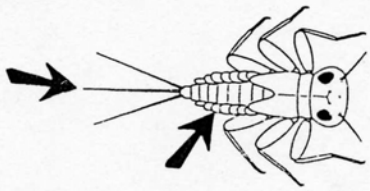
ON-SIGHT IDENTIFICATION OF AQUATIC INSECT

ORDERS AND FAMILIES

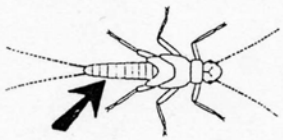
EPHEMEROPTERA, PLECOPTERA, AND TRICHOPTERA

The identification of the aquatic orders Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) is based on the presence or absence of gills along the abdomen, number of cerci or tales, and the presence of a pair of prolegs on the last abdominal segment. The separation of aquatic orders, and in most cases aquatic families, can be done with the unaided eye or with the use of a simple handheld magnifying lens. All EPT taxa will have three pair of segmented legs along the thorax which is often used to separate EPT taxa from many other orders.

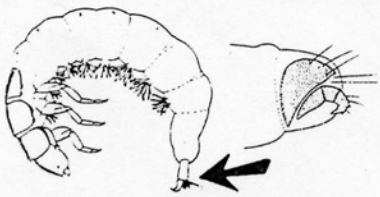
-With flat gills along sides of most abdominal segments and has three long, slender cerci (one common genera of mayfly has only two cerci, but it has flat abdominal gills) EPHEMEROPTERA



-Abdominal gills are absent or, if present, are filamentous and restricted to the first few abdominal segments. Thoracic gills common. Two cerci present. PLECOPTERA



-Abdomen ends in a pair of prolegs and not in a pair of segmented cerci. Body shape is worm-like. TRICHOPTERA



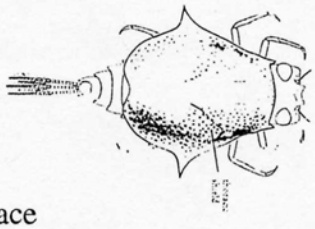
"If insects were the size of birds, or people the size of mice, 'bug watchers' would be as prevalent as bird watchers, and entomologists would command the budget of the Defense Department. ....The insect never ceases to astound with its capacity of combine beauty and ugliness, power and frailty, familiarity and otherworldliness-all in a package so small we can eliminate it, if we will, with a stamp of the foot."

Howard Evans, The Pleasures of Entomology, 1985

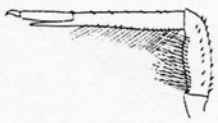
ON SIGHT IDENTIFICATION OF MAYFLY FAMILIES

For each of the families described in this key, I've also listed a 'typical' genera. Students can use this to 'backtrack' in the key. Note that this is not a dichotomous key and should not be used as such. Many of the illustrations are from W. Patrick McCafferty, *Aquatic Entomology: the Fishermen's and Ecologist' Illustrated Guide to Insects and Their Relatives.*

-Thoracic notum carapacelike and covering much of the addomen
(The only genus in this family is Baetisca spp) BAETISCIDAE

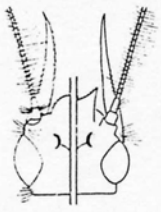


-Forelegs with rows of long setae on inner surface
(The most common genus is Isonychia spp) OLIGONEURIIDAE

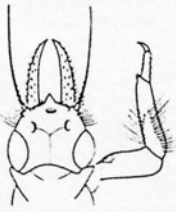


Oligoneuriidae

-Mayflies with large tusks which they use to burrow into soft sediments typically along the banks of streams. There are four families included in this group, three of which are commonly found in North Carolina streams. Difference between the families is the shape and function of the foretibiae and tusks. POTAMANTHIDAE
POLYMITARCIDAE
PALINGENIIDAE
EPHEMERIDAE
(The family Ephemeridae is by far the most common burrowing mayfly family found and a typical genera are Hexagenia and Ephemera)



Ephemeridae



Polymitarcyidae

Potamanthidae

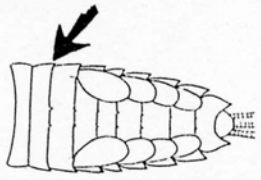
Palingeniidae

"To me, after all my eager pursuits, no solid pleasures now remain, but the reflection of a long life spent in meaning well, the sensible conversation of a few good ephemerae, and now and then a kind smile...."

Benjamin Franklin, from Soliloquy of a Venerable Ephemera
Who Had Lived Four Hundred and Twenty Minutes

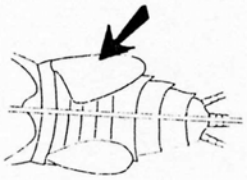
-The following seven mayfly families are rapid swimmers and have round (not flattened) heads

-Without gills on the second abdominal segment EPHEMERELLIDAE
(A very common family in mountain stream systems,
genus type is Ephemerella spp)

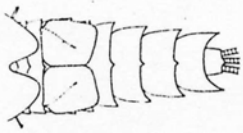


Ephemerellidae

-Gills on second abdominal segment operculate or semioperculate
-Operculate gills not meeting medially
(Tricorythodes spp, a very popular pattern for fly-fishers) TRICORYTHIDAE
-Operculate gills meeting medially
-Gills fused medially
(a common genus is Neoephemerella spp) NEOEPHEMERIDAE
- Gills not fused medially, but overlapping
(a common genus in this family is Caenis spp) CAENIDAE



Tricorythidae



Neoephemeridae

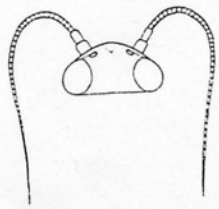
Caenidae

-Gills on second abdominal segment not operculate or semioperculate
-Claws on middle and hind lega 1/2 to nearly as long
as tibiae (a fairly rare genus is Siploplecton spp) METRETOPODIDAE

Metretopodidae

-Claws shorter
-Antennae short (such as Ameletus spp) SIPHLONURIDAE
-Antennae longer (a very common family,
genus type Baetis spp.) BAETIDAE

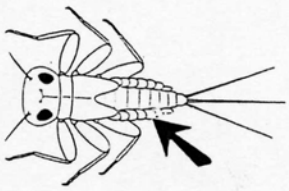
Siphlonuridae



Baetidae

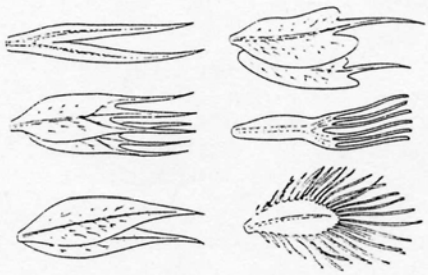
-The following two mayfly families are considered sprawlers had have flattened heads.

-Gills on abdominal segments 2-5 usually platelike. Most specimens have distinctly flattened bodies with horizontal heads and outspread legs. (perhaps the most common mayfly family in mountain stream systems, Stenonema and Epeorus are two very common taxa) HEPTAGENIIDAE



Heptageniidae

-Gills on abdominal segments 2-5 forked or double and elogate or with fingerlike projections or in clusters of filaments. (a common genus type in this family is Leptophlebia spp) LEPTOPHLEBIIDAE



Leptophlebiidae

"He had come to realize that a small river or stream flowing by one's door has many attractions over a large body of water like the Hudson, for one can make a companion of such a stream; he can walk with it and sit with it; and lounging on its banks, he can feel that it is all his own."]

Jonh Burroughs: NATURALIST. The Story of His Work and Family by His Granddaughter, Elizabeth Burroughs Kelly. 1959.

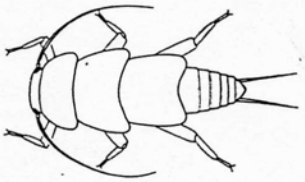
"Remember, we're not weird, we're scientists."

Mike Warzynski, following a fishing trip to the Pere Marquette River

ON SITE IDENTIFICATION OF STONEFLY FAMILIES

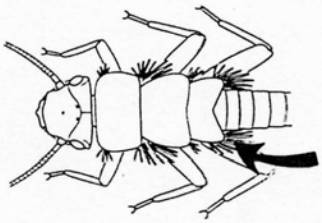
Stoneflies are perhaps the most intolerant of all aquatic insect orders and will often be the first group of insects to disappear as water pollution is introduced into a stream system. For this reason, they are very important indicator organisms in the field of water pollution biology.

-Roachlike; thorax with large shieldlike plates covering bases of head, legs and abdomen, and with overlapping plates ventrally (a very common stonefly often found in leafpacks, Tallaperla spp) PELTOPERLIDAE



Peltoperlidae

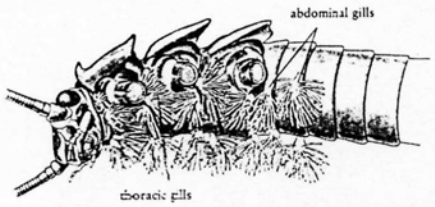
-The two following families have branching gills behind bases of legs.



-Some branching gills originate from basal abdominal segments (a very large conspicuous stonefly, again often found in leaf pack samples, Pteronarcys spp.) PTERONARCIDAE

-Branching gills never originating from basal abdominal segments (very common stonefly family in mountain stream systems, genus type Acroneuria spp. PERLIDAE

GIANT STONEFLIES
(Pteronarcyidae)

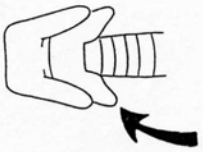


Perlidae

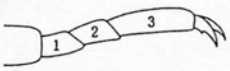
Unfortunatly, the separation characters for identification of the other stonefly families is just a little bit more difficult. However, once the taxonomist becomes familar with the particular genera of stoneflies within each of the families, he or she can 'backtrack' to the family level.

-Glossae and paraglossae of equal lengths. These are mouthparts and will need to be teased apart with forceps.

-Thorax robust with divergent wing pads.

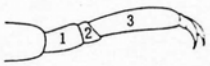


-Tarsal segments 1 and 2 about the same length (very common spring species of stoneflies, genus type, Taeniopteryx spp) TAENIOPTERYGIDAE



Taeniopterygidae

-Tarsal segments 2 much shorter than 1 (fairly uncommon spring species, genus type Amphinemoura spp.) NEMOURIDAE

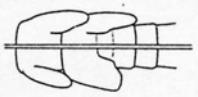


Nemouridae

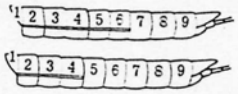
"Now at last I was in among the dancers. They flowed all around me, even lighter, more festive than before, and because they now danced directly between me and the sun, they glowed. They floated against the shining sky like luminous orange snowflakes - sculptured, living snowflakes - that never fell to earth but hung suspended as they lilted to a beat both tenuous and profound. It was a beat I had heard before. Out in the other world I could sometimes, in quieter monents, discern that everything we know is dancing to a common rhythm. And all at once I comprehended: this ethereal parade that trembled against the sky above me was a rare and exquisite distillation of that dance of life. Our dance of life."

Colin Fletcher, The Secret Worlds of Colin Fletcher, 1989.

-Glossae and paraglossae of equal length (continued)
-Thorax cylindrical-slender with parallel wing pads

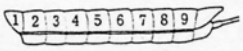


-Lateral longitudinal fold of abdomen not extending beyond segment 7. This characteristic is very difficult to see (uncommon spring species, genus type Leuctra) LEUCTRIDAE



Leuctridae

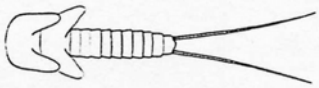
-Lateral longitudinal fold of abdomen extending through segment 8 (very common spring species, Allocapnia spp) CAPNIIDAE



Capniidae

-Glossae much shorter than paraglossae

-Wing pads divergent; tails long
(a very common spring species, genus type Isoperla spp.) PERLODIDAE



Perlodidae

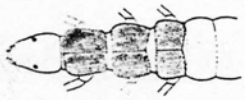
-Wing pads parallel; tail usually shorter than abdomen
(a fairly common species in small, first order mountain streams during spring periods, genus type Sweltsa spp) CHLOROPERLIDAE

Chloroperlidae

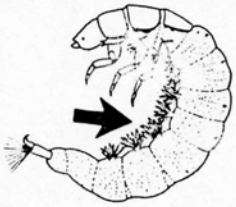
ON SITE IDENTIFICATION OF CADDISFLY FAMILIES

The Trichoptera form perhaps one of the most interesting and diverse orders of aquatic insects found in mountain stream systems. The taxonomy and ecology of this group can be a challange to water pollution biologists. However, caddisfly are a very important component of aquatic systems. One of the most fascinating aspects of the order is the behavior related to the construction of cases or retreats in which most of the larvae live.

-Each of the 3 thoracic nota completely and similarly sclerotized

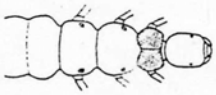


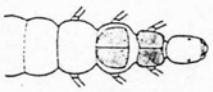
-With ventral abdominal gills (net spinners)
(one of the most common caddisfly, Hydropsyche spp.) HYDROPSYCHIDAE



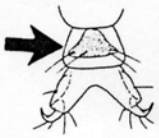
-Without ventral abdominal gill. This group of caddisfly are called the microcaddis, or purse-case caddisfly.
(Specimens are very small , Hydroptila spp.) HYDROPOTILIDAE

-At least the metathoracic notum with reduced sclerotization



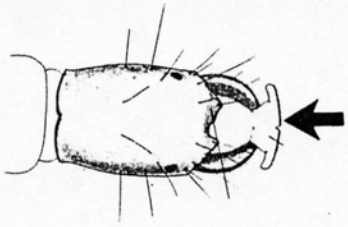


-NOT A CASE-MAKER
-9th abdominal tergum with a sclerotized plate
(Rhyacophila spp. is a very common predaceous caddis) RHYACOPHILIDAE



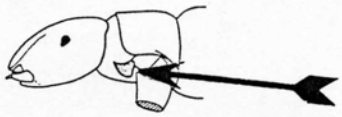
Rhyacophilidae

-Note a case maker (continued)
-9th abdominal tergum without a sclerite
-Labrum uniquely membranous, T-shaped
(larvae construct fingernet which have the smallest
mesh size known among netspinners, Chimarra) PHILOPOTAMIDAE



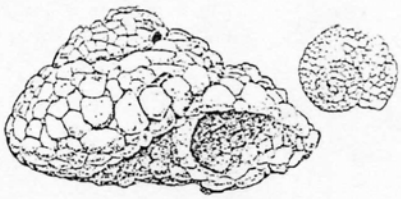
-Prothoracic trochantin acute or hatchet-shaped
(Common genera include Polycentropus and Lype) POLYCENTROPODIDAE
PSYCHOMIIDAE

Polycentropodidae



Psychomyiidae

-CASE-MAKERS
-Snail-shell shaped case (Helicopsyche) HELICOPSYCHIDAE



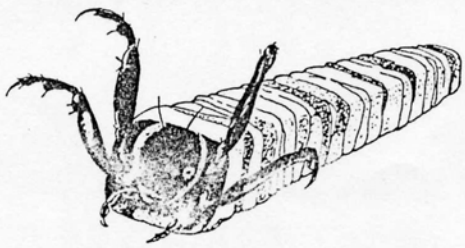
-Case not so shaped
-Antennae at least 6X as long as wide and/or
mesonotum with reversed parentheses marks.
(a fairly common bank species, Triaenodes spp) LEPTOCERIDAE

"'My snug little home is a place of delight;
If you want to live happy, live hidden from sight"'
Fabre, Fabre's Book of Insects, 1921.

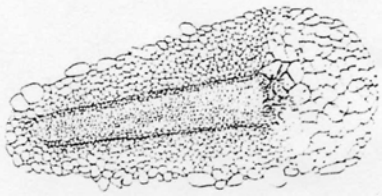
-Case not so shaped (continued)
-Antennae short (often hard to see); mesonotunum without parentheses marks
-Mesonotum with little or no sclerotization
-Tubular plant case (genus type, Ptilostomis), abdominal segment 1 with humps, usually large with striped head PHRYGANEIDAE

-Turtle-shell stone case (very common in clean water on the tops of rocks, genus type Glossosoma) GLOSSOSOMATIDAE

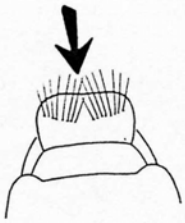
-Mesonotum mostly covered with sclerotized plates
-Abdominial segment 1 lacking both lateral and dorsal humps. Case constructed of small leaves or twigs in a square shape (very common mountain river species, Brachycentrus BRACHYCENTRIDAE

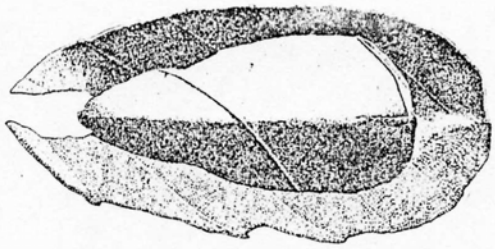


-Abdominal segment 1 with lateral humps, usually with dorsal hump
-Sand case with lateral flanges (infrequently found in clean sandy streams, genus type Molanna) MOLANNIDAE

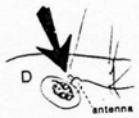


-Case without flanges, or, if present, made of plant material
-Labrum with row of about 16 setae (genus type, Anisocentropus case looks like a leaf with a bite out of the bottom) CALAMOCERATIDAE

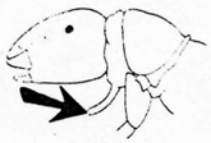


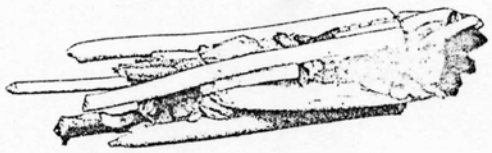


-Labrum with only 6 setae
-Antennae close to eyes. (Genus type Lepidostoma which builds a case of small square pieces of leaves, fairly common species in clean water) LEPIDOSTOMATIDAE



-Antennae midway between eyes and anterior margin of head. Prosternal horn present. (a very large family of caddisflies, a common genus is Pycnopsyche which is collected often and has a case of sticks) LIMNEPHILIDAE



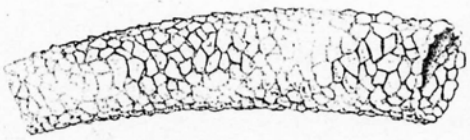


"In good light and in fair weather, when it comes up and takes the dry fly, the trout is a wonderful thing. But it is not enough. I sit and watch more, just for the love of running water, and I walk farther now than before. There are springs to see, and the shadows of small wild trout flicking across the bed of a side creek. I carry a wading staff and poke at interesting rocks. Sooner or later, one of them will be the tip of a half-buried lance point."

M.R. Montgomery, The Way of the Trout, 1991.

-Antennae close to anterior margin of head

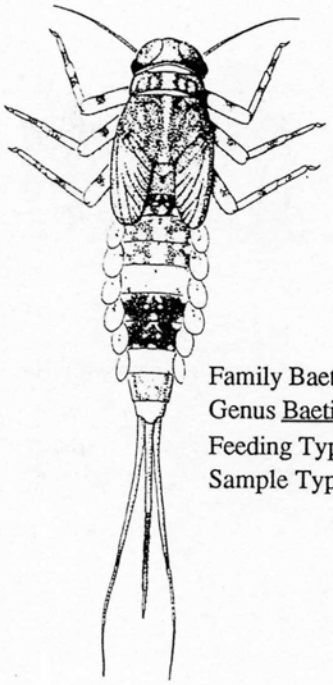
-Top of anal proleg with about 30 setae. (genus type Fattigia case is constructed of sand grains) SERICOSTOMATIDAE



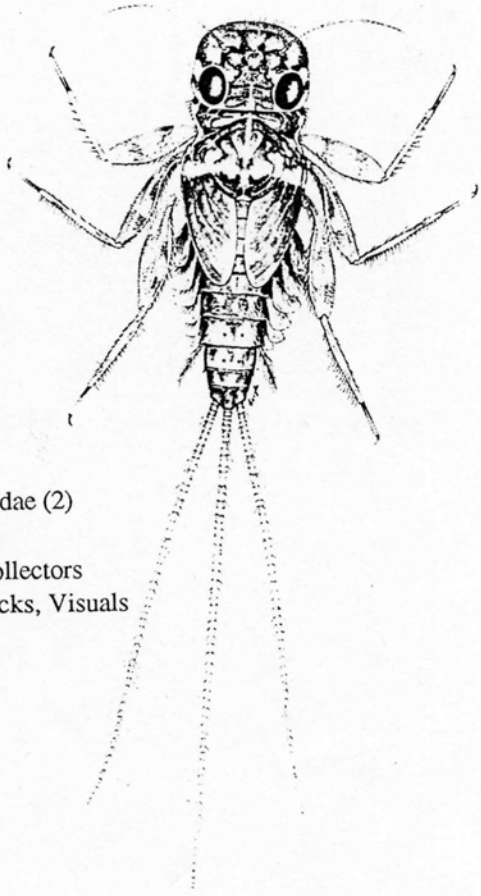
-Top of anal proge with 3-5 setae (genus type Psilotreta case is constructed of sand grains) ODONTOCERIDAE

"My classroom was on the headwaters of the river. Its meadows were willow-bordered, its origins deep in the springs of a cedar swamp."
Earnest Schwiebert, Remembrances of Rivers Past. 1972.

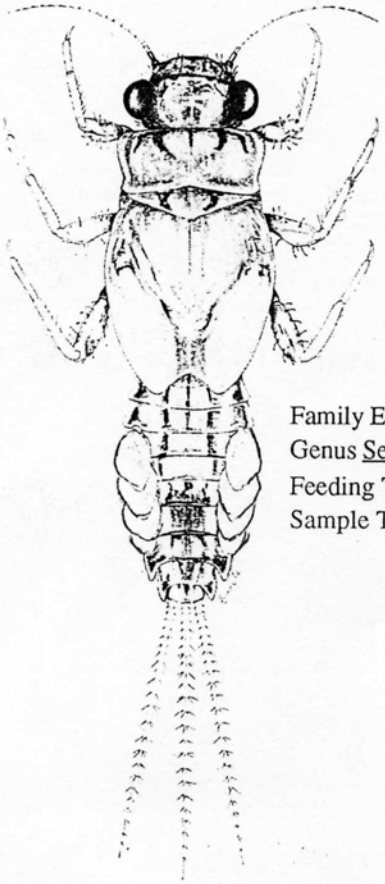
EPHEMEROPTERA



Family Baetidae (1)
Genus Baetis
Feeding Type - Scraper
Sample Type - Kicks

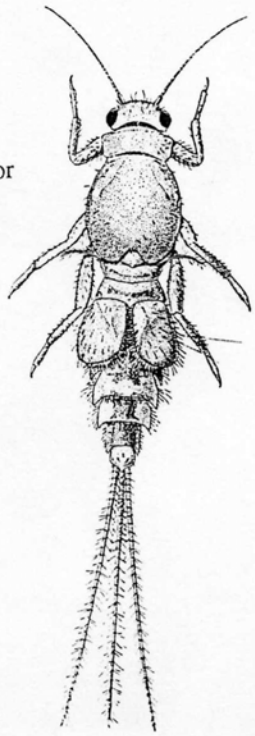


Family Heptageniidae (2)
Genus Stenonema
Feeding Type - Collectors
Sample Type - Kicks, Visuals

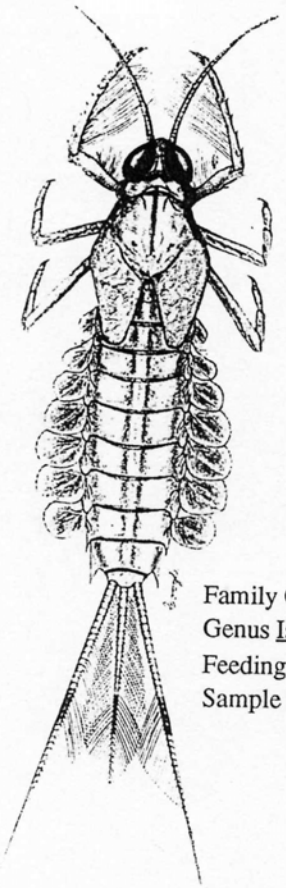


Family Ephemerellidae (2)
Genus Serratella
Feeding Type - Collector
Sample Type - Kicks

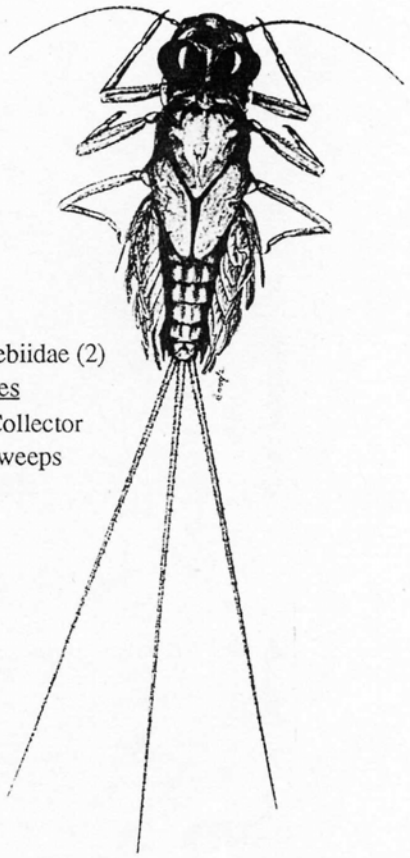
Family Caenidae (1)
Genus Caenis
Feeding Type - Collector
Sample Type - Sweeps



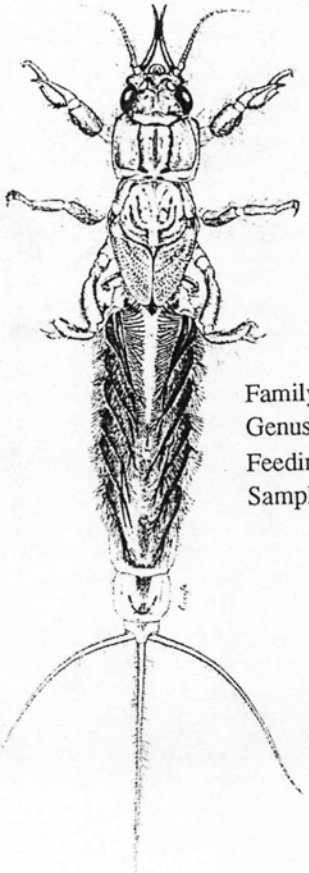
EPHEMEROPTERA



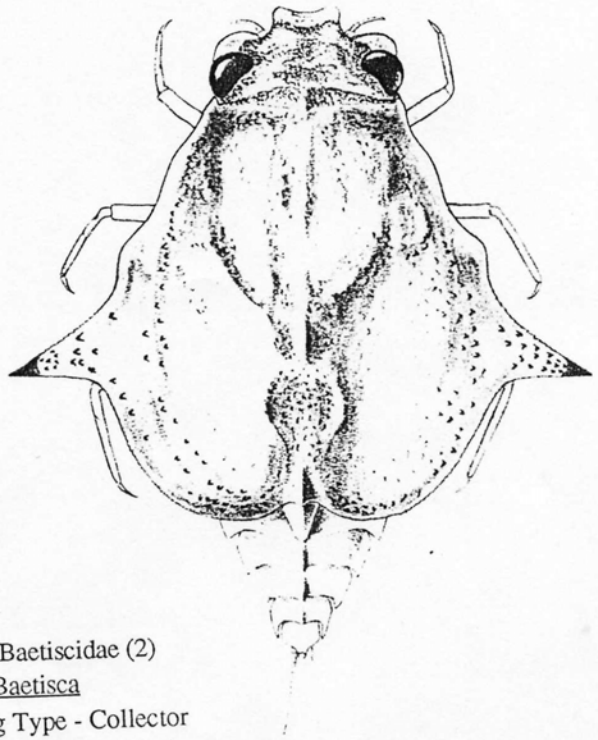
Family Oligoneuriidae (2)
Genus Isonychia
Feeding Type - Filter Feeder
Sample Type - Kicks



Family Leptophlebiidae (2)
Genus Choroterpes
Feeding Type - Collector
Sample Type - Sweeps

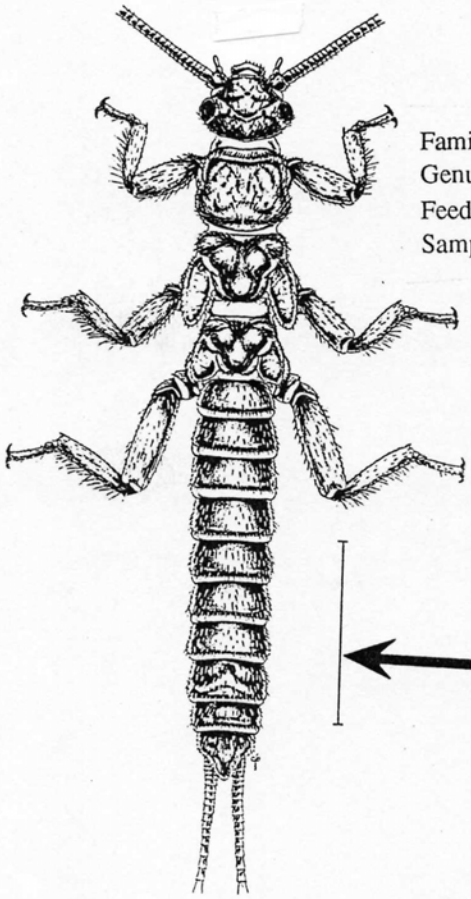


Family Ephemeridae (2)
Genus Hexagenia
Feeding Type - Collector
Sample Type - Sweeps, Visuals

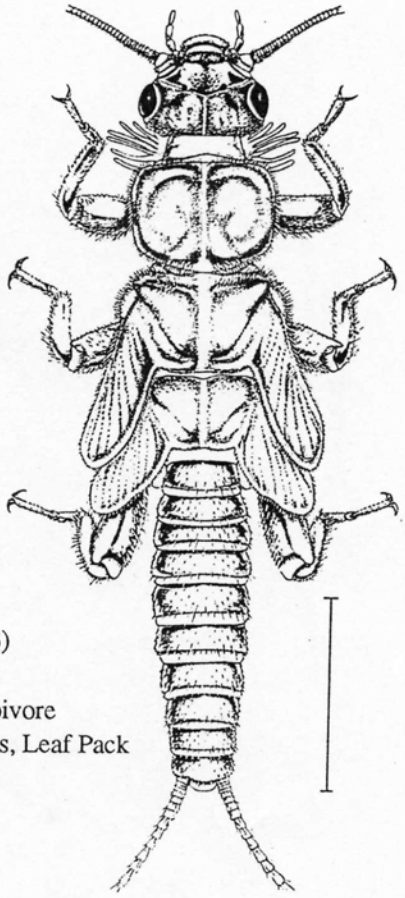


Family Baetiscidae (2)
Genus Baetisca
Feeding Type - Collector
Sample Type - Kicks, Sweeps

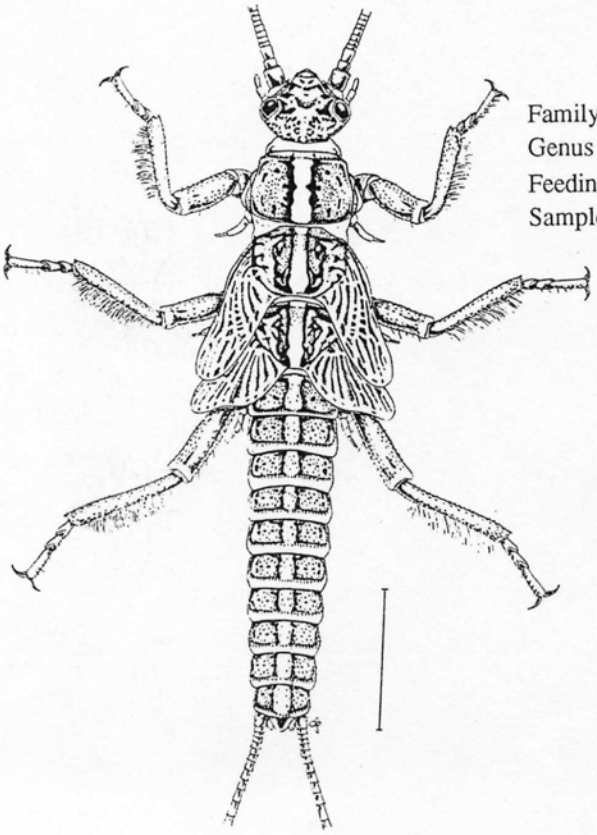
PLECOPTERA



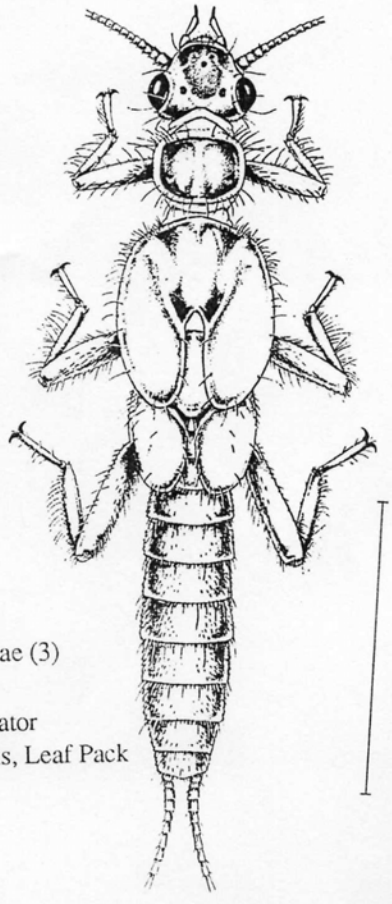
Family Nemouridae (3)
Genus Amphinemura
Feeding Type - Herbivore
Sample Type - Kicks, Leaf Pack



Family Capniidae (3)
Genus Allocapnia
Feeding Type - Herbivore
Sample Type - Kicks, Leaf Pack

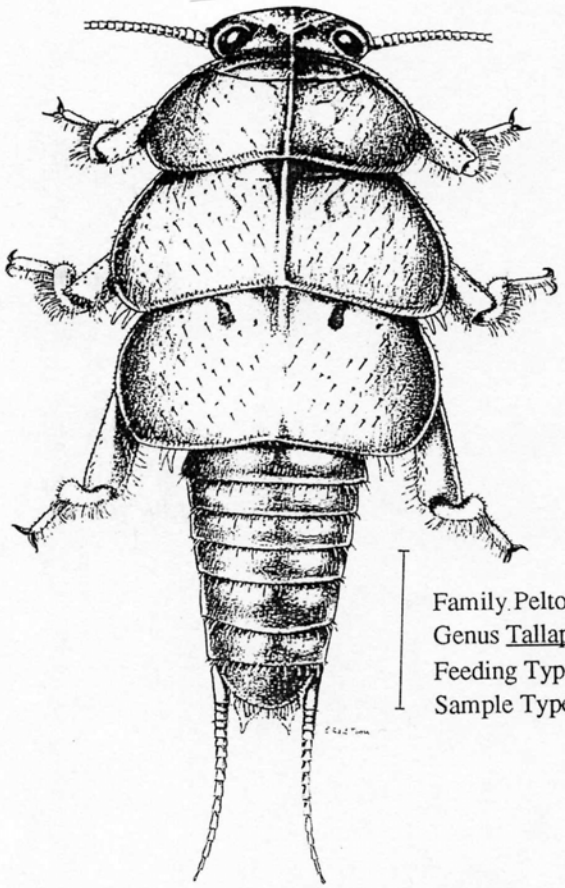


Family Taeniopterygidae (3)
Genus Taeniopteryx
Feeding Type- Herbivore
Sample Type - Kicks, Leaf Pack



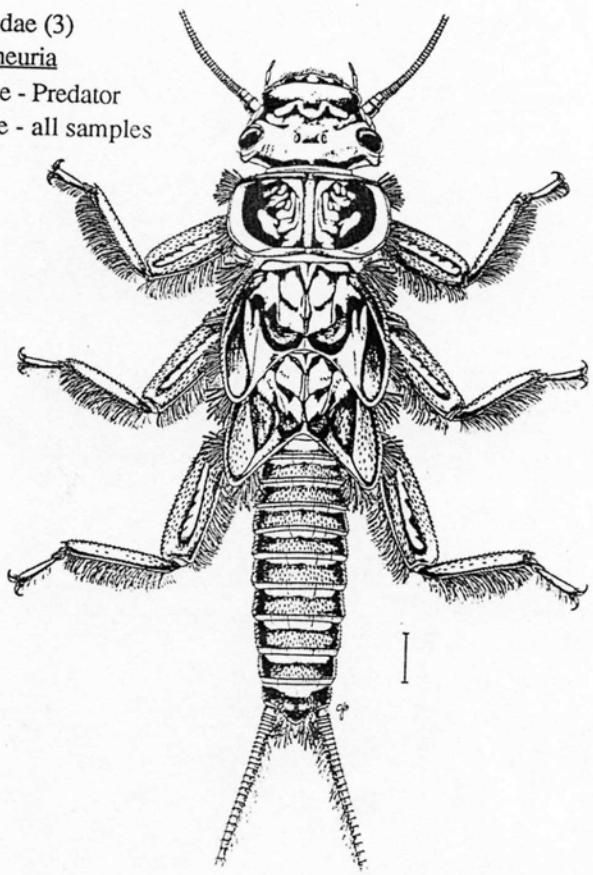
Family Chloroperlidae (3)
Genus Haploperla
Feeding Type - Predator
Sample Type - Kicks, Leaf Pack

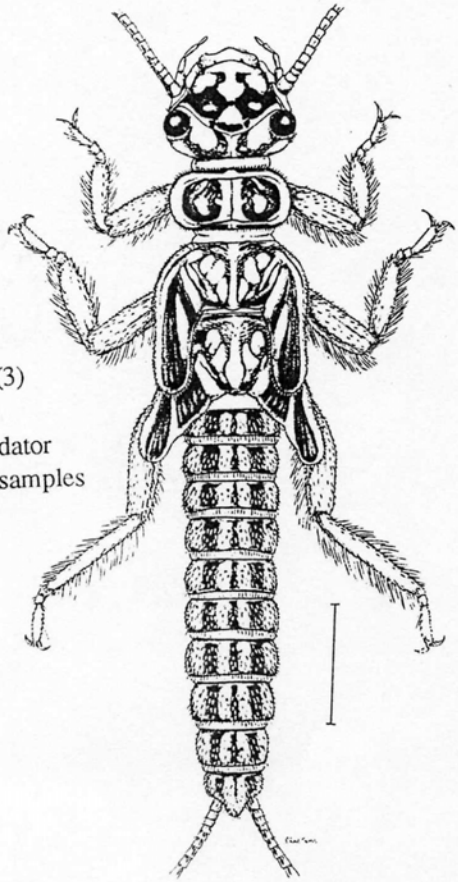
PLECOPTERA



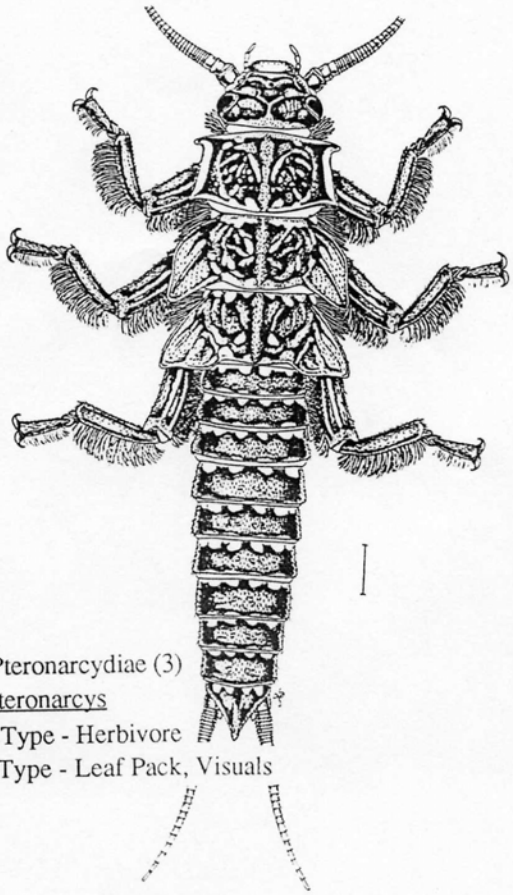
Family Peltoperlidae (3)
Genus Tallaperla
Feeding Type - Herbivore
Sample Type - Leaf Pack

Family Perlidae (3)
Genus Acroneuria
Feeding Type - Predator
Sample Type - all samples



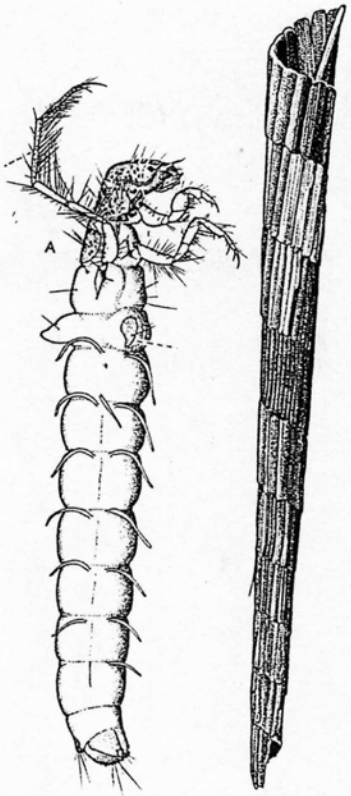


Family Perlodidae (3)
Genus Isoperla
Feeding Type - Predator
Sample Type - all samples

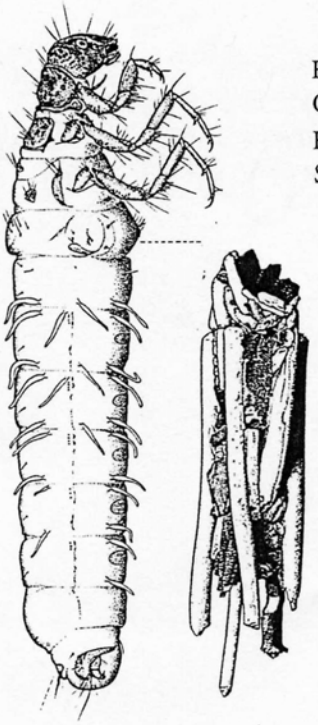


Family Pteronarcydiae (3)
Genus Pteronarcys
Feeding Type - Herbivore
Sample Type - Leaf Pack, Visuals

TRICHOPTERA



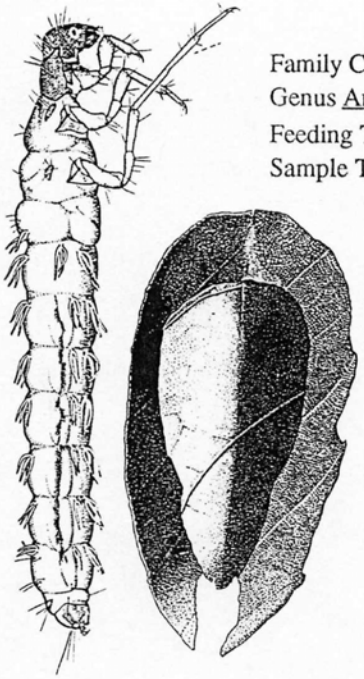
Family Leptoceridae (4)
Genus Triaenodes
Feeding Type - Herbivore
Sample Type - Sweep



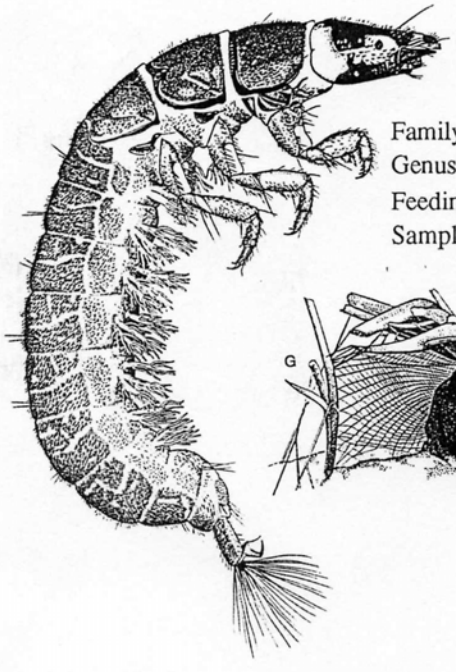
Family Limnephilidae (4)
Genus Pycnopsyche
Feeding Type - Detritivore
Sample Type - Sweep, Visuals

TRICHOPTERA

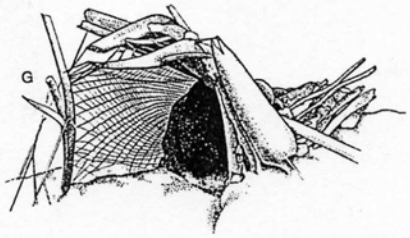
Family Brachycentridae (4)
Genus Brachycentrus
Feeding Type - Scraper
Sample Type - Kick, Visuals

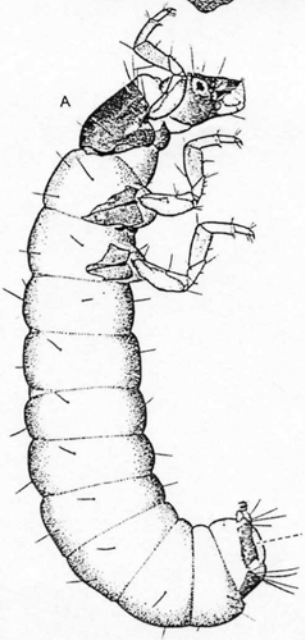


Family Calamoceratidae (4)
Genus Anisocentropus
Feeding Type - Detritivore
Sample Type - Sweep, Visuals



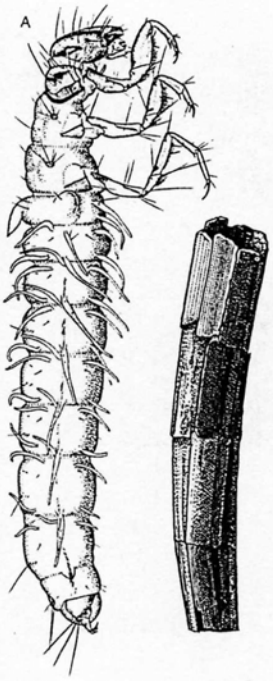
Family Hydropsychidae (4)
Genus Hydropsyche
Feeding Type - Filter Feeder
Sample Type - Kick, Visuals



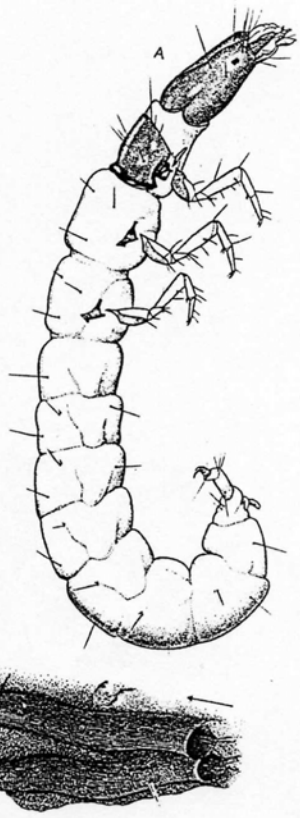


Family Glossosomatidae (4)
Genus Glossosoma
Feeding Type - Scraper
Sample Type - Kick, Visuals

TRICHOPTERA

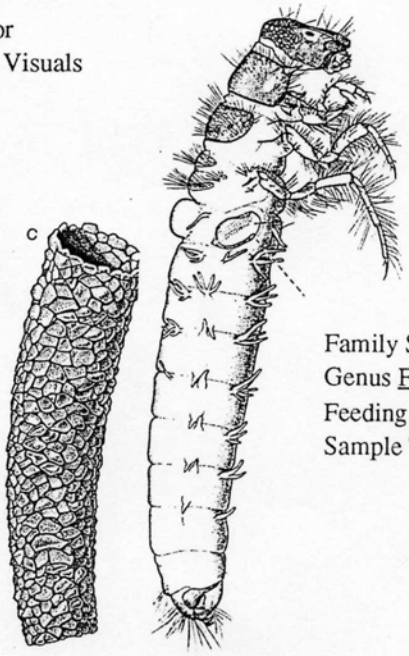


Family Phryganeidae (4)
Genus Ptilostomis
Feeding Type - Detritivore
Sample Type - Sweep, Visuals



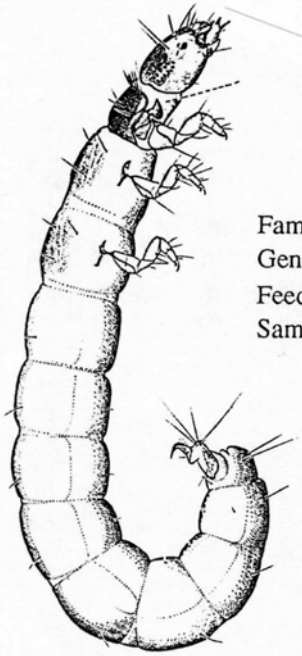
Family Philpotamidae (4)
Genus Dolophilodes
Feeding Type - Filter Feeder
Sample Type - Kick, Visuals

Family Rhyacophilidae (4)
Genus Rhyacophila
Feeding Type - Predator
Sample Type - Kicks, Visuals

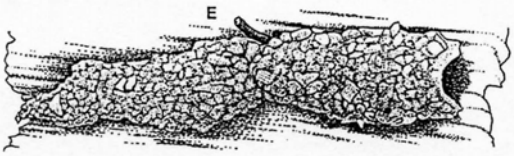


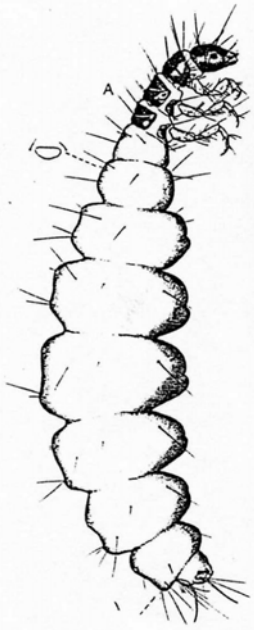
Family Sericostomatidae (4)
Genus Fattigia
Feeding Type - Detritivor
Sample Type - Kicks, Sweeps and Visuals

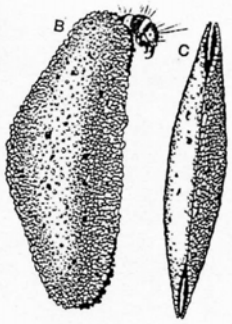
TRICHOPTERA



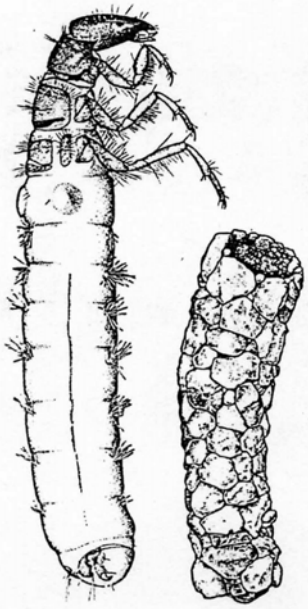
Family Psychomyiidae (4)
Genus Lype
Feeding Type - Detritivor
Sample Type - Visuals



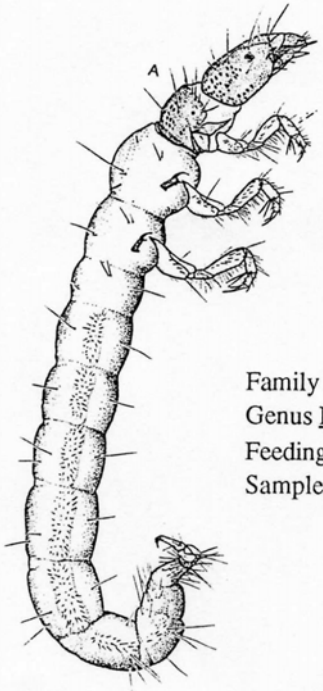


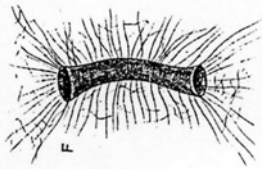


Family Hydroptilidae (4)
Genus Hydroptila
Feeding Type - Herbivore
Sample Type - Visuals



Family Odontoceridae (4)
Genus Psilotreta
Feeding Type - Scraper
Sample Type - Sweep, Visuals





Family Polycentropodidae (4)
Genus Polycentropus
Feeding Type - Predator
Sample Type - Kicks, Visuals