Know Your Macros!

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CAM Jr/Sr High ~ Battle Ground, WA

revised: September 2006 edited for NC 2/12/09 ram

What are Benthic Macroinvertebrates?

- Commonly referred to as: "macros"

- Benthic = bottom dwelling
- Macro = large enough to be seen without aid of a microscope
- Invertebrate = without a backbone

Why Study Macros?

- Macros have different tolerances to pollution
- Some are sensitive, others are tolerant
- They're used as bio-indicators of water quality
- They live in habitat continuously over an extended period of time
  - affected by sporadic changes (chemical leaks, …)
  - affected by seasonal variations of stream
- Macros are COOL!

Identifying Macros

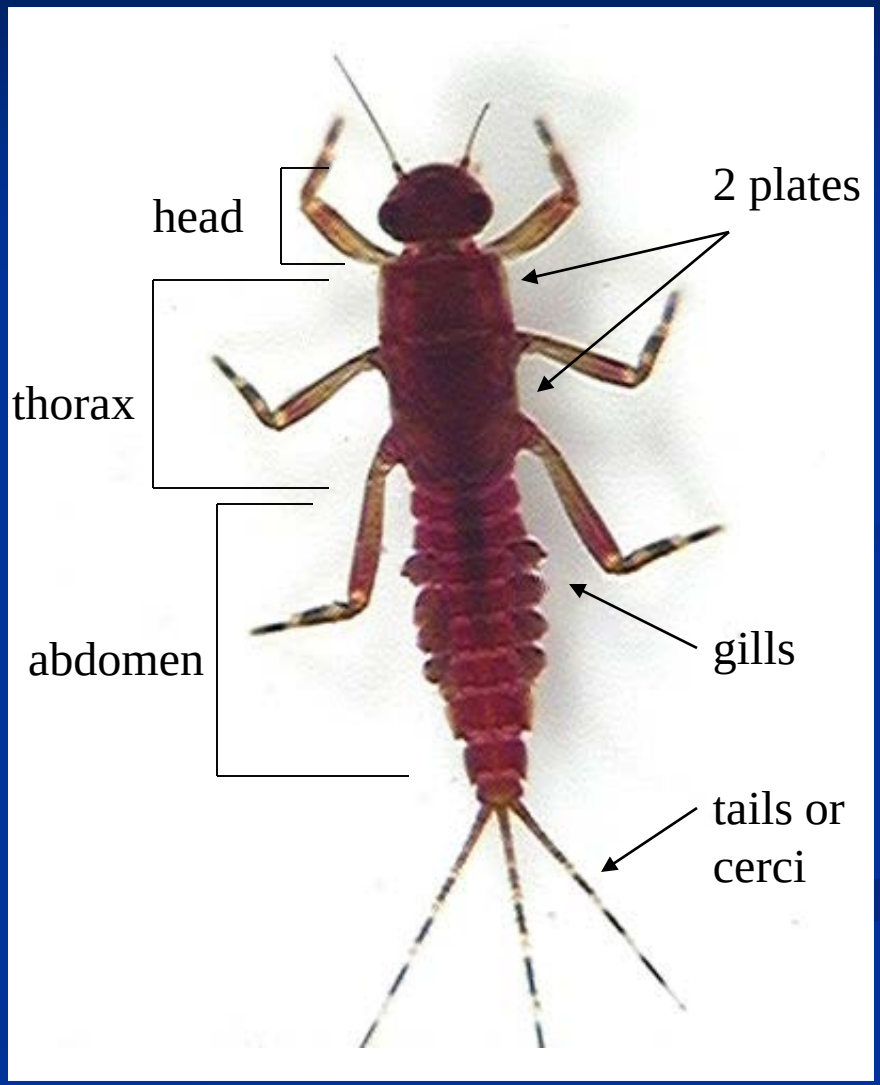
- Based on observable physical characteristics
- Organisms are identified using keys, requires …
  - awareness of distinguishing features
  - knowledge of life cycle (larva, pupa, adult)
- Classification of organisms
  - Different levels of classification (taxa)
  - Levels progress from general groupings to more specific
  - ID to Class & Order level (possibly Family)
- Professional Scientists use scientific names
  - Binomial (two names)
  - Based on Latin/Greek language
  - Scientific Name = *Genus species*

E-P-T: Important Indicators Species

- Ephemeroptera - mayflies
- Plecoptera - stoneflies
- Tricoptera - caddisflies

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
- Group I



Mayflies (Order Ephemeroptera)

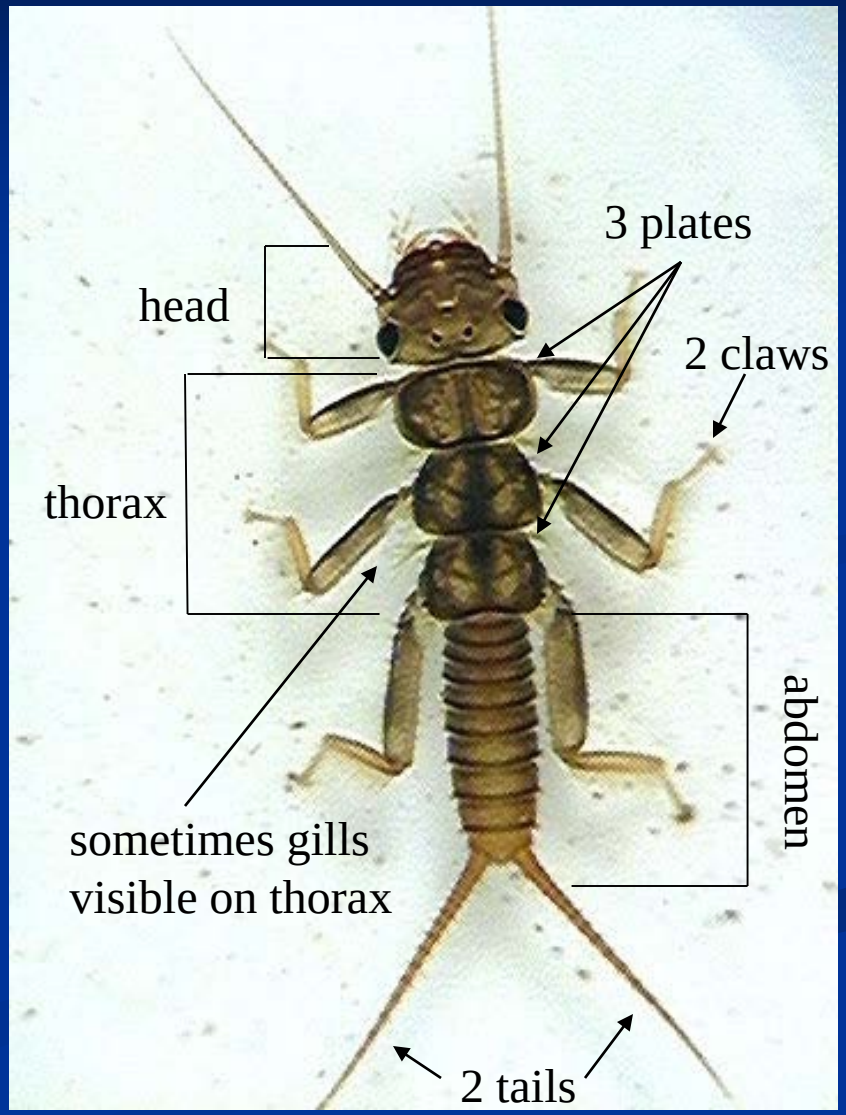
- Common Families:
  - Ameletid
  - Small Minnow
  - Flat-headed
  - Spiny Crawler
  - Prong-gilled





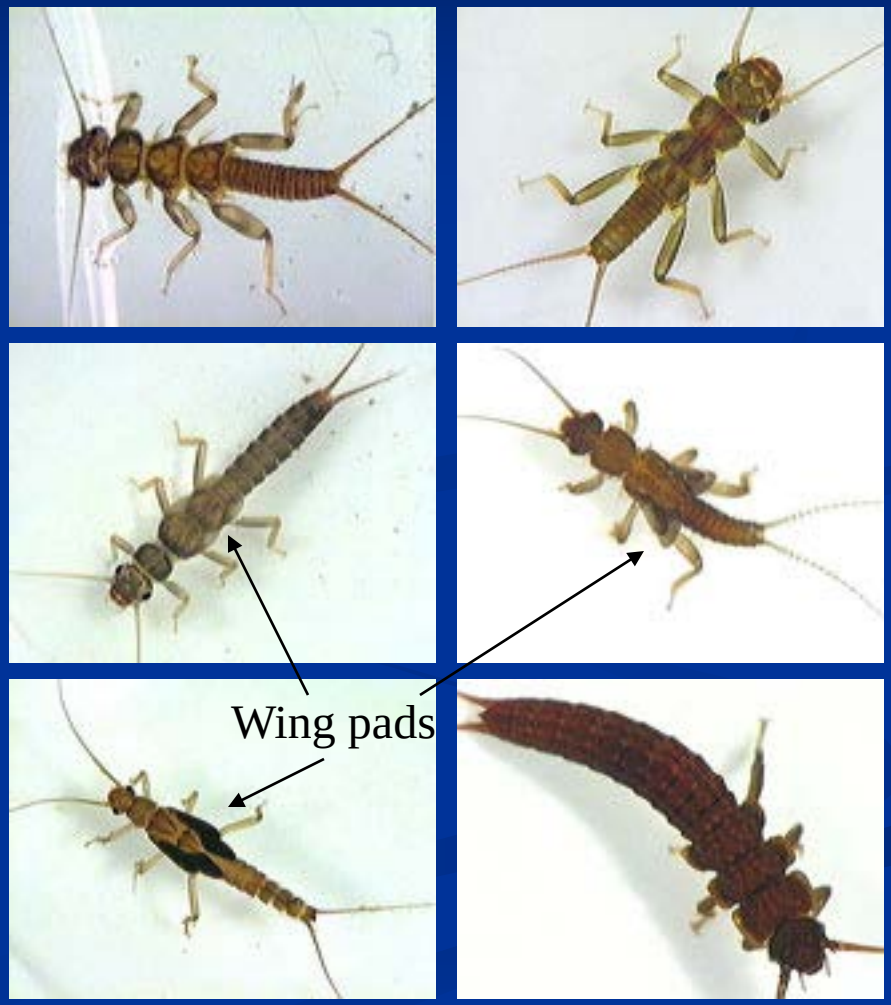
Stoneflies (Order Plecoptera)

- 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
- Group I



Stoneflies (Order Plecoptera)

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



Caddisflies (Order Trichoptera)

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

Caddisflies (Order Trichoptera)

- Common Families:
  - Northern casemaker
  - Saddle casemakers
  - Humpless case-maker
  - Netspinner (Hydropsychidae)
  - Freeliving (green rock worm)
  - Fingernet






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

- Flattened body; not segmented
- Eyespots (usually visible)
- "Glides" over surfaces
- Somewhat tolerant
- Group III

Aquatic Earthworm (Class Oligochaeta)

- Round, segmented body
- Small hair-like bristles along body
- Tolerant of pollution
- Group III

Snails (Class Gastropoda)

- Hard spiral shell
- Gilled snails (right-side opening with narrow end up) are somewhat sensitive – Group I
- Pouch snails (left-side) are tolerant – Group III

limpet

Clams & Mussels (Class Bivalvia)

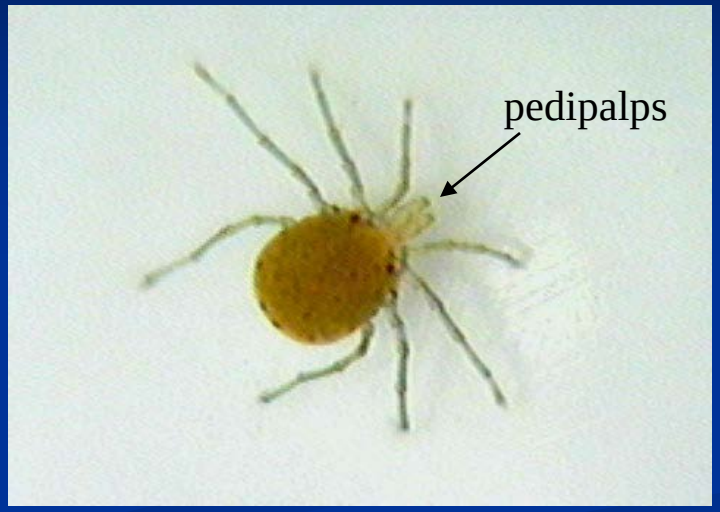
- 2 shells hinged together
- Clams are smaller and rounder than mussels
- Somewhat tolerant of pollution – Group II
- Important for stream health because they filter feed and clean the water

clam

mussel

Water Mites (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 (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
- Both Group II

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 – Group II
- Omnivore - mostly eats plant material, but also consumes carrion, scrapes algae, and preys on live macros

Water Beetles (Order Coleoptera)

- Diverse Order of insects
- Includes Riffle beetles, Predaceous beetles, Water Penny, & Whirligigs
- Sensitive to Pollution – Group I and II

Whirligig beetle

Riffle beetle

adult

larva

adult

Predaceous beetle

larva

Dragonflies & Damselflies (Order Odonata)

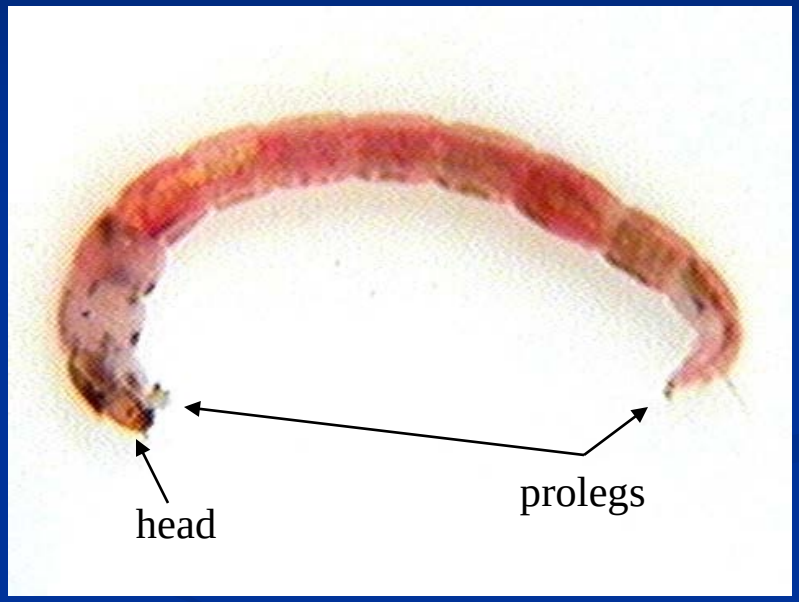
- Dragonflies
  - Large abdomen tapers to point(s), but no tail
  - Internal gills are not visible
- Damselflies
  - Narrow abdomen ends with 3 paddle-like gills
- Dragonflies & Damselflies
  - Predators
  - Extendable, hinged jaw captures prey
  - Somewhat tolerant - Group II

Dobsonflies & Alderflies (Order Megaloptera)

- Alderflies
  - Large gill filaments along abdomen
  - Abdomen ends with single, long, pointed tail filament
  - More tolerant of pollution than dobsonflies – Group II
- 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 – Group I

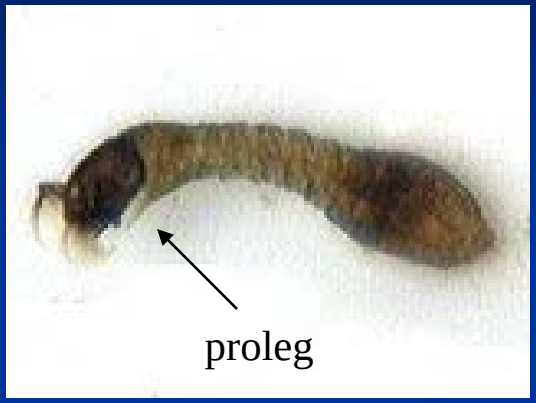
Midges (Order Diptera)

- Worm-like, but with definite head and prolegs (usually)
- "Twitchy" swimmers
- Pollution tolerant – Group III



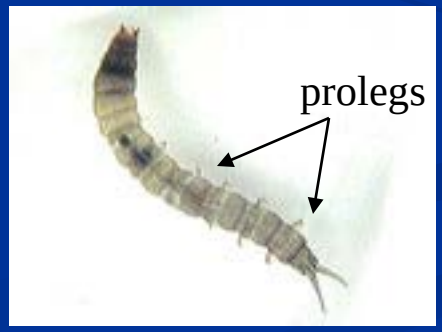
Blackflies (Order Diptera)

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



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) – Group II
- Some are shedders, other predators



Water Boatman & Water Striders (Order Hemiptera)

- Water Strider
  - "Skates" around on top of water
  - Front legs grab & beak pierces prey
  - Group II
- Water Boatman
  - Oval body with wavy lines across a dark colored back
  - Oar-like legs
  - Group III
- Backswimmer (not shown)
  - Similar to boatman but swims upside down
  - Dark underside & light-colored back
  - CAUTION -- can bite!
  - Group III

water boatman

Credits & Resources

- Photos
  - by Michael Clapp & Jr CAM science students
- Websites:
  - www.nwnature.net
  - Information on CAM Jr/Sr High School water quality monitoring and macroinvertebrate study can be found on the web:

    www.bgsd.k12.wa.us/hml/macros
- Email:
  - clapp.michael@bgsd.k12.wa.us
- Resources:
  - Macroinvertebrates of the Pacific Northwest
    by Jeff Adams and Mace Vaughan
  - Freshwater Macroinvertebrates from Streams in WA & OR
    by Michael R. Clapp
  - Aquatic Macroinvertebrate Field Guide and Biomonitoring Reference Manual for the Willamette Valley by Patrick Edwards
  - Freshwater Invertebrates
    by J. Reese Voshell, Jr.
  - Guide to Pacific Northwest Aquatic Macroinvertebrates
    by Rick Hafele & Steve Hinton