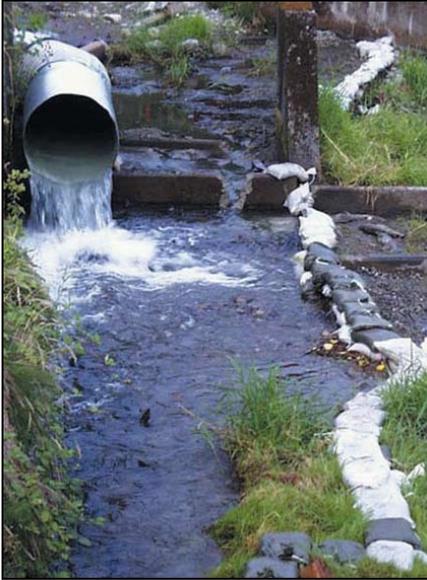


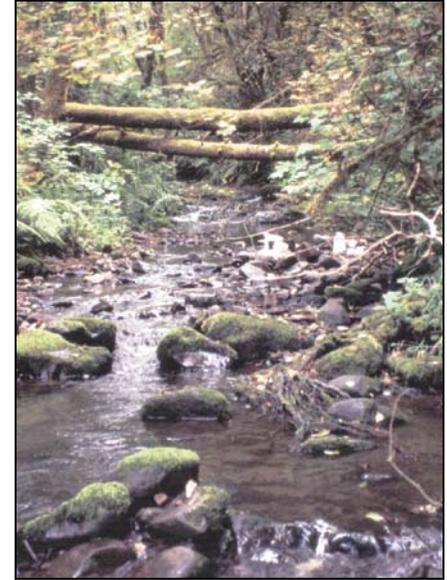
Macroinvertebrates of the Pacific Northwest



A FIELD GUIDE



Companion to the CD-ROM
*Stream Bugs as Biomonitors:
Guide to Pacific Northwest
Macroinvertebrate Monitoring*



Jeff Adams and Mace Vaughan

THE XERCES SOCIETY



Ephemeroptera: Baetidae
(small minnow mayflies)

Habitat: flowing and still waters

Behavior: swimmers

Feeding: collector-gatherers

Tolerance: tolerant

The most common mayflies; have 2 or 3 tails and round, flat gills; the antennae are much longer than the head is wide; in a sample tray, usually dart or swim quickly, stop, float down with legs spread, then swim again.



Ephemeroptera: Ameletidae
(ameletid minnow mayflies)

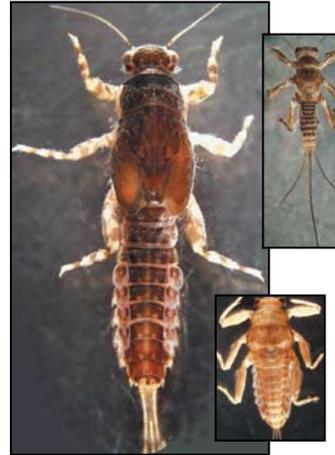
Habitat: rocks; flowing waters

Behavior: swimmers/clingers

Feeding: collector-gatherers

Tolerance: moderate

Sometimes common in small, mountain streams; 3-tailed mayflies with a striking color pattern, a large head, and short antennae; have round, flat gills with a dark line on the outside; fast-swimming.



Ephemeroptera: Ephemerellidae
(spiny crawler mayflies)

Habitat: rocks; flowing waters

Behavior: clingers

Feeding: collector-gatherers

Tolerance: sensitive

Diverse in number of species and appearance; when resting, the gills may move rapidly; gills are never present on the first and second abdominal segments; usually crawl around the bottom of a sample tray.



Ephemeroptera: Leptophlebiidae
(prong-gill mayflies)

Habitat: flowing and still waters

Behavior: swimmers/clingers

Feeding: collector-gatherers

Tolerance: moderate

Very common; found in a variety of freshwater habitats; have 3 tails and usually have long, forked gills; may have tusks at lower elevations; undulate through the water of a sample tray and often wave gills when resting.



Ephemeroptera: Heptageniidae
(flat-headed mayflies)

Habitat: rocks; flowing waters

Behavior: clingers

Feeding: scrapers

Tolerance: moderate

Mayflies with very flattened bodies and 2 or 3 tails; legs spread to the sides; the head appears rounded with large eyes; sometimes swim in a sample tray by undulating awkwardly, but usually cling closely to the bottom.



Ephemeroptera: Leptohyphidae
(little stout crawler mayflies)

Habitat: warmer valley streams and rivers

Behavior: clingers

Feeding: scrapers

Tolerance: tolerant

Stout-bodied mayflies; usually tan or beige with 3 tails; the pair of gills on the second abdominal segment are large triangular plates that cover the remaining gills.



Ephemeroptera: Ephemeridae
(common burrower mayflies)

Habitat: pools and edges of valley streams and rivers

Behavior: burrowers

Feeding: collector-gatherers

Tolerance: tolerant

Large, soft-bodied, and usually yellowish to gray; the front of the head has tusks; gills on the abdomen are large and feather-like; burrow in mud and soft sediments; rare in rocky riffles.



Plecoptera: Peltoperlidae
(roach-like stoneflies)

Habitat: rocks, mosses, leaf packs; flowing water

Behavior: clingers

Feeding: shredders

Tolerance: sensitive

Small stoneflies; shaped like tear drops with very short tails; legs relatively short; the gills are hidden under wingpads; look like tiny roaches; slow and camouflaged in a sample tray.



Plecoptera: Pteronarcyidae
(giant stoneflies)

Habitat: rocks, leaf packs;
flowing waters

Behavior: clingers

Feeding: shredders

Tolerance: moderate

The largest stoneflies, with dark bodies and short tails; slow and lumbering; clusters of white gills cover the underside of the thorax; the top of the first thoracic segment may have pointed corners.



Plecoptera: Perlidae
(golden stoneflies)

Habitat: rocks; flowing waters

Behavior: clingers

Feeding: predators

Tolerance: sensitive

Large, active stoneflies with clusters of finger-like gills between their legs and sometimes between their tails; color ranges from tan to black with light color patterns; gills are less obvious in earlier instars.



Plecoptera: Perlodidae
(little yellow stoneflies)

Habitat: rocks; flowing waters

Behavior: clingers

Feeding: predators

Tolerance: moderate

Medium-sized, active, diverse stoneflies; look similar to golden stoneflies, but without clusters of gills; may have one or two finger-like gills between their legs; may have light stripes running down the abdomen.



Plecoptera: Chloroperlidae
(little green stoneflies)

Habitat: rocks, leaf packs;
flowing water

Behavior: clingers

Feeding: predators

Tolerance: moderate

Common, small, tan stoneflies; the abdomen is long, widest in the middle; tails are shorter than the length of the abdomen; they crawl like in the water of a sample tray.



Plecoptera: Nemouridae
(little brown stoneflies)

Habitat: rocks, organic debris;
flowing water

Behavior: clingers

Feeding: shredders

Tolerance: moderate

Very common; small, hairy, reddish-brown stoneflies; the legs are relatively long; most have small gills beneath the neck or head; crawl slowly and blend into the debris in a sample tray.



Plecoptera: Leuctridae
(rolled-winged stoneflies)

Habitat: rocks, leaf packs;
flowing water

Behavior: sprawlers/clingers

Feeding: shredders

Tolerance: moderate

Long, thin stoneflies; bodies uniformly gray to reddish-brown; the entire abdomen is the same width; the tails are long, but break easily; may look very similar to a fir needle.



Plecoptera: Capniidae
(slender winter stoneflies)

Habitat: rocks, leaf packs;
flowing water

Behavior: sprawlers/clingers

Feeding: shredders

Tolerance: sensitive

Bodies are gray to tan; the abdomen is usually widest in the middle; the tails are long; very small in late summer or fall samples; may get caught in the surface tension of a sample tray.



Trichoptera: Hydropsychidae
(net-spinner caddisflies)

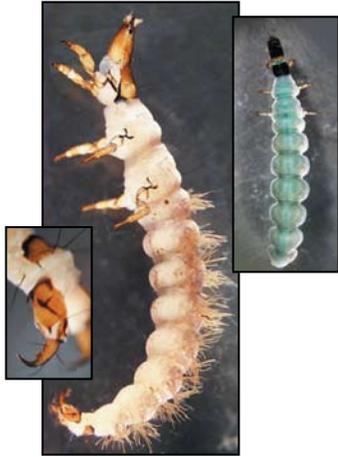
Habitat: rocks; flowing waters

Behavior: clingers

Feeding: collector-filterers

Tolerance: tolerant

Have solid plates on top of all 3 thoracic segments and a tuft of hair on each of the 2 legs at the end of the abdomen; build stationary shelters; in a sample tray, wiggle side-to-side or crawl with body hunched up.



Trichoptera: Rhyacophilidae
(free-living caddisflies)

Habitat: rocks; flowing waters

Behavior: clingers

Feeding: predators

Tolerance: moderate

The only caddisflies that do not build shelters or cases; most are bright green to greenish-brown; may or may not have gills; unlike others on this page, have a hard plate on top of the last abdominal segment.



Trichoptera: Philopotamidae
(finger-net caddisflies)

Habitat: under rocks; flowing waters

Behavior: clingers

Feeding: collector-filterers

Tolerance: moderate

The bodies are usually yellowish with tan heads; unlike others on this page, have a white fleshy extension at the front of the head; build stationary shelters; wiggle actively in a sample tray.



Trichoptera: Psychomyiidae
(net-tube caddisflies)

Habitat: rocks; flowing waters

Behavior: clingers

Feeding: collector-gatherers

Tolerance: moderate

Similar to free-living and tube-maker caddisflies, but have no plate on the last abdominal segment and lack spots on the head; have a hatchet-shaped appendage at the base of the front legs; build stationary shelters.



Trichoptera: Polycentropodidae
(tube-maker caddisflies)

Habitat: solid substrates; flowing or still water

Behavior: clingers

Feeding: predators

Tolerance: moderate

The heads usually have many dark spots; the long bodies are usually pinkish; have no plate on top of the last abdominal segment; build stationary shelters.



Trichoptera: Glossosomatidae
(saddle-case-maker caddisflies)

Habitat: rocks; flowing waters

Behavior: clingers

Feeding: scrapers

Tolerance: moderate

The body is distinctive with dark hard parts on the head, the legs, and the top of the first thoracic segment; the body is slightly curved, as is the unique tortoise-shell-like case that these caddisflies build of sand and pebbles.



Trichoptera: Hydroptilidae
(purse-case-maker caddisflies)

Habitat: mostly slower waters

Behavior: clingers/climbers

Feeding: scrapers

Tolerance: tolerant

Mature larvae of these algae eaters build purse-like cases of silk with sand or algae; the body is usually distinctly flattened side-to-side, with hard plates on the top of each thoracic segment; small and difficult to see.



Trichoptera: Helicopsychidae
(snail-case-maker caddisflies)

Habitat: gravels; flowing waters

Behavior: clingers/climbers

Feeding: scrapers

Tolerance: tolerant

Unmistakable, coiled sand cases are shaped like a snail; the body is also dramatically curved; found from cold springs to warm rivers and from fast streams to lake shores, but most common in large warm rivers.



Trichoptera: Leptoceridae
(longhorned case-maker caddisflies)

Habitat: most fresh waters

Behavior: clingers/sprawlers

Feeding: predators/collector-gatherers

Tolerance: moderate

The cases are made of sand or organic debris; the hind leg is long and curved behind the head; the only caddisflies with antennae long enough to be noticeable.



Trichoptera: Brachycentridae
(humpless case-maker
caddisflies)

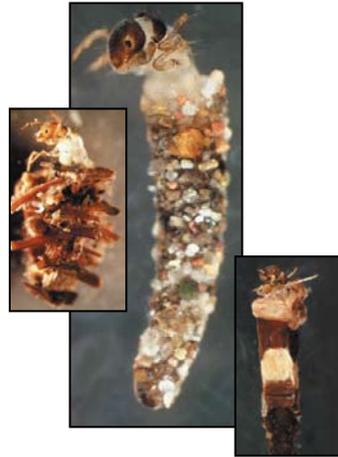
Habitat: flowing waters

Behavior: clingers/climbers

Feeding: shredders/collectors

Tolerance: moderate

Diverse in appearance and feeding; the case is either round or square in cross section; legs may be long for filtering food; the head and legs are tan to reddish-brown.



Trichoptera: Lepidostomatidae
(case-maker caddisflies)

Habitat: slower current of
smaller streams

Behavior: climbers/sprawlers

Feeding: shredders

Tolerance: sensitive

The case can be spiraling pieces of plant matter, a sand cone, or 4 wood-paneled sides; the head is usually dark with light spots; the antennae are at the front edge of the eye, but hard to see.



Trichoptera: Uenoidae
(case-maker caddisflies)

Habitat: rocks; flowing waters

Behavior: clingers

Feeding: scrapers

Tolerance: moderate

Relatively common case-maker caddisflies; the case is either thick and pebbly (moderately tolerant) or long, thin, and smooth (highly sensitive species found in mountain streams).



Trichoptera: Limnephilidae
(northern case-maker
caddisflies)

Habitat: most fresh waters

Behavior: climbers/sprawlers

Feeding: shredders

Tolerance: moderate

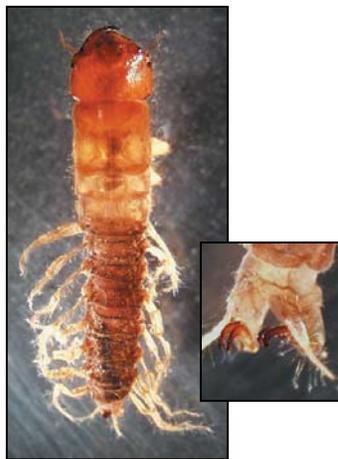
Diverse group of large caddisflies. [Less common case-maker caddisflies are not included in this guide; please see the CD-ROM for more detail.]



Megaloptera: Sialidae
(alderflies)

Habitat: slow and still waters
Behavior: burrowers/climbers
Feeding: predators
Tolerance: tolerant

Active predators found in slower areas of streams and in wetlands and other still water; the abdominal segments have a long filament sticking out to each side; the abdomen has a single, long filament at the end.



Megaloptera: Corydalidae
(hellgrammites)

Habitat: cold rocky streams
Behavior: clingers
Feeding: predators
Tolerance: sensitive

Large, active predators found in cold, rocky, mountain streams; the abdominal segments have a long filament sticking out to each side; the abdomen has a pair of prolegs at the end, each with a pair of hooks.



Odonata: Anisoptera
(dragonflies)

Habitat: mostly still waters
Behavior: sprawlers/climbers
Feeding: predators
Tolerance: tolerant

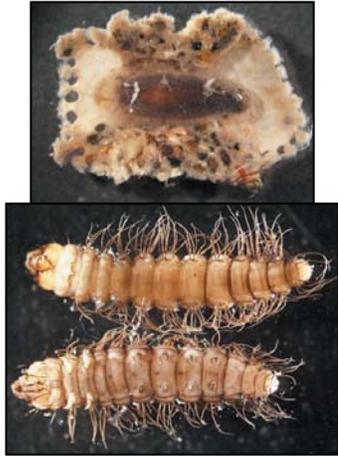
The body is wide; the underside of the head has an extendible mouthpart used for grabbing prey, but usually held tight to the head; the abdomen has no gills or tails, but may have 3 short, sharp points at the end.



Odonata: Zygoptera
(damselflies)

Habitat: mostly still waters
Behavior: climbers
Feeding: predators
Tolerance: tolerant

The body is long and thin; the underside of the head has an extendible mouthpart used for grabbing prey, but usually held tight to the head; the end of the abdomen has 3 flat, tail-like gills.



Lepidoptera: Pyralidae
(aquatic caterpillars)

Habitat: open rivers and streams

Behavior: clingers

Feeding: scrapers

Tolerance: tolerant

Usually found in larger, warmer rivers; build silken shelters on rocks in flowing water; the thorax and abdomen have clusters of gills; the eyes are a small group of spots; the middle of the abdomen has four pairs of tiny prolegs.



Coleoptera: Elmidae
(riffle beetles)

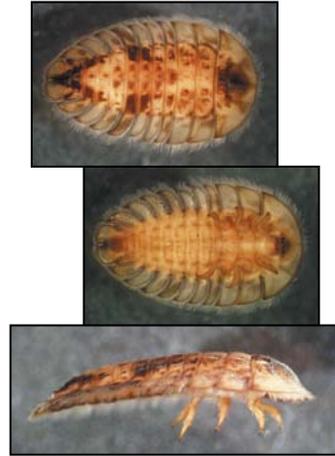
Habitat: flowing waters

Behavior: clingers/climbers

Feeding: collector-gatherers

Tolerance: moderate

Larvae and adults are both regularly collected in riffle samples; adults are very small and slow moving; larvae have long, hardened bodies; generally well-camouflaged and difficult to see in a sample tray.



Coleoptera: Psephenidae
(water pennies)

Habitat: strongly flowing waters

Behavior: clingers

Feeding: scrapers

Tolerance: tolerant

Flat, round beetle larvae; tan to brown, often with a mottled pattern; plates extending from the body segments cover the head and legs. [Other beetle families are less common in riffles; please see the CD-ROM.]



Arachnida: Hydracarina
(water mites)

Habitat: most fresh waters

Behavior: swimmers/clingers

Feeding: predators/scavengers

Tolerance: tolerant

Common in most freshwater habitats, and often collected in riffle samples; look like tiny red, gray, or green dots with 8 legs; move rapidly around the bottom of a sample tray.



Crustacea: Decapoda
(crayfish)

Habitat: most fresh waters
Behavior: sprawlers
Feeding: collector-gatherers
Tolerance: moderate

One of the largest and most easily observed macroinvertebrates in Northwest streams; has 8 legs and 2 large claws; the exoskeleton is usually quite hard. Only the genus *Pacifastacus* is native to the Northwest.



Crustacea: Amphipoda
(scuds)

Habitat: most fresh waters
Behavior: climbers/swimmers
Feeding: collector-gatherers
Tolerance: tolerant

Bodies are flattened side-to-side, curved from head to tail, and gray to green; may carry eggs under the abdomen; usually swim or crawl on their side in a sample tray.



Crustacea: Isopoda
(aquatic sow bugs)

Habitat: most fresh waters
Behavior: sprawlers
Feeding: collector-gatherers
Tolerance: tolerant

Bodies are flattened top-to-bottom and grayish to brown; found in most aquatic habitats, but can be common in shallow flowing waters; crawl flat along the bottom of a sample tray.



Crustacea: Ostracoda
(seed shrimp)

Habitat: most fresh waters
Behavior: climbing/swimming
Feeding: collector-gatherers
Tolerance: tolerant

Generally white to grayish-green; tiny, clam-like, jelly-bean-shaped crustaceans; the exoskeleton is expanded to cover the body with a bivalve "shell"; 1 dark eye and 3 pairs of highly modified legs are sometimes visible.



Diptera: Simuliidae
(black flies)

Habitat: most flowing waters

Behavior: clingers

Feeding: collector-filterers

Tolerance: tolerant

Bowling-pin shaped; usually brown to black, with 2 fans on the head; move in a sample tray by placing the head down, spinning a pad of silk, then inching the hind end forward to hook into the silk.



Diptera: Chironomidae
(midges)

Habitat: most fresh waters

Behavior: burrowers

Feeding: collectors/predators

Tolerance: tolerant

Extremely common, very diverse, and usually quite small; sometimes red, yellow, gray, or purple; the body is thin with a hard head and a pair of prolegs at each end; often wiggle actively in a sample tray.



Diptera: Ceratopogonidae
(biting midges)

Habitat: most fresh waters

Behavior: sprawlers/burrowers

Feeding: predators

Tolerance: tolerant

Either long, thin, and tubular with a brown head, striped body, and pointed hind end; or short, thick, and spiny with front and rear prolegs; may wiggle actively in a sample tray.



Diptera: Dixidae
(dixid midges)

Habitat: slow flowing waters

Behavior: swimmers/climbers

Feeding: collector-gatherers

Tolerance: moderate

Often dark; the head is usually tilted back; swim in a wiggling U-shape; feed with the curve of the U out of the water and head submerged; have plates on the rear end and 1 or 2 pairs of short prolegs at the front of the abdomen.



Diptera: Tipulidae
(crane flies)

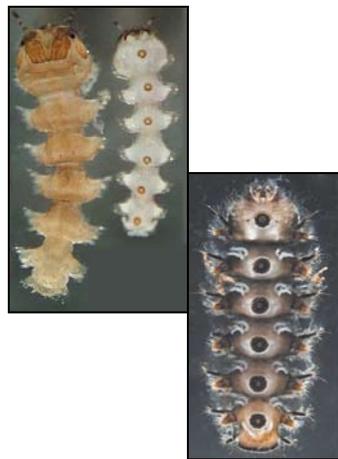
Habitat: most fresh waters

Behavior: burrowers/sprawlers

Feeding: predators/shredders

Tolerance: tolerant

Very diverse group: some have fleshy prolegs on the abdomen, some have swollen areas, others have neither; body gold to brown, often translucent; the head is concealed under the skin; hind end has 1 to 8 short to long lobes.



Diptera: Blephariceridae
(net-winged midges)

Habitat: fast, cold waters

Behavior: clingers

Feeding: scrapers

Tolerance: sensitive

Unique group with 7 deeply separated body sections (the largest includes the head); brown to black from above; a fleshy sucker is present on the underside of the first 6 body sections; move slowly; found on larger rocks.



Diptera: Deuterophlebiidae
(mountain midges)

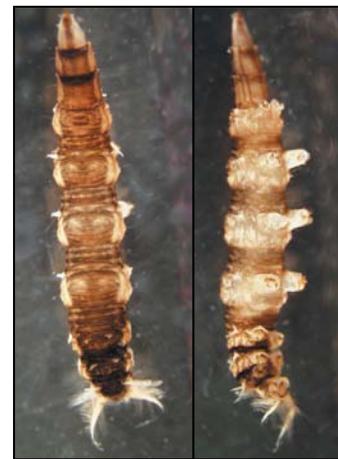
Habitat: small, fast, cold streams

Behavior: clinger

Feeding: scrapers

Tolerance: sensitive

The head is dark and distinct with long forked antennae; 3 thoracic segments are clearly visible; the abdomen has 7 pairs of fleshy legs; found on large rocks in fast, well-oxygenated streams.



Diptera: Athericidae
(water snipe flies)

Habitat: swift rocky streams

Behavior: clingers

Feeding: predators

Tolerance: tolerant

Usually brown in color; the abdomen has 7 pairs of prolegs and a single proleg at the end; the body has fleshy lobes sticking out to the sides and off of the hind end; crawl along the bottom of a sample tray.



Platyhelminthes: Turbellaria
(flatworms or planarians)

Habitat: most fresh waters

Behavior: clingers

Feeding: predators/collectors

Tolerance: moderate

Extremely flattened; gray to brown; very soft body, easily damaged or torn; no distinguishing features, but may be shaped like a wide arrow and have eyespots; glide smoothly across the bottom of a sample tray.



Annelida: Oligochaeta
(aquatic earthworms)

Habitat: most fresh waters

Behavior: burrowers

Feeding: collector-gatherers

Tolerance: tolerant

Long, tubular, many-segmented worms with blunt ends and few distinguishing features; have tiny bristles on each segment; color ranges from white to reddish brown.



Annelida: Hirudinea
(leeches)

Habitat: slow or still waters

Behavior: clingers/swimmers

Feeding: predators

Tolerance: tolerant

The body is usually tough and composed of dozens of segments; have front and rear suckers; the front sucker may be small; front segments usually have numerous eyespots; move by inching along with the suckers or swimming.



Nematoda
(roundworms or nematodes)

Habitat: all fresh waters

Behavior: burrowers

Feeding: mostly predators and parasites

Tolerance: tolerant

Short, unsegmented worms; clear, gray, or white in color; usually pointed on one end, and variously blunt on the other; tiny and rarely seen in the field.



Mollusca: Bivalvia
(clams)

Habitat: most fresh waters

Behavior: burrowers

Feeding: collector-filterers

Tolerance: tolerant

Small- to medium-sized mollusks with 2 round shells attached by a hinge; color may be clear or white to tan or brown. If it is much larger than a pea and has a shell with ridges, it is probably the introduced Asian clam.



Mollusca: Bivalvia
(mussels)

Habitat: soft to sandy bottoms

Behavior: burrowers

Feeding: collector-filterers

Tolerance: sensitive

Large mollusks with 2 hard, usually oval shells connected by a hinge; the outside of the shell is typically brown to black; more common in still or slow water, but those pictured on the left above may be found in streams.



Mollusca: Gastropoda
(snails)

Habitat: most fresh waters

Behavior: clingers

Feeding: scrapers

Tolerance: tolerant

Diverse in shape and size, but all have a single, coiled shell; the shell is most often cone-like or flattened; a hard plate may cover the opening in the shell when the soft body is retracted.



Mollusca: Gastropoda
(limpets)

Habitat: rocks; flowing waters

Behavior: clingers

Feeding: scrapers

Tolerance: tolerant

These snails have a dark, low cone for a shell instead of the typical coiled shell of most snails; a large foot and soft body are protected by the shell; a rasping mouthpart may also be visible when upside down.

This guide was developed as a field companion to the Xerces Society's CD-ROM, *Stream Bugs as Biomonitors: Guide to Pacific Northwest Macroinvertebrate Monitoring*. The images in this guide are representative of common and readily visible groups of species encountered in wadeable streams of the Pacific Northwest. General information is included on the identification and natural history of each group. Most images are of entire organisms; in some cases close-ups highlight particular features mentioned in the text.



Each entry begins with the scientific name of the group, followed by its common name in parentheses. The black and grey lines to the left of each image indicate the range of body lengths of the mature aquatic forms in each group (immature individuals are smaller). An arrowhead indicates that some of the species in the group may be larger than can be shown.

Habitat describes characteristics of the aquatic habitat in which each group of species is found.

Behavior indicates the behaviors typical of each group:

- Burrowers** live among silt, sand, and organic material;
- Clingers** attach to substrates in current;
- Climbers** move vertically on plants or debris;
- Sprawlers** live on top of plant debris or soft substrates;
- Swimmers** cling to submerged objects, then swim through the water column in short bursts.

Feeding indicates the **Functional Feeding Group** to which the species belong, and thus the feeding methods they employ:

- Shredders** shred large pieces of plant matter;
- Scrapers** eat algae coating underwater surfaces;
- Collector-filterers** filter fine particles of decomposing organic matter suspended in the water;
- Collector-gatherers** gather fine particles of decomposing organic matter from the substrate or surface film;
- Predators** eat living animals, usually other macroinvertebrates, but fish and amphibians as well;
- Parasites** live and feed on living animal hosts.

Tolerance indicates the ability of a group of species to withstand stresses caused by such human disturbances as water pollution, sedimentation, and changes in temperature:

- Sensitive** means that the species in the group are severely affected by human disturbance;
- Moderate** means that species in the group are somewhat sensitive to human disturbance;
- Tolerant** means that species in the group can withstand a high degree of human disturbance.

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