More organisms: Animals

Look Mom, no chlorophyll!

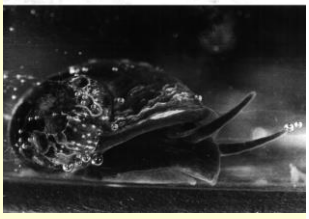


Fig. 10.1

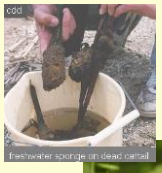
Multicellular freshwater invertebrate phyla

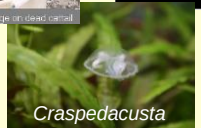
- Porifera
- Cnidaria
- Platyhelminthes
- Gastrotricha
- Rotifera
- Nematoda
- Nematomorpha
- Mollusca
- Annelida
- Bryozoa
- Tardigrada
- Arthropoda

Tardigrada

Freshwater invertebrate phyla (1)

- **Porifera**—sponges, filterers
- **Cnidaria**—freshwater jellyfish; includes *Hydra*
- **Platyhelminthes**—include planarians (Turbelleria) and some important parasites (causing schistosomiasis, swimmers' itch)

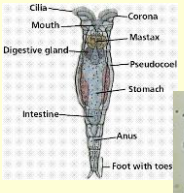




Craspedacusta

Freshwater invertebrate phyla (2)

- **Gastrotricha**—can be abundant; benthic; little known
- **Rotifera**—filterers



Brachionas filtering algae

Freshwater invertebrate phyla (3)

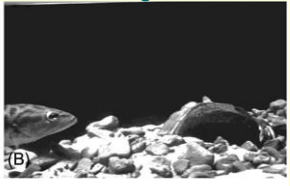
- **Nematoda**—important predators and microbivores
- **Nematomorpha**—horsehair worms
- **Mollusca**- Gastropoda (snails and limpets) and Bivalvia (clams and mussels)

Fig. 10.8

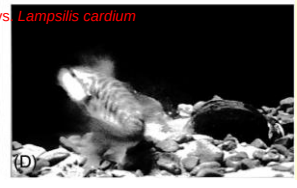
Unionid mussel lures

- **Glochidia**—specialized larval stage

Fig. 10.7



Micropterus coosae vs. *Lampsilis cardium*

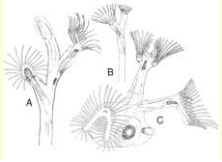


Freshwater invertebrate phyla (4)

- **Annelida**- segmented worms, Hirudinea
- **Bryozoa**- sessile ciliated invertebrates, 'moss animals'
- **Tardigrada**- water bears
- **Arthropoda**- includes Insecta, Crustacea, etc.

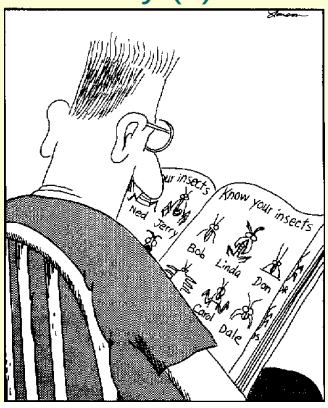






Arthropod diversity (1)

- Phylum **Arthropoda**
  - Class Arachnida
  - Subphylum Insecta
  - Subphylum Crustacea



Arthropod diversity (2)

- Class Arachnida
  - Spiders—semi-aquatic; lentic, wetland, and riparian; predators
  - Mites
    - Hydracarina; all habitats, mostly predators
- Subphylum Insecta
  - Orders
    - **Collembola**—springtails; sort of insects; semi-aquatic; lentic, wetland, and riparian; mostly detritivores


furcula

Arthropod diversity (3)

- **Ephemeroptera**—mayflies
  - Very sensitive to pollution; all habitats; scrapers and collectors; larvae
- **Plecoptera**—stoneflies
  - Very sensitive to pollution and DO; mostly lotic; shredders, collectors, and predators; larvae

Mayflies

Swarm

Stoneflies

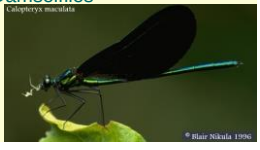

Arthropod diversity (4)

- **Odonata**—dragonflies and damselflies
  - Some are sensitive to pollution; all habitats; predators; larvae


Strike *Labium*


Dragonflies

Damselflies



Arthropod diversity (5)

- **Hemiptera**—true bugs
  - Not very sensitive to pollution; mostly lentic and wetland; mostly predators; larvae & adults

Giant water bug in action

Water striders


Figure 2 - Dorsal view of *Belostoma flumineum* adult (Belostomatidae)

Figure 3 - Rostrum of *Belostoma flumineum* adult (Belostomatidae)

Piercing-sucking mouthparts

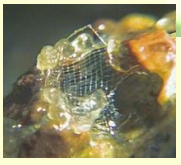
Arthropod diversity (6)

- **Trichoptera**—caddisflies
  - Pollution sensitivity varies; all habitats; all FFGs; larvae

Case glued together with silk

Helicopsyche

Pycnopsyche



Capture net

Arthropod diversity (7)

- **Megaloptera** and **Neuroptera**—fishflies, alderflies, and spongillaflies
  - Some are sensitive to pollution; all habitats; predators; larvae
- **Lepidoptera**—aquatic caterpillars
  - Pollution sensitivity?; mostly lentic on macrophytes; larvae shredders, scrapers

Hellgrammite

Lepidoptera

Arthropod diversity (7)

- **Coleoptera**—beetles
  - Some are sensitive to pollution; all habitats; all FFGs; larvae & adults
- **Diptera**—flies
  - Mostly pollution tolerant; all habitats; all FFGs; larvae

Midge fly

Invertebrate taxa richness in some NC streams

Group	Blue Ridge (n=13)	Piedmont (n=2)	Coastal Plain (n=8)
Ephemeroptera	22.0	15.5	10.0
Plecoptera	4.3	3.0	2.6
Trichoptera	17.5	15.5	13.8
Coleoptera	6.2	8.0	9.3
Odonata	4.5	9.0	10.1
Megaloptera	2.0	2.0	2.0
Diptera:Chironomidae	22.8	23.0	23.4
Diptera:Misc.	4.7	2.0	4.4
Oligochaeta	3.4	4.0	3.3
Crustacea	1.0	1.5	2.5
Mollusca	4.3	7.0	4.1
Other	1.9	5.0	4.4
Total	94.7	96.5	89.3

Mulholland and Lenat 1992

More arthropod diversity

- Subphylum Crustacea
  - **Ostracoda**: seed shrimp
  - **Copepoda**: copepods
  - **Branchiopoda**
    - Cladocera: water fleas (*Daphnia*)
    - fairy, tadpole, brine, and clam shrimps (e.g. *Artemia)*
  - **Decapoda**: crayfish, crabs, shrimps
  - **Isopoda**
  - **Amphipoda**: scuds and sideswimmers

Brine shrimp

Phylum Chordata, Subphylum Vertebrata

- Fishes

carp

Table 10.3 Some Orders of Fishes That Have Freshwater Representatives

Order	Common Name of Freshwater Species	Main Region of Dominance	Approximate Number of Freshwater Species
Petromyzontiformes	Lampreys	Worldwide, coastal	40
Myliobatiformes	SRays	Coastal	
Lepidosireniformes	Lungfishes	AF, SA	
Polypteriformes	Bichirs	AF	10
Acipenseriformes	Sturgeons, paddlefishes	PA, NA, AS	28
Lepisosteiformes	Gars	NA	7
Amiiformes	Bowfin	NA	1
Osteoglossiformes	Elephantfishes, bonytongues	AF	200
Anguilliformes	Eels	Worldwide	26
Clupeiformes	Herrings, shads	Worldwide, some freshwater	80
Gonorynchiformes	Milkfishes	AF, AS	29
Cypriniformes	Minnows, carps, algae eaters, suckers, loaches	Worldwide	2,600
Characiformes	Characins	SA, AF	1,300
Siluriformes	Catfishes	Worldwide	2,280
Gymnotiformes	Knifefishes	SA	62
Esociformes	Pikes, mudminnows	NA, PA	10
Osmeriformes	Smelts, galaxiids	Worldwide, AU	71

Phylum Chordata, Subphylum Vertebrata

- Fishes
- Tetrapods
  - Amphibians
    - Urodela or Caudata: salamanders
    - Anura: frogs
  - Birds
  - Reptiles
  - Mammals