

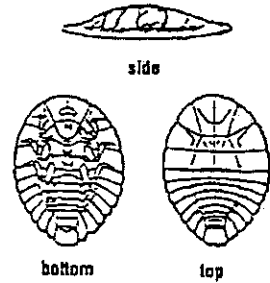
DICHOTOMOUS KEY TO STREAM MACROINVERTEBRATES

Drawings in this key are from: Merritt-Cummins: *An Introduction to the Aquatic Insects of North America*, Copyright 1977 by Kendall/Hunt Publishing Company; Izaak Walton League of America (IWL); or McCafferty: *Aquatic Entomology*, © 1981 Boston: Jones and Bartlett Publishers. Reprinted with permission.

- 1. A. Segmented legs.....go to 2
- B. No segmented legs.....go to 14

- 2. A. 6 legs.....go to 3
- B. More than 6 legs.....go to 23

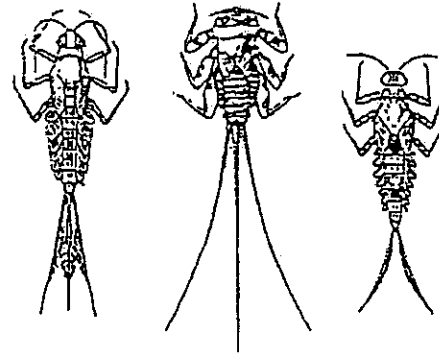
- 3. A. No wings, or wings not fully developed and do not cover entire body.....go to 4
- B. Wings cover entire body (but not legs), may appear beetle-like.....go to 26



- 4. A. Body longer than it is wide.....go to 5
- B. Body oval & flat; head & legs concealed beneath body.....**WATER PENNY**
 (a type of beetle larva)
 Order Coleoptera, Family Psephenidae
 Feeding Group: SCRAPER

1/4"
(excluding tails)
(all from IWL)

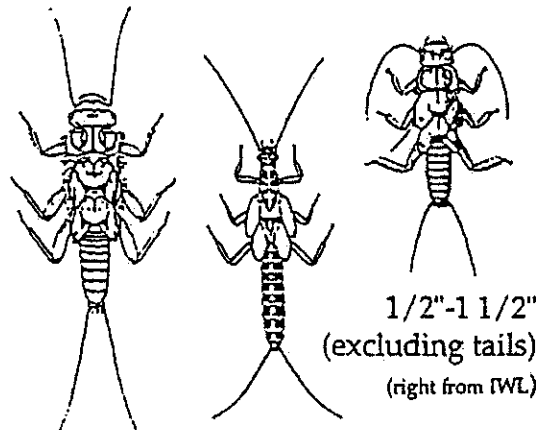
- 5. A. 2 or 3 distinct *hairlike* tails; tails not fleshy or hooked, but may be fringed with hairs.....go to 6
- B. Not as above.....go to 7



(center from IWL) 1/4"-1"
(excluding tails)

- 6. A. 2-3 tails; platelike or hairlike gills along sides of abdomen.....**MAYFLY LARVA**
 Order Ephemeroptera
 Feeding Group: VARIES*

- B. 2 tails; may have hairy gills under thorax.....**STONEFLY LARVA**
 Order Plecoptera
 Feeding Group: VARIES*



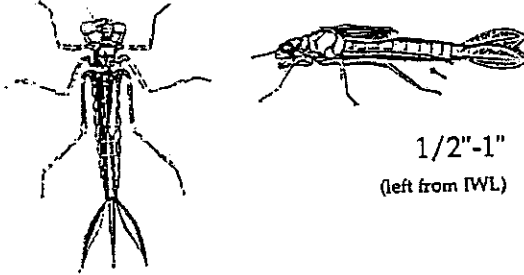
1/2"-1 1/2"
(excluding tails)
(right from IWL)

* If feeding group varies, see picture key on pages 155-157 for more information.
 (All drawings on this page are from McCafferty: *Aquatic Entomology*, except as noted)

DICHOTOMOUS KEY TO STREAM MACROINVERTEBRATES

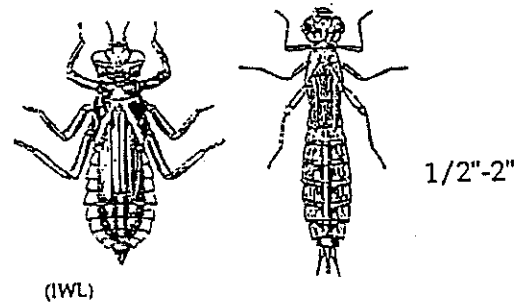
(Page 2)

7. A. 3 oar-shaped tails (gills) at *end* of abdomen; no gills along *sides* of abdomen
.....DAMSELFLY LARVA
Order Odonata, Suborder Zygoptera
Feeding Group: PREDATOR



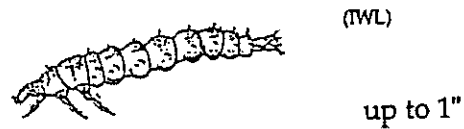
- B. Not as above.....go to 8

8. A. Fat abdomen; large eyes; mask-like lower lip.....DRAGONFLY LARVA
Order Odonata, Suborder Anisoptera
Feeding Group: PREDATOR



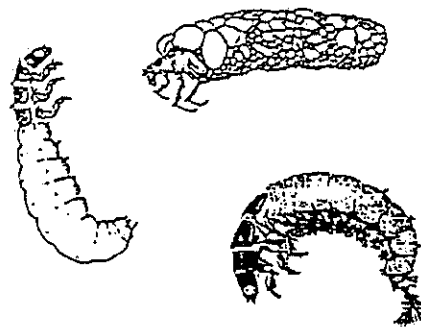
- B. Not as above.....go to 9

9. A. May be hiding in case made of gravel or plant parts; abdomen ends in pair of prolegs which may be hidden by hairs; each proleg has single hook on end, sometimes fused together
.....CADDISFLY LARVA
Order Trichoptera
Feeding Group: VARIES*



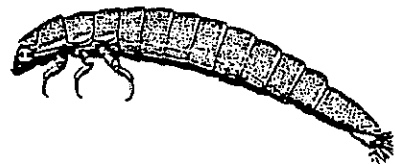
- B. Not as above.....go to 10

10. A. Well developed lateral filaments extend from abdominal segments.....go to 11



- B. No lateral filaments along abdomen; body is hardened & stiff; tip of abdomen has small plate-like opening with hooks and filaments.

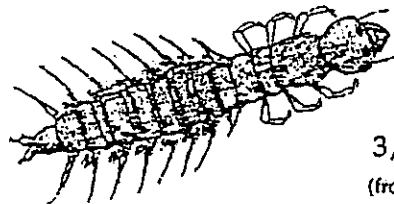
-RIFFLE BEETLE LARVA
Order Coleoptera, Family Elmidae
Feeding Group: GATHERER COLLECTOR



*If feeding group varies, see picture key on page 158-161 for more information
(all drawings on this page from McCafferty: *Aquatic Entomology*, except as noted)

DICHOTOMOUS KEY TO STREAM MACROINVERTEBRATES

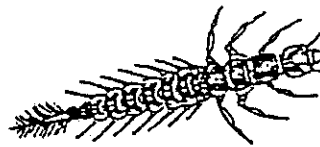
11. A. Fluffy or branched gill tufts under abdomen.....**DOBSONFLY LARVA**
("Hellgrammite")
Order Megaloptera, Family Corydalidae
Feeding Group: PREDATOR



3/4"-4"
(from IWL)

- B. Not as above.....go to 12

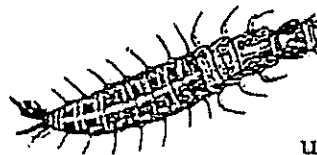
12. A. Abdomen ends in single, unforked, long, hairlike tail....**ALDERFLY LARVA**
Order Megaloptera, Family Sialidae
Feeding Group: PREDATOR



up to 1"

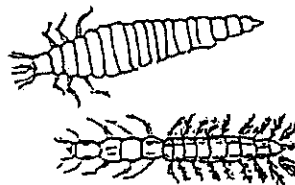
- B. Not as above.....go to 13

13. A. Abdomen ends in a pair of prolegs, each with 2 hooks.....**FISHFLY LARVA**
Order Megaloptera, Family Corydalidae
Feeding Group: PREDATOR



up to 1 1/2"

- B. Not as above; large, obvious mouthparts
.....**AQUATIC BEETLE LARVA**
Order Coleoptera
Feeding Group: PREDATOR

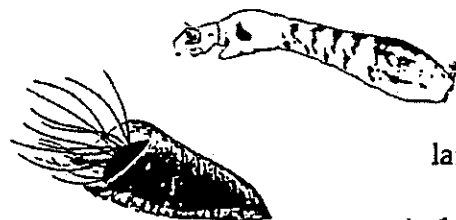


1/4"-1"
(from IWL)

14. A. Has small but distinct head; body less than 1/2" long.....go to 15

- B. Appears not to have a head, although it may be retracted into body.....go to 16

15. A. Body widens at bottom end (bowling pin shaped); may be attached to substrate; dark head....**BLACK FLY LARVA**
Order Diptera, Family Simuliidae
Feeding Group: FILTERER COLLECTOR



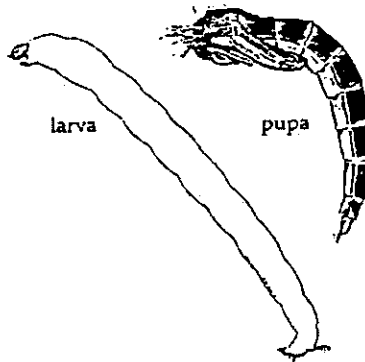
larva

pupa

up to 1/2"

(all drawings on this page from McCafferty: *Aquatic Entomology*, unless otherwise noted)

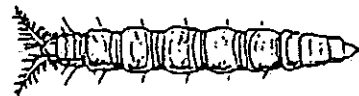
15. B. Both ends of body about the same width; tiny pair of prolegs under head & at tip of abdomen.....MIDGE LARVA
 Order Diptera, Family Chironomidae
 Feeding Group: GATHERER COLLECTOR



up to 1/2"

16. A. Fleshy Caterpillar-like body.....go to 17
 B. Body not caterpillar-like.....go to 18

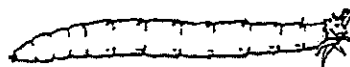
17. A. Two feathered "horns" at back end; caterpillar-like legs
WATERSNIPE FLY LARVA
 Order Diptera, Family Athericidae
 Feeding Group: PREDATOR



1/4"-1"

last segment not swollen - SHREDDER

- B. Can be up to 4" long; head not apparent because it is retracted into body; may have fleshy, finger-like extensions at one end
CRANEFLY LARVA
 Order Diptera, Family Tipulidae
 Feeding Group: SHREDDER OR PREDATOR



1/3"-4"

last segment swollen or no fingerlike extensions - PREDATOR
 (all from Cummins)

18. A. Body without hard shell.....go to 19
 B. Body with hard shell.....go to 21



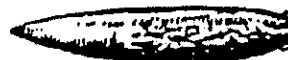
19. A. Flattened, unsegmented, worm-like body; distinct eye spots; gliding movement.....PLANARIAN (Flatworm)
 Class Turbellaria
 Feeding Group: PREDATOR or PARASITE

up to 3/4"
 (from IWL)



- B. Segmented body.....go to 20

20. A. Flattened body with suckers at each end
LEECH
 Class Hirudinea
 Feeding Group: PREDATOR or PARASITE



1/4"-2"
 (bottom figure from IWL)

(all drawings on this page are from McCafferty: *Aquatic Entomology*, unless otherwise noted)

DICHOTOMOUS KEY TO STREAM MACROINVERTEBRATES

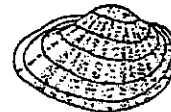
20. B. Segmented, earthworm-like body
AQUATIC EARTHWORM
 Class Oligochaeta
 Feeding Group: GATHERER COLLECTOR



1/4"-2"

21. A. Snail-like.....go to 21

B. Body enclosed within two hinged shells
FRESHWATER CLAM or MUSSEL
 Class Pelecypoda
 Feeding Group: FILTERER COLLECTOR



(both from IWL)

22. A. Has operculum (hard covering used to close the opening).....GILLED SNAIL
 Class Gastropoda, Order Prosobranchia
 Feeding Group: SCRAPER



(right from IWL)

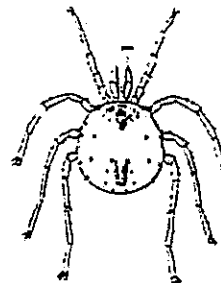


B. No operculum; may be spiral-shaped, limpet-like, or coiled in one plane
LUNG-BREATHING SNAIL
 Class Gastropoda, Order Pulmonata
 Feeding Group: SCRAPER



(both from IWL)

23. A. Looks like spider; may be very tiny; has 8 legs.....AQUATIC MITE
 Class Arachnida, Order Hydracarina
 Feeding Group: PREDATOR

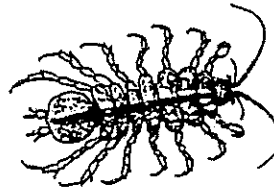


up to 1/8"

B. Not as above.....go to 24

24. A. Lobster or shrimp-like.....go to 25

B. Armadillo shaped body, wider than high; crawls slowly on bottom
AQUATIC SOWBUG
 Subphylum Crustacea, Order Isopoda
 Feeding Group: SHREDDER



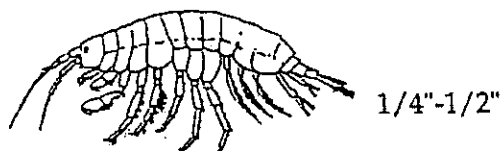
1/4"-3/4"

(all drawings on this page are from McCafferty: *Aquatic Entomology*, unless otherwise noted)

DICHOTOMOUS KEY TO STREAM MACROINVERTEBRATES

(Page 6)

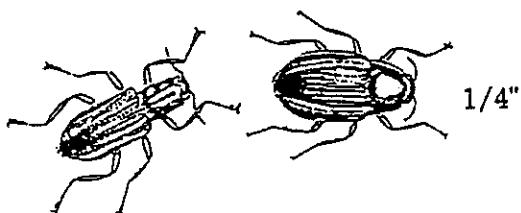
25. A. Looks like tiny shrimp; swims quickly on its side.....SCUD
Subphylum Crustacea, Order Amphipoda
Feeding Group: SHREDDER



- B. Looks like small lobster; has 2 large front claws (10 legs total).....CRAYFISH
Subphylum Crustacea, Order Decapoda
Feeding Group: GATHERER COLLECTOR

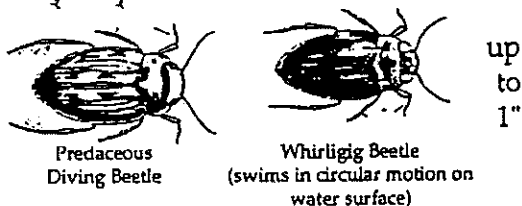


26. A. Beetle-like, crawls slowly on bottom
.....RIFFLE BEETLE ADULT
Order Coleoptera, Family Elmidae
Feeding Group: SCRAPER or
GATHERER COLLECTOR



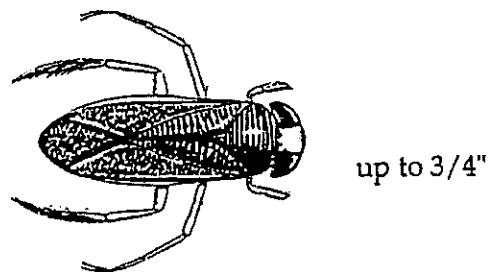
- B. Beetle-like, swims quickly.....go to 27

27. A. Wings meet along the midline of back side of body, they do not overlap
.....BEETLE ADULT
Order Coleoptera
Feeding Group: MOST ARE PREDATORS



27. B. Wings overlap on backside, usually form a visible triangular pattern just below head.....go to 28

28. A. Front legs are shorter than mid and hind legs; propels itself with oar-like strokes,
.....WATER BOATMAN
Order Hemiptera, Family Corixidae
Feeding Group: VARIES



- B. Similar to backswimmer but swims upside down, on its back
.....BACKSWIMMER
Order Hemiptera, Family Notonectidae

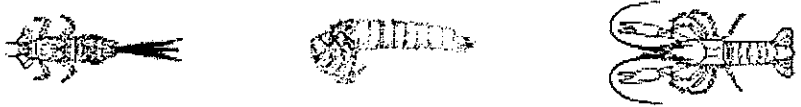


Feeding Group: PREDATOR

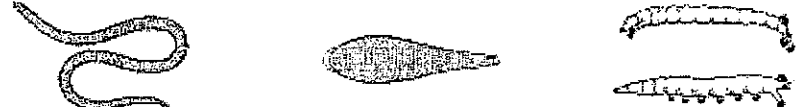
(all drawings on this page are from McCafferty: *Aquatic Entomology*, unless otherwise noted)

Dichotomous Key to Common Aquatic Invertebrates

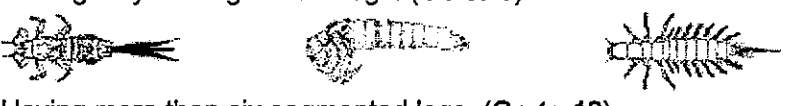
1.
 1-1 Having segments (jointed) legs. (Go to 2)




1-2 Does not have segmented legs. (Go to 15)




2.
 2-1 Having only six segmented legs. (Go to 3)



2-2 Having more than six segmented legs. (Go to 12)




3.
 3-1 Body elongated (longer than it is wide); legs not concealed beneath the body. (Go to 4)
 3-2 Body disk or oval shaped and very flat.




Order Coleoptera; family **Psephenidae** (Water penny)

4.
 4-1 Two or three distinct tail filaments that may appear hair-like webbed or paddle shaped. (Go to 5)



4-2 No tail filaments; tail consisting of a single long filament; tail having hooks that may or may not have filaments. (Go to 7)



See acknowledgements on page eight

5.

5-1 Two or three hair-like tail filaments (may appear webbed); plate-like, filamentous or feathery gills attached to the sides of the abdomen.



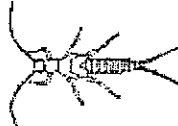
Order Ephemeroptera (Mayflies)

5-2 Two or three hair-like or paddle shaped tails; no gills attached to the abdomen. (Go to 6)



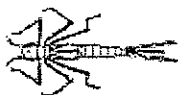
6.

6-1 Two hair-like tail filaments; no gills attached to the abdomen.



Order Plecoptera (Stoneflies)

6-2 Three broad paddle-shaped tails, which are actually gills; no gills attached to the abdomen.



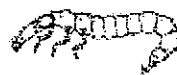
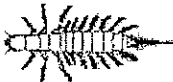
Order Odonata; sub-order Zygoptera (Damselflies)

7.

7-1 Abdomen is hardened; body is plated or skin is hardened. (Go to 8)



7-2 Abdomen is soft, not hardened or plated. (Go to 9)



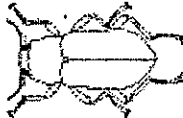
8.

8-1 Wide abdomen; large eyes; scoop-like lower lip (labium) that covers most of the mouthparts; may have pointed structures on the end of the abdomen.



Order Odonata; sub-order Anisoptera (Dragonflies)

8-2 Entire body is hardened; tail may have tiny hooks or filaments.



Order Coleoptera; family Elmidae (Riffle beetle)

9.

9-1 Pairs of fleshy or thin filaments extending from the abdomen. (Go to 10)



9-2 No pairs of abdominal filaments. (Go to 11)



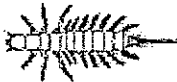
10.

10-1 Fleshy or thin filaments attached to the abdomen, may have tufts of gills beneath; short forked-tail; large chewing mouthparts on the head.



Order Megaloptera; family **Corydalidae** (Fishfly/Hellgrammite)

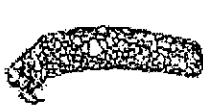
10-2 Fleshy or thin filaments attached to the abdomen; single filament-like tail extends from the end of the abdomen; large chewing mouthparts on the head.



Order Megaloptera; family **Sialidae** (Alderfly)

11.

11-1 Two forked hooks at the end of the abdomen, which may be very small; feathered or branched tail-like structures usually cover the hooks. The invertebrate may be inside a case built from streambed materials such as small pebbles, sand grain, leaves etc.



Order **Trichoptera** (Caddisflies)

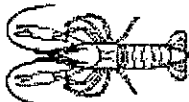
11-2 Soft abdomen; has pairs of caterpillar-like legs that may not be fully developed; abdomen may be smooth or may be covered by filaments or hairs.



Order **Lepidoptera** (Aquatic moth)

12.

12-1 Body is dorsally flattened (wider than it is high); has a thin plated fan-like tail. (Go to 13)



12-2 Body is dorsally flattened (wider than it is high); seven pairs of walking legs, the first is claw-like and may be slightly enlarged. Looks like the terrestrial pill-bug (roly-poly).



Order **Isopoda** (Aquatic sowbug)

13.

13-1 Body is long; has five pairs of walking legs, the first pair are usually enlarged forming claws; has a large fan-like tail. (Go to 14)



13-2 Body is flattened from side-to-side (higher than it is wide); seven-pairs of walking legs, first two are claw-like the remaining legs are simple. Has a habit of swimming sideways.



Order Amphipoda (Scud/sideswimmer)

14.

14-1 Body mostly dorsally flattened; five-pairs of legs, first three-pairs with hinged claws and the first pair of claws are greatly enlarged; abdomen terminates in a flipper-like structure.



Order Decapoda (Crayfish)

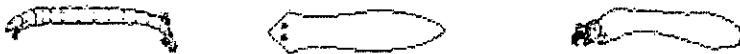
14-2 Body is flattened from side-to-side (higher than it is wide); five pairs of walking legs, the first are not enlarged forming a claw.



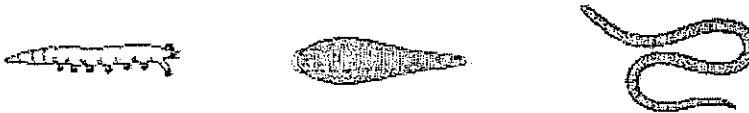
Order Decapoda; family Palaemonidae (Freshwater shrimp)

15.

15-1 Having a distinct head. (Go to 16)

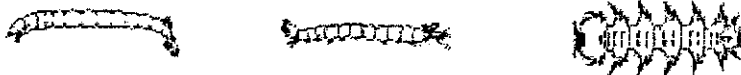


15-2 Does not have a distinct head. (Go to 20)



16.

16-1 Having a distinct head and one or more tiny pro-legs, which are leg-like appendages but are not segmented. (Go to 17)



16-2 Having a distinct head or the head region is obvious; no legs or pro-legs attached to the thorax. (Go to 19)





Teacher Information:

- Grade Level: 6 - 12
- Lesson time: 45 minutes - 1 hour
- Materials Needed: Dichotomous Keys to Aquatic Organisms
- DRBA ID Tub of Bugs Powerpoint - Includes eight aquatic insect examples to identify in class using a dichotomous key.
- Students may work in pairs/teams or singles to identify organisms.
- Objectives: Students will investigate and understand that adaptations support an organism's survival in an ecosystem; student will investigate and understand that ecosystems and organisms are dynamic and change over time; student will investigate and understand that relationships exist between ecosystem dynamics and human activity. **SOL: 6.8; 6.9; LS.7; LS.8; LS.9; LS.11; BIO.6; BIO.7; BIO.8**
- Students should include name and order to identify each organism.
- Use in combination with DRBA's Tub of Bugs Full Length Educational Video

Bugs in my water?!

Identifying Aquatic Organisms
(Stream Macroinvertebrates) with a
Dichotomous key



This activity was adapted from the Pittsylvania County STEM Academy lesson.



Example 1



Example 1 Answer: Crayfish: Order Decapoda





Female Crayfish with eggs





Example 2



Example 2 Answer: Hellgrammite: Order Megaloptera



**Adult Hellgrammite:
Dobson Fly**

Male pictured





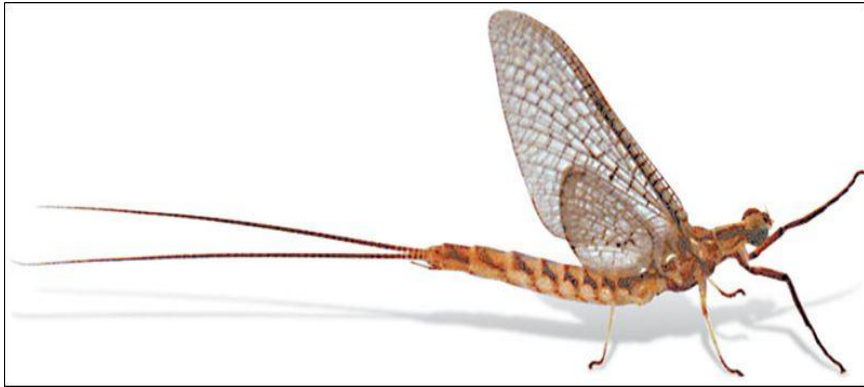
Example 3

Note: Three "tails"



Example 3 Answer: Mayfly: Order Ephemeroptera

Adult Mayfly





Mayfly Hatch



Mayfly Hatch



Example 4



**Example 4 Answer: Water Penny:
Order Coleoptera**

Adult Water Penny Beetle





Example 5



**Example 5 Answer: Crane Fly:
Order Diptera**

Adult Crane Fly





Example 6

Note: Two "tails"



Example 6 Answer:
Stonefly:
Order Plecoptera

Adult Stonefly





Example 7



Example 7 Answer:
Caddisfly: Trichoptera





Adult Caddisfly



Example 8



Example 8 Answer: Gilled Snail: Gastropoda

Stream Insects and Crustaceans ID Card

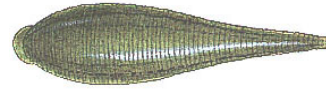
Lines under picture indicate the relative size of organisms



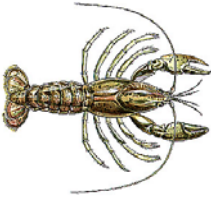
Aquatic Worm:
Class Oligochaeta
 $\frac{1}{4}$ " - 2", can be very tiny;
 thin, wormlike body, tolerant of
 impairment



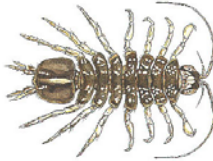
Flat Worm:
Family Planaridae
 Up to $\frac{1}{4}$ ", soft body,
 may have distinct head with
 eyespots, tolerant of impairment



Leech:
Order Hirudinea
 $\frac{1}{4}$ " - 2", segmented body,
 suction cups on both ends,
 tolerant of impairment



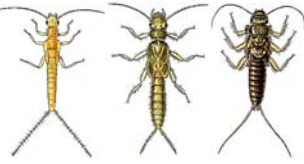
Crayfish: Order Decapoda
 Up to 6", 2 large claws, 8 legs, resembles
 a small lobster, somewhat tolerant of
 impairment



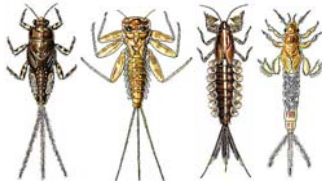
Sowbug: Order Isopoda
 $\frac{1}{4}$ " - $\frac{3}{4}$ ", gray oblong body wider
 than it is high, more than 6
 legs, long antennae, somewhat
 tolerant of impairment



Scud: Order Amphipoda
 $\frac{1}{4}$ ", white to gray, body
 higher than it is wide,
 swims sideways, more than
 6 legs, resembles small
 shrimp, somewhat tolerant
 of impairment



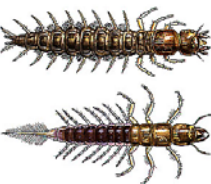
Stonefly: Order Plecoptera
 $\frac{1}{2}$ " - 1 $\frac{1}{2}$ ", 6 legs with hooked
 tips, antennae, 2 hair-like tails,
 no gills on abdomen, very
 intolerant of impairment



Mayfly:
Order Ephemeroptera
 $\frac{1}{4}$ " - 1", plate-like or feathery gills
 on abdomen, 6 hooked legs, 2 or 3
 long hair-like tails, tails may be
 webbed together, very intolerant
 of impairment



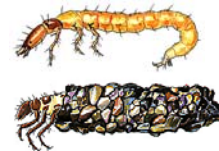
Dragonfly and Damselfly:
Order Odonata
 $\frac{1}{2}$ " - 2", large eyes, 6 hooked legs,
 large protracting lower jaw, 3
 broad oar-shaped tails OR wide
 oval to round abdomen, somewhat
 tolerant of impairment



Hellgrammite, Fishfly, and Alderfly:
Order Megaloptera
 $\frac{3}{4}$ " - 4", 6 legs, large pinching jaws, 8
 pairs of feelers along abdomen, 2 hooks
 on tail end OR 1 single spiky tail,
 somewhat tolerant of impairment




Common Netspinners:
Family Hydropsychidae
 Up to $\frac{3}{4}$ ", 6 hooked legs on
 upper 1/3 of body, 2 hooks at
 back end, underside of
 abdomen with white tufts of
 gills, somewhat tolerant of
 impairment



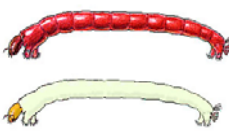
Most Caddisfly:
Order Trichoptera
 Up to 1", 6 hooked legs on
 upper 1/3 of body, may be in
 stick, rock or leaf case, no
 gill tufts on abdomen,
 intolerant of impairment

Stream Insects and Crustaceans ID Card


Lines under picture indicate the relative size of organisms



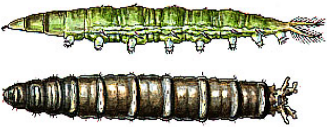
Beetles: Order Coleoptera
 $\frac{1}{4}$ " - 1", disk-like oval body with 6 small legs and gill tufts on underside OR small black beetle crawling on streambed OR comma-like brown "crunchy" body with 6 legs on upper 1/3 and possibly gill tuft on back end, OR (miscellaneous body form - rare), somewhat tolerant of impairment



Midges:
Family Chironomidae
 Up to $\frac{1}{4}$ ", distinct head, worm-like segmented body, 2 leg-like projections on each side, often whitish to clear, occasionally bright red, tolerant of impairment




Black Fly: Family Simuliidae
 Up to $\frac{1}{4}$ ", end of body wider (like bowling pin), distinctive head, sucker on end, tolerant of impairment



Most True Flies:
Order Diptera
 $\frac{1}{4}$ " - 2", bodies plump and maggot-like, may have caterpillar like "legs" along body, may have lobes or conical tails on end, tolerant of impairment



Gilled Snails:
Class Gastropoda
 Up to $\frac{3}{4}$ ", shell opening covered by a thin plate called an operculum, with helix pointed up shell opens to the right, intolerant of impairment

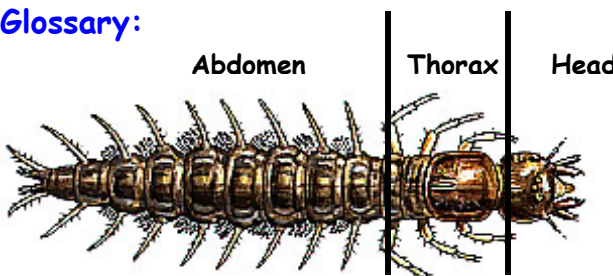


Lunged Snails:
Class Gastropoda
 Up to $\frac{3}{4}$ ", no operculum, with helix pointed up shell opens to the left, tolerant of impairment




Clams:
Class Bivalvia
 Up to $\frac{3}{4}$ ", fleshy body enclosed between two clamped together shells (if clam is alive, shells cannot be pried apart without harming clam), somewhat tolerant of impairment

Glossary:



Tails: There are many different kinds of macroinvertebrate tails. The thin thread-like tails found on stoneflies and mayflies are called cerci. The oar-shaped tails found on a damselfly are not really tails - they are actually gills called caudal lamellae!



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These sheets are modified from the National Izaak Walton League of America SOS Program Stream Insects & Crustaceans ID Card.
<http://www.iwla.org/SOS/index.html>