Regional Science Consortium

Macroinvertebrates – Teacher Guide

Lesson Tips and Tricks

PowerPoint Presentation

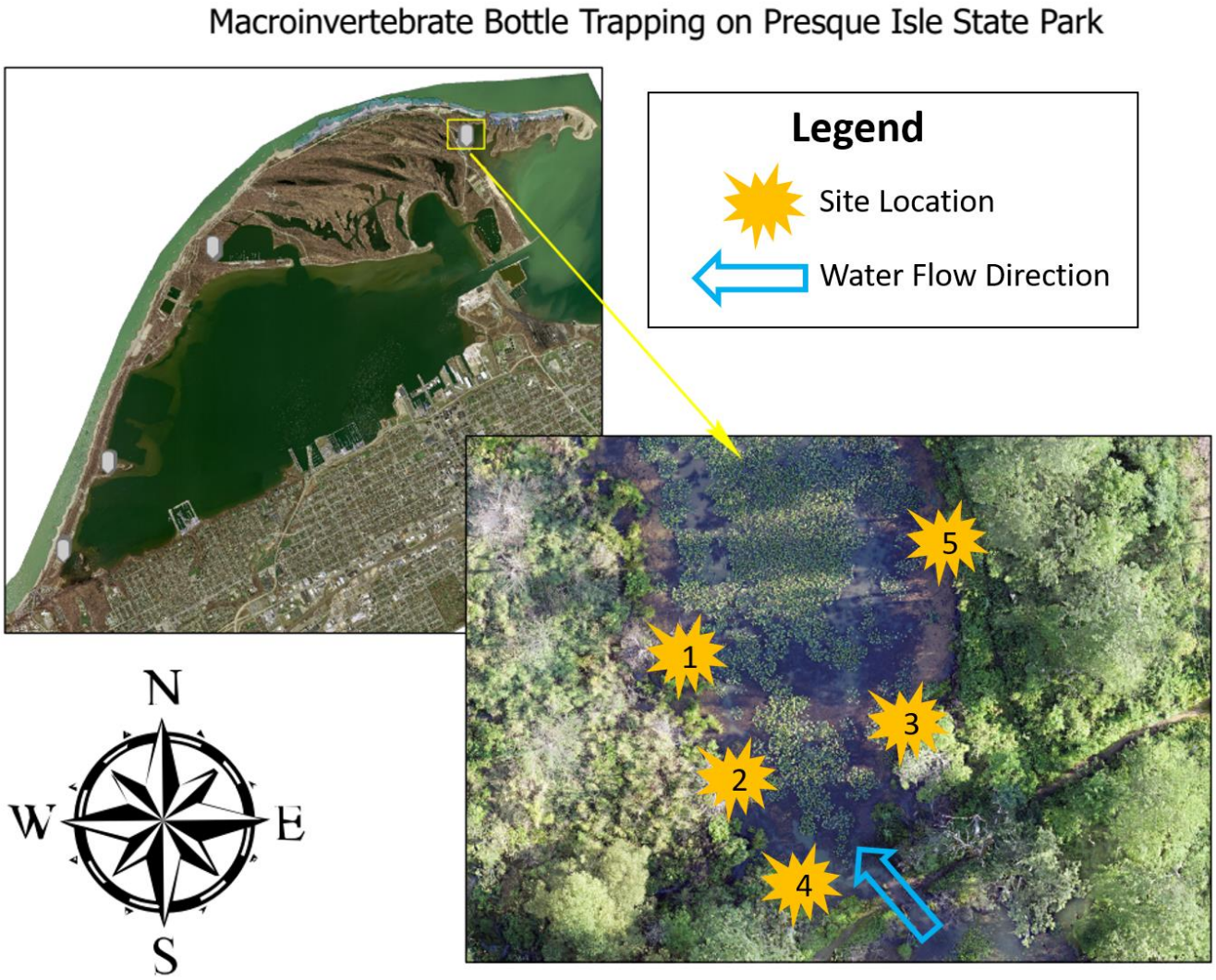
- This lesson contains many new terms for students to learn. We recommend providing students with the vocabulary sheet before beginning the recorded lesson to promote understanding and retention.
- On slide 4, Amber introduces students to how macroinvertebrates can be used to determine water quality using the criteria of species diversity and pollution tolerance. This concept is very important for students to understand and is utilized extensively throughout the activity. We recommend pausing here to evaluate student comprehension and review if needed.

Activity

- Students may struggle to identify the macroinvertebrates using the dichotomous key initially, but once they build this skill they can implement it throughout the remainder of the lesson. We recommend walking through the first 2 or 3 identifications together as a class to build initial understanding.
- Students may question why they are identifying the same insect in several samples. This is because they are evaluating the water quality at different sites and the same types of macroinvertebrates may be living in one or more sites. They are not considered to be the same insect because the scientists would be removing these insects from the sites for identification.
- The macroinvertebrates are identified to genus level instead of species level. This is because the identification to species level is much more intensive and requires additional skills and resources. The biotic index is built to be used at the genus level for the purposes of this lesson.

Student Worksheet Answer Key

Site Map



Site 1	
Macro 1	Macro 2
 Genus: **Scud**	 Genus: **Midge Larvae**
Quantity: 2	Quantity: 4
Macro 3	Macro 4
 Genus: **Mayfly Larvae**	 Genus: **Caddisfly Larvae**
Quantity: 1	Quantity: 1
Macro 5	
 Genus: **Stonefly Larvae**	
Quantity: 2	

Site 1 Water Quality Calculations

Intolerant Species	#	Moderately Tolerant Species	#	Tolerant Species	#
Caddisfly Larvae	1	Crane Fly Larvae		Aquatic Worms*	
Dobsonfly Larvae		Damselfly Larvae		Blackfly Larvae	
Mayfly Larvae	1	Dragonfly Larvae		Planaria (flatworms)	
Riffle Beetle		Scuds	2	Midge Larvae	4
Stonefly Larvae	2	Alderfly Larvae		Pouch Snails	
Water Penny		Beetle Larvae		Leeches	
Total = _____4_____ # Sensitive Individuals found x 3 = Index Value Index Value = ___12__		Total = _____2_____ # Somewhat Sensitive Individuals found x 2 = Index Value Index Value = ____4_____		Total = _____4_____ # Tolerant Individuals found x 1 = Index Value Index Value = ____4____	

TOTAL INDEX VALUE (sum of all values) = _____20_____

Circle the water quality rating for Site 1 below:

Excellent (>22)

Good (17-22)

Fair (11-16)

Poor (<11)

*Aquatic Worms – category that includes: Tubifex worm, Horsehair worm, Bristle worm, and Nematode or Threadworm

Site 2	
Macro 1	Macro 2
 Genus: **Scud**	 Genus: **Midge Larvae**
Quantity: 2	Quantity: 3
Macro 3	Macro 4
 Genus: **Mayfly Larvae**	 Genus: **Blackfly Larvae**
Quantity: 3	Quantity: 2
Macro 5	Macro 6
 Genus: **Stonefly Larvae**	 Genus: **Dragonfly Larvae**
Quantity: 1	Quantity: 2

Site 2 Water Quality Calculations

Intolerant Species	#	Moderately Tolerant Species	#	Tolerant Species	#
Caddisfly Larvae		Crane Fly Larvae		Aquatic Worms*	
Dobsonfly Larvae		Damselfly Larvae		Blackfly Larvae	2
Mayfly Larvae	3	Dragonfly Larvae	2	Planaria (flatworms)	
Riffle Beetle		Scuds	2	Midge Larvae	3
Stonefly Larvae		Alderfly Larvae		Pouch Snails	
Water Penny		Beetle Larvae		Leeches	
Total = ____4_____ # Sensitive Individuals found x 3 = Index Value Index Value = ___12_____		Total = _____4_____ # Somewhat Sensitive Individuals found x 2 = Index Value Index Value = ____8____		Total = ____5_____ # Tolerant Individuals found x 1 = Index Value Index Value = ____5____	

TOTAL INDEX VALUE (sum of all values) = _____25_____

Circle the water quality rating for Site 2 below:

Excellent (>22)

Good (17-22)

Fair (11-16)

Poor (<11)

*Aquatic Worms – category that includes: Tubifex worm, Horsehair worm, Bristle worm, and Nematode or Threadworm

Site 3	
Macro 1	Macro 2
 Genus: **Scud**	 Genus: **Caddisfly Larvae**
Quantity: 2	Quantity: 1
Macro 3	Macro 4
 Genus: **Midge Larvae**	 Genus: **Aquatic Worm**
Quantity: 2	Quantity: 3
 Genus: **Planaria (flatworm)**	 Genus: **Riffle Beetle**
Quantity: 2	Quantity: 1

Site 3 Water Quality Calculations

Intolerant Species	#	Moderately Tolerant Species	#	Tolerant Species	#
Caddisfly Larvae	1	Crane Fly Larvae		Aquatic Worms*	3
Dobsonfly Larvae		Damselfly Larvae		Blackfly Larvae	
Mayfly Larvae		Dragonfly Larvae		Planaria (flatworms)	2
Riffle Beetle	1	Scuds	2	Midge Larvae	2
Stonefly Larvae		Alderfly Larvae		Pouch Snails	
Water Penny		Beetle Larvae		Leeches	
Total = _____2_____ # Sensitive Individuals found x 3 = Index Value Index Value = ____6____		Total = _____2_____ # Somewhat Sensitive Individuals found x 2 = Index Value Index Value = ____4____		Total = _____7_____ # Tolerant Individuals found x 1 = Index Value Index Value = _____7____	

TOTAL INDEX VALUE (sum of all values) = _____17_____

Circle the water quality rating for Site 3 below:

Excellent (>22)

Good (17-22)

Fair (11-16)

Poor (<11)

*Aquatic Worms – category that includes: Tubifex worm, Horsehair worm, Bristle worm, and Nematode or Threadworm

Site 4	
Macro 1	Macro 2
 Genus: **Aquatic Worm**	 Genus: **Planaria (flatworm)**
Quantity: 1	Quantity: 1
Macro 3	Macro 4
 Genus: **Scud**	 Genus: **Blackfly Larvae**
Quantity: 3	Quantity: 1

Site 4 Water Quality Calculations

Intolerant Species	#	Moderately Tolerant Species	#	Tolerant Species	#
Caddisfly Larvae		Crane Fly Larvae		Aquatic Worms*	1
Dobsonfly Larvae		Damselfly Larvae		Blackfly Larvae	1
Mayfly Larvae		Dragonfly Larvae		Planaria (flatworms)	1
Riffle Beetle		Scuds	3	Midge Larvae	
Stonefly Larvae		Alderfly Larvae		Pouch Snails	
Water Penny		Beetle Larvae		Leeches	
Total = _____0_____ # Sensitive Individuals found x 3 = Index Value Index Value = _____0_____		Total = _____3_____ # Somewhat Sensitive Individuals found x 2 = Index Value Index Value = ___6_____		Total = _____3_____ # Tolerant Individuals found x 1 = Index Value Index Value = ____3_____	

TOTAL INDEX VALUE (sum of all values) = _____9_____

Circle the water quality rating for Site 4 below:

Excellent (>22)

Good (17-22)

Fair (11-16)

Poor (<11)

*Aquatic Worms – category that includes: Tubifex worm, Horsehair worm, Bristle worm, and Nematode or Threadworm

Site 5	
Macro 1	Macro 2
 Genus: **Scud**	 Genus: **Caddisfly Larvae**
Quantity: 1	Quantity: 1
Macro 3	Macro 4
 Genus: **Midge Larvae**	 Genus: **Dragonfly Larvae**
Quantity: 2	Quantity: 1
Macro 5	Macro 6
 Genus: **Aquatic Worm**	 Genus: **Mayfly Larvae**
Quantity: 3	Quantity: 2

Site 5 Water Quality Calculations

Intolerant Species	#	Moderately Tolerant Species	#	Tolerant Species	#
Caddisfly Larvae	1	Crane Fly Larvae		Aquatic Worms*	3
Dobsonfly Larvae		Damselfly Larvae		Blackfly Larvae	
Mayfly Larvae	2	Dragonfly Larvae	1	Planaria (flatworms)	
Riffle Beetle		Scuds	1	Midge Larvae	2
Stonefly Larvae		Alderfly Larvae		Pouch Snails	
Water Penny		Beetle Larvae		Leeches	
Total = _____3_____ # Sensitive Individuals found x 3 = Index Value Index Value = _____9_____		Total = _____2_____ # Somewhat Sensitive Individuals found x 2 = Index Value Index Value = ____4_____		Total = _____5_____ # Tolerant Individuals found x 1 = Index Value Index Value = ____5_____	

TOTAL INDEX VALUE (sum of all values) = _____18_____

Circle the water quality rating for Site 5 below:

Excellent (>22)

Good (17-22)

Fair (11-16)

Poor (<11)

*Aquatic Worms – category that includes: Tubifex worm, Horsehair worm, Bristle worm, and Nematode or Threadworm

Macroinvertebrate Investigation Questions

1. Which site has the worst water quality? Which macroinvertebrates helped you come to this conclusion?

   Site 4 has the worst water quality with a biotic index of 11 indicating that the water quality falls into the "poor" category. This is evident because of the high presence of tolerant macroinvertebrates. There are no pollution intolerant macroinvertebrates present and only one genus of moderately pollution tolerant macroinvertebrates found here.

2. Which site has the best water quality? Which macroinvertebrates helped you come to this conclusion?

   Site 2 has the best water quality with a biotic index of 25 indicating that the water quality falls into the "excellent" category. This is evident because of the high presence of pollution intolerant species and moderately tolerant macroinvertebrates. If the water at Site 2 was highly polluted, these macroinvertebrates would not be able to survive. There are two genus of pollution tolerant macroinvertebrates found at Site 2, but this is expected as they can live in very polluted waters or water with little to no pollution.

3. Based on the Site Map, what could impact the water quality of these sites?

   The site map indicates water flow direction toward sites 1-5. Fresh water would hit sites 3 and 4 first, and slowly be diluted as it flows to sites 1, 2, and 5. This indicates that a pollution source could be entering Thompson's Bay, impacting site 4 most heavily as it has the poorest water quality rating.

4. What kinds of Point and/or Non-Point Source Pollution might impact this area?

   There could be an illegal dump of chemicals or other pollution. Based on the location of Thompson's Bay, it is protected from full exposure to Lake Erie and Presque Isle Bay. Because of this, the most likely source of pollution is from accidental or purposeful dumping of chemicals. This is an example of point source pollution.

   Another potential source of pollution could be from offshore boats dispensing pollution into the water. The pollution could be entering through the channel. Plastic and other types of marine debris could also collect in isolated ponds like Thompson's Bay. This debris can negatively impact the water quality by adsorbing chemicals and degrading the food chain. These are examples of non-point source pollution.