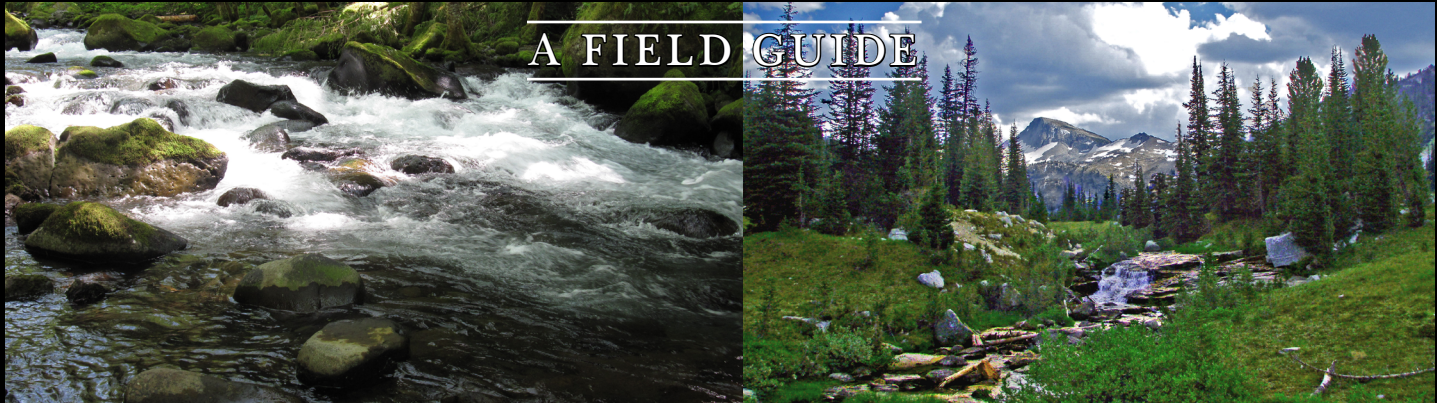


# Macroinvertebrate Indicators of Streamflow Duration OR, WA, & ID



Prepared for the U.S. Environmental Protection Agency, Region 10  
*A companion to the Streamflow Duration Assessment Method for the Pacific Northwest*

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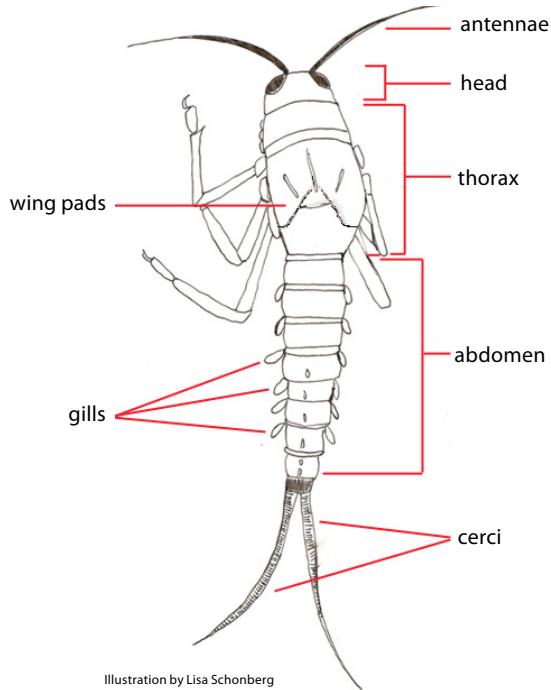
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THE XERCES SOCIETY

# ANATOMY AND TERMS

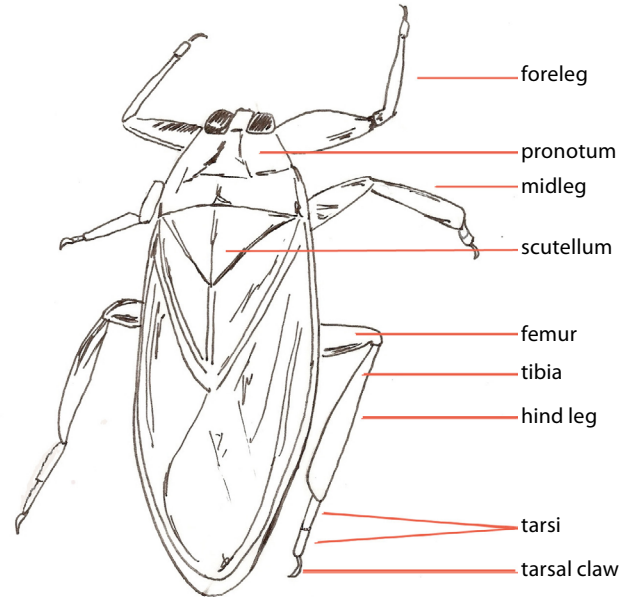
All insects have 3 major body regions: head, thorax, and abdomen. The thorax consists of 3 segments which bear 3 pairs of true legs; immature stages have wing pads, adults have 2 pairs of wings. The abdomen consists of 11 segments which may carry prolegs, gills, cerci, or filaments.

*Dorsal view of a mayfly (Ephemeroptera) nymph*



*Dorsal view of a giant water bug (Hemiptera) adult*

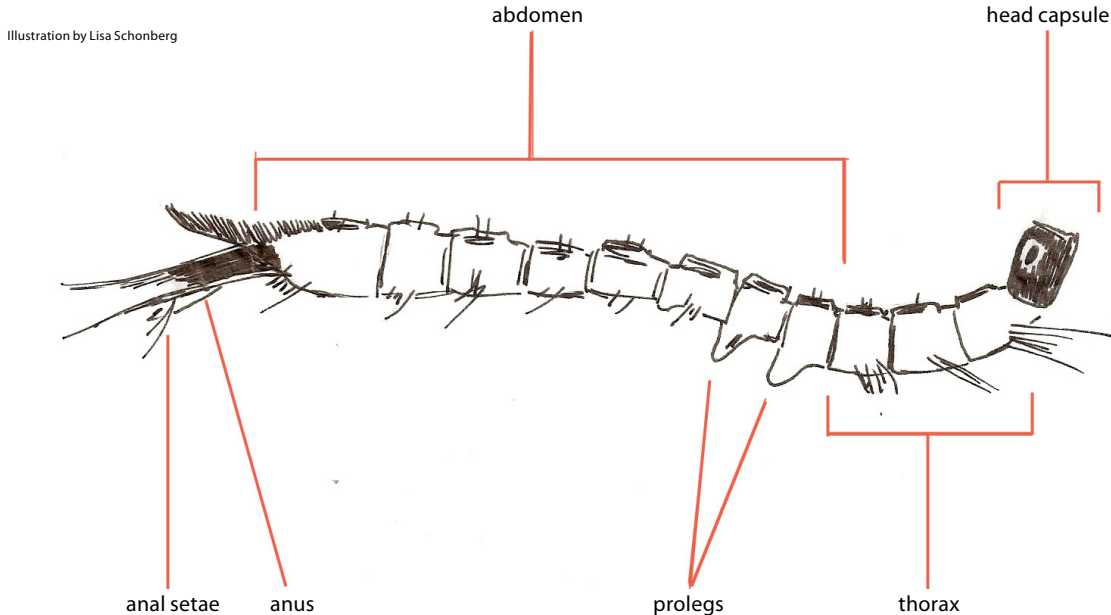
Illustration by Lisa Schonberg



# ANATOMY AND TERMS

Among insects that undergo incomplete metamorphosis (nymph → adult), nymph and adult forms look very similar (Ephemeroptera, Plecoptera, Hemiptera, Odonata). Among insects that undergo complete metamorphosis (larva → pupa → adult), larval and adult forms look very different (Diptera, Coleoptera, Megaloptera, Trichoptera).

## *Lateral view of a dixid midge fly (Diptera: Dixidae) larva*



# GUIDE TO ORDERS

<b><i>Ephemeroptera: Mayflies</i></b>	<i>Larvae (nymphs):</i> elongated body, may be cylindrical or flattened, 3 - 20 mm (0.1 - 0.8 in.); tip of abdomen with 3 (sometimes 2) long slender cerci (tails); developing forewing pads visible; plate-like, feathery, or fringed gills at sides of abdomen; some types have larger fore-gills that form a shield-like cover over other gills; conspicuous eyes; slender antennae; scale bars in guide do not include length of cerci.	Page 6
<b><i>Plecoptera: Stoneflies</i></b>	<i>Nymphs:</i> elongate, slightly flattened, roach-like body 5 - 35 mm (0.2 - 1.4 in.); long slender antennae; 2 pairs of wing pads visible on older larvae; tip of abdomen with 2 cerci (tails); finger-like or filamentous gills may be visible on bases of legs, thorax, or underside of abdomen; scale bars in guide do not include length of cerci.	Page 8
<b><i>Trichoptera: Caddisflies</i></b>	<i>Larvae:</i> elongate, caterpillar-like body; antennae reduced and inconspicuous; no wing pads; tip of abdomen has a pair of short, clawed anal prolegs but no cerci (tails); 2 - 40 mm (0.08 - 1.6 in.); filamentous gills may be present in some types; some are free-living and spin silken nets, others build elongated cylindrical, coiled, or saddle-shaped portable cases from stones, twigs, leaves, and other organic material; cases may persist in dry channels.	Page 10
<b><i>Coleoptera: Aquatic Beetles</i></b>	<i>Larvae:</i> body shapes vary; most types elongated, cylindrical, some dome-shaped; may have long filaments at the sides or tip of abdomen; well-developed, tough head and mouthparts; no wing pads; 2 - 70 mm (0.08 - 2.8 in.). <i>Adults:</i> body shapes vary; often oval and slightly flattened, some types cylindrical; forewings form hard, smooth, and shiny covers when folded, meet in straight line down the back, covering membranous hindwings and most of abdomen; legs may be flattened or fringed with swimming hairs; 1 - 40 mm (0.04 - 1.6 in.).	Page 12
<b><i>Odonata: Dragonflies &amp; Damselflies</i></b>	<i>Nymphs: dragonflies</i> = stout, cylindrical to flattened body; abdomen ends in 3 short stiff points; <i>damselflies</i> = slender elongated body with 3 flattened leaf-like gills at tip of abdomen; both have large eyes, wing pads, long extendable "lower lip" (labium) that masks the lower part of the head when not in use; 10 - 60 mm (0.4 - 2.4 in.).	Page 13



# GUIDE TO ORDERS

<b><i>Hemiptera: Aquatic True Bugs</i></b>	<i>Larvae (nymphs) and adults:</i> slender body, oval to elongate, may be flattened; 1 - 65 mm (0.04 - 2.6 in.); cone or needle-like beak arises from front of head, folded under body when not in use; have developing wing pads (nymphs) or wings (adults); adult forewings thickened and leathery at base, membranous at tips, cross at tips when folded; legs may be flattened like oars or fringed with swimming hairs.	Page 15
<b><i>Diptera: Aquatic &amp; Semi-aquatic True Flies</i></b>	<i>Larvae:</i> usually elongate, maggot-like forms; 1 - 100 mm (0.04 - 3.9 in.); head may or may not be well developed and conspicuous; eyes are poorly developed; mouthparts often highly modified; wing pads absent; abdomen is 8 - 10-segmented; abdomen may have variously developed prolegs (lobe-like legs or welts) on various segments; terminal segment may have prolegs or other fleshy or filamentous processes.	Page 16
<b><i>Mollusca: Bivalvia (mussels &amp; clams)</i></b>	Bivalves have 2 similar-looking halves of a shell connected by a hinge; large, strong foot for locomotion, and two siphons with which they pull water into the body, filter out food, then push the used water back out of the body. <i>Clams:</i> small to large ; white to tan, or brown and white striped. <i>Mussels:</i> are usually very large, brown to black, and oblong with the hinge just off-center of one of the shell's long edges.	Page 18
<b><i>Mollusca: Gastropoda (snails &amp; limpets)</i></b>	<i>Snails:</i> very diverse group; shell shape and color vary, but all have a single shell that is coiled one to several times and into which the soft body can be withdrawn; shell is most often cone-like or flattened often with a hard plate (operculum) covering the opening of the shell. <i>Limpets:</i> have a single, uncoiled shell that forms a tiny cone that protects the body only from above.	Page 19
<b><i>Additional Groups of Aquatic Invertebrates</i></b>	<i>Megaloptera</i> (fishflies, dobsonflies, & alderflies): larvae are large and distinctive; head is thick and tough with noticeable mouthparts; plate covers each thoracic segment; long tapering filaments on sides of abdomen. <i>Turbellaria</i> (flatworms): soft, elongated unsegmented bodies; strongly flattened from top-to-bottom. <i>Crustacea</i> (crustaceans): 5 or more pairs of legs (10 or more total); some have a shell-like carapace that may hide the legs. <i>Oligochaeta</i> (aquatic earthworms): soft, elongated tubular body with many segments; may look similar to earthworms but smaller. <i>Hirudinea</i> (leeches): soft, muscular, segmented body flattened top to bottom; sucker on anterior and posterior end. <i>Nematoda</i> (roundworms): small, unsegmented, worm-like; tough, usually white bodies.	Page 20

## Ephemeroptera: Mayflies



Ephemeroptera: Baetidae  
(small minnow mayflies)

**Habitat:** flowing and still waters

**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

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.



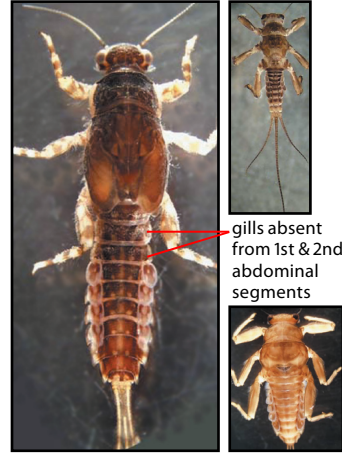
Ephemeroptera: Ameletidae  
(ameletid minnow mayflies)

**Habitat:** rocks; flowing waters

**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

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.



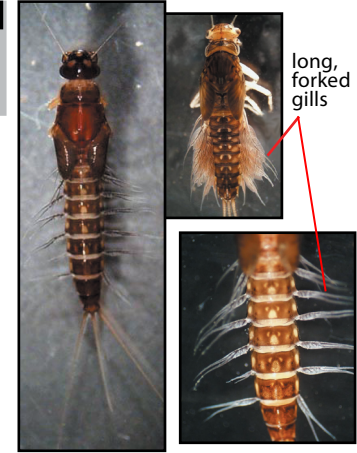
Ephemeroptera: Ephemerellidae  
(spiny crawler mayflies)

**Habitat:** rocks; flowing waters

**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

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

**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

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: Mayflies



Ephemeroptera: Heptageniidae  
(flat-headed mayflies)

**Habitat:** warmer valley streams

**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

Mayflies with very flattened bodies; 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.



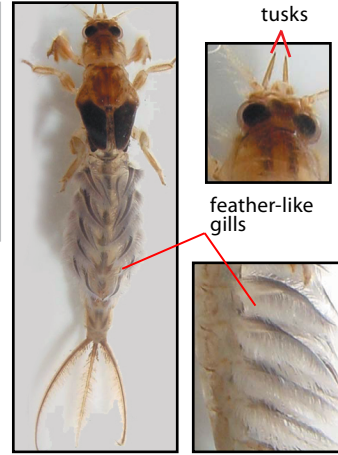
Ephemeroptera: Isonychiidae  
(brush-legged mayflies)

**Habitat:** flowing water; often in riffle areas

**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

Mayflies with a minnow-like appearance while swimming; forelegs with long rows of filtering hairs; gill tufts present at base of mouthparts.



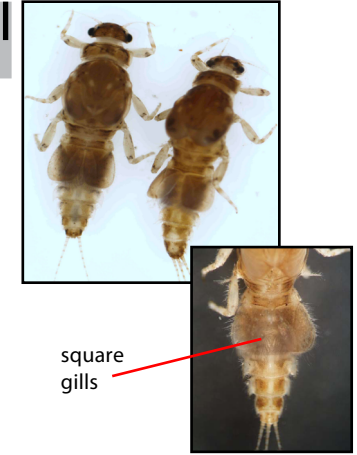
Ephemeroptera: Ephemeridae  
(common burrower mayflies)

**Habitat:** pools and edges of valley streams and rivers

**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

Large, soft-bodied, 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.



Ephemeroptera: Caenidae  
(little squaregill mayfly)

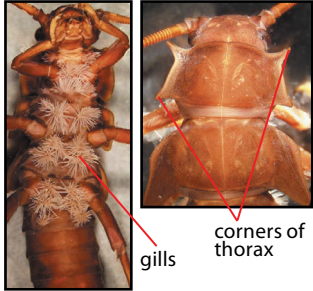
**Habitat:** slow water; silt-bottom edges of streams

**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

Distinguished by the small, square, plate-like gills that overlap and cover their succeeding pair of gills; somewhat hairy, they trap organic debris against their bodies .

## Plecoptera: Stoneflies



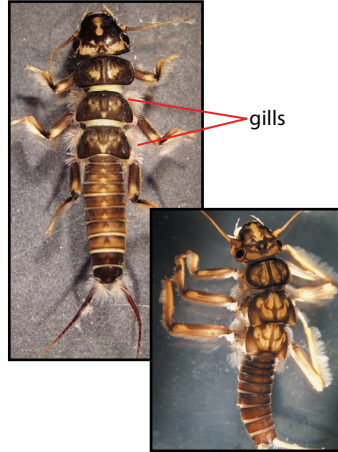
Plecoptera: Pteronarcyidae  
(giant stoneflies)

**Habitat:** rocks, leaf packs;  
flowing waters

**Indicator Status:** perennial

**Regional Distribution:** widespread

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.



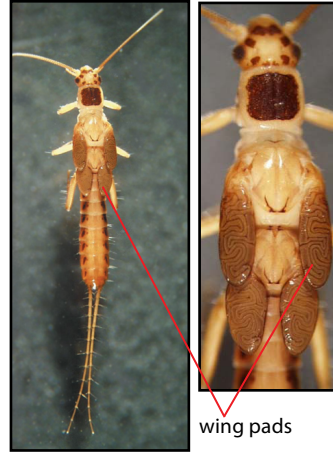
Plecoptera: Perlidae  
(golden stoneflies)

**Habitat:** rocks; flowing waters

**Indicator Status:** perennial

**Regional Distribution:** widespread

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.



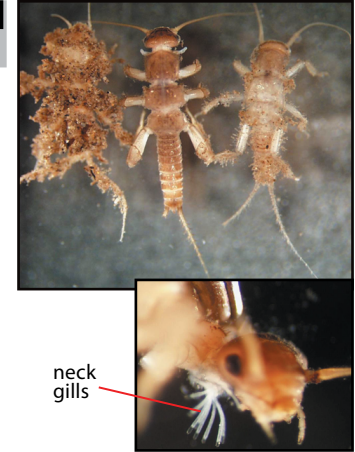
Plecoptera: Capniidae  
(slender winter stoneflies)

**Habitat:** rocks, leaf packs; flowing water

**Indicator Status:** intermittent

**Regional Distribution:** widespread

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.



Plecoptera: Nemouridae  
(little brown stoneflies)

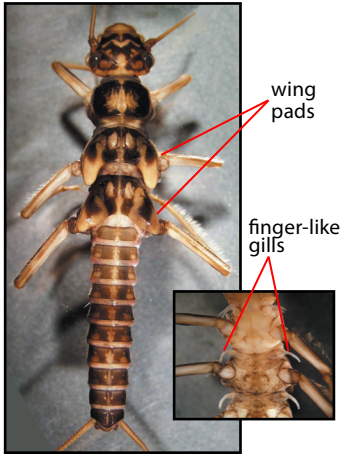
**Habitat:** rocks, organic debris; flowing water

**Indicator Status:** intermittent

**Regional Distribution:** widespread

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: Stoneflies



Plecoptera: Perlodidae  
(little yellow stoneflies)

**Habitat:** rocks; flowing waters

**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

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.



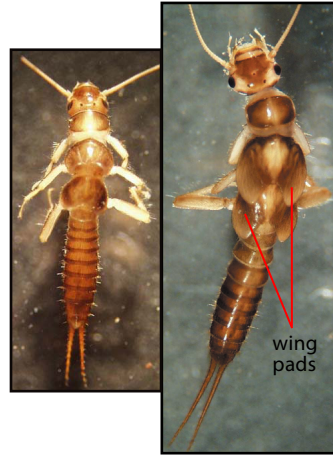
Plecoptera: Leuctridae  
(rolled-winged stoneflies)

**Habitat:** rocks, leaf packs; flowing water

**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

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.



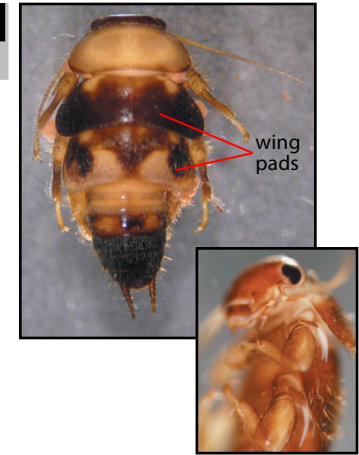
Plecoptera: Chloroperlidae  
(little green stoneflies)

**Habitat:** rocks, leaf packs; flowing water

**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

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



Plecoptera: Peltoperlidae  
(roach-like stoneflies)

**Habitat:** rocks, mosses, leaf packs; flowing water

**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

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.



## Trichoptera: Caddisflies



Trichoptera: Rhyacophilidae  
(free-living caddisflies)

**Habitat:** rocks; flowing waters

**Indicator Status:** perennial

**Regional Distribution:** widespread

The only caddisflies that do not build shelters or cases; most are bright green to greenish-brown; may or may not have gills; body looks constricted around each segment; have a hard plate on top of the last abdominal segment.



Trichoptera: Philopotamidae  
(finger-net caddisflies)

**Habitat:** under rocks; flowing waters

**Indicator Status:** perennial

**Regional Distribution:** widespread

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



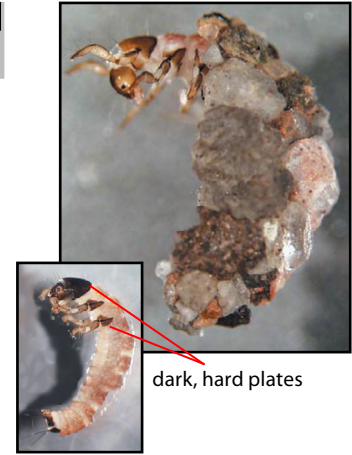
Trichoptera: Hydropsychidae  
(net-spinner caddisflies)

**Habitat:** rocks; flowing waters

**Indicator Status:** perennial

**Regional Distribution:** widespread

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



Trichoptera: Glossosomatidae  
(saddle-case-maker caddisflies)

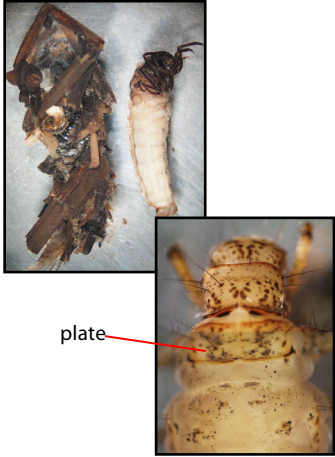
**Habitat:** rocks; flowing waters; esp. clear, cool forested headwater streams

**Indicator Status:** perennial

**Regional Distribution:** widespread

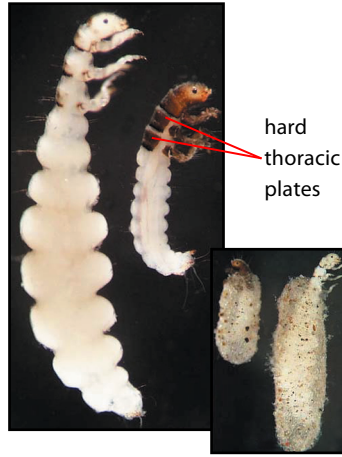
Body distinctive with dark hard plates on head, legs, and top of first thoracic segment; body is slightly curved, as is the unique tortoise shell-like case of sand and pebbles.

## Trichoptera: Caddisflies



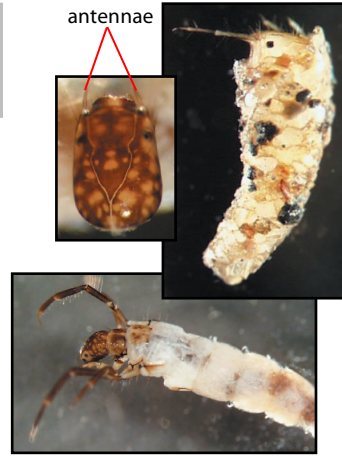
Trichoptera: Limnephilidae  
(northern case-maker caddisflies)

**Habitat:** most fresh waters  
**Indicator Status:** intermittent  
**Regional Distribution:** widespread  
 Diverse group of large caddisflies; cases vary and may be made from small twigs or particles of rocks; top of the 1st thoracic segment covered by hard plate; antennae halfway between eyes and front of head.



Trichoptera: Hydroptilidae  
(purse-case-maker caddisflies)

**Habitat:** mostly slower waters  
**Indicator Status:** > 1 stream class  
**Regional Distribution:** widespread  
 Mature larvae 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; very small and difficult to see.



Trichoptera: Leptoceridae  
(longhorned case-maker caddisflies)

**Habitat:** most fresh waters  
**Indicator Status:** > 1 stream class  
**Regional Distribution:** widespread  
 The cases are made of sand or organic debris; the hind legs are long and curved behind the head; the only caddisflies with antennae long enough to be noticeable.



Trichoptera: Helicopsychidae  
(snail-case-maker caddisflies)

**Habitat:** gravels; flowing waters  
**Indicator Status:** > 1 stream class  
**Regional Distribution:** widespread  
 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.



## Coleoptera: Beetles



Coleoptera: Elmidae  
(riffle beetles)

**Habitat:** flowing waters  
**Indicator Status:** perennial  
**Regional Distribution:** widespread  
 Larvae (bottom) and adults (top) are both regularly collected in riffle samples; adults are very small and slow moving; larvae have long, cylindrical, hard brown bodies; generally well-camouflaged and difficult to see in a sample tray.



Coleoptera: Psephenidae  
(water pennies)

**Habitat:** strongly flowing waters  
**Indicator Status:** perennial  
**Regional Distribution:** widespread; likely at low abundance  
 Larvae shaped like round, flattened discs; 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.]



Coleoptera: Dytiscidae  
(predaceous diving beetles)

**Habitat:** mostly still waters  
**Indicator Status:** intermittent  
**Regional Distribution:** widespread  
 Adults (right) with oval streamlined bodies; hind legs flattened, oar-like, and fringed with long swimming hairs; larvae (left) with elongated bodies that taper strongly toward the tip of the abdomen; long, slender, untoothed mandibles project in front of head.



Coleoptera: Hydrophilidae  
(water scavenger beetles)

**Habitat:** margins of still waters  
**Indicator Status:** intermittent  
**Regional Distribution:** widespread  
 Adults (right) dark, oval, strongly convex beetle with short clubbed antennae; larvae (left) have short legs, a blunt tapered abdomen, and toothed, curved mandibles that project in front of head.

## Odonata: Dragonflies & Damselflies



antennae

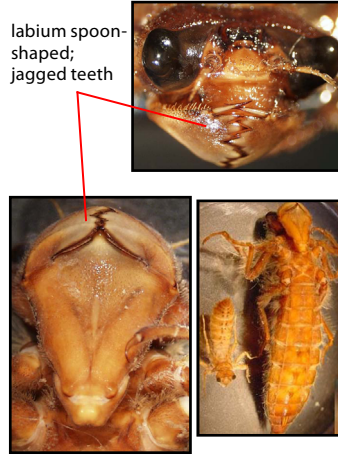
Odonata: Gomphidae  
(clubtail dragonflies)

**Habitat:** faster flowing waters

**Indicator Status:** perennial

**Regional Distribution:** wide-spread; less likely in W. OR and W. WA streams

Body slightly flattened, end of abdomen rounded or tapering to blunt tip; labium (lower lip) is flat, not spoon-shaped; short, thick 4-segmented antennae with enlarged 3rd segment.



labium spoon-shaped; jagged teeth

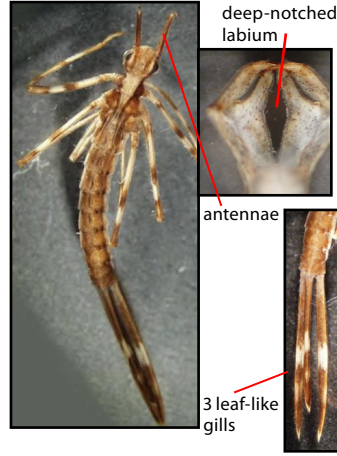
Odonata: Cordulegastridae  
(spiketail dragonflies; biddies)

**Habitat:** small streams

**Indicator Status:** perennial

**Regional Distribution:** widespread

Hairy, elongate body; labium (lower lip) is spoon-shaped with large, uneven jagged teeth, cupping bottom of the head when at rest; antennae slender and 7-segmented.



deep-notched labium

antennae

3 leaf-like gills

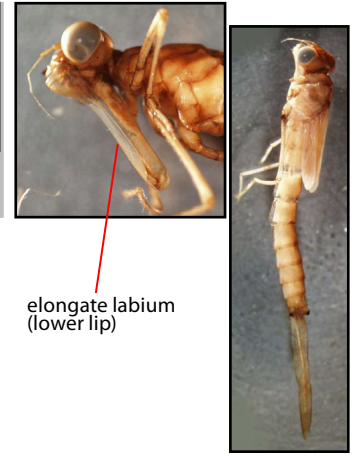
Odonata: Calopterygidae  
(broad-winged damselflies)

**Habitat:** occupy vegetation; moderately fast to slow-moving water

**Indicator Status:** perennial

**Regional Distribution:** widespread

Long slender body with conspicuous antler-like antennae; labium (lower lip) has deep notch; central gill at tip of abdomen shorter than the 2 gills on either side.



elongate labium (lower lip)

Odonata: Lestidae  
(spreadwing damselflies)

**Habitat:** plants & organic debris of still or slack waters

**Indicator Status:** OR intermittent

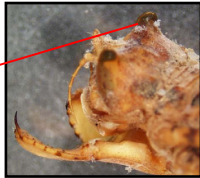
**Regional Distribution:** widespread

Hairy, elongate forms; highly elongate labium (lower lip) is spoon-shaped with large, uneven jagged teeth, cupping bottom of the head when at rest; antennae slender and 7-segmented.

## Odonata: Dragonflies & Damselflies



horn



scoop-shaped labium (lower lip)

Odonata: Macromiidae  
(river skimmer dragonflies)

**Habitat:** sand and silt bottoms  
**Indicator Status:** > 1 stream class  
**Regional Distribution:** widespread  
Larvae unique with a nose or horn on front of head; scoop-shaped labium (lower "lip") lobes have margin of teeth that are similar in size.

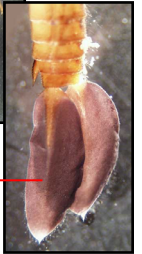
Odonata: Libellulidae  
(common skimmer dragonflies)

**Habitat:** still edgewaters of streams  
**Indicator Status:** > 1 stream class  
**Regional Distribution:** widespread  
Top of abdomen may have short spines or curved hooks; labium (lower lip) scoop-shaped and covers much of front of head at rest; lobes of labium usually don't have recognizable teeth.



Odonata: Aeshnidae  
(damner dragonflies)

**Habitat:** still waters  
**Indicator Status:** > 1 stream class  
**Regional Distribution:** widespread  
Abdomen generally longer and more cylindrical than most dragonfly larvae; body may be patterned; labium (lower lip) flat; long, thin 6-7 segmented antennae.

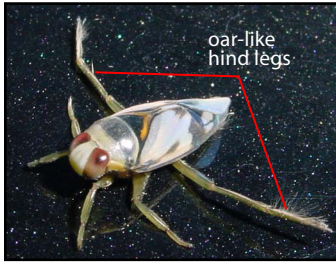


broad gills, pointed at tip

Odonata: Coenagrionidae  
(narrowwinged damselflies)

**Habitat:** nearly all types of aquatic habitats; often still waters  
**Indicator Status:** > 1 stream class  
**Regional Distribution:** widespread  
All antennal segments about the same length; labium (lower lip) thick, triangular, unnotched; gills often broad and pointed at tips.

## Hemiptera: Aquatic True Bugs



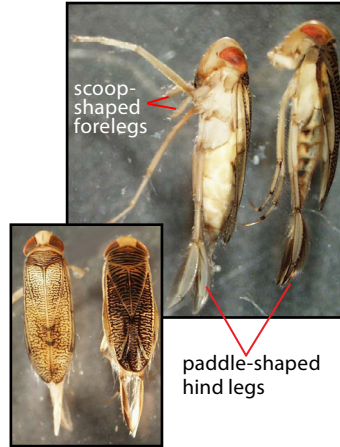
Hemiptera: Notonectidae  
(backswimmers)

**Habitat:** still and slack waters

**Indicator Status:** intermittent

**Regional Distribution:** widespread

Elongate, strongly canoe-shaped body with long oar-like hind legs; body shading reversed, i.e. light on top (dorsally) and dark on the bottom (ventrally); swim upside down.



Hemiptera: Corixidae  
(water boatman)

**Habitat:** still and slack waters

**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

Somewhat similar to notonectids but top of body flat, often mottled with fine wavy lines; distinctive scoop-shaped forelegs and short, blunt segmented beak; hind legs paddle-shaped and fringed with swimming hairs but lack claws.



male carrying eggs



Hemiptera: Belostomatidae  
(giant water bugs)

**Habitat:** margins of streams

**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

One of the largest insects seen in fresh waters; broad, oval, flattened bodies; short antennae; raptorial forelegs thickened and elbowed to grasp prey; tip of abdomen has pair of short, strap-like structures used to obtain air; hind legs with claws; males of some species carry eggs on back.



Hemiptera: Gerridae  
(water striders)

**Habitat:** non-turbulent waters

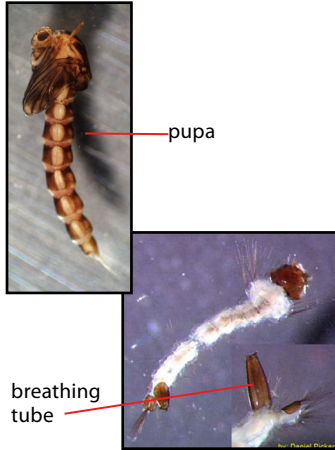
**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

Slender body with long, prominent antennae and long legs, giving a spider-like appearance; easily seen skating on surface of water.



## Diptera: Aquatic & Semi-aquatic True Flies



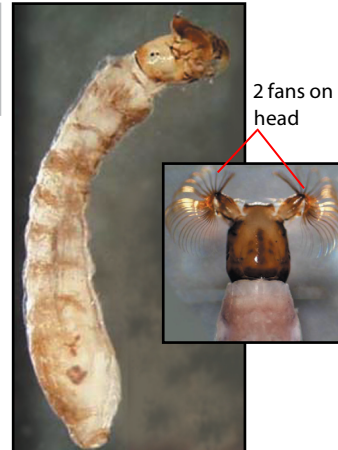
Diptera: Culicidae  
(mosquitoes)

**Habitat:** most still waters  
**Indicator Status:** ephemeral  
**Regional Distribution:** widespread  
 Large, distinct head capsule; fused, often swollen thoracic segments; no prolegs; head has mouth brushes and simple antennae; dorsal terminal breathing tube (siphon) is present in most species.



Diptera: Syrphidae  
(rat-tailed maggots)

**Habitat:** still and stagnant waters  
**Indicator Status:** ephemeral  
**Regional Distribution:** widespread  
 Head very reduced; thick, cylindrical body with blunt ends; 7 pairs of prolegs, one pair on 2nd thoracic segment and remaining pairs on abdominal segments; remarkably long, thin breathing tube on hind end can extend above water to obtain oxygen.



Diptera: Simuliidae  
(black flies)

**Habitat:** most flowing waters  
**Indicator Status:** > 1 stream class  
**Regional Distribution:** widespread  
 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  
(non-biting midges)

**Habitat:** most fresh waters  
**Indicator Status:** > 1 stream class  
**Regional Distribution:** widespread  
 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: Aquatic & Semi-aquatic True Flies



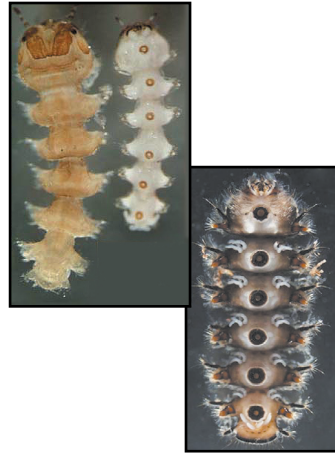
Diptera: Tipulidae  
(crane flies)

**Habitat:** most fresh waters

**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

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

**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

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



Diptera: Ceratopogonidae  
(biting midges)

**Habitat:** most fresh waters

**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

Common types with long, pale, narrow, cylindrical body; small narrow pointed head capsule, with a wiry, snake-like appearance; other types short, thick, and spiny with front and rear prolegs; may wiggle actively in a sample tray.



Diptera: Dixidae  
(dixid midges)

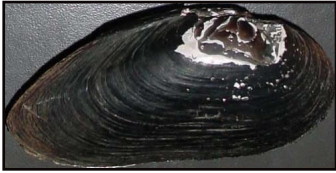
**Habitat:** slow flowing waters

**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

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.

## Mollusca: Bivalvia: Mussels & Clams



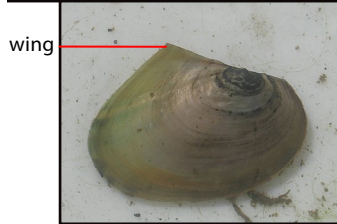
Mollusca: Bivalvia, Margaritiferidae  
(freshwater pearl mussels)

**Habitat:** soft to sandy bottoms

**Indicator Status:** perennial

**Regional Distribution:** widespread

Large mussels with 2 hard, ovoid shells connected by a hinge; shell has slightly concave margin, giving it a kidney bean shape; interior of shell pearly purple to pink; outside of shell is typically brown to black.



Mollusca: Bivalvia, Unionidae  
(Unionid mussels; *Anodonta* spp. - floaters)

**Habitat:** soft (sand & silt) bottoms; slow water; tolerant of sediment

**Indicator Status:** perennial

**Regional Distribution:** widespread

Shells are thinner, often lighter colored than other PNW genera, light to medium brown, often with greenish cast; light interior; shell generally rounded, lacks prominent ridge but may have pointed "wing".



Mollusca: Bivalvia, Unionidae  
(Unionid mussels; *Gonidea angulata* - western ridged mussel)

**Habitat:** soft to sandy bottoms; slow water

**Indicator Status:** perennial

**Regional Distribution:** widespread

Large mussels with 2 thick shells that have an angular ridge running diagonally from beak to edge; outside of the shell is typically brown to black.



fingernail clam



pea clam

Mollusca: Bivalvia, Sphaeriidae  
(pea clams & fingernail clams)

**Habitat:** flowing waters

**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

Small to minute round shells without raised growth rings; small beak is slightly off-center (pea clams) or is centered at the back of the shell (fingernail clams); if shell looks triangular, inflated at hinge, thickened, and with noticeable ridges, it is probably a non-native Asian clam.



## Mollusca: Gastropoda: Snails & Limpets



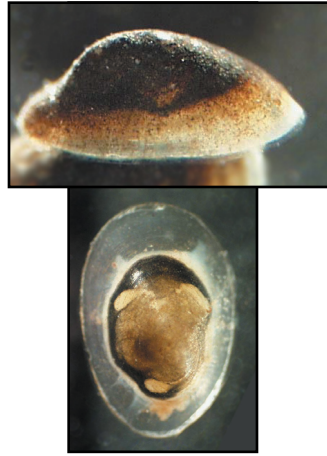
Mollusca: Gastropoda, Pleuroceridae  
(*Juga* spp.)

**Habitat:** flowing waters; less likely in small high-gradient streams

**Indicator Status:** perennial

**Regional Distribution:** OR & WA

Common and often abundant; usually reddish brown; long, conical cone-shaped shell that may be smooth or ridged; operculum (plate) covering opening of shell has spiral pattern of lines.



Mollusca: Gastropoda, Ancyliidae  
(freshwater limpets)

**Habitat:** rocks; flowing waters

**Indicator Status:** perennial

**Regional Distribution:** widespread

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



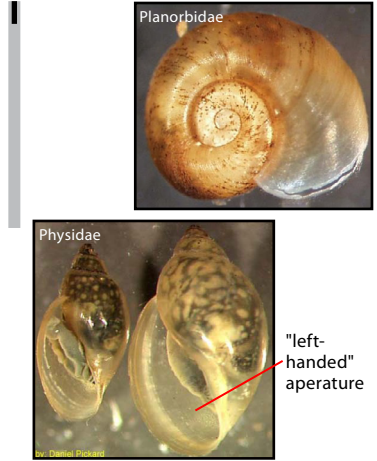
Mollusca: Gastropoda, Hydrobiidae  
(pebble snails)

**Habitat:** flowing waters

**Indicator Status:** perennial

**Regional Distribution:** widespread

Shell globulose (almost spherical) or conical (long and cone-like); operculum (plate covering shell opening) present with a single continuous line looping into a complete spiral before ending at the edge, slightly hardened, but still flexible.



Mollusca: Gastropoda, Planorbidae & Physidae

(ram's horn snails) & (bladder snails)

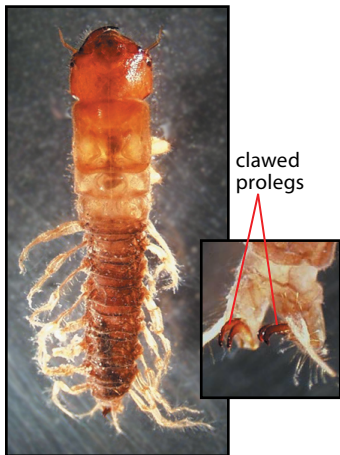
**Habitat:** slow or still waters

**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

Planorbidae: characteristic flattened, disk-like coiled shell; no operculum (plate) covering the aperture of the shell. Physidae: only "left-handed" (sinistral) snails in the northwest (when the shell's apex points up and the aperture faces you).

## Other Groups: Megaloptera, Crustacea, Isopoda, & Amphipoda



Megaloptera: Corydalidae  
(dobsonflies & fishflies)

**Habitat:** cold, rocky streams

**Indicator Status:** perennial

**Regional Distribution:** wide-spread; likely at low abundance

Large, active predators; hardened head with toothed jaws; long filaments project out to the side of each abdominal segment; end of the abdomen has 2 short, fleshy, clawed prolegs.



Megaloptera: Sialidae  
(alderflies)

**Habitat:** slow and still waters

**Indicator Status:** > 1 stream class

**Regional Distribution:** wide-spread; likely at low abundance

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.



Crustacea: Decapoda  
(crayfish)

**Habitat:** most fresh waters

**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

Large active predator; front of body cylindrical, rear flattened and segmented; 5 pairs of walking legs, with 1st pair largest, and with large hardened claws; color may be dark ranging from red or orange.



Crustacea: Amphipoda & Isopoda  
(scuds) & (aquatic sow bugs)

**Habitat:** most fresh waters

**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

Amphipoda: bodies are flattened side-to-side, curved from head to tail, gray/green to pink; usually swim or crawl on their side in a sample tray. Isopoda: bodies are flattened top-to-bottom, grayish to brown; crawl flat along the bottom of a sample tray.

## Other Groups: Turbellaria, Oligochaeta, Hirudinea, & Nematoda



head

Platyhelminthes: Turbellaria  
(flatworms or planarians)

**Habitat:** most fresh waters

**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

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, sometimes seeming "cross-eyed"; glide smoothly across the bottom of a sample tray.



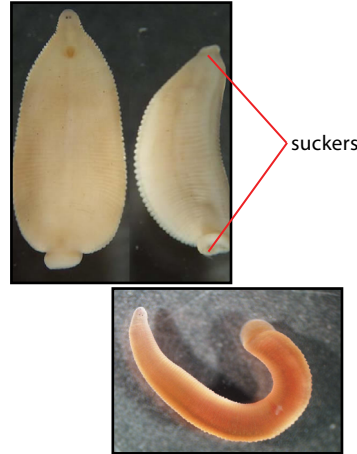
Annelida: Oligochaeta  
(aquatic earthworms)

**Habitat:** most fresh waters

**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

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.



suckers

Annelida: Hirudinea  
(leeches)

**Habitat:** slow or still waters

**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

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

**Indicator Status:** > 1 stream class

**Regional Distribution:** widespread

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.

This field guide was developed in support of the U.S. Environmental Protection Agency's Streamflow Duration Assessment Method for the Pacific Northwest. The images in this guide include taxa identified as streamflow duration indicators as well as those that are representative of common and readily visible groups of species encountered in 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 and/or lines are included to highlight diagnostic 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 for individuals in that group. Black bars show the lower length limit and the grey bar the upper length limit. An arrow-head indicates that some of the species in the group may be larger than can be shown.

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

**Indicator Status:** describes the streamflow duration class in which each group of species is an indicator.

**Perennial:** means that taxa in this group are indicators of permanent streamflow.

**Intermittent:** means that taxa in this group are indicators of intermittent streamflow.

**Ephemeral:** means that taxa in this group are indicators of ephemeral streamflow.

> **1 stream class:** may occur in 2 or more streamflow duration classes.

**Regional Distribution:** indicates the state or states in which each group is found, or indicates the group is widespread throughout the Pacific Northwest:

**Oregon; Washington; Idaho; widespread**

Unless otherwise indicated, the images in this guide are the property of the Xerces Society for Invertebrate Conservation. Please see the report "Macroinvertebrates as Indicators of Streamflow Duration" at <http://www.xerces.org/macroinvertebrate-streamflow-indicators/> for more information.



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