Aquatic Invertebrates of Missouri

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Water Bugs: What about ‘em?

- Often misunderstood
- Generally unknown
- Abundant!

Economic Importance

- Recreational (e.g., fly fishing)
- Disease Vectors
- Nuisances – biting, swarming, etc.

Ecological Importance:

- **Necessary components of food web**

- **Water quality indicators**
  - Ephemeroptera - mayflies
  - Plecoptera - stoneflies
  - Trichoptera - caddisflies

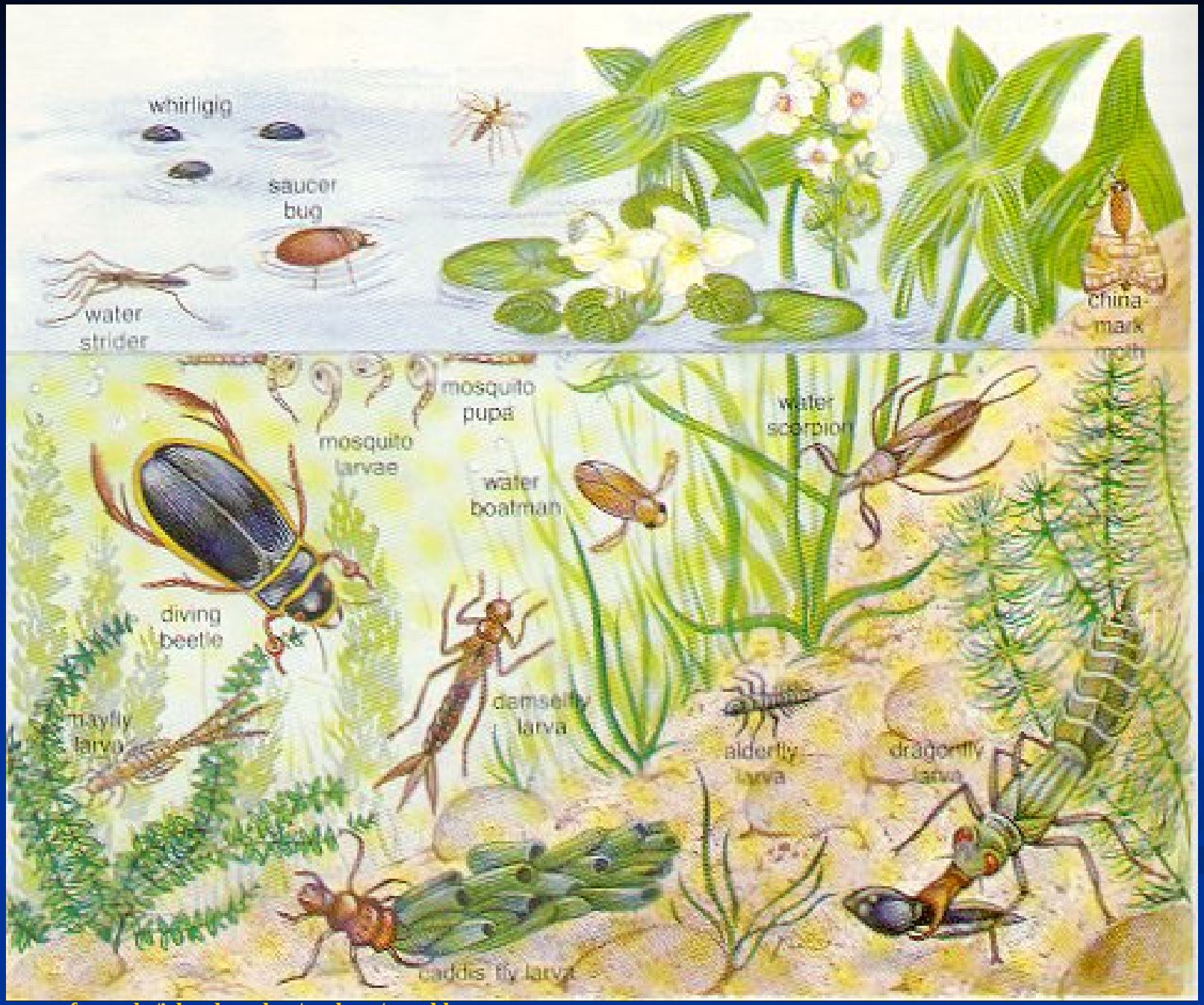
The presence / absence of these families indicates stream health

Stream Habitats

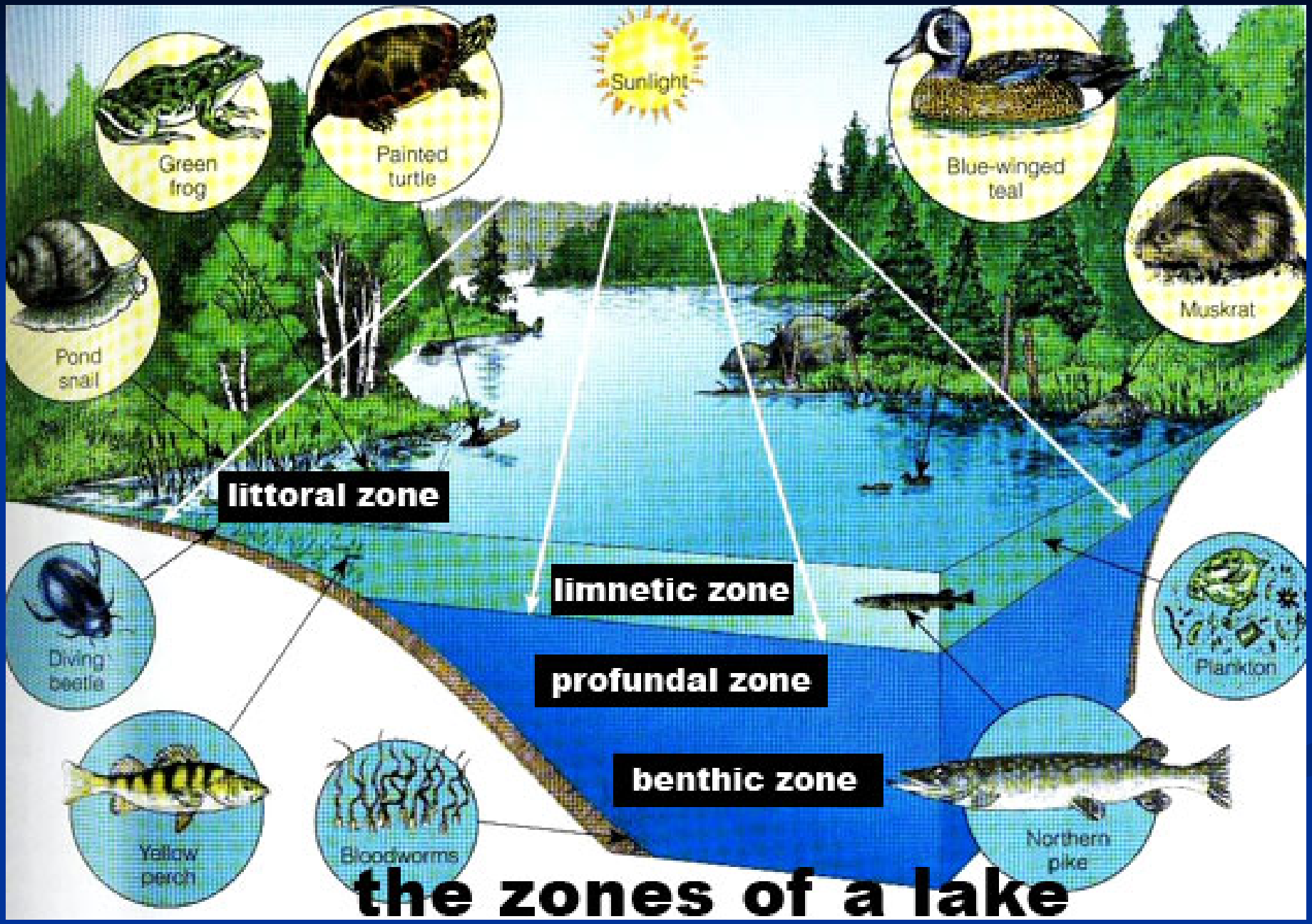
- Riffles
- Pools
- Root Mats
- Woody Debris

Biological Monitoring in Lakes, Ponds and Wetlands (Lentic waters)

- Qualitatively assess impacts of nutrient enrichment (eutrophication) by abundance of tolerant organisms
- Measure food availability for fish and/or waterfowl – zooplankton surveys
- Determine effectiveness of BMPs – benthos sampling



www.fcps.edu/islandcreekes/ecology/pond.htm

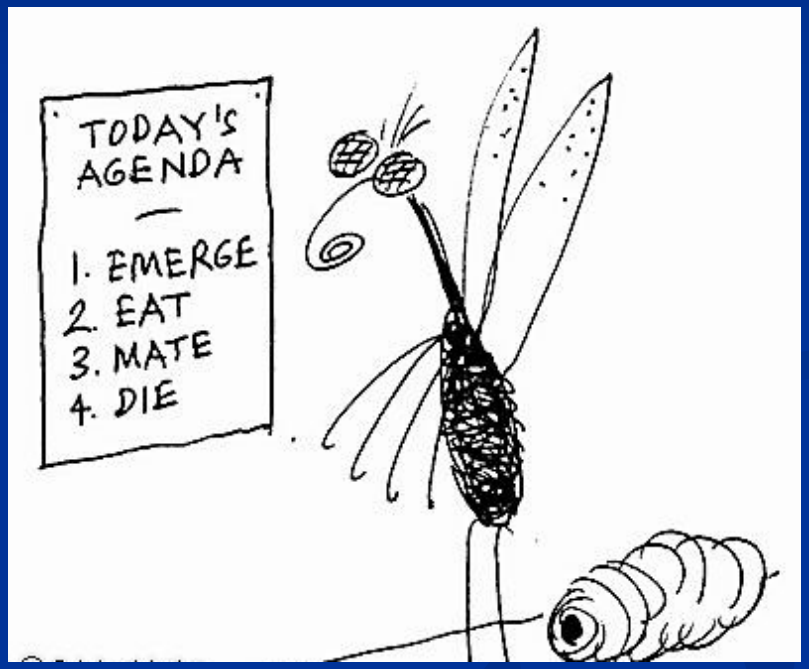

Sunlight
Green frog
Painted turtle
Blue-winged teal
Pond snail
Muskrat
littoral zone
limnetic zone
profundal zone
benthic zone
Diving beetle
Plankton
Yellow perch
Bloodworms
Northern pike
the zones of a lake

Aquatic Invertebrate Groups

- Insects – 10 major orders adapted to aquatic life
- Crustaceans – crayfish, amphipods, freshwater shrimp, zooplankton
- Mollusks – snails, clams, mussels
- Arachnids – water mites
- Worms – segmented (Oligochaeta, leeches); unsegmented (horsehair worms, flatworms)
- Cnidarians – hydras, freshwater jellyfish

Aquatic Invertebrates

- Morphology
- Habitat preference
- Feeding
- Locomotion
- Respiration
- General Life History



Freshwater Jellyfish

Phylum Cnidaria – Class Hydrozoa

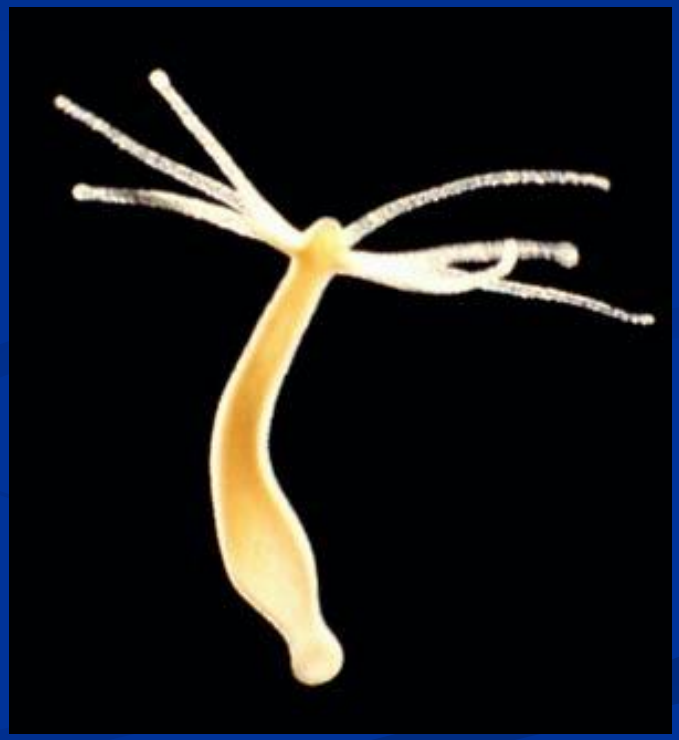
- Freshwater Jellyfish – *Craspedacusta sowerbyi*
  - Native to China, but common almost globally in temperate climates
  - Hydromedusae occurrences unpredictable

Free-swimming hydromedusae stage

Freshwater Jellyfish

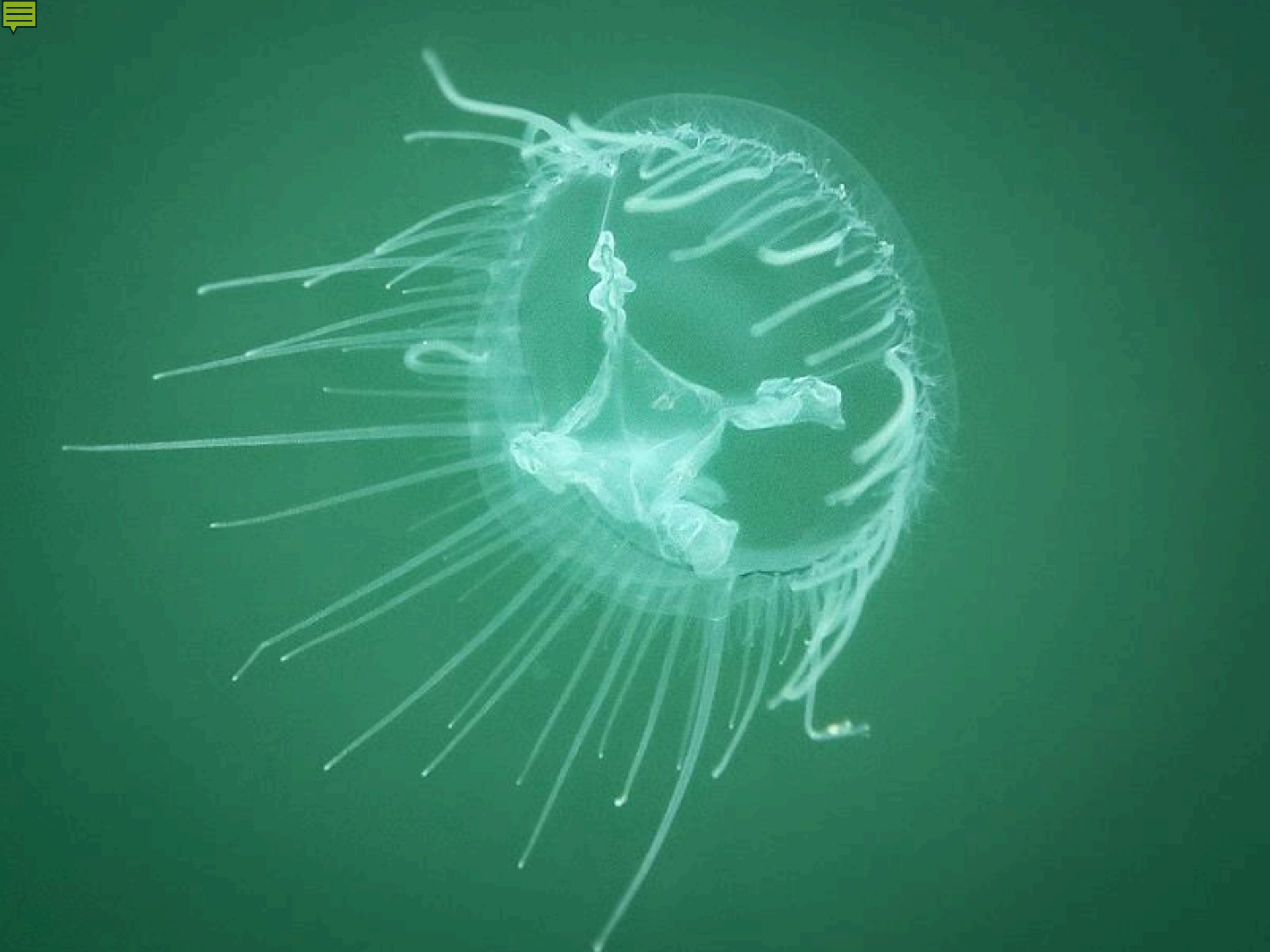
Phylum Cnidaria – Class Hydrozoa

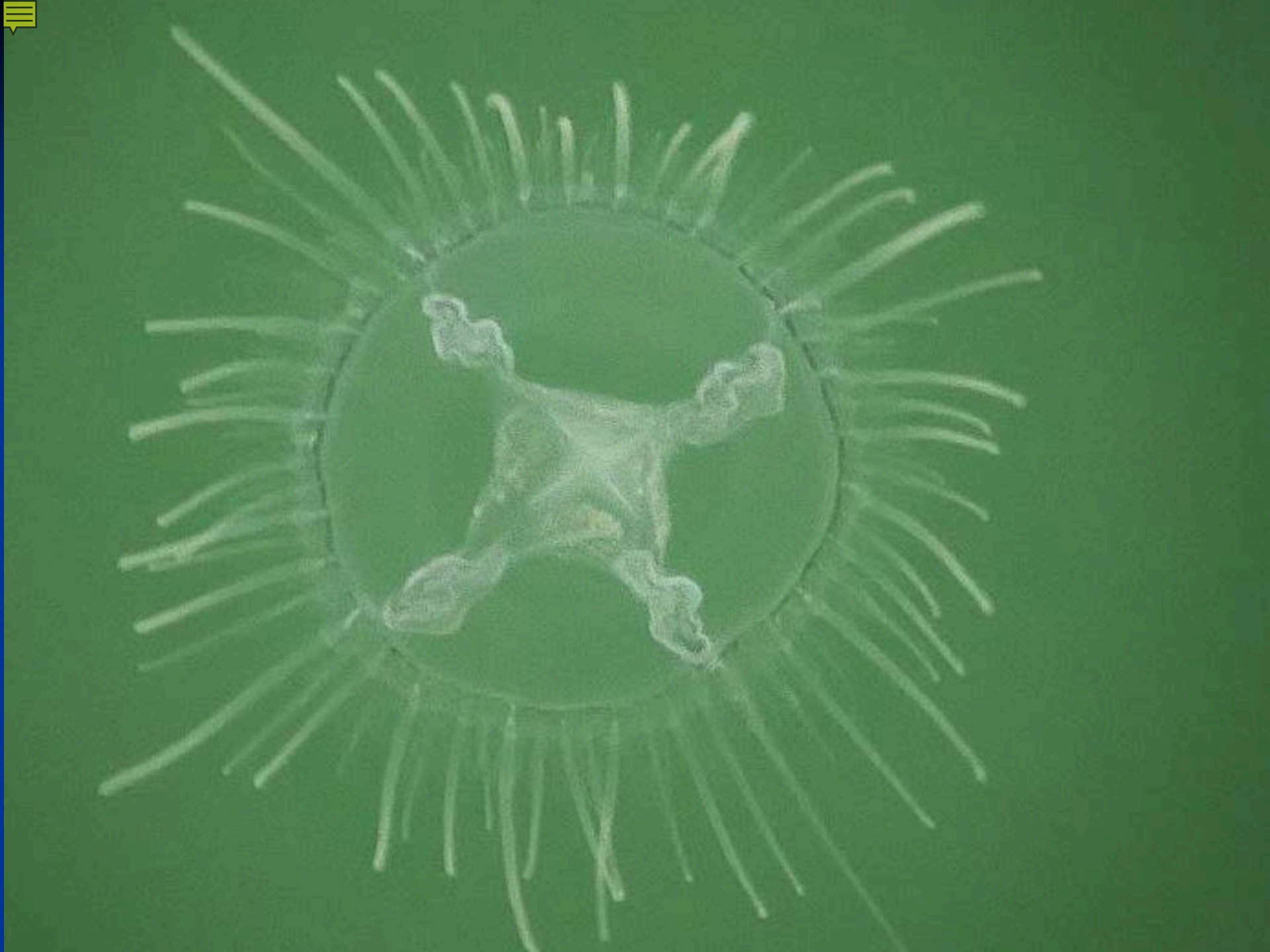
- Freshwater Jellyfish – *Craspedacusta sowerbyi*
  - Reproduce sexually or asexually by budding
  - Predatory
  - Can sting prey, harmless to humans
  - Usually all male or all female populations
  - Inhabits shallow pools and slow-moving streams



Sessile hydra stage

GVA

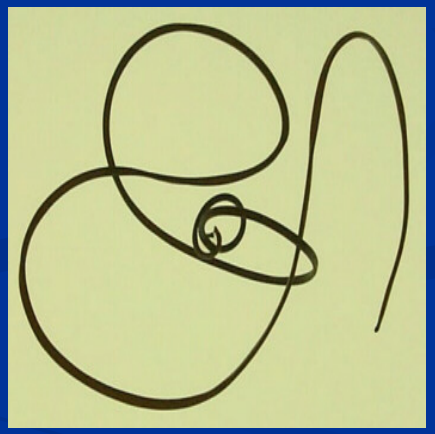




Aquatic Worms

- Phylum Platyhelminthes
  - Flat worms

- Phylum Nematomorpha
  - Horsehair worms



- Phylum Annelida, Class Oligochaeta
  - Aquatic earthworms

- Phylum Annelida, Class Hirudinea
  - leeches

Arachnids

Subclass Acari – “Hydracarina” – Water Mites

- Highly variable in shape, size, color
- Common in nearly all freshwater habitats
- Ectoparasitic larvae grow into predatory adults

Mollusks

Snails – Class Gastropoda

- Gilled Snails (Prosobranchia)
- Pouch snails (Pulmonata)

Clams and Mussels – Class Bivalvia

- Fingernail and asiatic clams (Corbiculoidea)
- Native mussels – Unionoidea

MDC photos

Mollusks

Native mussels – Unionoidea

- Sessile as adults, plant themselves on river or lake bottoms; filter-feeders
- 70% of N. American native mussels extinct or in peril due to:
  - physical habitat alterations
  - invasive species introductions
- Clear representations of habitat quality

Pimpleback

Pondmussel

Deertoe

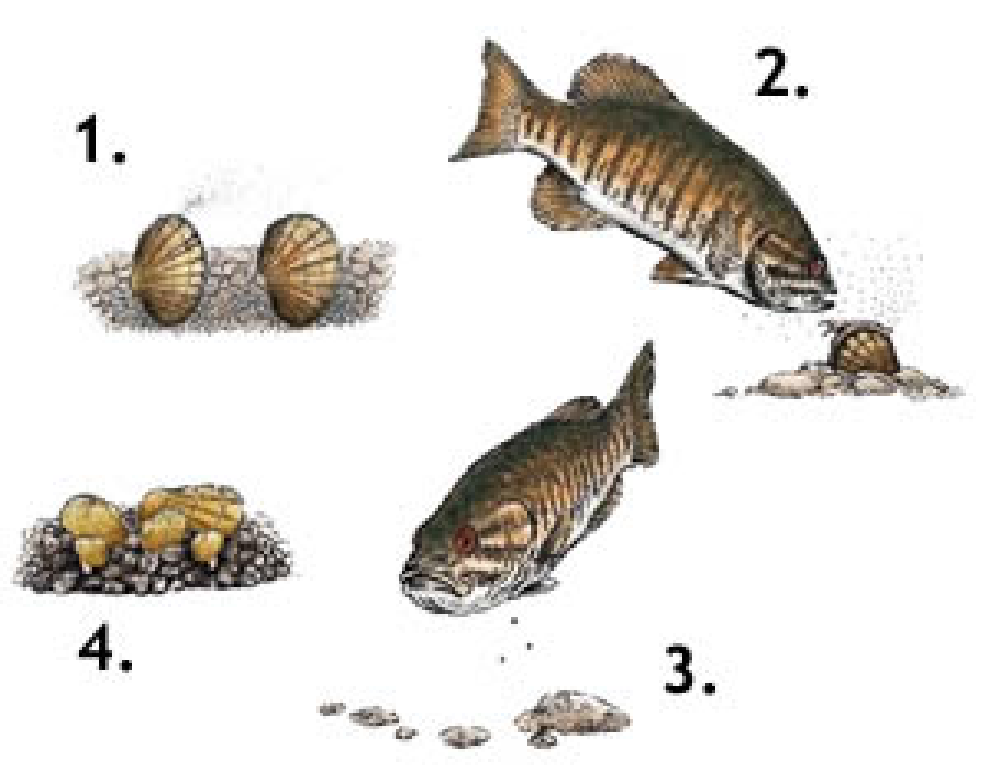
Lilliput

Pink Heelsplitter

Mollusks

Native Mussels – Unionoidea

1. Adult males release sperm into current; females filter sperm through siphon.
2. Females expel free-swimming larvae ("glochidia"), at times using a lure to attract the fish

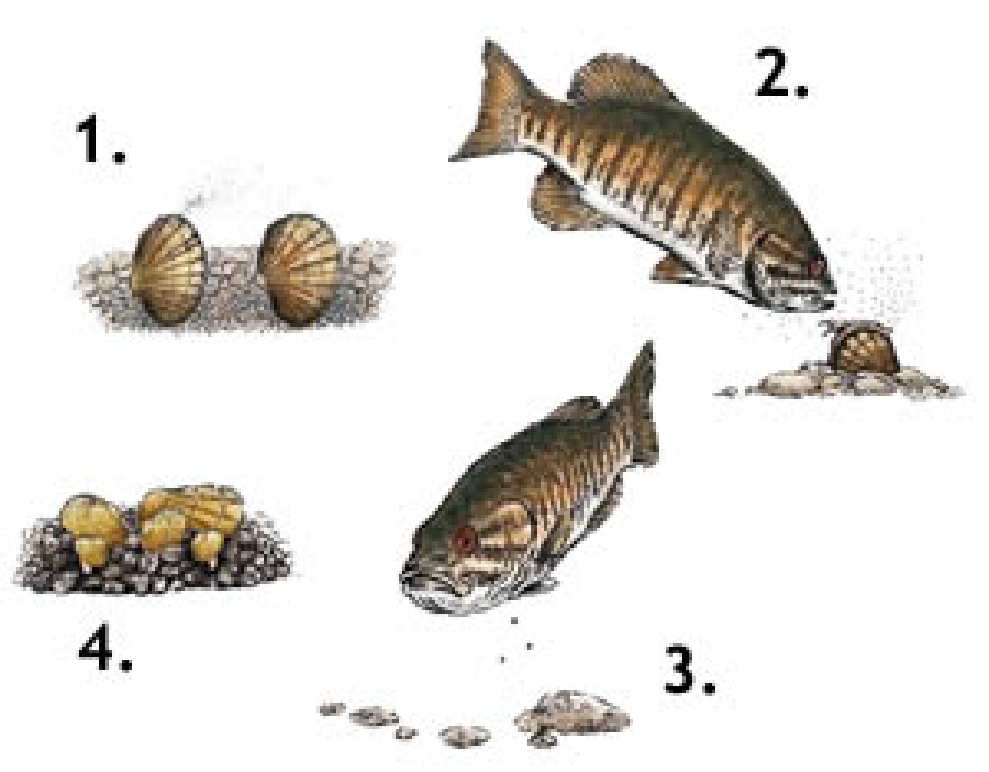


Mollusks

Native Mussels – Unionoidea

3. Larvae attach to gills of fish, hitch a ride for a few days/weeks, then drop off and become free-living

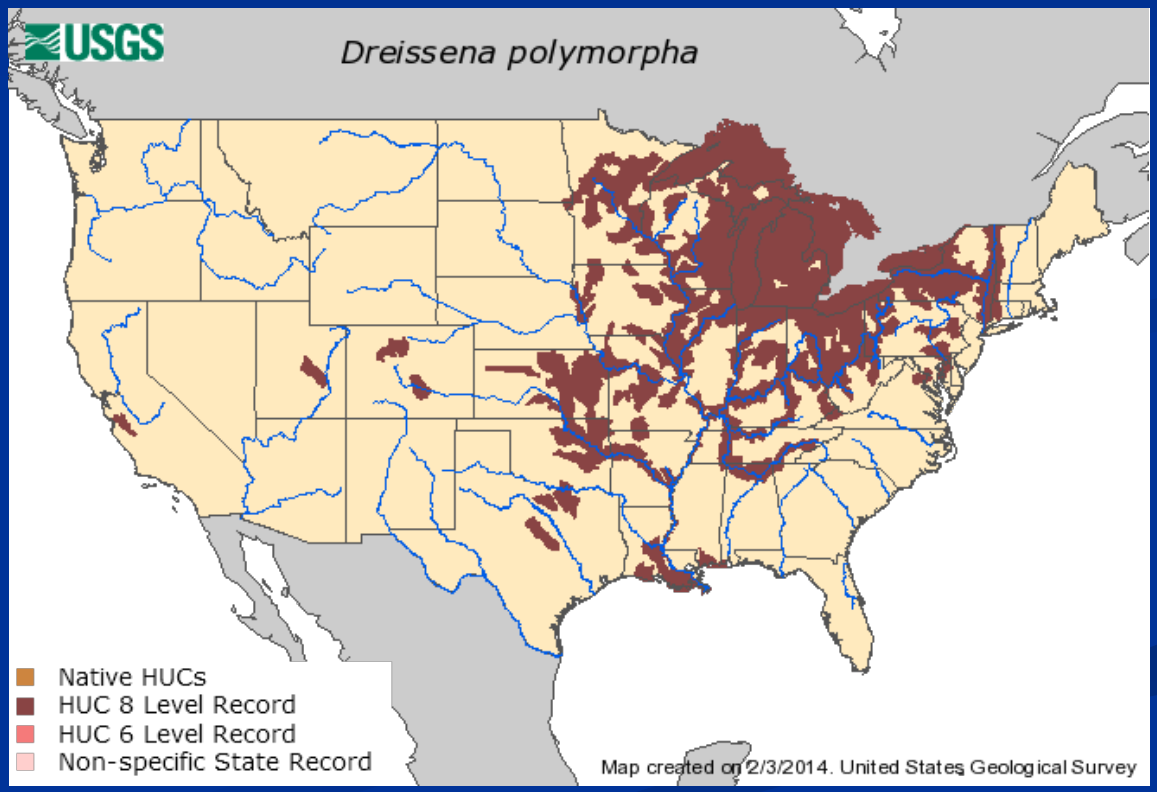
4. The mussel plants itself and grows. The host fish is unharmed.



Mollusks

- Zebra Mussels – Class Bivalvia
  - Zebra and Quagga Mussels (Dreissenoidea)

- Ecological impacts
- Economic impacts
- Recreational impacts



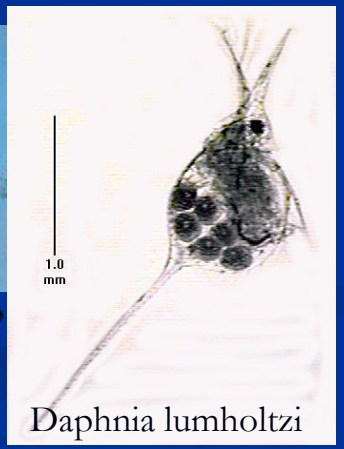
Crustacea

Branchiopoda, Ostracoda, and Copepoda = "zooplankton"

- Important to energy transfer in food chain
- Lentic habitats
- Essential food source of larval fish
- Consume microscopic algae, bacteria, detritus

Ostracoda

"Cladocera"



Daphnia lumholtzi

Copepoda

Crustacea

Branchiopoda: Anostraca and Notostraca – Fairy Shrimp and Clam Shrimp

- Visible to the naked eye
- Breed in shallow or vernal pools
- Filter feeders
- Tolerant to low oxygen levels
- Often responsible for bioturbation; pests to rice crops
- Mostly found in Bootheel of MO
- Native to CA (Tadpole shrimp)

Fairy Shrimp

Tadpole shrimp

Crustacea

Amphipoda – Scuds
Isopoda – Sowbugs

- Inhabit nearly all aquatic habitats
- Abundant in streams high in nutrients or near springs
- Many in subterranean habitats (caves, wells, etc.)
- Detritivores

Crustacea

Freshwater Shrimps

- Often called glass of ghost shrimp
- Common in small ponds, ditches, slow streams
- Use swimmerets (**pleopods**) for swimming, carrying eggs
- Detritivores, scavengers

Palaemonetes spp.

Crustacea

Crayfish

- Reproductively active during winter months
- Some can survive out of water for extended periods of time (burrowing crayfish)
- Opportunistic scavengers
- Some species in MO cave-dwelling, blind, unpigmented

Know your insects
Ned
Jerry
Bob
Linda
Don
Carol
Dale

Ephemeroptera – Mayflies

Stenonema femoratum

Isonychia spp

Caenis spp.

Ephemera spp.

Odonata – Dragonflies and Damselflies

Odonata – divided into two Suborders

- Anisoptera - Dragonflies
- Zygoptera – Damselflies
- 450 species in North America
- Exclusively predatory
- Extendible mouthparts to catch prey
- Long life cycles –usually 1+ year in water (up to 6 years), a few weeks to a few months as adults
- Both nymphs and adults eat mosquitoes ☺

Odonata – Zygoptera

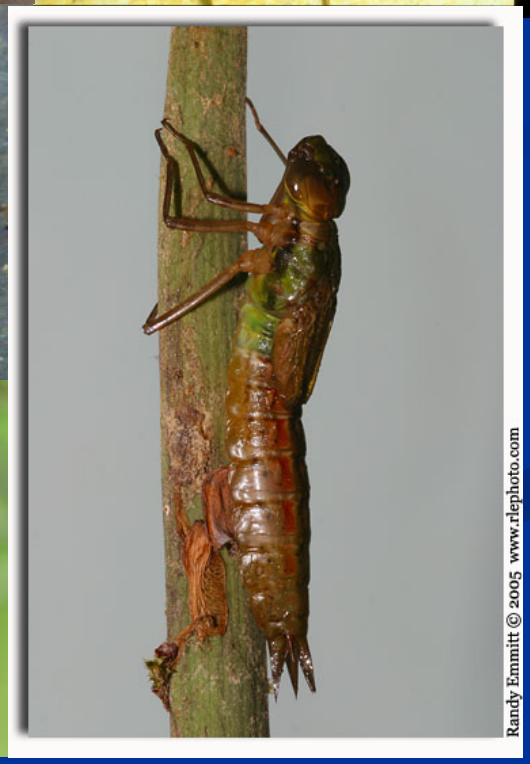
Damselflies

- Nymphs and adults elongate and narrow-bodied, with three **caudal** gills (i.e., **lamellae**)
- one life cycle per year
- 3 families in Missouri
- Primarily sprawlers and climbers

Odonata – Anisoptera

Dragonflies

- Large eyes in both nymphs and adults
- 6 families in Missouri
- Found in nearly all aquatic habitats
- Expel water through rectal chamber which aids in swift locomotion and respiration



Plecoptera – Stoneflies

Hemiptera

Common Families in Missouri:

- Nepidae – water scorpions
- Corixidae – water boatmen
- Belostomatidae – Giant Water Bugs
- Notonectidae – Backswimmers
- Naucoridae – creeping Water Bugs
- Gelastocoridae – toad bugs
- Gerridae, Veliidae – water striders
- Saldidae – Shore bugs

Nepidae

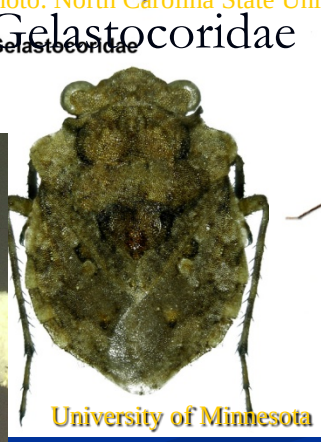
Corixidae

Naucoridae

Notonectidae

Photo: North Carolina State University

Gelastocoridae



Hydrometridae

Saldidae

Megaloptera

Corydalidae – Dobsonflies, Fishflies

- Inhabit lotic waters

- Dobsonflies – *Corydalus*
  - Gill tufts beneath lateral filaments
  - Highly patterned head and thorax
  - Adult lives a short time, does not feed

Neuroptera

Spongillaflies – Sisyridae, *Sisyra* sp.

- Feed on aquatic sponges

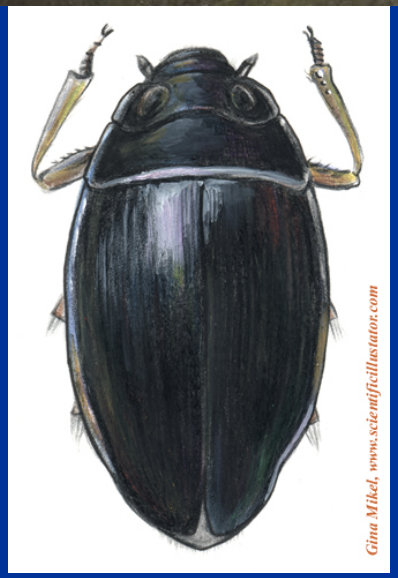
Coleoptera

Coleoptera – Beetles

- Largest order of insects in the world; 3% of which have an aquatic stage (about 1400 species in N.A.)
- Larvae soft-bodied
- Adults with 2 pairs of wings
  - 1st pair modified into elytra for protective cover
  - 2nd pair membraneous, providing flight ability
- Chewing mouthparts; various feeding habits
- Some families are good indicators of water quality

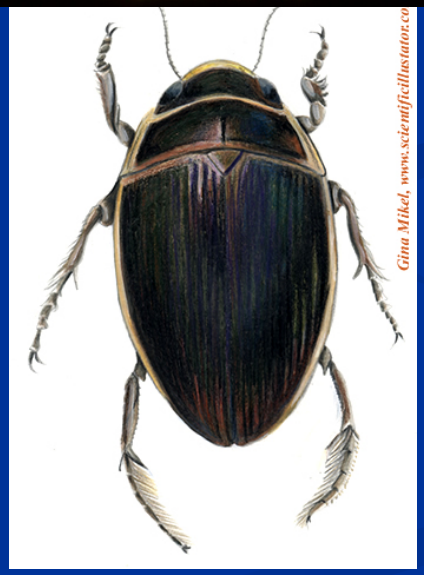
Coleoptera

Adephaga – fully aquatic



Whirligig Beetle

Gyrinidae



Predaceous Diving Beetle

Dytiscidae

Crawling Water Beetle

Haliplidae

Coleoptera

Polyphaga – fully and semi aquatic

Water Penny Beetle larvae
Psephenidae

Riffle Beetle
Elmidae

Water Scavenger Beetle
Hydrophilidae

Trichoptera

Caddisflies

- Retreats or cases for protection
- Most closely related to Lepidoptera
- Larval case designs are species-specific
- Larvae produce silk through their mouthparts
- Adults live up to two months
- Feed on vegetative fluid

Diptera – Nematocera

Phantom Midge

Biting Midge

Midges

Crane Fly

Black Flies

Diptera – Brachycera

Watersnipe flies – Athericidae

- Found in fast-flowing and clear, cool waters
- Predators
- Adults nectar feeding

Atherix spp

Horse flies – Tabanidae

- Found in lentic and lotic habitats
- Predators
- Adults blood feeding

Tabanus spp

References

Biological Information:

- McCafferty, W. Patrick. 1981. Aquatic Entomology. Science Books International, Boston, MA. 448p.
- Merritt, R.W. and K.W. Cummins. 1996. An Introduction to the Aquatic Insects of North America, 3rd Edition. Kendall/Hunt Publishing, Dubuque, IA 862p.
- Thorpe, J.H., and A.P. Covich. 2001. Ecology and Classification of Freshwater Invertebrates, 2nd Edition. Academic Press, San Diego, CA. 1056p.

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