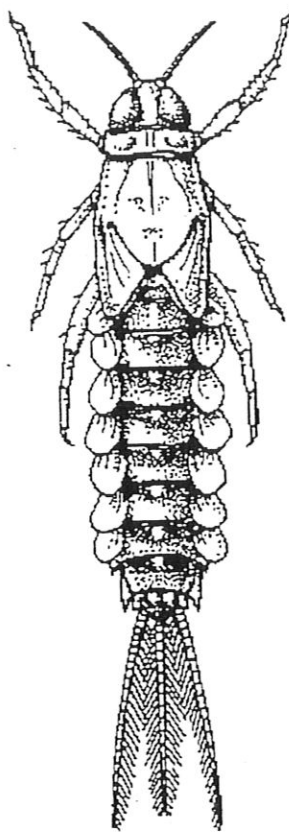


Identification Key to the Most Common Riffle-Dwelling Benthic Macroinvertebrates

1999 Minnesota Edition



Created by: Mike Beauchene, Project SEARCH, CT. Sponsored through a grant from the National Science Foundation in cooperation with the CT Dept. of Environmental Protection and the Science Center of CT.

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An Identification Key to the Most Common Riffle-Dwelling Benthic Macroinvertebrates

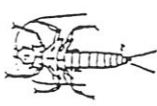

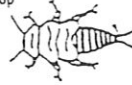
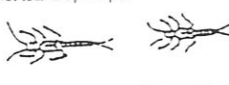
Fourth Edition

March 1999, MN

How to use this key:

This identification key is divided into 2 sections, the questions (#1-59) and the descriptions (#60-121). To begin, start by reading the question in box number 1. Answer the question as yes or no and continue to other numbers based on your selection. When you have reached the name of the organism, you will go to a number in the description section. If the organism you are trying to identify matches *both the picture in the box as well as the description*, the identification is complete. If it does not match either the picture or the description, return to the last question you were confident in answering and continue. As you proceed through the key for the second time, select a different answer for a question which you were unsure of the first time. Uncommon invertebrates can be found on the last page of the key. If you are unsure, ask your teacher for help!

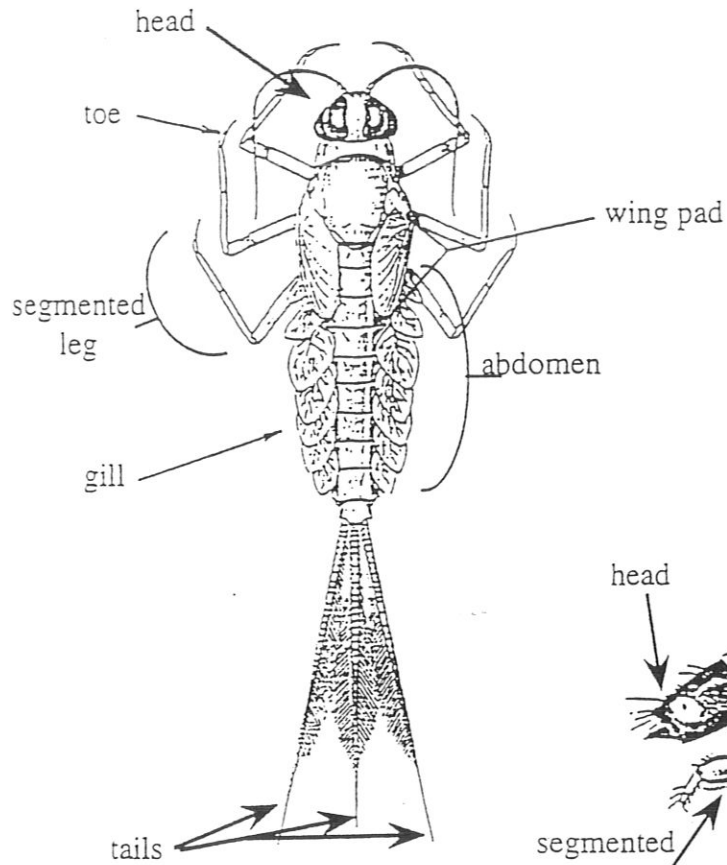
The layout of the question section follows this format:

		Example(s) of choice A	Example(s) of choice B
Question #	29.) What color is the organism?	A. Black	B. Brown or dark brown
Question	A. Black...go to #80 (Pteronarcyidae)		
Answer Choices	B. Brown or dark brown may have a pattern on the body...go to #81 (Perlidae)		
Next part of the key to go to (either another question or to a description)	30.) Is the organism tear drop shaped? A. Yes...go to #82 (Peltoperlidae) B. No...go to #31	A. Tear drop shaped 	B. Not tear drop shaped 

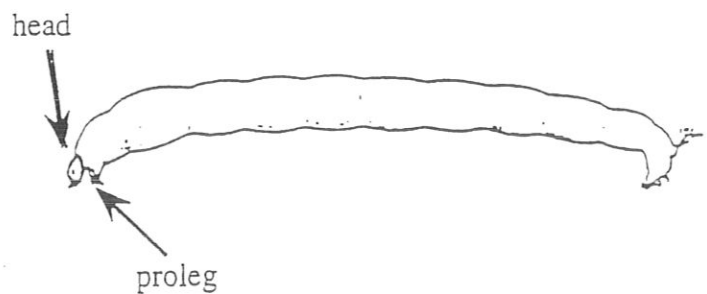
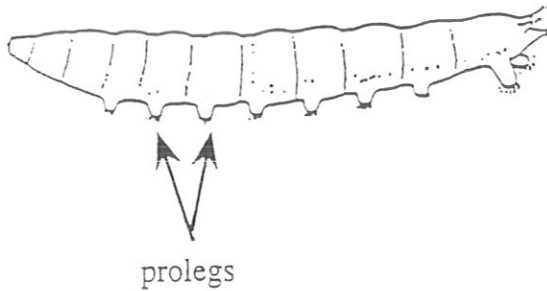
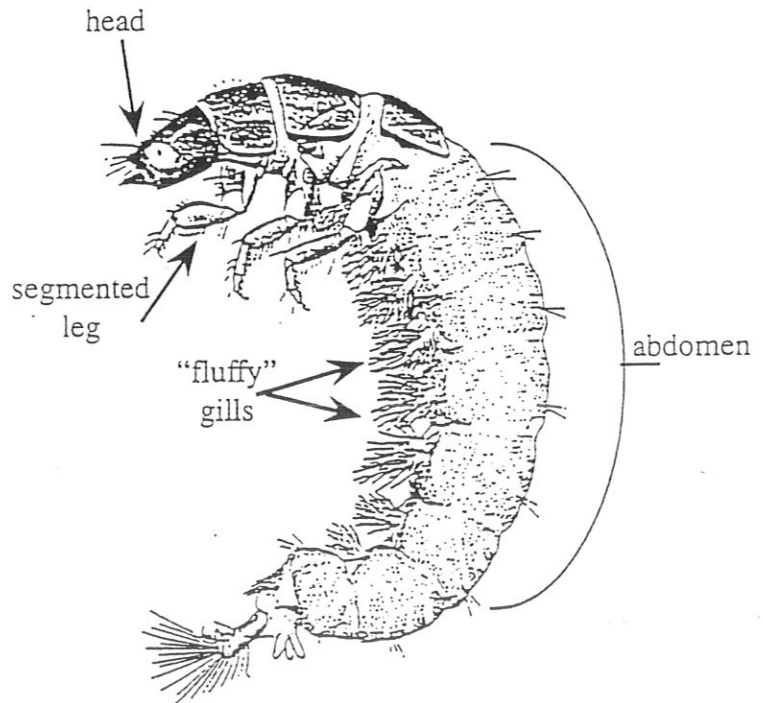
The layout of the description section follows this format:

Description number	81	Common name:	Common stonefly
General information about the organism.		Family name:	Perlidae
		Feeding group:	Predator
		Pollution tolerance:	Low = 1
		Type of stream found:	Moderate to fast moving streams of upland areas
The last question answered in the key. The choice selected said go to this description number.		Location found in stream:	Undereath loosely embedded stones in riffle areas.
		Couplet number in the key:	29B
Information about the organism which may help to determine if it is correctly identified. If the organism does not seem to match this information, double check your identification path.	<p>Trivia: This stonefly is very common in the streams of Minnesota. The nymph can grow to 1.5 inches in length and comes in a variety of brown color patterns. Perlid stoneflies have a tuft of gills where the leg meets the body (hairy armpits) but do not have gills on the first few sections of the abdomen. When these organisms are in an oxygen stressed environment they will try to physically move water over the gills by doing push-ups.</p> <p>Almost all stoneflies are very intolerant of organic pollutants. They have two tails, and two tarsal claws (toes) at the end of each leg. They all are dorsally flattened. Stoneflies prefer to live in very fast moving water under rocks, and in organic debris. Most stoneflies indicate high water quality.</p>		

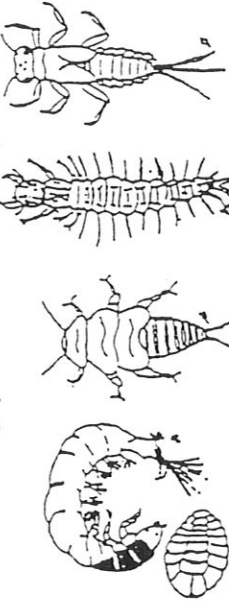
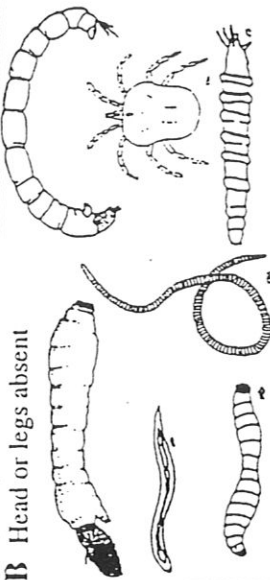

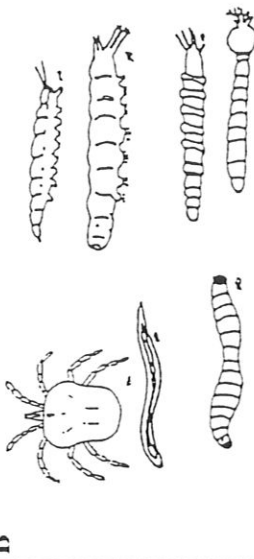



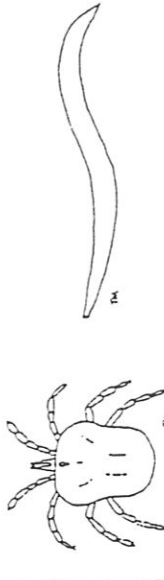
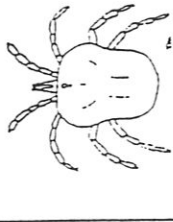

VISUAL GLOSSARY OF TERMS


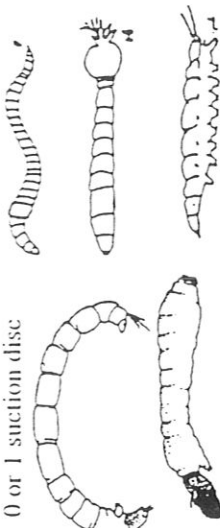
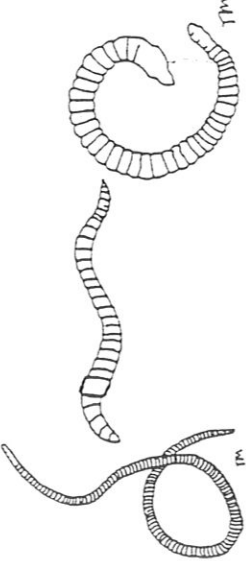
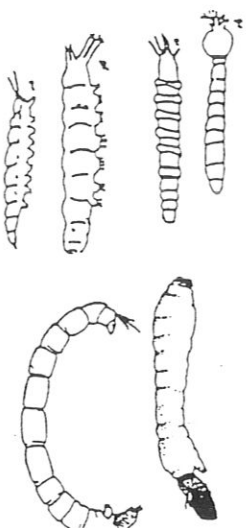
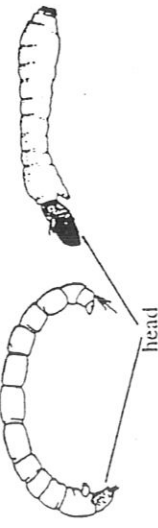

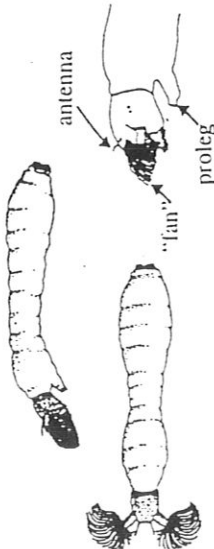
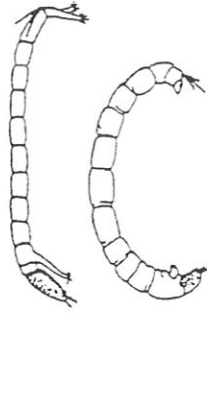
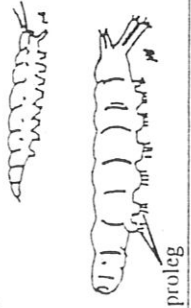
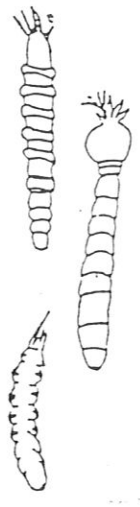


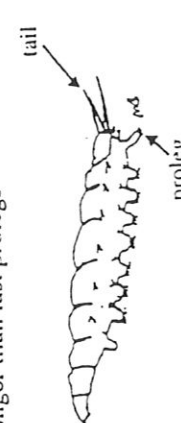

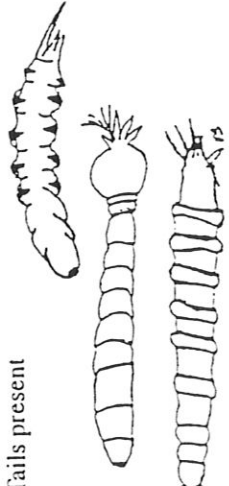

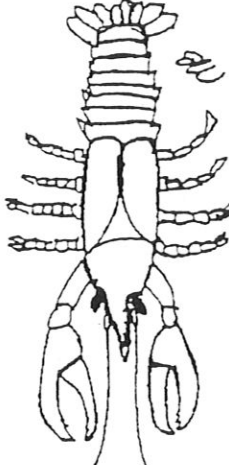
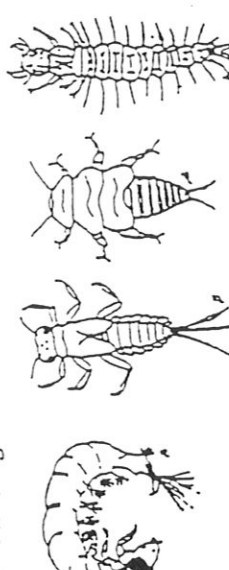
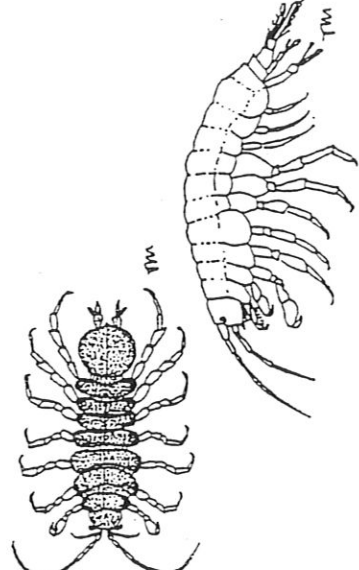
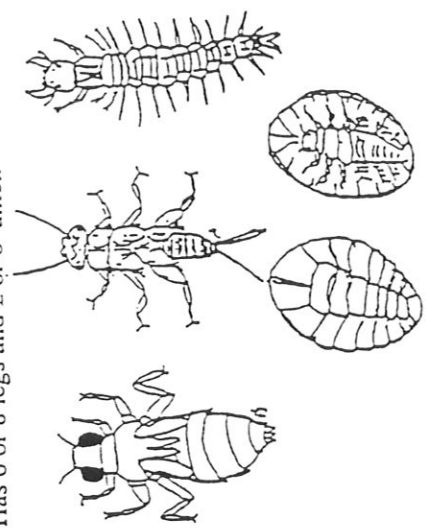
*Note: Some macroinvertebrates are delicate. Tails, legs, gills etc. may have broken off. Look carefully for remnants.

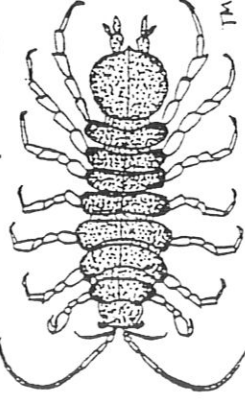
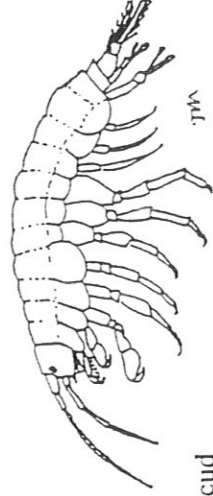
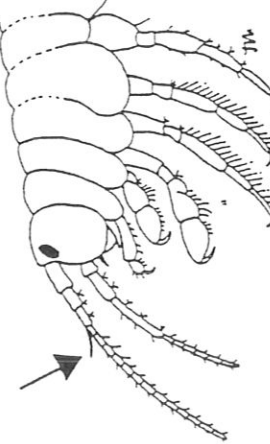
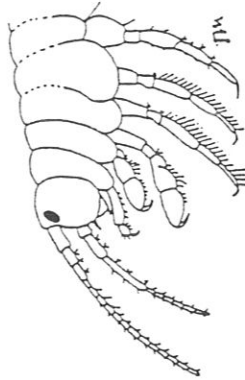
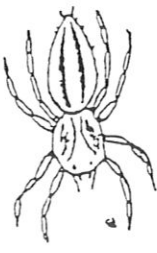
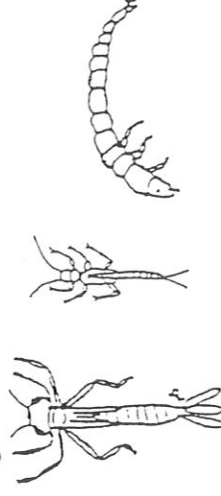

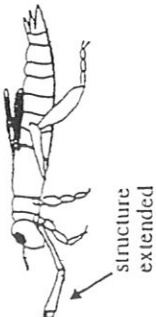
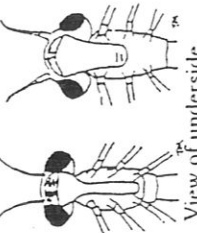
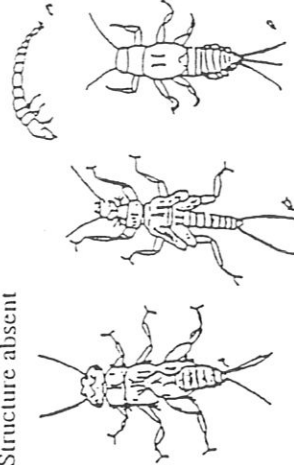


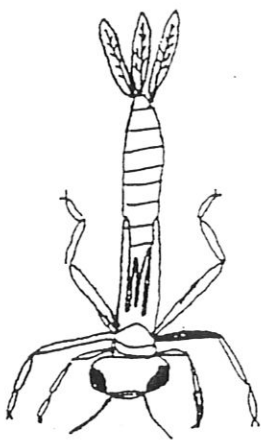

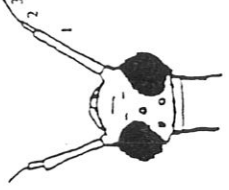

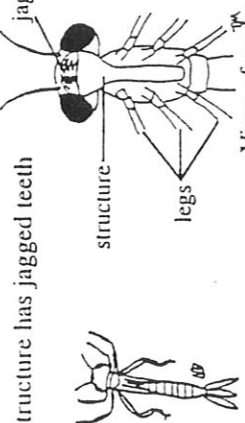
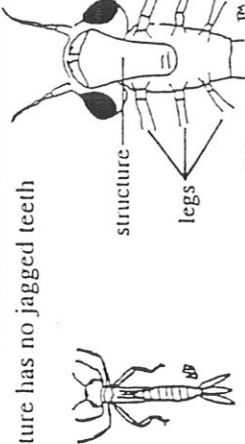
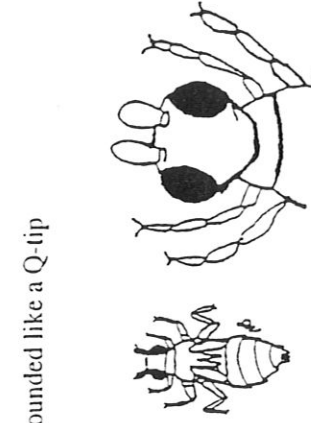
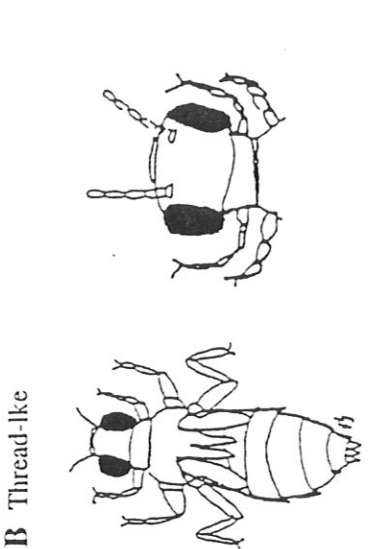
Start Here with an Unknown Organism

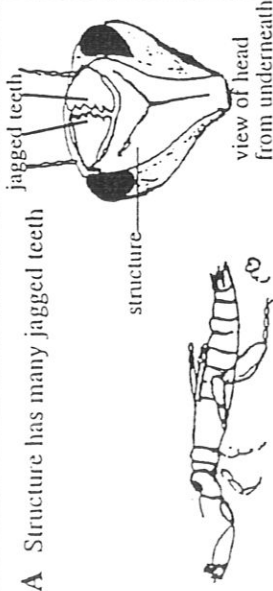
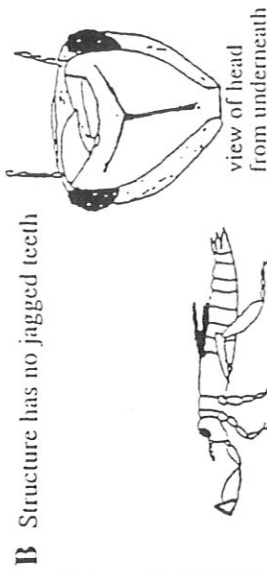
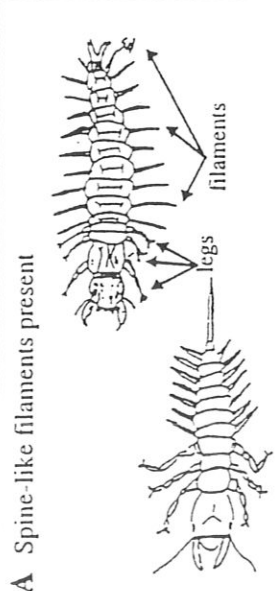
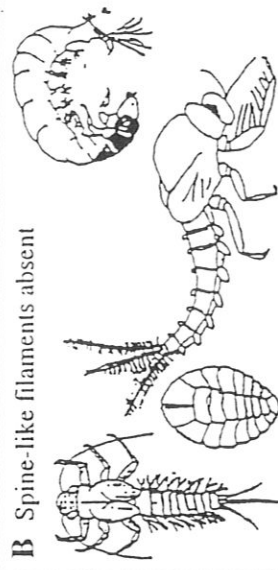
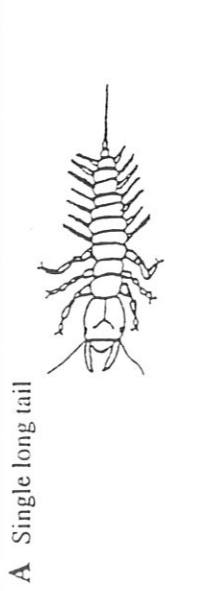
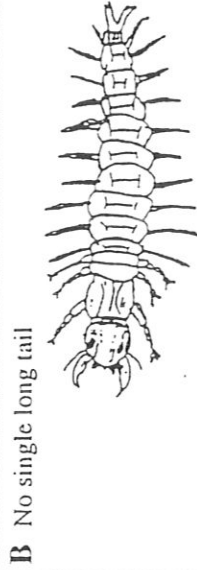
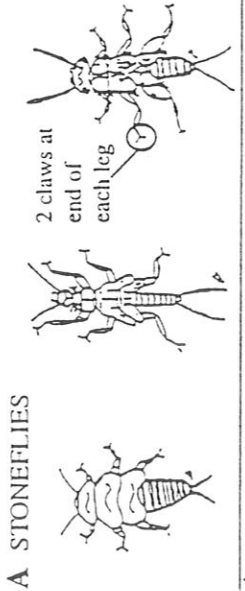
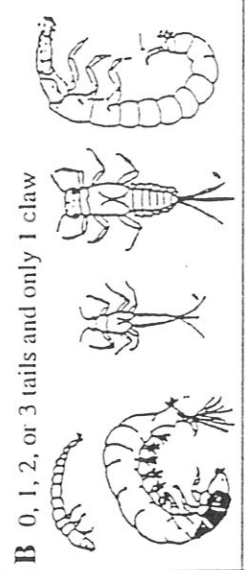

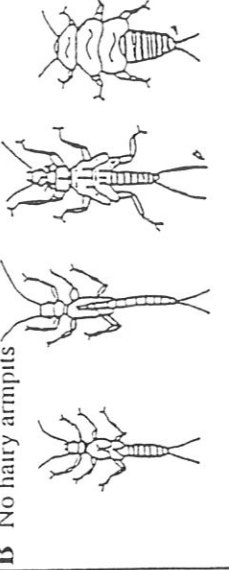
<p>1.) Does the organism have <u>both</u> a visible head and segmented legs?</p> <p>A. Yes...go to #13</p> <p>B. No...go to #2</p>	<p>A Head and legs present</p> 	<p>B Head or legs absent</p> 
<p>2.) Does the organism build a shell?</p> <p>A. Yes...go to #3</p> <p>B. No...(has an exoskeleton but not a true shell) go to #4</p>	<p>A</p> 	<p>B</p> 
<p>3.) How many pieces is the shell?</p> <p>A. 1 piece...go to #60 (Gastropoda: snails & limpets)</p> <p>B. 2 pieces...go to #61 (Pelecypoda: freshwater mussels & clams)</p>	<p>A</p> 	<p>B</p> 
<p>4.) Is the body divided into segments (sections)?</p> <p>A. Yes...go to #6</p> <p>B. No...go to #5</p>	<p>A The body appears to be divided into sections</p> 	<p>B The body appears to be 1 piece</p> 
<p>5.) Does the organism have legs?</p> <p>A. Yes...go to #62 (Hydracarina: water mite)</p> <p>B. No...go to #63 (Nematoda)</p>	<p>A Legs present</p> 	<p>B Legs absent. May be translucent.</p> 


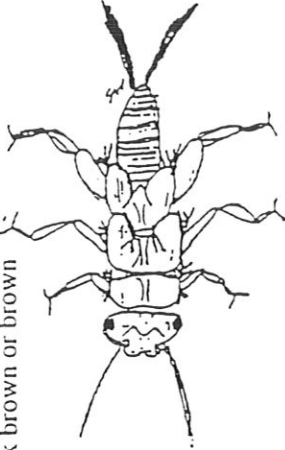
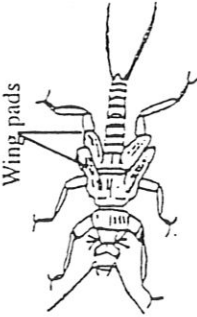
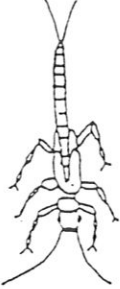




<p>6.) Does the organism have a suction disc at <u>both ends</u> of the body?</p> <p>A. Yes...go to #64 (Hirudinea: leech)</p> <p>B. No...go to #7</p>	<p>A Has 2 suction discs</p> 	<p>B 0 or 1 suction disc</p> 
<p>7.) How many divisions of the body can you see?</p> <p>A. More than 20...go to #65 (Oligocheata)</p> <p>B. Less than 20...go to #8</p>	<p>A More than 20 divisions</p> 	<p>B Less than 20 divisions</p> 
<p>8.) Does the organism have a visible head? Look carefully!</p> <p>A. Yes...go to #9</p> <p>B. No...go to #10</p>	<p>A Visible head</p> 	<p>B Head absent or hidden</p> 
<p>9.) Is the body thicker at the back end than in the middle and does it have 2 "fans" on its head?</p> <p>A. Yes...go to #66 (Simuliidae)</p> <p>B. No...go to #67 (Chironomidae)</p> <p>If it is red, label it "Chironomidae red." If not, label it "Chironomidae, other."</p>	<p>A Back end thicker than middle</p> 	<p>B Back end same thickness as middle</p> 
<p>10.) Does the organism have prolegs on or along the abdomen?</p> <p>A. Yes...go to #11</p> <p>B. No...go to #12</p>	<p>A Prolegs present</p> 	<p>B Prolegs absent</p> 

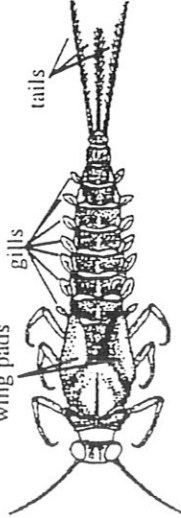
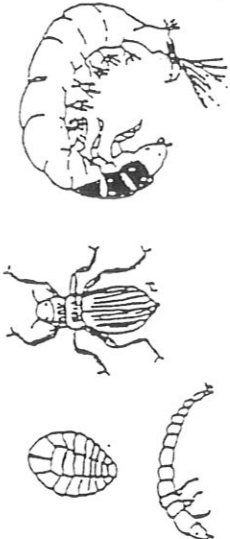
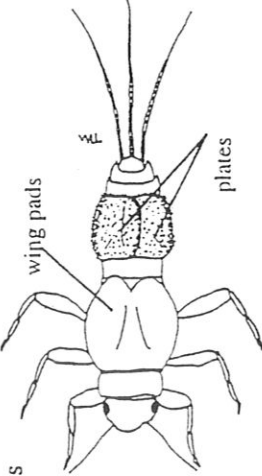
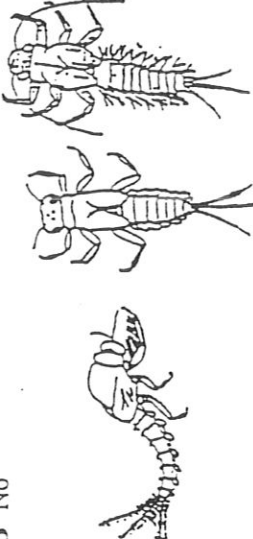
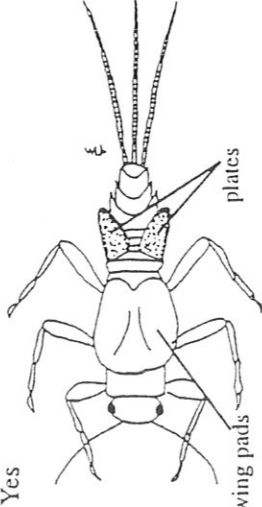
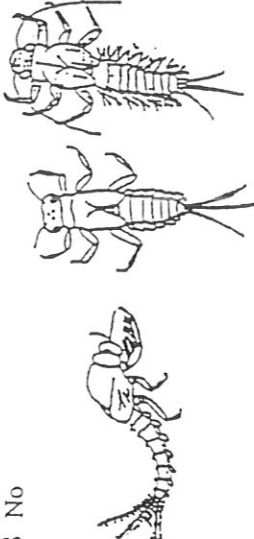
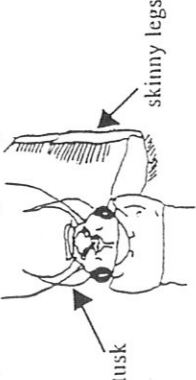
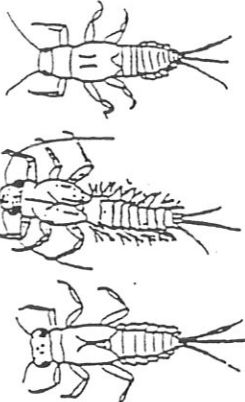
<p>11.) Are the tails longer than the last set of prolegs?</p> <p>A. Yes...go to #68 (Athericidae)</p> <p>B. No...go to #69 (Empididae)</p>	<p>A Tails longer than last prolegs</p> 	<p>B Tails shorter than last prolegs</p> 
<p>12.) Does the organism have tail-like structures?</p> <p>A. Yes...go to #70 (Tipulidae)</p> <p>B. No...go to #71 (Tabanidae)</p>	<p>A Tails present</p> 	<p>B Tails absent</p> 
<p>13.) Does the organism have large pinching claws and look like a small lobster?</p> <p>A. Yes...go to #72 (Decapoda: crayfish)</p> <p>B. No...go to #14</p>	<p>A Pinching claws present</p> 	<p>B Pinching claws absent</p> 
<p>14.) Does the organism have 4 antennae and <u>more than 6</u> segmented legs?</p> <p>A. Yes...go to #15</p> <p>B. No...go to #17</p>	<p>A Has more than 6 legs and has 4 antennae. If yes, it must look like one of these 2 pictures.</p> 	<p>B Has 6 or 8 legs and 2 or 0 antennae</p> 

<p>15.) What color is the organism? A. Grey or darker colored and body is flattened top to bottom...go to #73 (isopod) B. White or orange/light colored and body is flattened side to side...go to #16 (amphipod)</p>	<p>A Dark colored and flattened top to bottom</p> 	<p>B Light colored and flattened side to side</p> 
<p>16.) Is first antenna branched? If you are unable to tell with your scope, just label "Amphipod" A. Yes...go to #74 (Gammaridae) B. No...go to #74 (Talitridae)</p>	<p>A First antenna branched</p> 	<p>B No branch on first antenna</p> 
<p>17.) Does the organism have 8 legs? A. Yes...go to #75 (spider) B. No...go to #18</p>	<p>A 8 legs</p> 	<p>B 6 legs</p> 
<p>18.) Does the organism have a very large structure covering the mouth? *Note: Look carefully! Most often you will find the structure tucked underneath the head. Use tweezers to try to move the structure and see if it can extend far away from the head. If not, you are probably just looking at the lower jaw and should answer "no." A. Yes...go to #19 B. No...go to #24</p>	<p>A Structure present</p>  <p>structure tucked underneath head</p>  <p>structure extended</p> <p>Dragonflies & Damselflies</p>  <p>View of underside</p>	<p>B Structure absent</p> 

<p>19.) What shape is the body?</p> <p>A. Thin and skinny, elongate with 3 feather-like tails...go to #20</p> <p>B. Short and squat, robust with 3 triangular points for tails...go to #22</p>	<p>A Thin and skinny with 3 feather-like tails</p> 	<p>B Short and squat with 3 spike-like tails</p> 
<p>20.) Is the first section of the antenna much longer than the other sections?</p> <p>A. Yes...go to #76 (<i>Calopterygidae</i>)</p> <p>B. No... go to #21</p>	<p>A Much longer</p> 	<p>B Similar size and structure</p> 
<p>21.) Is the structure covering the mouth on a long thin stalk and have many jagged teeth?</p> <p>A. Yes...go to #77 (<i>Lestidae</i>)</p> <p>B. No...go to #78 (<i>Coenagrionidae</i>)</p>	<p>A Structure has jagged teeth</p>  <p>View of underside</p>	<p>B Structure has no jagged teeth</p>  <p>View of underside</p>
<p>22.) Are the antenna rounded like a Q-tip or are they thread-like?</p> <p>A. Rounded...go to #79 (<i>Gomphidae</i>)</p> <p>B. Thread-like...go to #23</p>	<p>A Rounded like a Q-tip</p> 	<p>B Thread-like</p> 

<p>23.) Does the structure covering the mouth have many jagged teeth?</p> <p>A. Yes...go to #80 (Cordulergastridae)</p> <p>B. No...go to #81 (Aeshnidae)</p>	<p>A Structure has many jagged teeth</p>  <p>B Structure has no jagged teeth</p> 
<p>24.) Does the organism have spine-like filaments along each side of the abdomen?</p> <p>A. Yes...go to #25</p> <p>B. No...go to #26</p>	<p>A Spine-like filaments present</p>  <p>B Spine-like filaments absent</p> 
<p>25.) Does the organism have a single long tail?</p> <p>A. Yes...go to #82 (Sialidae)</p> <p>B. No...go to #83 (Corydalidae)</p>	<p>A Single long tail</p>  <p>B No single long tail</p> 
<p>26.) Does the organism have both 2 hair-like tails and 2 claws (toes) at the end of each leg? *Note: Tails may be broken off, so look for remnants.</p> <p>A. Yes...go to #27</p> <p>B. No...go to #32</p>	<p>A STONEFLIES</p>  <p>B 0, 1, 2, or 3 tails and only 1 claw</p> 
<p>27.) Does the organism have a fluffy tuft of gills at the base of each leg (hairy armpits)?</p> <p>A. Yes...go to #28</p> <p>B. No...go to #29</p>	<p>A Hairy armpits</p>  <p>B No hairy armpits</p> 

<p>28.) Are there gills on the abdominal segments?</p> <p>A. Gills on first 2 abdominal segments and in "arm pits", often black in color...go to #84 (Pteronarycidae)</p> <p>B. Gills only in arm pits, often brown in color, may have a pattern on the body...go to #85 (Perlidae)</p>	<p>A Black</p> 	<p>B Dark brown or brown</p> 
<p>29.) Do the wing pads point away from the center of the body? (immature specimens may not be developed enough to do further ID. Just label as 'Stonefly')</p> <p>A. Yes...go to #30</p> <p>B. No...go to #31</p>	<p>A Wing pads pointing away from the center of the body</p> 	<p>B Wing pads parallel to the center of the body</p> 
<p>30.) Does the organism have a tuft of fluffy gills around the underside of the throat?</p> <p>A. Yes...go to #86 (Nemouridae)</p> <p>B. No...go to #87 (Perlidae)</p>	<p>A Gills on underside of the throat</p> 	<p>B No gills on the underside of the throat</p> 
<p>31.) Do the first pair of wing pads overlap the second pair?</p> <p>A. Yes...go to #88 (Leuctridae)</p> <p>B. No...go to #89 (Chloroperlidae)</p>	<p>A First pair overlap the second pair</p> 	<p>B First pair do not overlap the second pair</p> 

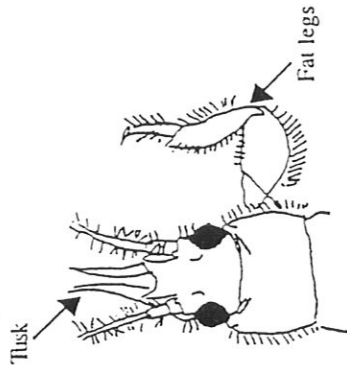
<p>32.) Does the organism have wing pads, 3 (sometimes 2) hair-like tails and gills on the side or top of the abdomen? *Note: Tails may be broken off. Look for remnants.</p> <p>A. Yes...go to #33</p> <p>B. No...go to #42</p>	<p>A Wing pads present</p>  <p>MAYFLIES</p>	<p>B Wing pads absent or has developed wings</p> 
<p>33.) Does the organism have square 'plates' overlapping on the abdomen?</p> <p>A. Yes...go to #96 (Caenidae)</p> <p>B. No...go to #34</p>	<p>A Yes</p> 	<p>B No</p> 
<p>34.) Does the organism have triangular "plates" on the abdomen?</p> <p>A. Yes...go to #118 (Leptohiphidae, formerly called Tricorythidae)</p> <p>B. No...go to #35</p>	<p>A Yes</p> 	<p>B No</p> 
<p>35.) Does the organism have large 'tusks' pointing forward on its head <u>AND</u> are the front leg segments narrow and slender?</p> <p>A. Yes...go to #97 (Potamanthidae)</p> <p>B. No...go to #36</p>	<p>A Yes, tusks are as big as organism's head.</p> 	<p>B No</p> 

36.) Does the organism have 'tusks' pointing forward on its head and the front leg segments fat and pointed?

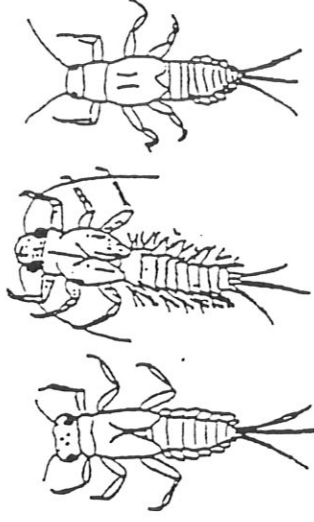
A. Yes...go to #98 (Ephemeridae)

B. No...go to #37

A Yes



B No

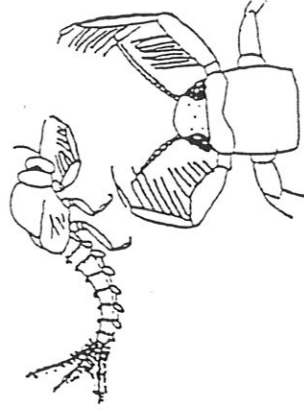


37.) Are there very long hairs on the inside surface of the front pair of legs (are the hairs as long as the legs)?

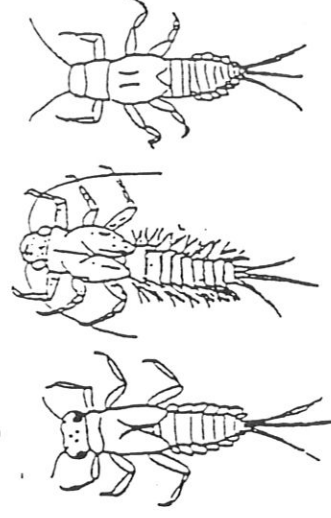
A. Yes...go to #90 (Oligoneuriidae)

B. No...go to #38

A Long hairs present



B Long hairs absent



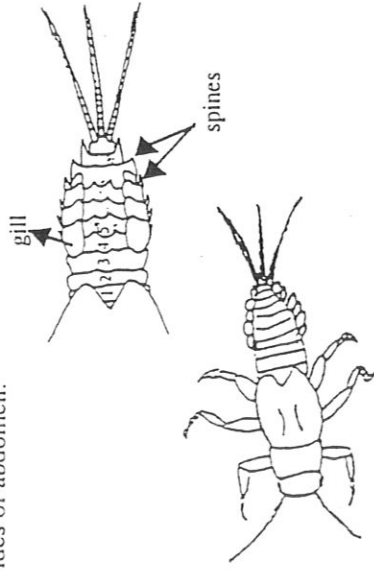
38.) Where do the gills start ?

*Note: Gills may have broken off, so look carefully for remnants.

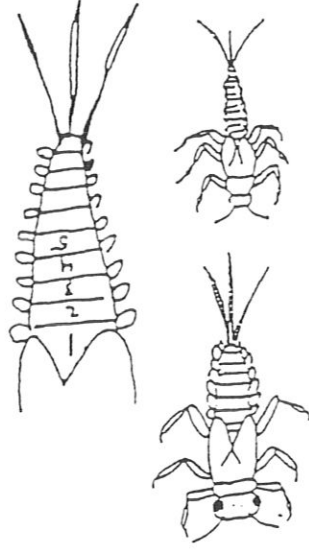
A. On the third section of the abdomen and there are spines present on sides of the abdomen...go to #91 (Ephemerellidae)

B. On the first or second section of the abdomen (starting at the wing pads)...go to #39

A Gills start on the 3rd section. Has spines on sides of abdomen.



B Gills start on the 1st or 2nd section

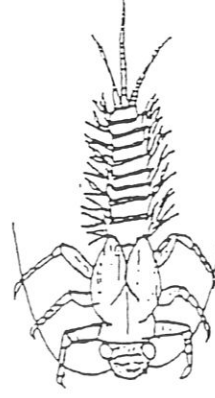


39.) What shape are the gills?

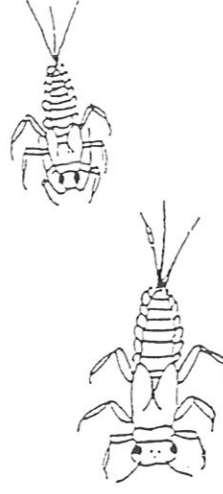
A. Fringed or forked...go to #92 (Leptophlebiidae)

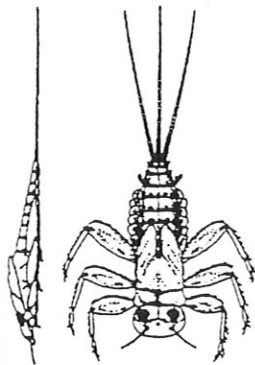
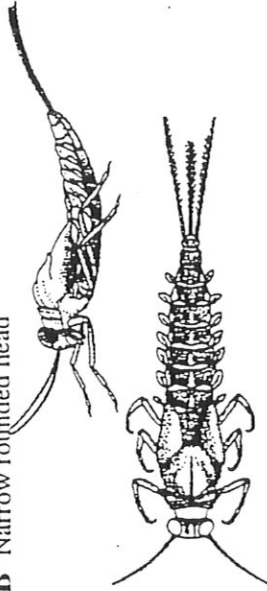
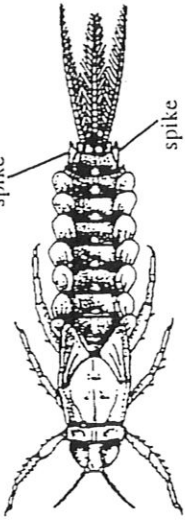
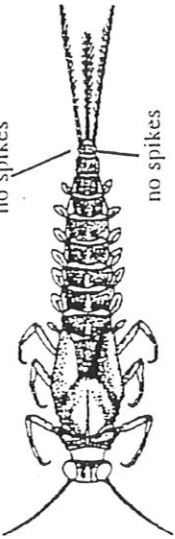

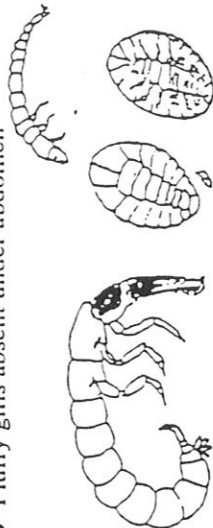
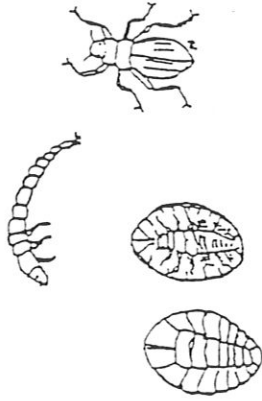
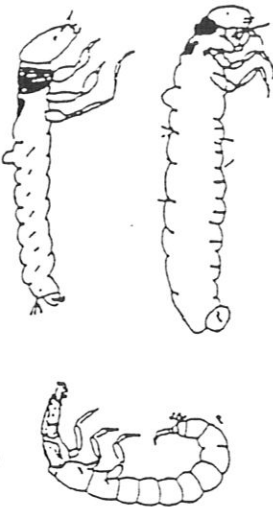
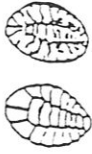

B. Rounded or oval...go to #40



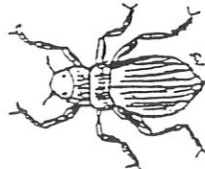
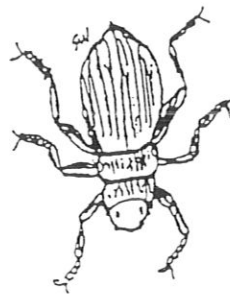


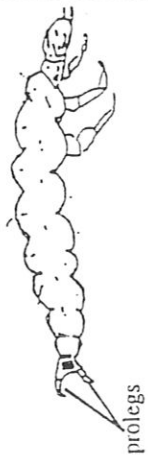
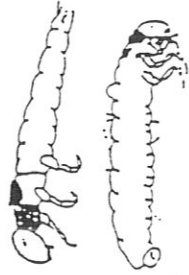
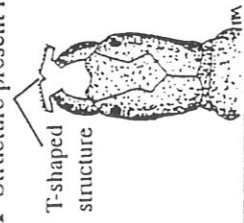
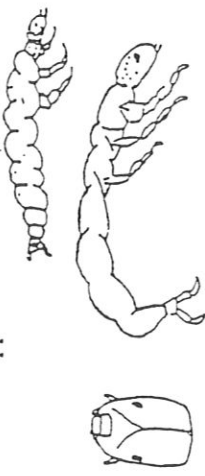
A Fringed or forked gills






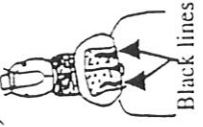


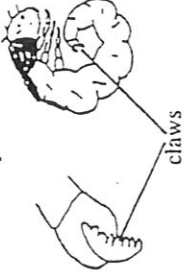


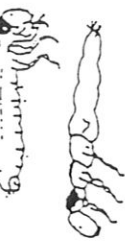




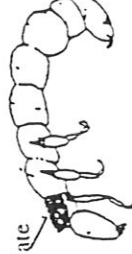
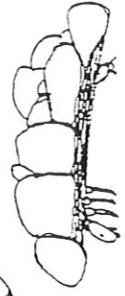
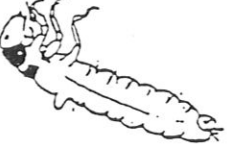



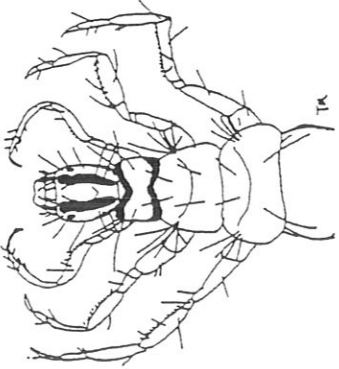
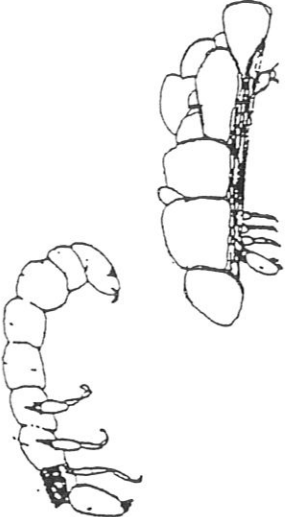
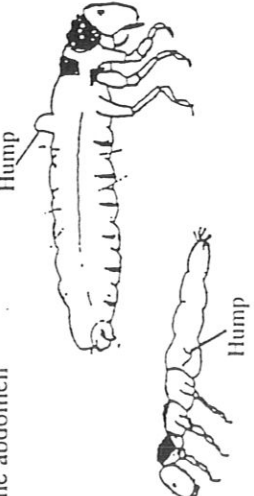



B Rounded or oval gills

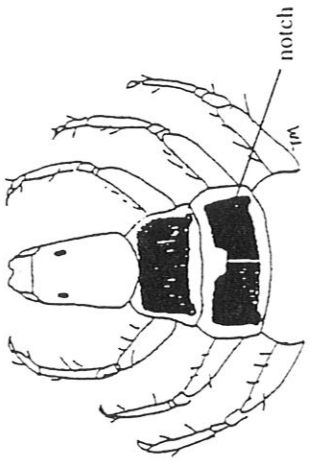

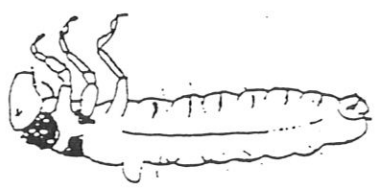

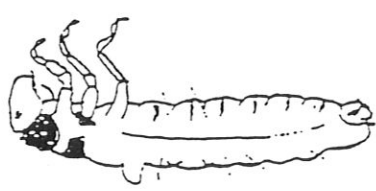





<p>40.) What shape is the head?</p> <p>A. Broad, wide, or flat and the body is flattened with legs sprawled out to the sides...go to #93 (Heptageniidae)</p> <p>B. Narrow, rounded, and not flat...go to #41</p>	<p>A Broad wide flat head</p>  <p>HINT: Body and head look very thin from side view.</p>	<p>B Narrow rounded head</p> 
<p>41.) Are there spikes on the last abdominal segment?</p> <p>A. Yes...go to #94 (Siphonuridae)</p> <p>B. No...go to #95 (Baetidae)</p>	<p>A</p>  <p>spike</p>	<p>B</p>  <p>no spikes</p>
<p>42.) Does the organism have tufts of fluffy gills on the underside of the abdomen?</p> <p>A. Yes...go to #99 (Hydropsychidae)</p> <p>B. No...go to #43</p>	<p>A Fluffy gills present under abdomen</p>  <p>yes</p>	<p>B Fluffy gills absent under abdomen</p> 
<p>43.) What color is the body of the organism?</p> <p>A. Dark colored (blackish/dark brown)...go to #44</p> <p>B. Light colored (white, light brown or grey)...go to #48</p>	<p>A Dark body</p> 	<p>B Light body</p> 
<p>44.) Is the body disc shaped?</p> <p>A. Yes...go to #100 (Psephenidae)</p> <p>B. No...go to #45</p>	<p>A Disc shaped body</p> 	<p>B Not disc shaped</p> 

<p>45.) Does the organism look like a tiny beetle?</p> <p>A. Yes...go to #46</p> <p>B. No...go to #47</p>		<p>B</p> 
<p>46.) Does the beetle have visible antenna?</p> <p>A. Yes...go to #101 (Elmidae adult)</p> <p>B. No...go to #102 (Dryopidae adult)</p>		<p>B</p> 
<p>47.) How large is the organism?</p> <p>A. 1 cm or less</p> <p>B. Greater than 1 cm...go to #104 (Ptilodactylidae larvae)</p>		<p>B</p> <p>Larger than 1 cm</p> 
<p>48.) Are there 2 large prolegs sticking out and separated from the last abdominal segment?</p> <p>A. Yes...go to #49</p> <p>B. No...go to #51</p>		<p>B</p> <p>Prolegs tucked into or attached to abdomen</p> 
<p>49.) Is there an obvious light-colored T-shaped structure in between the mouth parts?</p> <p>A. Yes...go to #105 (Philopotamidae)</p> <p>B. No...go to #50</p>		<p>B</p> <p>No structure apparent in mouth</p> 

<p>50.) Is there a small area on the last section of the abdomen that is a different color and harder than the rest of the section (just above the prolegs)?</p> <p>A. Yes...go to #106 (Rhyacophilidae)</p> <p>B. No...go to #107 (Polycentropodidae)</p>	<p>A Dark area present</p>  	<p>B Dark area absent</p>  
<p>51.) Does the organism have long antenna (appear very short but at least they are visible)? May also have 2 black lines on the back (see drawing)</p> <p>A. Yes...go to #108 (Leptoceridae)</p> <p>B. No...go to #52</p>	<p>A Long antenna (although still very short)</p>   <p>Black lines</p>	<p>B Very short antenna (may not be visible)</p>  
<p>52.) What shape are the claws at the end of the abdomen?</p> <p>A. Comb shaped...go to #109 (Helicopsychidae-will make snail-shaped case of sand grains)</p> <p>B. Hook shaped...go to #53</p>	<p>A Comb shaped claws</p>   <p>claws</p>	<p>B Hook shaped claws</p>  
<p>53.) Is there a dark plate above each of the pairs of legs?</p> <p>A. Yes...go to #110 (Hydroptilidae)</p> <p>B. No...go to #54</p>	<p>A A dark plate above each pair of legs</p>  	<p>B</p>  
<p>54.) Is there a dark plate above only the first pair of legs?</p> <p>A. Yes...go to #55</p> <p>B. No...go to #56</p>	<p>A Dark plate above 1st pair of legs only</p>   <p>plate</p>	<p>B</p>  

<p>55.) Is the head yellow with dark brown/black stripes?</p> <p>A. Yes...go to #111 (Phryganeidae)</p> <p>B. No...go to #112 (Glossosomatidae)</p> <p>Case will be "turtle-like" with rounded top and flat bottom.</p>	<p>A</p> 	<p>B</p> 
<p>56.) Does the organism have a hump on the top or side of the first section of the abdomen?</p> <p>A. Yes...go to #57</p> <p>B. No...go to #113 (Brachycentridae)</p>	<p>A</p> <p>Hump present on the top or side of the 1st section of the abdomen</p> 	<p>B</p> <p>No hump on the top or side of the 1st section of the abdomen</p> 
<p>57.) Does the organism have a hump on the top of the first section of the abdomen?</p> <p>A. Yes...go to #58</p> <p>B. No...go to #114 (Lepidostomatidae)</p>	<p>A</p> <p>Hump present on the top of the 1st section of the abdomen only</p> 	<p>B</p> <p>Hump present on the side of the 1st section abdomen only</p> 

<p>58.) Is the head long and somewhat pointed, and does the second set of hard plates have a "notch" in the middle?</p> <p>A. Yes...go to #115 (Uenoidae) B. No...go to #59</p>	<p>A Has notch in second set of plates</p>  <p>B No notch</p> 	
<p>59.) Does the organism have a poststernal horn?</p> <p>A. Yes...go to #116 (Limnephilidae) B. No...go to #117 (Odontoceridae)</p>	<p>A Prosternal horn present</p>   <p>B Prosternal horn absent</p>  	

DESCRIPTIONS

- 60** Common name: Snails and limpets
 Class name: Gastropoda
 Feeding group: Scraper
 Pollution tolerance: High = 8 (snails), 6 (limpets) sensitive to heavy metals and acidic conditions
 Type of stream found: Slow to fast moving streams below ponds or in wetlands
 Location found in stream: Surfaces of rocks and finer sediments
 Couplet number in the key: 3 A

Trivia: One group of snails has an operculum (hard disc) which covers the opening to the shell, the other does not. Snails use a file-like structure called a radula to scrape food from substrates.

Limpets are very small and build a cone-shaped shell. Like snails, they have a radula to scrape algae of the substrate. They can be found on the surface of rocks in rapidly flowing water.

- 61** Common name: Freshwater clams and mussels
 Class name: Pelecypoda
 Feeding group: Collector/Filterer
 Pollution tolerance: Variable
 Type of stream found: Slow moving streams below ponds or in wetland areas
 Location found in stream: Burrowed into the finer sediments like sand and silt.
 Mostly found in pools or along stream margins.
 Couplet number in the key: 3 B

Trivia: The Unionidae are very large (up to 3 inches long) while Sphaeriidae are the size of a fingernail. The most famous member of the freshwater bivalves is the zebra mussel. Zebra mussels are an introduced species which can have a major impact on North American aquatic ecosystems.

- 62** Common name: Water mites
 Family name: Hydracarina
 Feeding group: Parasitic on other aquatic organisms, free living
 Pollution tolerance: Moderate = 4
 Type of stream found: Slow moving streams
 Location found in stream: Found in the water column, on the substrate or on a host organism
 Couplet number in the key: 5 A

Trivia: Water mites are very small tick-like organisms. They occur in a wide variety of aquatic habitats. Some of the adult forms can be bright red or orange.

- 63** Common name: Round worms
Phylum name: Nematoda
Feeding group: Unknown, free living
Pollution tolerance: ?
Type of stream found: All types of streams
Location found in stream: Found in or on the stream bottom
Couplet number in the key: 5 B

Trivia: Nematodes are small worm-like organisms. They do not have a segmented body. They are very common organisms found in all types of habitats.

- 64** Common name: Leeches
Class name: Hirudinea
Feeding group: Parasitic on other aquatic organisms
Pollution tolerance: High = 10
Type of stream found: All types of streams
Location found in stream: Found attached to the substrate or on a host organism
Couplet number in the key: 6A

Trivia: Leeches are very common in MN. Sizes and color pattern depend upon the species. Leeches have a suction disc at both ends of the body. Leeches feed on the blood of a host organism by using a drill-like rasping tongue to penetrate the skin. The leech injects a chemical which prevents the blood from clotting (anticoagulant).

Some leeches are used in medical practice to remove the build up of blood and body fluids in bruised or surgically reattached appendages and tissues. When preserved leeches tend to curl up.

- 65** Common name: Aquatic earthworms
Class name: Oligochaeta
Feeding group: Collector/Gatherer
Pollution tolerance: High = 8
Type of stream found: Slow to fast moving streams (very common in very polluted streams)
Location found in stream: Found burrowing in or on finer stream substrates
Couplet number in the key: 7 A

Trivia: Aquatic earth worms have segmented bodies. These organisms especially Tubifex worms, can live in extremely polluted waters with very low dissolved oxygen levels. Often severely impacted streams will have very large populations of these worms.

- 66** Common name: Black flies
 Family name: Simuliidae
 Feeding group: Collector/ Filterer
 Pollution tolerance: Moderate = 6
 Type of stream found: Moderate to fast flowing streams (very common immediately downstream of a lake or pond)
 Location found in stream: Found attached to the surface of rocks which are in the fast flowing section of a riffle.
 Couplet number in the key: 9 A

Trivia: Black flies are very common in the streams of MN. The body is whitish-grey color, and is shaped like a bowling pin. The larvae can be up to 1/2 of an inch in length. Black flies have a ring of small hooks at the back end of the abdomen which enables them to adhere to a rock and not be swept away by the current. At a glance these hooks resemble a suction disc. Black flies use a brush-like structure to filter fine organic matter from the water column. Black fly abundance is strongly related to the time of year.

- 67** Common name: Midges
 Family name: Chironomidae
 Feeding group: Collector/Gatherer
 Pollution tolerance: Moderate = 6 (white forms) High = 8 (red forms)
 Tolerant of heavy metals
 Type of stream found: All types from fast to slow moving streams
 Location found in stream: Found in a tube or on the stream substrate
 Couplet number in the key: 9 B

Trivia: Adult midges are tiny flies. The larvae are very thin, 1/2 an inch long, and are white when preserved. The color in the red midges comes from a hemoglobin-like compound. This compound allows the midge to survive in very low oxygen levels. Midges have a high tolerance to heavy metals. In some streams, midges can be extremely abundant. When chironomidae is the dominant family, comprising greater than 70% of the sample, and few other types of organisms are present, the water quality may be impacted.

- 68** Common name: Water snipe flies
 Family name: Athericidae
 Feeding group: Predator
 Pollution tolerance: Low = 2
 Type of stream found: Moderate to fast flowing streams
 Location found in stream: Found burrowing in the substrate
 Couplet number in the key: 11 A

Trivia: Water snipe flies have a rough appearance to the exoskeleton. The body is elongate with several tail-like structures. The body narrows to a point at the opposite end of the tail-like structures. There are prolegs along the underside of the abdomen.

- 69** Common name: Aquatic dance flies
 Family name: Empididae
 Feeding group: Predator
 Pollution tolerance: Moderate = 6
 Type of stream found: Moderate to fast flowing streams
 Location found in stream: Found burrowing in the substrate
 Couplet number in the key: 11 B

Trivia: Aquatic dance flies have a white body and the exoskeleton does not have a rough appearance. There are several very small tail-like structures. The body does not narrow to a sharp point at the opposite end of the tail-like structures. The last few prolegs are very long.

- 70** Common name: Crane flies
 Family name: Tipulidae
 Feeding group: Shredder
 Pollution tolerance: Low = 3
 Type of stream found: Moderate to fast flowing streams
 Location found in stream: Found burrowing in the substrate and in leaf packs
 Couplet number in the key: 12 A

Trivia: All crane flies have what appear to be tails, however they are respiratory organs. The adult crane fly looks like a giant mosquito, however these insects can not bite. Most crane fly larva are very large up to 1.5 inches. Some of the largest look like a grey membranous sack. Some species have a bulb-like structure near the tails, while others have dark areas on the top and bottom of the abdomen.

- 71** Common name: Horse flies
Family name: Tabanidae
Feeding group: Predator
Pollution tolerance: Moderate = 6
Type of stream found: Moderate to fast flowing streams
Location found in stream: Found burrowing in the substrate
Couplet number in the key: 12 B

Trivia: Horse fly larva do not have any prolegs or tail-like structures. Instead they have creeping welts which are specialized areas around the body. The creeping welts help the organism move through the substrate. The adult horse fly prefers to feed on the blood of mammals and can provide a very painful bite.

- 72** Common name: Crayfish
Order name: Decapoda
Feeding group: Collector/Gatherer
Pollution tolerance: Moderate = 6
Type of stream found: Slow to Moderate flowing streams
Location found in stream: Found burrowing in the substrate and hiding under rocks
Couplet number in the key: 13 A

Trivia: Crayfish resemble tiny lobsters. They are scavengers on the stream bottom, feeding on a wide variety of food sources. Crayfish are the largest stream invertebrates. Often populations can be extremely numerous. They are a food source for both fish and humans.

- 73** Common name: Isopods or freshwater sow bugs
Order name: Isopoda
Family name: Asellidae
Feeding group: Collector/Gatherer
Pollution tolerance: High = 8
Type of stream found: Slow flowing streams
Location found in stream: Found crawling on the organic substrate and in slow moving areas
Couplet number in the key: 15 A

Trivia: Aquatic sow bugs are small dorsally flattened crustaceans. A close relative, the terrestrial sow bug, lives amongst decomposing leaves and logs. There is only one family of aquatic sow bugs which contains two species. Aquatic sow bugs are grey when preserved.

- 74** Common name: Amphipod, scud, side-swimmer
 Order name: Amphipoda
 Families: Gammaridae, Talitridae
 Feeding group: Collector/Gatherer
 Pollution tolerance: Talitridae: High = 8, Gammaridae: Low = 4
 Type of stream found: Slow moving areas of low gradient streams.
 Location found in stream: Found crawling on the organic substrate and in slow moving areas and living in aquatic vegetation.
 Couplet number in the key: 16 A, B

Trivia: Scuds are also crustaceans. They appear to be bleached white when preserved. Scuds can swim very rapidly on their sides when disturbed, therefore the name "side-swimmer". Most scuds are omnivorous and feed in organic debris.

- 75** Common name: Spiders
 Class name: Arachnida
 Feeding group: Predators
 Pollution tolerance: N/A
 Type of stream found: Any type
 Location found in stream: Surface tension along stream margins, suspended in vegetation over the stream.
 Couplet number in the key: 17 A

Trivia: There are two main types of spiders found commonly along streams. The Long-jawed spider, builds a web in the vegetation alongside and over a stream. The spider's body is long and narrow, with extremely long legs. These spiders capture recently hatched aquatic insects. The second type of spider lives on the surface tension. Fishing spiders and small wolf spiders, patrol the surface tension, eating prey either stuck on the surface or emerging through. These spiders are large and very hairy.

- 76** Common name: Broad-winged Damselflies
 Family name: Calopterygidae
 Feeding group: Predator
 Pollution tolerance: Moderate = 5
 Type of stream found: Slow to moderate flowing low gradient streams
 Location found in stream: Stream margins with abundant emergent vegetation
 Couplet number in the key: 20 A

Trivia: The first antennal segment, which is almost half of the entire antenna, separates this family from all other damselflies. The adult broad-wing damselfly is very common along streams, they body is iridescent green with black wings. They are some of the prettiest aquatic insects.

Damselflies in general are more slender, smaller, and delicate when compared to dragonflies. Adults can be differentiated from dragonflies because damselflies can fold their wings straight up over the body, dragonflies can not. Nymphs have three long tails (actually gills) off of the back of the abdomen, while dragonflies have 3 small spikes or triangular points.

- 77** Common name: Spread-winged Damselflies
 Family name: Lestidae
 Pollution tolerance: High = 9
 Type of stream found: Very slow, low gradient stream, swampy, below or in a pond or a wetland area.
 Location found in stream: Amongst thick emergent vegetation
 Couplet number in the key: 21 A

Trivia: The lower lip on these nymphs are very long and slender. The gills (tails) found at the end of the abdomen are very dark and thick. Adults hold the wings slightly open when at rest. These are not commonly found in a typical riffle area.

Damselflies in general are more slender, smaller, and delicate when compared to dragonflies. Adults can be differentiated from dragonflies because damselflies can fold their wings straight up over the body, dragonflies can not. Nymphs have three long tails (actually gills) off of the back of the abdomen, while dragonflies have 3 small spikes or triangular points.

- 78** Common name: Narrow-winged Damselflies
Family name: Coenagrionidae
Feeding group: Predator
Pollution tolerance: High = 9
Type of stream found: Slow to moderate flow low gradient streams.
Location found in stream: On rocks and vegetation in moderate flow.
Couplet number in the key: 21 B

Trivia: These damselflies are the most common. The gills of some members of this family are two-toned when alive. The adults have clear wings and either bright blue or green bodies.

Damselflies in general are more slender, smaller, and delicate when compared to dragonflies. Adults can be differentiated from dragonflies because damselflies can fold their wings straight up over the body, dragonflies can not. Nymphs have three long tails (actually gills) off of the back of the abdomen, while dragonflies have 3 small spikes or triangular points.

- 79** Common name: Club-tails
Family name: Gomphidae
Feeding group: Predator
Pollution tolerance: Low = 1
Type of stream found: All types of streams depending upon the species.
Location found in stream: On or in the organic substrate
Couplet number in the key: 22 A

Trivia: All gomphids have short antenna, of which the last section is Q-tipped shaped. There are many different species living in a wide variety of habitats. Most are adapted for burrowing into the substrate to wait for prey.

All dragonfly nymphs have 3 spikes or triangular points at the end of the abdomen. They move around primarily by crawling, however, short jets of water can be expelled through the rectum for rapid movement. Dragonfly adults can not fold their wings up over their back, and therefore are easily differentiated from the closely related damselflies. The lower lip of all Odonata are hinged, allowing to extend out to capture prey.

- 80** Common name: Biddies
Family name: Cordulergastridae
Feeding group: Predator
Pollution tolerance: Moderate = 3
Type of stream found: Fast to moderate flow of low to moderate gradient streams in wooded areas.
Location found in stream: Buried in areas of fine silt and sand accumulations (like behind large boulders, bridge abutments, and stream margins).
Couplet number in the key: 23 A

Trivia: These dragonflies nymphs appear to be extremely robust and hairy. They have a deeply rounded lower lip which extends out almost half the body length. The nymphs are light brown to match the fine silt and sand in a stream.

All dragonfly nymphs have 3 spikes or triangular points at the end of the abdomen. They move around primarily by crawling, however, short jets of water can be expelled through the rectum for rapid movement. Dragonfly adults can not fold their wings up over their back, and therefore are easily differentiated from the closely related damselflies. The lower lip of all Odonata are hinged, allowing to extend out to capture prey.

- 81** Common name: Darners
Family name: Aeshnidae
Feeding group: Predator
Pollution tolerance: Moderate = 3
Type of stream found: Slow to moderate to fast streams, moderate to low gradient.
Location found in stream: Amongst rocks and emergent vegetation.
Couplet number in the key: 23 B

Trivia: The darners are the largest adult dragonflies in Minnesota. The nymphs are usually very dark and almost black. The bodies are elongate with small thin legs. The darners are very common in a variety of streams. Unlike many other dragonfly nymphs, the darners stalk prey.

All dragonfly nymphs have 3 spikes or triangular points at the end of the abdomen. They move around primarily by crawling, however, short jets of water can be expelled through the rectum for rapid movement. Dragonfly adults can not fold their wings up over their back, and therefore are easily differentiated from the closely related damselflies. The lower lip of all Odonata are hinged, allowing to extend out to capture prey.

- 82** Common name: Alderflies
Family name: Sialidae
Feeding group: Predator
Pollution tolerance: Moderate = 4
Type of stream found: Moderate to fast flows, moderate gradient.
Location found in stream: Slow waters along the stream margins or in pools
Couplet number in the key: 25 A

Trivia: Alderfly larvae have a single long filament coming out of the end of the abdomen. The sides of the abdomen have many soft spine-like appendages. They also have well developed mandibles for capturing prey. The adults are black and resemble caddisfly adults in that they fold their wings in a tent-like fashion over the back. There is only one genus in North America. These organisms are not commonly captured in riffle areas.

- 83** Common name: Dobsonfly or Fishfly (Hellgrammites)
Family name: Corydalidae
Feeding group: Predator
Pollution tolerance: Moderate = 0
Type of stream found: Moderate to Fast moving streams steep to low gradient
Location found in stream: Under loosely embedded stones crawling around
Couplet number in the key: 25 B

Trivia: The dobsonfly larva come in a variety of sizes, from 1.5 inches to an impressive 4.5 inches. Like the Alderfly, the each abdominal segment has a pair of soft spine-like appendages. However, there are two prolegs at the end of the abdomen, each with two hooks. There is only one family and several genera. The larva climbs out of the river and travels up the bank where it crawls under logs or a loose rock to pupate. After pupation, the adult lays eggs in hard white egg cases on the sides of rocks or bridge abutments. The larvae are often used for fish bait.

- 84** Common name: Giant stonefly
 Family name: Pteronarcyidae
 Feeding group: Shredder
 Pollution tolerance: Low = 0
 Type of stream found: Fast moving streams
 Location found in stream: In leaf packs which are trapped in between rocks in fast flowing sections of streams.
 Couplet number in the key: 28 A

Trivia: The giant stonefly appear to be made out of a rigid exoskeleton. This family is the only stonefly which has gills present on the first few sections of the abdomen. To locate these gills, look at the bottom surface (ventral view). The body is usually black or dark brown with yellow stripes or spots and sometimes has white tips on the ends of the antenna. This stonefly can grow up to 2 inches in length. They have no tolerance for pollution. A positive collection is very important to documenting water quality.

Almost all stoneflies are very intolerant of organic pollutants. They have two tails, and two tarsal claws (toes) at the end of each leg. They all are dorsally flattened. Stoneflies prefer to live in very fast moving water under rocks, and in organic debris. Most stoneflies indicate high water quality.

- 85** Common name: Common stonefly
 Family name: Perlidae
 Feeding group: Predator
 Pollution tolerance: Low = 1
 Type of stream found: Moderate to fast moving streams of upland areas
 Location found in stream: Underneath loosely embedded stones in riffle areas.
 Couplet number in the key: 28 B

Trivia: This stonefly is very common in the streams of Minnesota. The nymph can grow to 1.5 inches in length and comes in a variety of brown color patterns. Perlid stoneflies have a tuft of gills where the leg meets the body (hairy armpits) but do not have gills on the first few sections of the abdomen. When these organisms are in an oxygen stressed environment they will try to physically move water over the gills by doing push-ups.

Almost all stoneflies are very intolerant of organic pollutants. They have two tails, and two tarsal claws (toes) at the end of each leg. They all are dorsally flattened. Stoneflies prefer to live in very fast moving water under rocks, and in organic debris. Most stoneflies indicate high water quality.

- 86** Common name: Nemourid stonefly
 Family name: Nemouridae
 Feeding group: Shredder
 Pollution tolerance: Low = 2
 Type of stream found: Moderate to fast moving streams of moderate gradient in forested areas
 Location found in stream: Found in and amongst leaf packs.
 Couplet number in the key: 30 A

Trivia: These are small stoneflies only reaching 1/2 of an inch. The gills are located around the underside of the throat, giving the organism the appearance of a hairy neck. They may be confused with Taeniopterygidae, however the latter have a single small filamentous gill at the base of each leg. Nemourids can be very common when conditions permit.

Almost all stoneflies are very intolerant of organic pollutants. They have two tails, and two tarsal claws (toes) at the end of each leg. They all are dorsally flattened. Stoneflies prefer to live in very fast moving water under rocks, and in organic debris. Most stoneflies indicate high water quality.

- 87** Common name: Perlodid stonefly
 Family name: Perlodidae
 Feeding group: Predator
 Pollution tolerance: Low = 2
 Type of stream found: Moderate to fast moving clean forested upland streams
 Location found in stream: Throughout a riffle area under loosely embedded rocks or on organic packs.
 Couplet number in the key: 30 B

Trivia: The hind wing pads are divergent from the body axis. The nymphs are long and slender, only about 3-6 mm wide. The body may have a light pattern on the wing pads, and head, while the abdomen may have several light lines.

Almost all stoneflies are very intolerant of organic pollutants. They have two tails, and two tarsal claws (toes) at the end of each leg. They all are dorsally flattened. Stoneflies prefer to live in very fast moving water under rocks, and in organic debris. Most stoneflies indicate high water quality.

- 88** Common name: Rolled winged stonefly
 Family name: Leuctridae
 Feeding group: Shredder
 Pollution tolerance: Low = 0
 Type of stream found: Fast to moderately fast moving water in upland streams with moderate gradient
 Location found in stream: Throughout the stream on leaf packs
 Couplet number in the key: 31 A

Trivia: These are small, elongated nymphs. Often they have a reddish brown tint. They are very difficult to identify. Many of the characters are seen under high power.

Almost all stoneflies are very intolerant of organic pollutants. They have two tails, and two tarsal claws (toes) at the end of each leg. They all are dorsally flattened. Stoneflies prefer to live in very fast moving water under rocks, and in organic debris. Most stoneflies indicate high water quality.

- 89** Common name: Green stonefly
 Family name: Chloroperlidae
 Feeding group: Predator
 Pollution tolerance: Low = 1
 Type of stream found: Moderate to fast moving clean forested upland streams
 Location found in stream: Throughout a riffle area under loosely embedded rocks or on organic packs.
 Couplet number in the key: 31 B

Trivia: The chloroperlid stoneflies are a small thin elongated stonefly. The wing pads are parallel to the body axis. The tails are shorter than the length of the abdomen. These nymphs prefer more upland streams. Adult chloroperlidae are bright yellowish-green, hence the name.

Almost all stoneflies are very intolerant of organic pollutants. They have two tails, and two tarsal claws (toes) at the end of each leg. They all are dorsally flattened. Stoneflies prefer to live in very fast moving water under rocks, and in organic debris. These stoneflies indicate high water quality.

- 90** Common name: Brush-legged mayflies
Family name: Oligoneuriidae
Feeding group: Collector/Filterer
Pollution tolerance: Low = 2
Type of stream found: Moderate to fast flowing stream of low gradient
Location found in stream: In moderate to fast current on the surface of rocks
Couplet number in the key: 37 A

Trivia: The most common genera in this family in Minnesota is *Isonychia*. The nymphs are the strongest swimmers of any aquatic insect. The three caudal filaments (tails) are made up of a series of small hairs. These hairs act like an oar on a boat, as the mayfly undulates the tail propels it through the water. This family of mayfly passively filters fine particulate matter from the water column. Close inspection of the front legs will reveal a double row of long hairs (hence the name). These hairs trap fine matter as it passes through. No other mayfly family has this characteristic.

Most mayflies have three tails, although some appear to have two. One genera actually has only 2. All mayflies have only one tarsal claw (toe) at the end of each leg. They have gills on the top or sides of the abdomen which can be seen from top of the insect (dorsal surface). In general mayflies actively gather fine organic matter and have low to moderate pollution tolerances.

Mayflies are generally intolerant to moderately intolerant of pollution.

- 91** Common name: Spiny Crawlers
Family name: Ephemerellidae
Feeding group: Collector/Gatherer
Pollution tolerance: Low = 1
Type of stream found: Moderate to fast flowing streams of any gradient
Location found in stream: On rocks and coarse organic substrates
Couplet number in the key: 38 A

Trivia: The distinguishing characteristic for the family is that gills are absent on the first and second abdominal sections. Their name derives from the serrated edge of the abdominal sections.

Most mayflies have three tails, although some appear to have two. One genera actually has only 2. All mayflies have only one tarsal claw (toe) at the end of each leg. They have gills on the top or sides of the abdomen which can be seen from top of the insect (dorsal surface). Mayflies are generally intolerant to moderately intolerant of pollution.

- 92** Common name: Prong-gills
 Family name: Leptophlebiidae
 Feeding group: Collector/gatherer
 Pollution tolerance: Low = 2
 Type of stream found: Moderate to fast flowing streams in forested areas
 Location found in stream: On rocks and gravel amongst woody and organic deposits
 Couplet number in the key: 39 A

Trivia: These are small mayflies which have forked gills. The gills are often lost when the organism is preserved. Without the gills the mayfly has a very smooth and shiny exoskeleton, like well polished leather shoes.

Most mayflies have three tails, although some appear to have two. One genera actually has only 2. All mayflies have only one tarsal claw (toe) at the end of each leg. They have gills on the dorsal surface of the abdomen (top surface). Mayflies are generally intolerant to moderately intolerant of pollution.

- 93** Common name: Flat-Headed mayflies (Shovel-nose mayfly)
 Family name: Heptageniidae
 Feeding group: Scraper
 Pollution tolerance: Moderate = 4
 Type of stream found: Moderate to fast flowing streams with moderate gradient
 Location found in stream: On the surface and underside of rocks
 Couplet number in the key: 40 A

Trivia: The flat headed mayflies are very common in Minnesota streams. Often they can be numerous found with the Hydropsychid caddisfly. They are well adapted to live in fast currents. The bodies are extremely flattened. The head is broad and flat, which forces the water up and over the insect, holding it to the substrate.

Most mayflies have three tails, although some appear to have two. One genera actually has only 2. All mayflies have only one tarsal claw (toe) at the end of each leg. They have gills on the dorsal surface of the abdomen (top surface). In general mayflies actively gather fine organic matter. This family feeds upon microscopic algae found growing on the substrate.

One type of Heptageniidae (*Epeorus*) appears to be a stonefly because they only have two tails. However, because there is only 1 claw at the end of each leg, they are mayflies. Mayflies are generally intolerant to moderately intolerant of pollution.

- 94** Common name: Primitive minnow mayflies
Family name: Siphonuridae
Feeding group: Collector/gatherer
Pollution tolerance: High = 7
Type of stream found: Moderate to fast flowing streams
Location found in stream: On rocky and organic substrates
Couplet number in the key: 41 A

Trivia: This family is easy to confuse with both the brush-legged mayflies and the small minnow mayflies. However, the primitive minnow mayflies (1) do not have a double row of long hairs on the front legs, and (2) they have short antenna. The members of this family are also very good swimmers.

Most mayflies have three tails, although some appear to have two. One genera actually has only 2. All mayflies have only one tarsal claw (toe) at the end of each leg. They have gills on the dorsal surface of the abdomen (top surface). Mayflies are generally intolerant to moderately intolerant of pollution.

- 95** Common name: Small minnow mayflies
Family name: Baetidae
Feeding group: Scraper
Pollution tolerance: Moderate = 4
Type of stream found: Moderate to fast flowing streams
Location found in stream: On and in rocky substrates
Couplet number in the key: 41 B

Trivia: These can be very small nymphs (2-4 mm in length). Some genera have appear to have only two tails. These mayflies can be very common when conditions permit. However, due to their extremely small size, they are easily missed when sampling.

Most mayflies have three tails, although some appear to have two. One genera actually has only 2. All mayflies have only one tarsal claw (toe) at the end of each leg. They have gills on the dorsal surface of the abdomen (top surface). Mayflies are generally intolerant to moderately intolerant of pollution.

- 96** Common name: Square gill mayflies
Family name: Caenidae
Feeding group: Collector/Gatherer, Scraper
Pollution tolerance: High = 7
Type of stream found: Wide variety of types of streams and rivers
Location found in stream: In debris (twigs, leaves, vegetation) in slow to fast current
Couplet number in the key: 33 A

Trivia: These square mayflies are very common in most aquatic habitats, ranging from lakes, ponds and marshes, to small streams and larger rivers. They appear to be more tolerant of low dissolved oxygen levels than any other mayfly.

Most mayflies have three tails, although some appear to have two. One genera actually has only 2. All mayflies have only one tarsal claw (toe) at the end of each leg. They have gills on the dorsal surface of the abdomen (top surface). Mayflies are generally intolerant to moderately intolerant of pollution.

- 97** Common name: Hacklegills
Family name: Potamanthidae
Feeding group: Collectors, filterers
Pollution tolerance: Moderate = 4
Type of stream found: Moderate to fast flowing streams and rivers
Location found in stream: Gravel and cobble runs of shallow streams, on rocks
Couplet number in the key: 35 A

Trivia: These mayflies have tusks like the burrowing may flies, but have slender front legs, because they do not make burrows in sediments. They live on rocks or woody debris in shallow streams and rivers. They can be fairly common and do not tolerate much organic pollution.

Most mayflies have three tails, although some appear to have two. One genera actually has only 2. All mayflies have only one tarsal claw (toe) at the end of each leg. They have gills on the dorsal surface of the abdomen (top surface). Mayflies are generally intolerant to moderately intolerant of pollution.

- 98** Common name: Burrowing mayflies
 Family name: Ephemeridae
 Feeding group: Collector/Gatherer
 Pollution tolerance: Moderate = 4
 Type of stream found: Moderate to fast flowing streams and rivers
 Location found in stream: Silt bottoms in larger streams, sand and gravel riffles
 Couplet number in the key: 36 A

Trivia: These mayflies make burrows in the sediments in the bottom of streams and rivers. When they emerge as adults, tremendous numbers can create problems for areas near rivers where their populations are high. They are susceptible to drops in dissolved oxygen concentrations, because they live in the sediments instead of on top of rocks, like many other mayflies.

Most mayflies have three tails, although some appear to have two. One genera actually has only 2. All mayflies have only one tarsal claw (toe) at the end of each leg. They have gills on the dorsal surface of the abdomen (top surface). Mayflies are generally intolerant to moderately intolerant of pollution.

- 99** Common name: Common net-spinners
 Family name: Hydropsychidae
 Feeding group: Collector/filterer
 Pollution tolerance: Moderate = 4
 Type of stream found: Moderate to slow flowing stream of moderate to low gradient
 Location found in stream: In silk nets on the substrate of riffle areas
 Couplet number in the key: 42 A

Trivia: The hydropsychid caddisflies are the most commonly collected caddisflies. They are distinguished from all other caddisflies in that the ventral sections of the abdomen (underneath) have pairs of fluffy gills. The organisms spin a silk web between the rocks. Here it filters fine organic matter from the water column. These caddisflies will defend a small territory around each web. They are extremely common below pond outflows and sewage treatment plants. When these are the dominant family in a sample comprising greater than 70% of the organisms collected, water quality is probably impaired.

Caddisflies, as a group, are elongate organisms with soft abdomens. There are two major types, the free living forms and the case building forms. Most of the free living forms build silken webs on the substrate to filter fine organic material. One free living family is predatory. The case builders make a shelter out of either inorganic or organic materials. Caddisflies are very common in just about every stream in Minnesota.

100 Common name: Water penny beetle
 Family name: Psephenidae
 Feeding group: Scraper
 Pollution tolerance: Moderate = 4
 Type of stream found: Fast flowing streams
 Location found in stream: Securely fastened to the surface of cobbles in a riffle
 Couplet number in the key: 44 A

Trivia: Do 100 water penny beetles make a sand dollar? The water penny larvae are flattened oval shaped organisms. They are well adapted to scrape microscopic algae off of the surface of rocks in fast current. The head, legs, and gills are located underneath of expanded body sections. The adults can be found on the downstream side of large boulders near the water surface.

101 Common name: Riffle beetle adults
 Family name: Elmidae
 Feeding group: Scraper
 Pollution tolerance: Moderate = 4
 Type of stream found: Moderate to fast flowing stream of any gradient
 Location found in stream: Riffle areas, on organic substrates
 Couplet number in the key: 46 A

Trivia: These are very small beetles (3-5 mm in length). They have long legs as compared to the body and the antenna are usually easy to see. These beetles are often missed when sampling in the field because of the small body size and the slow movements. Riffle beetles are one of the few beetle species which lives completely underwater in all life stages.

102 Common name: Long-toed water beetles
 Family name: Dryopidae
 Feeding group: Scraper
 Pollution tolerance: Moderate = 5
 Type of stream found: Moderate flowing streams of low to moderate gradients
 Location found in stream: In slower margins crawling on rocks
 Couplet number in the key: 46 B

Trivia: These beetles resemble the riffle beetles, however they are much larger (about twice the size). They are not collected very frequently. The antenna are very difficult to see because it is shortened.

- 103** Common name: Riffle beetle larva
Family name: Elmidae
Feeding group: Scraper
Pollution tolerance: Moderate = 4
Type of stream found: Moderate to fast flowing stream of any gradient
Location found in stream: Riffle areas, on organic substrates
Couplet number in the key: 47 A

Trivia: These are small (4-10 mm) brown arc-shaped larva. They are very difficult to see in the field.

- 104** Common name: Ptilodactylid beetle larva
Family name: Ptilodactylidae
Feeding group: Shredder
Pollution tolerance: Low = 2
Type of stream found: Moderate to fast flowing stream of any gradient
Location found in stream: Burrowing in soft substrates
Couplet number in the key: 47 B

Trivia: These are large (10-20 mm) brown arc-shaped larva. They are easy to see in the field. The larvae are not commonly collected. These look like giant riffle beetle larva.

- 105** Common name: Finger-net caddisflies
Family name: Philopotamidae
Feeding group: Collector/filterer
Pollution tolerance: Moderate = 3
Type of stream found: Moderate to fast flowing streams of moderate gradient
Location found in stream: In riffle areas in webs attached to the substrate
Couplet number in the key: 49 A

Trivia: The finger-net caddisflies are elongate and slender. They are one of four families of filtering caddisflies. The abdomen is white and the head is bright orange. The upper lip of the organism is transparent and T-shaped.

Caddisflies, as a group, are elongate organisms with soft abdomens. There are two major types, the free living forms and the case building forms. Most of the free living forms build silken webs on the substrate to filter fine organic material. One free living family is predatory. The case builders make a shelter out of either inorganic or organic materials. Caddisflies are very common in just about every stream.

106 Common name:	Free-living caddisflies (Michelin Man)
Family name:	Rhyacophilidae
Feeding group:	Predator
Pollution tolerance:	Low = 0
Type of stream found:	Moderate to fast flowing streams of high to moderate gradient
Location found in stream:	On substrates with mosses
Couplet number in the key:	50 A

Trivia: This is a very intolerant family. It free ranges for prey among mosses and algae. The larvae are large, bright-green, and very mobile when alive. When preserved they take on a purple color. The prolegs at the end of abdomen are long and have large hooks.

Caddisflies, as a group, are elongate organisms with soft abdomens. There are two major types, the free living forms and the case building forms. Most of the free living forms build silken webs on the substrate to filter fine organic material. One free living family is predatory. The case builders make a shelter out of either inorganic or organic materials. Caddisflies are very common in just about every stream.

107 Common name:	Trumpet-net caddisflies
Family name:	Polycentropodidae
Feeding group:	Collector/filterers
Pollution tolerance:	High = 6
Type of stream found:	Moderate to slow flowing streams of low gradient
Location found in stream:	Slower currents or stream margins
Couplet number in the key:	50 B

Trivia: This is the least commonly collected net spinner. The upper lip is not T-shaped, and the abdomen may have a purplish tint when preserved. The head may have dark spotted pattern.

Caddisflies, as a group, are elongate organisms with soft abdomens. There are two major types, the free living forms and the case building forms. Most of the free living forms build silken webs on the substrate to filter fine organic material. One free living family is predatory. The case builders make a shelter out of either inorganic or organic materials. Caddisflies are very common in just about every stream.

108 Common name: Long-horned case makers
 Family name: Leptoceridae
 Feeding group: Shredder
 Pollution tolerance: Moderate = 4
 Type of stream found: Slow moving streams of low to moderate gradient
 Location found in stream: In organic debris along stream margins
 Couplet number in the key: 51 A

Trivia: These caddisflies are distinguished from all others in that the antenna are very long for caddisflies (1-4 sections 1-4 mm in total length). They are very common when conditions permit. Most genera are shredders.

Caddisflies, as a group, are elongate organisms with soft abdomens. There are two major types, the free living forms and the case building forms. Most of the free living forms build silken webs on the substrate to filter fine organic material. One free living family is predatory. The case builders make a shelter out of either inorganic or organic materials. Caddisflies are very common in just about every stream.

109 Common name: Snail case makers
 Family name: Helicopsychidae
 Feeding group: Scraper
 Pollution tolerance: Moderate = 3
 Type of stream found: Fast moving streams with fine sand deposits
 Location found in stream: Crawling on gravel and coarse sand deposits
 Couplet number in the key: 52 A

Trivia: These caddisflies are very small. They make a snail shaped case constructed of tiny grains of sand and rock. The entire case is the size of a pea. They can be very common in clear cold gravely streams. They are very difficult to see in the field.

Caddisflies, as a group, are elongate organisms with soft abdomens. There are two major types, the free living forms and the case building forms. Most of the free living forms build silken webs on the substrate to filter fine organic material. One free living family is predatory. The case builders make a shelter out of either inorganic or organic materials. Caddisflies are very common in just about every stream.

- 110** Common name: Micro-caddisflies or purse case makers
Family name: Hydroptilidae
Feeding group: Scraper
Pollution tolerance: Moderate = 4
Type of stream found: Any type of stream conditions
Location found in stream: Attached to aquatic plants, cobbles or in fine sand substrates
Couplet number in the key: 53 A

Trivia: These are extremely small caddisflies, only a few millimeters in length. They make small cases out of a variety of materials. Above each pair of legs is a hardened plate. These are extremely difficult to see in the field.

Caddisflies, as a group, are elongate organisms with soft abdomens. There are two major types, the free living forms and the case building forms. Most of the free living forms build silken webs on the substrate to filter fine organic material. One free living family is predatory. The case builders make a shelter out of either inorganic or organic materials. Caddisflies are very common in just about every stream.

- 111** Common name: Giant Case Makers
Family name: Phryganeidae
Feeding group: Predator/herbivore
Pollution tolerance: Moderate = 4
Type of stream found: Slower currents, larger streams with vegetation
Location found in stream: In vegetation along the stream edge
Couplet number in the key: 55 A

Trivia: These can be very large (1 - 1 1/2") when the larvae are full grown. Their cases are usually made of cut pieces of leaves and/or bark, and are often fastened together in spirals or rings. They are more common along the shores of lakes and ponds. They usually have distinct brown stripes on yellow heads.

Caddisflies, as a group, are elongate organisms with soft abdomens. There are two major types, the free living forms and the case building forms. Most of the free living forms build silken webs on the substrate to filter fine organic material. One free living family is predatory. The case builders make a shelter out of either inorganic or organic materials. Caddisflies are very common in just about every stream in Minnesota.

112 Common name: Saddle case makers
 Family name: Glossosomatidae
 Feeding group: Scraper
 Pollution tolerance: Low = 0
 Type of stream found: Moderate to fast flowing waters
 Location found in stream: Securely fastened to the surface of cobbles in fast water
 Couplet number in the key: 55 B

Trivia: These caddis build a case of a few small pebbles. The overall shape looks like that of a tortoise. They are very common in streams when conditions permit. The organism has an elongated head compared to other caddisflies.

Caddisflies, as a group, are elongate organisms with soft abdomens. There are two major types, the free living forms and the case building forms. Most of the free living forms build silken webs on the substrate to filter fine organic material. One free living family is predatory. The case builders make a shelter out of either inorganic or organic materials. Caddisflies are very common in just about every stream in Minnesota.

113 Common name: Humpless case makers
 Family name: Brachycentridae
 Feeding group: Shredder
 Pollution tolerance: Low = 1
 Type of stream found: Slow to fast flowing waters
 Location found in stream: Crawling in slow water areas behind rocks, stream margins, and on organic material.
 Couplet number in the key: 56 B

Trivia: These caddisflies are very common. They build cases of a variety of materials from organic to inorganic. The cases are constructed of thin strips of material assembled in a circular or square form. These are medium sized caddisflies (5-15 mm).

Caddisflies, as a group, are elongate organisms with soft abdomens. There are two major types, the free living forms and the case building forms. Most of the free living forms build silken webs on the substrate to filter fine organic material. One free living family is predatory. The case builders make a shelter out of either inorganic or organic materials. Caddisflies are very common in just about every stream.

114 Common name: Lepidostomatid case makers
 Family name: Lepidostomatidae
 Feeding group: Shredder
 Pollution tolerance: Low = 1
 Type of stream found: Small forested streams with slow to fast flowing waters
 Location found in stream: In slower margins on organic debris
 Couplet number in the key: 57 B

Trivia: This caddisfly builds a case out of rectangular pieces of bark or wood. It resembles the family Brachycentridae, however, it has lateral humps on the first section of the abdomen.

Caddisflies, as a group, are elongate organisms with soft abdomens. There are two major types, the free living forms and the case building forms. Most of the free living forms build silken webs on the substrate to filter fine organic material. One free living family is predatory. The case builders make a shelter out of either inorganic or organic materials. Caddisflies are very common in just about every stream.

115 Common name:
 Family name: Uenoidae
 Feeding group: Grazer, scraper
 Pollution tolerance: Low = 3
 Type of stream found: Cool streams with moderate to fast current and rocky cobble bottom
 Location found in stream: Rocky bottoms, riffles, gravel areas
 Couplet number in the key: 58 A

Trivia: These caddisflies build cases of small pebbles and rocks. They feed on diatoms and small organic particles from rocks. Often these caddisflies will grow during the fall and winter and pupate in the spring, emerging as adults in early summer.

Caddisflies, as a group, are elongate organisms with soft abdomens. There are two major types, the free living forms and the case building forms. Most of the free living forms build silken webs on the substrate to filter fine organic material. One free living family is predatory. The case builders make a shelter out of either inorganic or organic materials. Caddisflies are very common in just about every stream in Minnesota.

116 Common name: Northern case maker
 Family name: Limnephilidae
 Feeding group: Shredder
 Pollution tolerance: Moderate = 4
 Type of stream found: Slow to fast flowing waters
 Location found in stream: Throughout the entire stream bottom
 Couplet number in the key: 59 A

Trivia: This is the largest group of caddisflies with 40 genera found in North America. These are large elongate caddisflies, up to 20 millimeters. They are case builders, using a variety of materials including sand grains and stick and plant fragments. The largest limnephilid in Minnesota builds a case of large stick fragments.

Caddisflies are elongate organisms with soft abdomens. There are two major types, the free living forms and the case building forms. Most of the free living forms build silken webs on the substrate to filter fine organic material. One free living family is predatory. The case builders make a shelter out of either inorganic or organic materials. Caddisflies are very common in just about every stream.

117 Common name: Strong case makers
 Family name: Odontoceridae
 Feeding group: Scraper
 Pollution tolerance: Low = 0
 Type of stream found: Moderate to fast moving streams
 Location found in stream: Securely fastened to cobbles
 Couplet number in the key: 59 B

Trivia: These caddisflies build arc-shaped cases of small stone fragments. The larvae are often grouped together on the sides of cobbles.

Caddisflies, as a group, are elongate organisms with soft abdomens. There are two major types, the free living forms and the case building forms. Most of the free living forms build silken webs on the substrate to filter fine organic material. One free living family is predatory. The case builders make a shelter out of either inorganic or organic materials. Caddisflies are very common in just about every stream.

118 Common name:	Little Stout Crawlers
Family name:	Leptohyphidae, formerly called Tricorythidae
Feeding group:	Collector/gatherers
Pollution tolerance:	Moderate=4
Type of stream found:	Moderate to fast flowing streams
Location found in stream:	In gravel or under rocks in permanent streams
Couplet number in the key:	35A

Trivia: This mayfly is similar to the squaregill mayflies (#93) except that they have triangular (rather than square) plates on their abdomen. They also have spines on the sides of the abdomen, similar to the spiny crawlers (#88). The family is widespread, but less common in northwestern states.

Most mayflies have three tails, although some appear to have two. All mayflies have only one tarsal claw (toe) at the end of each leg. They have gills on the top or sides of the abdomen which can be seen from the top of the insect (dorsal surface). In general mayflies actively gather fine organic matter.

119 Common name:	Water bug
Order name:	Hemiptera
Feeding group:	Predator or Collector/Gatherer
Pollution tolerance:	Not rated
Type of stream found:	All types
Location found in stream:	In slow or no-current areas (pools, stream margins, or vegetation)
Location in the key:	Uncommon Invertebrates page 44

Trivia: Most water bugs have an oval to slender body shape and are somewhat flattened. They have well-developed eyes, and mouths that are modified in the form of a beak. The beak is either a conelike structure, or a longer piercing and sucking structure. Some water bugs are large and known for their water skating habits. The majority of this order (except water boatmen) are active predators, sucking the body fluids from their prey. (Water boatmen generally feed on plants and detritus).

The Hemipteran order includes both terrestrial and aquatic families. Six families are truly aquatic, 5 families spend most of their time on the water surface, and six are shore-dwelling. Hemipterans do not breath oxygen dissolved in the water; instead they use atmospheric air. Therefore they can be found in any habitat, from very clean to very degraded water.

120 Common name: Soldier flies
Family name: Stratiomyidae
Feeding group: Collector/gatherers
Pollution tolerance: Not rated
Location found in stream: Slow currents (pools, stream margins)
Location in the key: Uncommon Invertebrates page 44

Trivia: Larvae are somewhat flattened with a distinctive head. Their bodies are somewhat stiff and hardened, often with bristles. They are usually found in the thick vegetation at the edge of ponds or lakes, although some are found submerged several feet in riffles. Their food sources include algae and organic debris. The family is large and widespread in North America, although not all species are aquatic.

121 Common name: Aquatic moth
Family name: Pyralidae
Feeding group: Scraper-herbivore
Pollution tolerance: Not rated
Type of stream found: Slow flowing
Location found in stream: In and among aquatic vegetation
Location in the key: Uncommon Invertebrates page 44

Trivia: Larvae have the characteristic body shape of terrestrial caterpillars, but have prolegs instead of typical terrestrial legs. Some live in a case of leaves, while some live in a silk-covered tentlike structure. They feed on micro flora and can be found across the U.S. in ponds with thick vegetation or in slower reaches of streams.

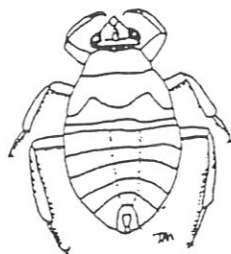
UNCOMMON INVERTEBRATES

1. Does the organism have a triangular or sharp pointed beak-like mouth?

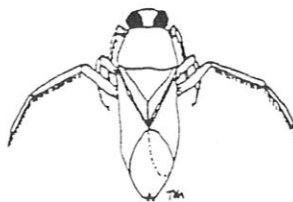
YES- Hemiptera (Order of True Bugs) NOT KEYED FURTHER. Go to #119



beak



Belostomatidae
(Giant Water Bug)



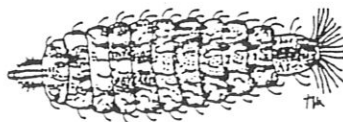
Notonectidae
(Backswimmer)



Corixidae
(Water Boatman)

2. Is the organism hard and leathery looking, with no legs and a tuft of hairs at the end of the abdomen?

YES- Stratiomyidae (Soldier fly). Go to #120



3. Is the organism caterpillar-like in appearance, sometimes with gills sticking out all over the body, possibly in a case of leaf parts folded over or glued together, and does it have four pairs of stubby bumps on the abdomen with a tiny ring of hooks on each bump?

YES- Pyralidae (Aquatic moth). Go to #121

