

MAINE STREAM EXPLORERS

A treasure hunt to find healthy streams in Maine

Volume 3: Expanded Macroinvertebrate Guide



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1. **Atlas of Common Freshwater Macroinvertebrates of Eastern North America** (Macroinvertebrates.org)
2. **Biodiversity Institute of Ontario** - Amphipod
3. **Brandon Woo** (bugguide.net) – adult Alderfly (*Sialis*) and water penny (*Psephenus herricki*)
4. **Don Chandler** (bugguide.net) - *Anax junius* naiad
5. **Fresh Water Gastropods of North America** – *Amnicola* and *Ferrissia rivularis*
6. **Gordon Dietzman**, National Park Service - *Anax junius* adult
7. **Ian Alexander** (commons.wikimedia.org) - *Glossosoma* egg mass
8. **Idaho Fish and Game** – green darner (*Anax junius*)
9. **Jan Hamrsky** (lifeinfreshwater.net) – Hydropsychidae in net and *Glossosoma* on rock
10. **Jason Neuswanger** (troutnut.com) – *Glossosoma* larva and pupae and dragonfly (*Hagenius brevistylus*)
11. **Mark Melton**, (bugguide.net) - *Lepidostoma* (inset)
12. **MJ Hatfield** (bugguide.net) – adult aquatic dance fly (*Rhamphomyia*)
13. **Ondřej Zicha** (www.biolib.cz) – Leech (*Erpobdella octoculata*)
14. **Richard Orr**, Mid-Atlantic Invertebrate Field Studies - *Anax junius* female emerging
15. **Robert Henricks** (bugguide.net) – caddisfly larva (*Glossosoma*) with case in life cycle
16. **Robert Jacobs** (Connecticut DEEP, retired) – crayfish
17. **Sage Ross** (commons.wikimedia.org) – adult damselfly (*Calopteryx*)
18. **Salvador Vitanza** (bugguide.net) – adult mayfly (*Callibaetis*), crane fly (*Tipula*), dobsonfly (*Corydalus*), blackfly (*Simulium*), and stonefly
19. **Sheryl Pollock** (www.discoverlife.org) - *Anax junius* laying eggs (dragonfly life cycle)
20. **Tom Danielson**
21. **Tom Murray** (bugguide.net) – adult caddisfly (*Hydropsyche*), adult non-biting midge (*Chironomus*), isopod (*Asellus*), dragon hunter naiad (*Hagenius brevistylus*)
22. **Thomas Palmer** (bugguide.net) – riffle beetle larva (*Macronychus*)
23. **Welter Schultes** (www.animalbase.uni-goettingen.de) – *Lymnaea* snails

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Aquatic Macroinvertebrates

Aquatic macroinvertebrates have one of three basic life cycles. Becoming familiar with these life cycles will help you recognize macroinvertebrates. First, some animals hatch from an egg and are tiny versions of their adult form. For example, baby crayfish and snails look like tiny versions of the adults and are called “immature”. Immature crayfish and other crustaceans molt their exoskeletons periodically as they grow. Like lobsters, they have a “soft shell” phase after molting, which allows them to increase in size before hardening again. In contrast, snails increase the size of their shells as they grow.

The terms “larvae”, “nymphs”, and “naiads” are sometimes used interchangeably in books and other resources, which can cause confusion.

The second life cycle type is called “complete metamorphosis” (Figure 1). Like the monarch caterpillar, these animals have four life stages: egg, larva, pupa, and adult. Most aquatic macroinvertebrates with complete metamorphosis have larvae that live in the water. Animals in this group include beetles, caddisflies, blackflies, and a wide diversity of flies. All the larvae look different than the adults. The larvae undergo metamorphosis in the pupal stage. In the pupa, the cells rearrange and transform the larva into the adult form.

The third life cycle type is called “incomplete metamorphosis” (Figure 2). These animals have three life stages: egg, nymph/naiad, and adult. Young insects in the group are called nymphs or naiads based on how they obtain oxygen. Naiads have gills to get oxygen from water while nymphs breathe air. Young dragonflies and damselflies primarily get oxygen from the water and are called naiads. In contrast, young water striders and water boatmen breathe air and are called nymphs. The nymphs and naiads look somewhat like the adults but do not have wings. For example, dragonfly naiads and adults have a head, a thorax with three sets of legs, and an abdomen. The basic body structure is similar, but the naiad does not have wings and it is adapted to breathe water instead of air. Dragonfly naiads start off tiny and molt their exoskeletons as they grow. Depending on the species, they may molt 8 or more times. After molting several times, they start to grow wing pads on their backs. The wings develop inside the wing pads. When they naiads are ready to turn into adults, they crawl out of the water and molt one last time. After molting, they pump up the wings and fly away.

Figure 1. Example of Complete Metamorphosis with the Tortoise-shell Caddisfly (*Glossosoma*)

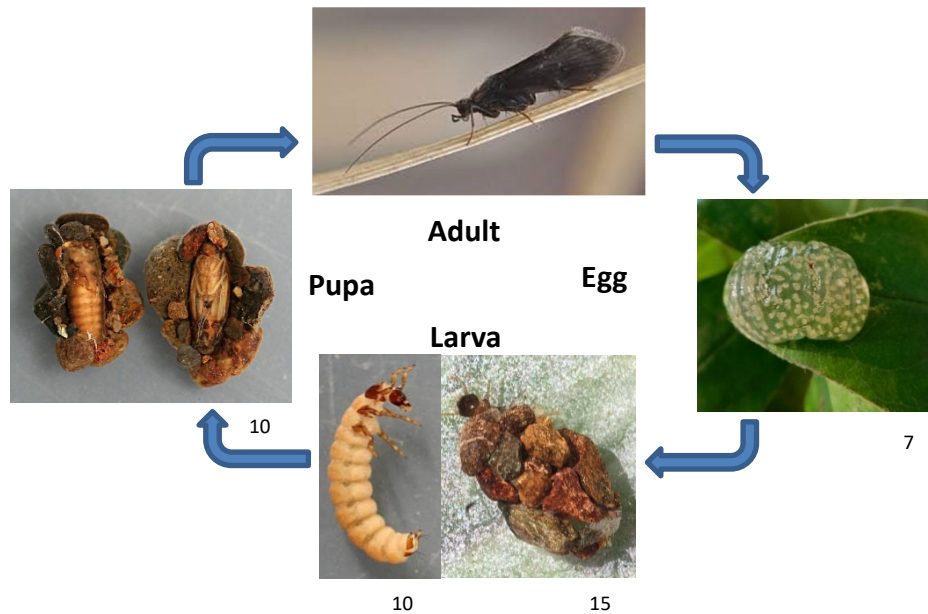
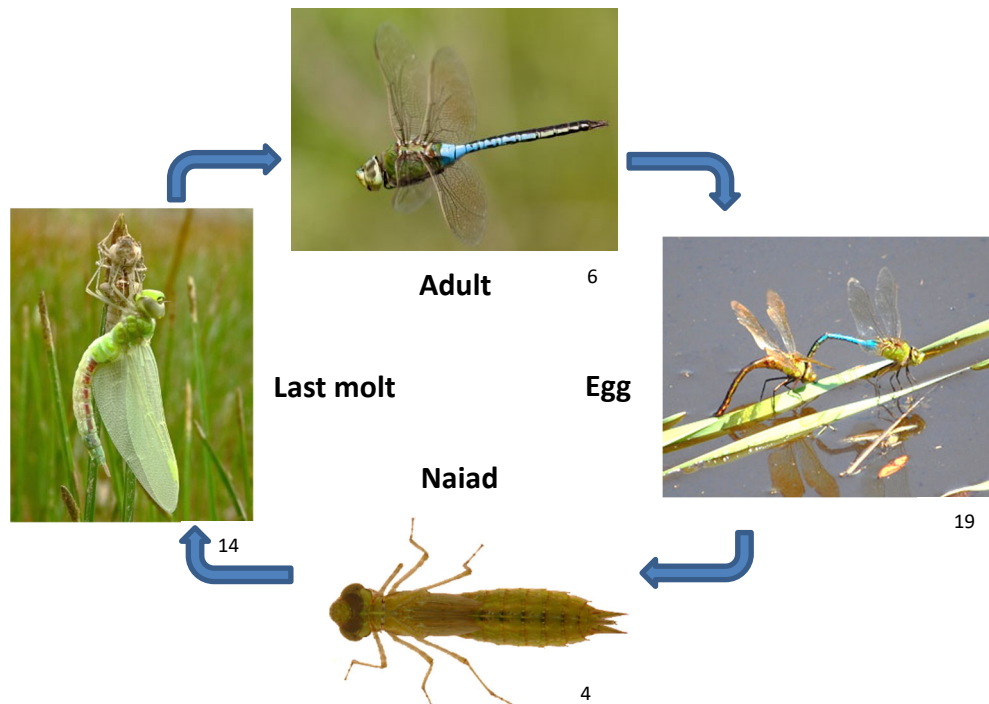


Figure 2. Example of Incomplete Metamorphosis with the Green Darner Dragonfly (*Anax junius*)



Some immature aquatic insects live in streams for only a few weeks before turning into adults, such as some kinds of non-biting midges. In contrast, some dragonfly naiads and dobsonfly larvae may live in streams for several years before leaving the water. After leaving the water, most adult caddisflies, dragonflies, and other insects have wings and can fly. Some may live for only a few days and do not eat as adults. For example, some mayfly adults live for a few days. Many mayflies, stoneflies, and caddisflies do not eat as adults. Some eat nectar or plants. Some adult insects may live for several weeks and eat a variety of foods. For example, adult dragonflies eat flying insects and some may live for several months. In comparison, adult crane flies eat nectar. As an adult, their main purpose is to find a partner, mate, and lay eggs. Many live in the forest and marshes that border the streams. If the forests next to the streams are cut down or otherwise damaged, then some adult insects will not have a place to live and may not be able to reproduce. Therefore, it is important to keep healthy forests and native plants next to our streams.

Maine is fortunate to have many streams with excellent water quality. Maine has water quality standards to keep our streams healthy, which include four classes: Class AA, Class A, Class B, and Class C. Class AA and A share the same environmental expectations, but Class AA have more restrictions on human activities. For example, dams and discharges of pollution are not allowed in Class AA streams. Since Class AA and A share the same environmental expectations, they will be grouped together as Class A for the remainder of this document. Each stream in the state has been assigned to one of these four classes by the State Legislature. DEP biologists collect and analyze samples of macroinvertebrates and algae from streams to determine if a stream attains biological criteria of its designated class (A, B, or C). DEP has collected more than 2,200 samples since the 1980s and has identified more than 1,400 different kinds of macroinvertebrates. Obviously, that is way too many kinds for volunteers to identify, so we had to narrow the list.

For the Stream Explorers project, we took the DEP sample results and grouped all species observations to the genus level. For example, if a sample had more than one species of it in the genus *Baetis*, then those species counts were added together in that sample. For each genus, we counted how many samples had that genus. Our next step was to remove uncommon genera from the list. We only included commonly seen macroinvertebrates in the Stream Explorers project. Finally, we grouped macroinvertebrates that have similar appearance and would be difficult to identify in the field. The resulting list of macroinvertebrates included some genera, some families, some groups of families, and some orders. For example, there is a kind of flatheaded mayfly, called *Epeorus*, that has a distinctive appearance by having only 2 tails compared to the other kinds of flatheaded mayflies that have 3 tails. It was worthwhile to keep *Epeorus* separate from the other flat-headed mayflies

Taxonomy of the *Baetis* mayfly

Kingdom – Anamalia, animals
 Phylum – Arthropoda, arthropods
 Class – Insecta, insects
 Order – Ephemeroptera, mayflies
 Family – Baetidae, small minnow mayflies
 Genus – *Baetis*
 Species – *B. bicaudatus*
 (examples) *B. pluto*
B. tricaudatus



because it tends to occur in clean, cold streams and some of the other flat-headed mayflies are somewhat more tolerant of pollution. In contrast, all isopods collected in Maine streams were grouped to the Order level, Isopoda, because they have similar appearance and tolerance to pollutants.

After selecting the macroinvertebrates for this project, DEP biologists grouped them as being “sensitive”, “moderately sensitive”, or “tolerant” of pollution, habitat degradation, and poor water quality. Macroinvertebrates that were most common in streams that attain Class A water quality standards were put in the “sensitive” group. Macroinvertebrates that were most common in streams that attain Class A or B water quality standards were put in the “moderately sensitive” group. Finally, macroinvertebrates that were most common in streams that did not attain Class A or B water quality standards were put in the “tolerant” group. *Tolerant macroinvertebrates are not bad.* They can be found in the highest quality streams along with sensitive and moderately sensitive macroinvertebrates. Tolerant macroinvertebrates are simply tough. They have adaptations that allow them to survive in streams with poor water quality. For example, some of them reproduce several times each year and can recolonize streams after disturbances. Some of them have adaptations that allow them to live in warm water that contains little oxygen. For example, some midges (Chironomidae) have hemoglobin that helps them extract oxygen from the water, like the hemoglobin that helps our red blood cells carry oxygen. Other macroinvertebrates are tolerant of water that has been contaminated by road salt.

The way that we assigned macroinvertebrates to the “sensitive”, “moderately sensitive”, and “tolerant” groups is not perfect. It is common to have related species show a range of tolerance to pollution. For example, there are several kinds of net-spinning caddisflies. Many of the net-spinning caddisflies are moderately sensitive but some are tolerant of pollution and nutrient enrichment, such as *Cheumatopsyche*. A great abundance of *Cheumatopsyche* caddisflies can be an indicator of pollution. However, it is difficult to distinguish different kinds of net-spinning caddisflies in the field and we ended up keeping them all together in the “moderately sensitive” group.

Most macroinvertebrates in a healthy Maine stream will be sensitive or moderately sensitive. In addition, there will be several kinds of sensitive macroinvertebrates (Figure 3). Tolerant macroinvertebrates live in the nice streams too, but they will be less abundant than the sensitive and moderately sensitive kinds. High-quality streams often have low abundance of macroinvertebrates because upstream areas are mostly forested and nutrients in the water are scarce. Streams with upstream sources of nutrient enrichment often have a lot of macroinvertebrates, but still have many sensitive and moderately sensitive kinds (Figure 4). Streams that are overly enriched with nutrients will have an extreme abundance of macroinvertebrates, often with a great abundance of moderately sensitive or tolerant midges and caddisflies that obtain food by filtering water with nets that they construct. In contrast, severely polluted streams may have low overall abundance with no sensitive macroinvertebrates (Figure 5).

Figure 3. Macroinvertebrates from a stream with good water quality (Image credits: 20)

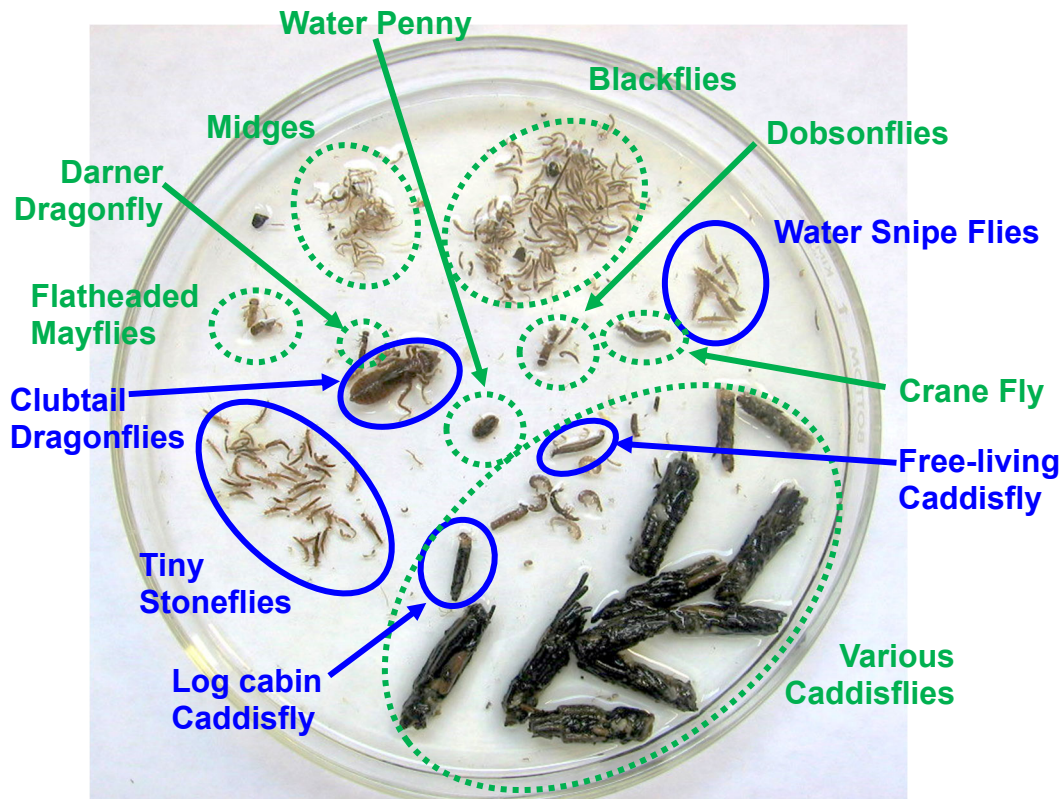


Figure 4. Macroinvertebrates from a stream that is moderately enriched with nutrients

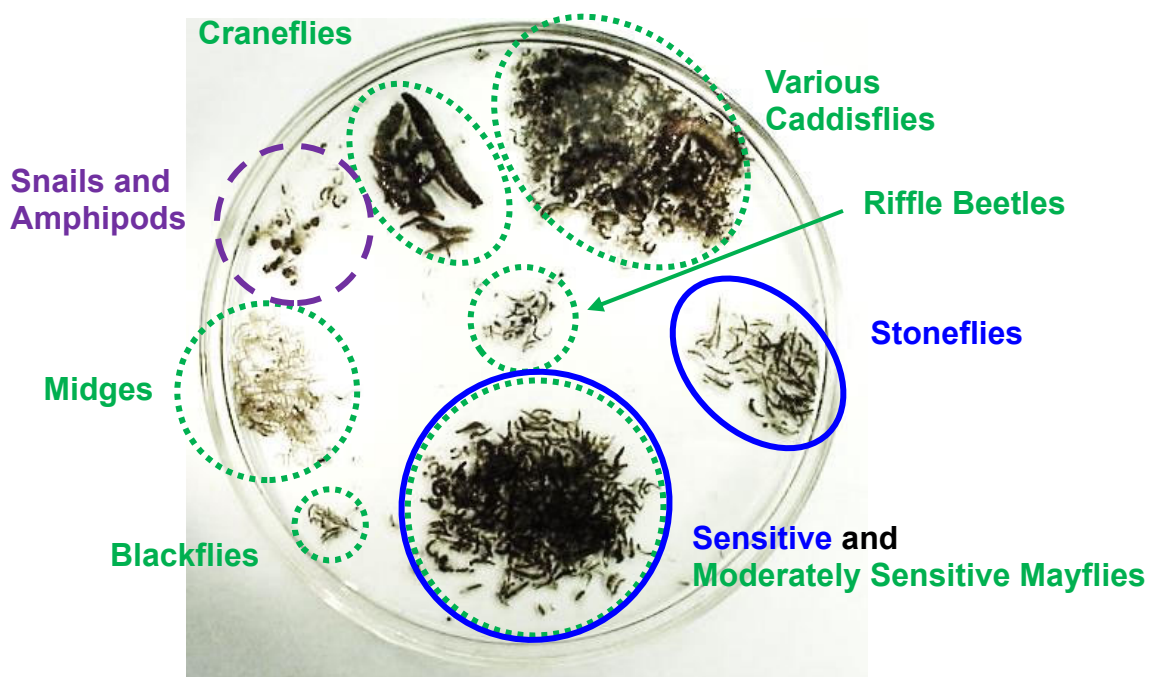
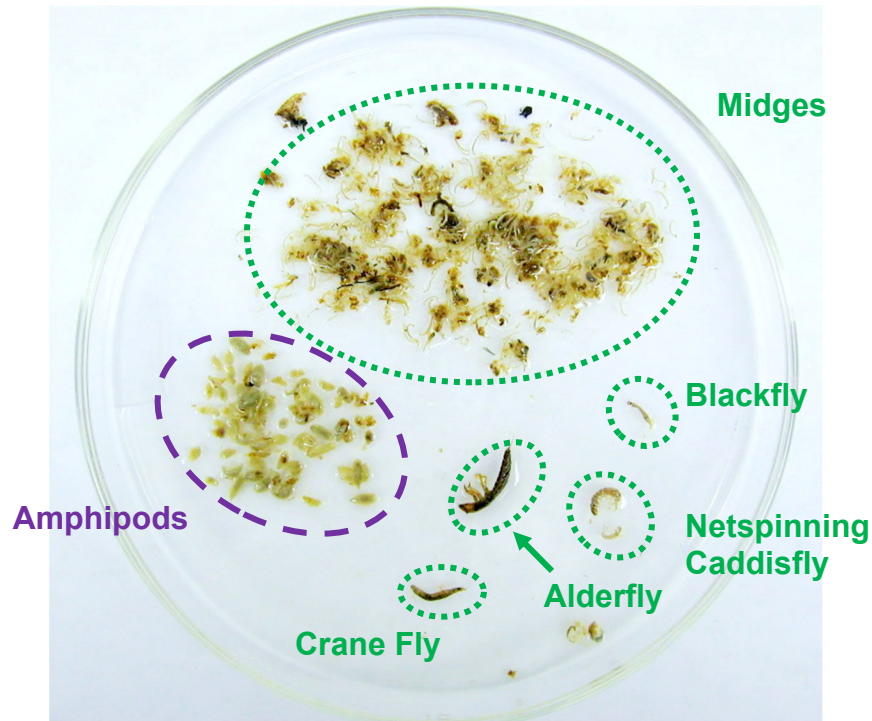


Figure 4. Macroinvertebrates from a severely polluted stream



Macroinvertebrate Descriptions

The taxonomic keys are restricted to the macroinvertebrates in this guide. There are many other macroinvertebrates not included in the keys or guide. The keys are designed for volunteers and are not as complex as those used by professionals. The pictures of macroinvertebrates in this guide are representative examples. Macroinvertebrates in the same group can come in many shapes, sizes, and color variations. Also, some of the specimens shown in this guide were preserved and may have different color than live organisms. The scale bars shown on the macroinvertebrate descriptions later in this guide show the range in the size of mature specimens. Young specimens are tiny and are smaller than the scale bars.

Most aquatic insects in Maine streams are naiads or larvae. It is helpful to become familiar with the basic body structures to use this guide. A larva has 1) a head, 2) a thorax comprised of three segments, and 3) an abdomen with 8-11 segments, depending on the species (Figure 5). Some larvae have a pair of segmented legs on all three thoracic segments. Some larvae have various bumps, prolegs (false legs), gills, and filamentous projections on the abdomen. Caddisfly larvae have hardened shields on the back of some or all thoracic segments. Some larvae have hooks on their rear end. Naiads have similar body structure but develop one or two pair of wing pads on thoracic segment 2 or segments 2 and 3 (Figure 6).

Figure 5. Body structure of a caddisfly larva (view from the side)

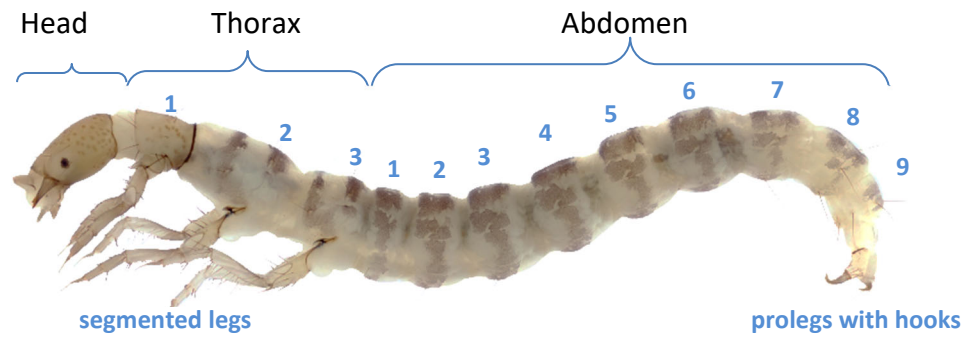


Figure 6. Body structure of a stonefly naiad (view from the top)

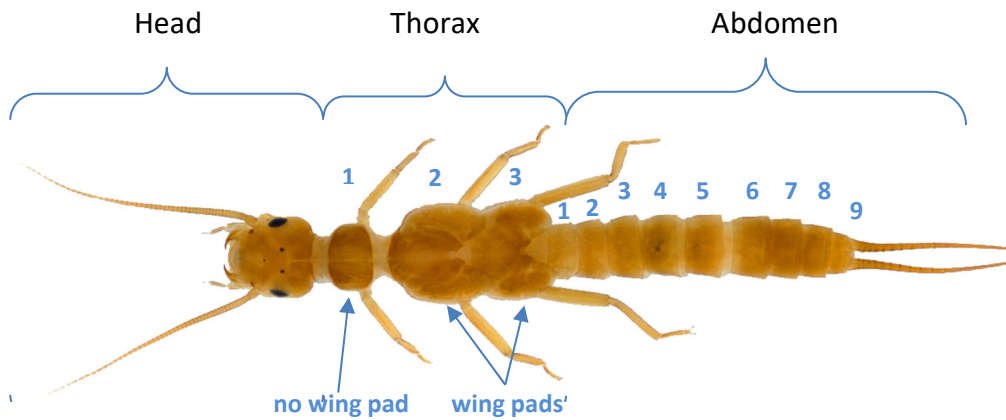


Image credits: 1

What do they look like as adults?

Here are some examples of adult forms of insects that live in streams as larvae or naiads. Each group may have a wide variety of shapes, sizes, and colors.

Alderfly 3



Aquatic Dance Fly 12



Blackfly 18



Caddisfly 21



Crane Fly 18



Damselfly 17



Dobsonfly 18



Dragonfly 8



Mayfly 18



Non-biting Midge 21



Stonefly 18



Water Penny 3

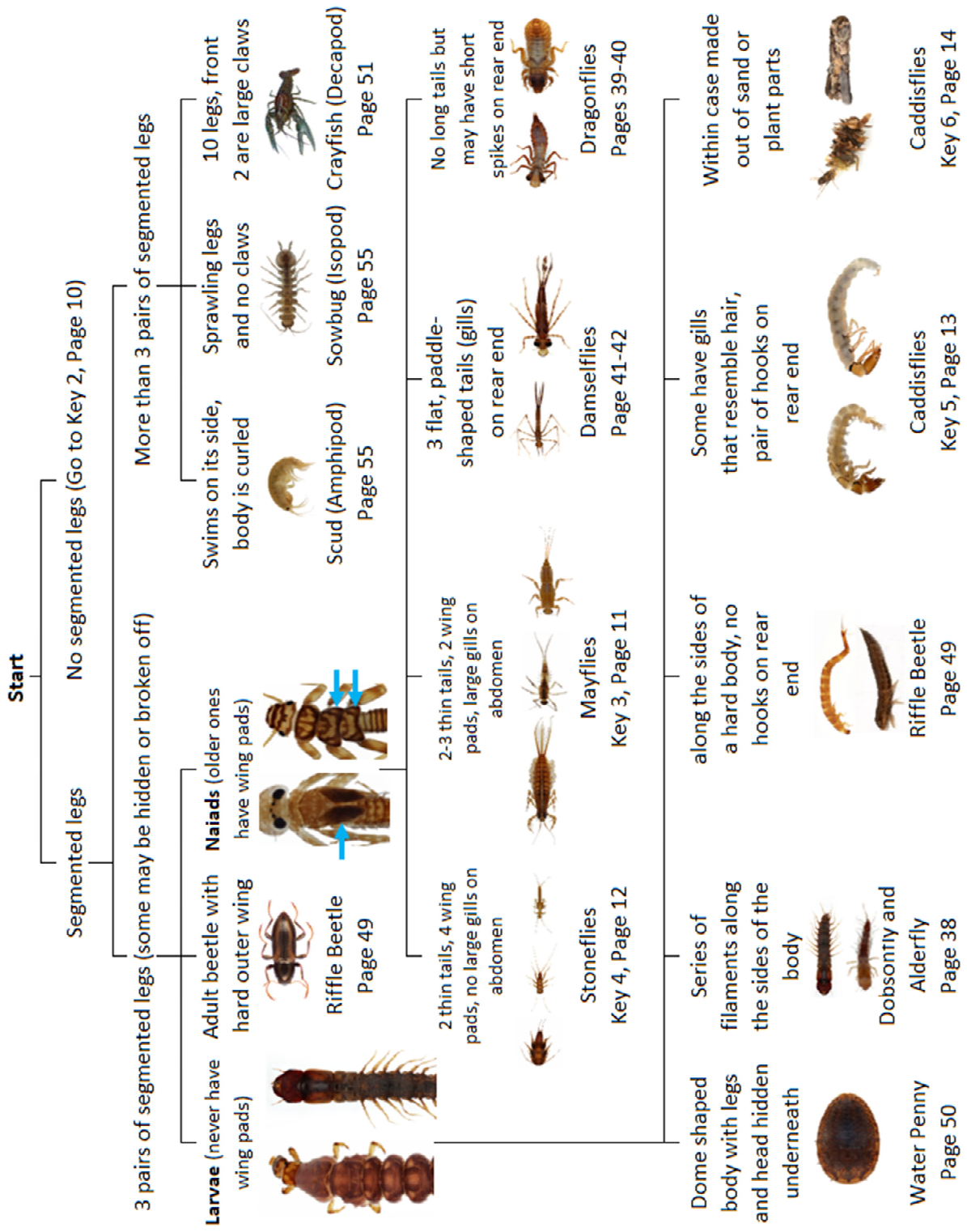


Taxonomic Keys

Taxonomic Key #1 – Start

KEY #1

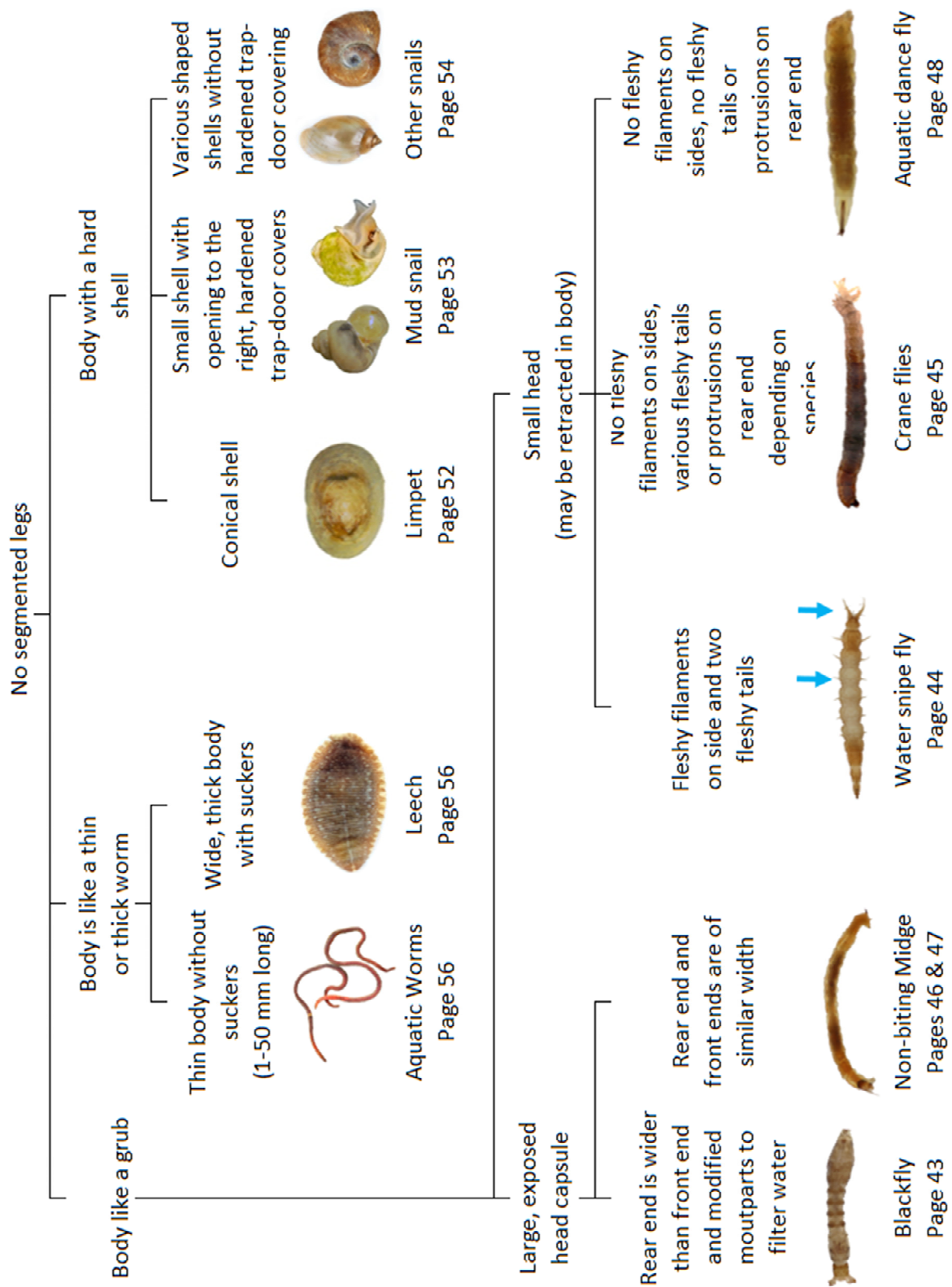
Key for Maine Stream Explorers: Expanded Macroinvertebrate Guide (3rd edition)



Taxonomic Key #2 – No Segmented Legs

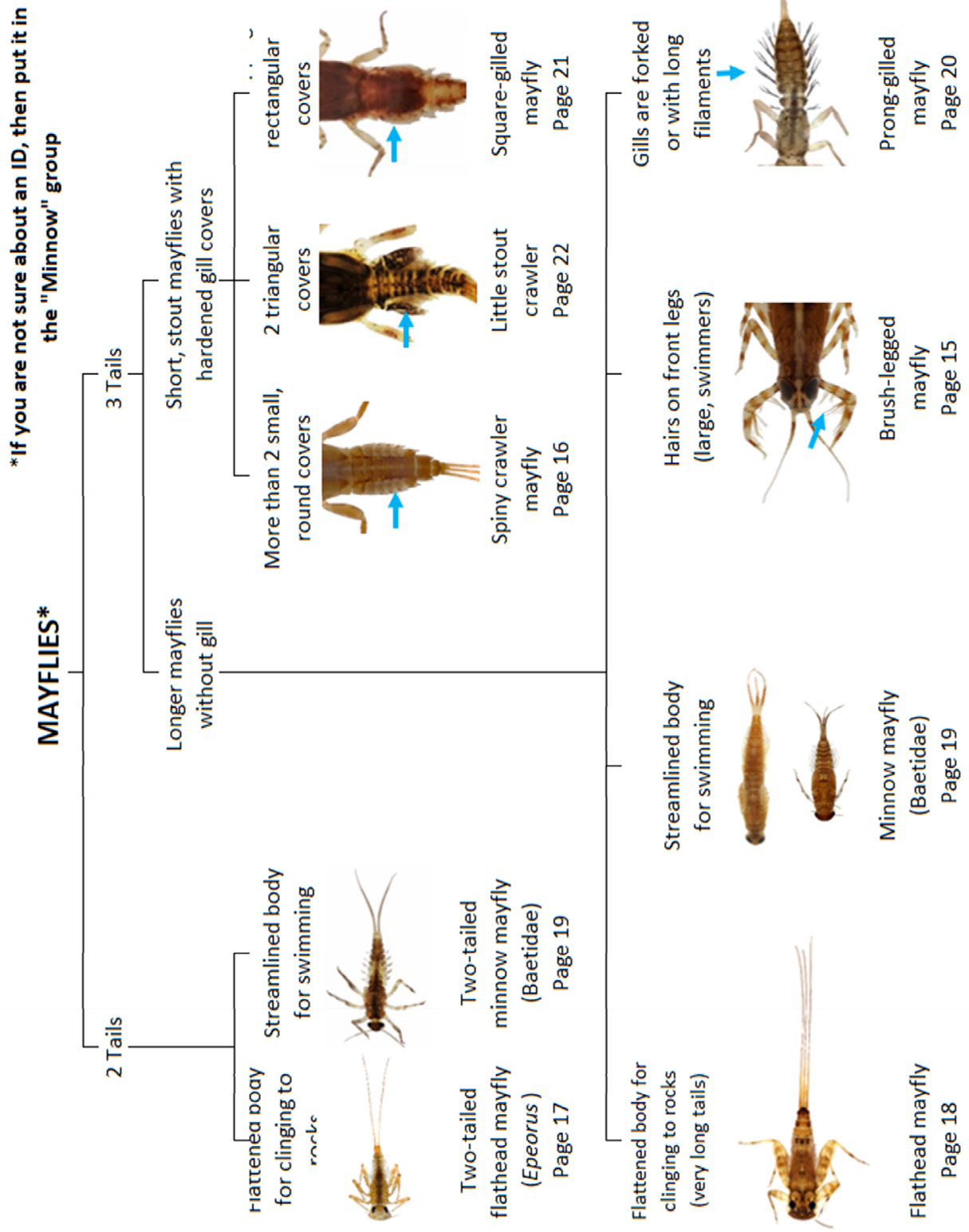
KEY #2

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Taxonomic Key #3 – Mayflies

Key for Maine Stream Explorers: Expanded Macroinvertebrate Guide (3rd edition) KEY #3



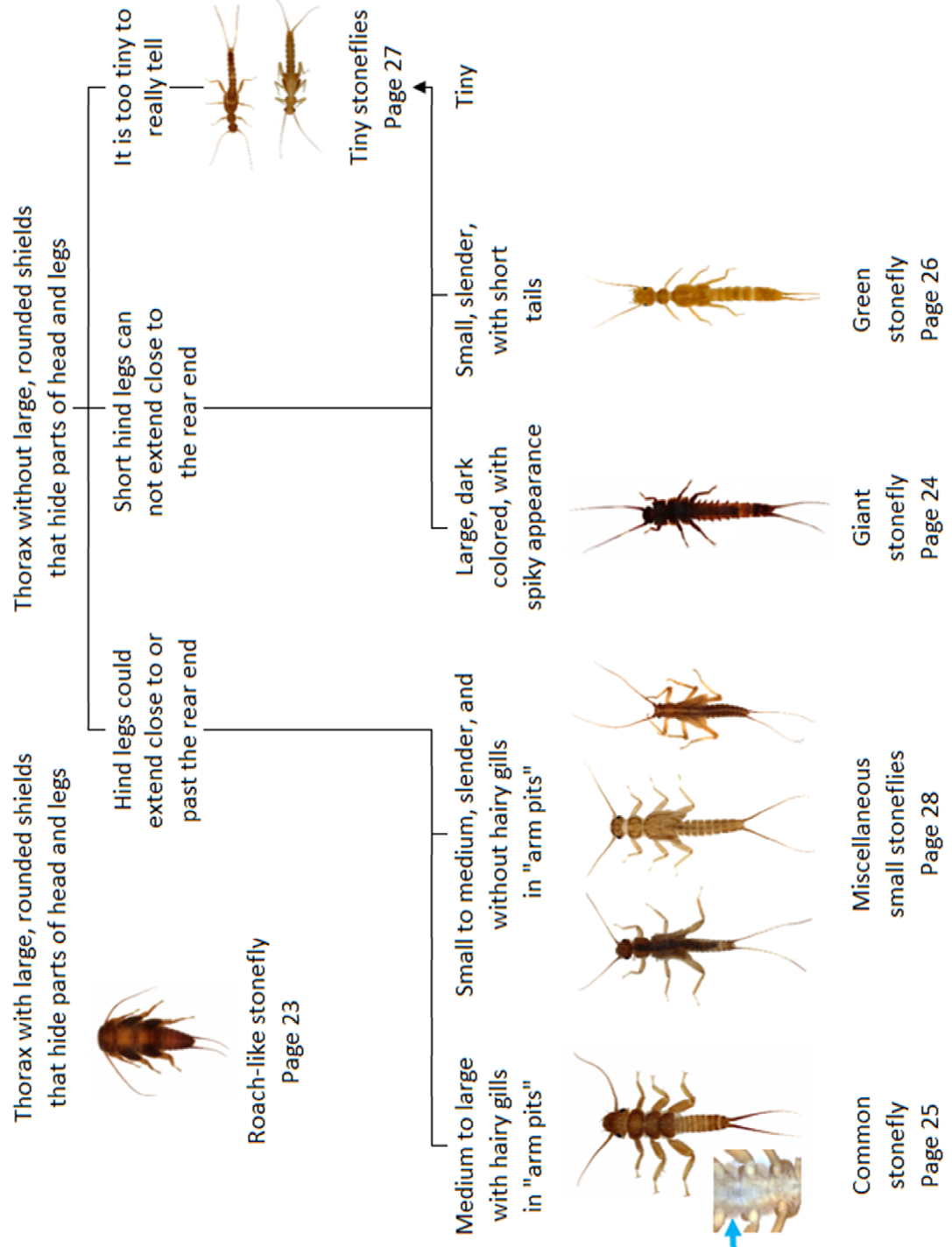
Taxonomic Key #4 – Stoneflies

KEY #4

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*If you are not sure about an ID, then put it in the "Miscellaneous Small" group

STONEFLIES*



Taxonomic Key #5 – Caddisflies

Key for Maine Stream Explorers: Expanded Macroinvertebrate Guide (3rd edition) KEY #5

*If you are not sure about an ID, then put it in the "Other" group

CADDISFLIES*

Full plates on the back of all three thoracic segments.
C-shaped body with bushy gills on underside of abdomen



Netspinning
Page 35

Full plates on the back of the first and second thoracic segments



Prolegs on rear end are well-developed, long body



Tubenet
Page 34

Prolegs on rear end are small, stout body



Tortoise shell
Page 38

Small and slender



Tubenet
Page 34

Large and thick



Free-living
Page 29

No hump on back of first abdominal segment



No bumps on side of first segment



Log cabin
Page 31

Bumps on side of first segment



Wood panel
Page 32

Hump on back of first abdominal segment



Can see antennae (but still small)



Long-horned
Page 33

Can't see the antennae

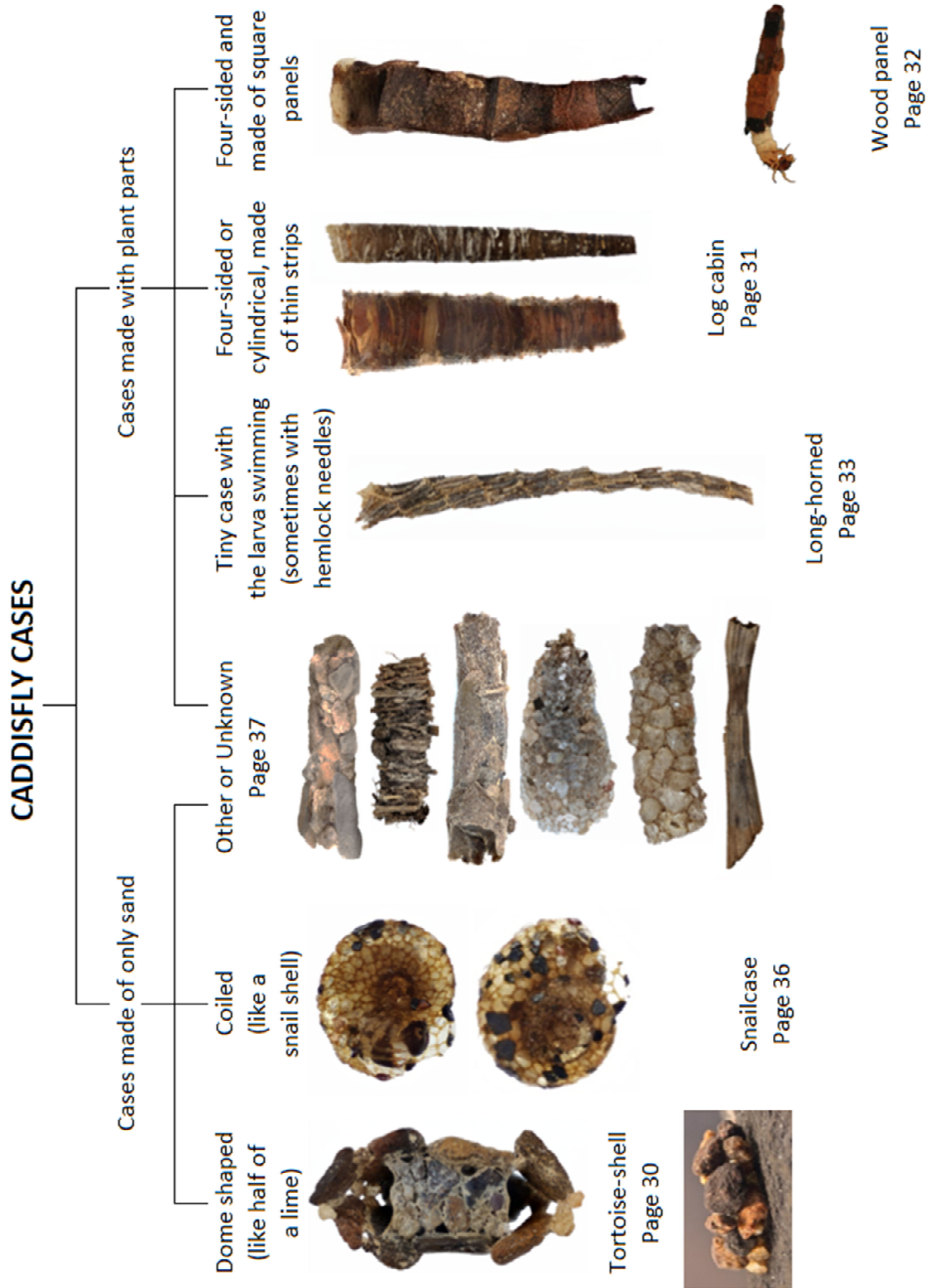


Other or
Page 37

Taxonomic Key #6 – Caddisfly Cases

KEY #6

Key for Maine Stream Explorers: Expanded Macroinvertebrate Guide (3rd edition)



There are hundreds of different kinds of caddisfly cases. If you can't match a case to one of these pictures, then put it in the "Other or Unknown" group.

SENSITIVE
(Most sensitive to pollution)

Taxonomy: Order
Family

Ephemeroptera
Isonychiidae
Brush-legged Mayfly

Brush-legged Mayfly

View from above



View from the side



Diagnostic characteristics

1. Has clearly distinguishable head, thorax with 6 legs, and abdomen
2. One pair of wing pads on back
3. Each leg ends with a single claw
4. Plate-like gills on abdominal segments 1 through 7
5. 3 thin tails
6. **Long hairs on front legs**
7. **The tails are hairy and often multi-colored**

The gills sometimes stick out to the sides.

They are excellent swimmers.

They face upstream and gather food with the hairs on their front legs.

Behavior

- Uses hairs on legs to get food
- Eats algae, detritus, and invertebrates
- Good swimmers with an up-down motion, like a dolphin

Environmental Sensitivity

- Mostly occurs in clean, cold streams with good habitat
- Prefers streams with rocks
- Prefers moderate to swift flowing water

Image credits: 1



Length: 8-17 mm, excluding tails

SENSITIVE
(Most sensitive to pollution)

Spiny Crawler Mayfly

Taxonomy: Order
Family

Ephemeroptera
Ephemerellidae
Spiny Crawler Mayfly

Ephemerella



Eurylophella



Serratella



Diagnostic characteristics

1. Has clearly distinguishable head, thorax with 6 legs, and abdomen
2. Each leg ends with a single claw
3. One pair of wing pads on back
4. Plate-like gills on abdominal segments 3 or 4 through 7
5. **Never gills on abdominal segment 2**
6. **Spines on back of head, thorax, or abdomen**
7. **1 or more pairs of protective gill covers**

Some spiny crawlers have "bulging biceps" on front legs

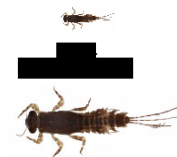
Behavior

- They like mats of moss, plants, and rock crevices
- Eats algae, detritus, and invertebrates
- Poor swimmers
- When scared, they sometimes raise the tip of abdomen over the back, like a scorpion

Gill covers are not as extensive as the those on the square-gill and triangle-gill mayflies

Environmental Sensitivity

- Mostly occurs in clean, cold streams with good habitat
- Prefers streams with rocks
- Prefers moderate to swift flowing water



Length: 5-15 mm, excluding tails

Image credits: 1

SENSITIVE
(Most sensitive to pollution)

Epeorus

Taxonomy: Order Ephemeroptera
Family Heptageniidae
Flatheaded Mayfly
Genus *Epeorus*

View from above



View from below

Diagnostic characteristics

1. Has clearly distinguishable head, thorax with 6 legs, and abdomen
2. One pair of wing pads on back
3. Each leg ends with a single claw
4. Plate-like gills on abdominal segments 1 through 6 or 7
5. **2 long tails (instead of the usual 3 for most mayflies)**
6. **Flat head and body (streamlined for hanging on rocks)**
7. **The head extends past the eyes so you can see part of the head to the side of the eye of the eye... the head extends past the eye**

Behavior

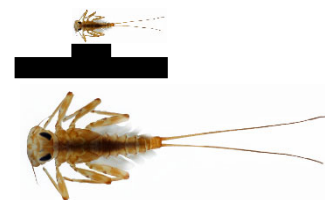
- Crawls on and clings to rocks
- Grazes on algae and detritus
- Sometimes swims with an up-down motion, like a dolphin

Environmental Sensitivity

- Mostly occurs in clean, cold streams with good habitat
- Prefers streams with rocks
- Prefers moderately to swiftly flowing water
- **Length:** 5-20 mm (excluding tails)

Image credits: 1

Don't confuse this mayfly with a small minnow mayfly in the family Baetidae, which also has 2 tails. It does not have a flattened head or body, however.



Length: 5-20 mm
(excluding tails)

MODERATELY SENSITIVE
(Moderately sensitive to pollution)

Taxonomy: Order Ephemeroptera
Family Heptageniidae
Flatheaded Mayfly

Flatheaded Mayflies

Leucrocuta



Maccaffertium



Stenacron



Diagnostic characteristics

1. Has clearly distinguishable head, thorax with 6 legs, and abdomen
2. One pair of wing pads on back
3. Each leg ends with a single claw
4. 3 long tails (middle one is sometimes short)
5. **Plate-like gills on abdomen**
6. **Flat head and body (streamlined for hanging on rocks)**
7. **The head extends past the eyes so you can see part of the head to the side of the eye**

These mayflies graze on algae that grows on rocks.

Behavior

- Crawls on and clings to rocks
- Grazes on algae and detritus
- Sometimes swims with an up-down motion, like a dolphin

Environmental Sensitivity

- Mostly occurs in clean, cold streams with good habitat
- Prefers streams with rocks
- Prefers moderately to swiftly flowing water

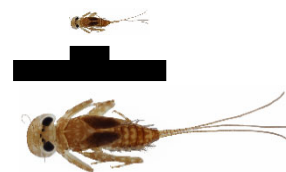


Image credits: 1

Length: 5-20 mm (excluding tails)

MODERATELY SENSITIVE
(Moderately sensitive to pollution)

Minnow Mayflies

Taxonomy: Order Ephemeroptera
Families Baetidae
Small Minnow Mayfly
Ameletidae
Ameletid Minnow Mayfly
Siphonuridae
Primitive Minnow Mayfly

Ameletus (Ameletidae)



Baetis (Baetidae)



Heterocloeon (Baetidae)



Diagnostic characteristics

1. Has clearly distinguishable head, thorax with 6 legs, and abdomen
2. One pair of wing pads on back
3. Each leg ends with a single claw
4. **3 thin tails (some species have 2 tails)**
5. **Plate-like gills on the side of the abdomen**
6. **Body is streamlined and roughly cylindrical**

Behavior

- These mayflies are excellent swimmers and swim with an up-down motion, like a dolphin
- Omnivorous that feed on detritus, algae, and small invertebrates

Environmental Sensitivity

- *Ameletus* requires cold, clean water and sometimes lives in small streams that might dry up
- Baetidae species usually live in streams with good water quality some species are somewhat tolerant of pollution and warmer water.

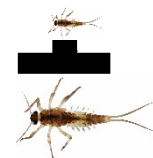


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Size: 3-12 mm (excluding tails)

MODERATELY SENSITIVE
(Moderately sensitive to pollution)

Prong-gilled Mayfly

Taxonomy: Order
Family

Ephemeroptera
Leptophlebiidae
Prong-gilled Mayfly

Leptophlebia



Paraleptophlebia



Diagnostic characteristics

1. Has clearly distinguishable head, thorax with 6 legs, and abdomen
2. One pair of wing pads on back
3. Each leg ends with a single claw
4. 3 thin tails (middle one is sometimes shorter)
5. **Gills are double and have long projections or are fringed**
6. **Body is streamlined but not as flat as a flat-headed mayfly**
7. **Can see the mouth parts in front of the head**

Paraleptophlebia feed on detritus during the day and feed on algae on top of rocks or logs during the night

Behavior

- Feed on detritus and algae
- They are poor swimmers and prefer to crawl

Environmental Sensitivity

- One of the more common mayflies in sandier streams
- Prefer to be on porous rocks, gravel, woody debris, and tree roots



Image credits: 1

Length: 4-15 mm (excluding tails)

MODERATELY SENSITIVE
(Moderately sensitive to pollution)

Small Square-gill Mayfly

Taxonomy: Order Ephemeroptera
Family Caenidae
Small Square-gill
Genus ***Caenis***

View from above



View from below



Diagnostic characteristics

1. Has clearly distinguishable head, thorax with 6 legs, and abdomen
2. One pair of wing pads on back
3. Each leg ends with a single claw
4. 3 thin tails
5. **Large, overlapping gill covers that are rectangular with rounded corners (on abdominal segment 2)**

Can be distinguished from Spiny Crawlers by the large, overlapping gill covers on abdominal segment 2.

Behavior

- Feed on detritus and algae
- They are poor swimmers

One of the more common mayflies in slowly flowing streams with plants and sandy or silty bottoms

Environmental Sensitivity

- Tolerant of silty substrate
- Somewhat more tolerant to warmer water, low dissolved oxygen concentrations, and slower flowing water than other mayflies



Image credits: 1

Length: 2-8 mm (excluding tails)

MODERATELY SENSITIVE
(Moderately sensitive to pollution)

Little Stout Crawler Mayfly

Crane	Order	Ephemeroptera
	Family	Leptohyphidae
		Little Stout Crawlers
	Genus	<i>Tricorythodes</i>

View from above



View from below



Diagnostic characteristics

1. Has clearly distinguishable head, thorax with 6 legs, and abdomen
2. Usually one pair of wing pads on back, rarely a second pair of tiny ones
3. Each leg ends with a single claw
4. 3 thin tails
5. **Large, triangular gill covers that do not overlap (on abdominal segment 2)**

Behavior

- Feed on detritus and algae
- They are poor swimmers

*Can be distinguished
from Ephemeridae
by shape of gill covers*

Environmental Sensitivity

- Tolerant of silty substrate
- More tolerant to warmer water,
low dissolved oxygen concentrations, and
slower flowing water than other mayflies

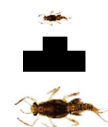


Image credits: 1

Length: 3-10 mm (excluding tails)

SENSITIVE
(Most sensitive to pollution)

Roach-like Stonefly

Taxonomy: Order
Family

Plecoptera
Peltoperlidae
Roach-like Stonefly

View from above (*Tallaperla*)



View from the side (*Tallaperla*)



Diagnostic characteristics

1. Has clearly distinguishable head, thorax with 6 legs, and abdomen
2. 2 pairs of wing pads on back
3. Each leg ends with two claws
4. 2 tails
5. No gills on abdomen
6. **Extensive shields over wing pads on back**
7. **Short and stout**
8. **Overlapping plates on belly**

Tend to be more common in spring and fall

Rounded head with broad shield is somewhat reminiscent of horseshoe crabs

Behavior

- They love to chew on dead leaves
- Common in leaf packs
- Primarily in springs and smaller streams

Environmental Sensitivity

- Mostly occurs in clean, cold streams with good habitat
- Prefers small streams with lots of leaves



Image credits: 1

Length: 8-15 mm excluding tails

SENSITIVE
(Most sensitive to pollution)

Taxonomy: Order Plecoptera
Family Pteronarcyidae
Genus ***Pteronarcys***

Giant Stonefly

View from above



View from below



Diagnostic characteristics

1. Has clearly distinguishable head, thorax with 6 legs, and abdomen
2. 2 pairs of wing pads on back
3. Each leg ends with two claws
4. 2 tails
5. **Dark brown to black coloration**
6. **Spiky appearance**
7. **Branched gills in "armpits" and abdominal segments 1 & 2**
8. **Back legs do not extend past tip of abdomen**

They are also called salmonflies because salmon like to eat them

They look tough but will sometimes curl into spiky balls when scared

Behavior

- Primarily eat plants and detritus
- Tend to inhabit mixed substrate, detritus, and woody debris

Environmental Sensitivity

- Mostly occurs in clean, cold streams with good habitat
- Some species require up to 3 years to grow before turning into an adult
- Sometimes can be moderately tolerant



Length: 15-50 mm (excluding tails)

Image credits: 1

SENSITIVE
(Most sensitive to pollution)

Common Stonefly

Taxonomy: Order Plecoptera
Family Perlidae
Common Stonefly

Acroneuria



Agnetina

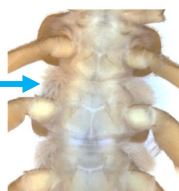


Paragnetina



Diagnostic characteristics

1. Has clearly distinguishable head, thorax with 6 legs, and abdomen
2. 2 pair of wing pads on back
3. Each leg ends with two claws
4. 2 tails
5. No gills on abdomen
6. **Hairy gills in "armpits"**
7. **Back legs are long and extend past tip of abdomen**
8. Some have bold "tiger" coloration



Midge larvae sometimes hitch-hike on the backs of common stoneflies.

Older naiads sometimes whack with their tails and try to flip each other in territorial disputes.

Behavior

- Older naiads are voracious predators of mayflies, caddisflies, and especially blackflies
- Young naiads are omnivorous, eating both plants and invertebrates

Environmental Sensitivity

- Mostly occurs in clean, cold streams with good habitat
- Most prefer rocky streams
- Most prefer moderate to fast flowing water

Image credits: 1



Length: 8-35 mm (excluding tails)

SENSITIVE
(Most sensitive to pollution)

Green Stonefly

Taxonomy: Order Plecoptera
Family Chloroperlidae
Green Stonefly

View from above (*Alloperla*)



View from below (*Alloperla*)



Diagnostic characteristics

1. Has clearly distinguishable head, thorax with 6 legs, and abdomen
2. 2 pair of wing pads on back
3. Each leg ends with two claws
4. 2 tails
5. **Wing pads are parallel**
6. **Abdomen is widest in the middle**
7. **Tails are shorter than abdomen**
8. **Hind legs do not reach rear end**
9. **Usually do not have gills**

One of their common names is Green Stonefly because adults of some species are bright green

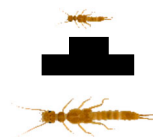
They "breathe" through their skin and require well oxygenated water

Behavior

- Prefer swift flowing water
- Tend to inhabit gravel and rocky substrate
- These predators eat other invertebrates

Environmental Sensitivity

- Mostly occur in clean, cold streams with good habitat



Length: 5-12m (excluding tails)

Image credits: 1

SENSITIVE
(Most sensitive to pollution)

Tiny Stoneflies

Taxonomy: Order Plecoptera
Families Leuctridae
Rolled-winged Stonefly
and Capniidae
Slender winter stonefly

Capniidae (*Allocaenia*)



Leuctridae (*Leuctra*)



Diagnostic characteristics

1. Has clearly distinguishable head, thorax with 6 legs, and abdomen
2. 2 pair of wing pads on back
3. Each leg ends with two claws
4. 2 tails, tails are longer than tails of Green Stoneflies
5. **Tiny**
6. **Usually cream or tan colored**
7. **Hind wing pads are parallel or nearly parallel**

Slender grains of rice with legs

Behavior

- They can be found in leaf packs and detritus
- Some live in intermittent streams
- Tend to prefer rocky substrate but can be found in sandy streams with branches
- They chew on leaves and detritus
- Capniidae tend to be more common in fall and winter

Leuctra is more tolerant of road salt than other stoneflies and can be found in some cold water urban streams

Environmental Sensitivity

- Mostly occur in clean, cold streams with good habitat
- They do not have gills and require well-oxygenated water



Length: 3-6 mm (excluding tails)

Image credits: 1

SENSITIVE
(Most sensitive to pollution)

Miscellaneous Small Stoneflies

Taxonomy: Order Plecoptera
Families Nemouridae
 Perlodidae
 Taeniopterygidae

Nemouridae (*Amphinemura*)



Perlodidae (*Isoperla*)



Taeniopterygidae (*Taeniopteryx*)



Diagnostic characteristics

1. Has clearly distinguishable head, thorax with 6 legs, and abdomen
2. Each leg ends with two claws
3. 2 tails
4. **Hind wing pads are strongly divergent (not parallel)**
5. **No gills on the abdomen**
6. **Some Perlodids have bold color patterns**

Behavior

- Nemourids are detritivores and chew on leaves
- Taeniopterygids are omnivorous
- Perlodidae are predators

Environmental Sensitivity

- Mostly occurs in clean, cold streams with good habitat
- These three families combined inhabit a wide range of habitats from rocky to sandy streams
- Some live in intermittent streams
- Taeniopterygidae can be moderately tolerant

Nemourid and Taeniopterygid naiads emerge as adults in the winter and spring. Some adults are flightless and lack wings.

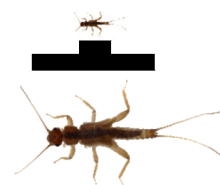


Image credits: 1

Length: 3-16 mm (excluding tails)

SENSITIVE
(Most sensitive to pollution)

Free-living Caddisfly

Taxonomy: Order Trichoptera
Family Rhyacophilidae
Free-living Caddisfly
Genus ***Rhyacophila***

View from above



View from the side



Diagnostic characteristics

1. Looks like a caterpillar
2. Has a head, thorax with six legs, and abdomen
3. Last abdominal segment has a pair of hooks on fleshy bumps
4. **The pair of bumps with the hooks are well developed (prolegs)**
5. **Deep constrictions between abdominal segments**
6. **No armor on the back of where the 2nd and hind legs join the body (thoracic segments 2 and 3)**
7. **Armor on the back of the first thoracic segment**
8. **No gills underneath abdomen**

Mature people may compare them to the "Michelin Man" and younger folks have no idea what they are talking about.

They are sometimes a pretty blueish-green color.

Behavior

- Do not spin webs or make cases
- Active predators of other invertebrates
- Are more mobile than most caddisflies

Environmental Sensitivity

- Mostly occurs in clean, cold streams with good habitat
- Prefer clear water

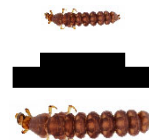


Image credits: 1

Length: 11-18 mm (sometimes longer)

SENSITIVE
(Most sensitive to pollution)

Tortoise-shell Caddisfly

Taxonomy: Order Trichoptera
Family Glossosomidae
Saddle-case Caddisfly
Genus ***Glossosoma***

View of larva from the side



View of case from underneath



Diagnostic characteristics

1. Looks like a caterpillar
2. Has a head, thorax with six legs, and abdomen
3. Last abdominal segment has a pair of hooks on fleshy bumps
4. **The pair of bumps (prolegs) with the hooks are small and broadly joined to the side of the body**
5. **No hard structures on the back of where the 2nd and hind legs join the body (thoracic segments 2 and 3)**
6. **Armored plate on back of last abdominal segment**
7. **Case is made of rocks and is dome shaped, like half of a lemon or a tortoise shell**
8. **No gills underneath abdomen**

Behavior

- They graze on algae and detritus
- They are usually found on top of rocks



Time-lapse films have shown them moving around the top of rocks like slow-motion bumper cars, sometimes trying to push each other out of the way.

Environmental Sensitivity

- Mostly occurs in clean, cold streams with good habitat
- Prefer fast currents
- Prefer rocky substrates

They sometimes abandon their cases when stressed.



Image credits: 1, 9 (case on rock)

Length: 3-7 mm (sometimes longer)

SENSITIVE
(Most sensitive to pollution)
Log Cabin Caddisfly

Taxonomy: Order
Family

Trichoptera
Brachycentridae
Humplless Case Makers



Brachycentrus (top view and case)



Micrasema (side view and case)

Diagnostic characteristics

1. Looks like a caterpillar
2. Has a head, thorax with six legs, and abdomen
3. Last abdominal segment has a pair of hooks on fleshy bumps
4. **No bumps on the back or on the sides of abdominal segment 1**
5. **No gills on abdomen**
6. **Legs extend near head (it is a filter feeder)**
7. **Back of second thoracic segment is partly or entirely armored**
8. **Cases of Maine genera are made of thin strips of plants and are either four-sided like a cabin (*Brachycentrus*) or cylindrical (*Micrasema*)**

Behavior

- They anchor their cases to rocks or plants with silk
- They use their legs to filter food from flowing water
- They eat detritus, algae, and small invertebrates

Environmental Sensitivity

- Mostly occurs in clean, cold streams with good habitat
- Prefer moderately or swiftly flowing water
- Prefer streams with rocks and/or plants

Image credits: 1



Length: 6-12 mm

SENSITIVE
(Most sensitive to pollution)
Wood Panel Caddisfly

Taxonomy: Order Trichoptera
Family Lepidostomatidae
Lepidostomatid
Genus *Lepidostoma*

View of larva from the side



View from the top



View of case



Diagnostic characteristics

1. Looks like a caterpillar
2. Has a head, thorax with six legs, and abdomen
3. Last abdominal segment has a pair of hooks on fleshy bumps
4. **A few hair-like gills on sides of abdomen**
5. **Bumps on the sides of abdominal segment 1**
6. **no bumps on top**
7. **Second thoracic segment is armored on the back**
8. **Cases of most species are four-sided and made of rectangular pieces of wood**



Behavior

- They eat detritus and algae

Environmental Sensitivity

- Mostly occurs in clean, cold streams with good habitat
- Some species live in tiny streams that may dry up



Image credits: 1, 11 (larva in case)

Length: 7-11 mm

SENSITIVE
(Most sensitive to pollution)

Long-horned Case Maker

Taxonomy: Order
Family

Trichoptera
Leptoceridae
Long-horned Case Maker

Ceraclea larva and case



Oecetis larva and case



Trietodes larva and case



Diagnostic characteristics

1. Looks like a caterpillar
2. Has a head, thorax with six legs, and abdomen
3. Last abdominal segment has a pair of hooks on fleshy bumps
4. **A few hair-like gills on sides of abdomen**
5. **Bumps on the sides of abdominal segment 1 and no bumps on top**
6. **Second thoracic segment some armor on back**
7. Variety of cases made of sand, wood, and plants
8. **Some cases are made of hemlock needles or freshwater sponges**

Some Ceraclea species burrow in and eat freshwater sponges and even make their cases out of pieces of sponge

Look for these tiny caddisflies swimming in the collection pan by wildly paddling their legs

Behavior

- Omnivorous feeding on detritus, algae, and small invertebrates
- *Oecetis* is a predator
- **Most are very good swimmers** (*Oecetis* is not a great swimmer because of heavier cases)

Environmental Sensitivity

- Most occur in slowly flowing water
- Many live on plants
- Require good water quality but need well-oxygenated water

Image credits: 1



Length: 7-15 mm

MODERATELY SENSITIVE
(Moderately sensitive to pollution)

Tubenet Caddisfly

Taxonomy: Order
Family

and

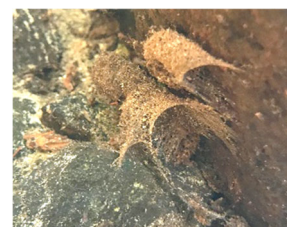
Trichoptera
Philopotamidae
Finger-net Caddisfly
Polycentropodidae
Tubemaking Caddis.

View of *Neureclipsis* (Polycentropodidae) from



the side

View of *Chimarra* (Philopotamidae) from the side



Neureclipsis makes a large silken net that is shaped like a cornucopia. Nets can be several inches long.

Philopotamidae larva make thin, silken tubes attached to rocks.

Diagnostic characteristics

1. Looks like a caterpillar
2. Has a head, thorax with six legs, and abdomen
3. Last abdominal segment has a pair of hooks on fleshy bumps
4. **The pair of bumps (prolegs) with the hooks are well developed**
5. **Areas between abdominal segment not deeply constricted**
6. **Usually pale cream to yellow bodies**
7. **No armor on the back of thoracic segments 2 and 3**
8. **No armor on the underside of last abdominal segment**

In comparison, free-living caddisflies (page 39) are usually larger, have deeper constrictions between abdominal segments, and has some armor on the underside of the last abdominal segment.

Environmental Sensitivity

- Occur in streams with good water quality but are often more abundant in nutrient-enriched streams
- Prefer rocky substrates
- Prefer streams with moderately or swiftly flowing water

Behavior

- **Spin nets with silk on the tops and sides of rocks (fine mesh)**
- Catch animal and plant matter in nets
- Will abandon nets when stressed

Image credits: 1, 20 (net)



Length: 10-12 mm (Philopotamidae)
15-25 mm (Polycentropodidae)

MODERATELY SENSITIVE
(Moderately sensitive to pollution)

Netspinning Caddisfly

Taxonomy: Order Trichoptera
Family Hydropsychidae
Netspinning Caddis.
Fish-net Caddisfly

Cheumatopsyche



Hydropsyche



Macrostemum



Diagnostic characteristics

1. Looks like a caterpillar
2. Has a head, thorax with six legs, and abdomen
3. Last abdominal segment has a pair of hooks on fleshy bumps
4. **A pair of bumps (prolegs) on rear end with hooks and sometimes hairs on the prolegs**
5. **Tufts of hairs on the prolegs**
6. **Armor on the back of all three thoracic segments**
7. **Large, bushy gills underneath abdomen**

Environmental Sensitivity

- Occur in streams with good water quality but are often more abundant in nutrient-enriched streams
- Prefer rocky substrates and swift water

Behavior

- **Spin nets with silk between rocks (coarse mesh)**
- Catch animal and plant matter in nets
- Will abandon nets when stressed



Image credits: 1, 9 (larva in net)

Netspinning caddisflies range in color from cream, to grey, brown, and lime green (they do not taste like limes, however).

They sometimes fight to take over nets or defend nets from interlopers (they make scraping vibrations to intimidate each other)



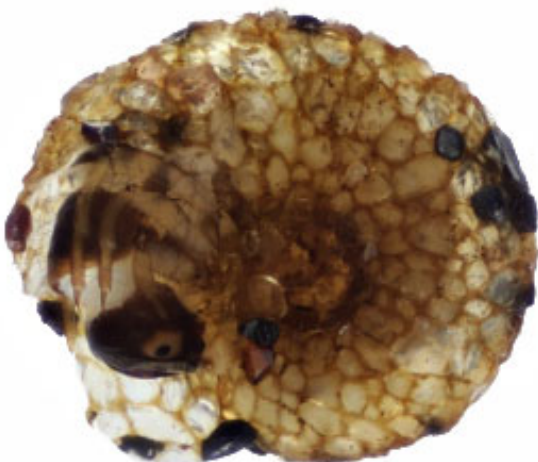
Length: 10-30 mm

MODERATELY SENSITIVE
(Moderately sensitive to pollution)

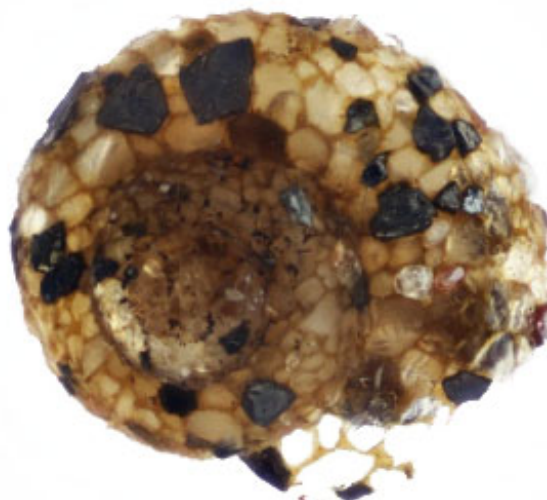
Snail-case Maker Caddisfly

Taxonomy: Order Trichoptera
Family Helicopsychidae
Snail-case Maker
Genus Helicopsyche

View from below



View from above



Diagnostic characteristics

1. Looks like a caterpillar
2. Has a head, thorax with six legs, and abdomen
3. Last abdominal segment has a pair of hooks on fleshy bumps
4. **Distinctive snail-shaped cases made of sand**
5. **Body is coiled to fit the case**

Behavior

- Graze algae and detritus on rocks
- They move around on top of rocks

Environmental Sensitivity

- Generally occur in streams with good water quality
- Some are tolerant of warmer water
- Some are tolerant of saltier water
- Prefer streams with moderately or swiftly flowing water
- Prefer rocky streams

These caddisflies are easily overlooked because of their small size and cryptic cases. Carefully search for them. Gently swirl the water in the collection pan and look for the contrast of stuff moving and them stuck to the pan.

They are rarely seen outside of their cases.



Length: 5-10 mm

Image credits: 1

MODERATELY SENSITIVE
(Moderately sensitive to pollution)

Taxonomy: Order
Families

Trichoptera
Limnephilidae
Molannidae
Odontoceridae
Phryganeidae
Hydroptilidae

Other Case-making Caddisflies

This group includes a variety of other caddisflies that make cases

Diagnostic characteristics

1. Looks like a caterpillar
2. Has a head, thorax with six legs, and abdomen
3. Last abdominal segment has a pair of hooks on fleshy bumps

Limnephilidae (Nothorn Casemakers) - The most diverse group of caddisflies. They build a wide variety of cases of sticks, sand, rocks, and plant parts



Molannidae (Hoodcase Makers) - Found in sandy streams and makes a hooded case of sand particles



Odontoceridae (Strongcase Makers) - Make the strongest cases out of sand and rocks



Phryganeidae (Giant Casemakers) - These large caddisflies make long, tube-shaped cases out of plants



Hydroptilidae (Micro Casemakers) - These tiny caddisflies make cases out of sand or just silk



Image credits: 1

MODERATELY SENSITIVE
(Moderately sensitive to pollution)

Taxonomy: Order Megaloptera
Family Corydalidae
Sialidae

Dobsonfly and Alderfly

Nigronia (Dobsonfly)

above



below



Sialis (Alderfly)

above



below



Diagnostic characteristics

- Has a head, thorax with six legs, and abdomen
- Abdomen has a series of well-developed filaments on their sides
- Head has large mouthparts
- **(Dobsonfly) abdomen ends with pair of prolegs, each with a pair of hooks**
- **(Alderfly) abdomen ends with a single, long tail**

If you were as small as a blackfly, the sight of a dobsonfly approaching would be truly frightening.

They mostly breathe through their skin but they also can breathe air (a little). The filaments on their sides help them absorb oxygen from the water.

They rarely bite fingers if handled roughly.

Behavior

- Active predators of other invertebrates
- Dobsonflies are most common in rocky streams with moderately or swiftly flowing water
- Fishflies are most common in sandy and silty streams with deposits of wood and detritus

Environmental Sensitivity

- Usually live in clean streams but are somewhat tolerant of organic enrichment and warmer water
- Dobsonfly larvae take three years or more to mature before pupating and turning into an adult. (It is a good sign to see a dobsonfly in a stream!)



Length: 25-90 mm (dobsonfly)
10-25 mm (alderfly)

Image credits: 1

SENSITIVE
(Most sensitive to pollution)

Clubtail Dragonfly

Taxonomy: Order Odonata
Family Gomphidae
Clubtail Dragonfly

Ophiogomphus



Lanthus



Hagenius brevistylis



Diagnostic characteristics

1. Has a head, thorax with six legs, and abdomen
2. 2 pairs of wing pads on back
3. No visible gills (they are on the inside)
4. Their mouthparts are hinged and can extend forward (see picture above of *Lanthus*)
5. Lower lip of mouth (labium) is large and flat
6. Club-shaped antennae on front of head

Adult clubtail dragonflies usually have bold black and yellow stripes (and a club shaped tail, of course)

Behavior

- These predators extend their hinged mouthparts to grab their prey (lightening quick!)
- Many clubtail naiads burrow in sand and gravels and wait to ambush prey
- Naiads will eat insects and small fish and amphibians
- Adult *Hagenius* dragonflies are known as dragon hunters because of their habit of eating other dragonflies (wow!)

Environmental Sensitivity

- Mostly occurs in clean, cold streams with good habitat
- Different species prefer rocky substrates or sandy substrates

Image credits: 1, 21 (*Hagenius*)

Length: 15-40 mm (up to 65 mm)



MODERATELY SENSITIVE
(Moderately sensitive to pollution)

Taxonomy: Order Odonata
Family Aeshnidae
Darners

Darner Dragonfly

Boyeria

from above

from below

Anax

from above



Diagnostic characteristics

1. Has a head, thorax with six legs, and abdomen
2. Has 2 pairs of wing pads on back
3. No visible gills (they are on the inside)
4. Their mouthparts are hinged and can extend forward (see picture of *Lanthus* on the previous page)
5. **Lower lip of mouth (labium) is large and flat**
6. **Thin antennae on front of head**
7. **5 short appendages on end of abdomen**

Behavior

- These predators extend their hinged mouthparts to grab their prey (lightening quick!)
- *Boyeria* prefer moderately and swiftly flowing streams
- *Aeshna* prefer slowly flowing streams

Environmental Sensitivity

- Prefer good quality water
- Somewhat tolerant to warmer water

Dragonflies can suck in water through their mouth and shoot it out of their rear end to jet forward (fart propulsion!)



Image credits: 1, 4 (*Anax*)

Length: 31-50mm

MODERATELY SENSITIVE
(Moderately sensitive to pollution)

Jewelwings

Taxonomy: Order Odonata
Family Calopterygidae
Broad-winged Damselfly
Genus *Calopteryx*

View from Above



View from Below



Diagnostic characteristics

1. Has a head, thorax with 6 legs, and abdomen
2. Has 2 pairs of wing pads on back
3. Their mouthparts are hinged and can extend forward
4. Long, slender bodies
5. 3 leaf-shaped gills that look like tails
6. **Antennae look like horns on front of head**

Behavior

- These predators extend their hinged mouthparts to grab their prey (lightening quick!)
- They eat other macroinvertebrates
- Poor swimmers, move with side to side motion
- They crawl on plants, tree roots, and between rocks in search of food
- Adults lay their eggs on aquatic plants, sometimes even going underwater to lay the eggs

Environmental Sensitivity

- Mostly occurs in streams with good water quality
- Are somewhat tolerant of warmer water

Adults jewelwings and have shiny, metallic green, blue, and gold bodies depending on the species and the angle of the sun. There are three species in Maine. The most common is the ebony jewelwing which has a greenish/blue body and black wings.



Image credits: 1

Length: 20-29 mm, excluding gills (tails)

MODERATELY SENSITIVE
(Moderately sensitive to pollution)

Narrow-winged Damselfly

Taxonomy: Order Odonata
Family Coenagrionidae
Narrow-winged Damselfly

***Argia* - view from above**



***Argia* - view from below**



Diagnostic characteristics

1. Has clearly distinguishable head, thorax with 6 legs, and abdomen
2. Has 2 pairs of wing pads on back
3. Their mouthparts are hinged and can extend forward
4. Long, slender bodies
5. 3 leaf-shaped gills that look like tails
6. **Small, thin antennae in front of head**

Behavior

- These predators extend their hinged mouthparts to grab their prey (lightening quick!)
- They eat other macroinvertebrates
- Poor swimmers, move with side to side motion
- They crawl on plants, tree roots, and between rocks in search of food

/Environmental Sensitivity

- Mostly occurs in streams with good water quality
- Are somewhat tolerant of warmer water
- They prefer streams with moderate current

The adults are called dancers because of their erratic flight behavior. Adults vary in color from powdery white, grey, purple, and bright blue.

Argia is the most common genus in this family.



Image credits: 1

Length: 13-25 mm, excluding gills (tails)

MODERATELY SENSITIVE
(Moderately sensitive to pollution)

Blackfly

Taxonomy: Order
Family

Diptera
Simuliidae
Blackfly

View from above



View from side



View from below



Diagnostic characteristics

1. Grub-like body with head and no legs
2. Has a small proleg below the head
3. Large, fan-like mouthparts
4. Swollen rear end
5. Rear end has a ring of tiny hooks that helps them attach to rocks and plants

Behavior

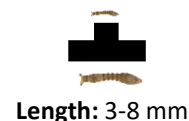
- They anchor themselves to rocks and plants
- They filter water and catch food with their fan-like mouthparts (algae, detritus, tiny invertebrates)
- They can move around with an inchworm movement

Environmental Sensitivity

- Mostly occurs in streams with good water quality
- Are somewhat tolerant of warmer water
- They prefer streams with moderate current

They spin silken threads and can anchor safety lines to where they are located. If a dobsonfly, common stonefly, or other predator comes too close, they can let go of the rock and float downstream. The safety lines prevent them from floating away until they can find something to grab on to.

Image credits: 1



Length: 3-8 mm

SENSITIVE
(Most sensitive to pollution)
Watersnipe Fly

Taxonomy: Order Diptera
Family Athericidae
Watersnipe Fly
Genus ***Atherix***

View from Above



View from the side



Diagnostic characteristics

1. Does not have segmented legs
2. Small head that can be partially retracted into body
3. Abdomen has pairs of prolegs (not true legs) which help them hold on to rocks in fast current
4. **Abdomen has a series of pointy, fleshy filaments on the sides and two larger ones with hairs on the rear end**

Adults lay eggs on plants that hang over the stream. When the eggs hatch, the larvae fall into the water.

Behavior

- These predators eat other macroinvertebrates
- They crawl between rocks in search of prey

Aquatic dance flies look similar but do not have the filaments on the side or rear end.

Environmental Sensitivity

- They inhabit cold, clean streams with good habitat
- Are intolerant of warmer water
- They prefer streams with moderate current

Image credits: 1



Length: 10-18 mm

MODERATELY SENSITIVE
(Moderately sensitive to pollution)

Crane Flies

Taxonomy: Order Diptera
Families Limoniidae
Pediciidae
Tipulidae

Antocha (Limoniidae)



Dicranota (Pediciidae)



Tipula (Tipulidae)



Diagnostic characteristics

1. Does not have segmented legs
2. Head is often retracted into body
3. Grub-like body
4. Various projections and breathing parts on their rear ends
5. Do not have filaments on the side of the body
6. Some have prolegs, some have bumps, some have neither

Adult craneflies look like giant mosquitoes with extra long legs.

The adults are peaceful vegetarians and do not bite, thankfully.

Behavior

- Most species are omnivores that eat detritus, algae, and small invertebrates
- *Dicranota* is a predator
- Most species are somewhat secretive because fish would find them quite tasty
- Some specialize on chewing on dead leaves and can be found in leaf packs
- Tipulidae are the largest crane flies (both larvae and adults)

Environmental Sensitivity

- Mostly occurs in streams with good water quality
- Are somewhat tolerant of warmer water
- They prefer streams with moderate current



Image credits: 1

Length: 10-25 mm but some Tipulidae can be more than 50 mm long

MODERATELY SENSITIVE
(Moderately sensitive to pollution)

Non-biting Midge

Taxonomy: Order Diptera
Family Chironomidae
Non-biting midge
Chironomid (midge)

Orthocladius (from the side)



Tanytarsus (from the side)



Diagnostic characteristics

1. Grub-like body with head and no legs
2. **Both ends of body have similar width**
3. **Pair of prolegs beneath head**
4. **Pair of prolegs on rear end (sometimes hairs too)**

Behavior

- They sometimes wriggle on the bottom of collection pans
- Some make tube-shaped retreats out of silken threads can be found on rocks or in sediment
- Most eat algae, plants, and detritus but a few are predators
- Some make nets out of silk to catch food in flowing water
- They range in color from white to yellow

Close to 400 kinds of midges have been collected from Maine streams, rivers, ponds, and wetlands. Almost all streams in Maine have some kind of midge living in them.

Environmental Sensitivity

- Species range from sensitive to tolerant
- Red midges (page 63) are tolerant of low dissolved oxygen concentrations

Image credits: 1



Length: 5-20 mm

TOLERANT
(Tolerant to pollution)

Non-biting midge
Chironomid (midge)

Red Non-biting Midge

Chironomus
(from the side)



Diagnostic characteristics

1. Grub-like body with head and no legs
2. **Both ends of body have similar width**
3. **Pair of prolegs beneath head**
4. **Pair of prolegs on rear end**
5. **Red or orange body color**

Behavior

- They sometimes wriggle on the bottom of collection pans
- They burrow and make silken tubes in sand and mud
- Most eat algae, plants, and detritus
- They range in color from orange to bright red

Environmental Sensitivity

- Tolerant of low oxygen concentrations

Red and orange midges have a substance like the hemoglobin in our blood, which makes our blood red. It helps them extract oxygen from the water, allowing these midges to survive in habitats where oxygen is scarce.



Length: 10-20 mm

Image credits: 1

MODERATELY SENSITIVE
(Moderately sensitive to pollution)

Aquatic Dance Fly

Taxonomy: Order Diptera
Family Empididae
Aquatic Dance Fly
Genus ***Hemerodromia***

View from the side



View from below



Diagnostic characteristics

1. Does not have segmented legs
2. **Grub-like body with thin neck and small head**
3. **Several short projections on their rear ends**
4. **Do not have projections on the side of the body**
5. **Series of short prolegs on underside of body**

Behavior

- Predators of other invertebrates
- Prefer rocky streams with swift current
- Adults have an erratic flight pattern of twisting and turning above the water ("dancing")
- Some larvae will form pupa in blackfly cocoons after eating the blackfly (some house guest!)

Environmental Sensitivity

- Mostly occurs in streams with good water quality

In comparison, crane flies do not have prolegs on the underside of their bodies.

Watersnipe flies have filaments on the side of their bodies and two longer projections on their rear ends.



Image credits: 1

Length: 2-20 mm

MODERATELY SENSITIVE
(Moderately sensitive to pollution)

Riffle Beetle

Taxonomy: Order
Family

Coleoptera
Elmidae
Riffle Beetle

Views of a *Dubiraphia* adult



Dubiraphia larva



Macronychus larva



Diagnostic characteristics (Adult)

1. Head, thorax with 6 legs, and abdomen
2. **Outer wing is a hard shell**
3. **Long legs with pairs of long claws**
4. **Tiny size**
5. **Long or club-shaped antennae**

Diagnostic characteristics (Larvae)

1. Head, thorax with 6 legs, and abdomen
2. **No wing pads on back**
3. **No projections on the side of the body**
4. **Body is slender and leathery**
5. **Has a tuft of hairs and gills and retractable gills on rear end**

Behavior

- Predators of other invertebrates
- Prefer fast flowing water and rocky substrates
- Some species are common in sandy and silty streams that have branches and woody debris
- Graze on algae and detritus

Environmental Sensitivity

- Mostly occurs in streams with good water quality
- Some occur in urban streams with poor water quality but abundant oxygen and detritus to eat

Image credits: 1

Larvae have retractable gills on their rear ends to get oxygen from water. In contrast, adults have millions of tiny hairs on their bellies that trap a thin layer of air. They breathe the air from this bubble. Oxygen from the water diffuses into the air bubble and replenishes the supply within the bubble. (cool!)



Length: 2-8 mm (adults)
and up to 16 mm (larvae)

MODERATELY SENSITIVE
(Moderately sensitive to pollution)

Water Penny

Taxonomy: Order Coleoptera
Family Psephenidae
Water Penny
Genus *Psephenus*

View from above



View from below



Diagnostic characteristics

1. Distinctive flat, elliptical shape
2. Head, thorax with six legs, and abdomen with gills (as seen from below)

Behavior

- Prefer rocky streams with moderately or swiftly flowing water
- Move around on top of rocks grazing on algae
- The streamlined body shape helps them stick to the top of rocks in fast currents and makes it harder for fish to eat them
- Adult beetles live on land near streams

Environmental Sensitivity

- Mostly occurs in streams with good water quality
- Somewhat tolerant to nutrient enrichment

It can be challenging to spot these in collection pans at first. Pick up any rocks or plants that are in the collection pan to see if the water pennies climbed on to them

Swirl water in the pan and look for the contrast of the swirling material and these beetles stuck to the bottom of the pan



Length: 3-10 mm

Image credits: 1

MODERATELY SENSITIVE
(Moderately sensitive to pollution)

Crayfish

Taxonomy: Order
Family

Decapoda
Cambaridae
Crayfish, Crawdads

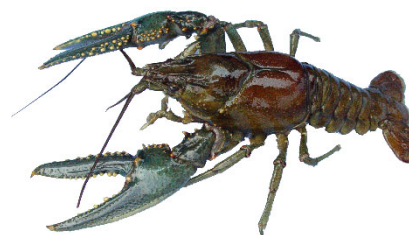
Spiny cheek crayfish (*Faxonius limosus*)

- Patch of spines on cheek, which are easy to feel and see
- Brown body and claws
- Some have reddish brown spots along center of their tail and silvery eyes



Northern Crayfish (*Faxonius virile*)

- Light-colored bumps on cheek and single spines on neck but not a patch of spiky spines on the cheek
- Blueish-green claws with orange tips and yellowish bumps
- Brown body
- Has a few spines on head



Rusty Crayfish (*Faxonius rusticus*)

- Non-native and invasive
- Prominent dark, rust colored spots on either side of the carapace
- Greenish-reddish claws with black bands at the tips



Behavior

- These species occur in a variety of stream habitats, from rocky to muddy
- They are opportunistic feeders that will eat almost anything, even live fish if they can catch them
- They can survive out of water for short periods of time if their gills remain wet
- They make burrows under rocks and in the mud
- Rusty crayfish are aggressive

Crayfish will flick their tails to swim backwards. They sometimes flick their tails when being held, which can startle people.

The best way to hold them is to pinch behind their claws on their carapace.

Environmental Sensitivity

- They mostly occur in streams with clean water but they can tolerate poor water quality to some degree
- They are somewhat tolerant of warm water

Image credits: 16

Length: Up to 100 mm

MODERATELY SENSITIVE
(Moderately sensitive to pollution)

Limpet

Taxonomy: Order Basommatophora
Family Ancyliidae
Limpet
Genus *Ferrissia*

View from the side



View from above



Diagnostic characteristics

1. This snail's unique shell is flattened with a wide opening that points down and a spire that points up and to the rear
2. Its tentacles, eyes and mouth are located under the shell

These non-descript snails have both a an air bubble in the shell that functions like a primitive lung and gill-like structure to obtain oxygen from the water.

Behavior

- Grazes algae from rocks, logs, and plants
- The streamlined body shape helps them stick to the top of rocks in fast currents and makes it harder for fish to eat them
- Although easily overlooked because of their small size, limpets are widespread in Maine streams, lakes, and ponds
- Limpets have 1-2 generations per year
- Air is stored in a cavity inside the shell near the pointy end and functions as a "lung"

Environmental Sensitivity

- Mostly occurs in streams with good water quality but is somewhat tolerant of warm water and nutrient enrichment
- Can be found on rocks, logs, and mud

Image credits: 5



Length: 3-7 mm

MODERATELY SENSITIVE
(Moderately sensitive to pollution)

Mud Snail

Taxonomy: Order
Family

Neotaenioglossa
Hydrobiidae
Mud Snail

***Amnicola* (closed)**



***Amnicola* (open)**



Diagnostic characteristics

1. The shell opens to the right when held with the pointy end up and the opening facing toward you
2. Spiraled shell that is widest by the opening
3. Shell is roughly shaped like a tear drop
4. The tip of the shell is blunt
5. Live snails have a “trap door” called an operculum

It can be challenging to spot these in collection pans at first

Behavior

- Graze on algae and detritus plants, rocks, and mud
- They have gills for obtaining oxygen from water

Pick up any rocks or plants that are in the collection pan to see if they climbed on to them

Environmental Sensitivity

- Mostly occurs in streams with good water quality but is somewhat tolerant of warm water and nutrient enrichment
- They can be abundant in streams with a little nutrient enrichment
- Can be found on rocks, logs, and mud

Swirl water in the pan and look for the contrast of the swirling material and these snails stuck to the bottom of the pan

Image credits: 5



Length: 3-5 mm

TOLERANT
(Least sensitive to pollution)

Other Snails

Taxonomy: Order Basommatophora
Families Lymnaeidae
Physidae
Planorbidae

***Lymnaea* (Lymnaeidae)**



***Physa* (Physidae)**



***Helisoma* (Planorbidae)**



Diagnostic characteristics (Lymnaeidae)

1. When held with the spire up and the opening facing you, the opening is on the right
2. Coils counter-clockwise from the opening to the tip of the spire
3. Does not have a trap-door (operculum)
4. Shell is 5-40 mm from opening to tip of the spire

Diagnostic characteristics (Physidae)

1. When held with the spire up and the opening facing you, the opening is on the left
2. Coils clockwise from the opening to the tip of the spire
3. Does not have a trap-door (operculum)
4. Shell is 5-40 mm from opening to tip of the spire

Diagnostic characteristics (Planorbidae)

1. Coils do not form a pointy spire
2. Shell lays flat like a cinnamon roll
3. Does not have a trap-door (operculum)
4. Shell is 3-30 mm across

Behavior

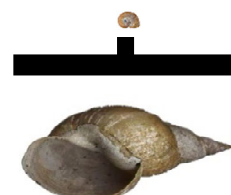
- They mostly graze on algae and detritus

Environmental Sensitivity

- These three snail families are tolerant of warm, polluted water
- They are abundant in nutrient enriched streams

These are the most common types of snails in Maine streams, in addition to the Hydrobiidae. Several other pond snails might show up in streams with sluggish current.

Image credits: 1, 23 (*Lymnaea*)



Length: 3-30 mm

TOLERANT
(Least sensitive to pollution)

Amphipod

Taxonomy: Order

Amphipoda
Side-swimmer,
Scud

Diagnostic characteristics

1. **More than 10 legs**
2. Some resemblance to shrimp
3. Legs are designed for swimming
4. It swims on its side



Behavior

- Eats algae, plants, and detritus
- Several generations per year allows it to recolonize after disturbance

Environmental Sensitivity

- Some species are tolerant of warm water
- Some species are common in urban streams
- Most common in sandy and mucky streams with plants or decaying organic matter



Image credit: 2

Length: 3-5 mm

TOLERANT
(Least sensitive to pollution)

Isopod

Taxonomy: Order

Isopoda
Isopod, Sowbug

Diagnostic characteristics

1. **More than 10 legs**
2. Legs are designed for crawling
3. Pair of appendages on rear end

Behavior

- Eats algae, plants, and detritus
- Several generations per year allows it to recolonize after disturbance

Environmental Sensitivity

- Some species are tolerant of warm water
- Some species are common in urban streams
- Most common in sandy and mucky streams with plants or decaying organic matter



Asellus

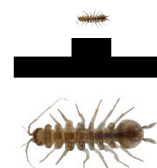


Image credits: 1

Length: 5-20 mm

TOLERANT
(Least sensitive to pollution)

Taxonomy: Order Tubificida
Aquatic oligochaete worm

Aquatic Worm

Diagnostic characteristics

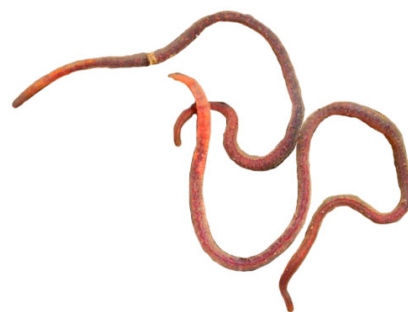
1. Long, thin, delicate segmented body
2. Some have hairs on them
3. Grey to pink coloration

Behavior

- Eats detritus
- Several generations per year allows it to recolonize after disturbance

Environmental Sensitivity

- Some species are tolerant of warm water
- Some species are reddish because they contain hemoglobin
- Some species are common in urban streams
- Most common in sandy and mucky streams



Length: 1-30 mm

TOLERANT
(Least sensitive to pollution)

Taxonomy: Order Hirudinida
Leech

Leech

Diagnostic characteristics

1. Thick, segmented body (A)
2. Mouth adapted for sucking (B)
3. Sucker on rear end (B, C)
4. Range in color from cream to dark grey and brown
5. Bodies can stretch and contract like an accordion

Behavior

- Most are predators and scavengers
- Some suck blood from animals
- Several generations per year allows it to recolonize after disturbance

Environmental Sensitivity

- Some species are tolerant of warm water
- Some species are common in urban streams

Placobdella



Erpobdella



Length: 5-20 mm in Maine streams
(some pond leeches are larger)

Image credits: 1, 13 (*Erpobdella*)

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MAINE STREAM EXPLORERS

A treasure hunt to find healthy streams in Maine.

For information on how to volunteer, please contact Hannah Young with Maine Audubon at 207-781-2330, ext. 219 or hyoung@maineaudubon.org

For help identifying macroinvertebrates, please contact Tom Danielson with the Maine Department of Environmental Protection at thomas.j.danielson@maine.gov