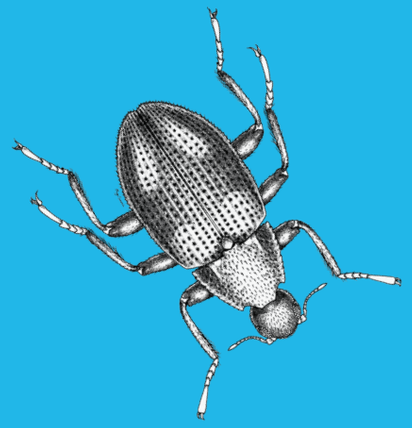
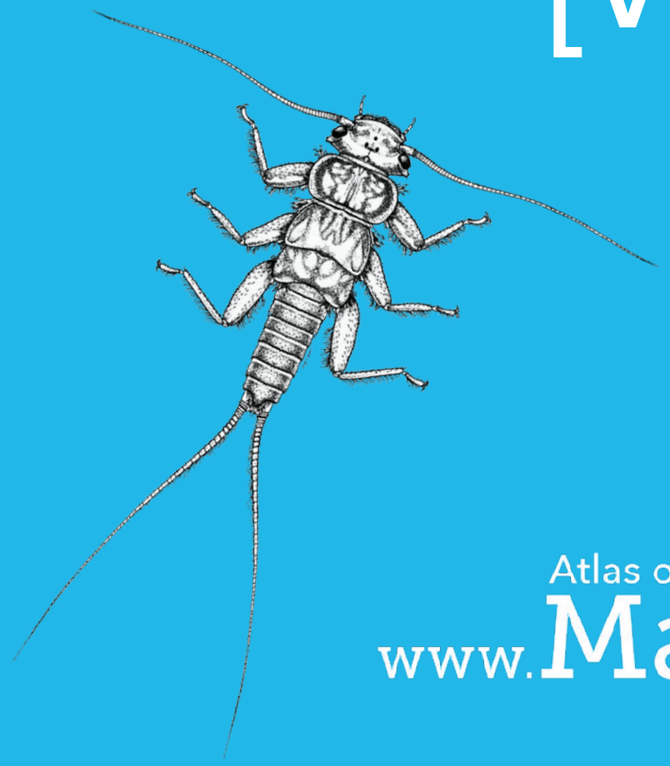


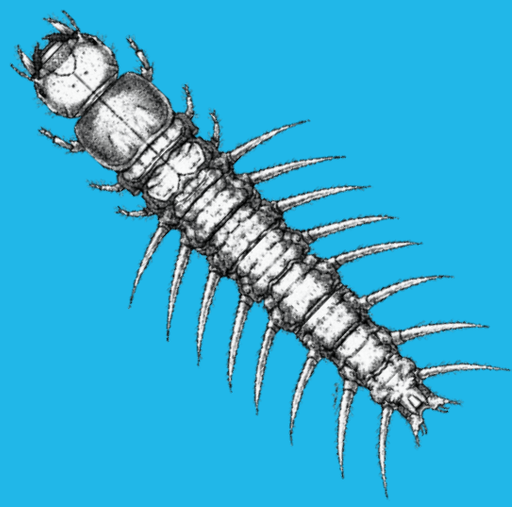




Identifying Aquatic Macroinvertebrates

[Volunteer Level]





Atlas of Common Freshwater

www.Macroinvertebrates.org

of Eastern North America

Benthic Freshwater Macroinvertebrates

















Benthic Freshwater Macroinvertebrates



Inhabit bottom areas/substrate



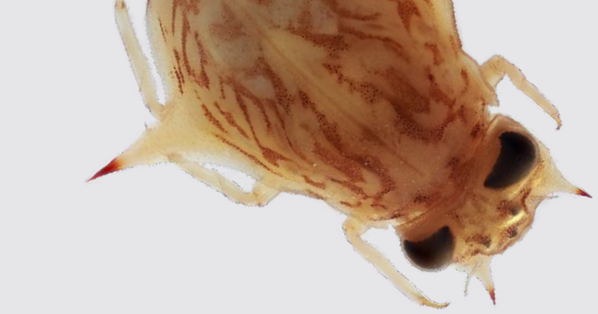




Benthic Freshwater Macroinvertebrates

Streams, rivers, lakes, ponds













Benthic Freshwater

Macroinvertebrates

Relatively “large” (>0.2–0.5mm)

Benthic Freshwater

Macroinvertebrates

Animals without vertebrae











Benthic Freshwater

Inhabit bottom areas/substrate

Streams, rivers, lakes, ponds





Macroinvertebrates

Relatively “large” (>0.2–0.5mm)

Animals without vertebrae





Benthic Freshwater Sensitivities

Pollution Sensitive



Stonefly Nymph



Riffle Beetle (adult)



Riffle Beetle (larva)



Mayfly Nymph



Caddisfly Larva
(non-Hydropsychidae)



Aquatic Snipe Fly Larva



Water Penny Larva



Right-handed / Gilled Snail

Somewhat Sensitive



Dragonfly Nymph



Crane Fly Larva

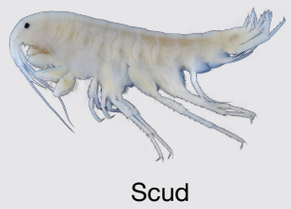


Aquatic Sowbug



Clams & Mussels

Damselfly Nymph



Scud



Crayfish



Net-spinning Caddisfly Larva



Dobsonfly / Fishfly / Alderfly

Tolerant



Midge Fly Larva



Black Fly Larva



Leech



Aquatic Worm



Left-Handed/Lunged
Snail



Planarian

What makes identification difficult?

What makes identification difficult?

Same Order



What makes identification difficult?

Different Order



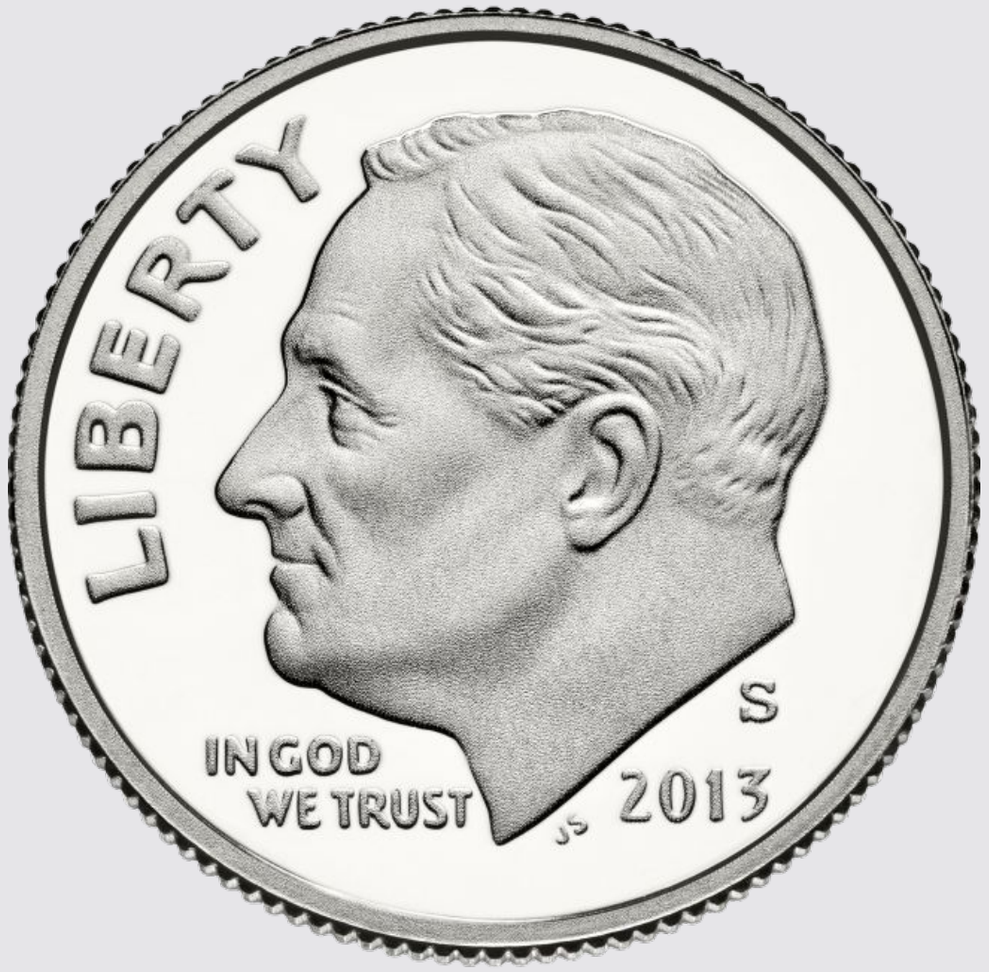


What makes identification difficult?

Specimen Size



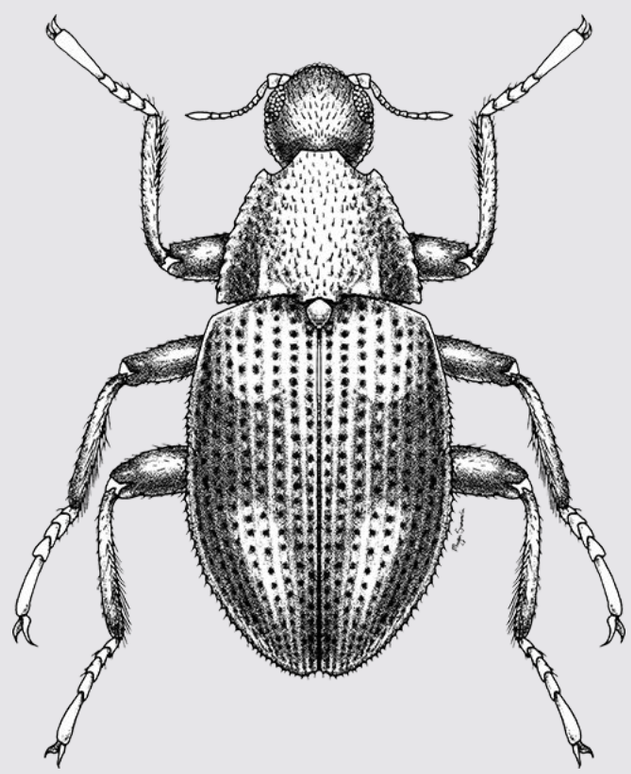
0.5–1.5”
length



0.705”
diameter

Tips for diving into ID

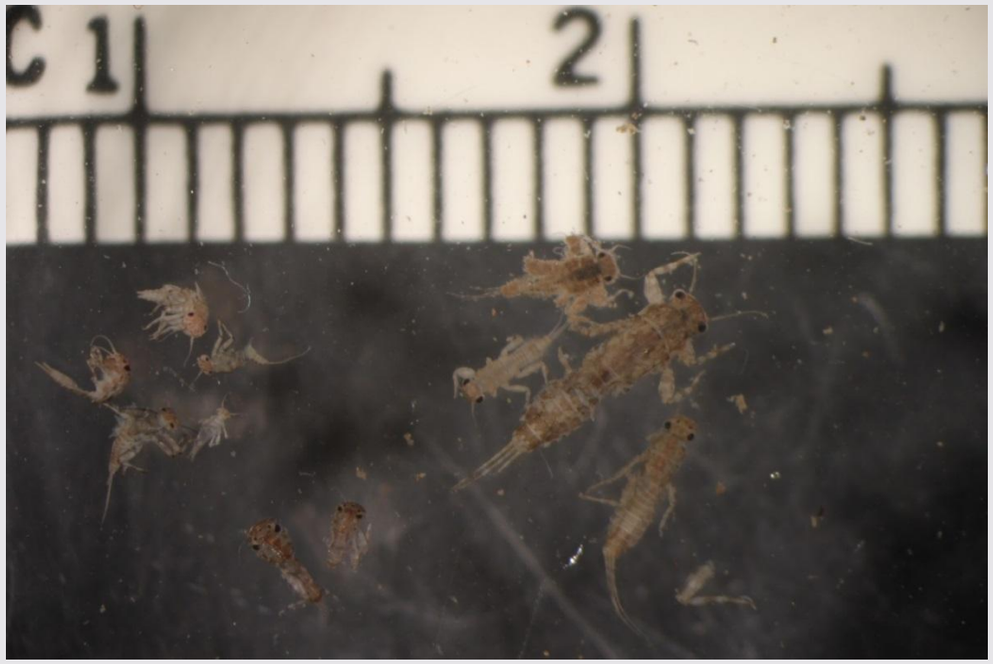
1. Start with characteristic features (morphology)
2. Pay attention to general size ranges
3. Go slow!
4. Dive into one Order at a time, and compare Orders
5. Know habitat: where to expect them, sensitivity levels
6. Watch live movement
7. Repetition!
8. Confirm IDs = Confidence
9. Use multiple resources
10. Cool facts and compelling videos!



Tips for diving into ID cont'd

1. Instars
2. Sorting–'like' critters
3. Broken appendages—legs,tails
4. Looking closely at sample—try not to miss the tiny stuff









Tips for diving into ID

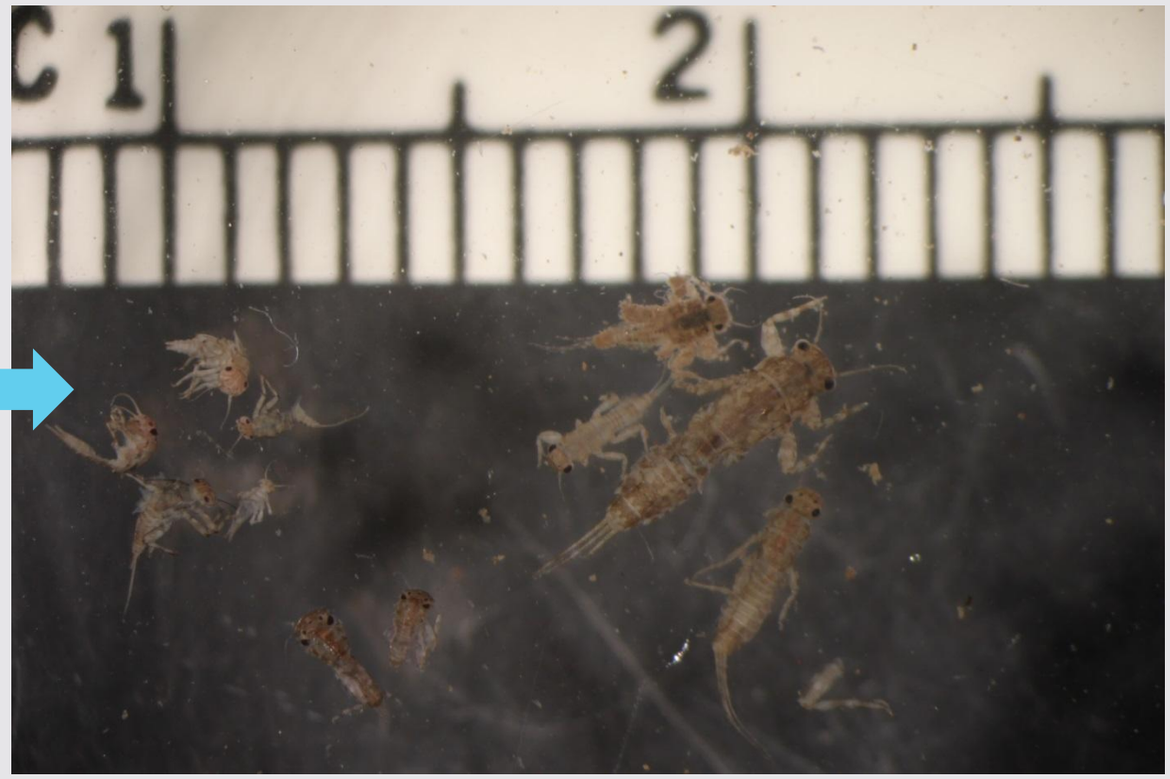
1. Instars
2. Size



Tips for diving into ID

3. Sorting–like with like





Tips for diving into ID

4. Broken appendages—legs, tails

   Bilateral symmetry: the property of being divisible into symmetrical halves on either side of a unique plane



Tips for diving into ID

4. Broken appendages—legs, tails

   Bilateral symmetry is helpful when looking at damaged specimens.



Tips for diving into ID

5. Looking closely at the sample-try not to miss the tiny stuff



Looks like only the one worm body but actually several small ones are present too.

Working with a live insect









Tools to use:

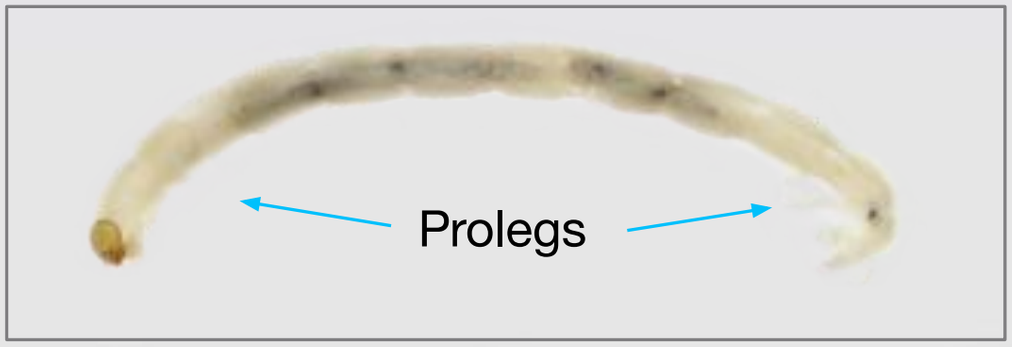
1. Small paint brush and/or plastic spoon
2. Forceps are ok, try not to smoosh the critter!
3. White sorting pan, or petri dish
4. Work from a table
5. Hand-lens and flashlight



Reminders:

1. The macroinvertebrate must be submerged in water
2. Best to keep them in the shade, cooler temperatures
3. Minimize handling time
4. Insects need oxygen!

The Insect



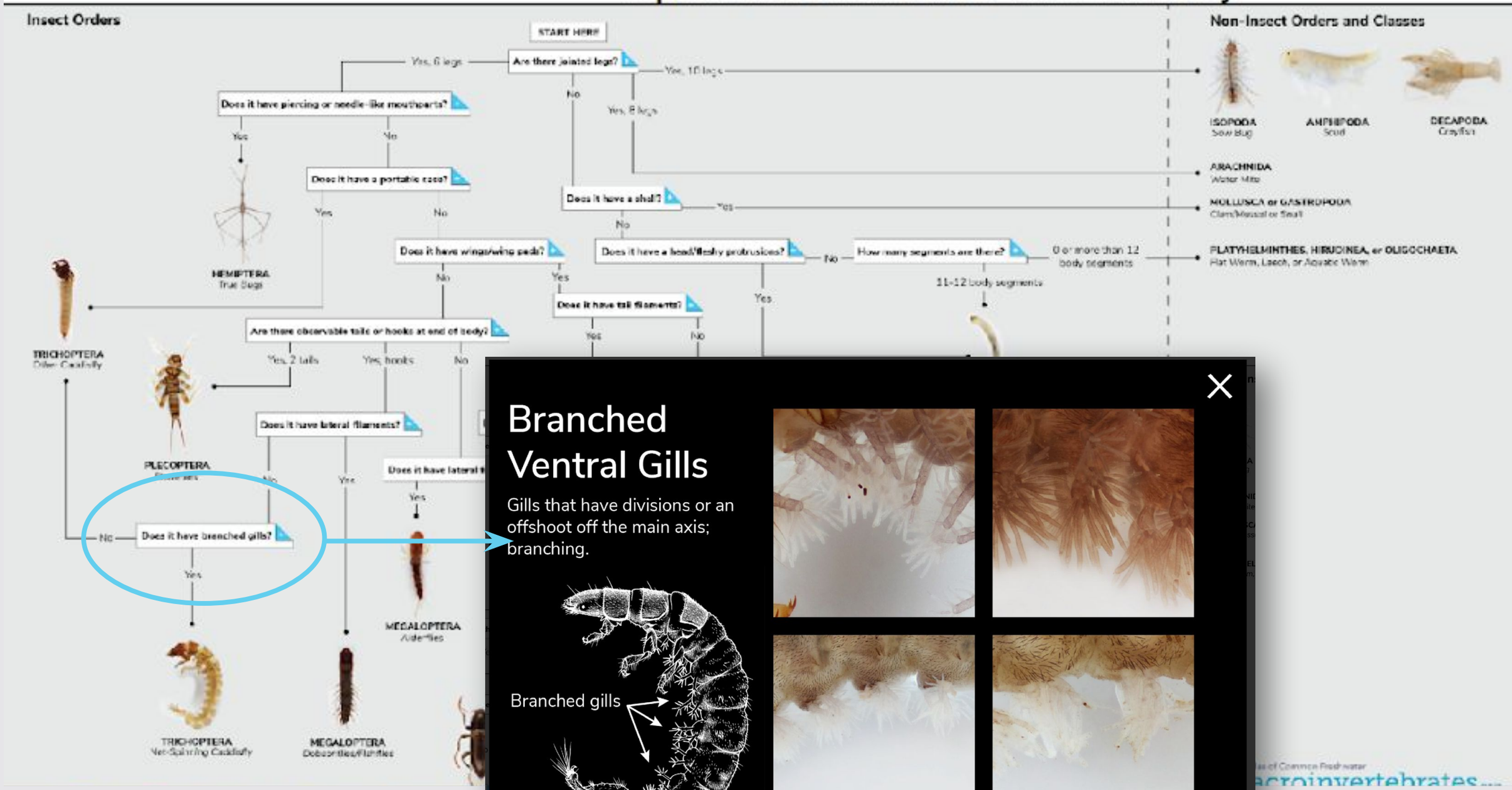
Lateral

Lateral

Anterior

Posterior

Aquatic Macroinvertebrate Order Level Key



Branched Ventral Gills

Gills that have divisions or an offshoot off the main axis; branching.

Macroinvertebrates.org

ID Key

Search

ORDER

Trichoptera

"Caddisflies"

All | Case-making Caddisflies | Free-living Caddisflies | Net-spinning Caddisflies

Hydropsychidae

"Net-spinning Caddisflies, Common Netspinners, Seine-net Weavers"



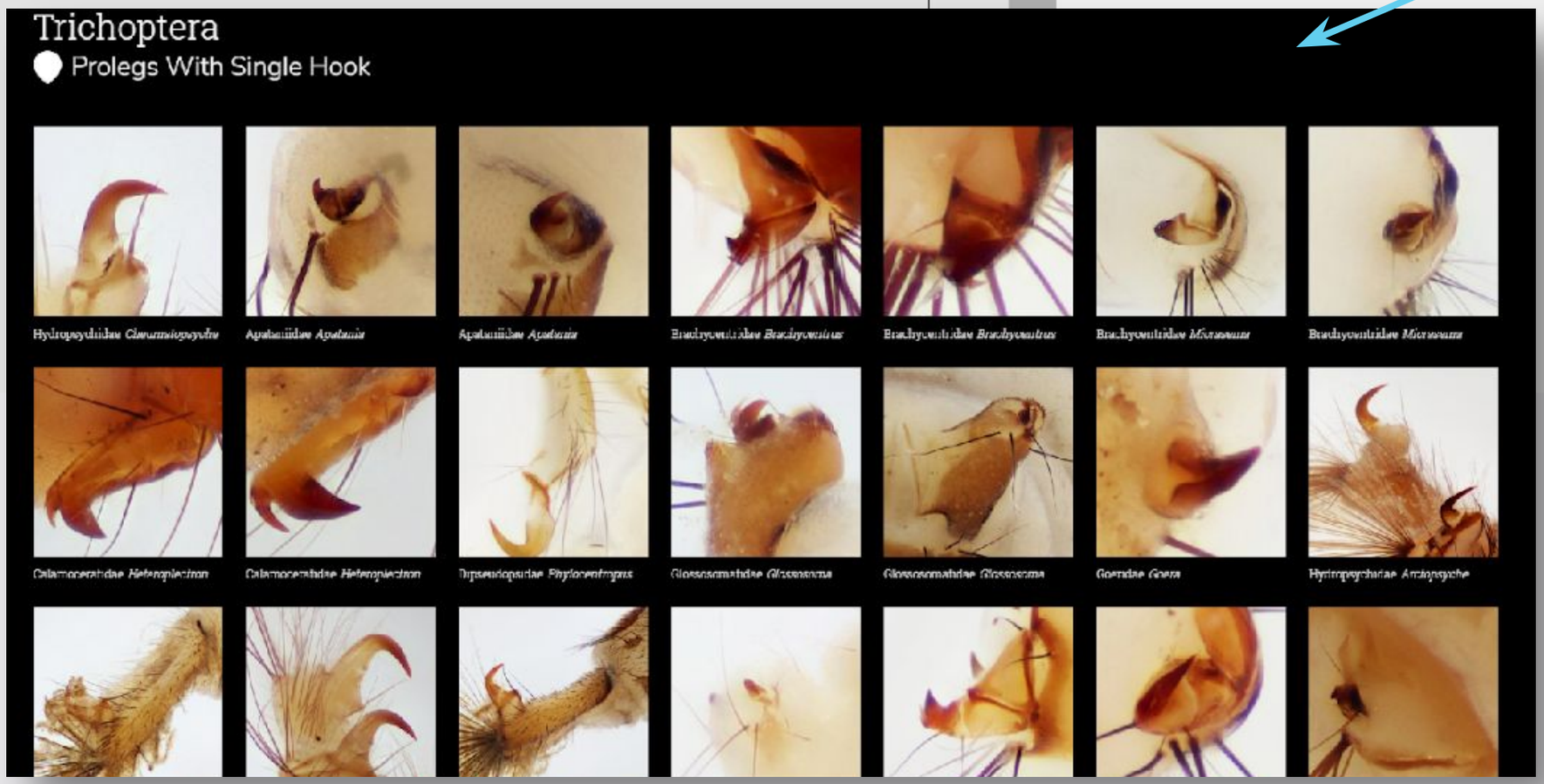
Arctopsyche

Diagnostic Characters

ORDER



Prolegs With Single Hook



Commonly Misidentified Taxa



Stoneflies



Mayflies



Dragonflies



Damselflies



Planaria



Leeches



Aquatic Worms



Crane Flies

Midge Flies

Black Flies

Watersnipe Flies



Riffle Beetles



Caddisflies



Midge Flies



Gilled Snail



Lunged Snail



Alderflies



Fishflies /Dobsonflies



Scuds



Sowbugs

The Atlas of Common Freshwater
www.Macroinvertebrates.org
of Eastern North America

Group 1 Taxa: **Pollution Sensitive!**

- Require **High** Levels of Dissolved Oxygen
- Found in **Good** Quality Water



Mayfly Nymph



Stonefly Nymph



Riffle Beetle (adult/larva)



Water Penny Larva



Caddisfly Larva
(non-Hydropsychidae)



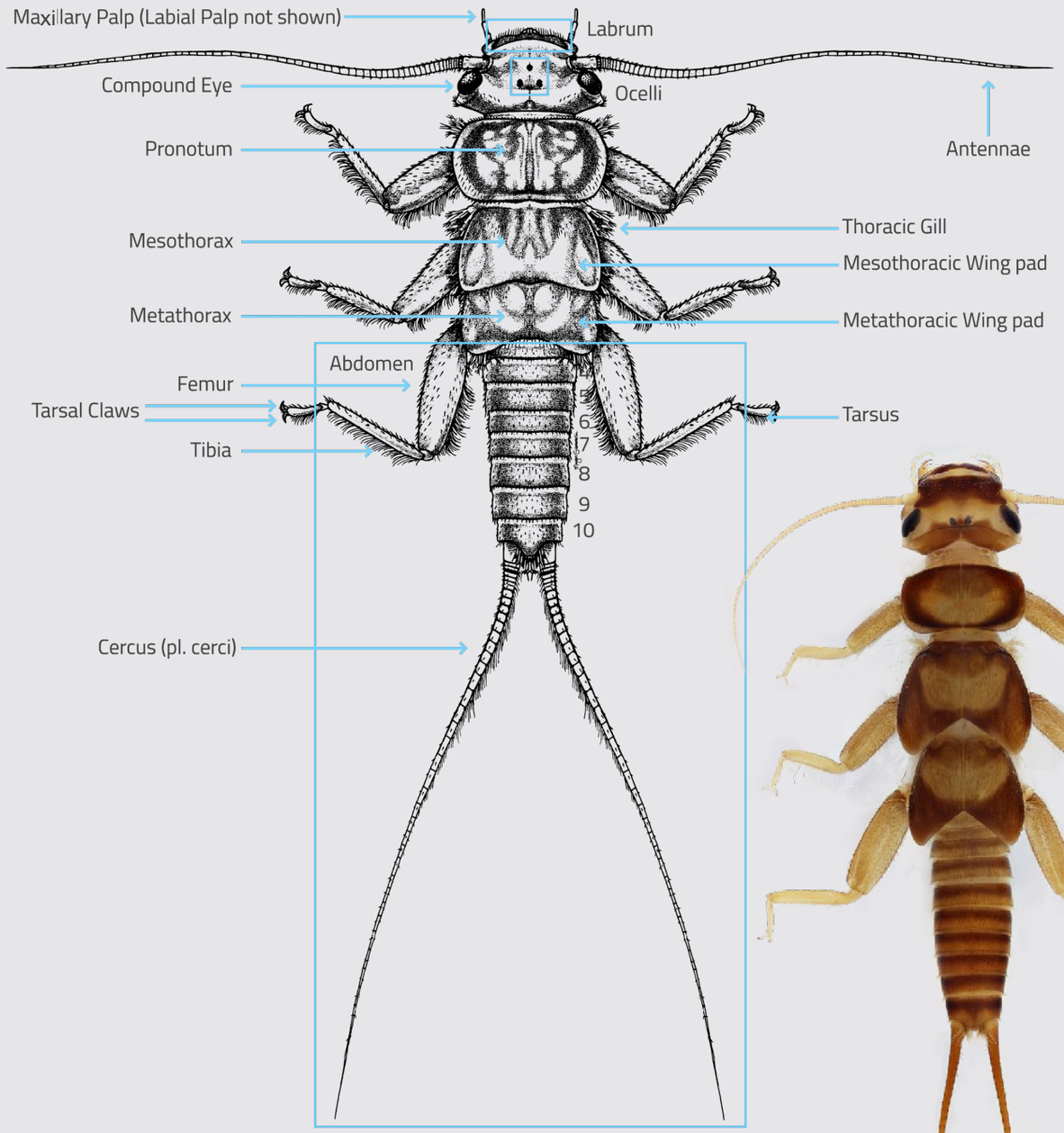
Watersnipe Fly Larva



Right-handed /
Gilled Snail

Stonefly Nymph | **Plecoptera**

- 9 families, 780 species
- **½ to 1½ inches** in length (not including tails)
- Yellow to brown in color
- Stonefly nymphs <u>always</u> have **2 tails, prominent antennae, and 2 claws at the end of each leg**
- **Two sets of wing pads** (seen better after molting)
- Some with **branched gills** between legs on underside of body
- Prefer **cold, swift-moving streams**.
- Streamlined, flattened bodies enable them to move about rocky streambeds in rapid currents



Similar to Mayfly

Group 1: **Pollution Sensitive**

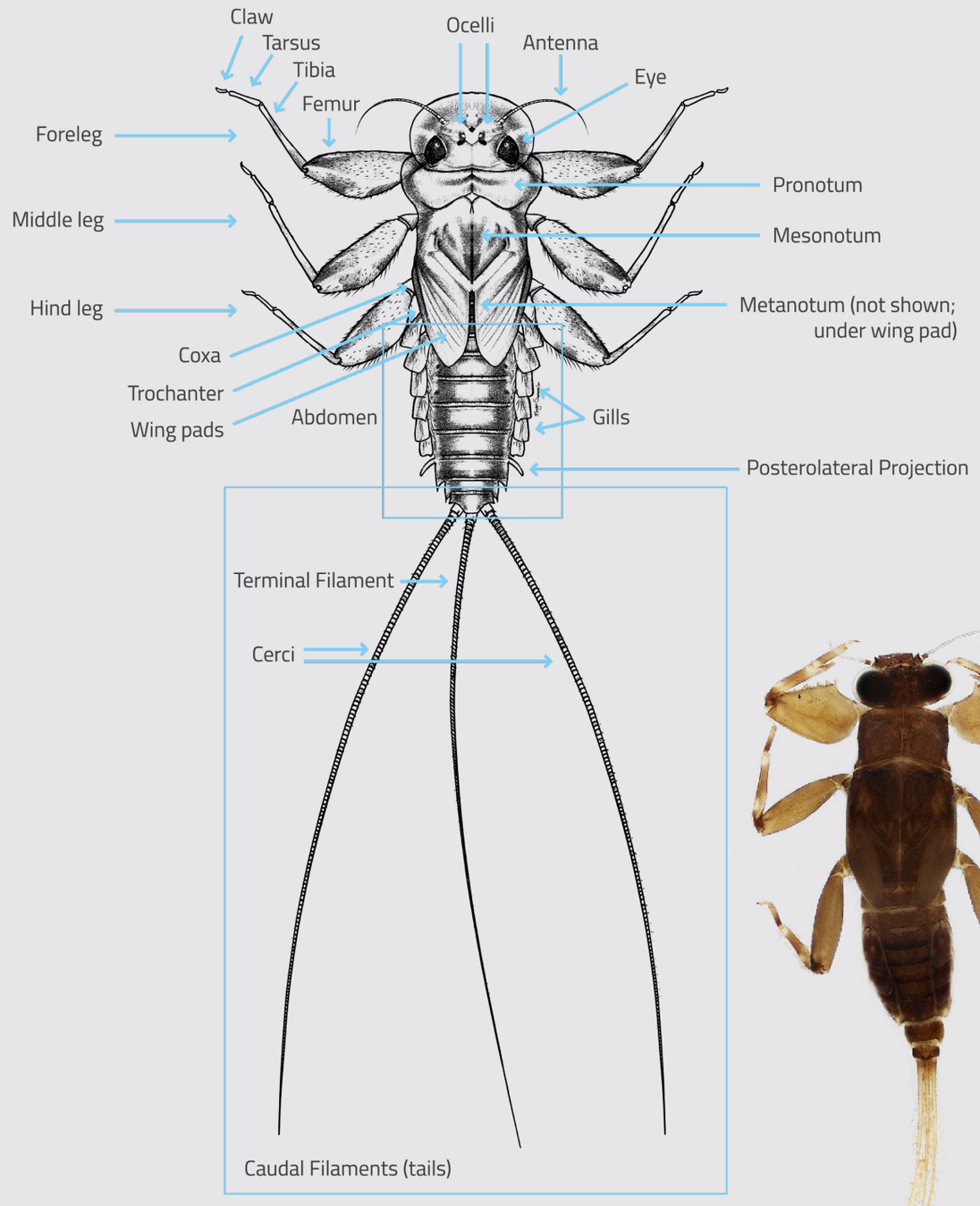

Plecoptera
Two Tails
Taeniopterygidae Taeniopteryx
Taeniopterygidae Taeniopteryx
Capniidae Allocapnia
Chloroperlidae Alloperla
Perlidae Acroneuria
Perlidae Agnetina
Perlidae Neoperla
Perlidae Paragnetina


Plecoptera
Two Tarsal Claws
Taeniopterygidae Taeniopteryx
Taeniopterygidae Taeniopteryx
Capniidae Allocapnia
Chloroperlidae Alloperla
Perlidae Acroneuria
Perlidae Agnetina
Perlidae Neoperla
Perlidae Paragnetina


Wing Pads
Developing wings or the sheath of a developing wing.

Mayfly Nymph | **Ephemeroptera**

- Up to ¾ **inch** in length (not including tails)
- **Slender antennae, gills on abdomen, one tarsal claw**
- **May be minnow-like** with a <u>vertically-oriented head</u> and three tails (pictured) —or— **may be more flattened** with a <u>horizontally-oriented head</u> and two tails
- **Two rows of long hairs present on inside of front legs**, used for filtering food particles from the water (this is for family IDs)



Similar to Stonefly

Group 1: **Pollution Sensitive**

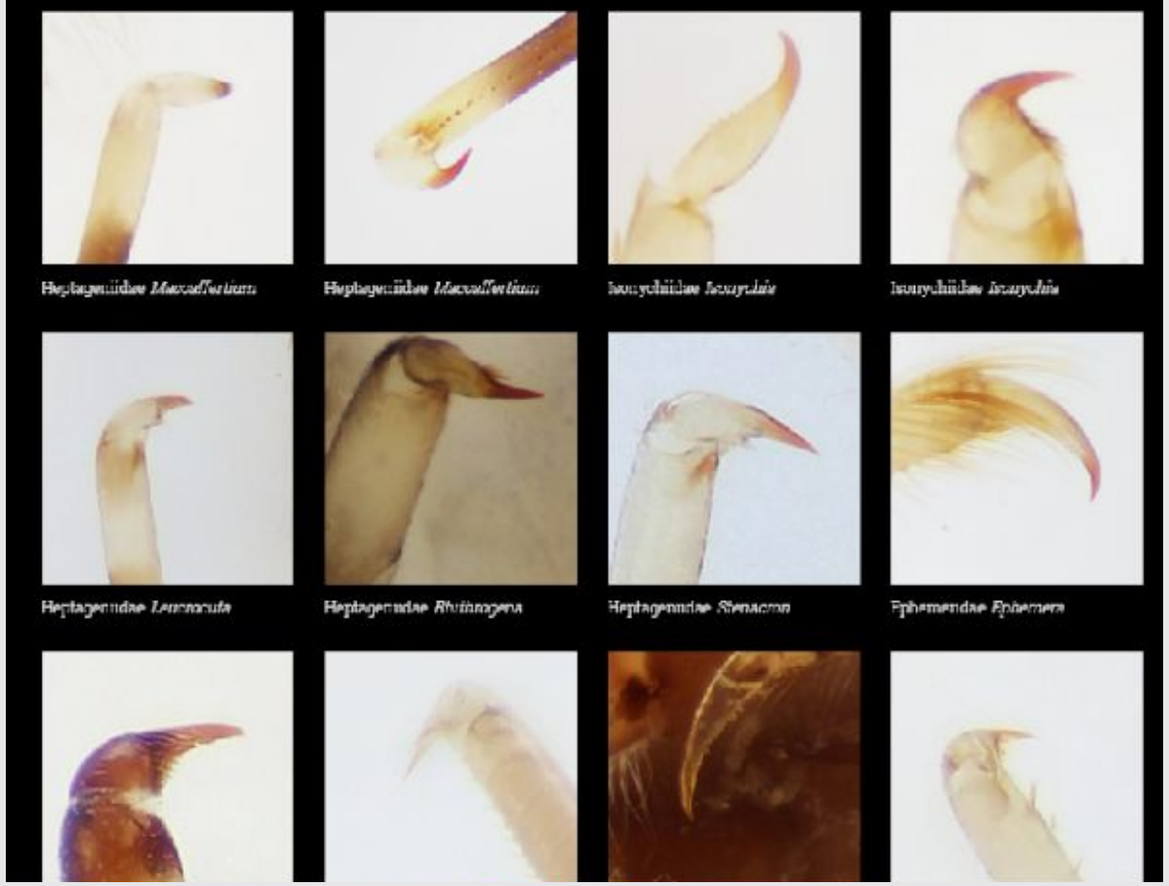
Ephemeroptera

Abdominal Gills



Ephemeroptera

Single Tarsal Claw



Ephemeroptera

Usually 3 Tails

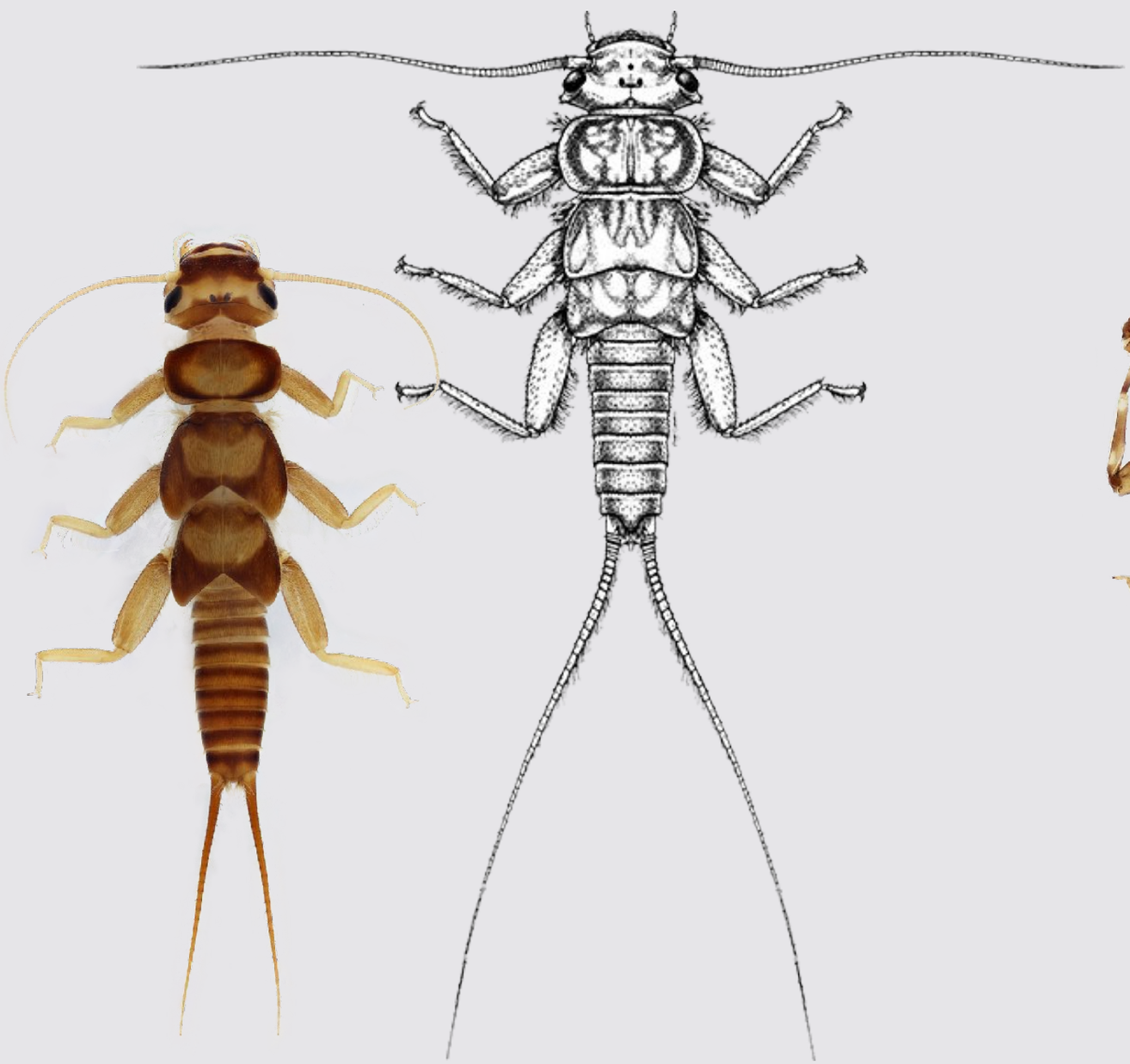


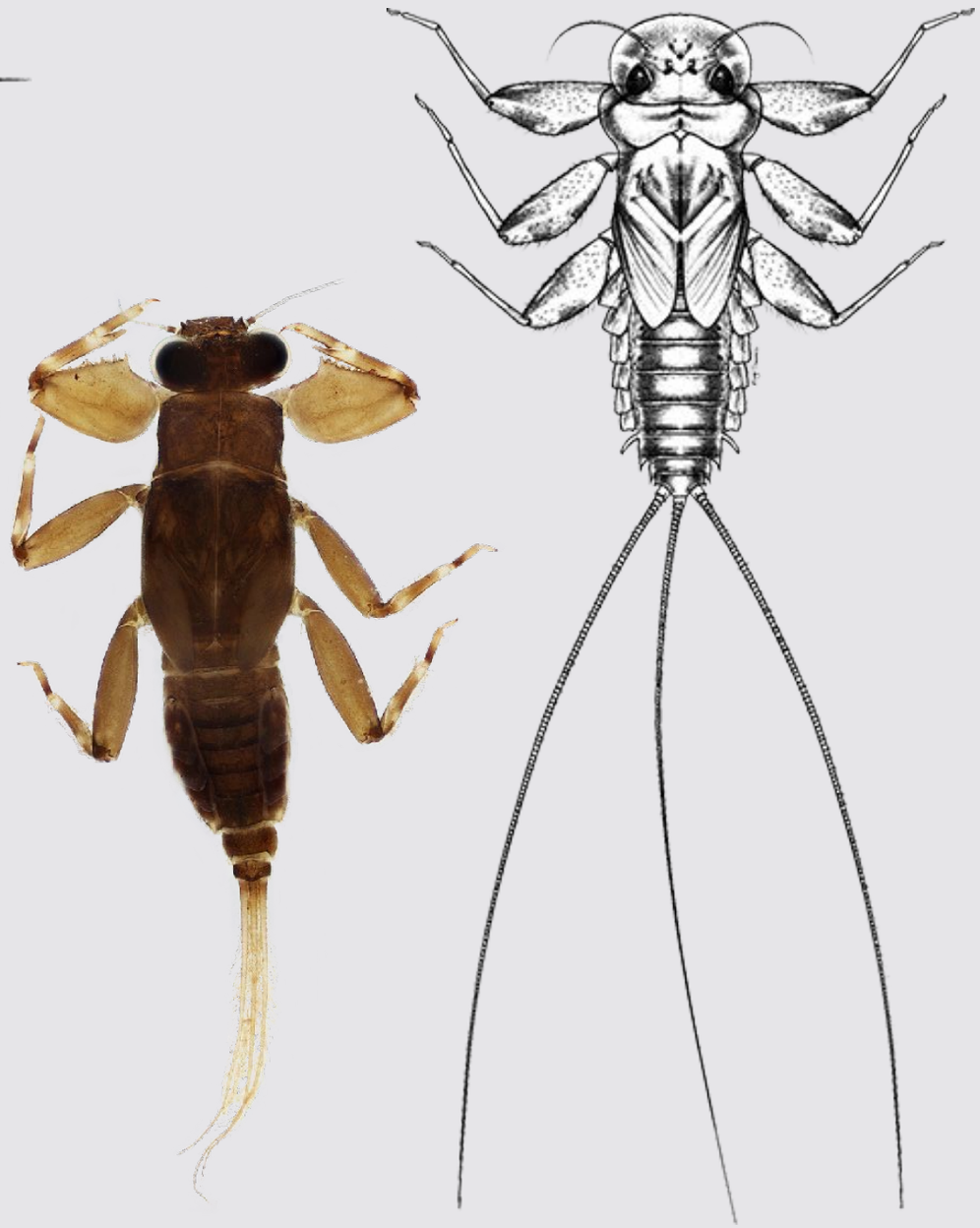
Wing Pads

Developing wings or the sheath of a developing wing.



Stoneflies vs. **Mayflies**





Group 1: Pollution Sensitive

Water Penny Larva | **Coleoptera**

- **¼ inch** in length
- Distinctive **flat, disk-like body**
- **Head and legs not visible** from above
- **6 legs** and most have **branched gills** on underside
- Prefer **cold, fast-moving water**
- **Smooth, flattened bodies** enable them to resist the pull of the current.
- **Usually found on smooth rocks** where they graze on attached algae



Coleoptera: Psephenidae

Group 1: **Pollution Sensitive**

Gilled Snail | **Gastropoda**

- Shell usually **opens on the right**
- **Shell opening covered by a thin plate** (operculum)
- When monitoring, **do not count empty shells!**



Similar to Lunged Snail

Group 1: **Pollution Sensitive**

Caddisfly Larva | **Trichoptera**

***(excluding Hydropsychidae)**

- Up to **1.5 inch** in length
- **Three pairs of legs**
- **Two claws** at <u>posterior</u> end
- **Antennae reduced** and **inconspicuous**
- **Curls up <u>slightly</u>** (not as tight as the common net-spinning caddisfly)
- Some build **distinctive cases** made of sticks, rocks, sand, plant material, other debris
- Some **may not have a case** when found!



Similar to Riffle Beetle Larva, Net-spinning Caddisfly, Midge Fly

Group 1: Pollution Sensitive

Trichoptera

Prolegs With Single Hook



Hydropsychidae *Cheumatopsyche*



Apataniidae *Apatania*



Apataniidae *Apatania*



Brachycentridae *Brachycentrus*



Calamoceratidae *Heteroplectron*



Calamoceratidae *Heteroplectron*



Uenoidae *Thylacentrop*









Portable Cases

Structure made of leaves, twigs, or sand that some caddisfly and midge larvae carry with them.





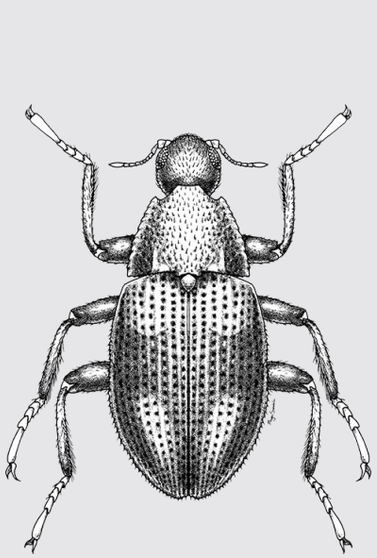




Riffle Beetle | **Coleoptera**

- Includes **adults** and **larvae**
- Measure approximately **1/16 to ¼ inch** in length

(Elmidae)







Adult

- Body small, usually ovular
- Legs are long
- Antennae usually slender
- Do not swim on surface; found under water

Larvae

- Usually no lateral abdominal gills. If gills present, then 4 hooks clustered on segment 10
- Thoracic legs, each usually with 4 or 5 segments, and 1 or 2 claws

Similar to Caddisfly, Midge Fly

Group 1: **Pollution Sensitive**

Riffle Beetles vs. **Caddisflies** Vs. Other **Beetle Larvae**



Group 1: **Pollution Sensitive**

Riffle Beetles vs. **Caddisflies** Vs. Other **Beetle Larvae**



Group 1: **Pollution Sensitive**

Watersnipe Fly Larva | **Diptera**

- Measure ¼ -1 inches in length
- Mostly cylindrical, with the front tapering to a cone-shaped point
- 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



Similar to Crane Fly, Midge Fly and other ‘True Flies’

Group 1: **Pollution Sensitive**

Group 2 Taxa: **Somewhat Sensitive!**

- Require **Moderate** Levels of Dissolved Oxygen
- Found in **Good or Fair** Quality Water



Dragonfly Nymph



Damselfly Nymph



Crane Fly Larva



Aquatic Sowbug



Clams & Mussels



Crayfish



Scud



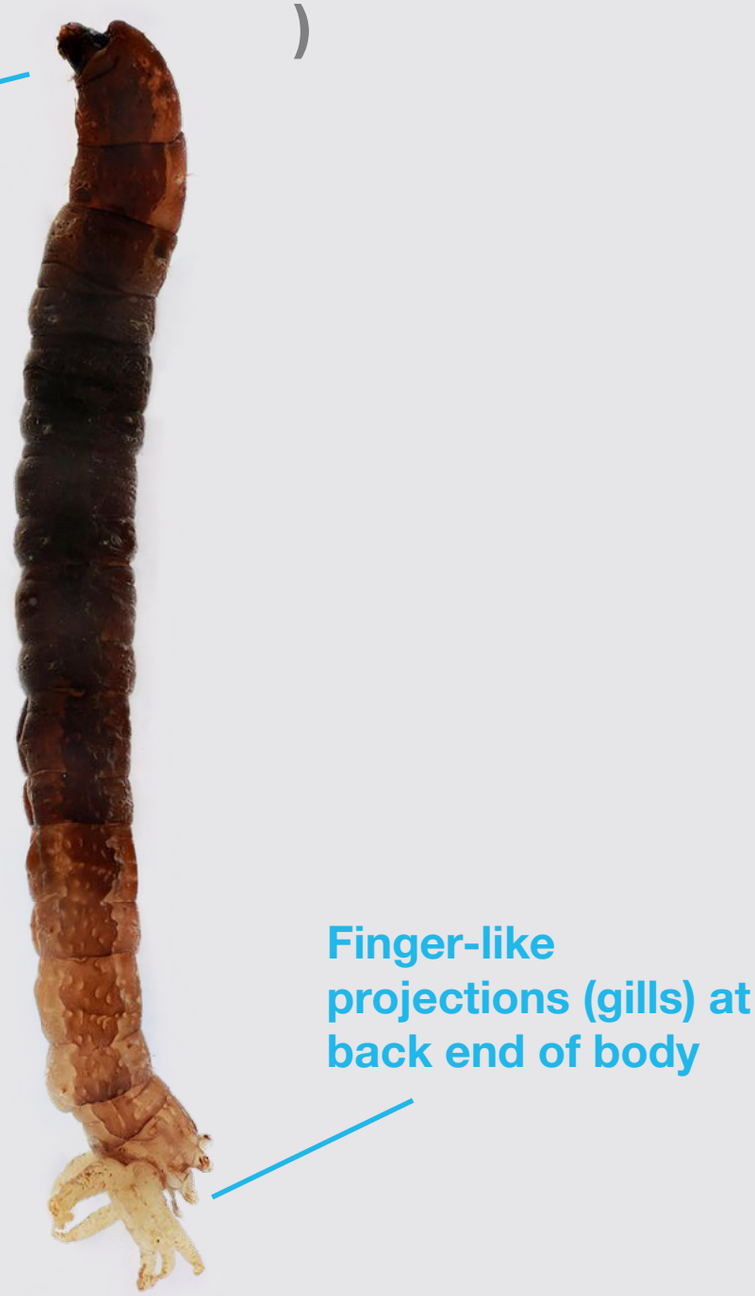
Caddisfly Larva (Net-spinning ones)



Dobsonfly/Fishfly/ Alderfly

Crane Fly Larva | **Diptera**

(Tipulidae)



- Measure 1/3-2 inches in length
- Plump caterpillar-like segmented body
- Milky green to brown color

Similar to Midge Fly, Black Fly, Snipe Fly, Worms

Group 2: **Somewhat Sensitive**

Watersnipe vs. **Crane Flies** vs. **Dance Flies**







Group 2: **Somewhat Sensitive**

Watersnipe vs. **Crane Flies** vs. **Dance Flies**

Front of body tapered to a point

Paired, caterpillar-like prolegs



Two pointed tails with feathery hairs at back end

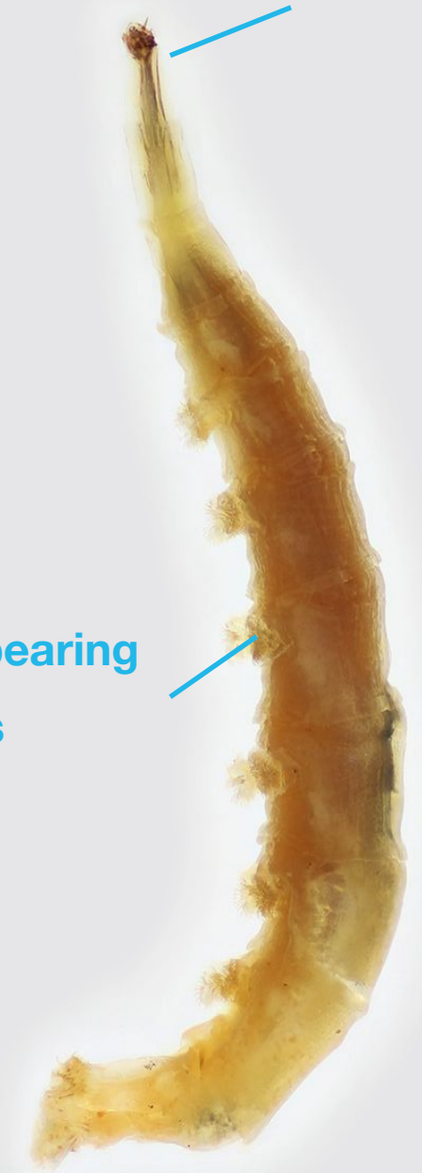
Head is usually pulled back into the front of the body



Finger-like projections (gills) at back end of body

Head exposed

Hook-bearing prolegs



1-4 Rounded lobes on end of abdomen

Group 2: **Somewhat Sensitive**

Clams & Mussels





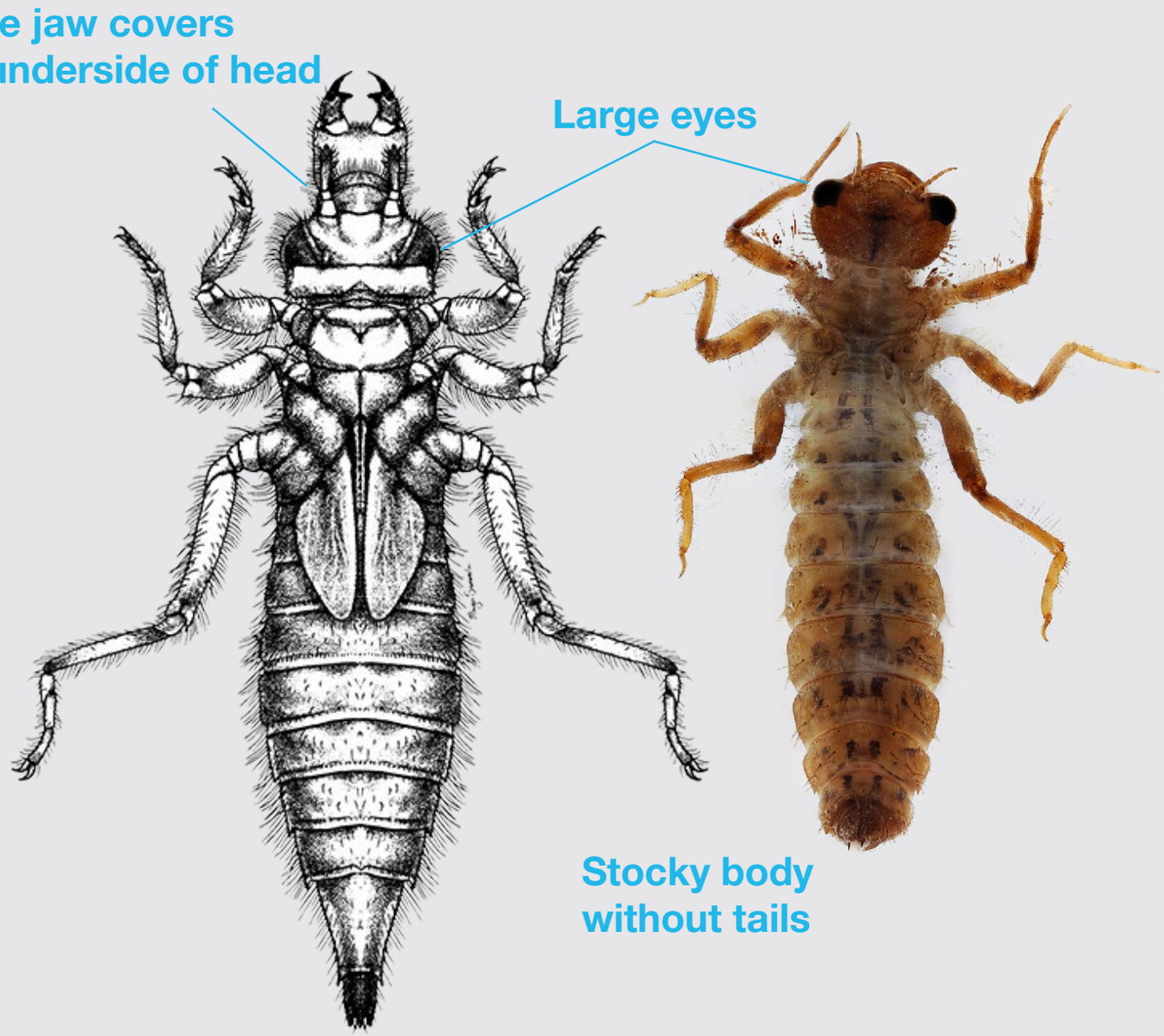
- Fleshy body enclosed between two clamped shells
- If alive, shells cannot be pried apart
- When monitoring, do not count empty shells
- Can be confused with seed pods

Group 2: **Somewhat Sensitive**

Dragonfly Larva | **Odonata**

(Anisoptera)

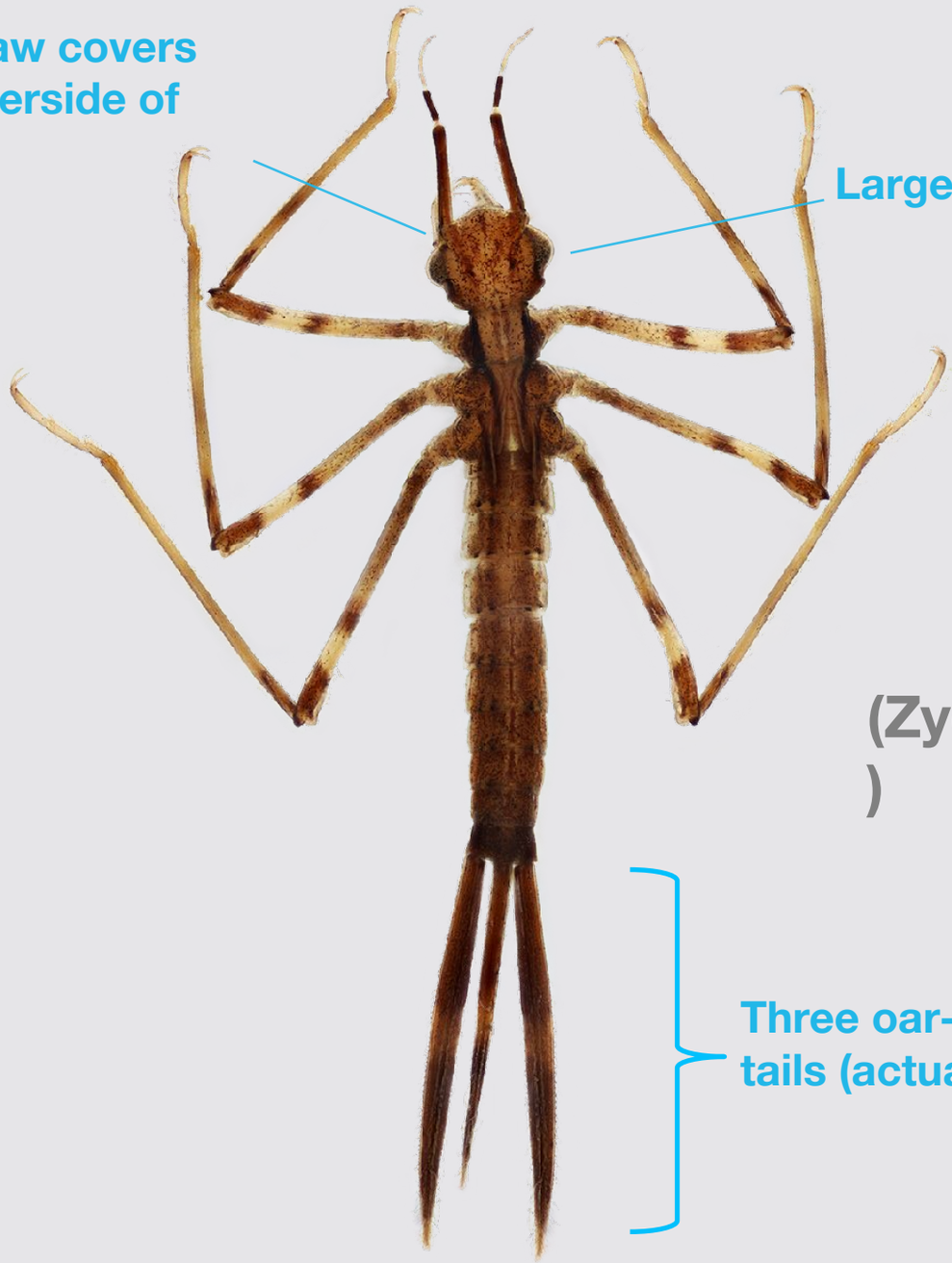
- ½ - 2 inches in length
- **Two** pairs of wing pads
- Large round or oval abdomen
- Abdomen terminates in three small pointed structures
- Prefers cool, still water
- Often found among vegetation and leaf packs or burrowed in sediment



Similar to Mayfly, Stonefly, Damselfly

Group 2: **Somewhat Sensitive**

Damselfly Larva | **Odonata**



- ½ - 1 inch in length
- Abdomen usually more narrow and slender than dragonflies

(Zygoptera)

Similar to Mayfly, Stonefly, Dragonfly

Group 2: **Somewhat Sensitive**

Odonata

Labial Mask



Aeshnidae *Boyeria*



Calopterygidae *Calopteryx*



Coenagrionidae *Argia*



Coenagrionidae *Enallagma*



Gomphidae *Lanthus*



Gomphidae *Ophiogomphus*



Lestidae *Lestes*



Libellulidae *Libellula*

Odonata

Two Pairs of Wing Pads



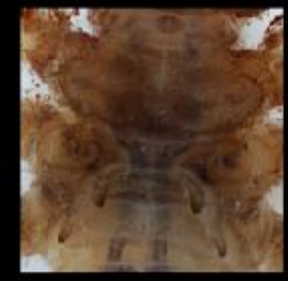
Coenagrionidae *Argia*



Coenagrionidae *Enallagma*



Coenagrionidae *Ischnura*



Corduleg*stridae *Cordulegaster*



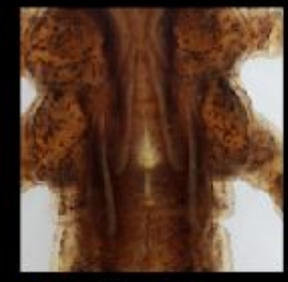
Lestidae *Lestes*



Libellulidae *Libellula*



Aeshnidae *Nasiaeschna*



Calopterygidae *Calopteryx*

Odonata

Abdomen with 5 Sharp Stiff Points or 3 Gills



Coenagrionidae *Enallagma*



Coenagrionidae *Argia*



Coenagrionidae *Ischnura*



Cordulegastridae *Cordulegaster*



Corduliidae *Epitheca*



Gomphidae *Lanthus*



Gomphidae *Ophiogomphus*



Lestidae *Lestes*



Libellulidae *Libellula*



Aeshnidae *Nasiaeschna*



Calopterygidae *Calopteryx*

Dragonfly vs. **Damselfly**



Group 2: **Somewhat Sensitive**

Dragonfly vs. **Damselfly**



Stocky body without tails, ends with points



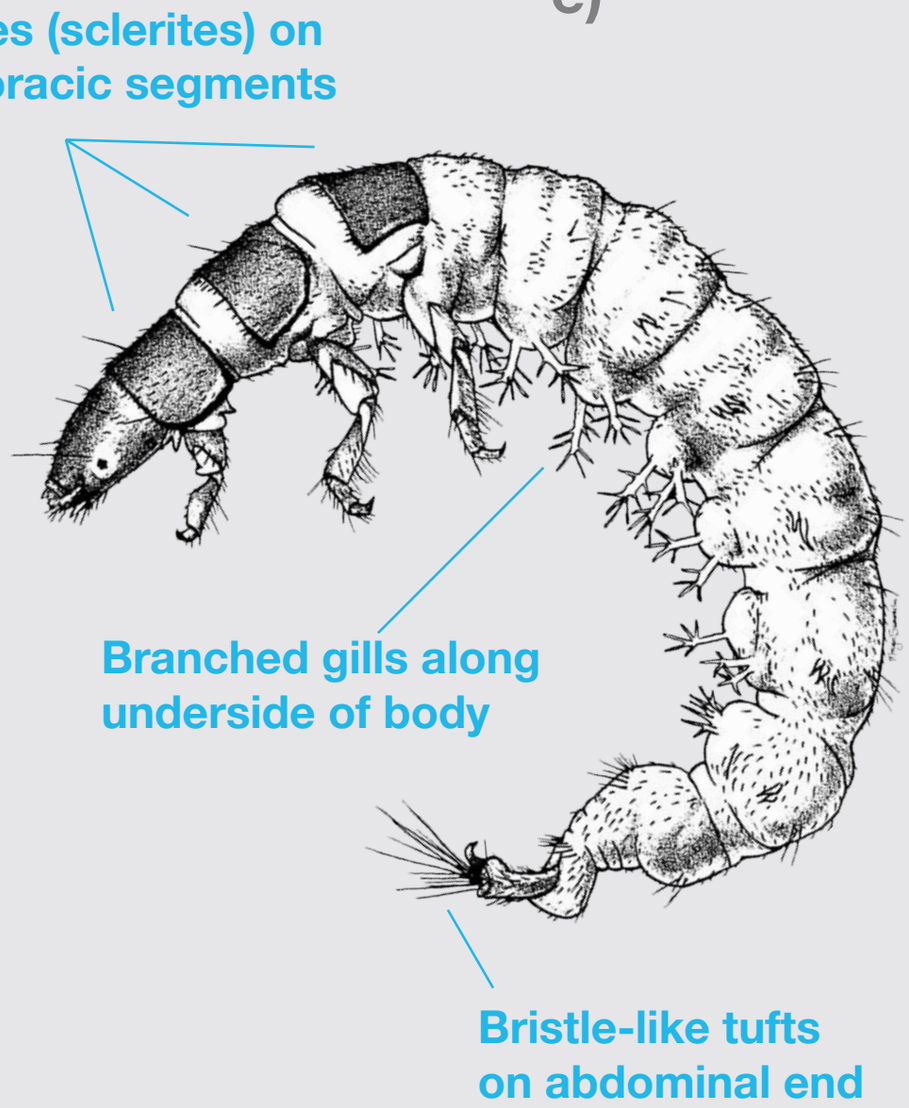
Three oar-shaped tails (actually gills), may break off,

Group 2: **Somewhat Sensitive**

Netspinning Caddisfly | **Trichoptera**

(Hydropsychidae)

- Body is caterpillar-like with **three** pairs of legs
- Body is strongly curved
- Three dark plates on the dorsal side of the thorax
- Gills on the underside of the abdomen
- Setal Fan on prolegs (each proleg with a single hook)



Similar to Riffle Beetle Larva, Case-making Caddisfly

Group 2: **Somewhat Sensitive**

Trichoptera Hydropsychidae

Setal Fan On Prolegs



Chrematopsyche *Arctopsyche* *Diplectrona* *Hydropsyche* *Macrostemum*

Trichoptera Hydropsychidae

Ventral Branched Abdominal Gills



Chrematopsyche *Hydropsyche* *Arctopsyche* *Diplectrona* *Macrostemum*

Trichoptera Hydropsychidae

All Nota Sclerotized



Chrematopsyche *Arctopsyche* *Diplectrona* *Hydropsyche* *Macrostemum*

Trichoptera

Prolegs With Single Hook



Hydropsychidae *Chrematopsyche* Apataniidae *Apatania* Apataniidae *Apatania*

Calamoceratidae *Heteroplectron* Calamoceratidae *Heteroplectron* Dipseudopsidae *Phylocentropus*

Comparing Caddisflies





Group 2: **Somewhat Sensitive**

Dobsonfly & Fishfly Larva | **Megaloptera**

(Corydalidae)

- Measure 3/4 - 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 (a.k.a. hellgrammites) are usually found on the underside of large rocks in cool, slow-moving streams
- Handle Dobsonflies carefully larger ones may deliver a painful pinch!



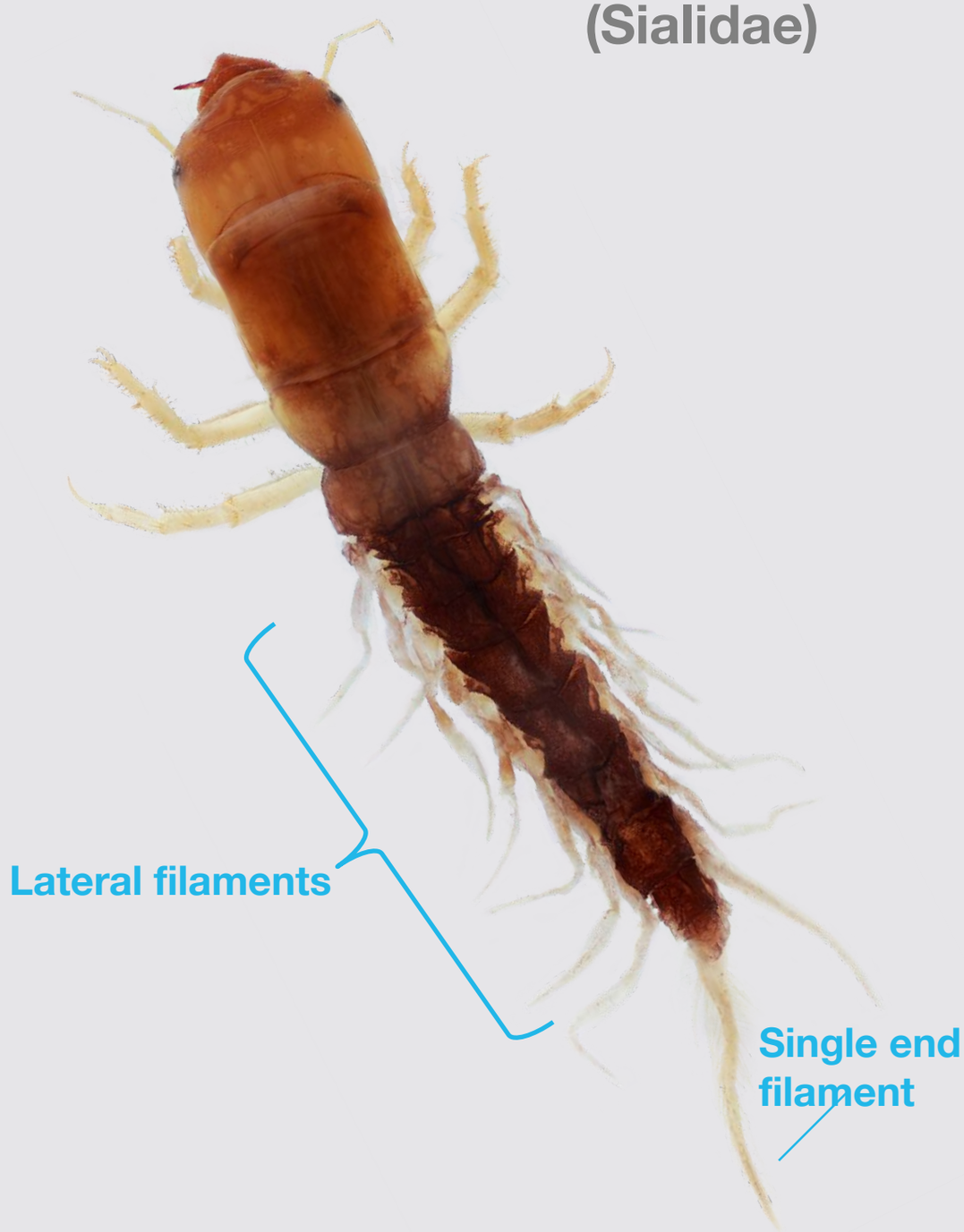
Similar to Alderfly

Group 2: **Somewhat Sensitive**

Alderfly Larva | **Megaloptera**

(Sialidae)

- Closely related and similar looking to hellgrammites
- Lateral filaments along the abdomen
- Body ends with a single hairy filament



Similar to Fishfly / Dobsonfly

Group 2: **Somewhat Sensitive**

Megaloptera

- 1 Tail or 2 Prolegs



Corydalidae *Nigronia*



Sialidae *Sialis*

Megaloptera

- Lateral Filaments



Sialidae *Sialis*



Corydalidae *Nigronia*

Dobsonfly/Fishfly vs. **Alderfly**





Group 2: **Somewhat Sensitive**

Dobsonfly/Fishfly vs. **Alderfly**





Group 2: **Somewhat Sensitive**

Crayfish | **Decapoda**



- Measure up to 6 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.

Similar to Scud, Sowbug

Group 2: **Somewhat Sensitive**

Scud | **Amphipod**

- Measure 5-20 mm 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



Similar to Crayfish, Sowbug

Group 2: **Somewhat Sensitive**

Aquatic Sowbug | **Isopoda**

- Measure 5-20 mm in length
- Clear whitish to pink in color
- Dorsoventrally flattened (top to bottom).
- Seven pairs of legs, the first are modified for grasping
- Found in shallow freshwater on rocks or detritus



Similar to Crayfish, Scud

Group 2: **Somewhat Sensitive**

Scud vs. **Sowbug**





Group 2: **Somewhat Sensitive**

Group 3 Taxa: **Pollution Tolerant**

- Tolerate **Low** Levels of Dissolved Oxygen
- Found in **Any** Quality Water



Aquatic Worm



Planaria



Leech



Black Fly Larva



Midge Fly Larva



Left-Handed Snail

Midge Fly Larva | **Diptera**

- Measure up to 1- 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



Similar to Riffle Beetle Larva, Caddisfly Larva, Crane Fly, Worm, Leech

Group 3: **Pollution Tolerant**

Black Fly Larva | **Diptera**

- Measure to 1/2 inch in length
- Abdomen terminates in an attachment disc
- Black Fly larva prefer cold running water
- Usually found attached by the end of their abdomens to rocks, woody debris, or vegetation in the currents of rivers and streams



(Simuliidae)

Similar to Riffle Beetle Larva, Caddisfly Larva, Crane Fly, Worm

Group 3: **Pollution Tolerant**

Midge Fly vs. **Black Fly**



Group 3: **Pollution Tolerant**

Midge Fly vs. **Black Fly**



Posterior prolegs

Head contains fan-like mouth brushes

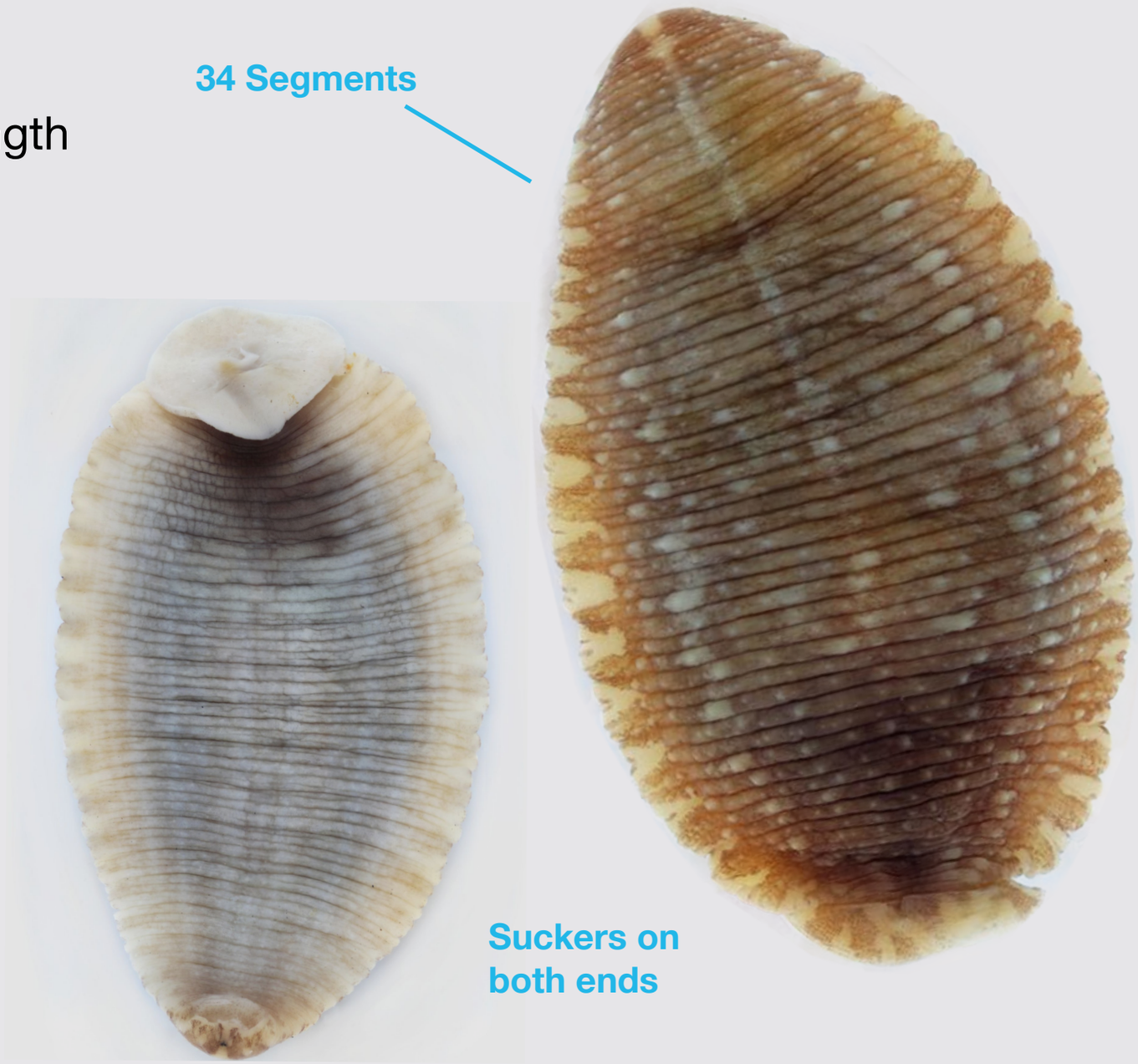


Body is larger at the rear end, similar to a bowling pin

Group 3: **Pollution Tolerant**

Leech | **Annelida**

- Measures 1.0 mm to 5.0 cm in length
- Segmented
- Typically dorsoventrally flattened
- Soft and muscular
- No legs
- Two distinct suction discs on the bottom of the body, at each end
- Leeches are common in warm protected waters of lakes, ponds, streams, and marshes



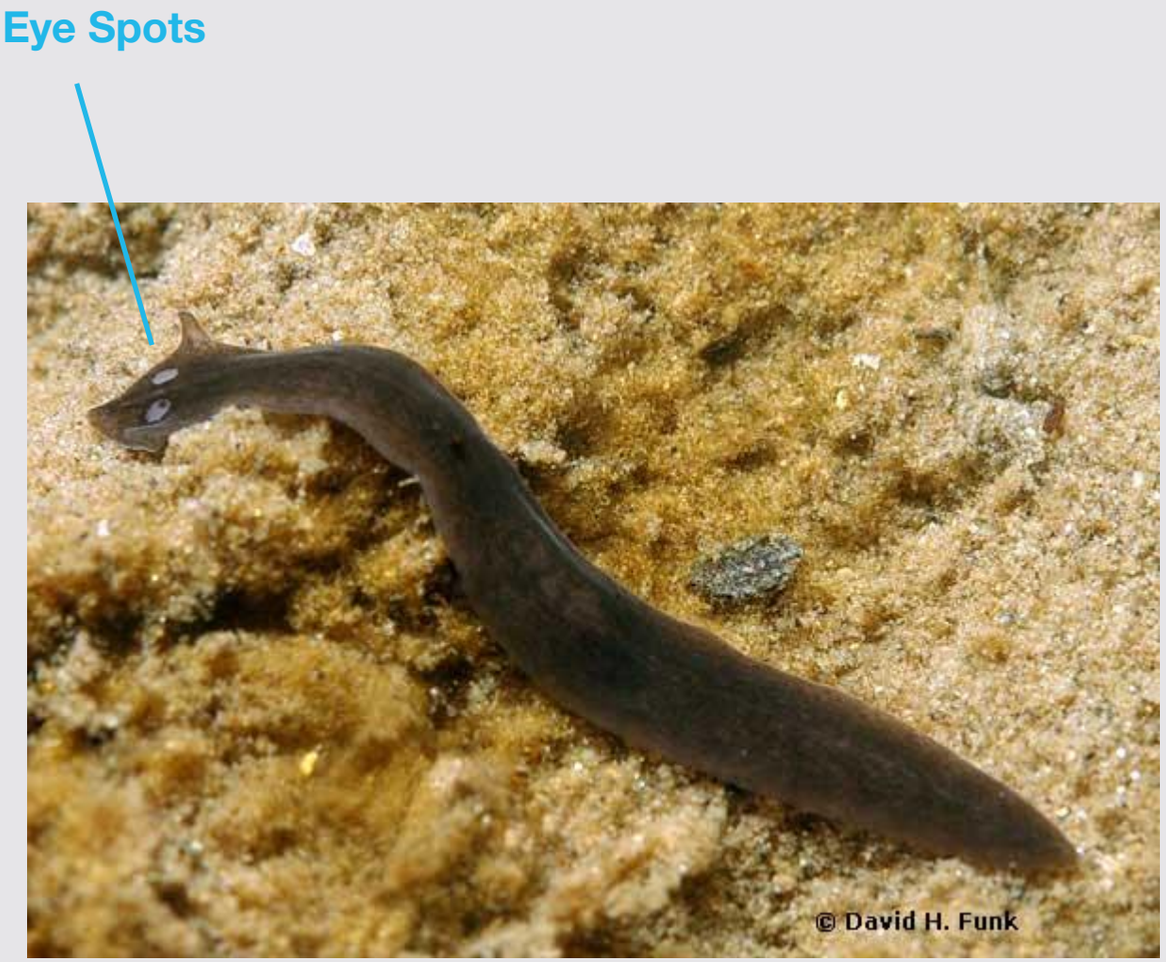
Similar to Planaria

Group 3: **Pollution Tolerant**

Planaria | **Platyhelminthes**

(Turbellaria)

- 200 species in North America
- Measures 5.0 mm to 20.0 mm in length
- Non-segmented body
- Soft body, typically dorsoventrally flattened
- Head somewhat triangular
- Two eyespots
- One opening that functions as both mouth and anus on the underside



Similar to Leech

Group 3: **Pollution Tolerant**

Aquatic Worm | **Annelida**

- Measure 1-30 mm in length, but sometimes over 100 mm
- Clear whitish to pink in color.
- Body consists of 7 to 500 segments.
- Segments often have bristles or hairs
- Found in low oxygen, silty substrates and among debris or detritus in ponds, lakes, streams and rivers
- Approximately 200 species in North America



Naididae (naidid worms)



Nematoda



Oligochaeta (aquatic earthworms)

Similar to Riffle Beetle Larva, Midge Larva, Leech

Group 3: **Pollution Tolerant**

Lunged Snails | **Gastropoda**

- Shell usually opens to the **left** when **pointed end is up**
- Breathes air
- No operculum
- When <u>monitoring</u>, **do not count empty shells**!



Similar to Gilled Snail, Clams & Mussels

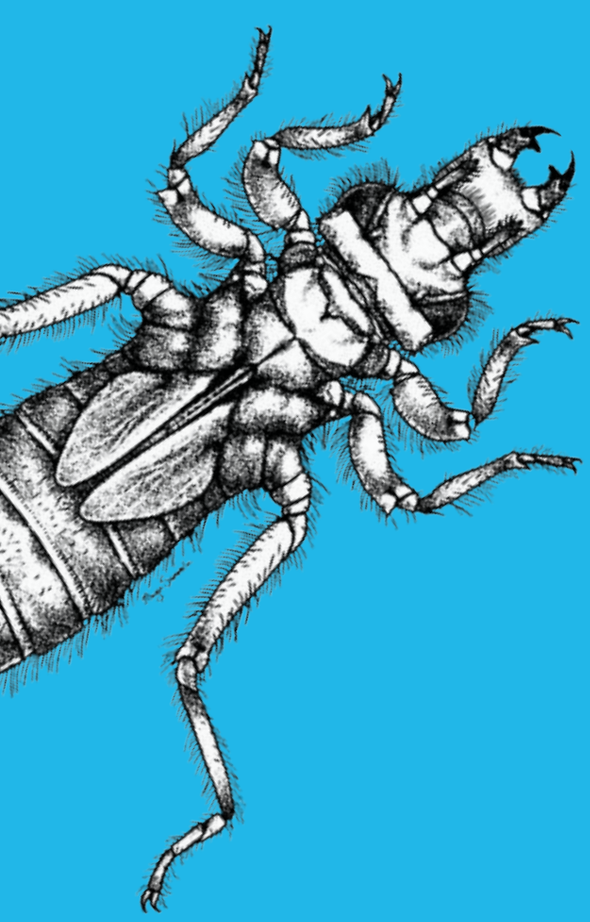
Group 3: **Pollution Tolerant**

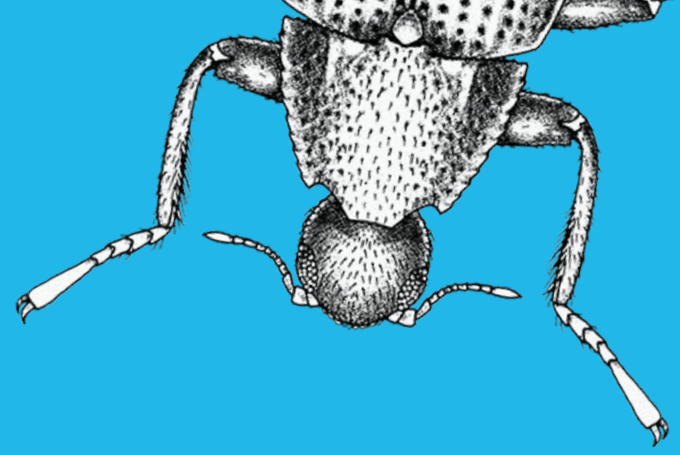
Gilled vs. **Lunged** Snails

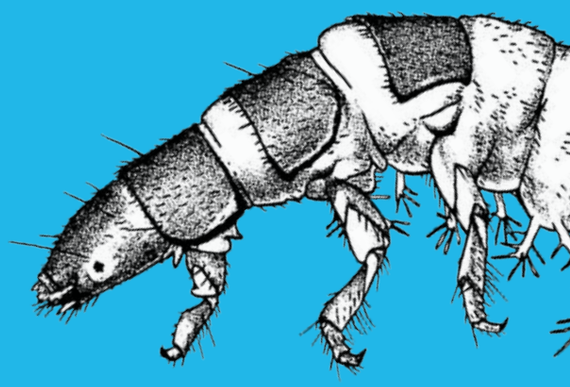




Group 3: **Pollution Tolerant**







Thank you!

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