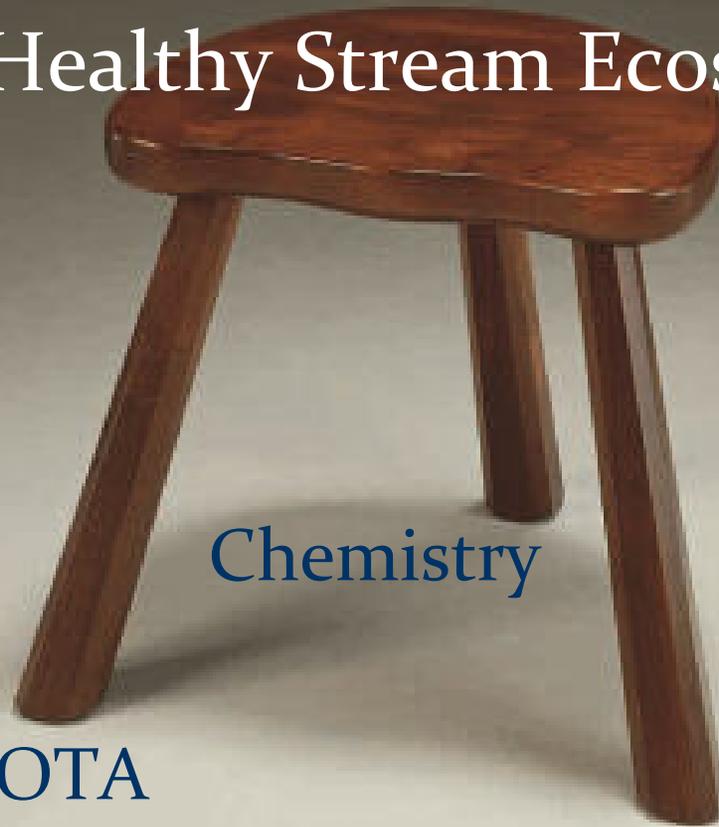




Basic Stream Ecology

Dan Boward and Sara Weglein
Monitoring and Non-tidal Assessment

A Healthy Stream Ecosystem



Chemistry

BIOTA

Physical Habitat

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- Sedimentation/siltation
- Flood control
- mining
- Watershed imperviousness
- construction
- Acid rain
- Thermal impacts
- Road maintenance
- Recreational/commercial harvestation
- Underground piping of streams
- Exotic/invasive species
- toxics
- logging
- Eutrophication/nutrient enrichment
- Water withdrawals
- Migration barriers
- Road salt
- Riparian zone destruction
- Stream "improvements"





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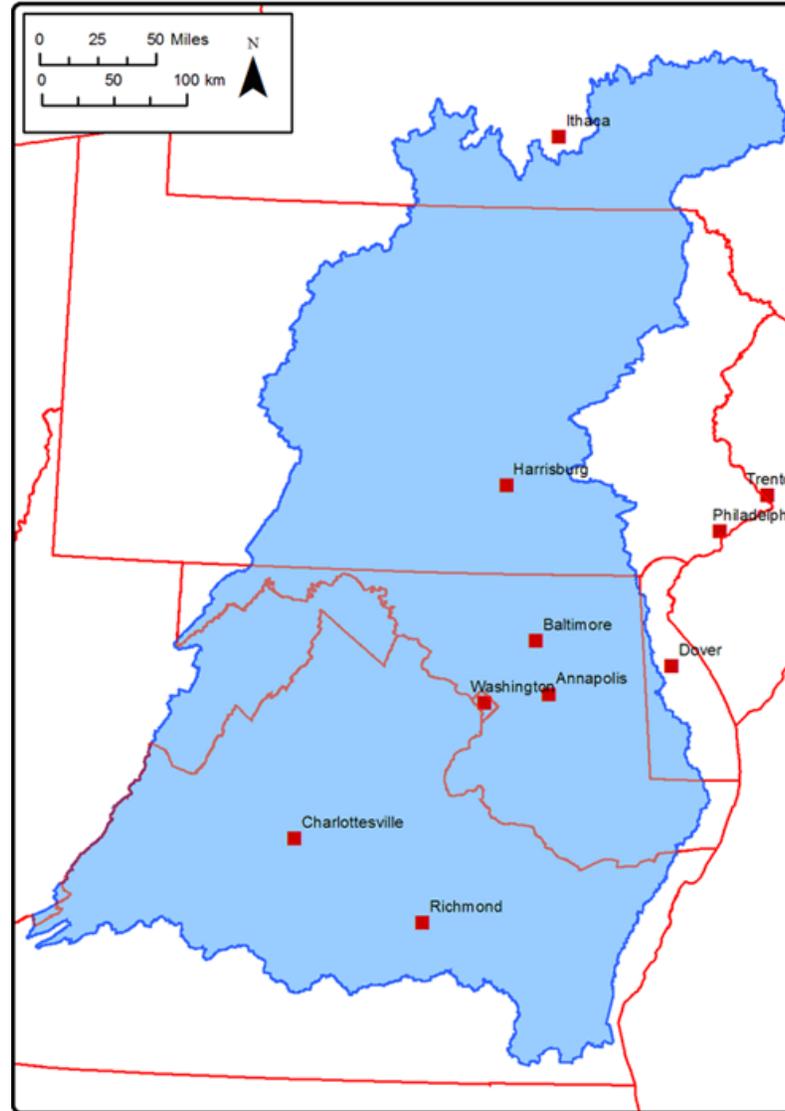
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Geology and Scale

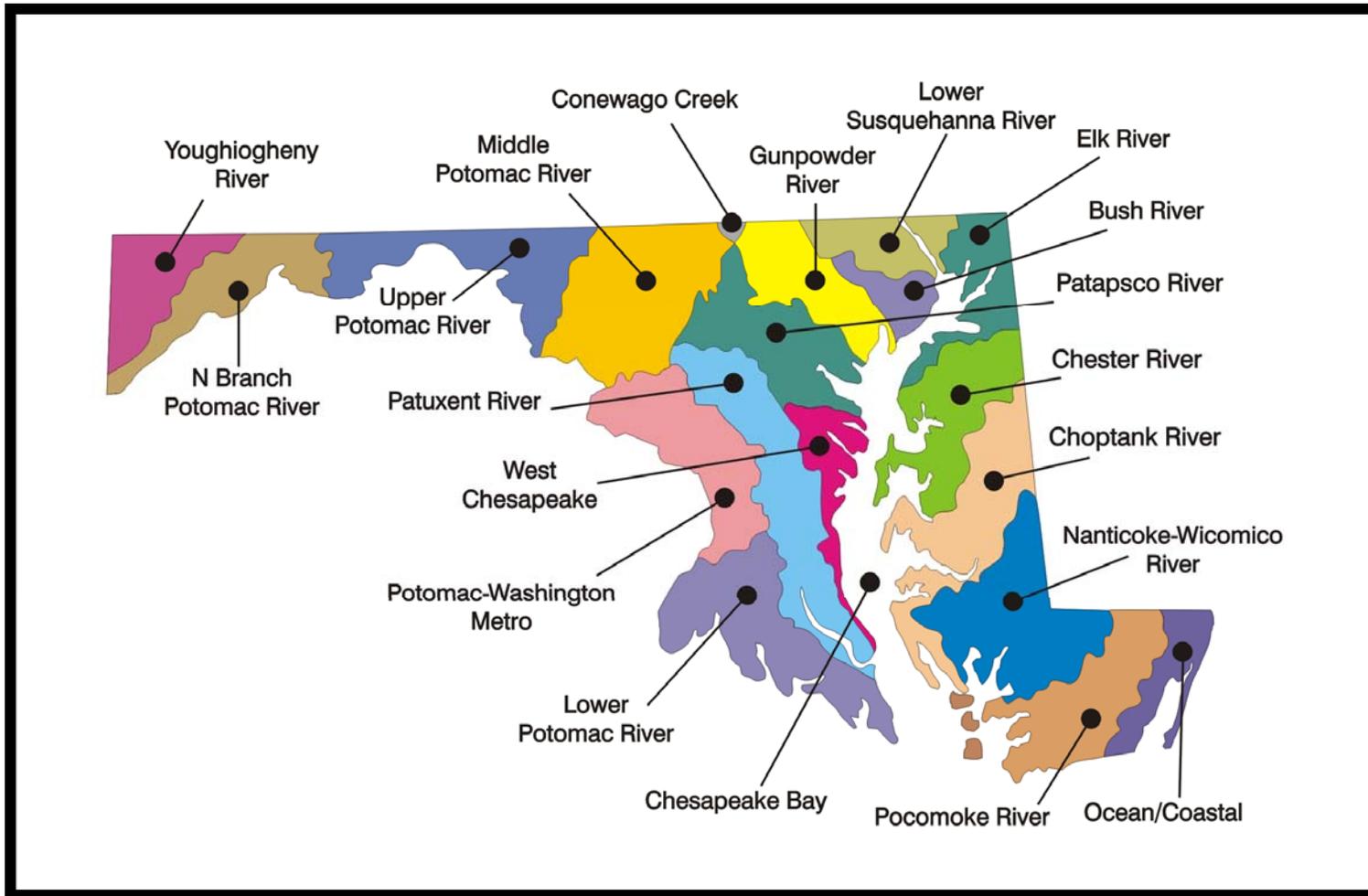
Watershed-
the area
drained by
a river or
stream

<http://tecalive.mtu.edu/meec/module01/whatiswatershed.htm>

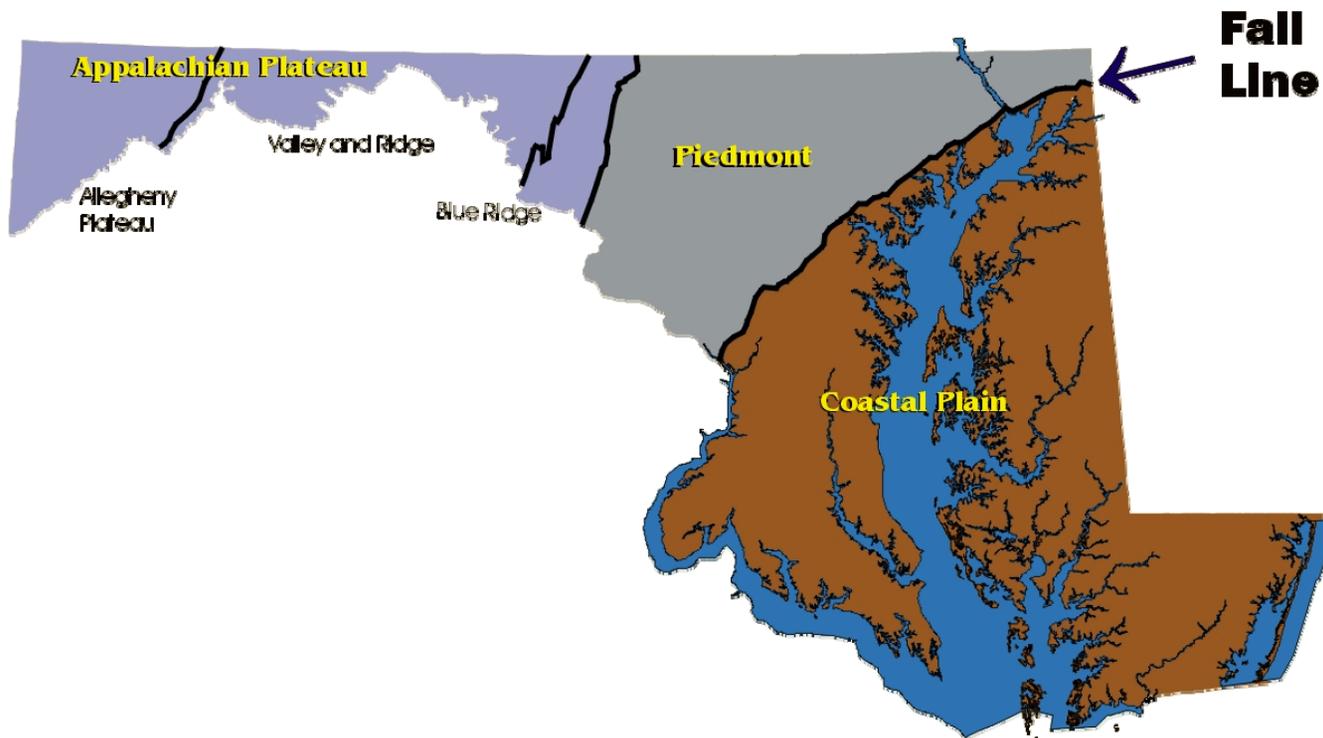


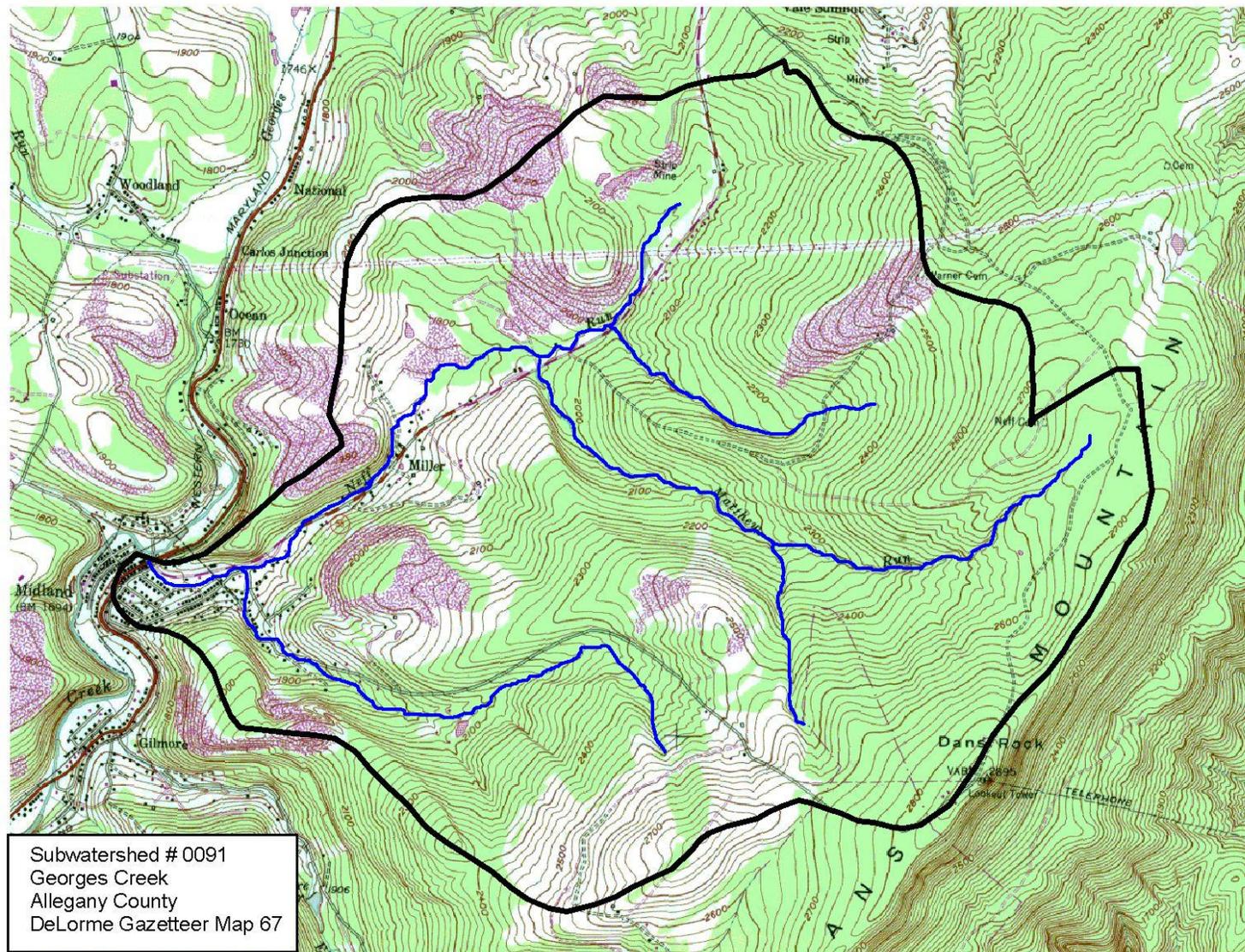
Chesapeake
Bay
Watershed

Maryland's River Basins



MARYLAND PHYSIOGRAPHY







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Chemistry

Chemical Factors

Temperature

Dissolved Oxygen (DO)

pH/Buffering Capacity

Conductivity

Nutrients

Sediment

- Higher water temperature = lower dissolved oxygen
- More canopy cover = lower water temperature = higher dissolved oxygen
- More riffles = higher dissolved oxygen



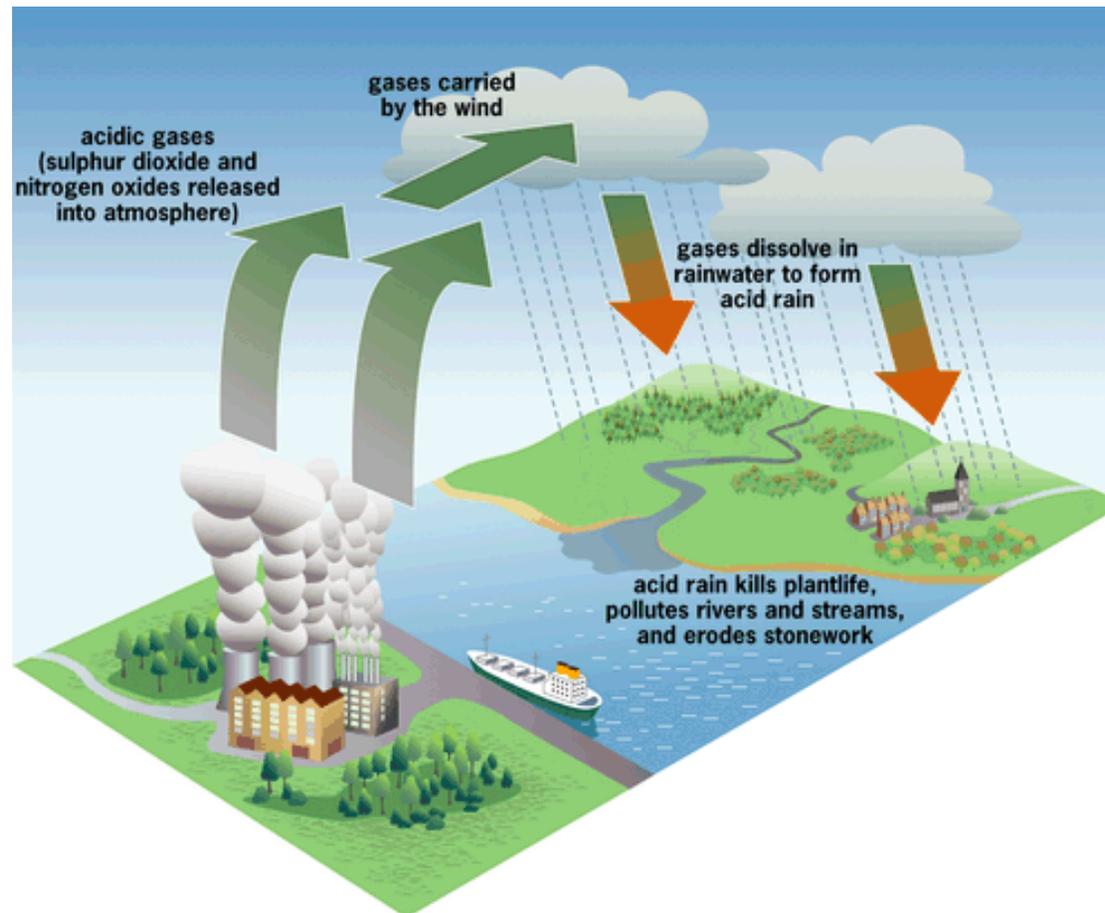


Stonefly (needs high DO)



Eastern mudminnow
(tolerant of low DO)

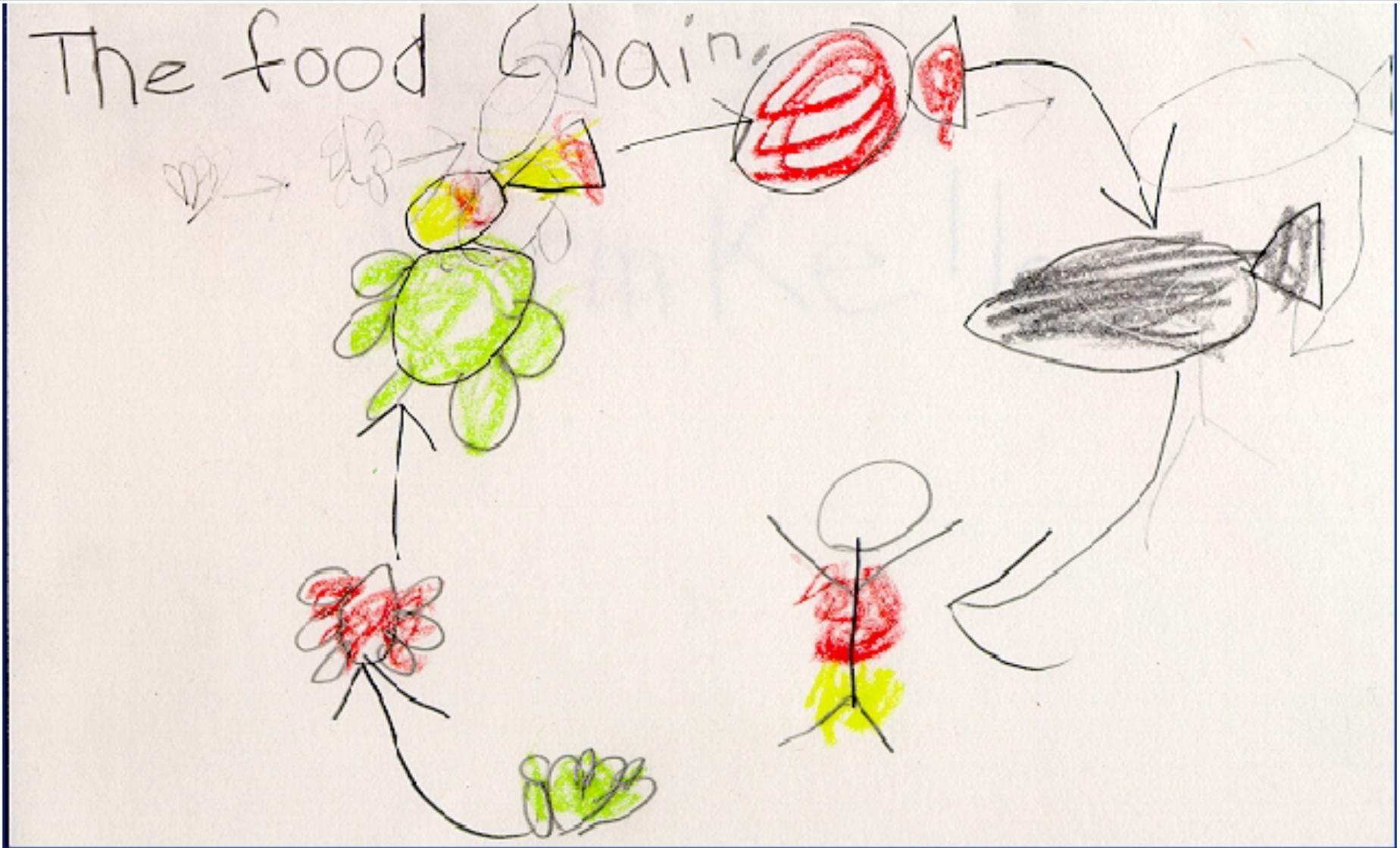
Acid Rain affects a stream's pH



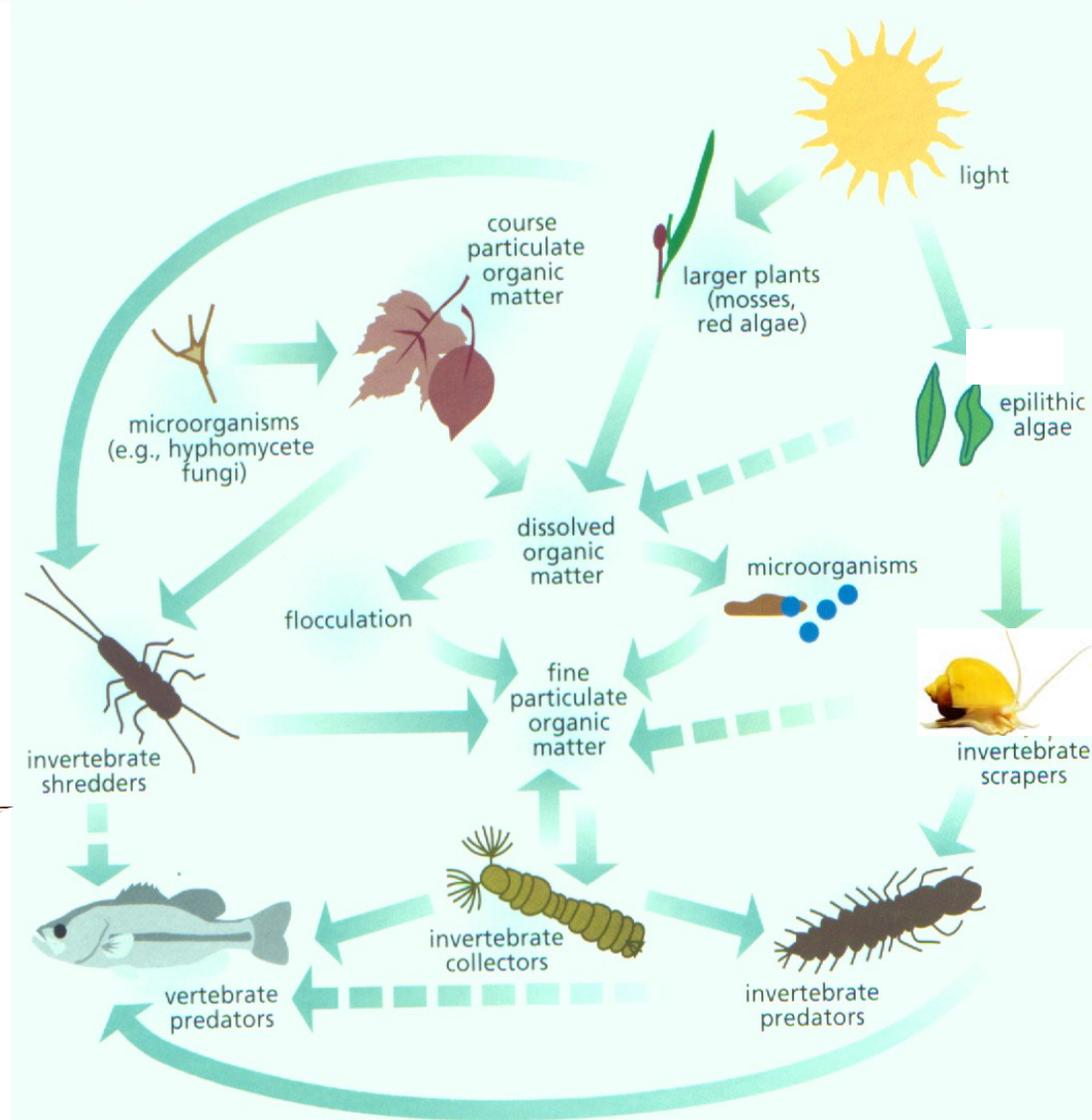


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Ecology



Stream Food Web





External vs Internal Energy Inputs



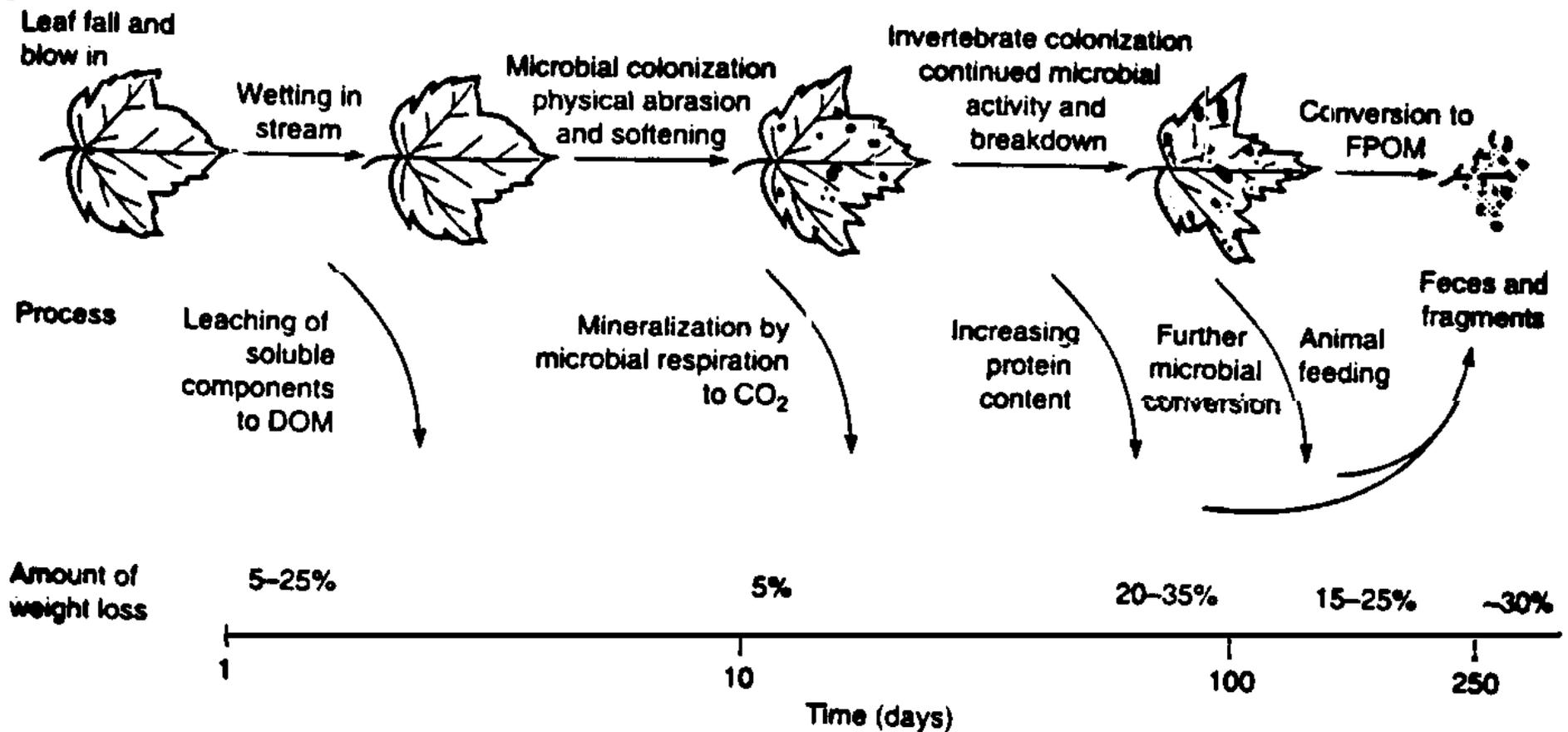
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Leaf Processing Sequence

Leaf processing sequence

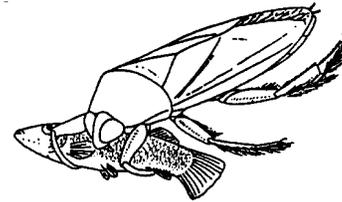


**Benthic Feeding
Groups**

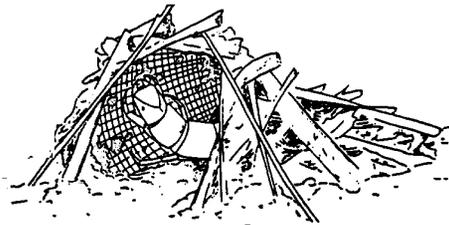
Borer



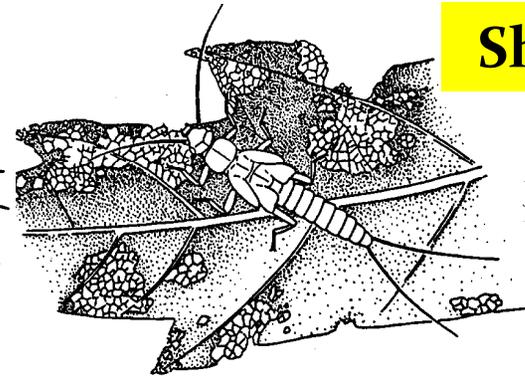
Piercer



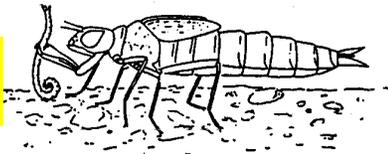
Filterer



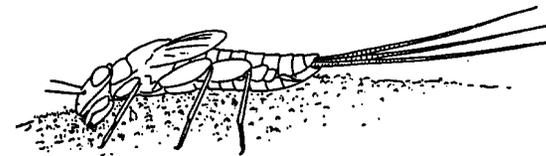
Shredder



Engulfer

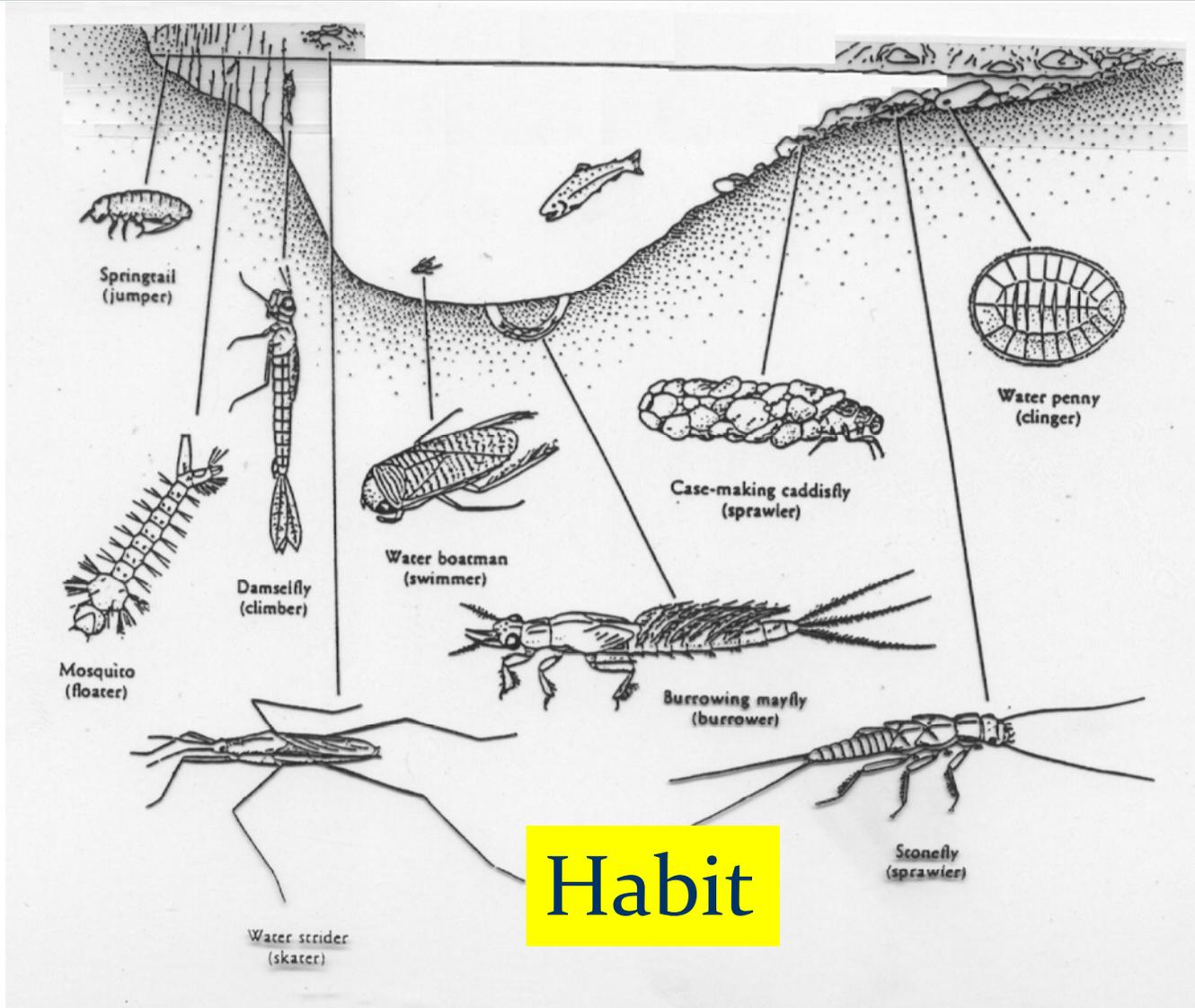


Scraper

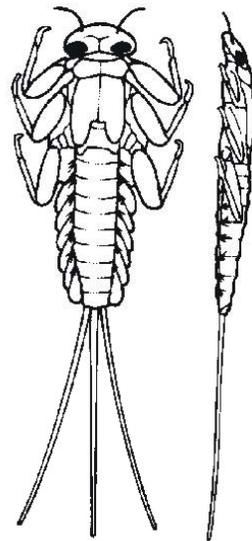


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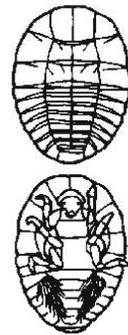
Explore and Restore Your Schoolshed



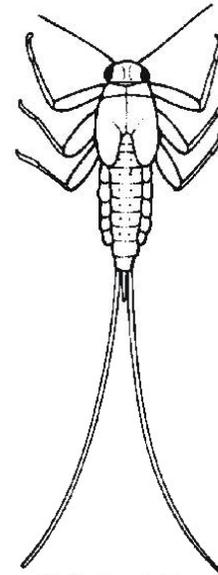
Invertebrate Adaptations to Life in Running Water



(a) *Rhithrogena*



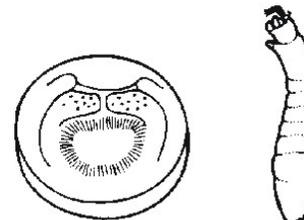
Psephenus x3



(b) *Baetis subalpinus*



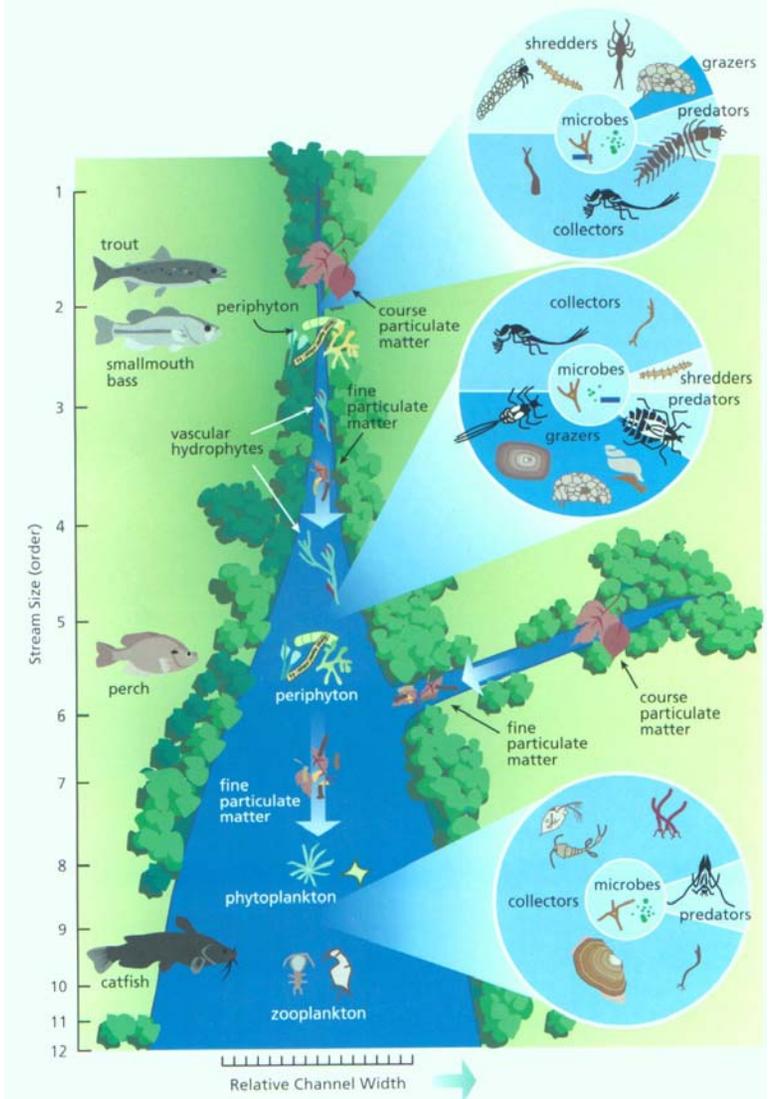
(c) *Philorus*



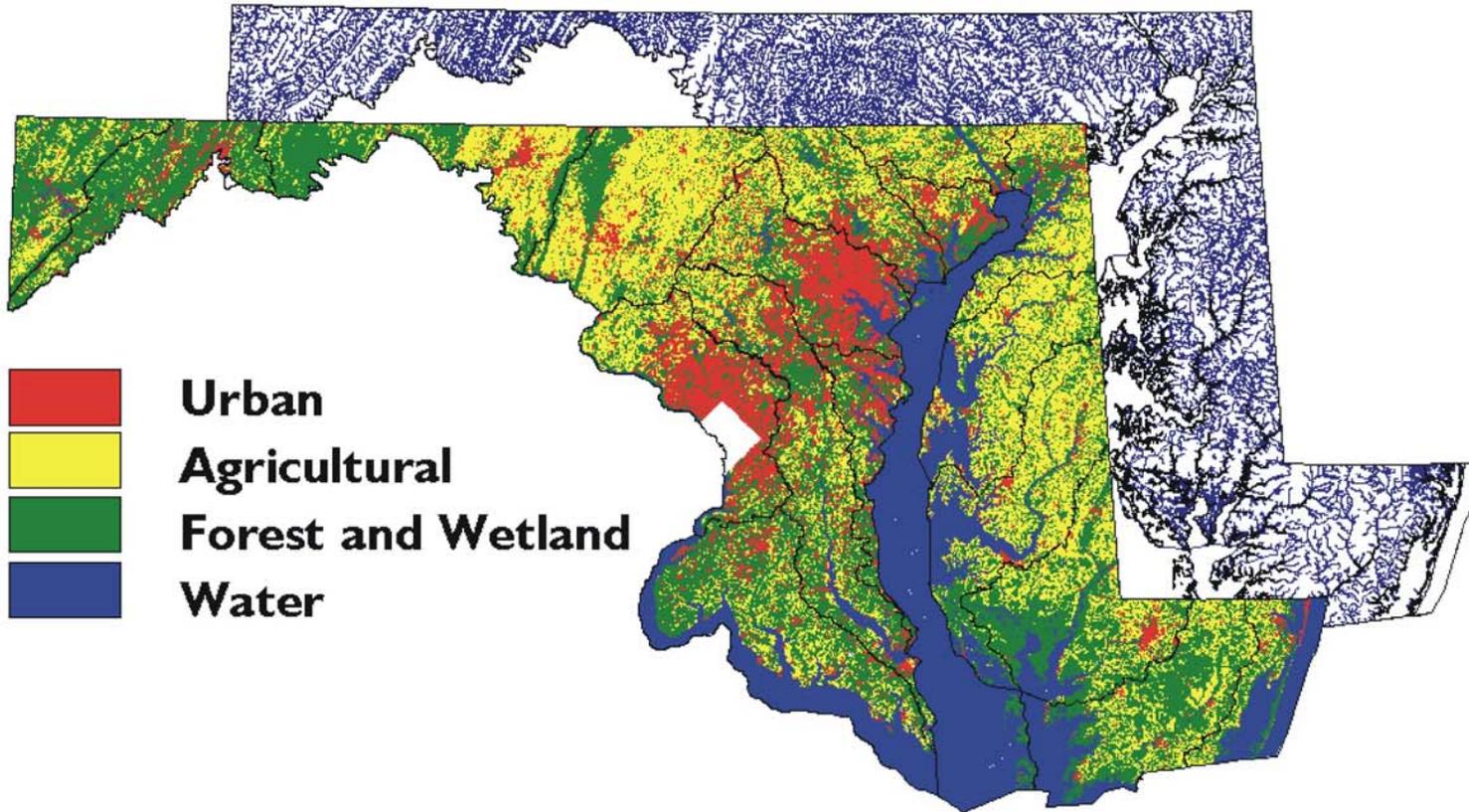
(d) *Simulium*

River Continuum Concept

Biota reflect energy sources and river size



Land Use in Maryland



MBSS 1995-1997

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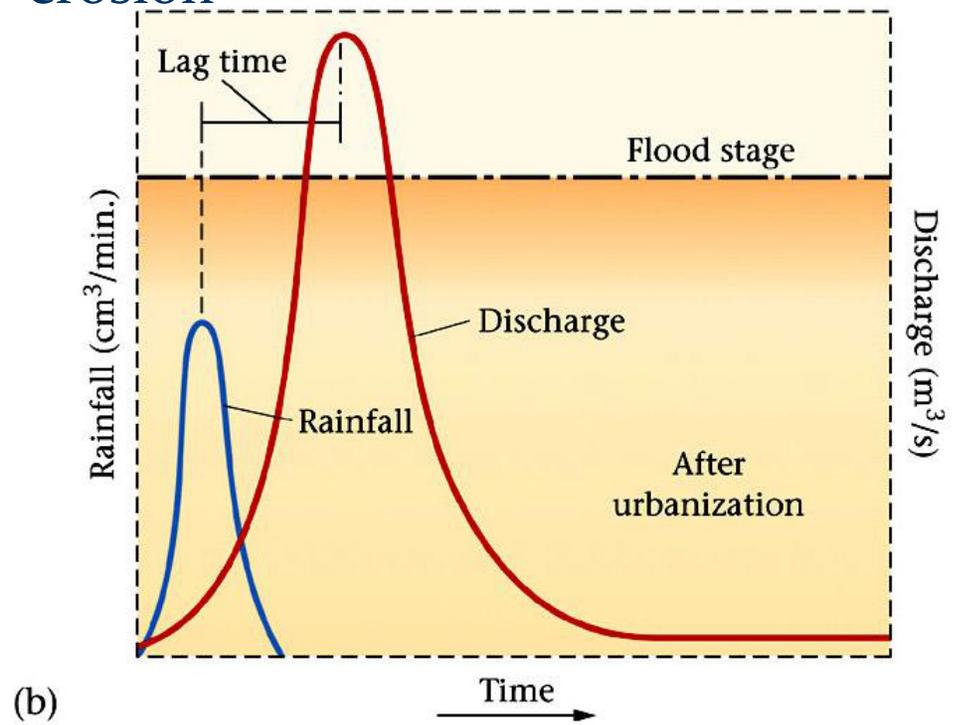
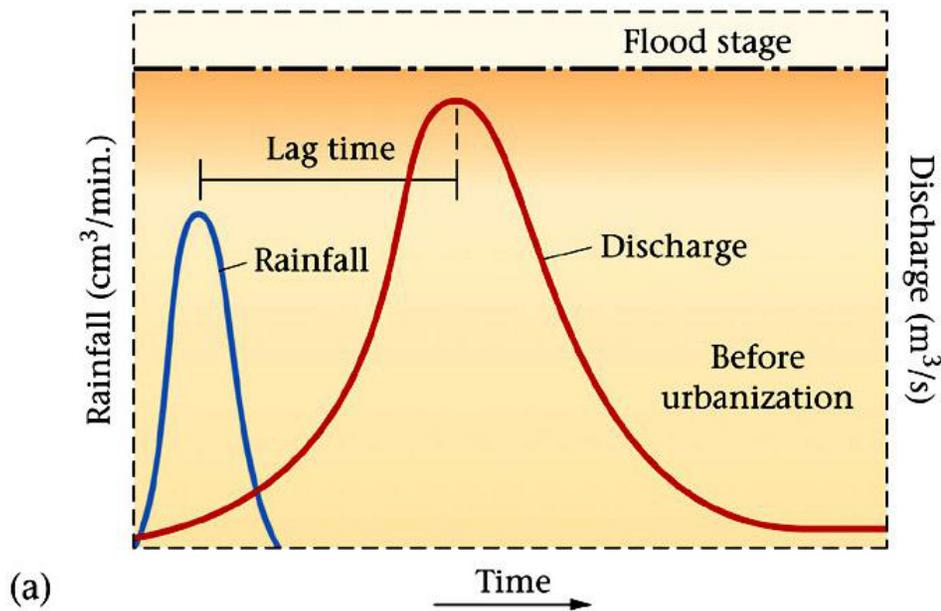
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Effects of **impervious surfaces** on streams

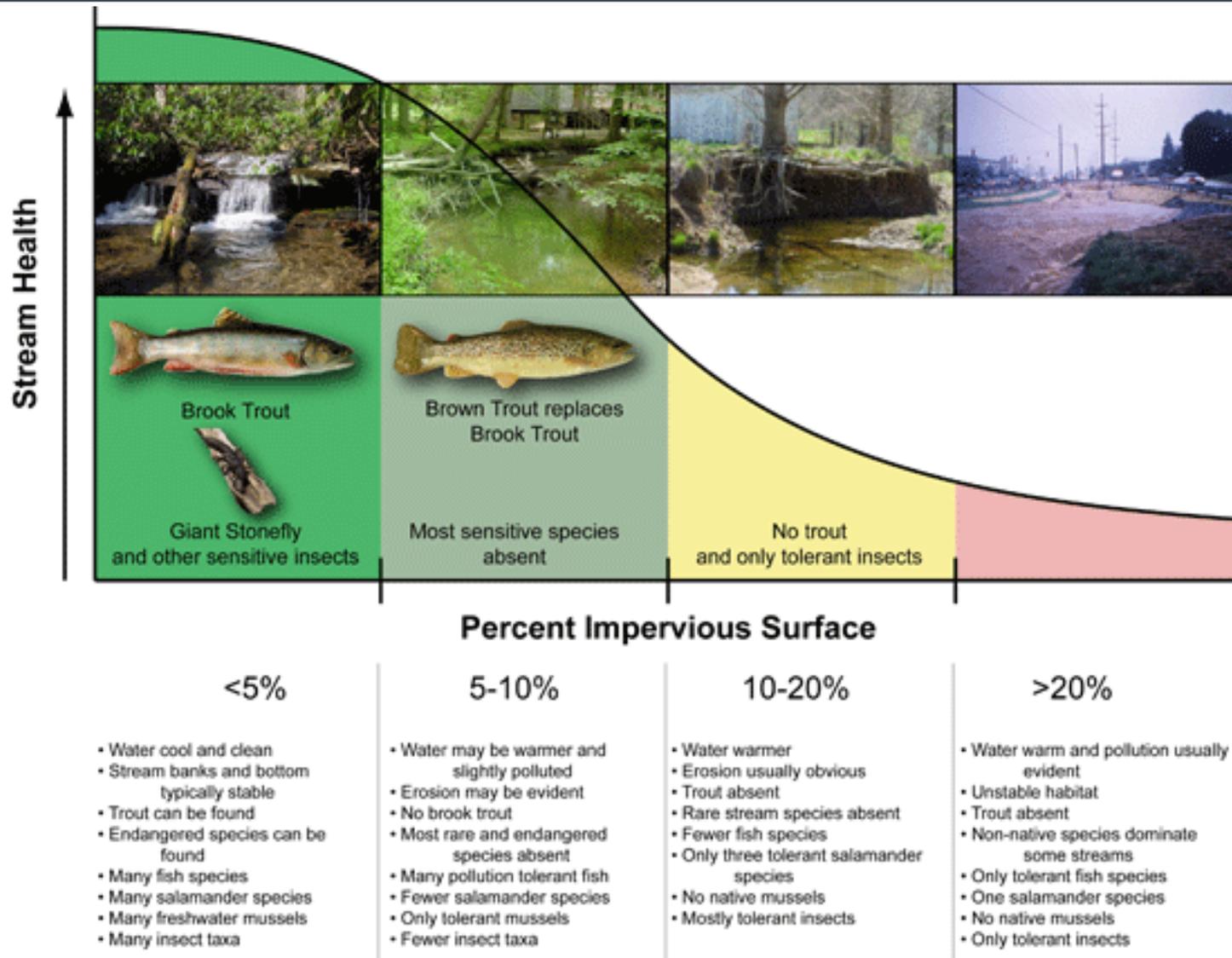
Rainwater enters stream faster as sheetwash rather than seeping in slowly through ground water, causing...

- Elevated stream temperature
- An influx of pollutants from lawns, parking lots, agriculture etc.
- Unnaturally high stream flows resulting in flooding and bank erosion



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Benthic Macroinvertebrates



What are Benthic Macroinvertebrates?

Associated with "bottom"*

Visible to the naked eye

>500 microns

Fish food

*
during some part of life cycle

Kingdom Animalia

Phylum Arthropoda

Class Insecta (insects)

Subphylum Crustacea (crayfish, isopods, amphipods)

Phylum Mollusca (snails, clams, mussels)

Phylum Annelida (segmented worms)

Systematics (taxonomy) – the branch of Biology that deals with classification and nomenclature.

Kingdom

Phylum

Class

Order

Family (idae)

Genus

Species

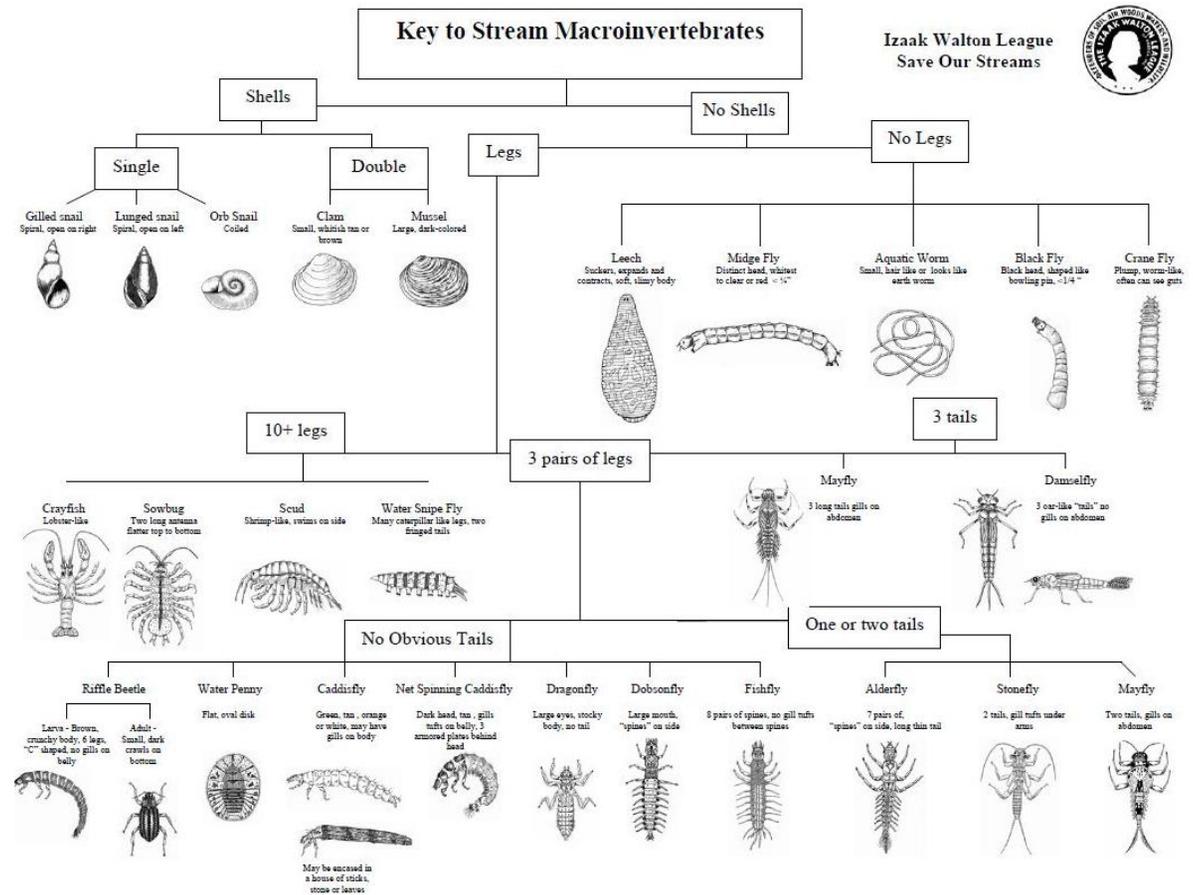
Getting to know your...



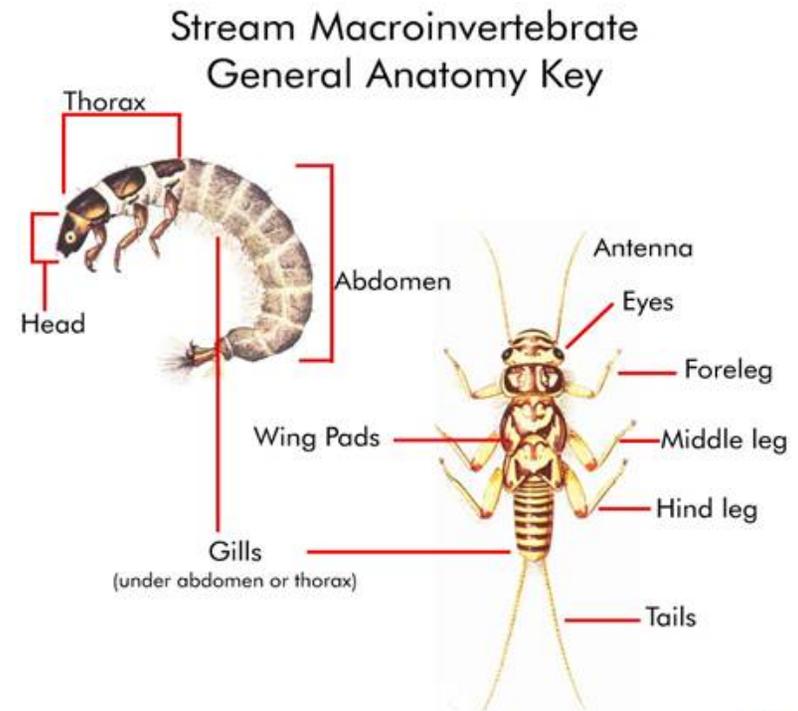
BUGS!

Role as Bioindicators

- Pollution sensitive
 - Dissolved oxygen, temperature, turbidity, etc.
- Easy and inexpensive to collect
- Useful in long-term monitoring



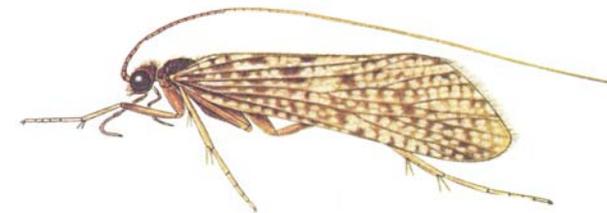
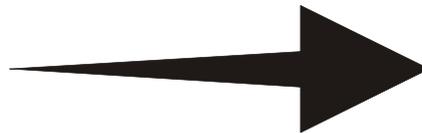
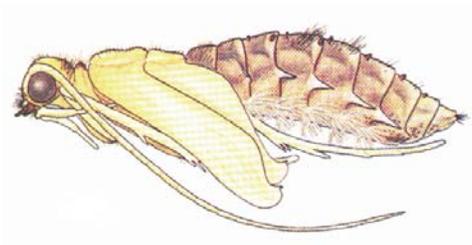
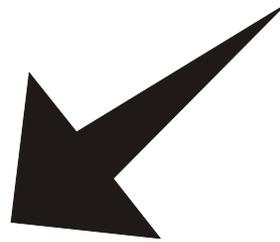
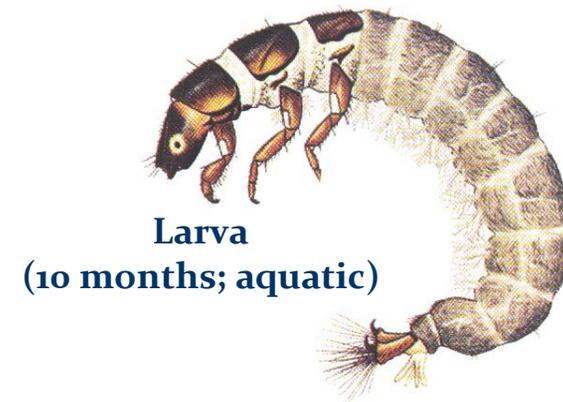
- 3 Major Body Parts
- Diagnostic Features:
 - Mouthparts
 - Legs
 - Abdomen length
 - Wing pads
 - Tails
 - Gills
 - Overall Shape



Life History of a Caddisfly (Complete Metamorphosis)



Egg
(1 week; aquatic)

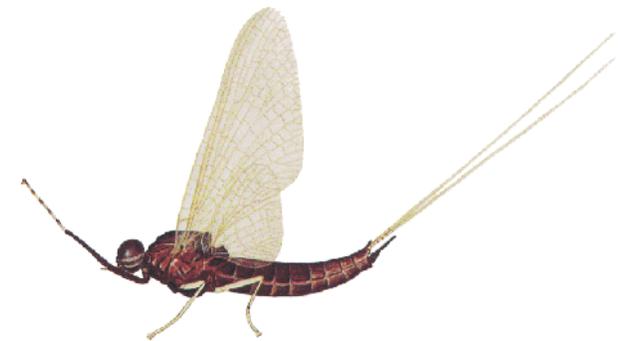


Life History of a Mayfly (Incomplete Metamorphosis)

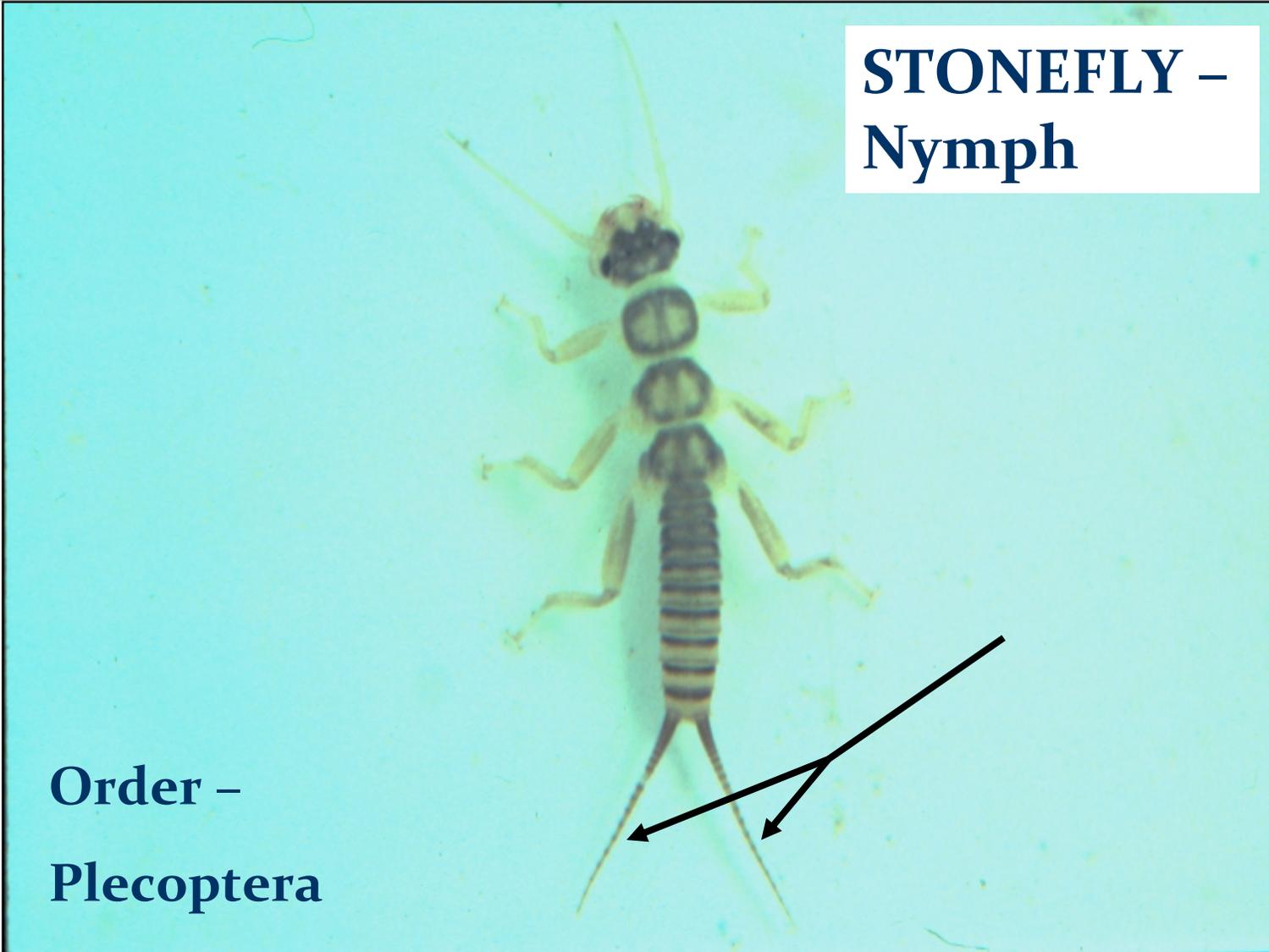

Egg
(2 weeks; aquatic)



Nymph
(11 months; aquatic)



Adult
(2 days; terrestrial)



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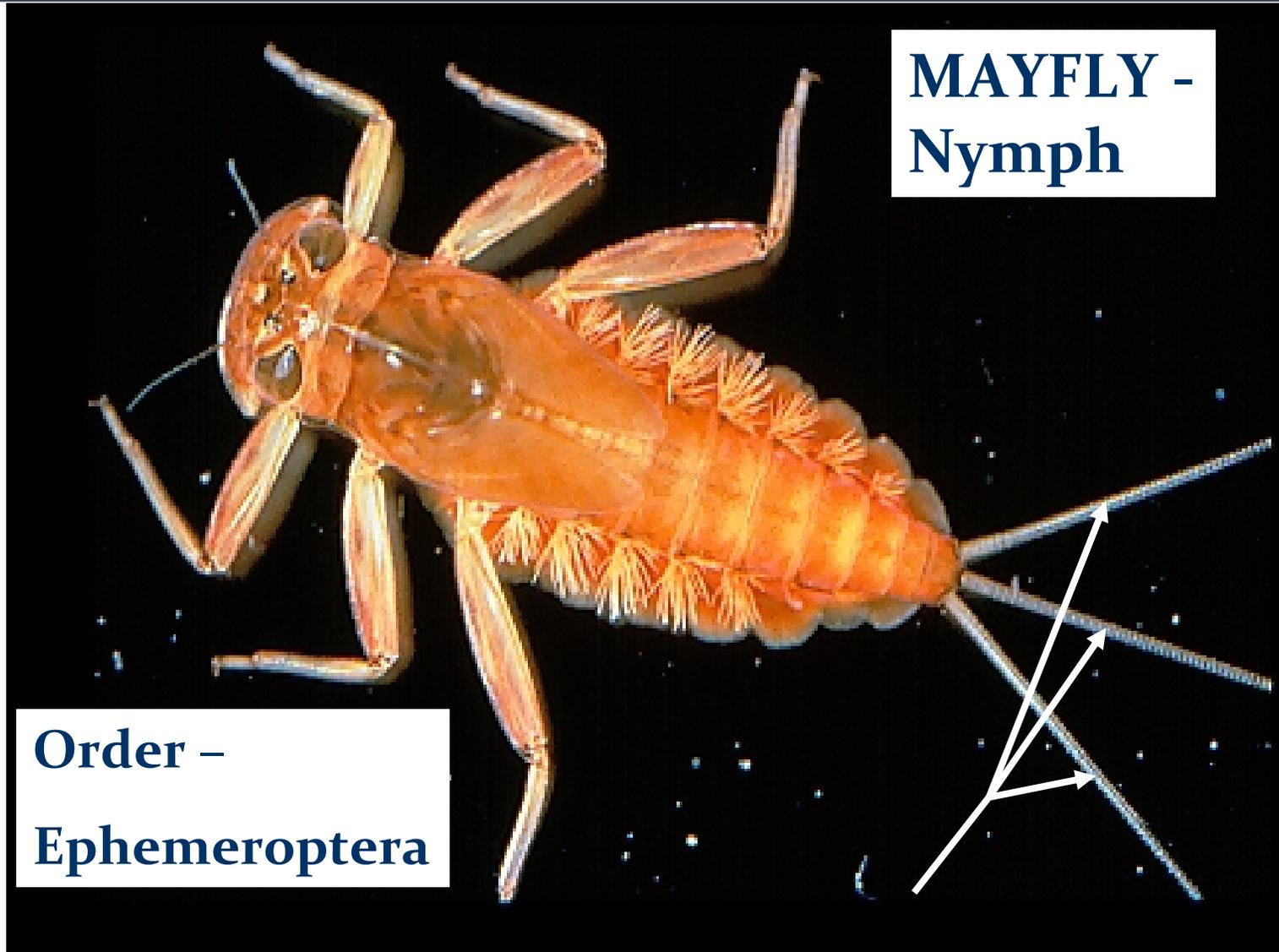
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STONEFLY - Adult



Order – Plecoptera



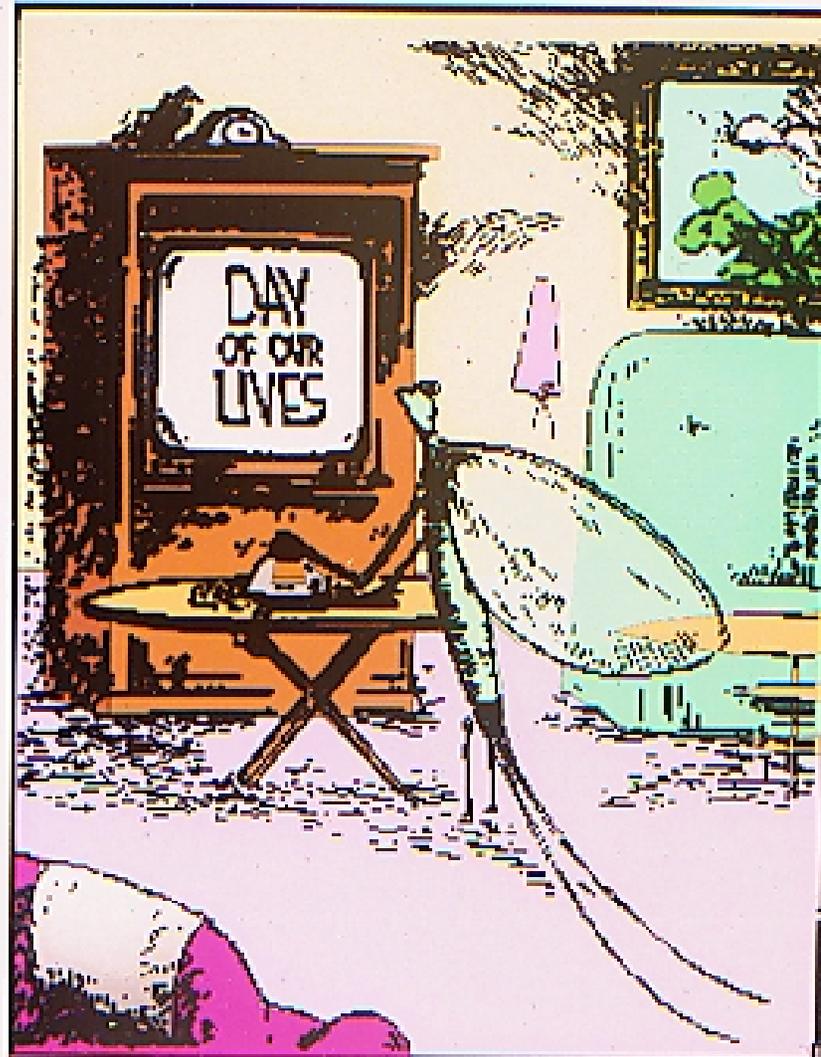
**MAYFLY –
Adult**



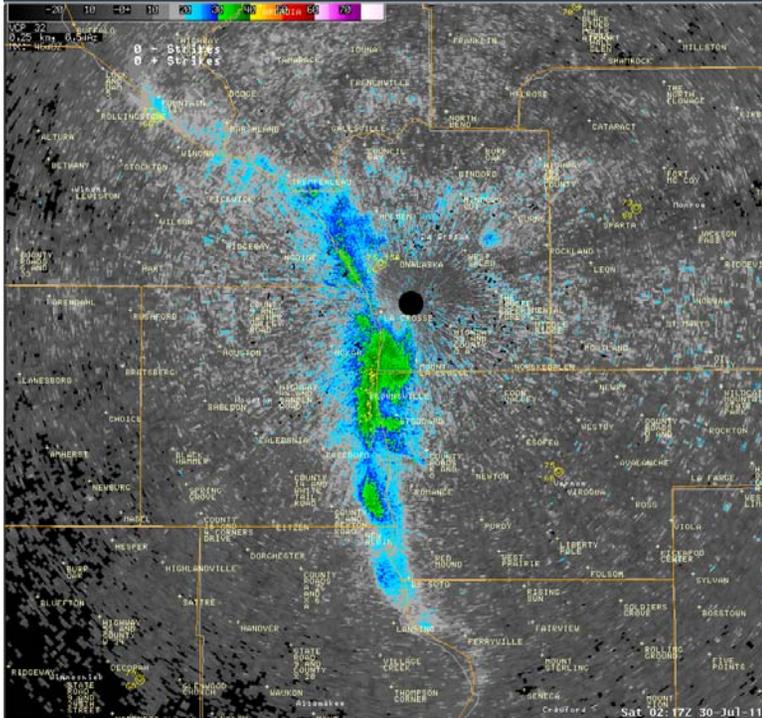
Order – Ephemeroptera

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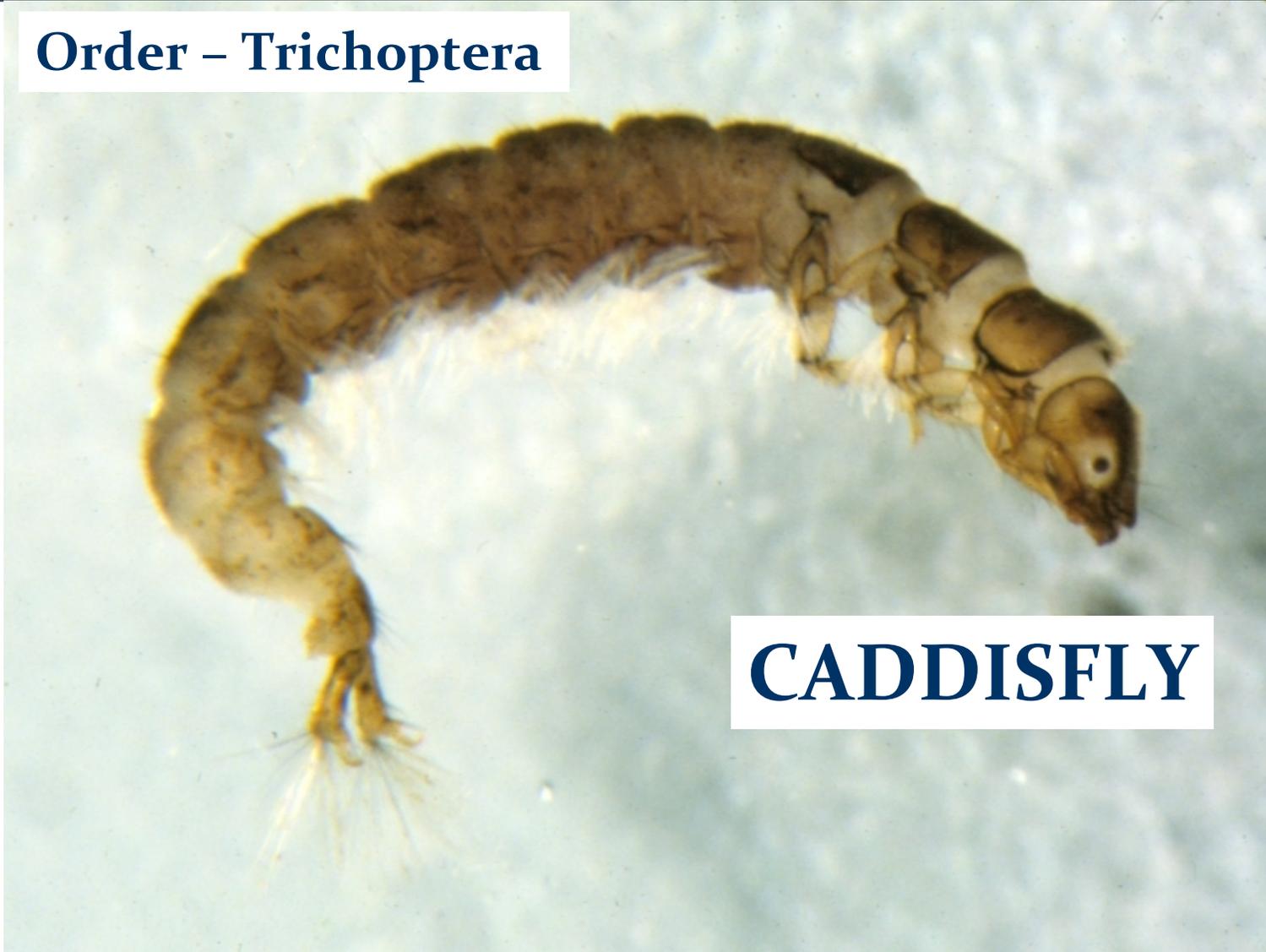
MAYFLY SOAP OPERAS



A swarm of newly hatched mayflies on the Mississippi River showing up on radar.



Order – Trichoptera



CADDISFLY

Order – Trichoptera

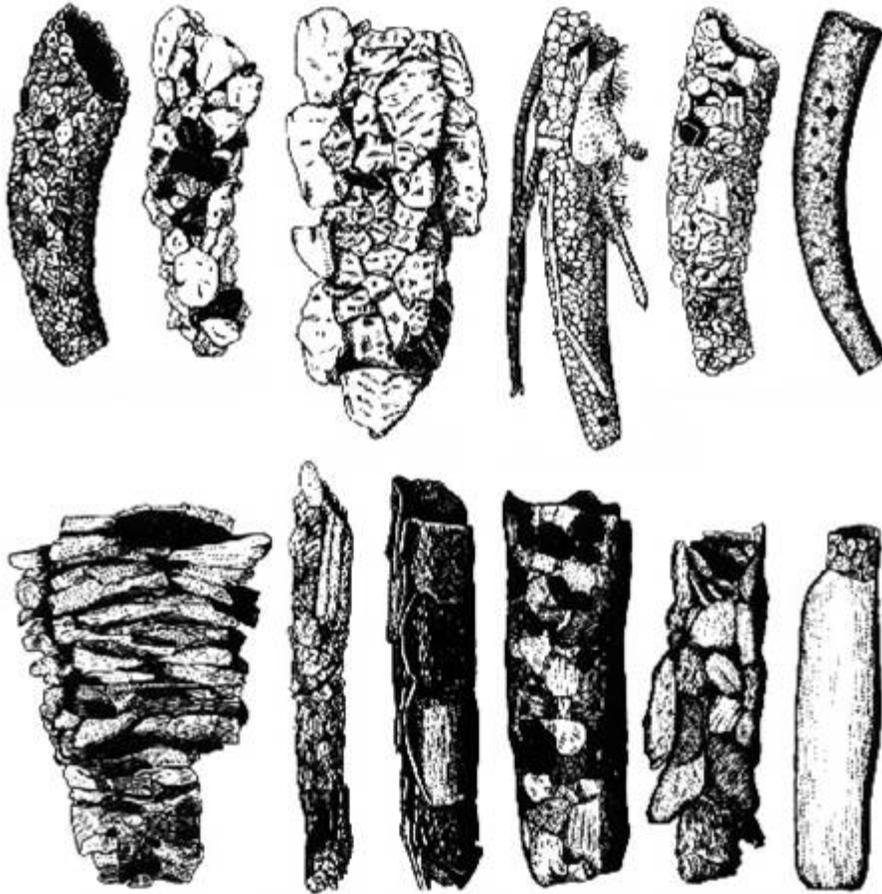
CADDISFLY



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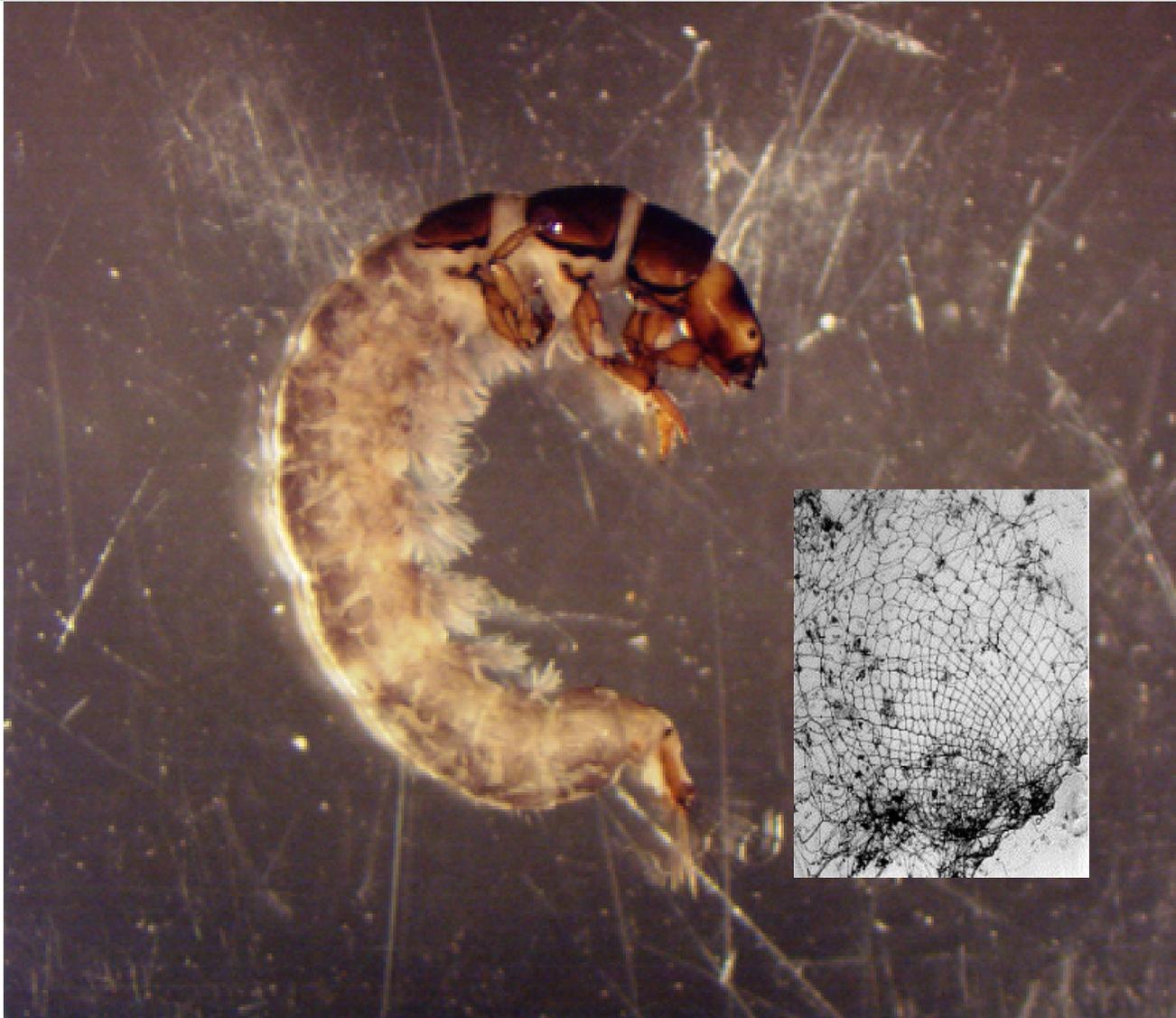
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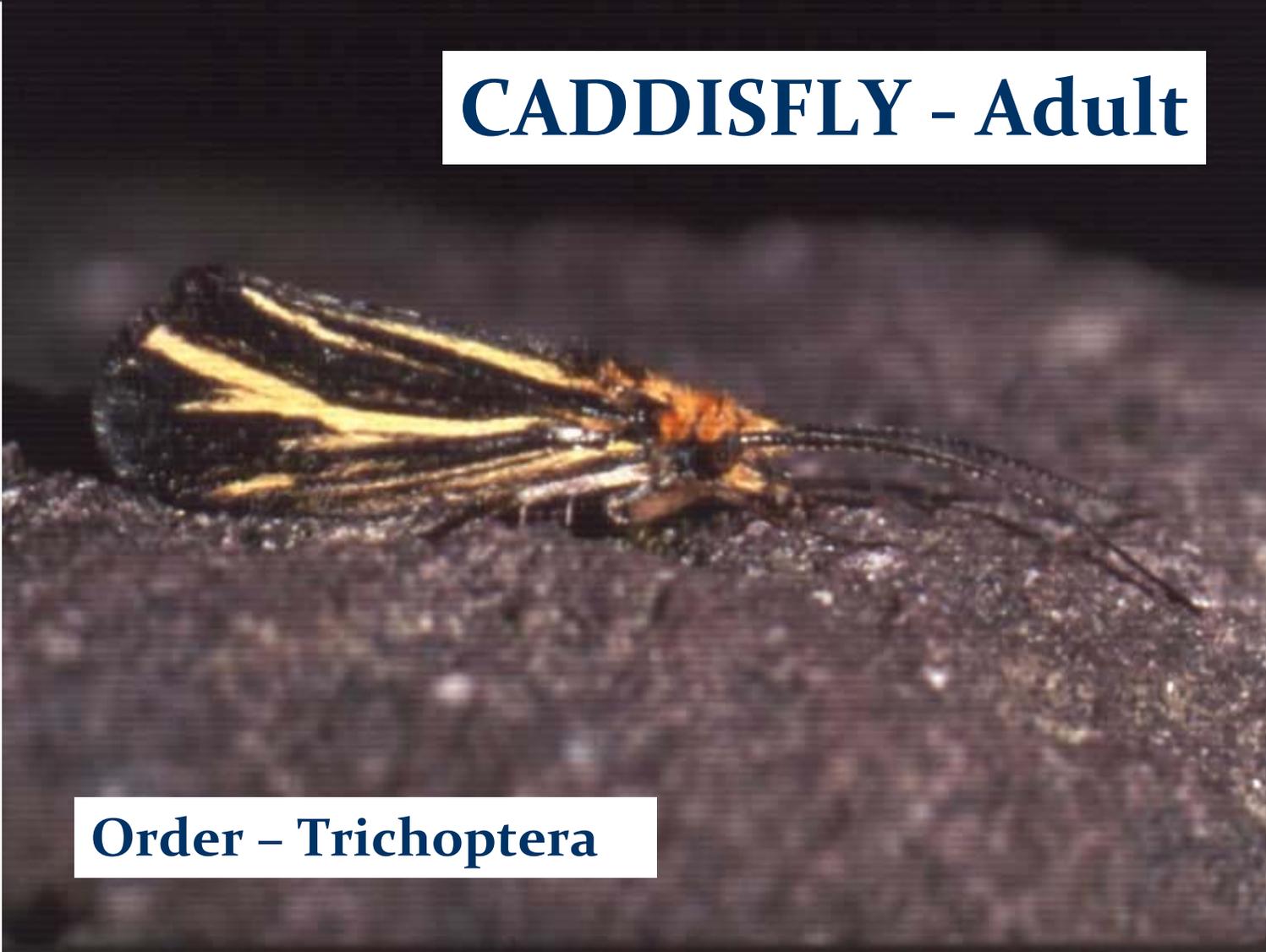


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CADDISFLY - Adult



Order – Trichoptera

WATER SNIPEFLY



Order – Diptera

Water Penny – Larva

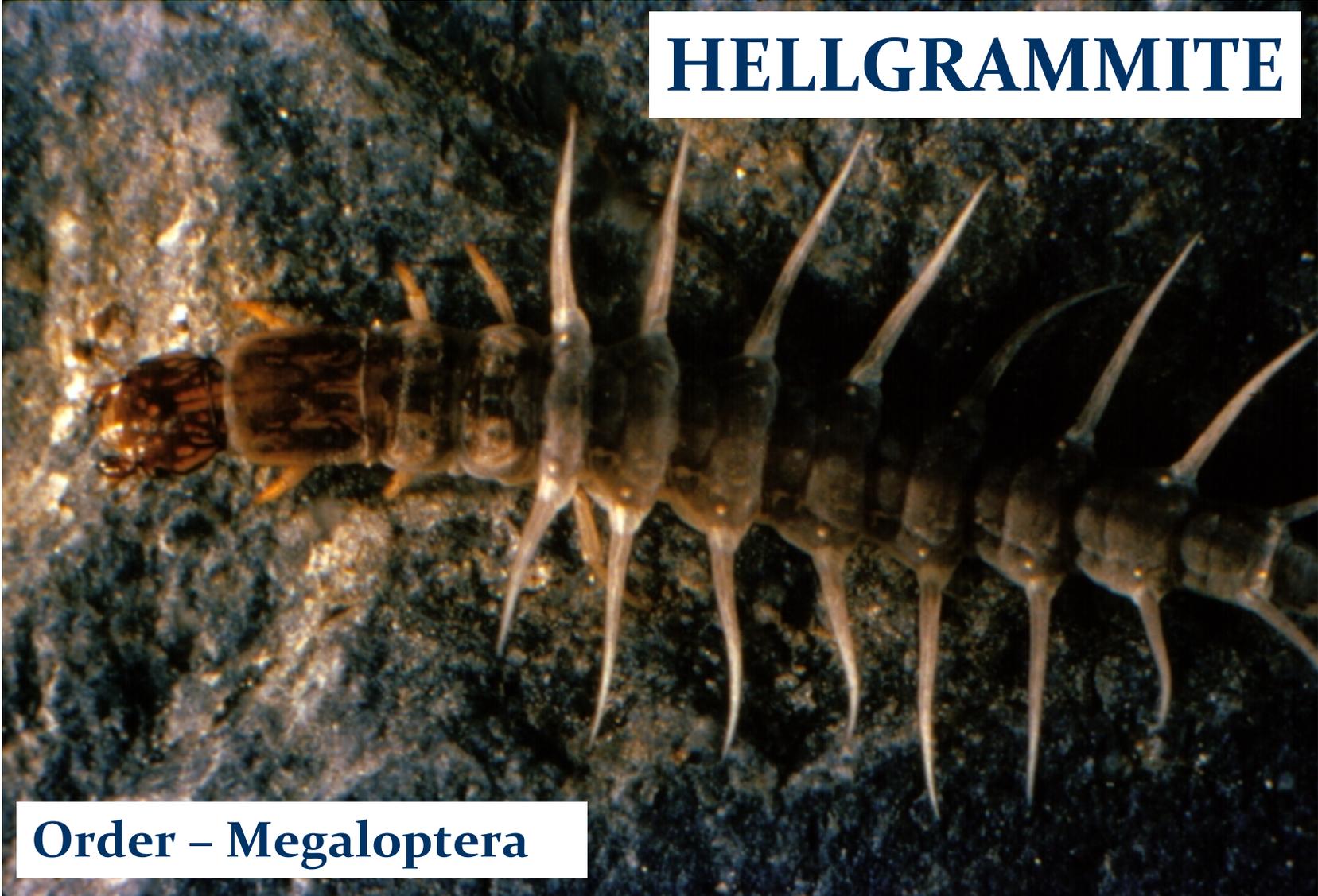


Order – Coleoptera



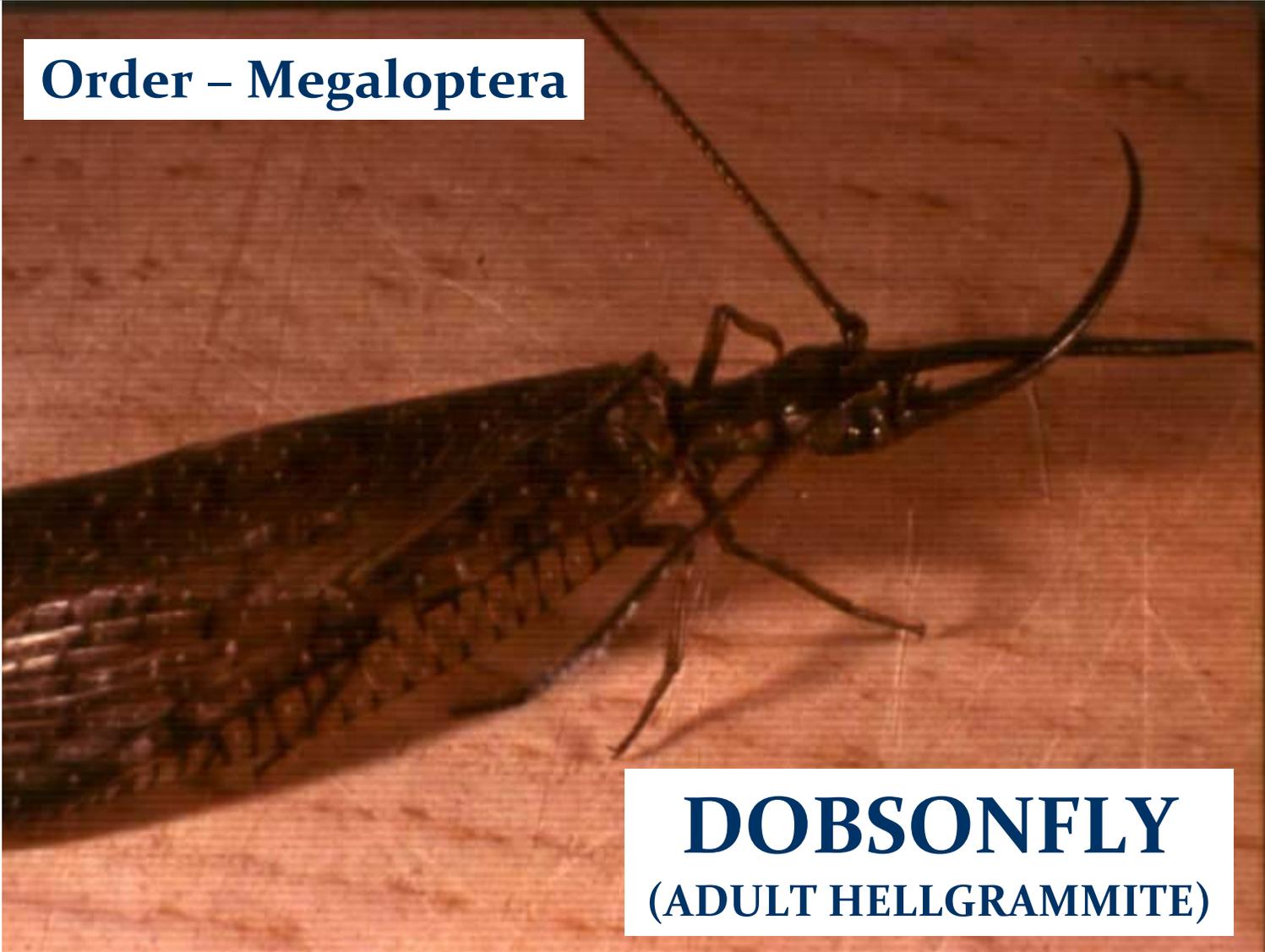
Adult

HELLGRAMMITE



Order – Megaloptera

Order – Megaloptera



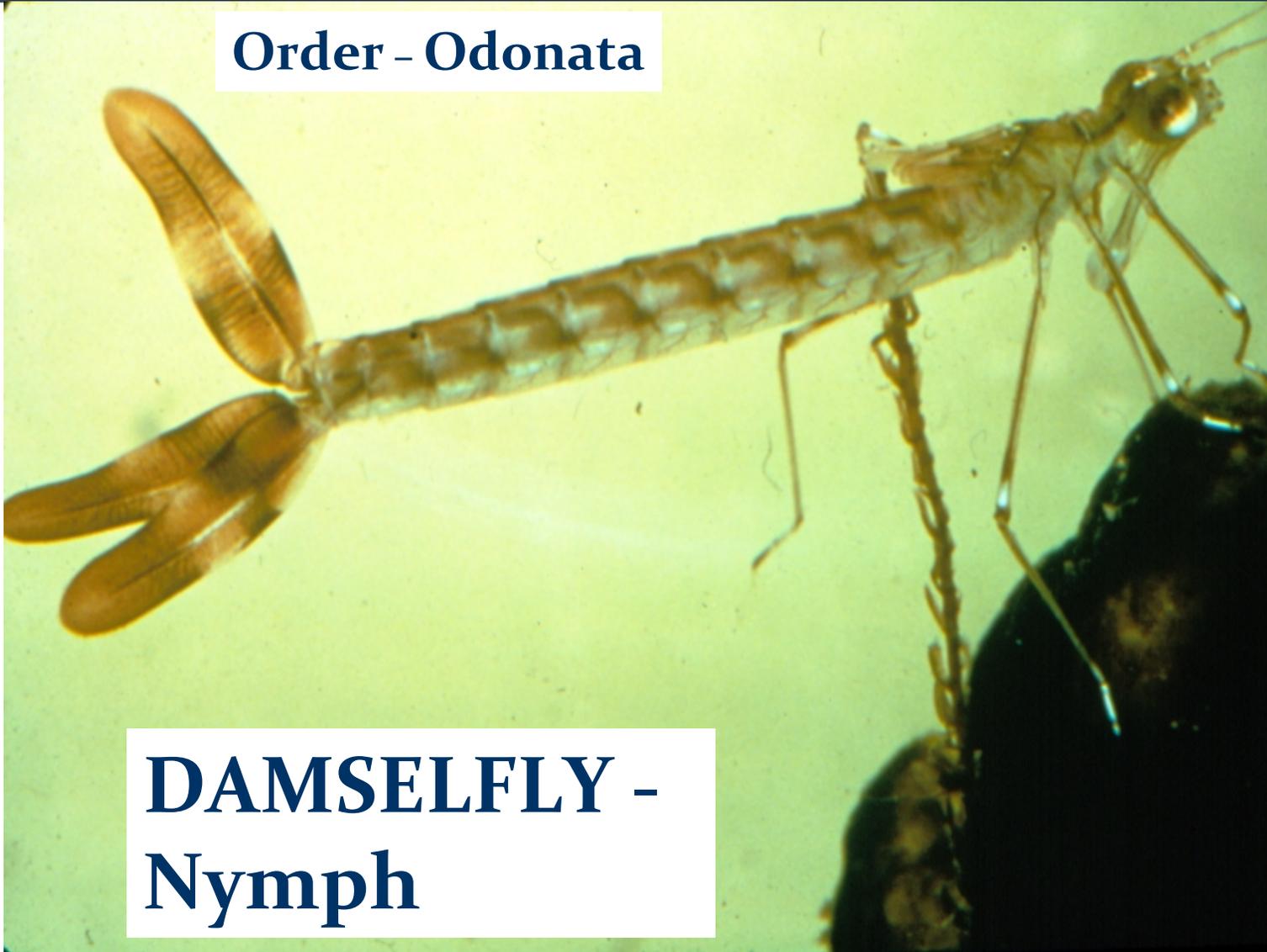
DOBSONFLY
(ADULT HELLGRAMMITE)



ALDERFLY

Order – Megaloptera

Order - Odonata



**DAMSELFLY -
Nymph**

**DAMSELFLY –
Adults**



Order – Odonata

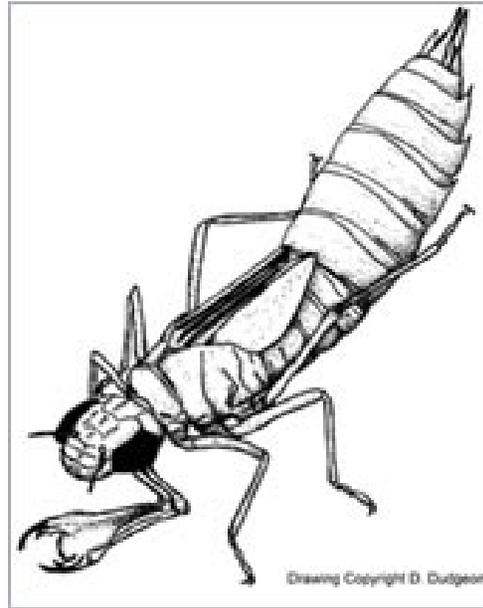
Order – Odonata



**DRAGONFLY –
Nymph**



Innocent looking
dragonfly nymph



Really the
stuff that
nightmares
are made of





RIFFLE BEETLE



Order – Coleoptera



Larva

Predaceous Diving Beetle



Adult

Order – Coleoptera

Cranefly



Order – Diptera





BLACK FLY

Order – Diptera



NON-BITING MIDGE

Order – Diptera



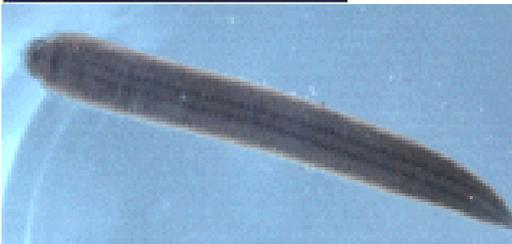
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Other Phyla

- Subphylum Crustacea
 - Crayfish, Isopods, Amphipods
- Phylum Mollusca
 - Snails, Clams, Mussels
- Phylum Annelida
 - Segmented Worms (ie. leeches)



Crustaceans

SCUDS
(AMPHIPODS)



CRAYFISH



ASIATIC CLAM
(EXOTIC)



POUCH SNAIL
(LEFT-HANDED)



GILLED SNAIL
(RIGHT-HANDED)

Mollusks



FRESHWATER
MUSSEL

AQUATIC WORM
(OLIGOCHAETE)

Annelids



LEECH

Maryland Stream Waders

- Volunteer component of MBSS
- Benthic macroinvertebrate sampling



Streamwaders.dnr@maryland.gov