Stream Bioassessments, Part A

Learning Module #16

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Agenda

Time	Length	Activity
1:00	**15 min**	**Opening Activity**
1:15	**1 hour, 10 min**	**All about Macroinvertebrates**
2:25	*10 min*	*BREAK*
2:35	**20 min**	**Stream Bioassessments**
2:55	**40 min**	**Practice Macroinvertebrate Bioassessments**
3:35	*10 min*	*BREAK*
3:45	**15 min**	**Closing Activity**
4:00	**30 min**	**Bacteria Follow-up**

Opening Activity

Instructions:

1. Write your response to the questions on the lesson worksheet.

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Opening Activity

- **Question 1**: What do you think the term “bioassessment” means? (Hint: think about the two separate parts of the term.)

- **Question 2:** How do you think we use a “bioassessment” in a stream ecosystem?

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All About Macroinvertebrates

Over the next two days, we are going to be leaning how to perform stream bioassessments using macroinvertebrates.

But, before we learn more about bioassessments, we need to learn more about macroinvertebrates themselves.

What do you know about macroinvertebrates?

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Macroinvertebrates – organisms with out skeletons that we can see with our eyes

- Have no skeleton
- Some kinds only live part of their lives in the water (e.g., dragonfly, mayfly)
- Some kinds live their whole lives in the water (e.g., snails, crayfish)
- Important part of stream food web (food for fish!)

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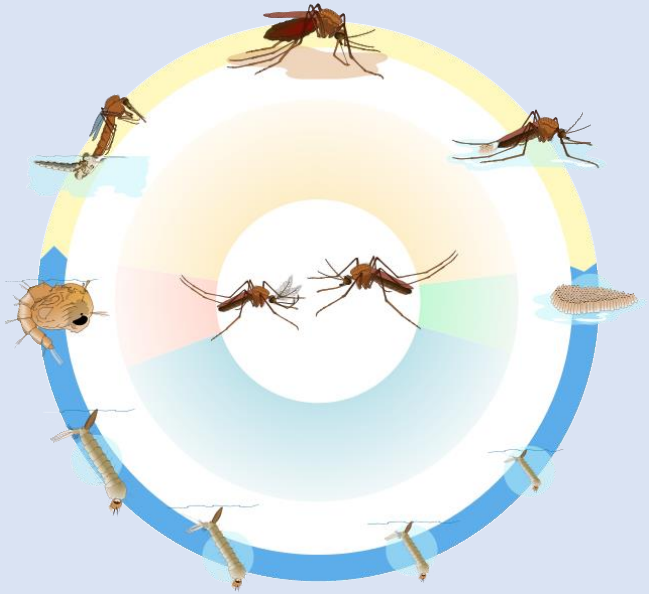

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All About Macroinvertebrates

Today, we will be learning more about individual macroinvertebrates.

To do this, you will each be creating PowerPoint slides about different types of macroinvertebrates. Then, you will present your slide(s) to the class!

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All About Macroinvertebrates

- Aquatic snipe flies
- Aquatic sow bugs
- Aquatic worms
- Black fly larvae
- Caddisflies
- Clams
- Craneflies
- Crayfish
- Damselfly nymphs
- Dobsonfly nymphs
- Dragonfly nymphs
- Gilled snails
- Leeches
- Lunged snails
- Mayfly nymphs
- Midge fly larvae
- Net-spinning caddisflies
- Riffle beetle larvae
- Scud
- Stonefly nymphs
- Water penny larvae

Note: some macroinvertebrates have “nymphs” or “larvae” – that’s because they only live in water for part of their life cycles!

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All About Macroinvertebrates

For each of your macroinvertebrates, you will create one PowerPoint slide. Each macroinvertebrate slide should contain:

1. Common name of macroinvertebrate (e.g., “Mayflies”)
2. Two images (make sure to provide image credit)
3. Two facts
4. Pollution tolerance:

    **Use this wording:

    -Sensitive (low tolerance)

    -Somewhat sensitive (medium tolerance)

    -Tolerant (high tolerance)

When you are finished, email your slides to your instructor!

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All About Macroinvertebrates

Resources:

- Macroinvertebrates.org
- Georgia Adopt-A-Stream Macroinvertebrate Guide (printed at front)
- Book: A Guide to Freshwater Invertebrates of North America (with instructor)
- Google
- Wikipedia

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All About Macroinvertebrates

While presenting:

- You will have one minute (tops!) to present each of your slides/macroinvertebrates.

While watching the presentations:

- For each macroinvertebrate slide, use the chart on your lesson worksheet to write down the pollution tolerance each macroinvertebrate.
- You can also write down any other notes that you wish.

Take a break!

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Stream Bioassessments

There are no guided notes this afternoon.

Feel free to take notes on your own, and raise your hand to ask questions!

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Stream Bioassessments

What are bioassessments?

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Stream Bioassessments

What are bioassessments?

- The use of organisms to evaluate environmental quality

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Stream Bioassessments

Why do we use stream bioassessments?

In other words – If we want to know how healthy or unhealthy a stream is, why don't we just measure the dissolved oxygen, pH, or nutrients instead of looking at organisms?

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Stream Bioassessments

Why do we use stream bioassessments?

In other words – If we want to know how healthy or unhealthy a stream is, why don't we just measure the dissolved oxygen, pH, or nutrients instead of looking at organisms?

Take five minutes to brainstorm ideas with a partner or group. Write your ideas down on your lesson worksheet.

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Stream Bioassessments

In other words – If we want to know how healthy or unhealthy a stream is, why don't we just measure the dissolved oxygen, pH, or nutrients instead of looking at organisms?

Why do we use stream bioassessments?

- Measuring physical/chemical parameters of stream (pH, O_2 , temperature, nutrients, toxins, etc.) only give us an idea of the stream health at **one point in time**.

  → Bioassessments give us an idea of stream health over an **integrated period of time**.
- Can be less expensive and/or time consuming to use bioassessments than to evaluation for physical/chemical parameters.

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What organisms do we typically use for stream bioassessments?

- Algae (primarily diatoms)
- Macroinvertebrates
- Fishes

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Stream Bioassessments

What makes macroinvertebrates useful for stream bioassessments?

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Stream Bioassessments

What makes macroinvertebrates useful for stream bioassessments?

Take five minutes to brainstorm ideas with a partner or group. Write your ideas down on your lesson worksheet.

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Stream Bioassessments

What makes macroinvertebrates useful for stream bioassessments?

- They are affected by the physical, chemical, and biological conditions of the stream
- Not very mobile
- Present in almost all streams
- Relatively easy to catch
- Can view and identify with your eyes (no microscope required)

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Stream Bioassessments

What are the pollution sensitivities of macroinvertebrates?

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Stream Bioassessments

What are the pollution sensitivities of macroinvertebrates?

Sensitive

- Found in good quality water

Somewhat sensitive/Somewhat tolerant

- Found in good or fair quality water

Tolerant

- Found in any quality water

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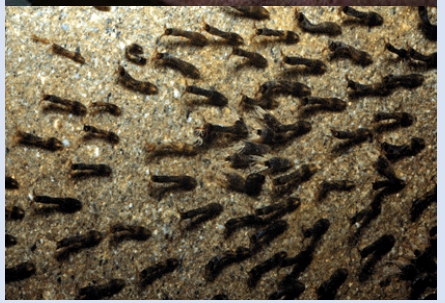

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Take a break!

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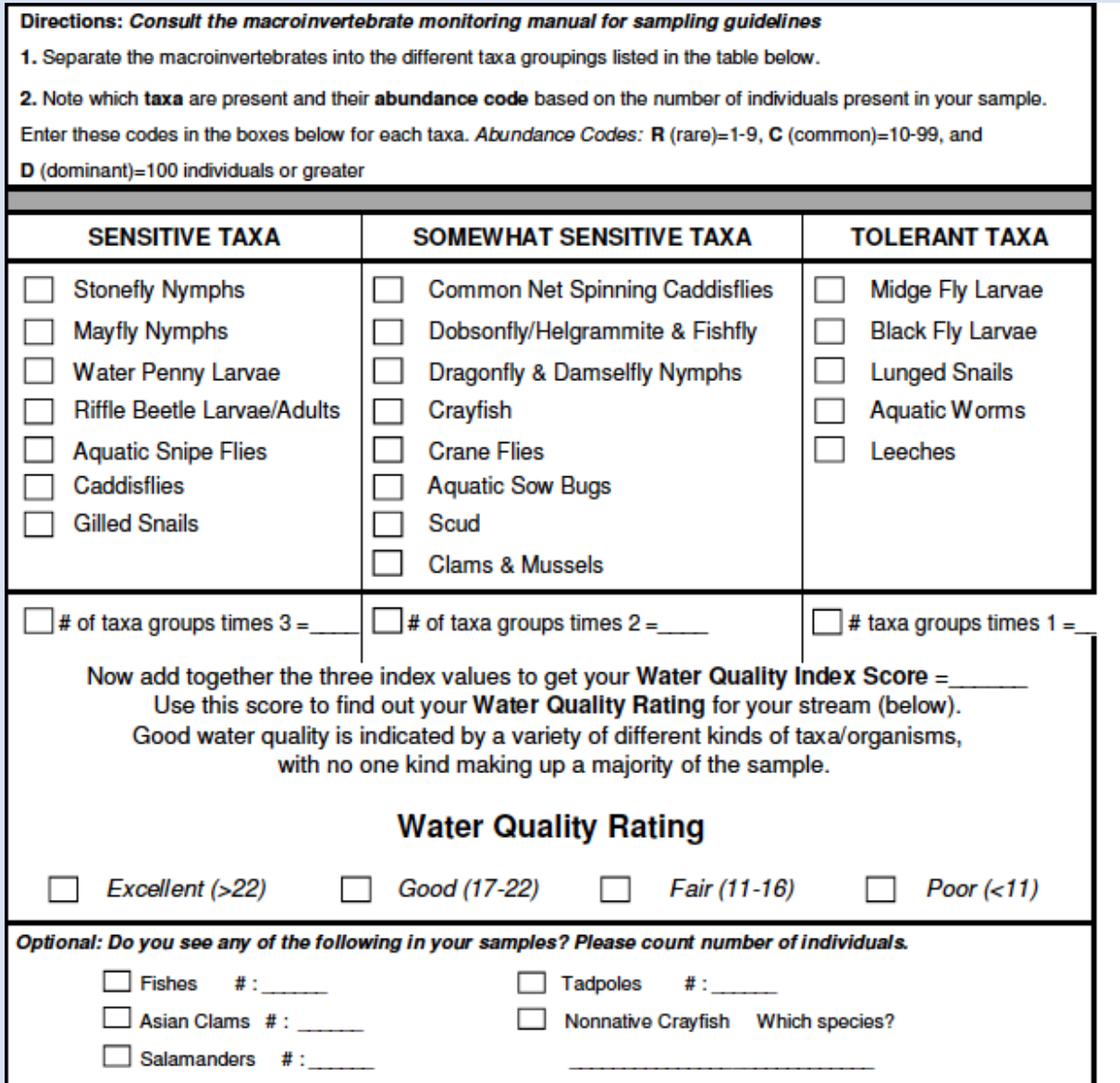
Practice Stream Bioassessments

We are going to practice using the Georgia Adopt-A-Stream Macroinvertebrate Bioassessment form



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

SENSITIVE TAXA	SOMEWHAT SENSITIVE TAXA	TOLERANT TAXA
☐ Stonefly Nymphs	☐ Common Net Spinning Caddisflies	☐ Midge Fly Larvae
☐ Mayfly Nymphs	☐ Dobsonfly/Helgrammite & Fishfly	☐ Black Fly Larvae
☐ Water Penny Larvae	☐ Dragonfly & Damselfly Nymphs	☐ Lunged Snails
☐ Riffle Beetle Larvae/Adults	☐ Crayfish	☐ Aquatic Worms
☐ Aquatic Snipe Flies	☐ Crane Flies	☐ Leeches
☐ Caddisflies	☐ Aquatic Sow Bugs	
☐ Gilled Snails	☐ Scud	
	☐ Clams & Mussels	
☐ # of taxa groups times 3 =____	☐ # of taxa groups times 2 =____	☐ # taxa groups times 1 =__

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 Crayfish Which species?
☐ Salamanders # :_____ _____

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Practice Stream Bioassessments

We are going to practice using the Georgia Adopt-A-Stream Macroinvertebrate Bioassessment forms with

1) A “sample” macroinvertebrate collection – *work with a partner*
2) Macroinvertebrate data from Simulations 3, 4, and 5 of the “Biodiversity” lesson – *work on your own*

<u>In total, you should fill out 4 forms</u>! (One for the sample collection, 3 for the simulations)

Practice Stream Bioassessments

Debrief:

-Did you have any questions or difficulties with the macroinvertebrate bioassessment form?

-Did you have any observations or learn anything new as you were working through the forms?

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Closing Activity

Instructions:

1. Write your response to the question on your lesson worksheet.

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Closing Activity

Scenario: Imagine that you are conducting a macroinvertebrate bioassessment at a stream near a local trail. Two people hiking on the trail stop to talk to you. They ask you what you are doing.

Question 1: How would you answer the hikers?

(Make sure to explain what macroinvertebrate bioassessments are, and why they can be useful.)

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Bacteria follow-up

<u>Steps for Bacteria Monitoring</u>

1. Prepping the blank/control sample 
2. Collecting samples in the field 
3. Plating your samples 
4. Incubating 
5. Clean up and disinfect 
6. Read the results

Two days ago, we plated our bacteria samples on petrifilm.

Our samples have incubated for 48 hours, so now it is time to quantify the *E. coli* colonies!

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Bacteria follow-up

Reading the results

1. Counting the colonies

When reading Petrifulm plates, ***E. coli*** colonies appear blue to red-blue and are closely associated with entrapped gas. **General coliform** colonies appear bright red and closely associated (approximately one colony diameter) with entrapped gas. Remember that we are only concerned with counting the *E. coli* colonies in the medium, and we do not count colonies that appear on the foam barrier of the plate. Gas bubble patterns associated with gas producing colonies are shown on the right. **Only count blue to red-blue colonies that have a gas bubble!**

Possible gas bubble patterns associated with gas producing colonies.

All of these examples would be counted when reading plates.

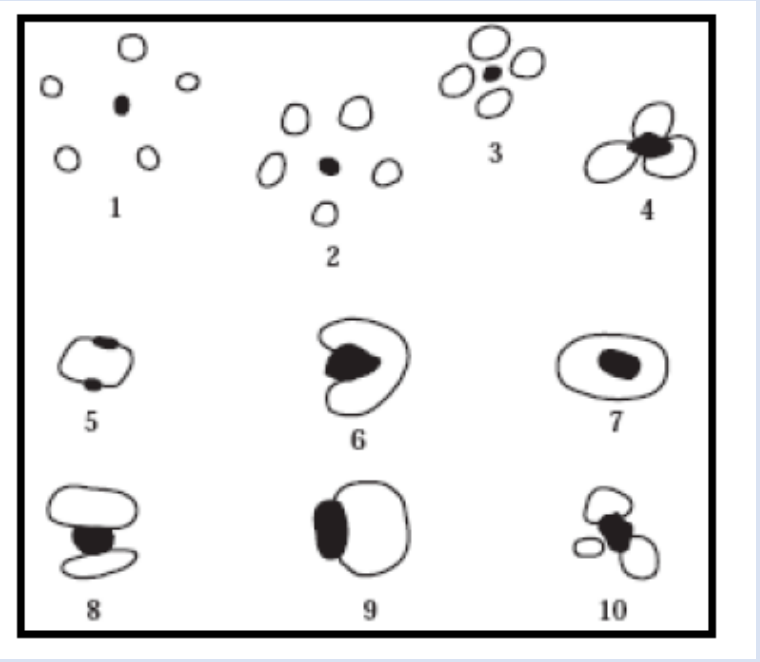

Image: Georgia Adopt-A-Stream

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Bacteria follow-up

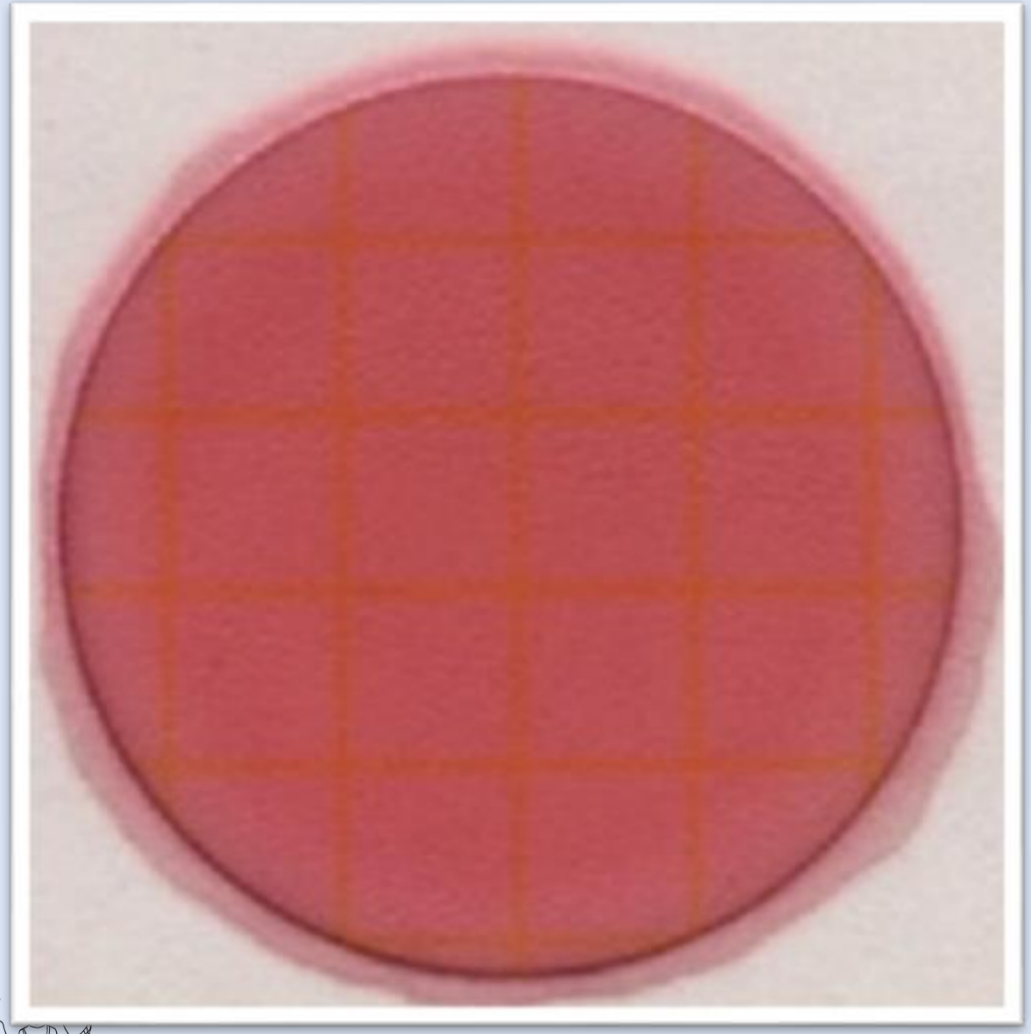

Image: Georgia Adopt-A-Stream

Blank/Control

There should not be any colonies on the blank.

If any colonies appear on blank, sample is null and void! And new sample must be taken from site location.

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Bacteria follow-up

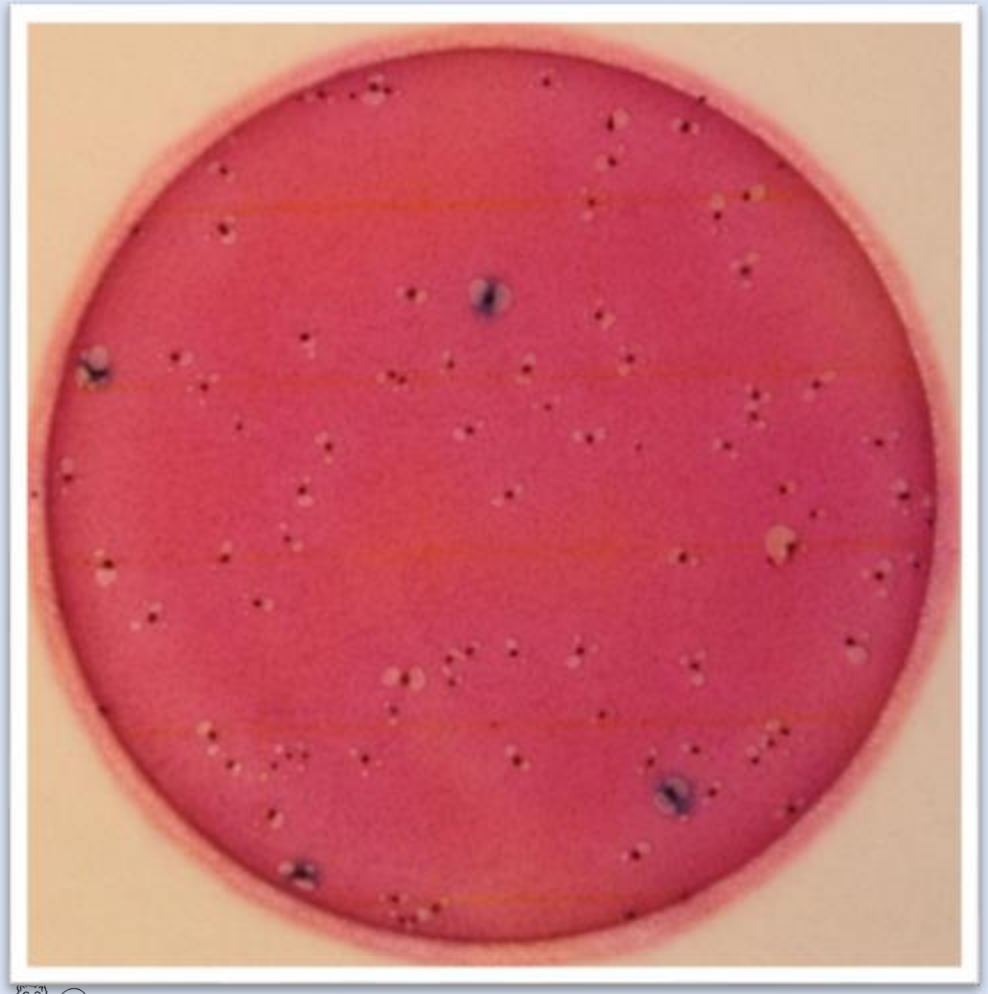

Image: Georgia Adopt-A-Stream

Example 1

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

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Bacteria follow-up

Image: Georgia Adopt-A-Stream

Example 2

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

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Bacteria follow-up

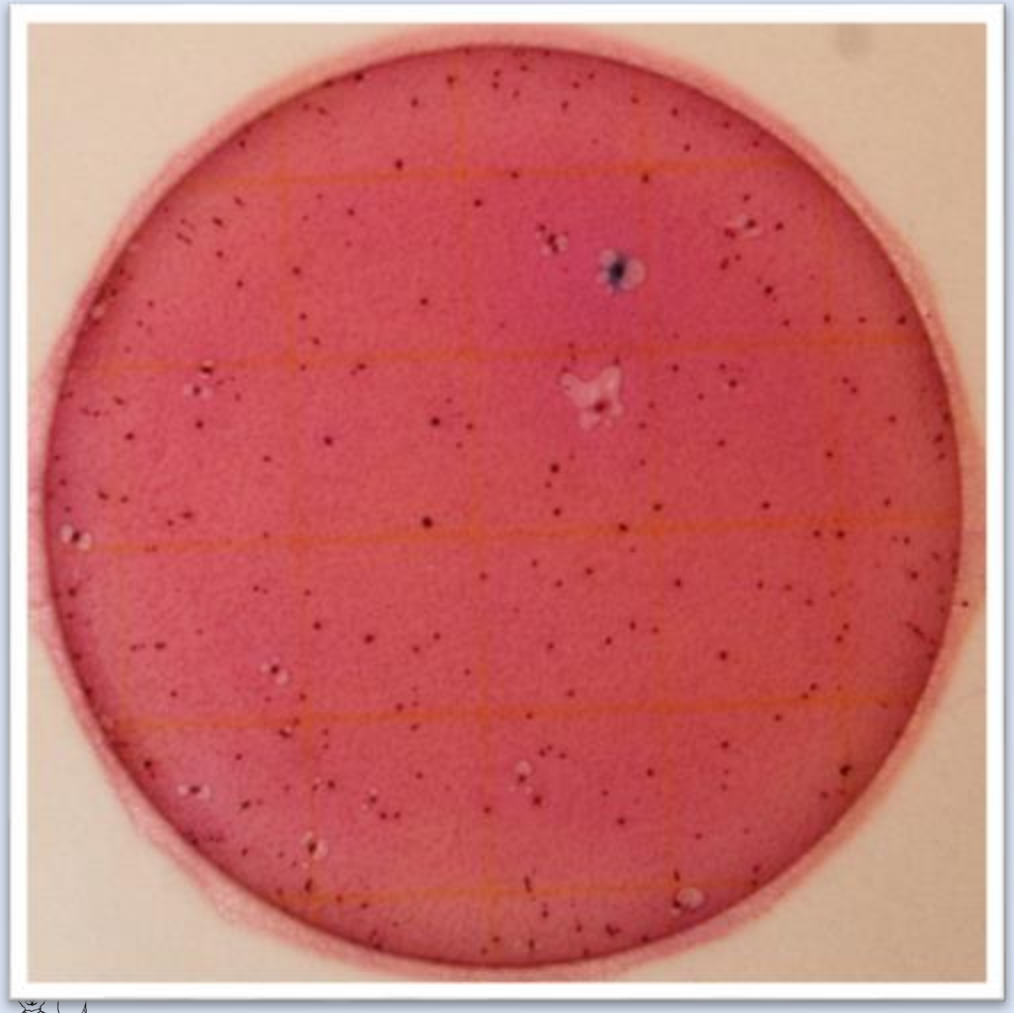

Image: Georgia Adopt-A-Stream

Example 3

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

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Bacteria follow-up

<u>Reading the results</u>

<u>2. Calculating the results</u>

Bacteria growths on plates are enumerated using a standard unit. The standard reporting unit is the number of **c**olony **f**orming **u**nits per 100 milliliters of water sample (cfu/100ml).

Each Petrifilm plate holds 1mL of sample.

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Bacteria follow-up

2. Calculating the results

STEP I. Count the number of *E.coli* colonies on all three of your plates and add them together.	⇨	Let's assume you counted 6, 7, and 8 colonies = 21 colonies
STEP II. Find the average number of colonies. Take the total number of colonies and divide them by the number of plates used.	⇨	21 colonies / 3 plates = 7
STEP III. Now, multiply the average number of colonies by 100. You have now determined the number of colony forming units per 100 ml of sample.	⇨	7 x 100 = **FINAL COUNT** **700 cfu/100 ml**

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Bacteria follow-up

	Example 1	Example 2	Example 3
E. coli Colonies	4	3	1

Step 1: 4 + 3 + 1 = 8 colonies

Step 2: 8 colonies / 3 plates = 2.67 CFU

Step 3: 2.67 CFU/1 ml x 100 ml = **<u>267 CFU/100 ml</u>**

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Bacteria follow-up

Now, let’s count the colonies and calculate the results for our own samples!

You will count your own sample, and then we will calculate the results as a class.

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