Know Your Macros!

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What are Benthic Macroinvertebrates?

- Commonly called: “macros”
- Benthic = bottom dwelling
- Macro = large enough to be seen without aid of a microscope
- Invertebrate = without a backbone

Why Study Macros?

- Macros are COOL! (collectible, observable, omnipresent, & learnable)
- Important source of food & breakdown organic matter
- Macros can be used as bio-indicators of water quality
  - they have different tolerances to pollution
  - some are sensitive; others are tolerant
- They live in a habitat continuously over an extended period of time
  - affected by sporadic changes (spills, temperature spikes, …)
  - affected by seasonal variations of stream
- Useful for teaching: classification, diversity, life cycles, adaptations, energy roles, environmental factors

Identifying Macros

- Based on observable physical characteristics
- Organisms are identified using keys, requires …
  - awareness of distinguishing features
  - knowledge of life cycle (larva, pupa, adult)
- Classification of organisms
  - Different levels of classification (taxa) – Class, Order, Family, …
  - Levels progress from general groupings to more specific
  - Field ID to Class & Order level … possibly Family
- Scientific Name = *Genus species*
  - Two part name; often based on Latin or Greek words

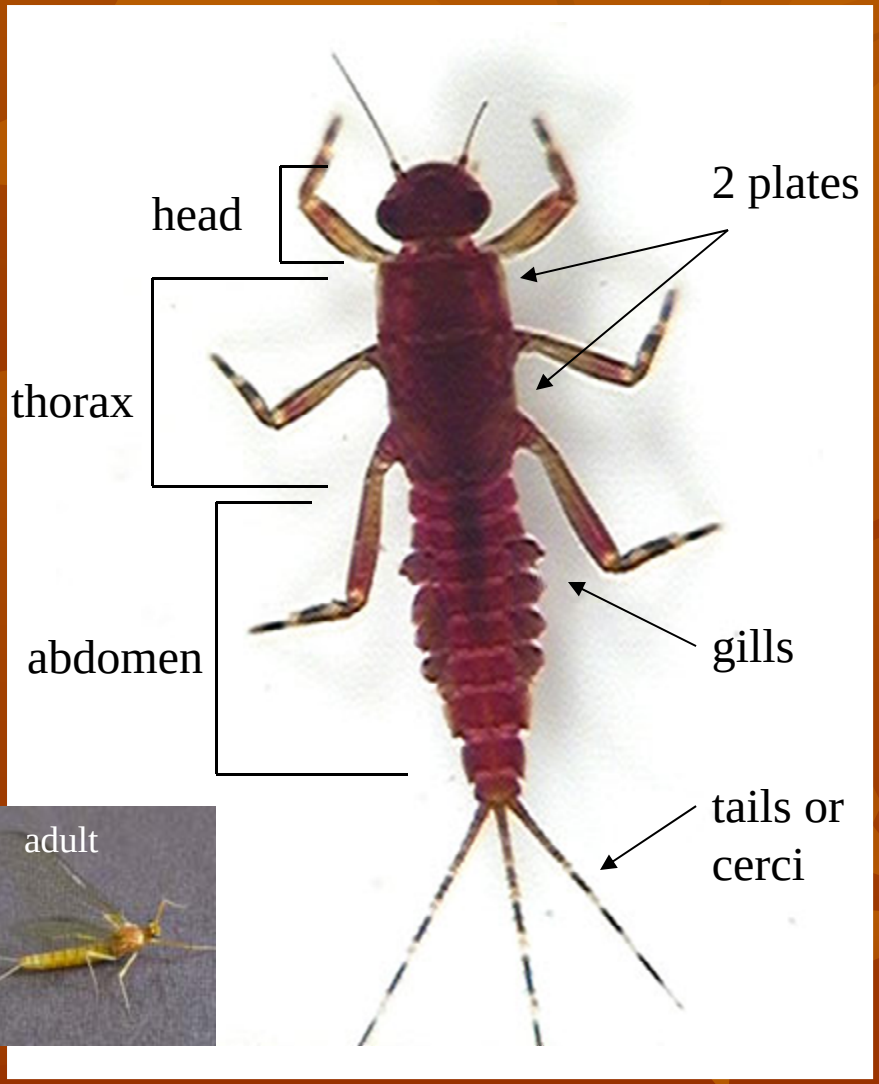
E-P-T: Important Indicators

Orders:

- Ephemeroptera = mayflies
  - Tolerance levels vary by type; often sensitive or moderately tolerant
  - Richness (diversity) in families more important than quantity of just one or two species
- Plecoptera = stoneflies
  - Generally sensitive to water pollution
- Tricoptera = caddisflies
  - Tolerance levels vary by type
  - Netspinners are tolerant; others mostly moderate
  - Richness (diversity) in families more important than quantity of just one or two species

Mayflies (Order Ephemeroptera)

- Six legs attached to thorax
- Thorax does not appear divided
- Gills along the abdomen
- 2 or 3 tails
- 1 pair wing pads, if present
- Generally collector gatherers and shredders
- Sensitive or moderately tolerant of pollution



Mayflies (Order Ephemeroptera)

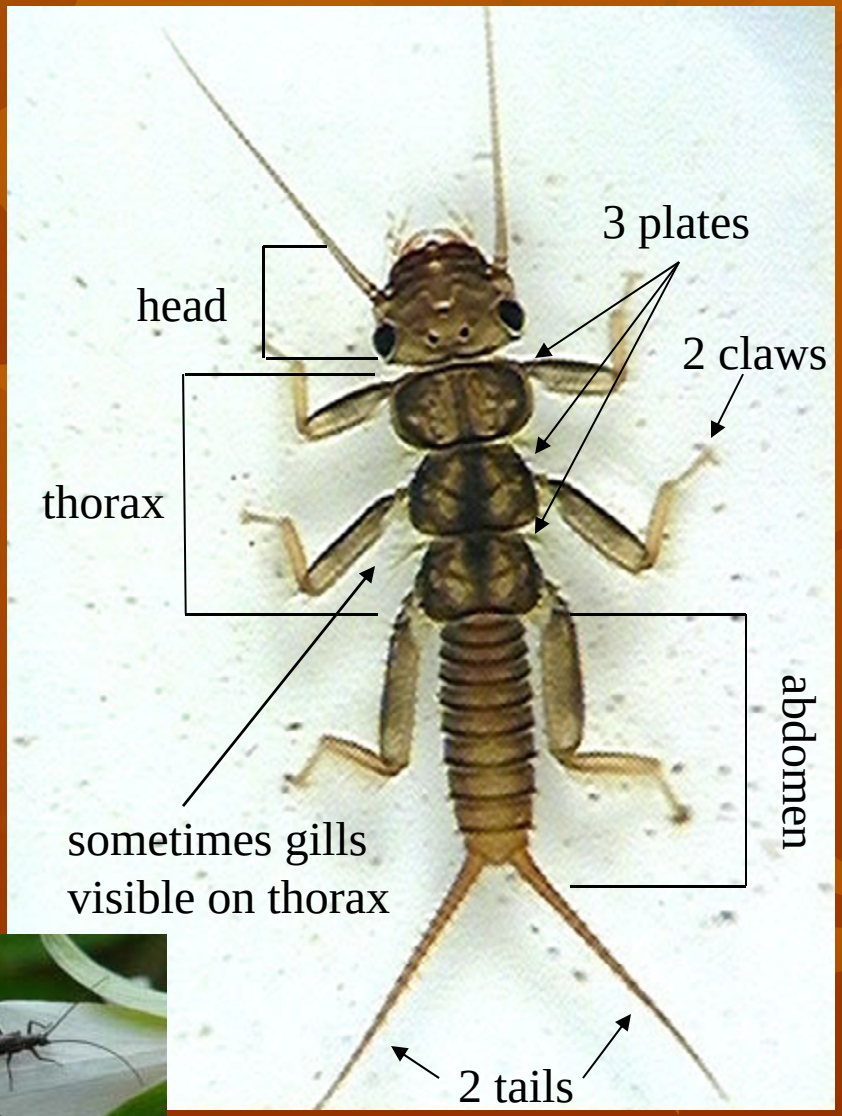
- Common Families:
  - Ameletid
  - Small Minnow
  - Flatheaded
  - Spiny Crawler
  - Pronggilled





Stoneflies (Order Plecoptera)

- Thorax divided into 3 parts
  - Pair of legs for each part
  - 2 claws at end of each leg
- 2 pair wing pads, if present
- Only 2 tails
- Gills may be visible on thorax (“hairy armpits”) or under neck
- Shredders and predators
- Mostly sensitive to pollution




adult

Stoneflies (Order Plecoptera)

- Common Families:
  - Golden
  - Little Yellow
  - Little Green
  - Slender Winter
  - Little Brown
  - Roach-like
  - Giant

Caddisflies (Order Trichoptera)

- 6 legs attached to thorax
- Fleshy abdomen; some with hair-like gills
- Prolegs with hooks at end of abdomen; some with hair-like tufts
- Some build cases from rocks and/or plant material (case-makers)
- Some spin nets as a retreat and to collect detritus (netspinners)
- Some crawl around in search of prey (free-living)
- Sensitive or moderately sensitive to pollution


adult

pupa

casemaker

Caddisflies (Order Trichoptera)

- Common Families:
  - Northern casemaker
  - Saddle casemakers
  - Lepidostomatid casemaker
  - Humpless casemaker
  - Netspinner
  - Freeliving (gr. rockworm)
  - Fingernet

Lepidostomatid - two case styles

Other Common Taxa of Aquatic Macros

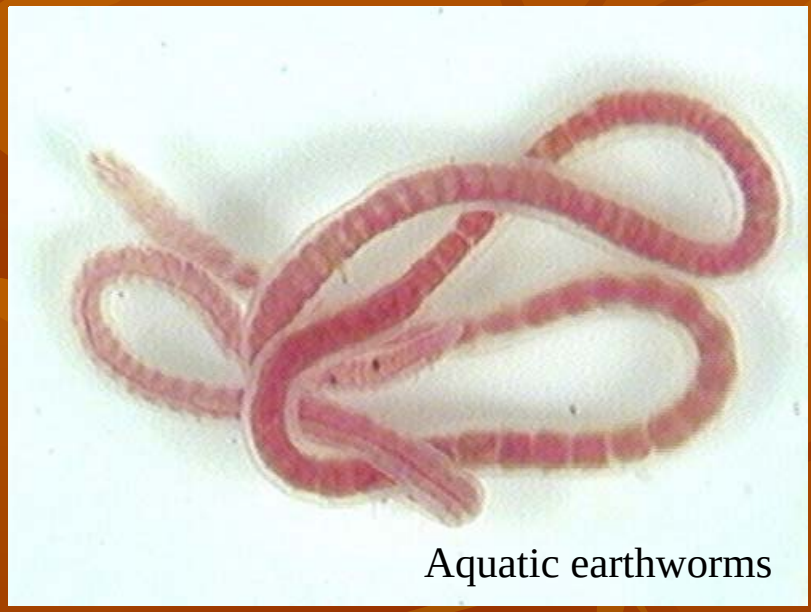
- Worms: flatworms, earthworms, & leeches
- Mollusks: snails, mussels, & clams
- Arachnids: water mites
- Crustaceans: aquatic sowbugs, scuds, & crayfish
- Insects: true bugs, beetles, dragonflies & damselflies, dobsonflies & alderflies, midges, black flies, & crane flies

Flatworms (Class Turbellaria)

- Flattened body; not segmented
- Eyespots (usually visible)
- “Glides” over surfaces
- Somewhat tolerant

Aquatic Earthworm (Class Oligochaeta)

- Round, segmented body
- Small hair-like bristles along body
- Generally tolerant of pollution



Aquatic earthworms

Leech (Class Hirudinea)

- Suckers at front & rear

leech

Snails (Class Gastropoda)

- Hard spiral shell
- Gilled snails (right-side opening with narrow end up) are somewhat sensitive


right-side

- Pouch snails (left-side opening) are tolerant


left-side

- Limpet - small, dome-like shell


limpet

Clams & Mussels (Class Bivalvia)

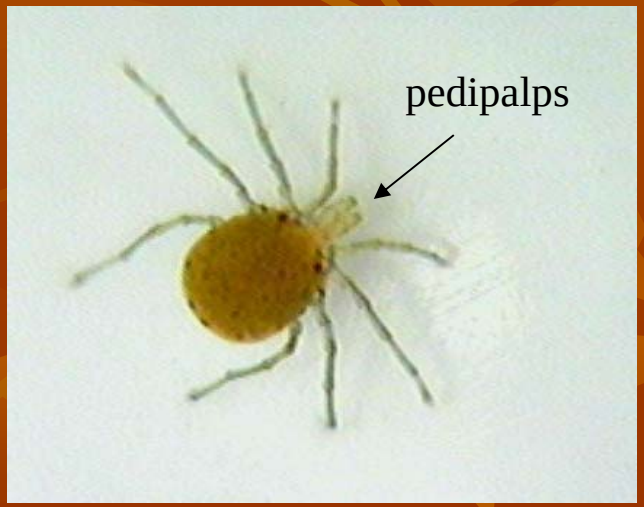
- 2 shells hinged together
- Clams are smaller and rounder than mussels
- Somewhat tolerant of pollution
- Important for stream health because they filter feed and clean the water
- Some mussels can live more than 100 years

clams

mussel

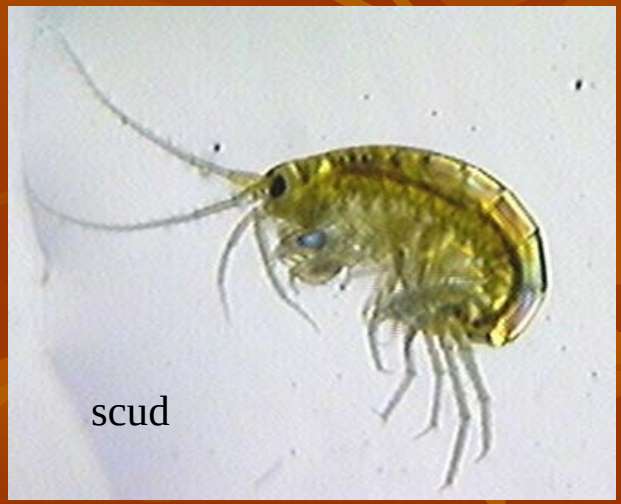
Water Mites (Class Arachnids)

- Round body with no visible segments
- 8 legs
- 2 finger-like pedipalps project forward
- Small (usually 1-3 mm); look like moving dots
- Most are predators, piercing their prey with fang-like mouth parts; others consume plants or carrion or feed as external parasites
- Generally tolerant to somewhat tolerant



Sowbugs & Scuds (Class Crustacea)

- Aquatic Sow bug (Order Isopoda)
  - Tan, brown, or greyish in color
  - 7 pair of segmented legs
  - Body flattened top-to-bottom
  - Crawls flat on bottom of tray
- Scud (Order Amphipoda)
  - Curved, shrimp-like body
  - 7 pair of segmented legs
  - Flattened from side-to-side
  - Swims on its side



Crayfish (Order Decapoda)

- Crustaceans
- 5 pairs of walking legs
- Enlarged claw at end of first pair of legs
- Wide flipper at end of abdomen
- Somewhat tolerant of pollution
- Omnivore - mostly eats plant material, but also consumes carrion, scrapes algae, and preys on live macros

Branchiobdellid (Crayfish) Worm

Water Beetles (Order Coleoptera)

- Diverse Order of insects
- Includes Riffle beetles, Predaceous beetles, Water Penny, & Whirligigs
- Generally sensitive or moderate tolerance


Whirligig beetle


Water penny


Scavenger beetle


adults

Riffle beetles


larva


larva

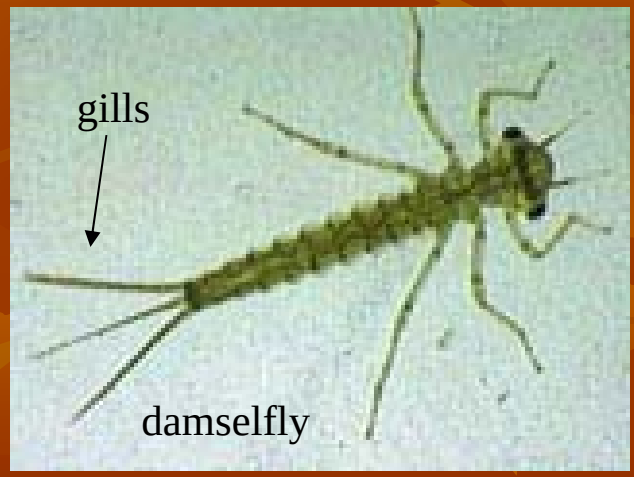

adult

Predaceous beetle

Dragonflies & Damselflies (Order Odonata)

- Dragonflies
  - Large abdomen tapers to point(s), but no tail
  - Internal gills are not visible
- Damselflies
  - Narrow abdomen ends with 3 paddle-like gills
- Dragonflies & Damselflies
  - Predators
  - Extendable, hinged jaw captures prey
  - Somewhat tolerant


dragonflies



Dobsonflies & Alderflies (Order Megaloptera)

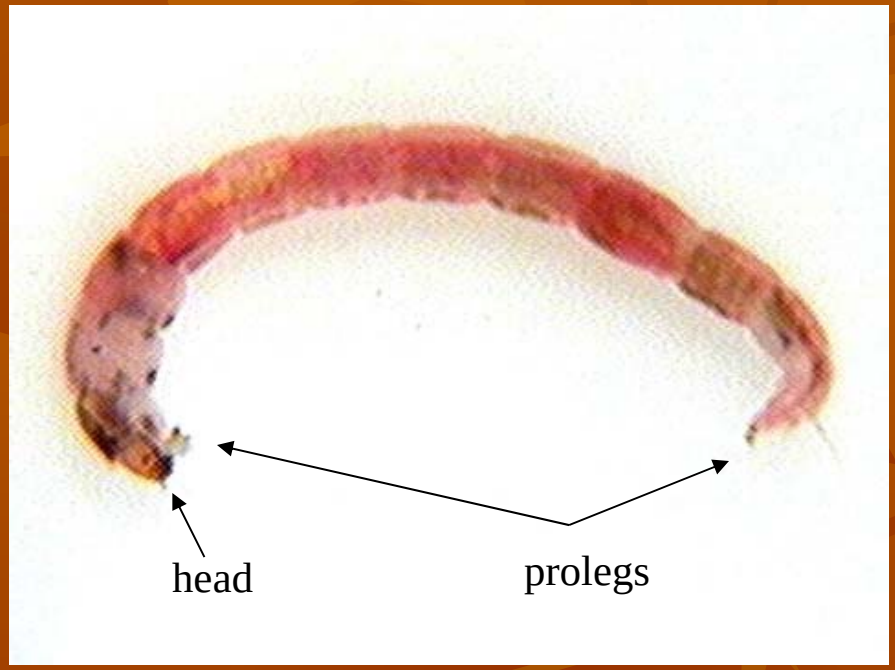
- Alderflies
  - Large gill filaments along abdomen
  - Abdomen ends with single, long, pointed tail filament
  - More tolerant of pollution than dobsonflies
- Dobsonflies
  - Stout, flexible filaments, extend from abdomen
  - Long, somewhat flattened body
  - 2 prolegs at the end, with two claws on each proleg
  - Sensitive to pollution


alderfly


dobsonfly

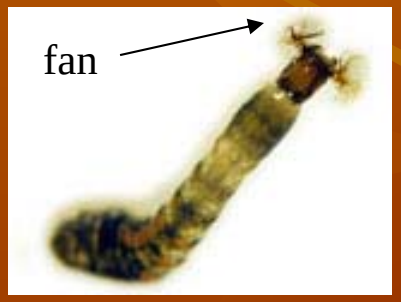
Midges (Order Diptera)

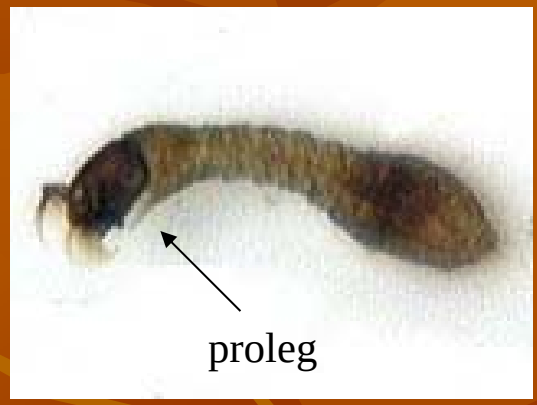
- Worm-like, but with definite head and prolegs (usually)
- “Twitchy” swimmers
- Pollution tolerant



Blackflies (Order Diptera)

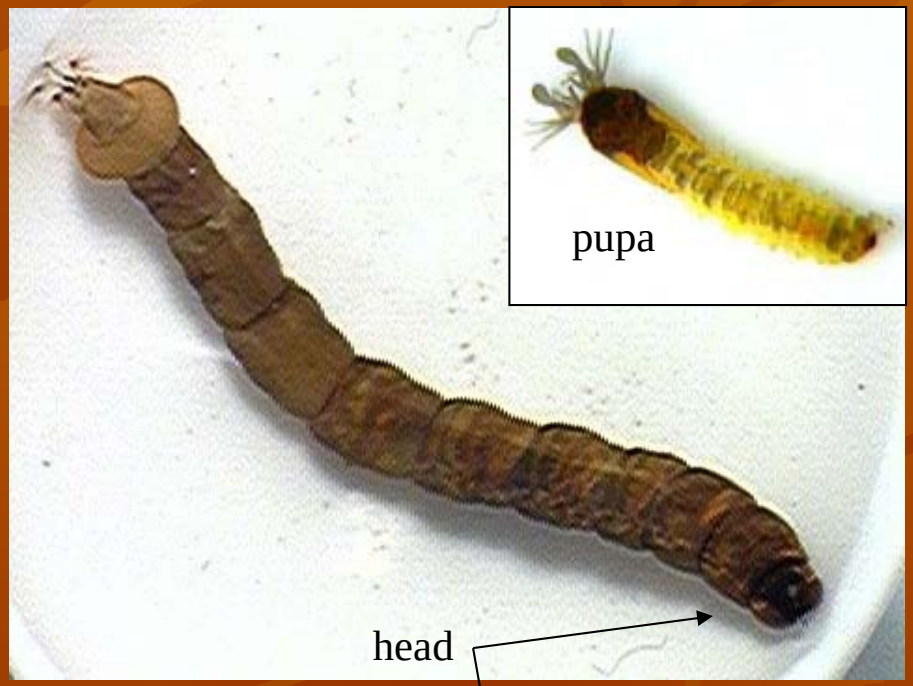
- Shaped like bowling pin
- Two fans on top of head for filtering
- Attaches to substrate with ring of hooks at end of abdomen
- Single proleg beneath head
- Tolerant of pollution

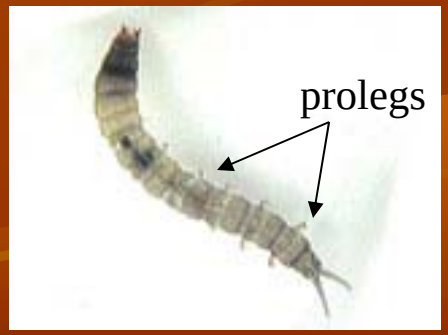




Craneflies (Order Diptera)

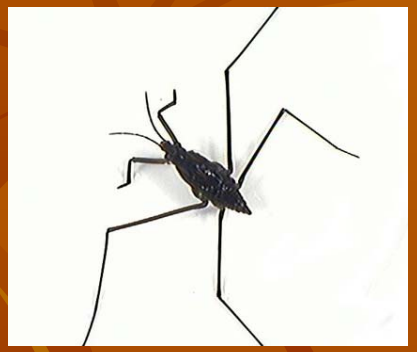
- Long, fleshy abdomen
- Head often withdrawn & concealed by thorax
- Some have pairs of prolegs beneath abdomen
- Somewhat tolerant (other Diptera are more tolerant)
- Some are shedders, others predators





Water Boatman & Backswimmer (Order Hemiptera)

- Water Strider
  - "Skates" around on top of water
  - Front legs grab & beak pierces prey
- Water Boatman
  - Oval body with wavy lines across a dark colored back
  - Oar-like legs
- Backswimmer
  - Similar to boatman; swims upside down
  - Dark underside & light-colored back
  - CAUTION -- can bite!



water strider

water boatman

backswimmer

Credits & Resources

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- Websites:
  - www.nwnature.net
- Email:
  - mclapp@nwnature.net
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