



Benthic Macroinvertebrate Rapid Identification

With a focus on Mayflies and
Stoneflies

Compiled by Paul Steen for the 2019 MiCorps Conference

A little history of aquatic insects and the MiCorps conference

Rapid Identification Workshops:

- ▶ Mayflies and Stoneflies (2009)
- ▶ Caddisflies (2010)
- ▶ Beetles (2012)
- ▶ Dragonflies and Damselflies, True Bugs (2014)
- ▶ True Flies (2016)
- ▶ Mayflies and Stoneflies (2019)...10th anniversary!

Today's Agenda:

- ▶ Beginner work
 - ▶ Quick review of identification at the required MiCorps level
- ▶ Tips for Mayfly/Stoneflies
- ▶ Practice!

Aquatic Macroinvertebrate Overview

Classification System

	Kingdom- Animalia
	Phylum- Arthropoda, Mollusca, Annelida
MiCorps ID Level	
sometimes {	Class- Insecta (Crustacea, Pelecypoda, Gastropoda, Oligochaeta, Hirundea)
usually {	Order- i.e. Diptera (true flies)
sometimes {	Family- i.e. Tipulidae (crane flies)
	Genus- Do-able but takes a lot of effort.
	Species- Hope you have lots of time and will power.

Group 1: Sensitive

- ___ Caddisfly larvae (Trichoptera)
EXCEPT Net-spinning caddis
- ___ Hellgrammites (Megaloptera)
- ___ Mayfly nymphs (Ephemeroptera)
- ___ Gilled (right-handed) snails (Gastropoda)
- ___ Stonefly nymphs (Plecoptera)
- ___ Water penny (Coleoptera)
- ___ Water snipe fly (Diptera)

Group 2: Somewhat-Sensitive

- ___ Alderfly larvae (Megaloptera)
- ___ Beetle adults (Coleoptera)
- ___ Beetle larvae (Coleoptera)
- ___ Black fly larvae (Diptera)
- ___ Clams (Pelecypoda)
- ___ Crane fly larvae (Diptera)
- ___ Crayfish (Decapoda)
- ___ Damselfly nymphs (Odonata)
- ___ Dragonfly nymphs (Odonata)
- ___ Net-spinning caddisfly larvae
(Hydropsychidae; Trichoptera)
- ___ Scuds (Amphipoda)
- ___ Sowbugs (Isopoda)

Group 3: Tolerant

- ___ Aquatic worms (Oligochaeta)
- ___ Leeches (Hirudinea)
- ___ Midge larvae (Diptera)
- ___ Pouch snails (Gastropoda)
- ___ True bugs (Hemiptera)
- ___ Other true flies (Diptera)

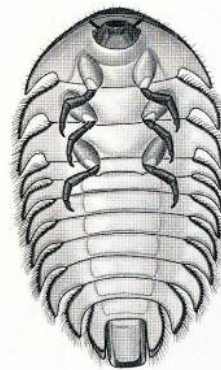


Figure 13.41. Eubriinae larva (ventral)

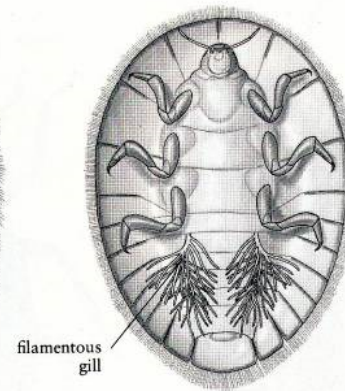


Figure 13.42. Psepheninae larva (ventral)



Figure 13.43. *Psephenus* adult

Water Penny (beetle)

Phylum: Arthropoda
Class: Insecta
Order: Coleoptera
Family: Psephenidae

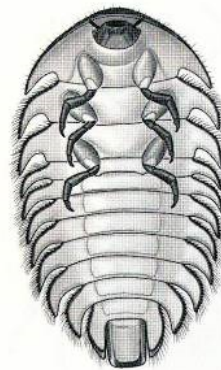


Figure 13.41. Eubriinae larva (ventral)

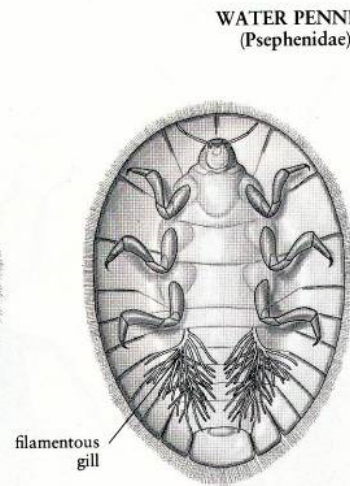


Figure 13.42. Psepheninae larva (ventral)



Figure 13.43. *Psephenus* adult





Mayflies

- 3 tails
- 6 legs
- Feathery or platelike gills on abdomen

- Phylum: Arthropoda
- Class: Insecta
- Order: Ephemeroptera



Figure 14.58. *Dicosmoecus* larval case



Figure 14.59. *Limnephilus* larval case



Figure 14.60. *Limnephilus* larval case

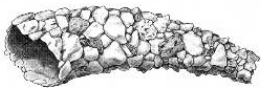


Figure 14.62. *Apatania* larval case

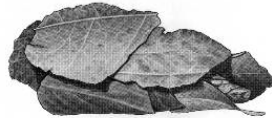


Figure 14.61. *Pycnopsyche* larval case



Figure 14.63. *Neophylax* larval case



Figure 14.64. *Furula* larval case



Figure 14.65. *Manophylax* larval case

Size ranges:

 3 mm



44 mm

Caddisflies



- 3 legs
- Wormlike
- Often with plates on thorax
- Often in a case (sand, leaves, twigs)
- Some types are free-living

- Phylum: Arthropoda
- Class: Insecta
- Order: Trichoptera

Size ranges:

 3 mm



44 mm



Gilled Snail (Right-handed)

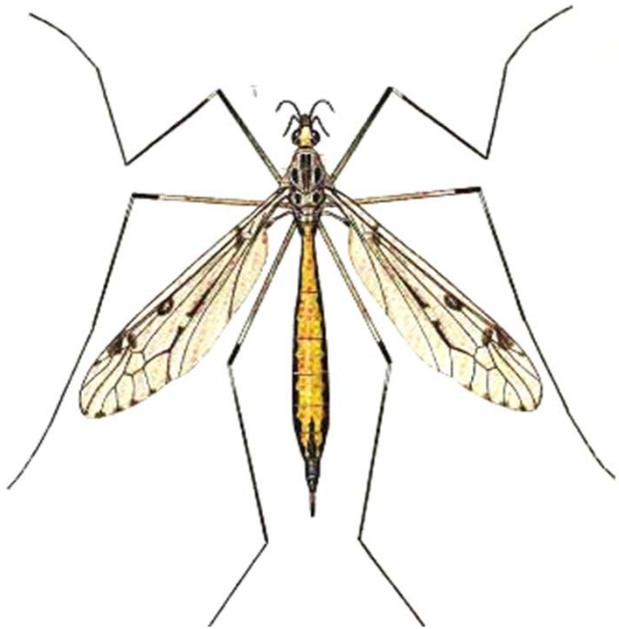
- Phylum: Mollusca
- Class: Gastropoda
- Order: various

- ▶ Have an operculum or plate-like door that protects the opening of the shell and can be quickly closed to avoid predators.
- ▶ Coiled shells that usually open on the right-hand side (coils spin clockwise)
- ▶ Don't collect empty shells— who knows how long that shell has been sitting there, or where it came from?

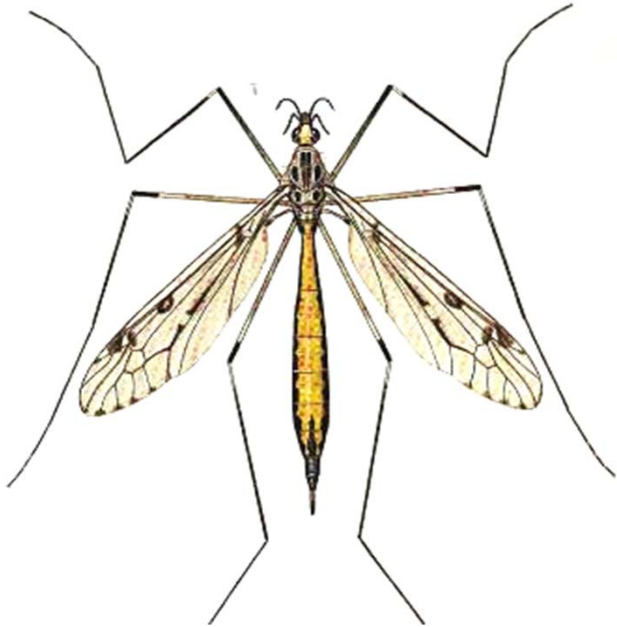


Gilled Snail





Crane Fly



Huge Diversity in sizes
(one useful character:
mandibles on horizontal plane)



Phylum: Arthropoda
Class: Insecta
Order: Diptera
Family: Tipulidae



Crane
fly
Diversity



Hexatoma

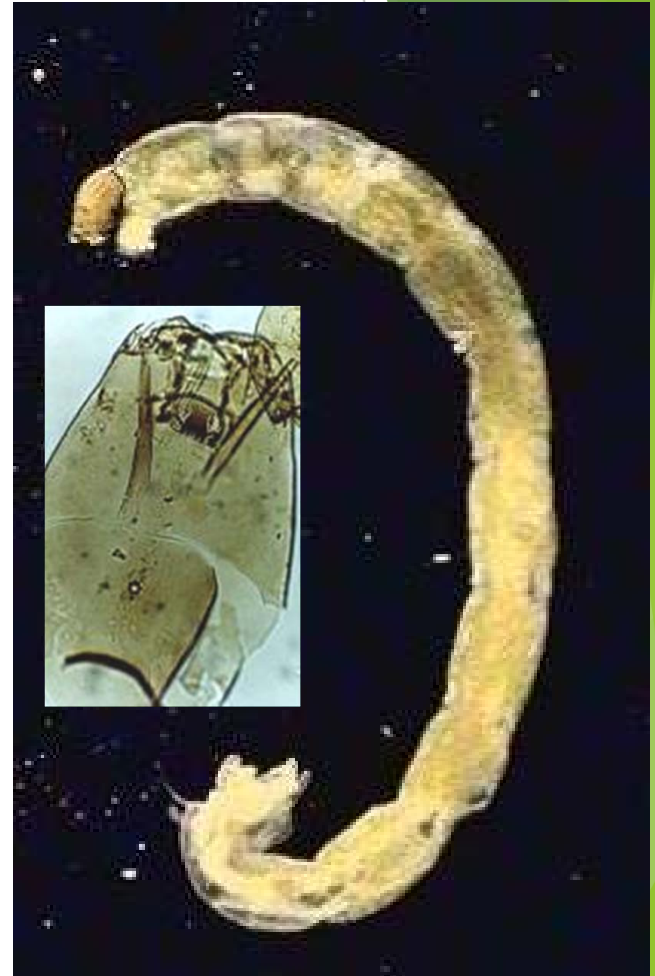
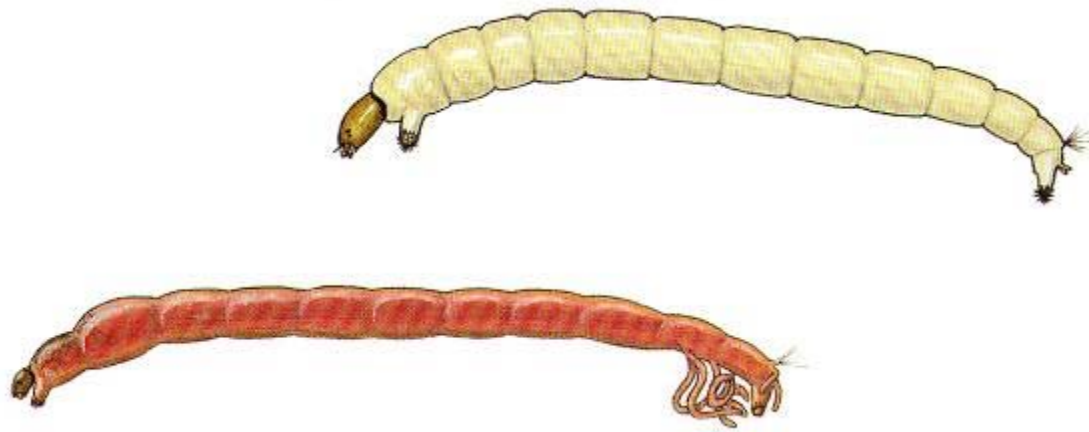


Jason Neuswanger
www.troutnut.com

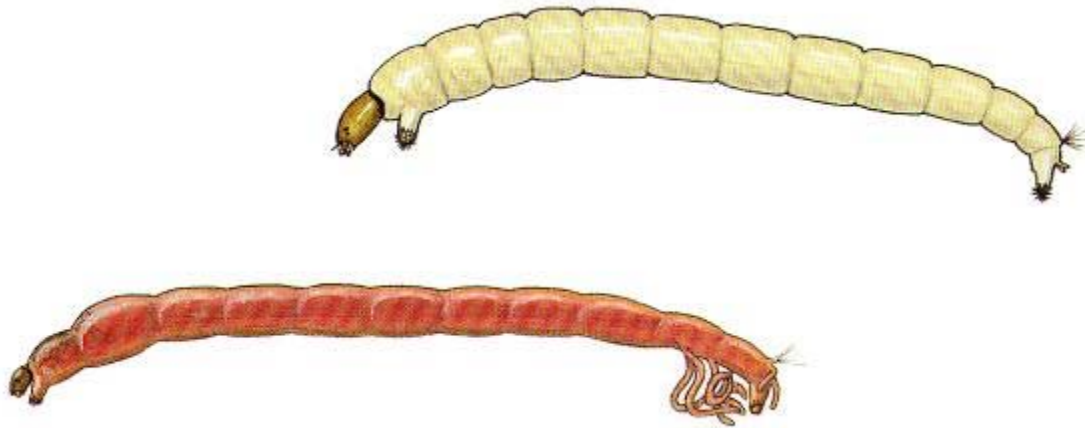
Tipula



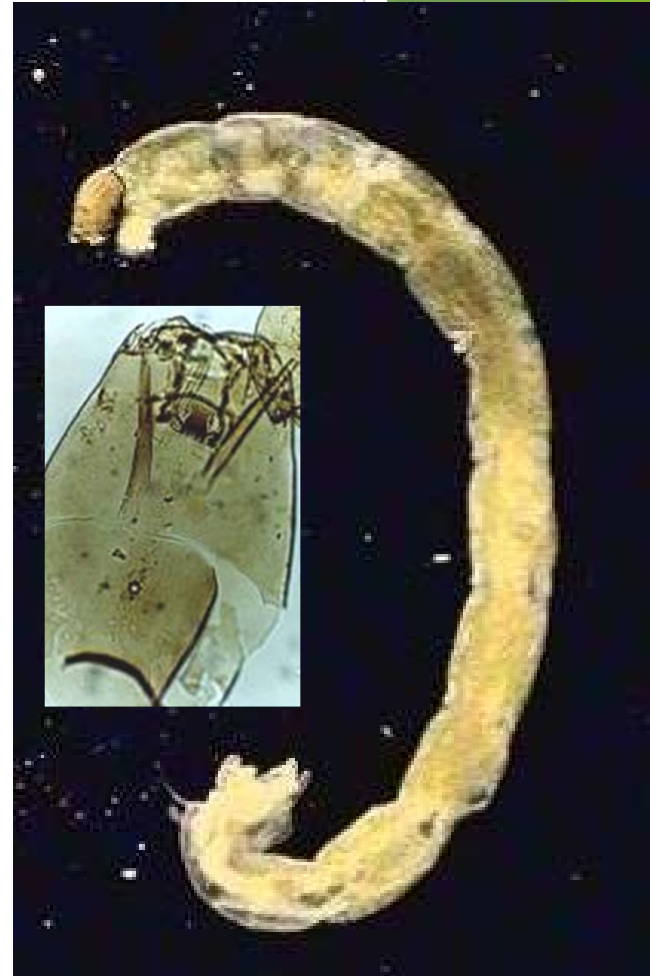
Antocha



Midges

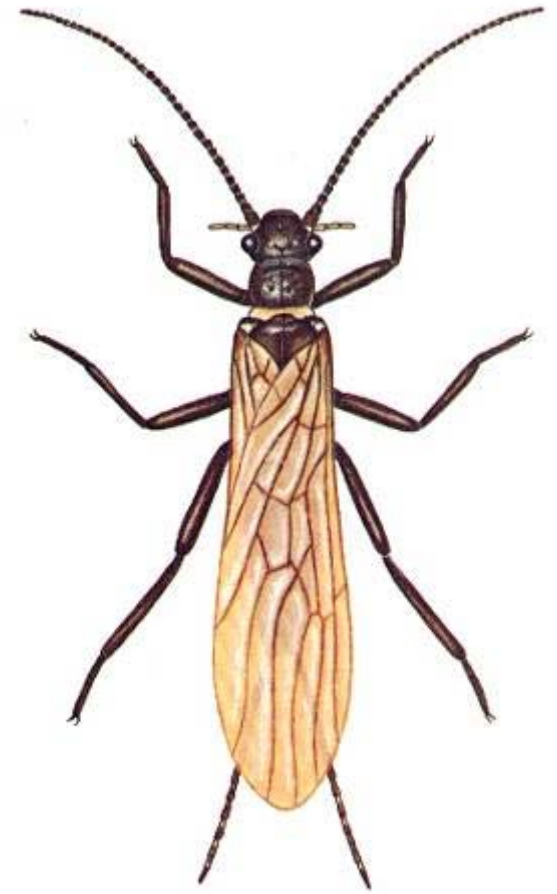


- Phylum: Arthropoda
- Class: Insecta
- Order: Diptera
- Family: Chironomidae





Nymph



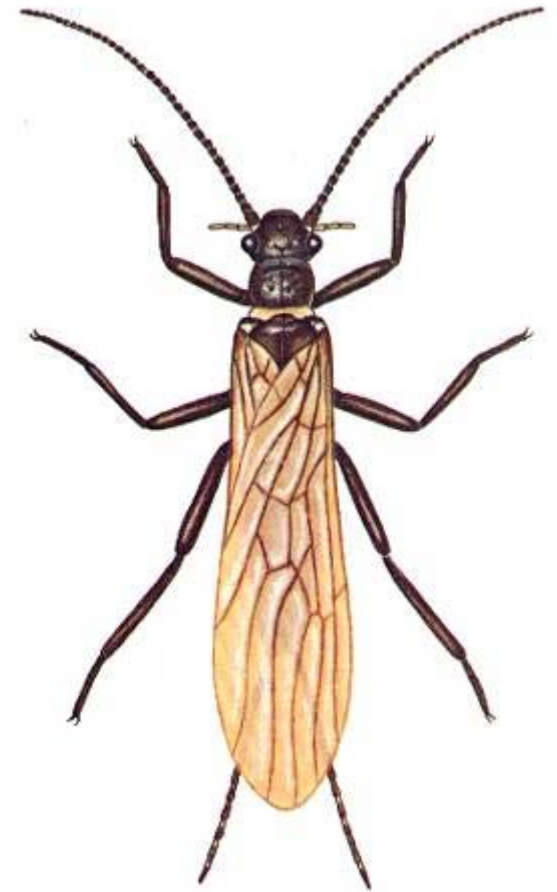
Adult

Stonefly

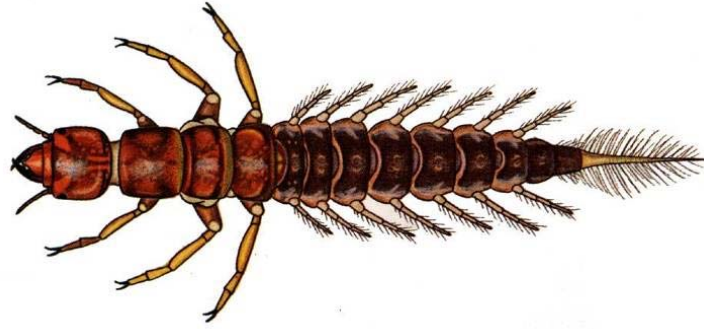
- Phylum: Arthropoda
- Class: Insecta
- Order: Plecoptera
- Two tails
- Long antennae
- 3 pairs of legs
- Sometimes gills are on underside of thorax but never running up and down the top of the abdomen



Nymph



Adult

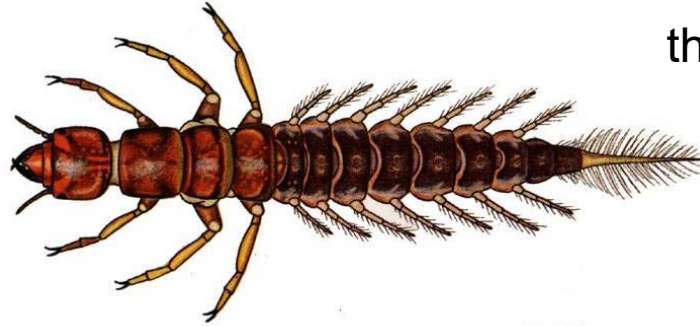


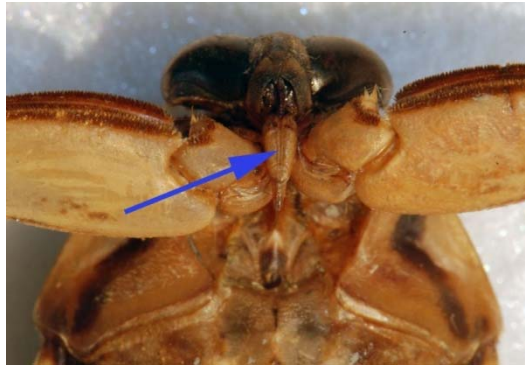
Alderfly

Alderfly

- Family Sialidae Distinct, single tail
- Generally smaller than their cousin, the hellgrammite

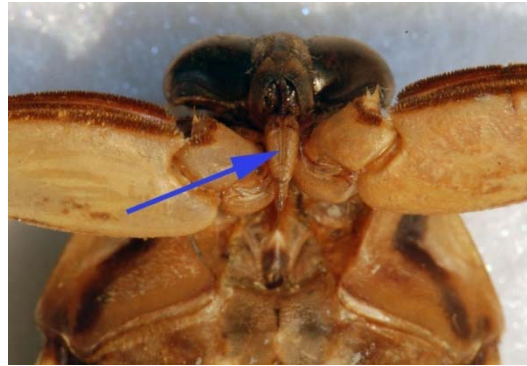
Group 2:
Somewhat
Sensitive



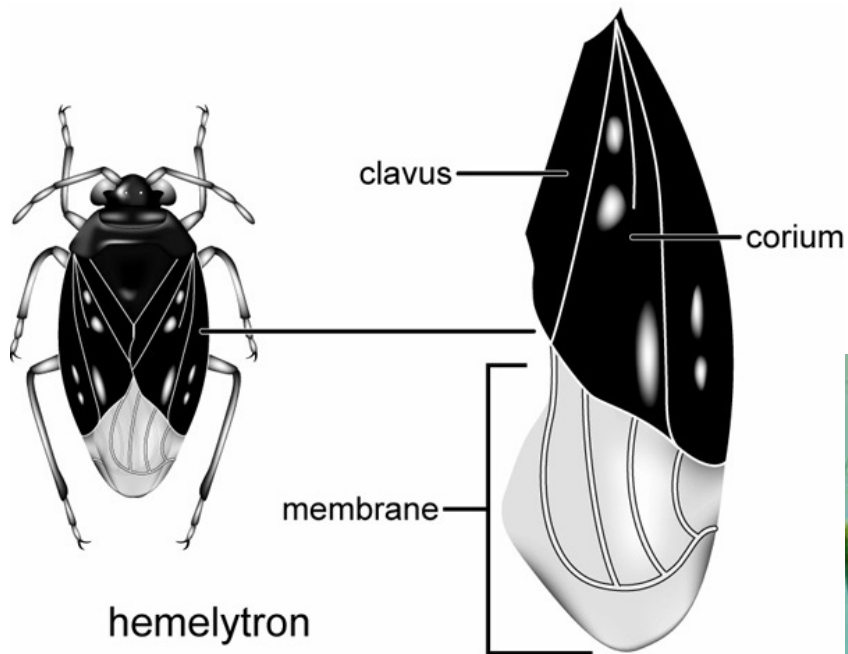


True Bugs

Wings hardened near the base and membranous everywhere else



Tube-like sucking mouthparts
(except in water boatman)



Phylum: Arthropoda
Class: Insecta
Order: Hemiptera



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Beetles

Chewing or biting mouthparts

3 Pairs of legs

Generally well sclerotized

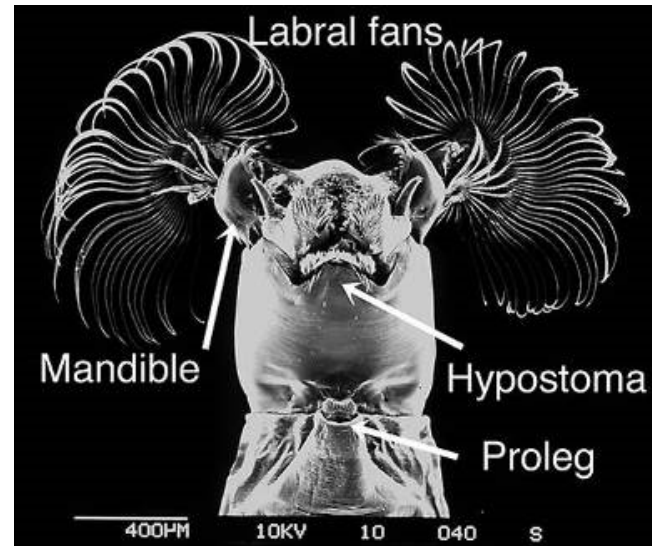


Phylum: Arthropoda

Class: Insecta

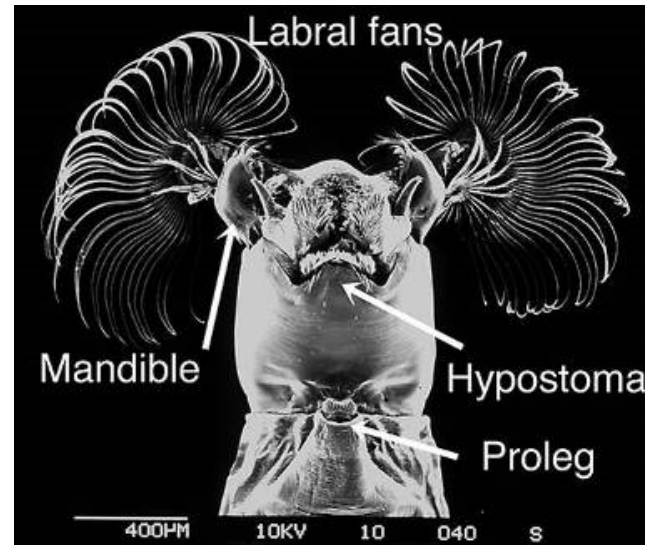
Order: Coleoptera





Black Fly

- Phylum: Arthropoda
- Class: Insecta
- Order: Diptera
- Family: Simuliidae



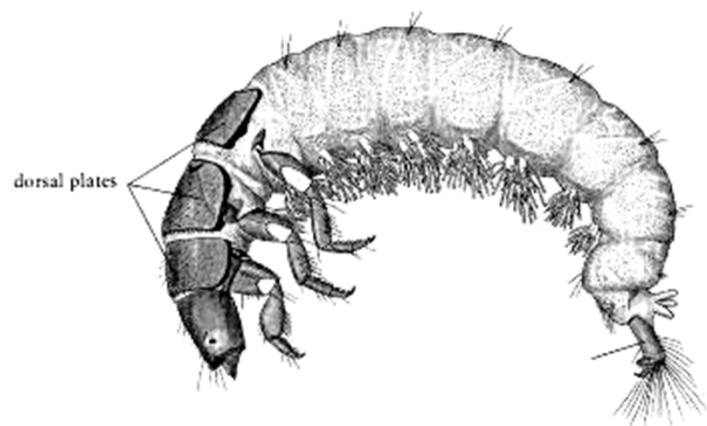


Dragonflies

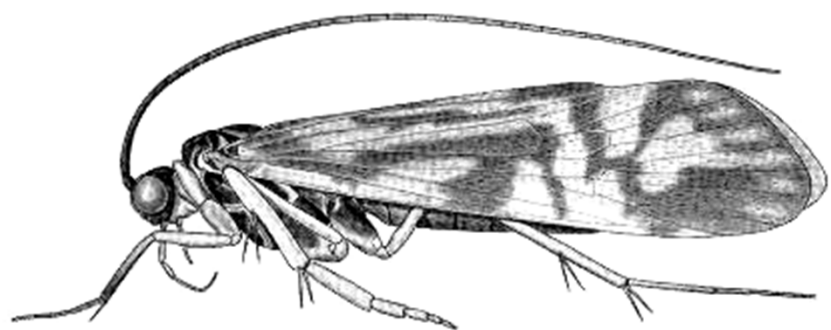
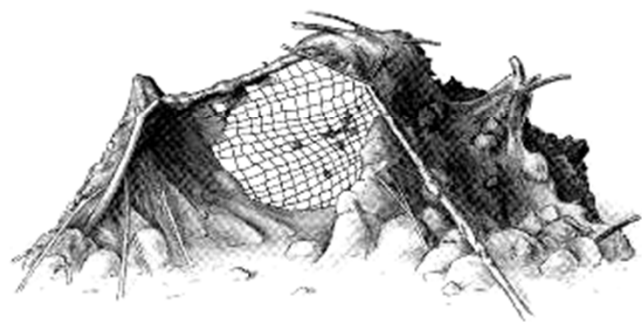


Phylum: Arthropoda
Class: Insecta
Order: Odonata
Suborder: Anisoptera



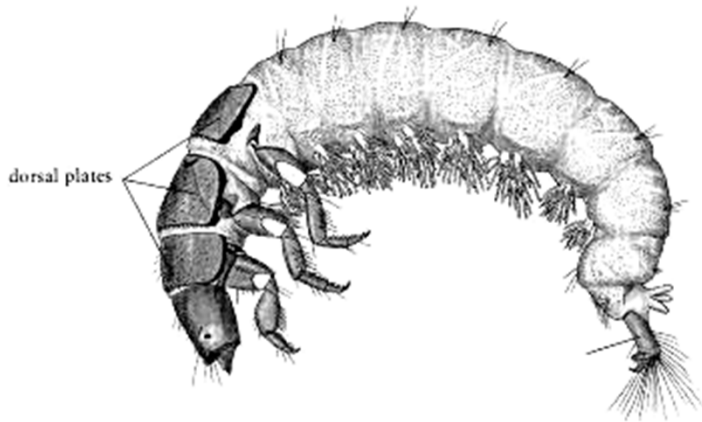


•10 mm

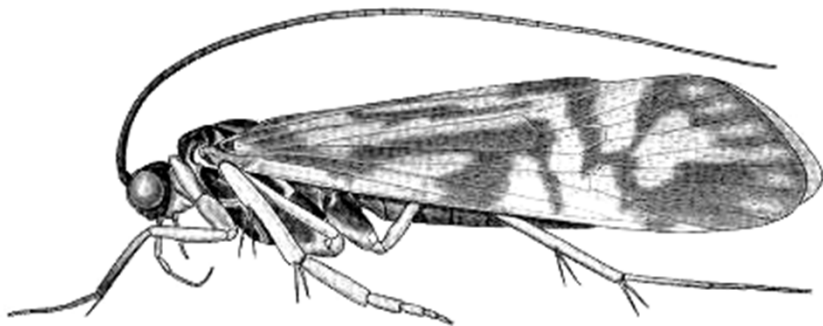
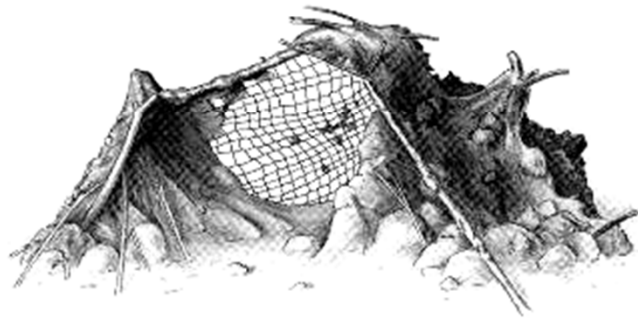


Common Net-spinning Caddisfly

NOT a sensitive species



•10 mm



- Phylum: Arthropoda
- Class: Insecta
- Order: Trichoptera
- Family: Hydropsychidae



Beetle larvae (order Coleoptera)

Often misidentified. They can be tricky





Scuds, Sideswimmers

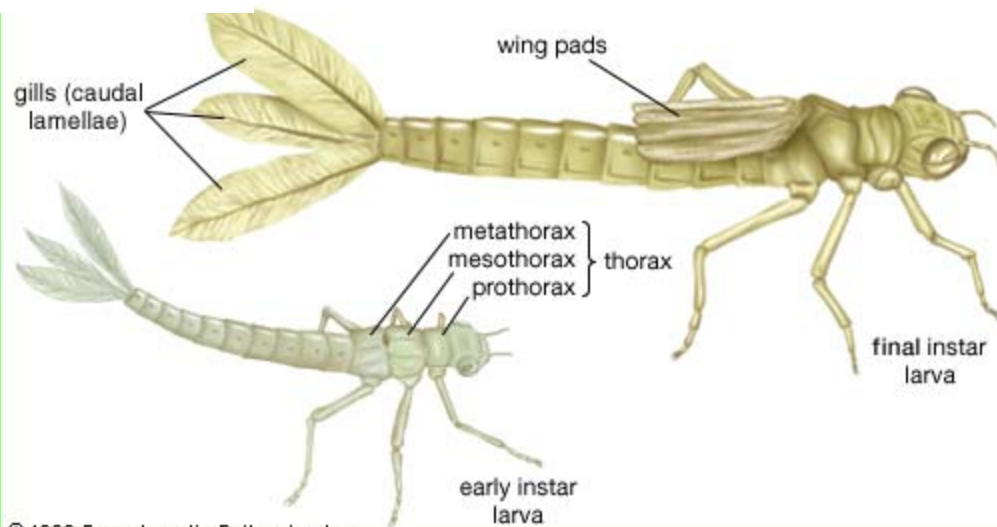


- Phylum: Arthropoda
- Class: Crustacea
- Order: Amphipoda

- 2 pairs antennae
- 7 pairs of legs
- Flattened (laterally)



(missing leg piece)



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Damselflies

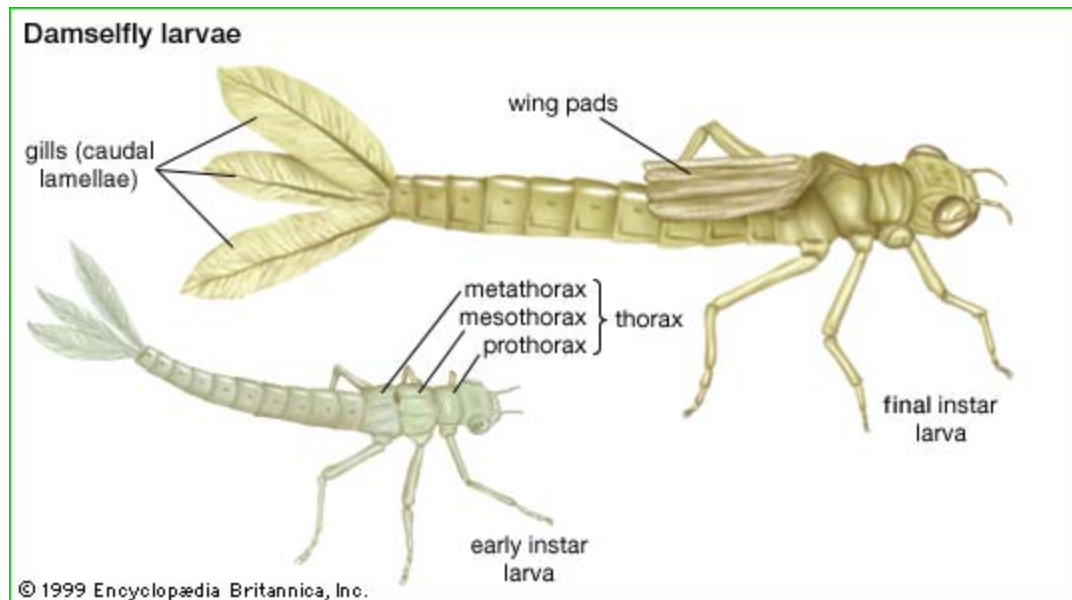
Phylum: Arthropoda

Class: Insecta

Order: Odonata

Suborder: Zygoptera

(missing leg piece)





Sowbugs



- Phylum: Arthropoda
- Class: Crustacea
- Order: Isopoda

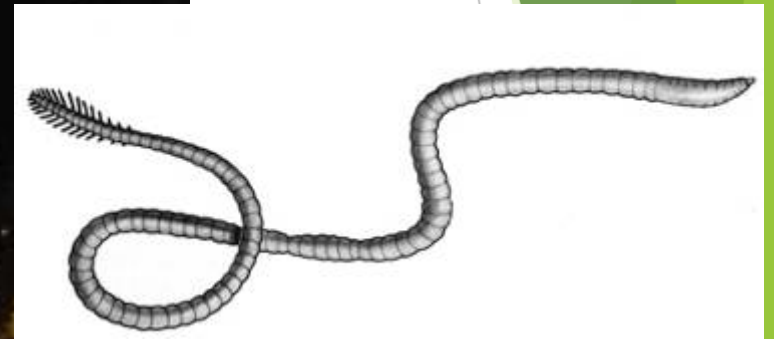


- 2 pairs antennae
- 7 pairs of legs
- Flattened (dorsally-ventrally)
- Leg-like gills on posterior end

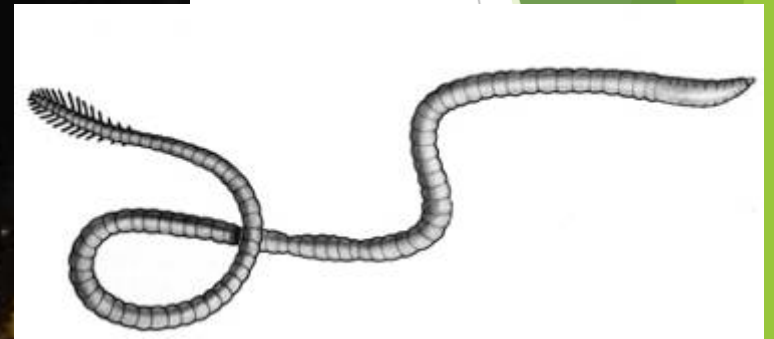




Dobsonfly (Helgrammite)



Aquatic Worms (class Oligochaeta)



•Note the segments!

- Phylum: Annelida
- Class: Oligochaeta
- Order: various



Leeches



- Many, many striations (surficial only)
- 2 suckers- front and back

- Phylum: Annelida
- Class: Hirundae
- Order: various



Miscellaneous Snails

- ▶ Does not have a plate-like covering over the shell opening.
- ▶ Has shell that spirals with opening usually on your left side (counter-clockwise), or shell that is coiled in one plane, or shell that is dome or hat shaped with no coils.

- Phylum: Mollusca
- Class: Gastropoda
- Order: various



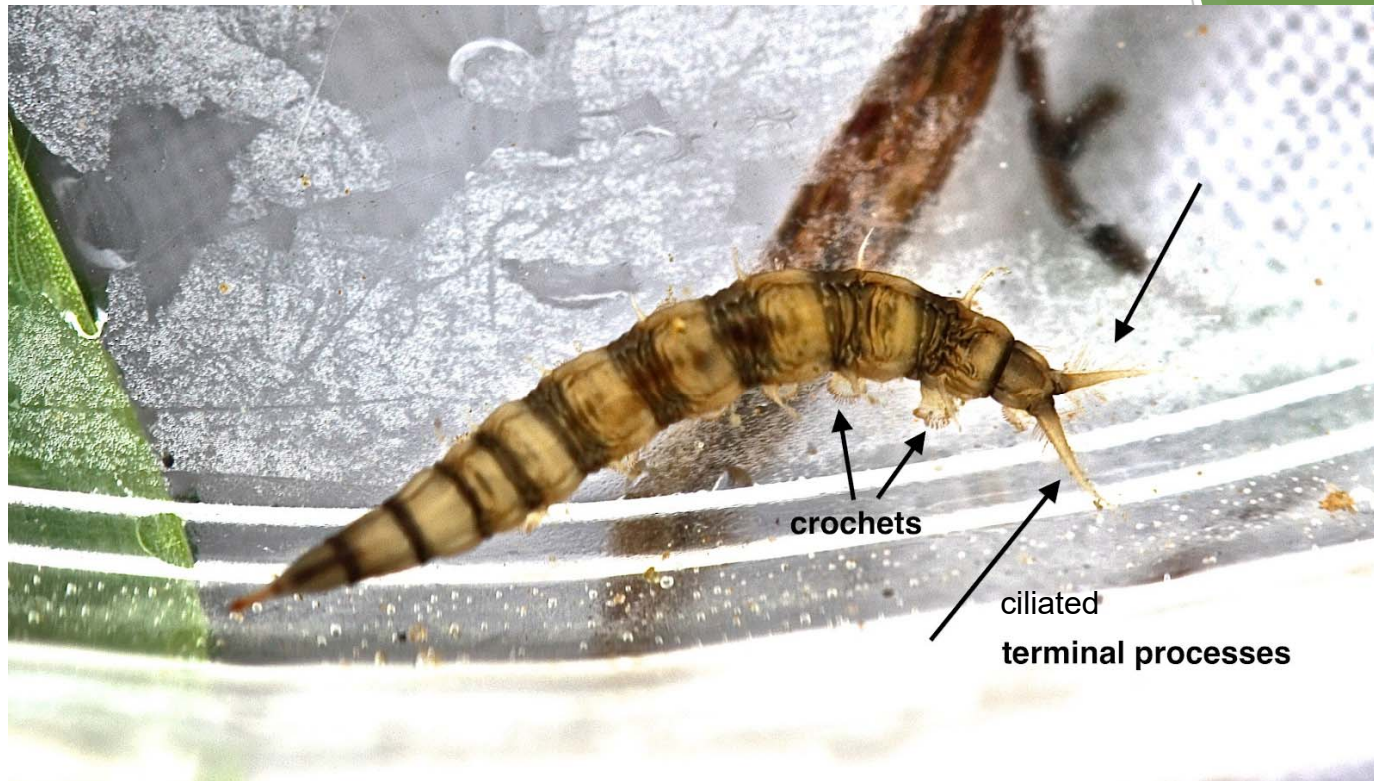
Left-handed snail



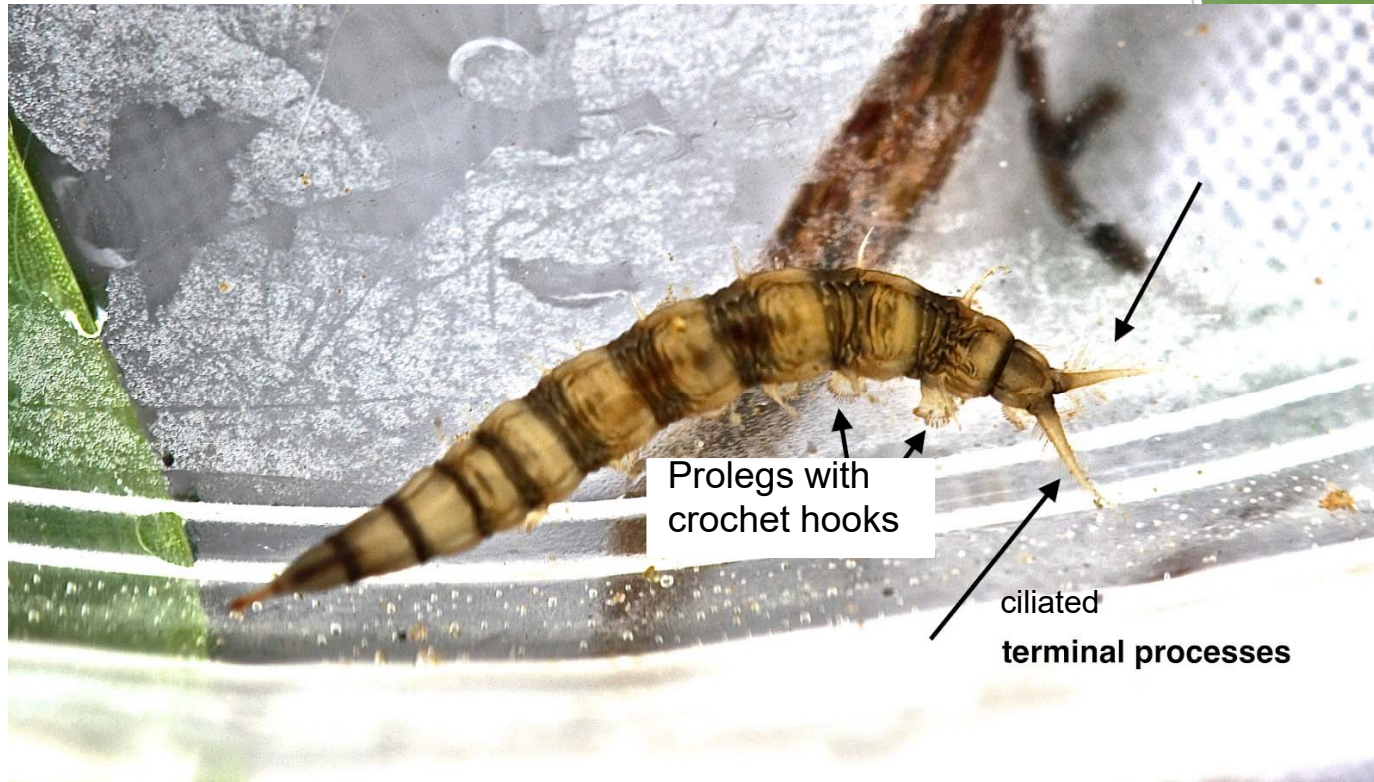
Planorbidae



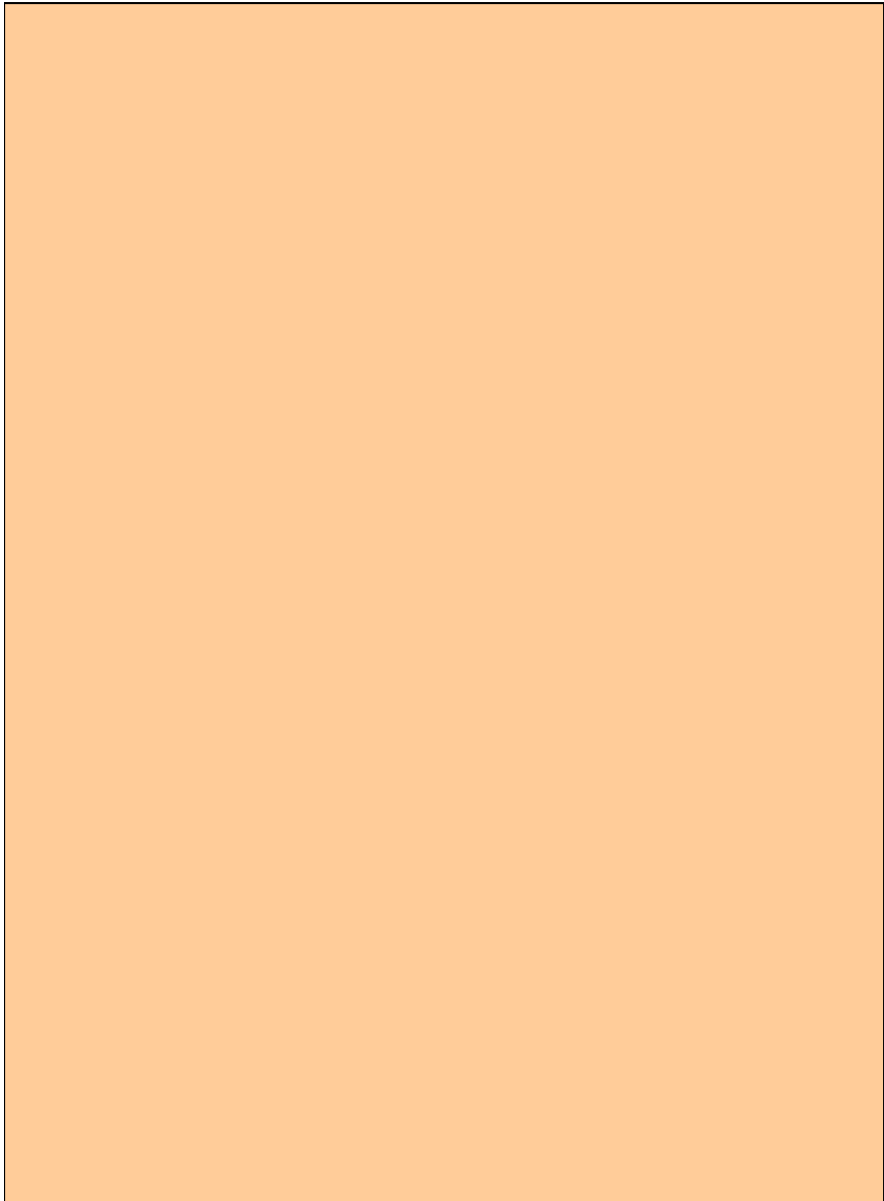
Limpets



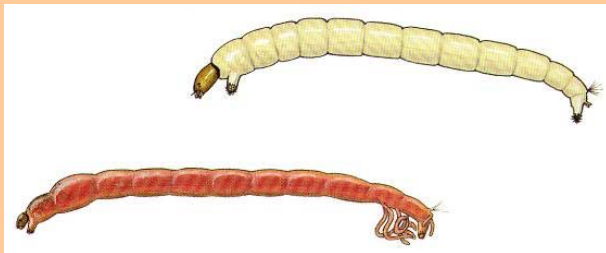
Watersnipe Fly



- Phylum: Arthropoda
- Class: Insecta
- Order: Diptera
- Family: Athericidae



Other True Flies... a catch all category



Already seen...



- Phylum: Arthropoda
- Class: Insecta
- Order: Diptera

What is “rapid identification”?

- ▶ Learn the clearly visible features of the insect so that you can id without relying on scopes or keys (as much as possible anyway)
- ▶ Mentally categorize groups of insects into bins so that it takes 2-3 steps to get to the right id rather than 10+ like a key
- ▶ Very possible for all orders and many family level id.
- ▶ You can do this pretty easily with mayflies. Stoneflies will take more practice (hard to see mouthparts)

Rapid Family Identification for Mayfly Nymphs

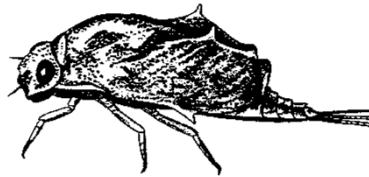
Mayflies can be divided into families by using only a small handful of major characteristics

It is important to check all of these other characteristics prior to choosing "swimming shape". This is the most generic character. Some mayflies may appear to have a "swimming shape" but more importantly have one of the other, more distinct characteristics.

Carapace

Baetiscidae

The thorax is covered in a tough pointy shell. Nothing else looks like this.

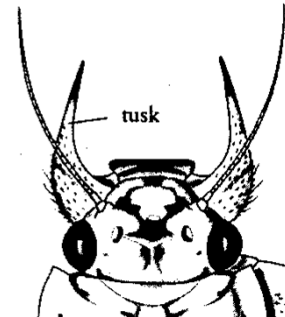


Tusks

Page 2

Ephemeridae
Polymitarcidae
Potamanthidae

Tusks protrude from the front of the head

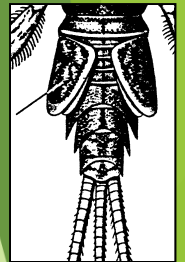


Weird Gills

Page 3

Caenidae
Leptohyphidae
Leptophlebiidae
Ephemerellidae

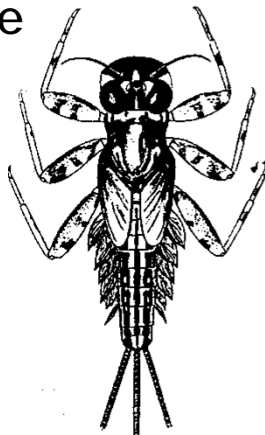
These gills are unusual shapes, overlap, or are missing (takes a little experience to see this character)



Flattened Shape

Heptageniidae

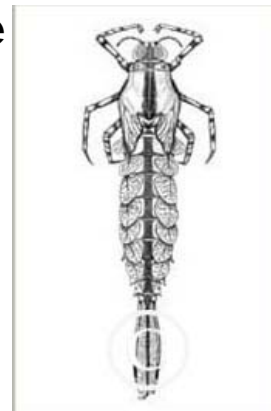
This mayfly is very flat. Its eyes are obviously on the top of the head looking up.



Racing Stripe

Metretopodidae

A dark stripe running along a light body. This mayfly also has a double claw on the front legs



Swimming shape

Page 4

Isonychiidae
Siphonuridae
Baetidae

These mayflies have an aerodynamic shape and move gracefully in the water



Rapid Family Identification for Stonefly Nymphs

Stonefly

No gill tufts or gill tufts
are on the neck only

Page 3

Gill
tufts plentiful

Uneven glossae/paraglossae
(mouthparts)

Perlodidae
Chloroperlidae

Even
glossae/para-
glossae
(mouthparts)

Gills
everywhere!

Gills on legs but
not abdomen

Pteronarcyidae

Perlidae



Overlapping
Thorax
Segments.
This one just
look weird.

Peltoperlidae

Divergent Wingpads

Nemouridae
Taeniopterygidae

Parallel Wingpads

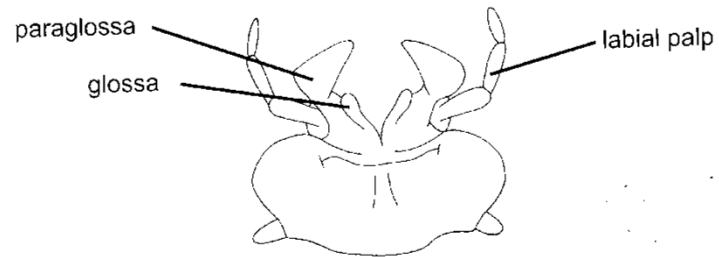
Capniidae
Leuctridae

Page 4

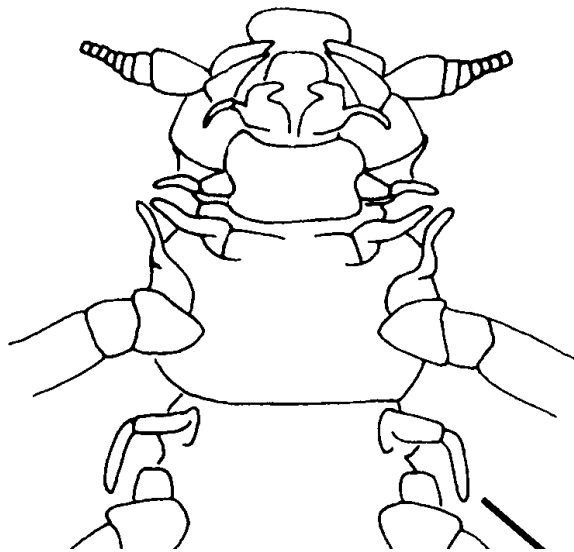
Page 2

Uneven glossae/paraglossae

Close up of mouth parts

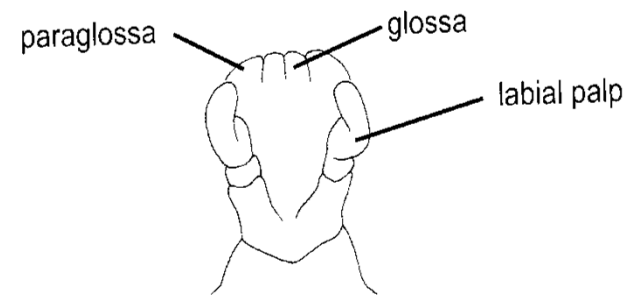


Ventral view of insect:

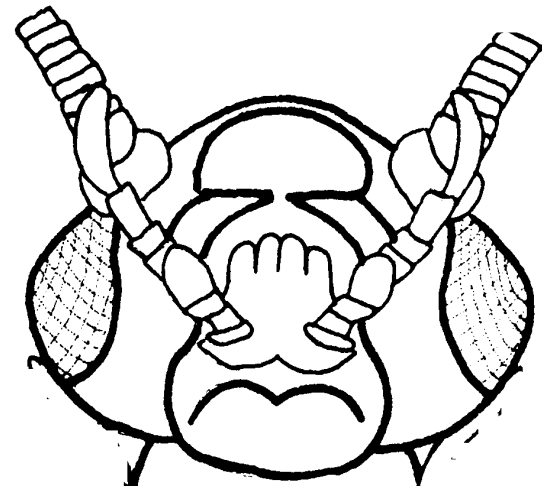


Even glossae/paraglossae

Close up of mouth parts



Ventral view of head:



For the remainder of our time

Beginners

- ▶ Use the MiCorps Datasheet
- ▶ Try to find as many on the list as possible...
- ▶ Look at the differences between insects of the same group
- ▶ Nik will help anyone of this group

Mayflies/Stonefly Students

- ▶ Use the handouts to go through the samples
- ▶ There are "U" (unknown samples) to challenge you.
- ▶ Answer key is...

