Watershed Management

Healthy Headwaters Lab
Great Lakes Institute for Environmental Research
University of Windsor

www.HealthyHeadwatersLab.ca
email: healthy.headwaters@uwindsor.ca

University of Windsor

What is watershed management?

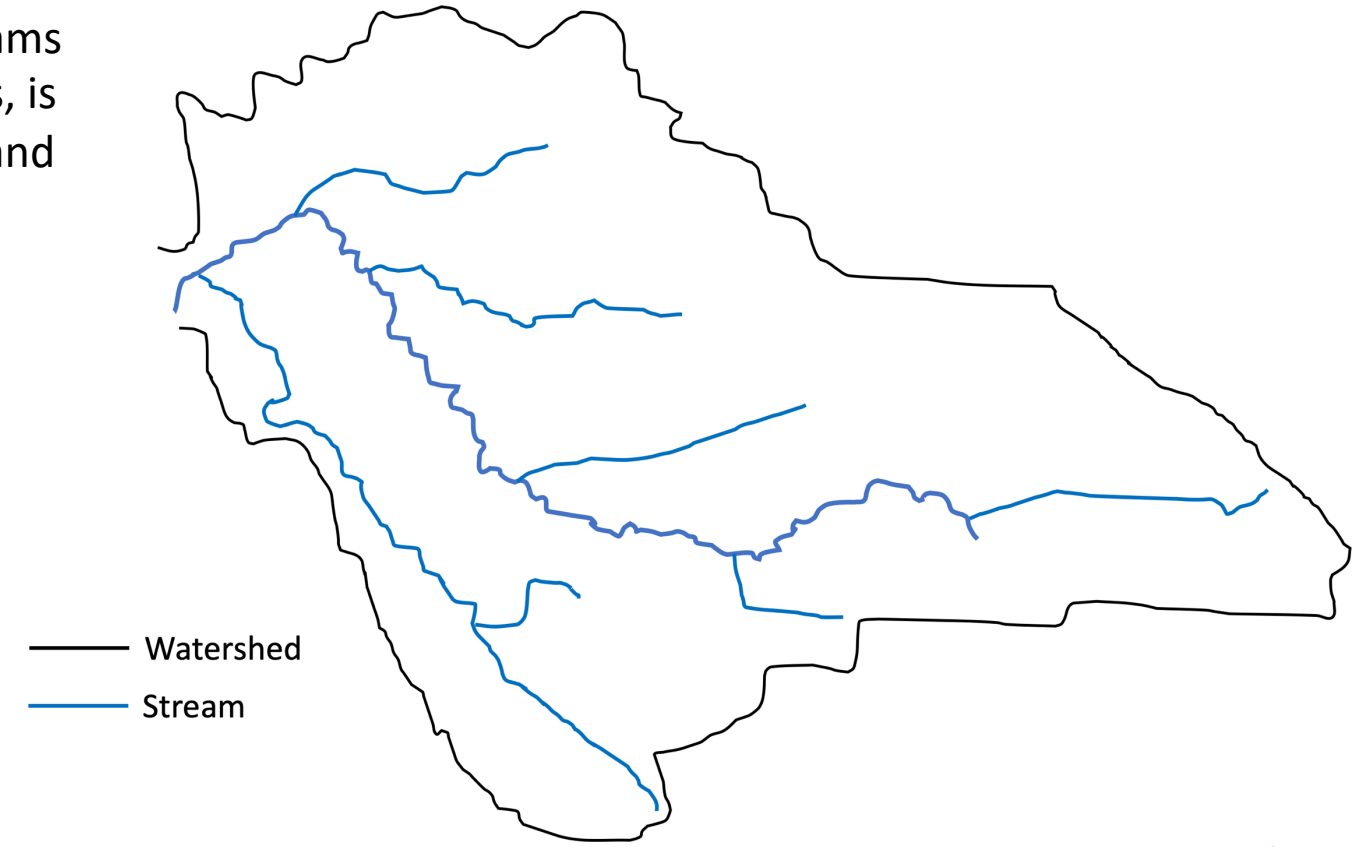
Watershed management – involves studying different aspects of a watershed (land, water, plants and animals, human impact) and developing plans and programs for the benefit of all these components that make up a watershed.

Frazao & Febria 2020

What is a watershed?

An area of land that channels water out through streams and rivers. Water that falls as rain, or snow that melts, is drained through these channels and away from the land into larger bodies of water like lakes and oceans.

Watersheds can also be called **drainage basins** or **catchments.**



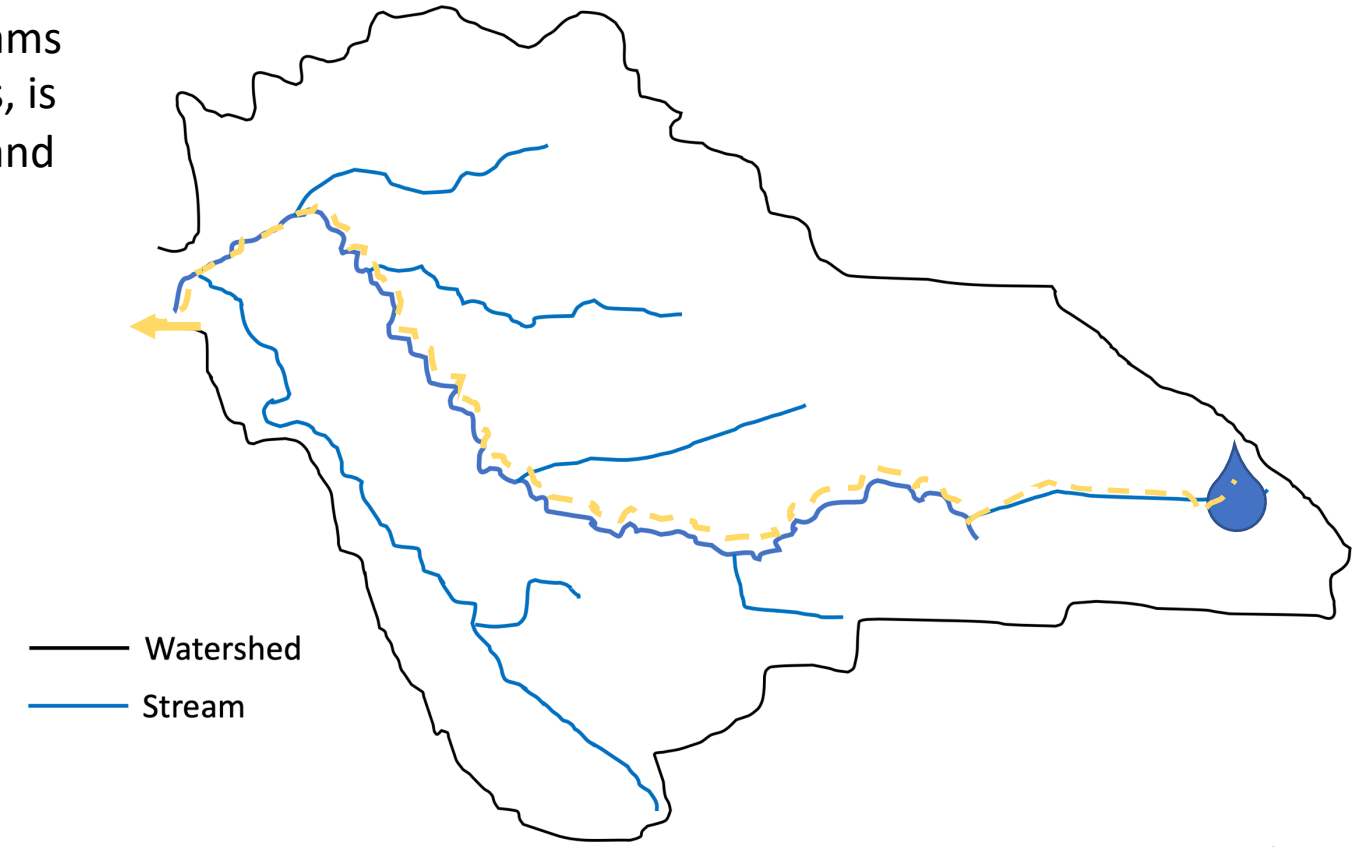
Frazao & Febria 2020

What is a watershed?

An area of land that channels water out through streams and rivers. Water that falls as rain, or snow that melts, is drained through these channels and away from the land into larger bodies or water like lakes and oceans.

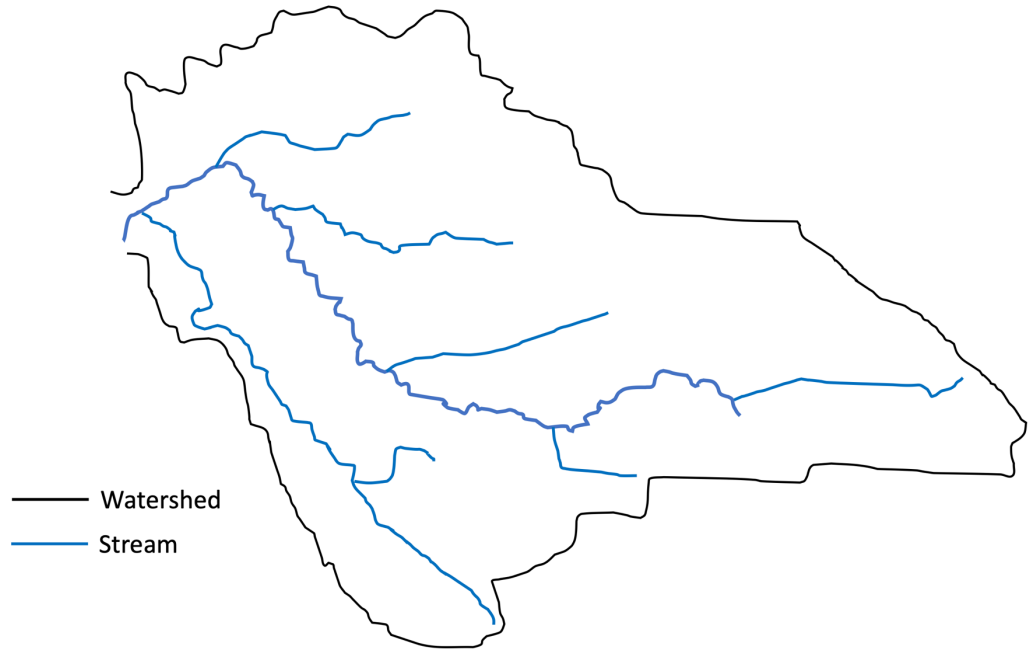
Watersheds can also be called **drainage basins** or **catchments.**

The watershed outlines the area that the stream reaches to. Wherever rain falls, let's say where the waterdrop is, the water will travel down the stream until it flows off the land into another larger body of water.



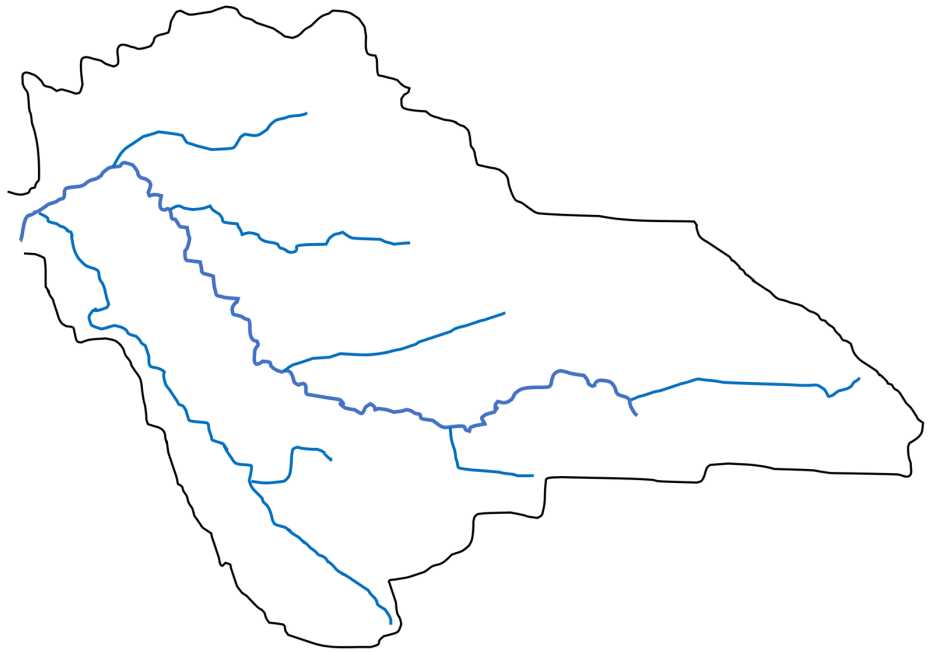
Frazao & Febria 2020

Does this watershed look familiar?



Frazao & Febria 2020

Does this watershed look familiar? → It's the Canard River, here in Essex County.



Frazao & Febria 2020

Essex Region Conservation Authority
Public Interactive Mapping

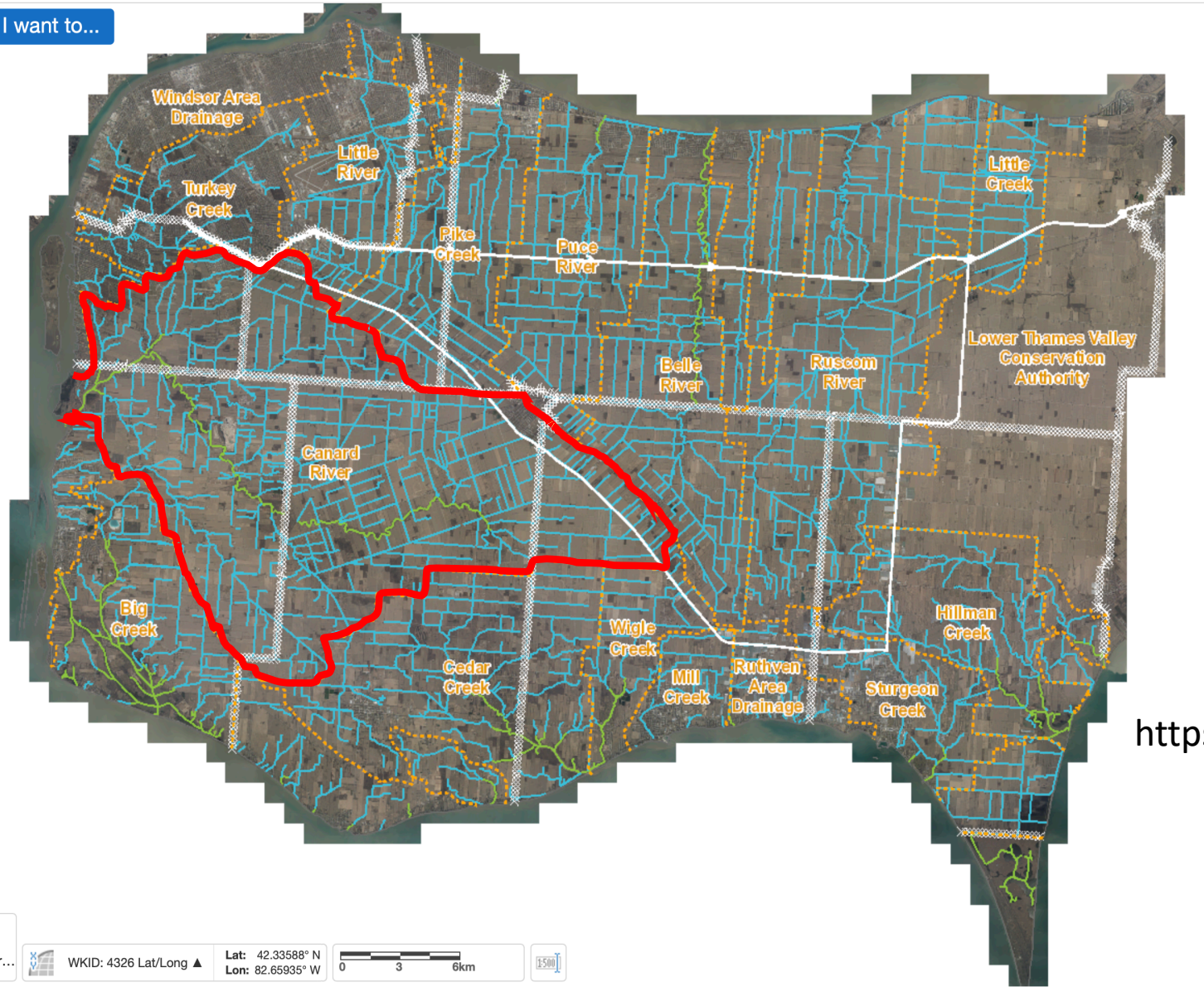
Search...

Getting Around | Map | Tools | Workflows

Tool Labels

Initial View | Full Extent | Pan | Zoom In | Zoom Out | Previous Extent | Next Extent | Bookmarks — Navigation
Identify — Find Data
Print | Export | Share — Tasks

I want to...



Interested in looking at what the rest of Essex County looks like?

Visit ERCA's website and check out their Public Interactive Mapping.

https://essexregionconservation.ca/map-your-property/

2019 Air...
WKID: 4326 Lat/Long ▲
Lat: 42.33588° N
Lon: 82.65935° W
0 3 6km

Frazao & Febria 2020

ERCA

We collect a bunch of materials and readings out in the field so that we can understand it more, and so we know what is happening out there.

This is important because we want to understand the world around us better.

One of the ways that we can get information from the field is by using electronic equipment that can take readings.

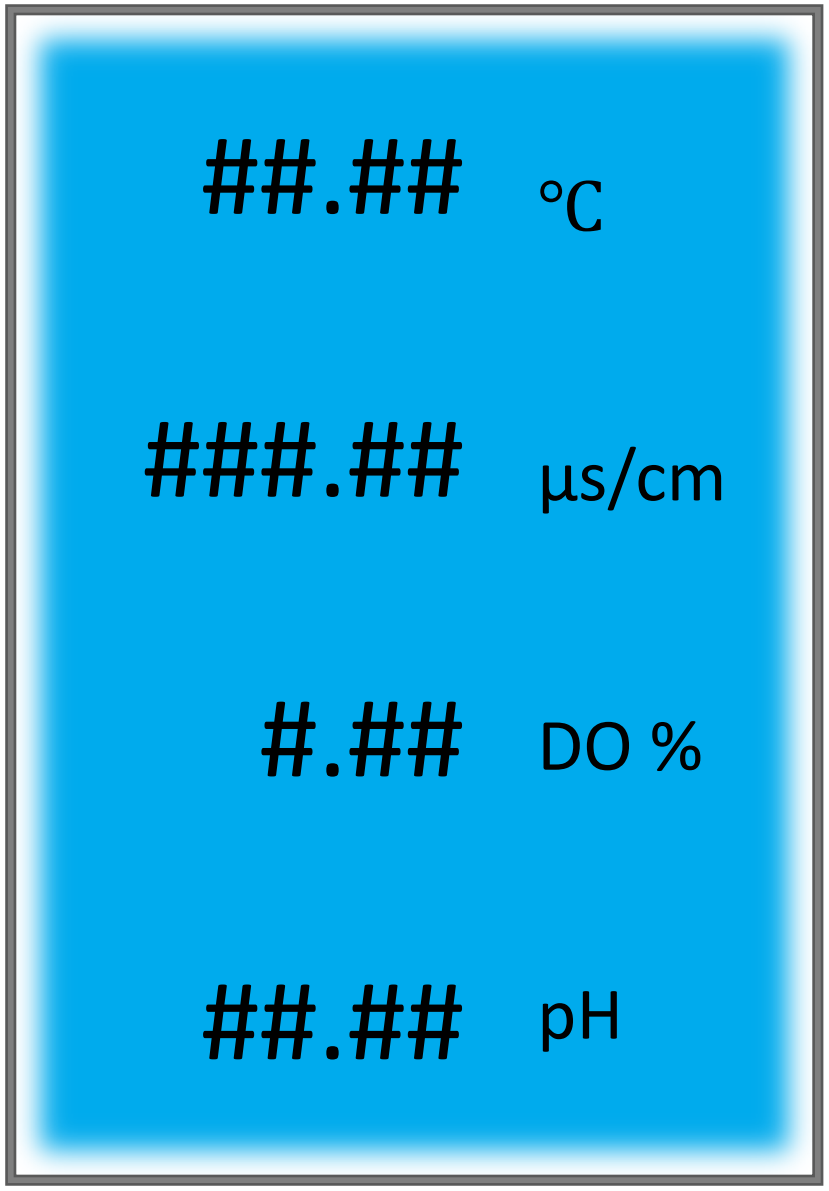
For example, we use a Multi-probe YSI.

This piece of equipment can tell us 4 different water quality readings:

1. Temperature
2. Conductivity
3. Percent Dissolved Oxygen
4. pH

Frazao & Febria 2020

https://www.equipcoservices.com/images/products/sales/product_pages/ysi_professional_plus_large.jpg



TEMPERATURE:

- can submerge the probe in the water and it measures its temperature.
- if we take it out of the water, it can also tell us the surrounding air temperature.

CONDUCTIVITY:

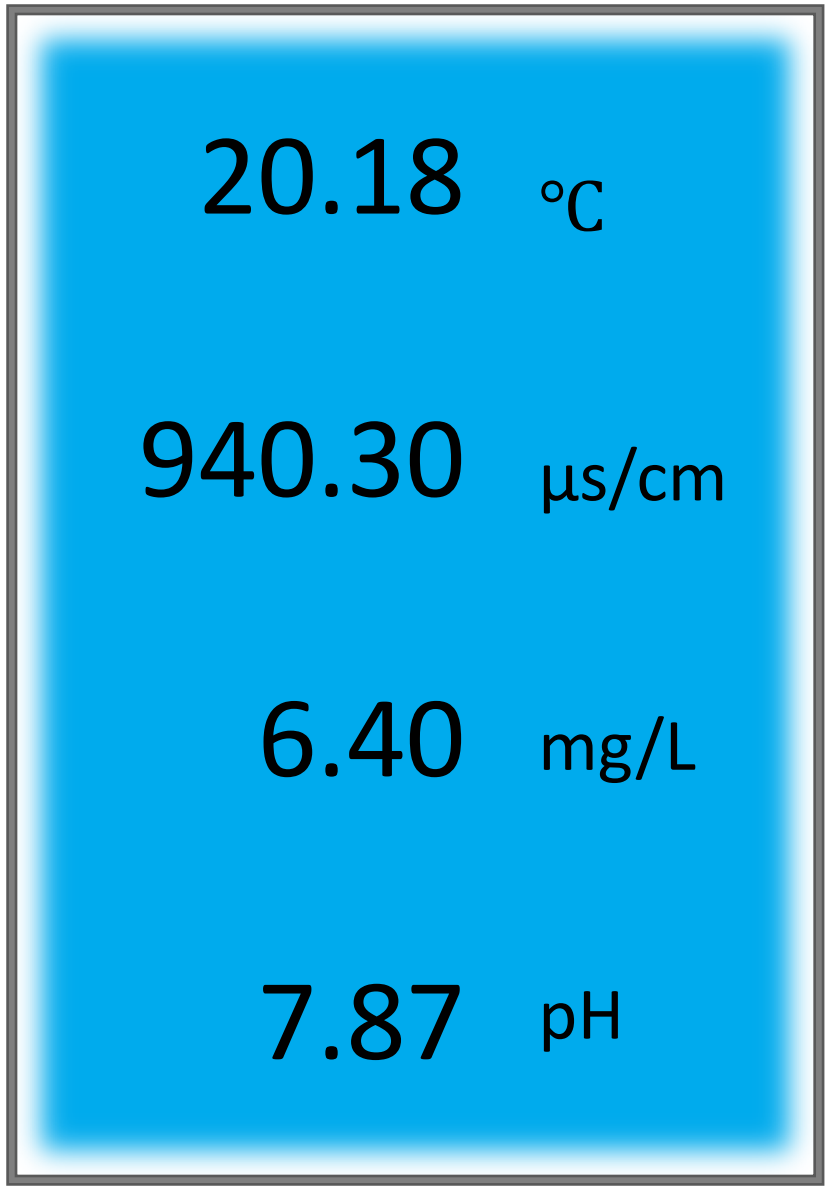
- measures how well the water can conduct electricity, reflecting how many dissolved ions are present.
- these ions includes things like sodium, chloride and magnesium.

PERCENT DOSSOLVED OXYGEN:

- how much oxygen is dissolved, or available in the water.

pH:

- how acidic or basic the water is.



There are ranges for each of the measurements shown below in blue text. Take a guess as to what the readings on our YSI (pictured left) tell us about a stream we've just measured.

TEMPERATURE: -4 to 25℃

Freezing	Mild	Warm

CONDUCTIVITY: 100- 2000µs/cm

High	Mid-range	Low

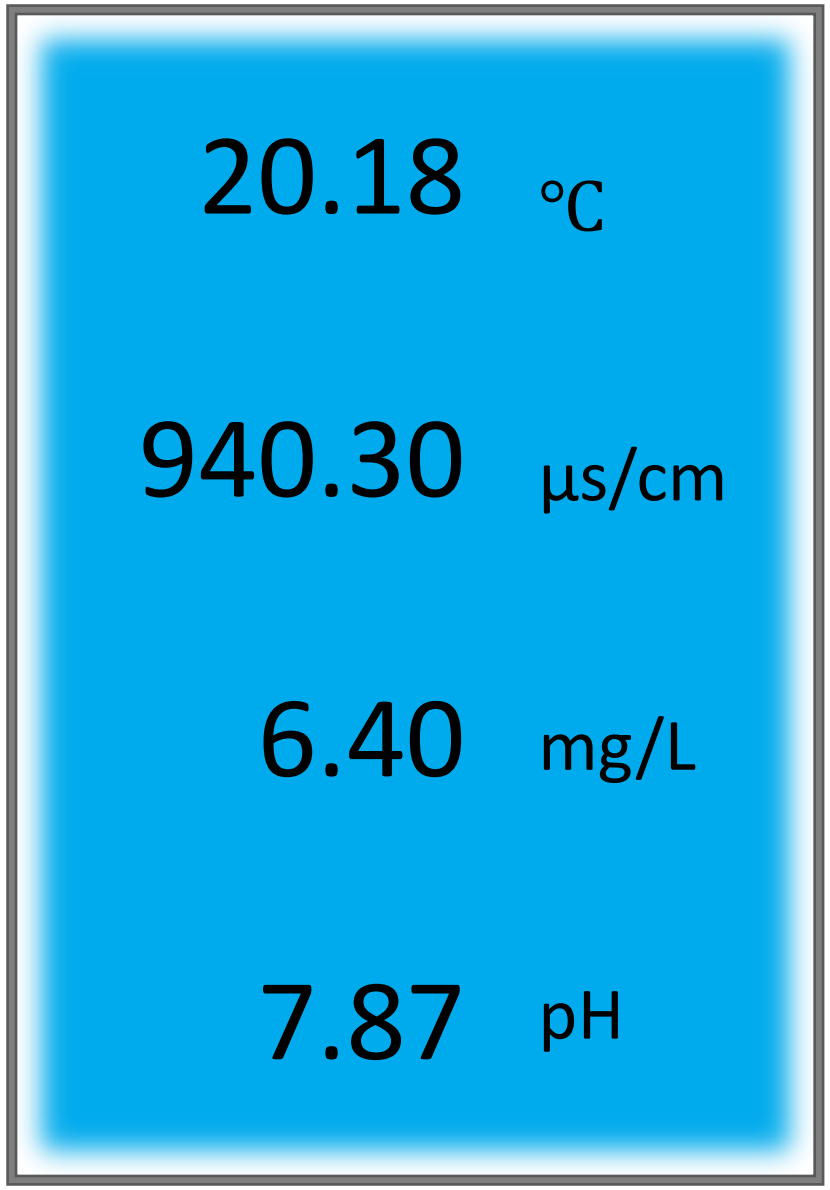
PERCENT DOSSOLVED OXYGEN: 0-12mg/L

0 All fish are dead	4- 9.5 Most fish can live	9.5- 12 All fish can live

---

pH: 6- 8

Acidic	Neutral	Basic



There are ranges for each of the measurements shown below in blue text. Take a guess as to what the readings on our YSI (pictured left) tell us about a stream we've just measured.

TEMPERATURE: -4 to 25℃

Freezing | Mild | **Warm**

CONDUCTIVITY: 100- 2000µs/cm

High | **Mid-range** | Low

PERCENT DOSSOLVED OXYGEN: 0-12mg/L

0
All fish are dead

4- 9.5
Most fish can live

9.5- 12
All fish can live

pH: 6- 8

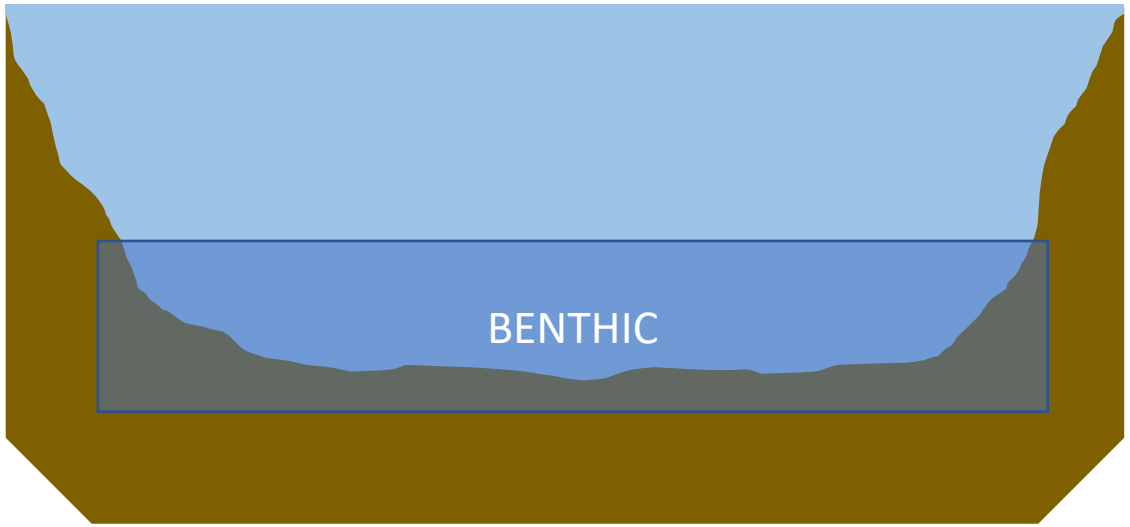
Acidic | Neutral | **Basic**

We can also collect physical samples from these systems as well.
We will focus on benthic samples.

Benthic = bottom

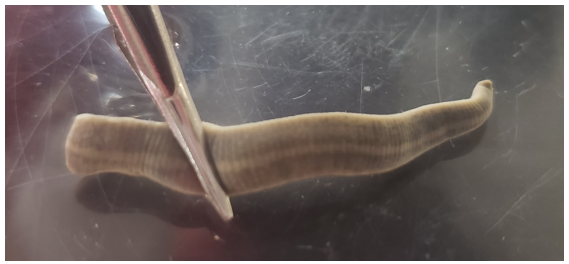
Thus, we are collecting materials that are at the bottom of the waterbody (stream, wetland, river).

What do you think we would find at the bottom of these streams?



Stream Cross-section

Leeches



Dragonflies

True Flies

Crayfish

Snails

We actually find many living organisms such as these **macroinvertebrates**.

Macro = large
invertebrate = without a backbone

They are an important part of the ecosystem since they can provide many services.

- some of them can break down organic matter like leaves that have fallen into the stream,
- are food to larger organisms like fish,
- can tell us about the water quality

How can we collect them?

We use what is called a **D-framed sweep net**.

https://www.forestry-suppliers.com/Images/Original/5064_53755_p1.jpg

To use it we gently hit the bottom with the flat side of the net and this causes the materials to lift up, like a cloud.

Then, we move the net back and forth to collect that cloud and whatever is in it.

We do this across the stream for 3 minutes, going back and forth in a zig-zag pattern.

Different types of invertebrates can tolerate different environments. Whether or not an invertebrate is present can tell us a lot about the system.

If there is an invertebrate that is considered to have **”Low Tolerance”** this means it only likes to live in very specific environmental conditions.

For example:
- it can only survive if oxygen is at a high level
- if the pH is specifically between 6.5 and 7.

***indicates good stream quality**

If there is an invertebrate that is considered to have **”High Tolerance”** this means it can survive in a whole range of environmental conditions.

For example:
- it can survive if oxygen is either at a really low level AND it can survive if oxygen is at a really high level
- if the pH is between 6 and 8.

***indicates poor stream quality**

These are examples of some macroinvertebrates that we can find in streams. The names are intimidating so don't worry about them too much.

Low Tolerance — High Tolerance

0 1 2 3 4 5 6 7 8 9 10

Chloroperlidae 0

Libellulidae 2
Ephemeridae 2

Elmidae 5
Haliplidae 5

Erpobdellidae 8
Physidae 8

Oligochaeta 10

Question:
Let's say we've collected the following macroinvertebrates in our sample Based on this information, what range on our tolerance scale would you suggest our stream might be in?

a. 0-3
b. 4-6
c. 7-10
d. None of the above

(Leech)

(Aquatic Worm)

(Snail)

These are examples of some macroinvertebrates that we can find in streams. The names are intimidating so don't worry about them too much.

Low Tolerance — High Tolerance

0 1 2 3 4 5 6 7 8 9 10

Chloroperlidae 0

Libellulidae 2
Ephemeridae 2

Elmidae 5
Haliplidae 5

Erpobdellidae 8
Physidae 8

Oligochaeta 10

Question:
Let's say we've collected the following macroinvertebrates in our sample Based on this information, what range on our tolerance scale would you suggest our stream might be in?

a. 0-3
b. 4-6
✓ **c. 7-10**
d. None of the above

(Leech)

(Aquatic Worm)

(Snail)

Frazao & Febria 2020

These are examples of some macroinvertebrates that we can find in streams. The names are intimidating so don't worry about them too much.

Question:
Based on this range of 7-10 on our tolerance scale, what condition/ heath would you suggest our stream system is in:

a. Poor
b. Fair
c. Good
d. None of the above

These are examples of some macroinvertebrates that we can find in streams. The names are intimidating so don't worry about them too much.

Question:
Based on this range of 7-10 on our tolerance scale, what condition/ heath would you suggest our stream system is in:

✓ **a. Poor**
b. Fair
c. Good
d. None of the above

These are examples of some macroinvertebrates that we can find in streams. The names are intimidating so don't worry about them too much.

Low Tolerance — High Tolerance

0 1 2 3 4 5 6 7 8 9 10

Chloroperlidae 0

Libellulidae 2
Ephemeridae 2

Elmidae 5
Haliplidae 5

Erpobdellidae 8
Physidae 8

Oligochaeta 10

Question:
Based on this range of 7-10 on our tolerance scale, what condition/ heath would you suggest our stream system is in:

✓ **a. Poor**
b. Fair
c. Good
d. None of the above

Keep in mind, we do more complicated calculations for our scoring systems. We are showing you a few pieces of the puzzle, so don't be alarmed if you only see worms or snails in your local streams!

Frazao & Febria 2020

We’ve gone out and collected our samples and other observations from the field.

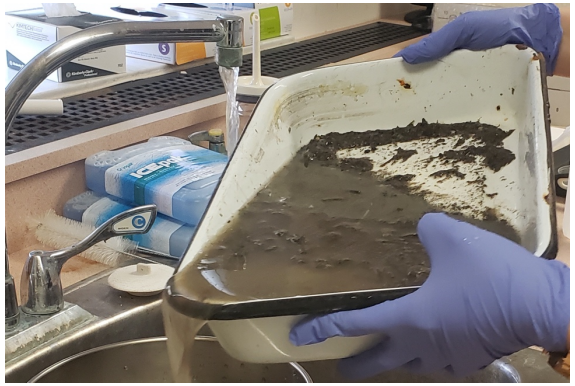
Now what do we do next?

We open our samples and search through the materials to find the macroinvertebrates!

Amongst the samples are bits of wood, leaves, twigs and sand. We look amongst all of this to find the macroinvertebrates.

There can be hundreds to thousands of invertebrates found in a sample.

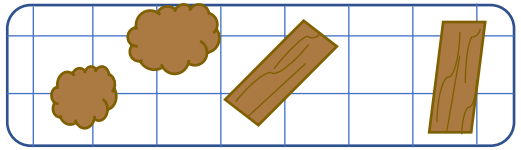
First, we must wash the sample.



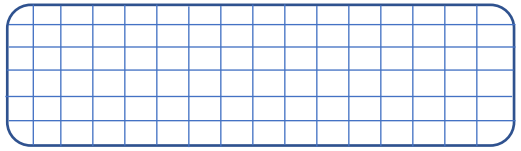
The materials are poured through different sized sieves so that the contents of the sample will be separated into similarly sized objects, dependent on the size of the mesh.

Size of the Mesh Opening

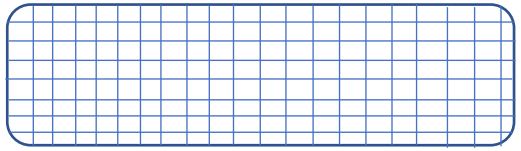
4 mm



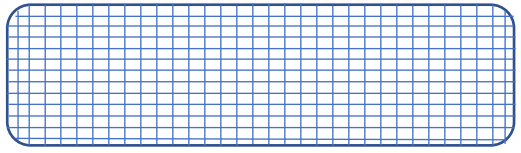
1 mm



0.5 mm

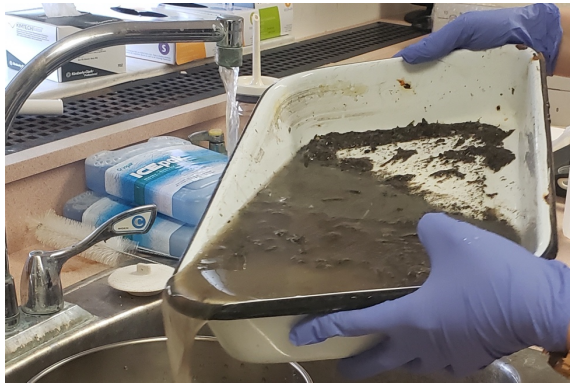


0.25 mm



Anything larger than 4 mm will remain on top. Materials smaller than 4 mm will pass through.

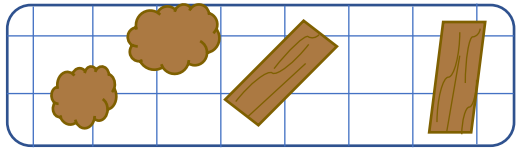
First, we must wash the sample.



The materials are poured through different sized sieves so that the contents of the sample will be separated into similarly sized objects, dependent on the size of the mesh.

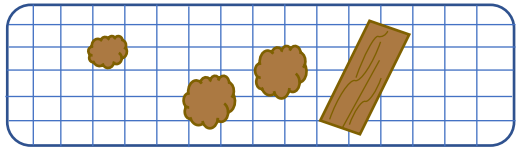
Size of the Mesh Opening

4 mm



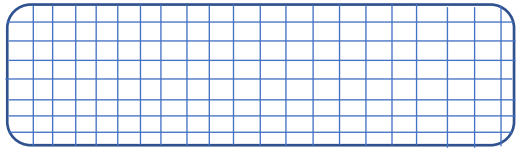
Anything larger than 4 mm will remain on top. Materials smaller than 4 mm will pass through.

1 mm

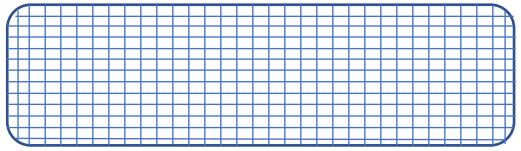


Then it meets the next sieve, 1 mm. Is it larger or smaller than 1 mm? If larger it will remain, if smaller it will pass through to 0.5 mm sieve.

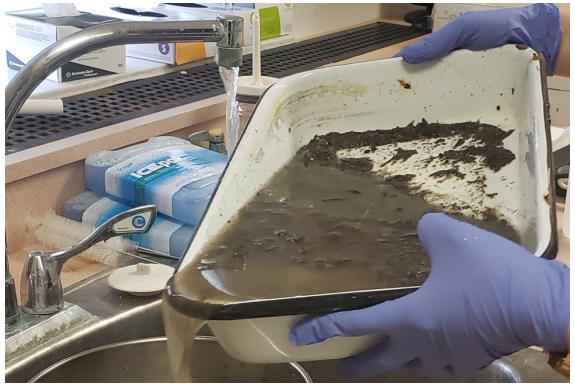
0.5 mm



0.25 mm



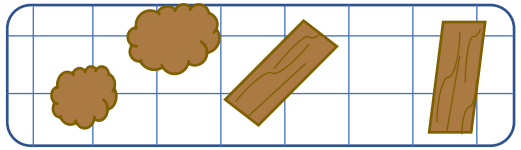
First, we must wash the sample.



The materials are poured through different sized sieves so that the contents of the sample will be separated into similarly sized objects, dependent on the size of the mesh.

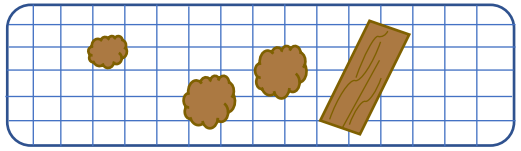
Size of the Mesh Opening

4 mm



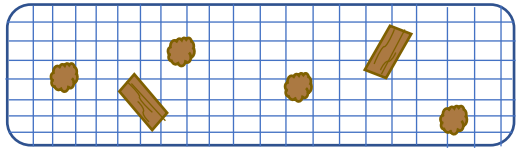
Anything larger than 4 mm will remain on top. Materials smaller than 4 mm will pass through.

1 mm



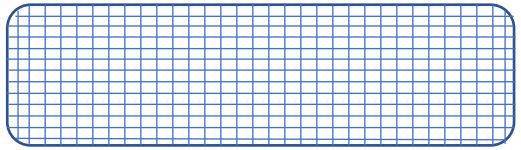
Then it meets the next sieve, 1 mm. Is it larger or smaller than 1 mm? If larger it will remain, if smaller it will pass through to 0.5 mm sieve.

0.5 mm



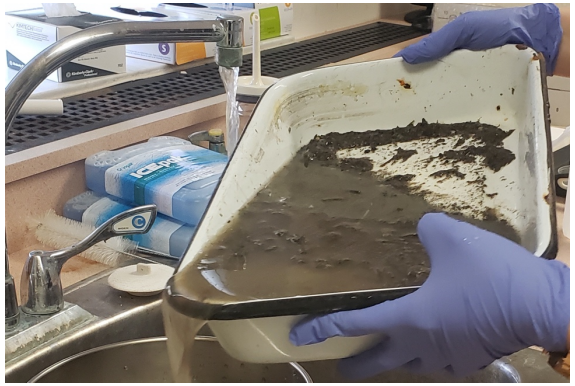
Once again it will be determined if it shall go through to the next sieve or remain.

0.25 mm



Frazao & Febria 2020

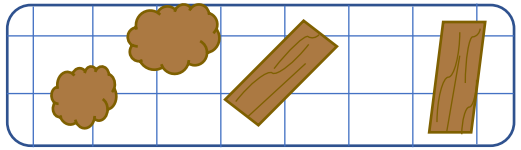
First, we must wash the sample.



The materials are poured through different sized sieves so that the contents of the sample will be separated into similarly sized objects, dependent on the size of the mesh.

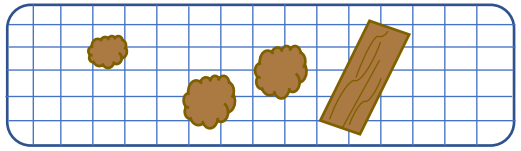
Size of the Mesh Opening

4 mm



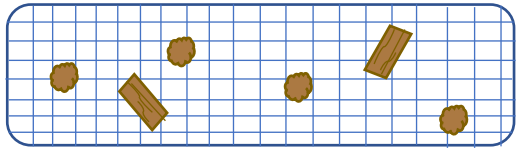
Anything larger than 4 mm will remain on top. Materials smaller than 4 mm will pass through.

1 mm



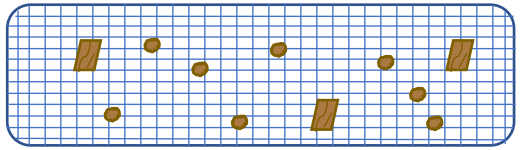
Then it meets the next sieve, 1 mm. Is it larger or smaller than 1 mm? If larger it will remain, if smaller it will pass through to 0.5 mm sieve.

0.5 mm



Once again it will be determined if it shall go through to the next sieve or remain.

0.25 mm



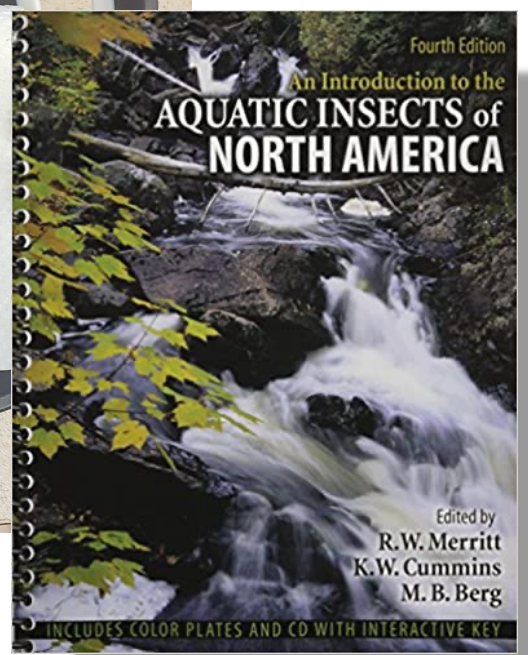
Any materials that are smaller than 0.25 mm will go through the entire stack and go down the drain.

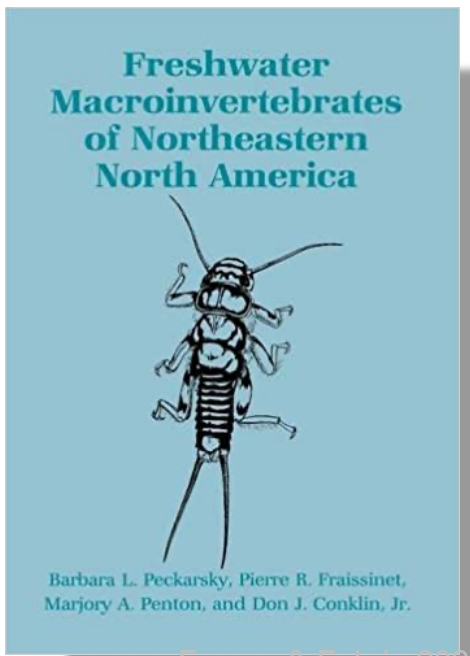
Frazao & Febria 2020

We are left with our divided sample.

We get out our books as well to help us identify the invertebrates that we find. They are called taxonomic keys.

You will instead have your own taxonomic key which you will use to identify some invertebrates you find in our virtual sample. You may find this key here:
10.6084/m9.figshare.12353399





Frazao & Febria 2020

Here is your stereomicroscope along with the sample you will go through.

What can you find?

What can you find?

Hint:

There are 3 macroinvertebrates here.

What can you find?

Hint:

There are 3 macroinvertebrates here.

Macroinvertebrate Dichotomous Key

1.a. Animal has a hard shell and looks like a clam.....Bivalvia

b. no shell 2

2. a. Has 4 pairs of legs .....Decapoda (Crayfish)

b. Does not have 4 legs 3

3.a Wing or wing pads are present.....4

b. wings or wing pads absent.....8

You were provided with a Macroinvertebrate Dichotomous Key.

You are going to use it to identify the invertebrates you have just found in your sample to the level of ORDER.

KINGDOM

PHYLUM

CLASS

ORDER

GENUS

SPECIES

Access Key: 10.6084/m9.figshare.12353399

Frazao & Febria 2020

Macroinvertebrate Dichotomous Key

1.a. Animal has a hard shell and looks like a clam.....Bivalvia

b. no shell 2

2. a. Has 4 pairs of legs .....Decapoda (Crayfish)

b. Does not have 4 legs 3

3.a Wing or wing pads are present.....4

b. wings or wing pads absent.....8

Let's practice together to find what Order this macroinvertebrate is in. You were given two photos to make certain features clearer, it is the same individual:

Read question **1.a.** carefully. Does this macroinvertebrate look like what it's describing?

Yes

Then this is in Bivalvia

No

Then move onto 1.b.

Frazao & Febria 2020

Access Key: 10.6084/m9.figshare.12353399

Macroinvertebrate Dichotomous Key

1.a. Animal has a hard shell and looks like a clam.....Bivalvia

b. no shell 2

2. a. Has 4 pairs of legs .....Decapoda (Crayfish)

b. Does not have 4 legs 3

3.a Wing or wing pads are present.....4

b. wings or wing pads absent.....8

Let's practice together to find what Order this macroinvertebrate is in. You were given two photos to make certain features clearer, it is the same individual:

Read question **1.b.** carefully now. Does this macroinvertebrate look like what it's describing?

Yes

Then move onto question 2.

No

Then read 1.a again to see which fits best.

Frazao & Febria 2020

Access Key: 10.6084/m9.figshare.12353399

Macroinvertebrate Dichotomous Key

1.a. Animal has a hard shell and looks like a clam.....Bivalvia

b. no shell 2

2. a. Has 4 pairs of legs .....Decapoda (Crayfish)

b. Does not have 4 legs 3

3.a Wing or wing pads are present.....4

b. wings or wing pads absent.....8

Let's practice together to find what Order this macroinvertebrate is in. You were given two photos to make certain features clearer, it is the same individual:

Does the macroinvertebrate look like a crayfish?

Yes

No

Moving on to 2.b. which directs us to question 3.

Access Key: 10.6084/m9.figshare.12353399

Frazao & Febria 2020

Macroinvertebrate Dichotomous Key

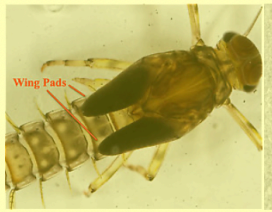
1.a. Animal has a hard shell and looks like a clam.....Bivalvia

b. no shell 2

2. a. Has 4 pairs of legs .....Decapoda (Crayfish)

b. Does not have 4 legs 3

3.a Wing or wing pads are present.....4



b. wings or wing pads absent.....8

Let's practice together to find what Order this macroinvertebrate is in. You were given two photos to make certain features clearer, it is the same individual:

Does it have wings or wing pads? (Wing pads are wings that are still growing).

Yes

No

Moving on to 3.b. which directs us to question 8.

Access Key: 10.6084/m9.figshare.12353399

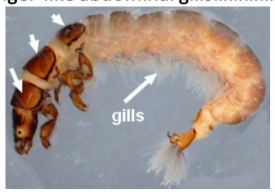
Frazao & Febria 2020

8.a. No legs, maggot-like……Diptera (True Flies)

b. With jointed legs……9

Figure 5 - Leg of *Duberaphia* sp. larvae (Elmidae)

9.a. Abdomen with many short finger-like abdominal gills……Trichoptera



b. no finger-like gills……Coleoptera (Beetle larvae)

Let's practice together to find what Order this macroinvertebrate is in. You were given two photos to make certain features clearer, it is the same individual:

Does it have legs?

Yes

As described in 3.b. which directs us to question 9.

No

Access Key: 10.6084/m9.figshare.12353399

Frazao & Febria 2020

8.a. No legs, maggot-like.....Diptera (True Flies)

b. With jointed legs.....9

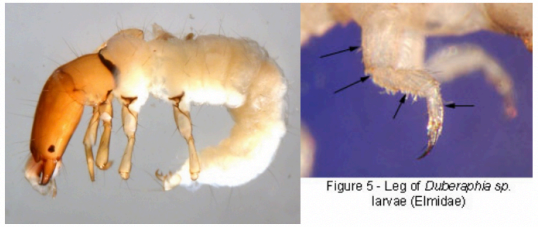
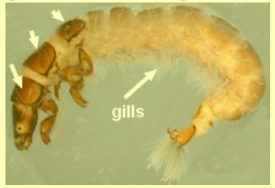


Figure 5 - Leg of *Duberaphia sp.* larvae (Elmidae)

9.a. Abdomen with many short finger-like abdominal gills.....Trichoptera



b. no finger-like gills.....Coleoptera (Beetle larvae)

Let's practice together to find what Order this macroinvertebrate is in. You were given two photos to make certain features clearer, it is the same individual:

Does it have gills on its abdomen, as shown in the key?

Yes

This means you've discovered this invertebrate belong in **Trichoptera!**

No

Frazao & Febria 2020

Access Key: 10.6084/m9.figshare.12353399

Thank you!

Healthy Headwaters Lab

Great Lakes Institute for Environmental Research
University of Windsor

www.HealthyHeadwatersLab.ca

email: healthy.headwaters@uwindsor.ca

University of Windsor