Eman, Lee, Allen, Raymond, Julianna

Benthic Macroinvertebrates Worksheet (Middle and High School)

Put the different kinds of animals into different compartments in the ice cube trays.
Use the bug identification chart Macroinvertebrates of the Huron River Basin to figure out their names. Get help from an adult if you're not sure.
Make a mark beside the right name below to keep track of the number of each kind of animal.
When you're done, count the marks and write down the total for each animal.

Group 1 *Very sensitive* to pollution

Critter Name	Total	Critter Name	Total
1. Caddisfly larvae with case		4. Dobsonfly larvae	✓
2. Clubtail Dragonfly nymph		5. Gilled Snails	✓
3. Watersnipe Fly larvae		6. Stonefly nymphs	

2

Group 2 Can *tolerate a little* pollution

Critter Name	Total	Critter Name	Total
7. Alderfly larvae		15. Dragonfly nymphs	✓
8. Asiatic clam	✓	16. Mayfly nymphs	✓
9. Backswimmer		17. Riffle Beetles	✓
10. Caddisfly larvae (free-swimming)	✓	18. Scud	
11. Cranefly larvae		19. Sowbug	✓
12. Crayfish		20. Water Boatman	
13. Damselfly nymphs	✓	21. Water Penny Beetle	✓
14. Diving Beetle	✓	22. Whirligig Beetle	

9

Group 3. Pollution tolerant—can *live in quite polluted* water

Critter Name	Total	Critter Name	Total
23. Aquatic Worms		27. Pouch Snails	
24. Blackfly larvae		28. Water Scorpion	✓
25. Leeches		29. Water Strider	
26. Midge larvae		30. Zebra mussel	✓

2

Huron River Watershed Council, 2016

*If you have any critters from Group 1, the water quality is excellent.
*If you have no critters from Group 1, but do have critters from Group 2, the water quality is fair to good.
*If you have no critters from Group 1 or Group 2 but do have critters from Group 3, the water quality is poor.
*If you found no critters at all, the water quality is bad.

1. Calculate a taxon-averaged water quality index:

A. Write down the number of taxa (kinds) (e.g. all mayflies together are one taxa, all midge larvae count as "1", etc.) of critters found in each of the three groups above; N_1 = number of kinds in Group 1, N_2 = number of kinds in Group 2, N_3 = number of kinds in Group 3.

N_1 = 2 N_2 = 9 N_3 = 2

B. Calculate the sum $N_1 + N_2 + N_3 = N_{total}$ = 13

C. Calculate the water quality index

Q_{taxa} = [1xN_1 + 3xN_2 + 5xN_3]/ N_{total} = $\frac{(2+27+10)}{13} = 3$

This index lies in the range 1 to 5. The <u>smaller</u> the index you calculate, the higher the water quality is.

4. In general, what do benthic macro-invertebrates tell us about water quality over time? How clean the water is, the quality of the water as a habitat

5. What was the water quality in this spot, as indicated by the animals your group found?

average - not great, not terrible

6. What can you do to improve this condition?

Not pollute the water, have vegetation on sides of stream

Stream Temperature Data Sheet

Temperature Readings
66°F
Sum of temperature readings ____________________

Species	Preferred temperature Degrees F	Degrees C
Catfish	74-78	23.3 – 25.5
Bluegill	73-77	22.7 - 25.0
Smallmouth bass	68-72	20.0 – 22.2
Northern pike	62-71	16.6 – 21.6
Steelhead	58-60	14.4 – 15.5
Coho salmon	54-55	12.2 – 12.8
Lake trout	48-52	8.9 – 11.1

Average temperature reading = Sum of readings divided by 3 (or number of readings): 66°F

1. On the basis of your average temperature reading, which of the fish listed could live comfortably in this stream today?

   Northern Pike

2. How do warmer temperatures affect the amount of dissolved oxygen in the water?

   The warmer, the less O_2 dissolved

3. In addition to fish, what other organisms are affected by lower oxygen levels?

   bugs, plants, reptiles, amphibians

4. What human actions can affect the temperature of this stream?

   mowing stream edge, adding dirt to water (directly/indirectly), paved surfaces

Huron River Watershed Council, 2013

Dissolved Oxygen (DO) Data Sheet

Student observations:

Minimum DO requirements for some aquatic organisms

Trout	6.5 mg/L
Smallmouth bass	6.5 mg/L
Caddisfly larvae	4.0 mg/L
Mayfly larvae	4.0 mg/L
Catfish	2.5 mg/L
Carp	2.0 mg/L
Mosquito larvae	1.0 mg/L

1. Drops of thiosulfate solution added to decolorize one measuring tube of sample:
13 DO concentration = 13 mg/L

2. How does oxygen from the atmosphere get into the water?
rain, surface, rapid areas

3. Name 3 factors that affect or can change Dissolved Oxygen concentration in a stream.
- temperature
- water velocity
- turbidity

4. Does this water meet the Michigan state requirement of 5.0 mg/L as the minimum acceptable DO concentration? yes

5. Based on your DO measurements, could trout and smallmouth bass live in this stream?
yes

6. Would you expect similar DO concentrations in this stream during the summer? Why or why not? Similar but slightly less due to high temps

Does that change your answer to #5? If yes, explain why.
No, we have a very large excess of DO

7. How could the DO concentration over time affect the <u>types</u> and <u>numbers</u> of critters (BMIs)?
If it went down in seasons like summer, the type/# of critters would also go down

8. What can people do to improve the DO concentration in our watershed
plant rain gardens, plants along edge

Turbidity Data Sheet

Turbidity indicates the amount of dirt in the water. Dirt, or sediment, hurts the river many ways. It makes it more expensive to clean our drinking water. It can coat the gills of small organisms. It can keep organisms from attaching to gravel or rocks, which may cause them to get swept away in fast water.

Transparency measurement	**Turbidity** $\text{Turbidity} = \frac{\underline{100\text{ cm/meter}}}{\text{Transparency (cm)}}$	**Scale**
1 87.1 **cm**	**1** 1.15 **m^{-1}**	**A turbidity of 1.0 m^{-1} or less is quite good—very clear water.**
2 ____________ **cm**	**2** ____________ **m^{-1}**	**Between 1.0 and 2.0 is pretty good.**
3 ____________ **cm**	**3** ____________ **m^{-1}**	**From 2.0 to 5.0 is a bit muddy.**
	____________ **m^{-1}** **Average turbidity (add the 3 measurements, divide the sum by 3)**	**From 5.0 to 10.0 is quite muddy.**
		Greater than 10 means that the water is really bad.

1. **How would you rate this water in terms of its turbidity?**
   Pretty good
2. **What do the measurements tell us about the health of this stream today?** pretty good
3. **What conditions could cause the measurements to be different?**
   rain, impermeable surfaces leading to runoff, rock types, construction
4. **What are some results of high turbidity?**
   habitat destruction, predators/prey can't see, warmer water
5. **What can people do to reduce stream turbidity?**
   plant things along edges to prevent erosion, make ponds, etc for runoff

Huron River Watershed Council, 2013

Stream Electrical Conductivity Data Sheet

Conductivity tests the amount of ions in the water. It tells us if there might be salt in the stream. If there is too much salt, it hurts the organisms that live in the water.

1st reading: 930 **2nd reading:** ______________ **3rd reading:** ______________ **4th reading:** ______________ **Average =** ______________ **(Sum of readings divided by 4, or number of readings)**	The unit for measuring conductivity in water is the microsiemen per centimeter (µs/cm). The conductivity of pure water is in the range 0.5 to 3 µs/cm. Lake and river water in the U.S. is much higher, generally ranging from 50 to 1500 µs/cm. Streams that support good populations of freshwater fish have conductivities in the range 150 to 800 µs/cm. Conductivities outside this range tend to be unsuitable for some species of fish and aquatic macro-invertebrates.

1. **Does the conductivity suggest the presence of pollution? (Recall that a conductivity in the range 150 to 800 µs/cm is OK for most critters.**

   Yes

2. **On the basis of your average conductivity reading, is high salt concentration a problem in this stream?**

   Yes

3. **How can people keep the conductivity of the stream in a healthy range?**

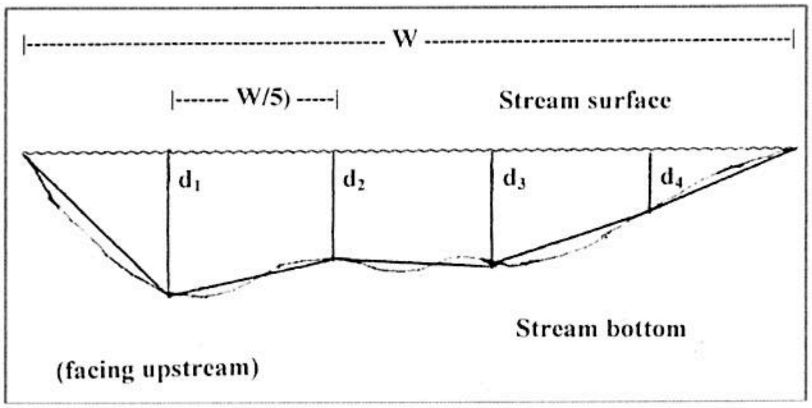
   Use less Salt / mix sand w/ salt in winter
   Don't mine near water
   Treat sewage
   Avoid H_2O softeners

Stream Discharge Data Sheet, Version A Date__________ Time________ Location __________

Team members ____

1. Stream width (W) 15 ft Length of stream reach (L) 10 ft

Depth in feet d1: 0.5 d2: 1.5 d3: 1.2 d4: 0.9



	Time (t)	Velocity (v) = L/t
t_i		
t_2	27.47	0.364
t_3	14.66	0.682
t_4	15.66	0.639

2. Calculate.

$A = (1/5)^{4} * W * (d_1 + d_2 + d_3 + d_4) =$ 13.5 ft^2 $v_{ave} = (1/4)^{3} * (v_1 + v_2 + v_3 + v_4) =$ 0.56 ft/sec $Q = A * v_{ave} =$ 7.58 ft^3/sec	Note: 1 cubic feet per sec is the equivalent of about 7.8 gallons per second. How much water per second is passing by you right now?

7.58 × 7.8 = 59.14 gallons/sec

3. How do varying amounts of water affect this stream?

4. How do human activities contribute to "flashiness" or fast variations in stream discharge amounts?

5. What can ordinary citizens do to improve this?

6. How do people use stream discharge data?

Stream Discharge Data Sheet, Version B

Date 9/19 Time 10:05 Location Parker Mill

Team members Eman, Allen, Raymond, lee, Julianna

1. Stream width (W) 20 ft Length of stream reach (L) 10 ft

Depth point	Depth in feet (d)	Time in sec (t)	Velocity L/t_i = v, ft/sec	Discharge $v_i d_i$, ft^2/sec
1	d_1= 1.4	t_1 19.81	L/t_1 = v_1 0.50	$v_i d_i$ = 0.70
2	d_2= 1.42	t_2= 15.22	L/t_2 = v_2 0.66	$v_2 d_2$ = 0.44
3	d_3= 1.1	t_3= 19.53	L/t_3 = v_3 0.51	$v_3 d_3$ = 0.56
4	d_4= 1.21	t_4 = 23.60	L/t_3 = v_3 0.42	$v_4 d_4$= 0.47

2. Calculate for discharge (Q).

10.68 53.4 2.67

$$Q = (1/5)*W*(v_1d_1 + v_2d_2 + v_3d_3 + v_4d_4) = \underline{10.68}\ ft^3/sec$$

Note: 1 cubic foot per sec is the equivalent of about 7.8 gallons. How much water is passing by you right now?

83.30 gallons total

3. How do varying amounts of water affect this stream?

More water more erosion, faster flow means lower temp [illegible]

4. How do human activities contribute to "flashiness" or fast variations in stream discharge amounts?

Human activities contribute to flashiness by altering water [illegible]

5. What can ordinary citizens do to improve this?

Build rain gardens, plant plants/trees, get rid of impermeable surfaces

6. How can people use stream discharge data?

To convince lawmakers/builders of steps that should be taken to reduce flashiness, find cause of problems in river