

Curse of the Creepy Crawlers...





- Niece

- U of I Film Festival

Aquatic Macroinvertebrates of Illinois

A Supplement For the Illinois RiverWatch Program



RiverWatch

- Created by IDNR 1995; taken over by Great Rivers R and E
- Employs “trained” citizen scientists to sample stream biology
- Creates a database of macroinvertebrate samples and metrics (MBI)
- Tracks long term trends and regional distributions



New guide is intended to help RiverWatch citizen scientists
Uses RiverWatch taxa categories
Useable by stream stewards and anyone interested in local
stream ecology

**Macroinvertebrates= See them without aid of a microscope
in general 1 mm up to several hundred mm**

Common Name

Taxa weight

Taxonomic hierarchy

Scuds or side-swimmers Taxa Index=4.0 Phylum Arthropoda, Class Crustacea, Order Amphipoda

Taxa Description

NAME: Amphipoda (side) pods (bat)
LARVA: Newly hatched amphipods look like the adults but will go through a series of molts until they obtain their adult size.
1.) flattened from side to side
2.) the body is made up of a head, thorax (perceon), and abdomen (pleon)
3. multiple jointed appendages, some of which function as legs and others for grasping (gnathopods)
4.) gills are flat sacs that extend from the abdomen. See anatomy drawing

DO NOT confuse isopods (that are flattened top to bottom) with amphipods (that are flattened side to side). Most common amphipods are also "C" or crescent shaped.

ADULT: Adults are exclusively aquatic. There will be slight anatomical differences between males and females.

REPRODUCTION: Sexual reproduction occurs when males attach to females transferring sperm to her genital duct. Fertilized eggs are incubated in the female's ventral brood pouch
FUNCTIONAL FEEDING GROUPS: Omnivores; Scapers; Collector-gatherer
FOOD: Primarily plant and animal debris.

GENERAL ECOLOGY AND IMPORTANCE: Side-swimmer is descriptive since amphipods actively swim and forage on their sides. They are generally associated with bottom sediments and/or leaf detritus. Uropods at the back of the abdomen are used for burrowing, swimming, and jumping They are good indicators of water quality, being sensitive to a range of chemical pollutants.

LINKS:
http://summits.usd.edu/biota.ca/Projects/Aquatic-Invertebrates



Don't confuse amphipods with isopods

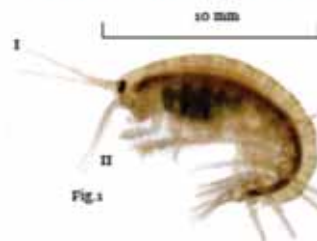


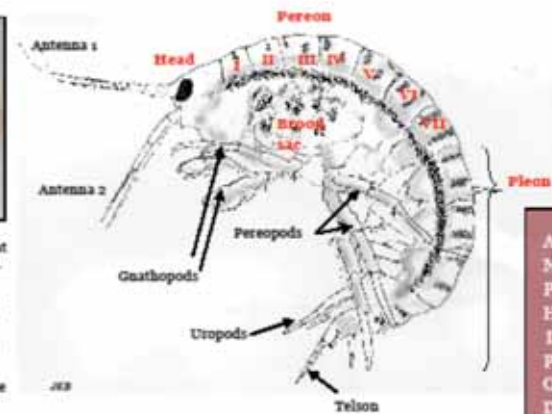
Fig. 1: Female amphipod Gammarus sp. Live specimen with eggs in the brood sac. Photo shot with transmitted light. Note double sets of antennae (I,II)



Fig. 2 Male Gammarus sp. Live specimen photographed with transmitted light.



Fig. 3 This is the same specimen as pictured in Figure No. 1. Macroinvertebrates can look dramatically different under different light sources. The first specimen was shot in water in an aquarium, whereas the 2nd specimen was photographed out of water in reflected light. As macroinvertebrates are preserved they will lose some of their color. The side to side flattening is more evident in this view as well.



AMPHIPODA

Anatomical traits used for id.

Ecological significance

Relative size range



Penny reference along with scale bars

Fun stuff and/or elaboration of taxa

- Background materials designed to elaborate on the nature of the organisms being described. i.e.
- Rasping sucker +hirudin enzyme of leeches
- Fish , frog, turtle leeches
- Leech brood sac
- Parasitic vs free living life style
- Engulfing predators

Leeches Taxa Index:8.0 Phylum Annelida, Class Hirudinea

IN DEPTH...

LEECHES AS PARASITES
Almost all leeches feed on bodily fluids even those which prey on invertebrates. True parasites or blood sucking leeches typically have fine teeth located behind the front sucker. The mouth and teeth are used to rasp a wound, secrete an anticoagulant (hirudin), and feed on blood of the prey animal. Some leeches are capable of increasing their body weight five-fold with a blood meal. Specialized blood sucking leeches exist for frogs, turtles, fish, water fowl and mammals. Turtle leeches are amongst the most common. Most leech parasites extract a meal and then fall off, others represent semi-permanent residents of the host. Some leeches have a protrudible proboscis that is used for penetrating the body of potential hosts. Medical use of leeches involved blood letting; it's historic use may or may not have helped the patient. Modern use takes advantage of the anticoagulant properties of hirudin and is typically used to bleed localized injuries where blood has accumulated beneath the skin.

LEECHES AS FREE LIVING PREDATORS
Predatory leeches always feed on invertebrates. Prey includes worms, snails, and insect larvae. Feeding is relatively frequent and prey are usually swallowed whole. Free-living forms are usually associated with slow moving water and are found in quiet protected shallow areas of ponds, wetlands, and marshes. They typically avoid direct sunlight and become active during the night. Leeches are prey for a variety of wildlife including fish, snakes, frogs, and birds.


Fig. 3

Fig. 3 How many leeches can you find in this photo?



Fig. 4

Fig. 4 There are five separate leeches in this photo. This form of leech uses a brood sac which is attached. After the eggs hatch they remain attached to the parent. This contrasts with the leech on the preceding page which creates a cocoon for its young.

Fig. 5

Fig.5 Medical leech

HIRUDINEA

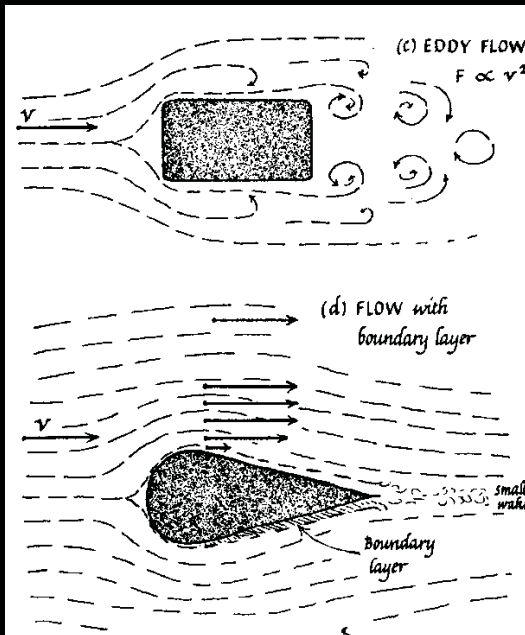
Leeches are still used in some medical procedures to drain local blood accumulations

Adaptations to Flow

Reynolds numbers= measured resistance to flow; actually physically measured in some engineering studies



Clinging and stationary



Free swimming



Clinging but mobile



Clinging, mobile against substrate

All stream organisms must be adapted to flow; method of adaptation will differ with life style



Figure 4.26: Heptageniidae larva, Lateral View.

Feeding Groups

- Collector/gatherers: detritivores FPOM
- Collector/filterers: filter and strain FPOM from water column
- Parasites: live on or in other organisms (i.e. nematode worms)
- Piercers: pierce then suck body fluids (some leeches)
- Predators: capture prey and consume whole
- Scrapers: harvest rock algae, diatoms, and critters
- Shredders: herbivores and detritivores on whole live or dead tissue



Micro-Crustaceans: Amphipods and isopods



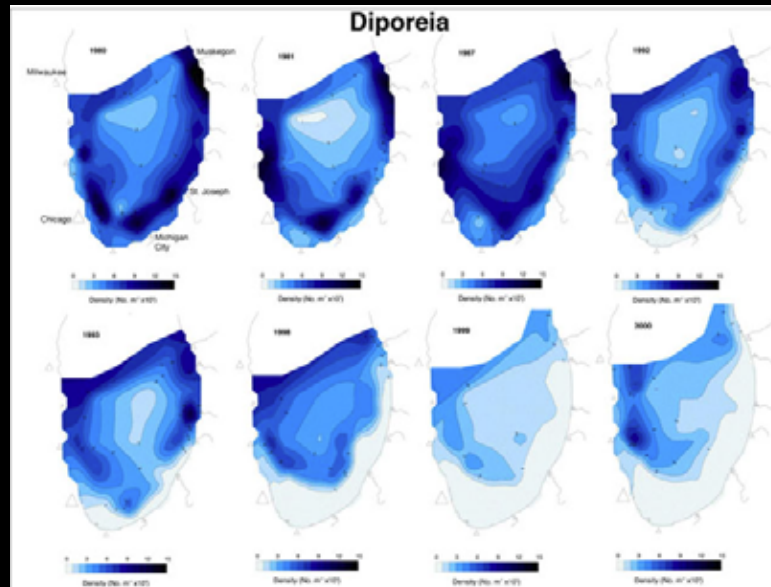
Side-swimmer
Amphipods



Aquatic sow bug
isopod

- i.d. = Dorso-ventral vs. lateral flattening
- Significance: freshwater and marine food webs (i.e. Lake Michigan)
ubiquitous in streams and lakes
- Taxa weight: Isopods indicative of high organic loading= taxa
weighting; Amphipods higher quality waters
- Amphipod use as basic bioassay organism...i.e. chemical dose challenges
(*Hyalla azteca*)
- In Lake Michigan apparent competition with zebra mussels; *Diporeia* is
critical element of fish food webs

>10,000 sq. m



+ mostly gone in 2009

- Colonize the bottom , bodies are high in oil content
- Diporeia was significant food source (alewives, whitefish, sculpins)
- Zebra and quagga mussels compete with amphipod for food
- Zebra and quagga not a good prey species for fish
- Atrazine , PCBs, others may play a role

Invasive species



Zebra mussel infestation on bottom of Jon boat in local inland lake



Fat mucket native mussel colonized by zebra mussels



Rocks in stream covered by zebra mussels a competitor with microcrustaceans

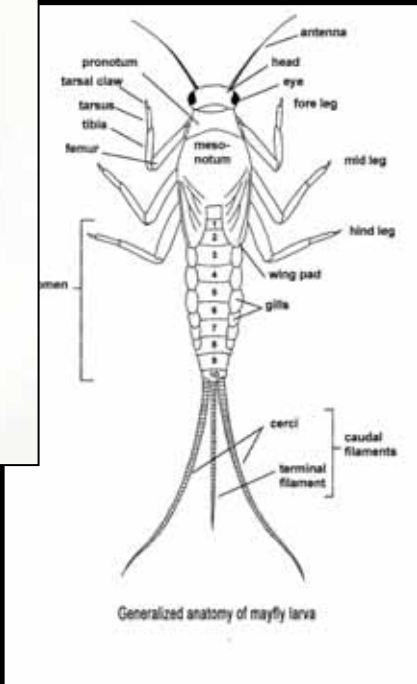
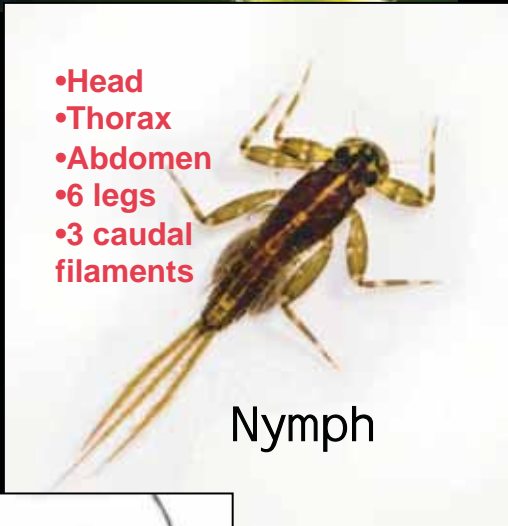
Assessing High Quality Stream Environments

- EPT Taxa = simple count of EPT taxa
 - Ephemeroptera mayflies
 - Plecoptera stoneflies
 - Trichoptera caddisflies



- MBI metric= sum of the taxa numbers * taxa weighting/total number of organisms
 - = lower numbers < 5.0 = high quality stream reaches
- Simple diversity= total number of taxa
- Absence of exotics

Mayflies : Ephemeroptera



- One of most common faunal elements
- Adult numbers can be so large that they can be tracked on radar
- Incomplete metamorphosis= egg, nymph (larva), adult **No pupa**
- Adults have 4 triangular wings (gracile)
- Multiple life styles and habitats
- Exceptionally important fish food
- Nymphs = 3 caudal filament/
•**distinguish from damselfly gills**
- Caudal filaments sensory + stabilization

Mayflies : Ephemeroptera II.....multiple mayfly families in Illinois

Isonychiidae



Swimming mayflies

Baetidae



Ameletida



Torpedo mayflies

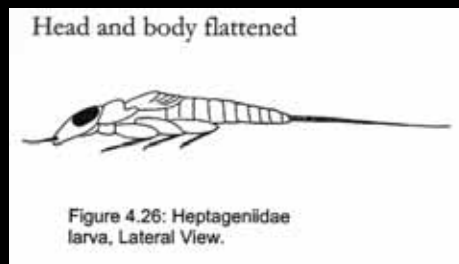
Streamlined, active swimmers
High quality, fast moving stream
Low taxa indices (3,4)= good quality water
Poorer quality for some families (Siph.+ Baetids
Filter feeders and collector -gathers

Mayflies : Ephemeroptera III

Clinging mayflies



- Dorso-ventral flattening
- Abdominal gills
- Tarsal claws
- High quality fast flowing streams (generally but not always)
- Scrappers and collectors
- Important fish food
- Taxa Index= 3.5



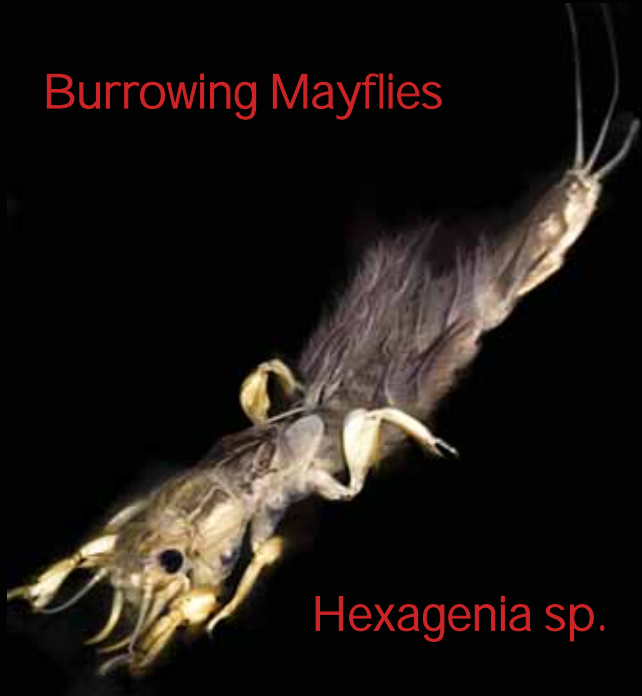
Crawling Mayflies



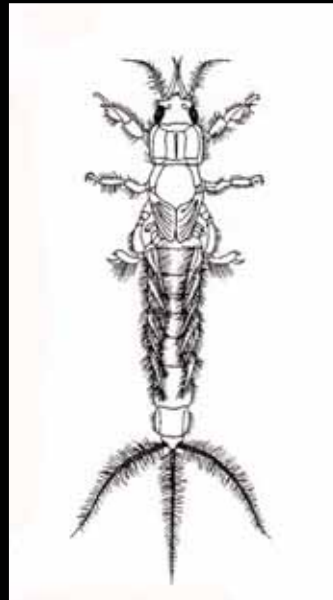
- Actively move about
- Generally in quite waters
- Very small
- Silty bottoms; depositional waters
- Taxa Index= 5.5 (not as good as other mayfly families)
- **Very, very common**
- Scrappers and collectors
- Operculate (hidden/enclosed) gills

Mayflies : Ephemeroptera IV

Burrowing Mayflies



Hexagenia sp.



- Largest of mayflies (1 to 2 inches)
- Soft sediment environments (i.e. Spring Creek)
- Make borrows; gills fan the borrow
- Collector gathers
- Hatches can generate 100's of thousands of mayflies; lake Erie radar signature
- Tusks are used for burrowing
- Taxa index= 5.0

Stoneflies Plecoptera (folded wings)

2 wing pads; some w external gills



2 cerci



bifurcated claws

adult



winter stonefly



- lowest taxa index (best streams)
- predators or shredders
- 76 species (15 species gone; 13 are known from 5 or fewer localities)
- example of invertebrate E/T
- winter stoneflies (dark coloration+ antifreeze)
- 8 families in Illinois

Caddisflies Trichoptera (hair winged ; refers to adult)



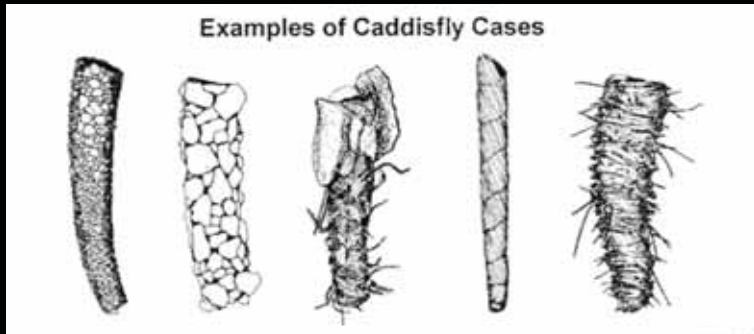
Net spinning caddisfly
Hydropsychidae

- most common
- Stridulation for territories

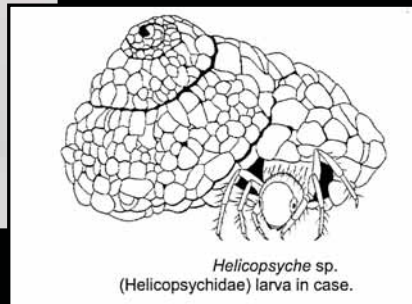
- Related to moths and butterflies
- Spin silk to create either "nets" or houses made from different materials
- "Caddis" term from English clothing salesman
- ~ 18 different families in midwest
- Wide variety of feeding groups
- Complete metamorphosis



Caddisflies Trichoptera II Types of caddis fly cases



Giant case builder



Types of caddisfly cases:

- Cases stuck together with silk
- Complete metamorphosis w pupae (similar to moths and butterflies)
- None-free living
- Net-spinners
- Leaves, vegetation
- Twigs
- Stones
- Sand grains

Aquatic beetles Coleoptera

Riffle beetle adults and larvae



Water penny larvae



Ventral

Whirligig beetles and larvae



Assorted aquatic beetle larvae Coleoptera II



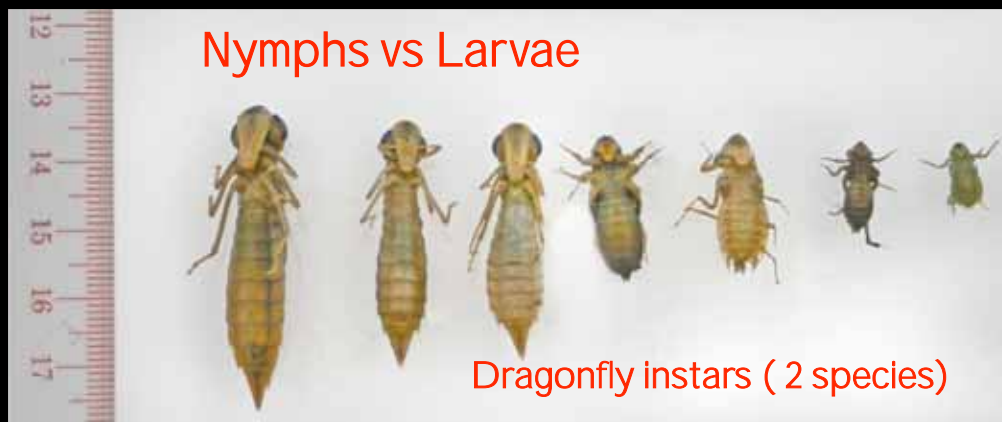
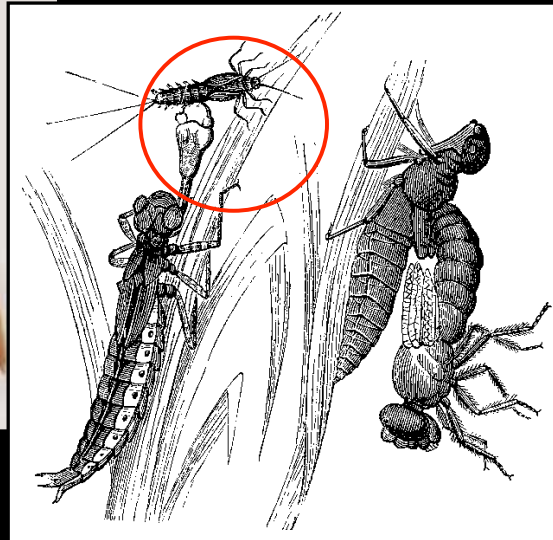
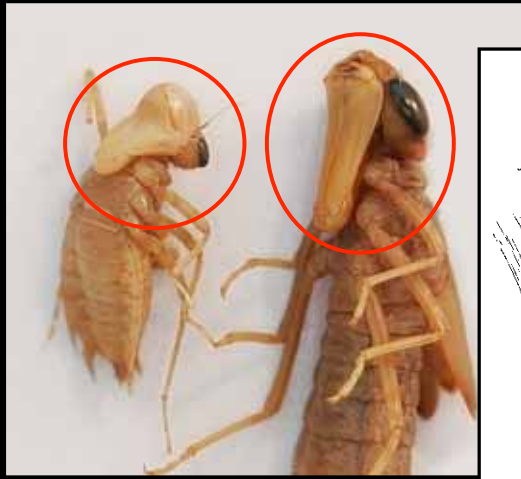
Predacious diving beetle
Dytiscidae



Gyrinidae
Dineustus sp.
Whirligig beetle

Water penny larvae

Dragonflies and damselflies Odonata (7 families of dragonflies in Illinois)



- **Incomplete** metamorphosis
- **Nymphs** not larvae
- Instars with wings on final instar
- Extensible lower jaw (labium,)
- Nymphs jet propelled ; squirt water from their anus
- Complex compound eyes with ommatidia (wide field of vision and detailed resolution)
- **PREDATORS**



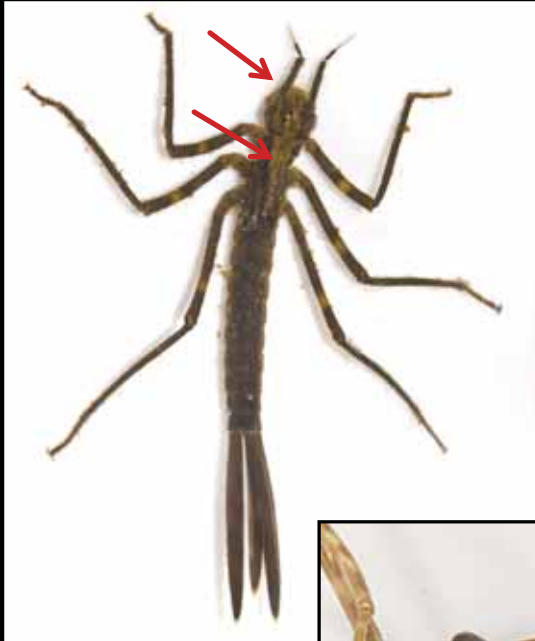
- At least one web site claims that the jaws for the “monster” from Alien was modeled after the extensible jaw of the dragonfly.
- Extensible jaw of dragonfly can be very fast= 1/100th of a second
- Able to eat relatively large prey i.e. larva with minnow



Please note that dragonfly nymphs don't bite people....they simply aren't that tasty

Dragonflies and damselflies Odonata SubO. Zygoptera 3 families of damselflies

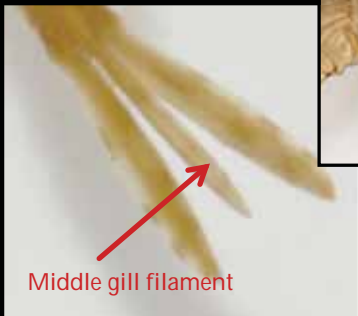
Broad-winged damselfly



Narrow-winged damselfly



Spread-winged damselfly



True flies Dipterans (two winged) , bizarre, ubiquitous and biologically significant

The good



Snipe fly

- Piercing predator
- Fast flowing streams
- Feed on soft bodied prey
- Taxa index=4.0 (very good)
- Adults may feed on other insects
- Adults=lookdown flies because of posture on substrates



The bad (always relative)



Black flies

- Minnesota's monster
- Bite and look for blood
- Keystone species
- River blindness (17 million)
- Not as common in Illinois
- Generally good high flow streams
- Pupae C



Ouch!

The ugly



Biting midge

Non-biting midge

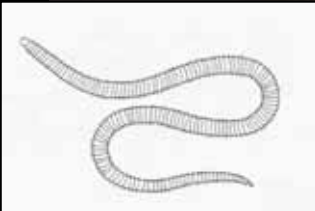
Bloodworm midge



- Exceptionally important stream fauna
- Can dominate numbers
- Blood worm adaptations
- Important fish food and also prey for other mac's
- Biting midges= piercing predators
- Diversity, stream #'s, stream biomass

Aquatic worms Oligochaeta (hair on each segment)

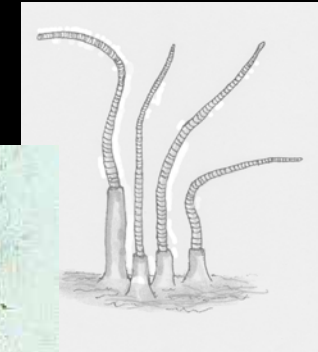
Aquatic earthworms



- Segmented (aka earthworms)
- Hair on each segment
- Texture bottom sediments
- Burrow into upper layer and keep it oxygenated



Tubifex worms



- Archetypical signature below STP (i.e. sludge worms)
- Hemoglobin for low DO environments
- Burrows in sediments
- Feed on detritus and other organics in sediment
- Filter feeders
- Densities of up to 8000/sq. m

Dobsonflies (Hellgrammites), alderflies, fish flies Megaloptera (large wings)



Hellgrammite

Taxa index= 5.5



Alderfly

Taxa index= 7.5



Fishfly

Taxa index= 7.5

- Dobsonfly has ventral gill tufts
- Fishfly has caudal breathing tube
- Alderfly has terminal filament but no gills

- Strong mandibles
- Active predators
- Taxa index reflects differences in habitat
- Engulfer predator
- Dobsonfly found in fast water high quality streams

2 Warnings.....



Watch out for giant alderflies

Sleep tight ,
don't let the
bed bugs bite



Illinois RiverWatch

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See training schedule sheets
for new volunteers