- [ ] Rotten Egg
- [ ] Fishy
- [ ] Chlorine
- [ ] Other: ___________________________

**TRASH**

- [ ] None
- [ ] Yes, I did a cleanup
- [ ] This site needs an organized cleanup

**PHOTOS**

Please take images to document your observations and changes in water quality conditions. Photo point directions can be found in the manuals. Images can be submitted online with your other data.

**COMMENTS**

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

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Please submit data to our online database at www.AdoptASstream.Georgia.Gov
**Observations**

- Flow/Water Level
- Water Clarity
- Water Color
- Water Surface
- Water Odor
- Trash
- Photos

<table>
<thead>
<tr>
<th>Observations</th>
<th>Flow/Water Level</th>
<th>Water Clarity</th>
<th>Water Color</th>
<th>Water Surface</th>
<th>Water Odor</th>
<th>Photos</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dry</strong></td>
<td><strong>Stagnant/Still</strong></td>
<td><strong>Low</strong></td>
<td><strong>Normal</strong></td>
<td><strong>High</strong></td>
<td><strong>Flood (over banks)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Clear/Transparent</strong></td>
<td><strong>Cloudy/Somewhat Turbid</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>No Color</strong></td>
<td><strong>Brown/Muddy</strong></td>
<td><strong>Green</strong></td>
<td><strong>Milky/White</strong></td>
<td><strong>Tannic</strong></td>
<td><strong>Other:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Clear</strong></td>
<td><strong>Oily sheen:</strong> Does it break when disturbed? Yes/No (circle one)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Foam</strong></td>
<td><strong>Greater than 3” high</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Natural/None</strong></td>
<td><strong>Gasoline</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sewage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rotten Egg</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fishy</strong></td>
<td><strong>Chlorine</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Photos:** Please take images to document your observations and changes in water quality conditions. Photo point directions can be found in the manuals. Images can be submitted online with your other data.

**Trash:** | **None** | **Yes, I did a cleanup** | **This site needs an organized cleanup** |
Calculate Your Results

This form calculates the water quality rating based on the abundance and, more importantly, the diversity of benthic macroinvertebrates found.

**Directions:** Consult the macroinvertebrate monitoring manual for sampling guidelines

1. Separate the macroinvertebrates into the different taxa groupings listed in the table below.
2. Note which taxa are present and their abundance code based on the number of individuals present in your sample. Enter these codes in the boxes below for each taxa. Abundance Codes: R (rare)=1-9, C (common)=10-99, and D (dominant)=100 individuals or greater

<table>
<thead>
<tr>
<th>TAXA GROUPS</th>
<th>SENSITIVE TAXA</th>
<th>SOMEWHAT SENSITIVE TAXA</th>
<th>TOLERANT TAXA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stonefly Nymphs</td>
<td>Common Net Spinning Caddisflies</td>
<td>Midge Fly Larvae</td>
</tr>
<tr>
<td></td>
<td>Mayfly Nymphs</td>
<td>Dobsonfly/Heuglinita &amp; Fishfly</td>
<td>Black Fly Larvae</td>
</tr>
<tr>
<td></td>
<td>Water Penny Larvae</td>
<td>Dragonfly &amp; Damselfly Nymphs</td>
<td>Lunged Snails</td>
</tr>
<tr>
<td></td>
<td>Riffle Beetle Larvae/Adults</td>
<td>Crawfly</td>
<td>Aquatic Worms</td>
</tr>
<tr>
<td></td>
<td>Aquatic Snipe Flies</td>
<td>Crane Flies</td>
<td>Leeches</td>
</tr>
<tr>
<td></td>
<td>Caddisflies</td>
<td>Aquatic Sow Bugs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gilled Snails</td>
<td>Scud</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clams &amp; Mussels</td>
<td></td>
</tr>
</tbody>
</table>

Now add together the three index values to get your Water Quality Index Score = _______

Use this score to find out your Water Quality Rating for your stream (below). Good water quality is indicated by a variety of different kinds of taxa/organisms, with no one kind making up a majority of the sample.

**Water Quality Rating**

- Excellent (>22)
- Good (17-22)
- Fair (11-16)
- Poor (<11)

**Optional:** Do you see any of the following in your samples? Please count number of individuals.

- Fishes #:
- Tadpoles #:
- Asian Clams #:
- Nonnative Cranefly Which species?
- Salamanders #:
**After Calculating Your Results...**

<table>
<thead>
<tr>
<th>If you find:</th>
<th>You may have:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A variety of macroinvertebrates, lots of each kind</td>
<td>Healthy stream</td>
</tr>
<tr>
<td>Little variety, with many of each kind</td>
<td>Water enriched with organic matter</td>
</tr>
<tr>
<td>A variety of macroinvertebrates, but a few of each kind, or NO</td>
<td>Toxic pollution</td>
</tr>
<tr>
<td>macroinvertebrates but the stream appears clean</td>
<td></td>
</tr>
<tr>
<td>Few macroinvertebrates and the streambed is covered with sediment</td>
<td>Poor habitat from sedimentation</td>
</tr>
</tbody>
</table>
Submit the Data

As soon as possible after monitoring is complete

Data should be submitted to the state program’s online database:

AdoptAStream.Georgia.gov

Share your data with partners, local governments and your local Adopt-A-Stream coordinators
From the website’s Home Page, select “Data Submission Form” under the Data Entry tab.
Enter your site information as well as any weather and observation information on this page.
Click “Submit” at the bottom of the page to record your data. You must submit your site data before you can enter macro-invertebrate data.
After clicking “Submit,” click on the Macro-invertebrate tab to continue entering data.
Fill out the form and click “Submit” to record your data!
Volunteer Monitoring Data Uses

- Local water departments
- City Councils
- Colleges and Universities
- Forestry Services
- Environmental Groups
- Riverkeepers
- Consulting Agencies
- Local and State Government

**Just the Facts**

A: awareness  
D: data  
O: observations  
P: partnerships  
T: tools & training

**AAS Macro Key:**  
DISSOLVED OXYGEN

**Data – On-line database as soon as possible, local program, city & county government & municipality, partners, county commissioners, universities, others.**

**South vs. North Georgia**

**Diversity vs. Abundance**

**Invertebrates are mobile (not!)**

**Decomposing organic matter**

**Water & Habitat Quality**

**quarterly/every season/every 3 months**

**Invertebrate ID!!**

**Storm events**

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### Methods

<table>
<thead>
<tr>
<th>Habitat Type</th>
<th>Net Used</th>
<th>Area Sampled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rocky Bottom</td>
<td>Kick Seine</td>
<td>2ft X 2ft</td>
</tr>
<tr>
<td>Muddy Bottom</td>
<td>D-Frame</td>
<td>1ft X 1ft</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Habitat Type</th>
<th>Veg Margin</th>
<th>Organic Matter</th>
<th>Substrate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rocky Bottom</td>
<td>None</td>
<td>4 grabs (1ft x 1ft)</td>
<td>3 kicks</td>
</tr>
<tr>
<td>Muddy Bottom</td>
<td>7 scoops</td>
<td>4 scoops</td>
<td>3 scoops</td>
</tr>
</tbody>
</table>
Macro ID
Pollution Sensitive Organisms

Require High Levels of Dissolved Oxygen
Found In Good Quality Water
STONEFLY NYMPH

- Measure ½ – 1 ½ inches in length (not including tails)
- 2 sets of wing pads
- Branched gills between legs on underside of body
- Yellow to brown in color
- Superficially similar to certain flattened mayfly nymphs, however stonefly nymphs always have two tails, prominent antennae, and two claws at the end of each leg.
- Stoneflies do not tolerant low levels of dissolved oxygen and therefore prefer cold, swift-moving streams. The streamlined, flattened bodies of stonefly nymphs enable them to move about the rocky streambed in rapid currents.

Two hair-like tails
Two claws on each foot
MAYFLY NYMPH

Similar to a stonefly, but with noticeable gills on abdomen and three tails instead of two

- Mature nymphs measure **up to 1 inch** in length (excluding tails)
- Two rows of long hairs present on inside of front legs, used for filtering food particles from the water.
- Slender antennae
- May be minnow like with a vertically oriented head and three tails (as pictured) or may be more flattened with a horizontally oriented head and two tails.
CADDISFLY NYMPH

Builds distinctive cases made of sticks, rocks, sand, plant material and/or other debris

- **Up to 1½ inch** in length
- Antennae reduced and inconspicuous
- Curls up slightly (not as tightly as the common net-spinning caddisfly)
AQUATIC SNIPE FLY LARVA

- Measure ¼ - 1 inch in length
- Mostly cylindrical, with the **front tapering to a cone-shaped** point
- Body is pale brown to green color
- Larva have a number of mostly paired caterpillar-like prolegs
- Two stout, pointed tails with feathery hairs at back end
WATER PENNY

- Measures ½ inch in length
- Flat disk-like body
- Head and legs concealed from above
- 6 legs and branched gills on underside
- Prefers cold running water
- Water pennies prefer cold, fast-moving streams. Their smooth, flattened bodies enable them to resist the pull of the current. Water pennies are usually found on smooth rocks where they graze on attached algae.
RIFFLE BEETLE

- Riffle beetles measure approximately 1/16 to 1/8 inch in length
- Body small usually oval
- Legs are long
- Antennae are usually slender
- Riffle beetles walk slowly underwater. They do not swim on the surface.
GILLED SNAIL

- Measures ¼ to 1 inch

- Shell usually opens on right

- Shell opening covered by a thin plate (operculum)

- When monitoring, do not count empty shells!
Somewhat Pollution Tolerant Organisms

Require Moderate Levels of Dissolved Oxygen Found In Good or Fair Quality Water
COMMON NET SPINNING CADDISFLY NYMPH

- Measures up to 1 inch
- Body is caterpillar-like with three pairs of legs
- Body is strongly curved
DOBSONFLY & FISHFLY LARVA

- Measure ¾ - 4 inches in length
- Body is elongate and somewhat flattened
- Short inconspicuous antennae
- Abdomen terminates in two small prolegs, each bearing two claws
- Feeds on other aquatic insects
- Dobsonflies (hellgrammites) are usually found on the underside of large rocks in cool, slow-moving streams
- Handle Dobsonflies (hellgrammites) carefully - larger individuals may deliver a painful pinch!
Measures between \( \frac{1}{2} - 2 \) inches in length

Two pairs of wing pads

Large round or oval abdomen

Abdomen terminates in three small pointed structures

Prefers cool, still water. Often found among vegetation and leaf packs or burrowed in sediment
DAMSELFLY NYMPH

- Measure $\frac{1}{2}$ - 1 inch in length
- Abdomen usually much more narrow and slender than that of dragonflies
CRANEFLY LARVA

- Measure $\frac{1}{3} - 2\frac{1}{2}$ inches in length
- Plump caterpillar-like segmented body
- Milky green to brown color
- Head is usually pulled back into the front of the body
CRAYFISH

- Measure **up to 5 inches** in length
- Resembles a small lobster
- Crayfish are usually active only at night. During the day they hide in burrows or under rocks.
- Crayfish are omnivorous, eating both plants and animals.
AQUATIC SOWBUG

- Measures $\frac{1}{4}$ - $\frac{3}{4}$ inch in length.
- Clear whitish to pink in color.
- Dorsoventrally flattened (top to bottom).
- Seven pairs of legs, the first two are modified for grasping.
- Found in shallow freshwater on rocks or detritus.
SCUD

- Measure $1/8 - 1/4$ inch in length.
- Clear whitish to pink in color
- Laterally flattened (side to side)
- Found in shallow freshwater springs, streams, lakes and ponds
- Most species feed on detritus
- Scuds are an important food source for many fishes
**CLAMS & MUSSELS**

- Fleshy body enclosed between two clamped shells
- If alive, shells cannot be pried apart
- When monitoring, do not count empty shells
Pollution Tolerant Organisms

Can Survive in Low Levels of Dissolved Oxygen
Found In Any Quality Water
MIDGEFLY LARVA

- Measure up to \( \frac{1}{4} \) inch in length
- Body small, cylindrical, and slightly curved
- Occasionally deep red in color, otherwise variously colored
- Two small prolegs just posterior to head
- Frequently found in bottom sediments of lakes, streams, and ponds where they feed on deposited organic material
BLACKFLY LARVA

- Measure to ¼ inch in length
- Abdomen terminates in an attachment disc
- Blackfly larva prefer cold running water and are usually found attached by the end of their abdomens to rocks, woody debris, or vegetation in the currents of rivers and streams
Leech

- Measures ¼ - 2 inches in length.
- Typically dorsoventrally flattened.
- Leeches are common in warm protected waters of lakes, ponds, streams, and marshes.
- Leeches usually avoid light by hiding under rocks or among aquatic vegetation or detritus.
- Silty substrates are unsuitable for leeches because they cannot attach properly.
AQUATIC WORM

- Usually measure about **1 inch** in length, but **up to 4 inches**.
- Clear whitish to pink in color.
- Body consists of 7 to 500 segments.
- Segments often have bristles or hairs.
- Tolerant of low dissolved oxygen concentrations.
- Found in silty substrates and among debris or detritus in ponds, lakes, streams and rivers.
- Dense populations of Tubificids can often be found in organically polluted rivers.
- Approximately 200 species in North America
LUNGED SNAILS

- Measures up to 2 inches
- Shell **usually opens to the left** when pointed end is up
- Breathes air
- No operculum
- **When monitoring, do not count empty shells!**