

University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

Distance Master of Science in Entomology
Projects

Entomology, Department of

2018

Macroinvertebrates of the Teton River Drainage

Maggie P.J. Heumann

Follow this and additional works at: <https://digitalcommons.unl.edu/entodistmasters>



Part of the [Entomology Commons](#)

This Thesis is brought to you for free and open access by the Entomology, Department of at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Distance Master of Science in Entomology Projects by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

Macroinvertebrates of the Teton River Drainage

By: Maggie P.J. Heumann



Table of Contents

About the Teton River.....	3
Maps of the Teton River.....	4-5
Macroinvertebrate & Life History Overview.....	6-8
Major Macroinvertebrate Groups	
Mayflies.....	9-16
Ameletidae	
Baetidae	
Ephemerellidae	
Heptageniidae	
Leptohyphidae	
Leptophlebiidae	
Siphonuridae	
Caddisflies.....	17-22
Brachycentridae	
Glossosomatidae	
Hydropsychidae	
Limnephilidae	
Rhyacophilidae	
Stoneflies.....	23-30
Capniidae	
Chloroperlidae	
Nemouridae	
Perlidae	
Perlodidae	
Pteronarcyidae	
Taeniopterygidae	
True Flies.....	31-38
Athericidae	
Ceratopogonidae	
Chironomidae	
Culicidae	
Empididae	
Simuliidae	
Tipulidae	
Beetles.....	39-42
Dytiscidae	
Elmidae	
Halplidae	
Dragonflies & Damselflies.....	43
True Bugs (Hemiptera).....	44
Worms & Leeches.....	45
Mollusks & Snails.....	46
Crustaceans.....	47
Mites.....	48
Glossary.....	49
Bibliography.....	50-51
About the Author.....	52

About the Teton River

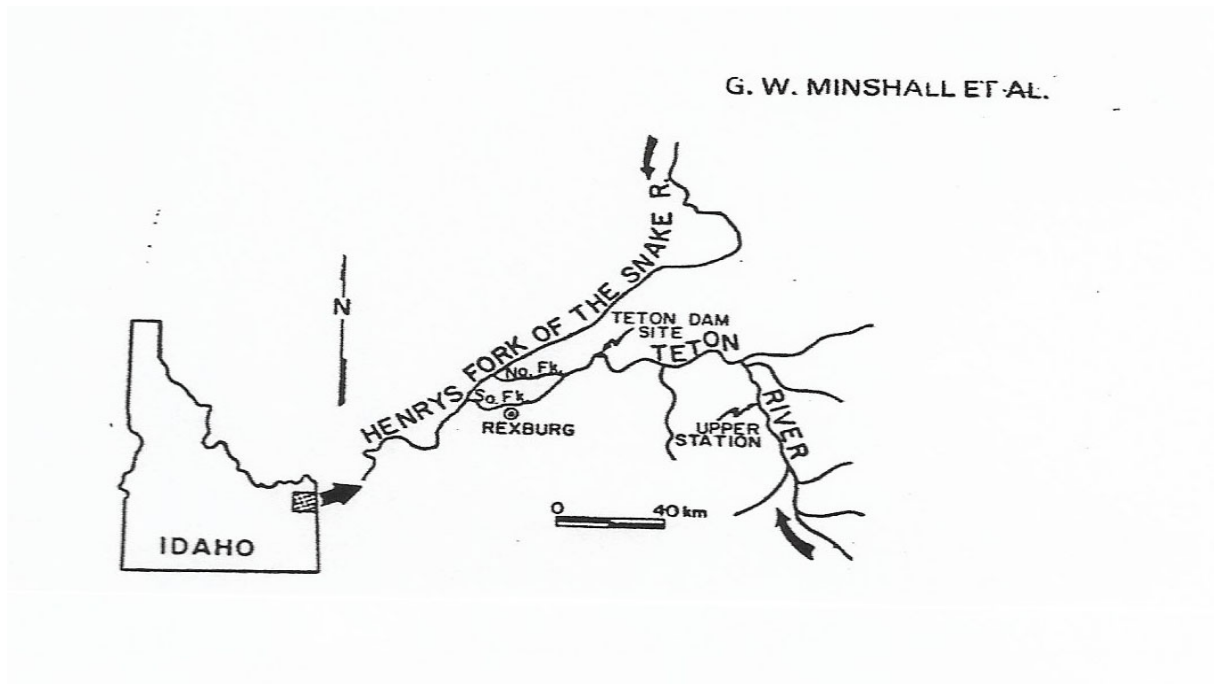
The Teton River is a spring creek that forms on the northern end of Teton Valley, Idaho. It begins small, and gradually turns in to a calm, winding river tucked in between dense willow thickets flowing through luscious Idaho farm meadows. After about twenty miles, the river flows under a bridge on State Highway 33, and begins carving out a large canyon in between larger, commercial agricultural operations. At the end of the canyon is the former location of the Teton Dam. Beyond the former dam site, the river morphs back in to a small, calm meadow stream before it converges with Henry's Fork of the Snake River, eventually leading the waters in to the Columbia River drainage. The Teton River exhibits an incredible amount of diversity in its ecology, from the types of water flows to the insect biodiversity in just a short 64 miles with over 60 small tributaries.

The Teton River is very unique for many reasons. It possesses wide, flat, lake-like portions near the headwaters and technical, Class 4 rapids downstream in the canyon. This allows for a wide range of diversity when it comes to the macroinvertebrates that inhabit the river system. Several large tributaries feed in to the Teton in the upper valley portion, including: Mahogany Creek, Patterson Creek, Trail Creek, Horseshoe Creek, Fox Creek and Rainey Creek. In the canyon section, Bitch Creek, Badger Creek and Canyon Creek are the major tributaries.

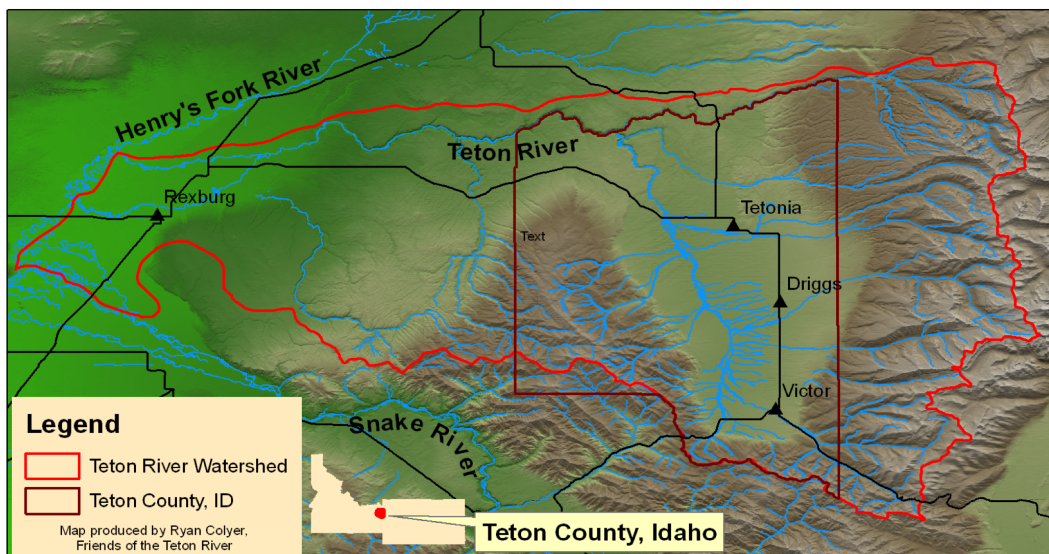
In 1962, an earthen dam was commissioned by the Bureau of Reclamation to be built in the Teton River Canyon, just Northeast of Rexburg near Sugar City. On June 5, 1976, as the dam was finished and was being filled with water, the dirt gave way and flooded the towns below. This incident killed eleven people and forever altered the landscape. Future research may include loss of or change in macroinvertebrate biomass and diversity in the areas below the dam, where critical habitat was washed away and replaced with sediment from the structure.

In this study, a combination of historical collection info, State of Idaho Department of Environmental Quality Beneficial Use Reconnaissance Program, or BURP data, as well as my own collection and observation data from myself and fishing guides that frequent all portions of the river. Sample locations included the main stem of the Teton River and the following tributaries: Fox Creek, Mahogany Creek, Darby Creek, Badger Creek, Bitch Creek, Trail Creek, Warm Creek, and Teton Creek. Sample data years ranged from 1977-present.

Maps of the Teton River

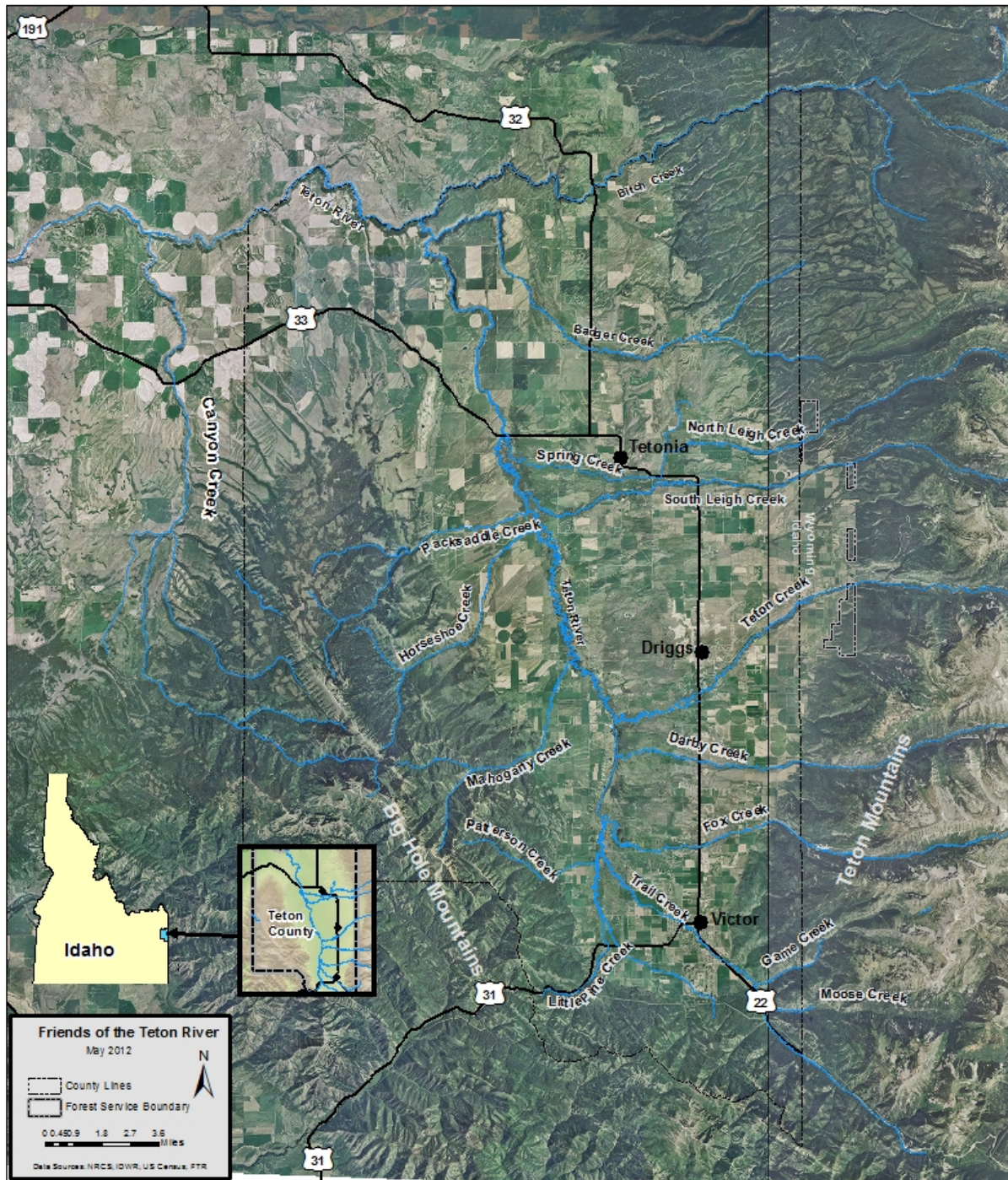


Map courtesy of Idaho State University & Dr. Wayne Minshall



Map Courtesy of Friends of the Teton River

Upper Teton River Watershed



Map Courtesy of Friends of the Teton River

Macroinvertebrate Importance

Macroinvertebrates of all shapes and sizes are found throughout the Teton River drainage. They can be very useful tools in determining environmental changes and giving an overall gauge of ecosystem health.

Insects, and other macroinvertebrates, are easy to use when assessing stream fitness because of their sensitivity to changes in the environment around them. They spend the majority of their lives under water, sometimes years as a nymph and days as an adult. They are typically found in large numbers, making them easy organisms to collect. They also don't migrate large distances over the course of their lives, both terrestrial and aquatic, again, making them an ideal instrument for evaluation.

Geographical shifts in populations over time can become an effective tool for future studies on climate change. It is important to catalog macroinvertebrates in watersheds in order to keep a baseline for potential follow-up monitoring.

For each group documented in this guide, the pollution tolerance is listed under "additional info". The Teton River has exceptionally clean water and a large abundance of the key bioindicator orders, Ephemeroptera, Plecoptera, and Trichoptera (EPT) are a testament to that.

Insect Life History

Insects are arthropods with six legs and three body segments: the head, thorax and abdomen. Almost all insects are born of an egg (there are a few live-birth exceptions like aphids). They emerge into a nymph or larva and proceed to **molt** by shedding their **exoskeleton** in order to grow. The stages of growth in an immature insect are referred to as **instars**. All insects undergo metamorphosis.

Complete metamorphosis refers to insects that undergo a complete change from immature to adult. This involves an egg phase, a larval or nymphal phase, and a pupal phase before adult emergence. The immature looks nothing like the adult.

Incomplete metamorphosis refers to insects that do not have a pupal phase and simply molt and go through instars before completing a final molt and becoming an adult. There is a type of incomplete metamorphosis, sometimes referred to as **Hemimetabolous** metamorphosis, that is used to describe insects that complete their immature life stages aquatically and emerge as a terrestrial adult.

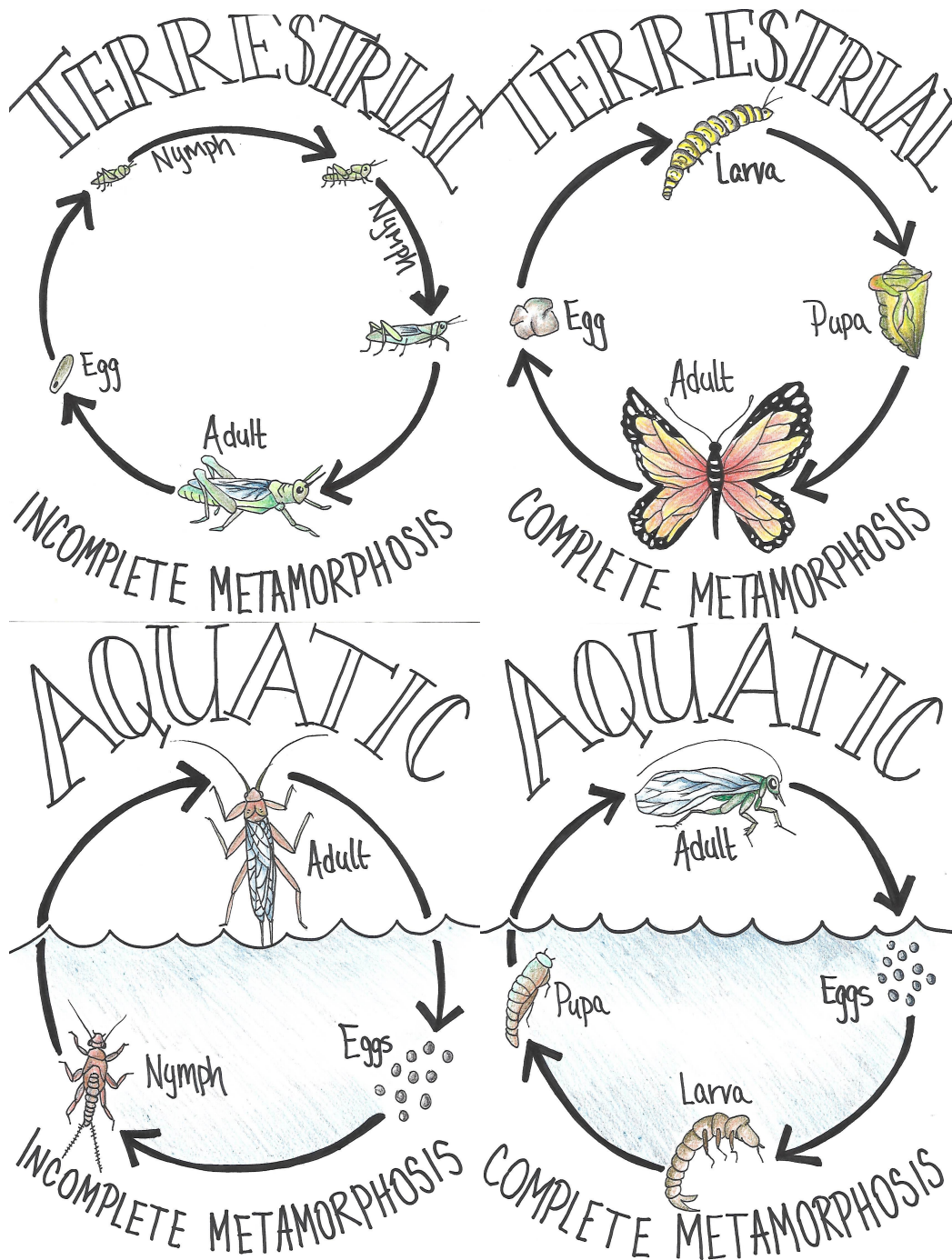
Nymph, naiad, and larvae are all terms used to describe the early life stages of insects. Immature is a general term that applies to any arthropod that is not a fully developed adult. Nymph is a term that can be associated with or without an aquatic portion to the life cycle. It refers to an immature insect that undergoes incomplete metamorphosis, such as the Hemiptera. Naiad is a more specific term, referring to the Ephemeroptera, Plecoptera, and Trichoptera immatures, which can also be identified as nymphs. These are all insects that undergo incomplete metamorphosis, yet look totally different and occupy a different habitat from immature to adulthood. Larvae is the term referring to the immature stage of an insect that undergoes complete metamorphosis. This can be both terrestrial (caterpillar) and aquatic (caddis).

Voltinism is the term used to describe the number of broods an insect produces per year. Univoltine means there is one brood or generation per year. Bivoltine means there are two generations per year. Multivoltine means there are more than two generations per year. Semivoltine means that the insects develop over a number of years before emerging into adulthood. Many times, it is dependent on the genera to determine an insect's voltinism.

The ecology of the insect is referring to the specific habitat that is occupied while living under water. Insects and other arthropods have adapted their body shapes to move more efficiently in different types of substrate and water flows.

Many aquatic insect species have **vestigial** mouthparts as adults, meaning they are not functioning and they don't feed at all. This is why the main functional feeding groups discussed in this guide are in reference to the immature life stages. Adult feeding habits are mentioned when applicable.

Metamorphosis



MAYFLIES

Order: Ephemeroptera

Type of Metamorphosis: Aquatic Incomplete

Mayflies are easily identified by their delicate appearance and upright wings. The males have large, contiguous, **turbinate** eyes. They are most unique because they are the only insect group to molt as adults. When the nymphs emerge as terrestrial adults, they are in the **dun** or **subimago** form. Their wings are opaque and within hours, they molt into a sexually mature adult with clear wings. This form is known as the **spinner** or **imago**. The males gain length in their forearms to make grasping females for in-flight mating easier. They then proceed to mate and die. Tail numbers often change from immature to adult.

Mayflies cruise the surface of the Teton River most of summer Small *Baetis* and *Ephemerella* or Blue-Winged Olives (BWOs) and Pale Morning Duns (PMDs) cover up the river most of the summer, while the Fall is known for the presence of the Gray Drake of the *Siphonurus* genus.

Ecology

Burrowers- use tusks to burrow into the silt substrate at the bottom of a river. Although some habitat seems ideal , no burrowing mayfly species have been reported from the Teton River.

Clingers- Evolved flattened bodies in order to cling to rocks & other structures in rushing waters

Crawlers- Have stout, often spiny in appearance bodies that are designed to move along rocks and other substrate in high water flows

Swimmers:-Have a torpedo-shaped bodies, very minnow-like for swimming in river systems

Functional Feeding Groups

Filterer- have modified mouthparts to filter sediments and water to feed

Gatherer- gathers or collects food and stores it or eats immediately

Scraper- scrapes rocks or plant matter for nutrients and food

Shredder- shreds plant detritus, an important part of the ecosystem

Predator- hunts other invertebrates for food

Identifying Features

Nymphs

- Two or three tails
- One tarsal claw on each leg
- Gills on abdomen (main identifying factor, especially for family identification)

Adults

- Hindwing not always present
- When hindwing is present, it's much smaller than forewing
- Forewing large, upright like a sailboat and triangular
- Two or three tails

FAMILY: AMELETIDAE



Photo Credit: Gunnisoninsects.org; Genus *Ameletus* Nymph



Photo Credit: Troutnut.com; Genus *Ameletus* Dun

Common Name(s): Brown Dun

Key ID Feature for Adults: Mottled-winged dun, 2 tails

Key ID Features for Nymphs: Band across the tail, oval abdominal gills with a dark edge, comb-like mouthparts for filter-feeding, torpedo-shaped body, 3 tails

Ecology: Swimmer

Feeding Group: Scraper/Gatherer

Life Cycle: Univoltine

Immature Size: ≤14mm

Immature Color: Grey

Adult Size: 10-14mm

Adult Color: Brown, sometimes with deep red undertones

Additional Info: Sensitive to pollution, often confused with Baetidae as a nymph and Siphonuridae as an adult

Approximate Teton River Emergence: May-October

Known Species in the Teton River Drainage:

- *Ameletus oregonensis*

FAMILY: BAETIDAE



Genus: *Baetis* Nymph



Genus: *Baetis* Nymphs

Common Name(s): Blue-Winged Olives (BWOs), Minnow Mayflies

Key ID Feature for Adults: Small with a green body and grey wings, often seen in the dun or subimago form, 2 tails

Key ID Features for Nymphs: Slender, torpedo or minnow-shaped bodies, three tails, oval-shaped gills, 2 or 3 tails, greenish-grey color

Ecology: Swimmer

Feeding Group: Scraper/Gatherer

Life Cycle: ≥ 1 generation per year; 2 generations every 3 years; can be univoltine or bivoltine

Immature Size: ≤ 12 mm

Immature Color: Greenish-grey, sometimes with black wingpads

Adult Size: 3-12mm

Adult Color: Grey/Black/Green

Additional Info: Moderately sensitive to pollution

Approximate Teton River Emergence: March-December (Can be all year)

Known Species in the Teton River Drainage:

- *Baetis tricaudatus*
- *Baetis bicaudatus*
- *Diphetor hageni* (formerly *Baetis parvus*)

FAMILY: EPHEMERELLIDAE



Genus: *Drunella* Nymphs



Genus: *Drunella* Dun



Genus: *Ephemerella* Dun

Common Name(s): Pale Morning Duns (PMDs), Green Drakes, Flavs

Key ID Feature for Adults: 3 Tails; large for a mayfly

Key ID Features for Nymphs: No gills on second abdominal segment, 3 tails, spiny, stout bodies with “muscular-looking” legs (*Drunella*)

Ecology: Crawler

Feeding Group: Scraper/gatherer/predator

Life Cycle: ≥ 1 generation per year; Univoltine

Immature Size: ≤ 15 mm

Immature Color: Green/Grey/Brown

Adult Size: 7-15mm

Adult Color: Green/Grey/Brown

Additional Info: Sensitive to pollution

Approximate Teton River Emergence: June-September

Known Species in the Teton River Drainage:

- *Caudatella hystrix*
- *Drunella coloradoensis*
- *Drunella doddsi*
- *Drunella flavilinea*
- *Drunella grandis*
- *Drunella spinifera*
- *Ephemerella excrucians*
- *Ephemerella tibialis*

FAMILY: HEPTAGENIIDAE



Common Name(s): Flat-Headed Mayflies, March Browns, Pale Evening Dun, Yellow Quill

Key ID Feature for Adults: 2 tails, flat head

Key ID Features for Nymphs: Flat head, 2 or 3 tails, brown to red in color, gills form a “suction cup” underneath in *Rhithrogena* (see middle photo)

Ecology: Clinger

Feeding Group: Scraper/Gatherer

Life Cycle: Univoltine

Immature Size: ≤20mm

Immature Color: Dark brown to bright red

Adult Size: 6-15mm

Adult Color: Variant from creamy yellow to a dark brown, mottled dun phase

Additional Info: Moderately sensitive to pollution

Approximate Teton River Emergence: March-June

Known Species in the Teton River Drainage:

- *Cinygmula par*
- *Epeorus deceptivus*
- *Epeorus longimanus*
- *Epeorus grandis* (Yellow Quill)
- *Heptagenia solitaria*
- *Rhithrogena hageni*
- *Rhithrogena robusta*

FAMILY: LEPTOHYPHIDAE



Photo Credit: Troutnut.com



Photo Credit: Whitney Cranshaw, Colorado State University, Bugwood.org

Common Names: Tricos

Key ID Feature for Adults: Small, stout bodies; 3 tails; No hind wings

Key ID Features for Nymphs: Two large triangular gills on abdomen, 3 tails

Ecology: Clinger/Sprawler

Feeding Group: Scraper/Gatherer

Life Cycle: ≥ 1 generation per year; can be univoltine or bivoltine

Immature Size: ≤ 10 mm

Immature Color: Brown variations to light greenish-yellow

Adult Size: 3-6mm

Adult Color: Black

Additional Info: Moderately sensitive to pollution

Approximate Teton River Emergence: July-September

Known Species in the Teton River Drainage:

- *Tricorythodes explicatus*

FAMILY: LEPTOPHLEBIIDAE



Photo Credits: Troutnut.com

Common Name(s): Mahogany Duns

Key ID Feature for Adults: Rounded hind wings; 3 tails

Key ID Features for Nymphs: Pronged fork in the abdominal gills, 3 tails, uniformly shaped oblong body

Ecology: Crawler

Feeding Group: Scraper/Gatherer

Life Cycle: Univoltine

Immature Size: $\leq 15\text{mm}$

Immature Color: Dark brown to dark reds

Adult Size: 7-9mm

Adult Color: Red/Brown

Additional Info: Sensitive to pollution, Called “mahogany” for its color

Approximate Teton River Emergence: Late Spring/ Early Summer

Known Species in the Teton River Drainage:

- *Neoleptophlebia heteronea*

FAMILY: SIPHLONURIDAE



Photo Credit: Troutnut.com



Common Names: Grey Drakes

Key ID Feature for Adults: Large size, large hind wing & slate gray color, 2 tails

Key ID Features for Nymphs: Double-flapped gills on the first abdominal segment, 3 tails

Ecology: Swimmer

Feeding Group: Predatory/Gatherer

Life Cycle: Bivoltine; Summer & Fall emergence

Immature Size: ≤17mm

Immature Color: Light grey or brown

Adult Size: 12-15mm

Adult Color: Grey/Black

Additional Info: Moderately sensitive to pollution, Dense emergence in September, mainly near the headwaters

Approximate Teton River Emergence: July- September

Known Species in the Teton River Drainage:

- *Siphonurus occidentalis*

CADDISFLIES

Order: Trichoptera

Type of Metamorphosis: Aquatic Complete

Caddisflies are most closely related to butterflies and moths and resemble them in both the larval and adult forms. Larva have six legs with hooked claws. Many larvae build protective cases from organic matter, pebbles, and twigs. Some larva are free-living and spin nets to catch and filter their food. Some species are predatory, while some are more plant-based feeders and filterers. Adults are identified by wings that are held roof-like over the body. They are typically seen in mass quantities when hatching on the Teton River.

Caddisflies have consistent emergence all summer and Fall on the Teton River, some even in the middle of winter. They are one of the most consistent species found throughout the Teton River.

Ecology

Clingers- Have evolved flattened bodies in order to cling to rocks or other structures in rushing waters

Sprawlers- occupies habitat on top of fine sandy and silty sediment

Functional Feeding Groups

Filterer- builds a net to filter out food particles from water

Gatherer- gathers or collects food and stores it or eats immediately

Scraper- scrapes rocks or plant matter for nutrients and food

Shredder- shreds plant detritus, an important part of the ecosystem

Predator- hunts other invertebrates for food, also uses a net in some free-living species

Identifying Features

Larvae

- Looks similar to a caterpillar
- Housed in a protective case
- Six legs near head
- Anal gills (sometimes)

Adults

- Wing's held roof-like (think A-frame or tent-like) over the body
- Looks similar to a small moth
- Light hair on the wings
- Smaller species usually found in groups; larger more solitary

*Other Families of note that are not covered: Apataniidae, Helicopsyche, Lepidostomatidae

FAMILY: BRACHYCENTRIDAE



Common Name(s): Grannom, Mother's Day Caddis, Apple Caddis

Key ID Feature for Adults: Small size, huge numbers when hatching

Key ID Features for Larvae: Cases are small and usually in a perfect square or tapered cone shape

Ecology: Clingers

Feeding Group: Filterer/Gatherer/Shredder

Life Cycle: Univoltine

Immature Size: $\leq 17\text{mm}$

Immature Color: Creamy white to lime green body, brown head and legs

Adult Size: 6-12mm

Adult Color: Brownish-grey, sometimes with a green body- lighter brown in color when first emerging

Additional Info: Sensitive to pollution; needs very clean water

Approximate Teton River Emergence: April-August

Known Species in the Teton River Drainage:

- *Amiocentrus aspilus*
- *Brachycentrus americanus*
- *Brachycentrus occidentalis*
- *Micrasema* sp.

FAMILY: GLOSSOSOMATIDAE



Photo Credits: Thedragonflywoman.com

Common Name(s): Saddle-Case Makers, Little Black Caddis

Key ID Feature for Adults: Small in size, mottled wing

Key ID Features for Larvae: Oval, pebble casing; looks like small bean-shapes made of rocks attached to larger rocks

Ecology: Clinger

Feeding Group: Scraper

Life Cycle: Multivoltine

Immature Size: ≤8mm

Immature Color: Creamy body with brown head & legs

Adult Size: 6-10mm

Adult Color: Mottled greyish-brown

Additional Info: Clinger; builds a “turtle-shell-like” case on the sides of rocks and builds a bigger one every time they grow

Approximate Teton River Emergence: April-October

Known Species in the Teton River Drainage:

- *Glossosoma intermedium*
- *Glossosoma velona*

FAMILY: HYDROPSYCHIDAE



Photo Credit: Thedragonflywoman.com

Common Name(s): Net-spinning Caddis, Spotted Sedge

Key ID Feature for Adults: Medium-sized, antennae about the same length as body, mottled wing

Key ID Features for Larvae: No case, large, tufted gills, 3 dark plates on dorsal thoracic segments

Ecology: Clinger/Net-Spinner

Feeding Group: Filters through a web/Predatory

Life Cycle: Univoltine

Immature Size: $\leq 15\text{mm}$

Immature Color: Creamy white to lime green body, brown head and legs

Adult Size: 10-14mm

Adult Color: Brownish-grey with mottling of the wings

Additional Info: Moderately sensitive to pollution, spin a net to filter out their food or prey on smaller arthropods

Approximate Teton River Emergence: May-October

Known Species in the Teton River Drainage:

- *Hydropsyche oslari*
- *Parapsyche elsis*

FAMILY: LIMNEPHILIDAE



Common Name(s): October Caddis, Snow Sedge, Silver-Marked Sedge, Fall Caddis

Key ID Feature for Adults: Largest caddis in the area, straw or grey-colored, silvery stripe on wing

Key ID Features for Larvae: Large rock or stick casing; dorsal hump on first abdominal segment (see middle photo)

Ecology: Sprawler

Feeding Group: Shredder/Gatherer

Life Cycle: Univoltine

Immature Size: ≤33mm

Immature Color: Creamy white body, brown head and legs

Adult Size: 20-30mm

Adult Color: Grey to Straw Yellow, varies depending on genus, orange or straw-colored legs

Additional Info: Moderately sensitive to pollution, *Psychoglypha* emerges in the winter

Approximate Teton River Emergence: September-February

Known Species in the Teton River Drainage:

- *Ecclisomyia maculosa*
- *Hesperophylax designatus*
- *Neothremma alocia*
- *Onocosmecus unicolor*
- *Psychoglypha suborealis*

FAMILY: RHYACOPHILIDAE



Common Name(s): Green Rock Worm, Free-living Caddis

Key ID Feature for Adults: Small, similar to Brachycentridae, but with a more rounded wing

Key ID Features for Larvae: Glowing green color, no case, no thoracic plates, only first segment darkened

Ecology: Clinger/Sprawler

Feeding Group: Predatory/Gatherer

Life Cycle: Univoltine

Immature Size: ≤23mm

Immature Color: Bright green

Adult Size: 8-16mm

Adult Color: Green to brown

Additional Info: Sensitive to pollution

Approximate Teton River Emergence: May-October

Known Species in the Teton River Drainage:

- *Rhyacophila alberta*
- *Rhyacophila angelita*
- *Rhyacophila betteni*
- *Rhyacophila brunnea*
- *Rhyacophila coloradoensis*
- *Rhyacophila pellisa*
- *Rhyacophila vacuua*
- *Rhyacophila verrula*

STONEFLIES

Order: Plecoptera

Type of Metamorphosis: Aquatic Incomplete

Stoneflies are typically found in cool, clean mountain streams. We have stonefly species that emerge year-round. There are larger species that emerge in the heat of the summer and smaller species that emerge during the winter months. Stoneflies have the longest life cycle of any aquatic insects, taking up to four years for some nymphs to emerge in to adults. Most females lay eggs over the water or swim down and lay egg masses on substrate.

With the diversity of the Teton River, a multitude of stoneflies inhabit different habitats. We have a larger population of winter and spring stones like Capniidae, Perlodidae, Chloroperlidae in the valley area, with an abundance of the larger species, such as Perlidae & Pteronarcyidae, being found in the highly oxygenated waters of the Teton River canyon. Stoneflies are a great indicator of water quality, which is why the Teton River has such a dense population.

Ecology

Clingers- Have evolved flattened bodies in order to cling to rocks or other structures in rushing waters

Sprawlers- occupies habitat on top of fine sandy and silty sediment

Functional Feeding Groups

Shredder- shreds plant detritus, an important part of the ecosystem

Predator- hunts other invertebrates for food

Identifying Features

Nymphs

- Two tails
- Two tarsal claws on each leg
- Gills on thorax either present or absent
- Often elaborate patterning on thorax segments
- Obvious wing pads

Adults

- 2 sets of wings, some males **brachypterous**
- Wings folded flat on top of each other and flush to the body
- Two tails
- Long antenna

*Other Families of note that are not covered: Leuctridae

FAMILY: CAPNIIDAE



Capnia Nymph



Capnia Adult Female



Capnia Adult Male

Common Name(s): Snowflies, Little Winter Stones

Key ID Feature for Adults: Mid tarsal segment shorter than basal segment, skinny, small and black, long cerci

Key ID Features for Nymphs: Abdominal segments are widest towards the bottom; hind wing pads are about as broad as they are long

Ecology: Clinger

Feeding Group: Predator

Life Cycle: Univoltine

Immature Size: $\leq 10\text{mm}$

Immature Color: Caramel brown to dark brown

Adult Size: 4-10mm

Adult Color: Black, sometimes with dark brown legs

Additional Info: Highly sensitive to pollution

Approximate Teton River Emergence: December-March

Known Species in the Teton River Drainage:

- *Capnia coloradoensis*
- *Capnia distincta*
- *Capnia gracilaria*
- *Capnia lemoniana*

FAMILY: CHLOROPERLIDAE



Photo Credit: Troutnut.com

Common Name(s): Green Stoneflies, Spring Stones, Yellow Sallies

Key ID Feature for Adults: Small size, usually very yellow/green in color

Key ID Features for Nymphs: No distinct thorax markings, no gills

Ecology: Clinger

Feeding Group: Predator

Life Cycle: Univoltine

Immature Size: ≤10mm

Immature Color: Varies from light caramel brown to yellow or tan

Adult Size: 7-12mm

Adult Color: Light green/yellow

Additional Info: Very sensitive to pollution

Approximate Teton River Emergence: July-August

Known Species in the Teton River Drainage:

- *Alloperla severa*
- *Sweltsa coloradoensis*
- *Suwallia pallidula*
- *Triznaka diversa*
- *Triznaka pintada*
- *Triznaka signata*

FAMILY: NEMOURIDAE



Photo Credit: Troutnut.com

Common Name(s): Little Black Stones, Winter Stones

Key ID Feature for Adults: X-pattern of crossveins on wings, small and blackish-grey in color, can't see cerci past wings

Key ID Features for Nymphs: Filamentous, cervical (neck) gills (see top left photo); generally hairy body, rear wing pads divergent from thorax

Ecology: Clinger

Feeding Group: Shredder

Life Cycle: Multivoltine

Immature Size: $\leq 12\text{mm}$

Immature Color: Dark Brown

Adult Size: 7-12mm

Adult Color: Black/Grey with mottled wings

Additional Info: Highly sensitive to pollution

Approximate Teton River Emergence: January-May

Known Species in the Teton River Drainage:

- *Malenka flexura*
- *Zapata cinctipes*
- *Zapata columbiana*
- *Zapata oregonensis*

FAMILY: PERLIDAE



Common Name(s): Common Stonefly

Key ID Feature for Adults: Large size, often golden or brown in color

Key ID Features for Nymphs: Large gill tufts under arms and on thorax

Ecology: Clinger

Feeding Group: Predator

Life Cycle: <1 per year; nymph life cycle can take up to 3 years

Immature Size: ≤38mm

Immature Color: Dark brown with light brown & yellow markings, white gills

Adult Size: ≤38mm

Adult Color: Brown or gold with lighter markings

Additional Info: Highly sensitive to pollution

Approximate Teton River Emergence: June-July

Known Species in the Teton River Drainage:

- *Claasenia sabulosa*
- *Hesperoperla pacifica*

FAMILY: PERLODIDAE



Common Name(s): Springflies & Little Yellow Stones, Golden Stones

Key ID Feature for Adults: Similar to Perlidae, smaller in size, some with brachypterous wings (pictured on right)

Key ID Features for Nymphs: Lack of gills under appendages

Ecology: Clinger

Feeding Group: Predator

Life Cycle: Univoltine

Immature Size: $\leq 16\text{mm}$

Immature Color: Dark brown with light brown & yellow markings

Adult Size: 7-16mm

Adult Color: Brown/Black/Yellow

Additional Info: Highly sensitive to pollution

Approximate Teton River Emergence: May-August

Known Species in the Teton River Drainage:

- *Cultus aestivali*
- *Cultus tostonus*
- *Isogenoides* sp.
- *Isoperla patricia*
- *Isoperla pinta*
- *Isoperla sardida*
- *Kogotus modestus*
- *Megarcys signata*
- *Pictetia expansa*
- *Skwala Americana*

FAMILY: PTERONARCYIDAE



Common Name(s): Salmonfly

Key ID Feature for Adults: Enormous size, orange banding on neck portion

Key ID Features for Nymphs: Large, uniform dark color, large thoracic gills on ventral side

Ecology: Clinger

Feeding Group: Shredder

Life Cycle: 2-4 years

Immature Size: ≤50mm

Immature Color: Dark brown, almost black

Adult Size: 30-50mm

Adult Color: Dark brown to black with orange band at neck

Additional Info: Highly sensitive to pollution, females much larger than males, fly over open water and drop egg masses

Approximate Teton River Emergence: June-July

Known Species in the Teton River Drainage:

- *Pteronarcys californica*

FAMILY: TAENIOPTERYGIDAE



Photo Credits: Troutnut.com

Common Name(s): Willowflies, Winter Stones

Key ID Feature for Adults: 1st and 2nd tarsal segments of equal length, can't see cerci past wings

Key ID Features for Nymphs: Wing pads not parallel with body, 1st and 2nd tarsal segments of equal length

Ecology: Clinger/Sprawler

Feeding Group: Shredder

Life Cycle: Univoltine

Immature Size: ≤14mm

Immature Color: Dark brown with lighter brown markings

Adult Size: 7-14mm

Adult Color: Black and grey, often mottled

Additional Info: Sensitive to pollution; Often confused with genus *Zapada*, distinguished by tarsal segments

Approximate Teton River Emergence: January-June

Known Species in the Teton River Drainage:

- *Doddsia occidentalis*

TRUE FLIES

Order: Diptera

Type of Metamorphosis: Aquatic Complete

True flies are very significant to the balance of an aquatic ecosystem. They are typically the most abundant, in both biomass and species diversity. This is likely true in the Teton River drainage. They can withstand all types of habitats, from clean, fast-moving to stagnant, polluted water. They also emerge all year long, including all winter. True flies also include many of the nuisance species such as mosquitos and no-see-ums that bite. These are also often important disease vectors.

Ecology

Burrowers- Use worm-like body to burrow into the silt substrate at the bottom of a river.

Clingers- Evolved suction mechanisms to cling to rocks & other structures in rushing waters

Crawlers- Have stout, often spiny in appearance bodies that are designed to move along rocks and other substrate in high water flows

Sprawlers- Occupies habitat on top of fine sandy and silty sediment

Swimmers-Have elongated bodies for swimming easily in any water type

Wrigglers- Make sharp writhing motions; most often displayed by maggots, especially mosquitoes

Functional Feeding Groups

Filterer- uses brush-like appendages to filter food from flowing water

Collector-Gatherer- gathers or collects food and stores it or eats immediately

Scraper- scrapes rocks or plant matter for nutrients and food

Shredder- shreds plant detritus, an important part of the ecosystem

Predator- hunts other invertebrates for food, sometimes piercing them to suck out **hemolymph**

Identifying Features

Nymphs (Larvae)

- Maggot or worm-like in appearance
- **Prolegs** or no jointed legs present
- Head not always obvious

Adults

- 1 pair of wings
- Tiny pair of **halteres** behind wings (see up-close photo of Chironomidae)
- Many males have plumose antennae

Other Families of note that are not covered: Pediciidae, Dixidae

FAMILY: ATHERICIDAE



Photo Credit: R. Pfau, bugguide.net

Common Name(s): Watersnipe Flies

Key ID Feature for Adults: Similar look to a house or deerfly, banded abdomen, wings with black spots

Key ID Features for Larvae: Glowing green, worm-like body with two “Shrek” horn appendages on abdomen that are typically “furry” in appearance, prolegs on 7 abdominal segments

Ecology: Sprawler/Burrower

Feeding Group: Predator (piercer)

Life Cycle: Univoltine

Immature Size: ≤20mm

Immature Color: Lime green

Adult Size: 10-15mm

Adult Color: Bright green nymph/ black adult fly

Additional Info: Sensitive to pollution

Approximate Teton River Emergence: May-August

Known Species in the Teton River Drainage:

- *Atherix* sp.

FAMILY: CERATOPOGONIADE



Photo Credit: Stephen Luk, bugguide.net.

Photo Credit: Charles Olsen, USDA APHIS PPQ, Bugwood.org

Common Name(s): Punkies, No-see-ums, Biting Midges

Key ID Feature for Adults: Males with plumose antennae, difficult to see with the naked eye

Key ID Features for Larvae: Worm-like, head is obvious, no legs

Ecology: Sprawler/Swimmer/Burrower

Feeding Group: Predator/Collector-Gatherer

Life Cycle: ≥ 1 generation per year

Immature Size: $\leq 10\text{mm}$

Immature Color: Creamy white with light brown head capsule

Adult Size: 1-3mm

Adult Color: Brown, Black, Grey, sometimes with red hues

Additional Info: Moderately sensitive to pollution

Approximate Teton River Emergence: June-August

Known Species in the Teton River Drainage:

- *Bezzia* sp.
- *Corynoneura* sp.

FAMILY: CHIRONOMIDAE



Chironomid larvae, "Bloodworm" larvae, Chironomid pupae, Adult male midge with halteres highlighted

Common Name(s): Midges

Key ID Feature for Adults: One pair of wings, small size

Key ID Features for Larvae: Obvious head with one pair of prolegs beneath

Ecology: Burrower/Crawler

Feeding Group: Shredder

Life Cycle: Can be Univoltine, Bivoltine or Multivoltine (genus dependent)

Immature Size: $\leq 7\text{mm}$

Immature Color: Creamy white, small brown head to solid red

Adult Size: 3-5mm

Adult Color: Black

Additional Info: Pollution tolerant

Approximate Teton River Emergence: Year-round

Known Species in the Teton River Drainage:

- *Brillia* sp.
- *Cricotopus* sp.
- *Eukiefferiella* sp.
- *Heleniella* sp.
- *Micropsectra* sp.
- *Orthocladius* sp.
- *Pagastia* sp.
- *Parametriocnemus* sp.
- *Thienemanniella* sp.
- *Tvetenia bavarica*

FAMILY: CULICIDAE



Photo Credits: Ary Farajollahi, Bugwood.org

Common Name(s): Mosquitos

Key ID Feature for Adults: Wings outlined with fringe, a long proboscis, arched thorax, sometimes abdomen is filled with blood

Key ID Features for Larvae: Usually in large numbers, moving in a “wriggling” motion, air siphon on abdomen, can be in all types of water including stagnant

Ecology: Swimmer/Wriggler

Feeding Group: Filterer/Collector-Gatherer/Piercer-Predator

Life Cycle: Multivoltine

Immature Size: $\leq 1\text{mm}$

Immature Color: Light yellowish-tan to brown and grey hues

Adult Size: 2-10mm

Adult Color: Black or grey, sometimes with white markings

Additional Info: Can survive in poor water quality conditions because they siphon air and don't breathe underwater through gills; often found in the floodplains of the Teton River

Approximate Teton River Emergence: May-August

Known Species in the Teton River Drainage:

- *Aedes* sp.
- *Culex* sp.

FAMILY: EMPIDIDAE



Photo Credit: Valley City State Invertebrate Lab, North Dakota

Photo Credit: Kevin Hall, Bugguide.net

Common Name(s): Dance Flies

Key ID Feature for Adults: Small size, long legs, pronounced, humpback thorax, sometimes with raptorial front legs, similar look to Simuliidae

Key ID Features for Larvae: Similar looking to Athericidae, except with rounded lobes on abdomen and hooks at tip of each proleg set

Ecology: Sprawler/Burrower

Feeding Group: Predator

Life Cycle: Univoltine or Bivoltine

Immature Size: $\leq 12\text{mm}$

Immature Color: Light creamy yellow, almost clear

Adult Size: 1-15mm

Adult Color: Black/grey body with clear to yellowish/orange wings

Additional Info: Moderately sensitive to pollution

Approximate Teton River Emergence: June-August

Known Species in the Teton River Drainage:

- *Chelifera* sp.
- *Clinocera* sp.
- *Metachela* sp.

FAMILY: SIMULIIDAE



Photo Credit: Royal M. Tyler, Jr., Bugguide.net

Common Name(s): Black Flies

Key ID Feature for Adults: Large, arching thorax, wings clear and broad with very visible veins

Key ID Features for Larvae: Shaped like a bowling pin, usually found in large numbers

Ecology: Clinger (via suction)

Feeding Group: Filterer

Life Cycle: Univoltine or Multivoltine

Immature Size: $\leq 7\text{mm}$

Immature Color: Black

Adult Size: 1-5.5mm

Adult Color: Black

Additional Info: Moderately tolerant of pollution

Approximate Teton River Emergence: May-September

Known Species in the Teton River Drainage:

- *Simulium* sp.

FAMILY: TIPULIDAE



Common Name(s): Crane Flies, Mosquito Hawks

Key ID Feature for Adults: Looks like a giant mosquito

Key ID Features for Larvae: Large, chunky, worm-like, with a “crown-shape” on one end

Ecology: Clinger/Burrower/Sprawler

Feeding Group: Shredder/Gatherer/Predator

Life Cycle: Univoltine or Bivoltine

Immature Size: $\leq 100\text{mm}$

Immature Color: Light creamy white, almost clear

Adult Size: 10-38mm

Adult Color: Light to dark brown/Tan/Grey

Additional Info: Sensitive to pollution

Approximate Teton River Emergence: May-August

Known Species in the Teton River Drainage:

- *Antocha* sp.
- *Hexatoma* sp.
- *Tipula* sp.

BEETLES

Order: Coleoptera

Type of Metamorphosis: Aquatic Complete

Beetles can live in a variety of habitats from arid deserts to highly oxygenated rivers. Many adult beetles use **plastron** respiration to trap air and breathe underwater without the use of gills. They look similar to terrestrial beetles, but complete their immature stages underwater, and live breathing air, but still in water as an adult. Beetles are found throughout all portions of the Teton River and its tributaries.

Ecology

Clingers- Evolved flattened bodies in order to cling to rocks & other structures in rushing waters

Crawlers- Have stout bodies that are designed to move along rocks and other substrate in high water flows

Swimmers-Have streamlined bodies for swimming in fast water

Functional Feeding Groups

Collector-Gatherer- gathers or collects food and stores it or eats immediately

Scraper- scrapes rocks or plant matter for nutrients and food

Shredder- shreds plant detritus, an important part of the ecosystem

Predator- hunts other invertebrates for food, sometimes piercing them to suck out **hemolymph**

Identifying Features

Larvae

- Grub or maggot-like
- Obvious head
- Sometimes has a tail

Adults

- 2 sets of wings; top set made of hardened **elytra**
- Wing venation not visible with naked eye
- Look like terrestrial beetles

FAMILY: DYTISCIDAE



Photo Credit: Jan Hamrsky, lifeinfreshwater.com

Photo Credit: Thedragonflywoman.com

Common Name(s): Predaceous Diving Beetle

Key ID Feature for Adults: Rounded ventral side, segmented antennae, last pair of legs split the first two abdominal segments

Key ID Features for Larvae: Abdomen has 8 segments, tail usually longer than first abdominal segment

Ecology: Climber/Swimmer

Feeding Group: Predator

Life Cycle: Semivoltine; Univoltine

Immature Size: ≤ 70 mm

Immature Color: Creamy tan

Adult Size: 2-45mm

Adult Color: Black with grey and brown variants and markings

Additional Info: Moderately sensitive to pollution

Approximate Teton River Emergence: Adults can be found year round

Known Species in the Teton River Drainage:

- *Agabus sp.*

FAMILY: ELMIDAE



Common Name(s): Riffle Beetles

Key ID Feature for Adults: Look like small terrestrial ground beetles, textured elytra

Key ID Features for Larvae: Caddis-like, 6 legs near the head, anal gill tufts

Ecology: Clinger

Feeding Group: Gatherer/Scraper/Shredder

Life Cycle: ≤ 1 generation/year

Immature Size: ≤ 3.5 mm

Immature Color: Dark brown

Adult Size: 1-8mm

Adult Color: Black with brown legs

Additional Info: Highly sensitive to pollution

Approximate Teton River Emergence: Can be present all year as adults

Known Species in the Teton River Drainage:

- *Cleptelmis addenda*
- *Heterlimnius corpulentus*
- *Narpus* sp.
- *Optioservus* sp.
- *Zaitzevia parvula*

FAMILY: HALIPLIDAE



Photo Credit (left only): Jan Hamrsky, lifeinfreshwater.com

Common Name(s): Crawling Water Beetle

Key ID Feature for Adults: Plates covering rear leg coxae (see far right photo), elytra is textured

Key ID Features for Larvae: Looks very worm-like, sometimes with heavy, hairy extensions

Ecology: Climber/Crawler

Feeding Group: Scraper/Predator; Plant-piercer as adult

Life Cycle: Univoltine or bivoltine (adults can live over a year)

Immature Size: ≤ 4.5 mm

Immature Color: Creamy tan

Adult Size: 2mm-6mm

Adult Color: Caramel to dark brown with black markings

Additional Info: Moderately sensitive to pollution

Approximate Teton River Emergence: Can be present all year as adults

Known Species in the Teton River Drainage:

- *Brychius* sp.

Other Insect Orders of Note: DRAGONFLIES & DAMSELFLIES

Order: Odonata



Photo Credit (top right only): Thedragonflywoman.com

Type of Metamorphosis: Aquatic Incomplete

Found more abundantly in in back waters and slower portions of the river. Little research has been done of Odonata on the Teton River. These families are moderately sensitive to pollution.

Functional Feeding Groups

Predator- hunts other invertebrates for food

Identifying Features

Nymphs

- Damselflies have leaf-like anal gills, dragonflies have none
- Dragonflies have a retractable jaw (see middle, bottom photo above-ventral view)
- Dragonflies abdomens act as a pump to push water out as a mode of transportation

Adults

- Dragonflies lack a wing-folding mechanism and maintain a T-shape
- Damselflies fold wings upright over body
- 2 sets of wings
- Long, slender abdomen

Other Insect Orders of Note: TRUE BUGS

Order: Hemiptera



Photo Credit: Thedragonflywoman.com

Type of Metamorphosis: Aquatic/Terrestrial Incomplete

This group includes the water striders, backswimmers and water boatmen. They are found more abundantly in slower portions, pools and side channels of the river. They use a **beak** to pierce their prey and slurp up the insides. These insects are moderately sensitive to pollution.

Functional Feeding Groups

Predator/Piercer- hunts other invertebrates for food, pierces plants & other insects

Identifying Features

Nymphs

- Look like smaller versions of adults
- Piercing mouthparts

Adults

- Piercing mouthparts
- Leathery body and wings

Non-Insects: WORMS & LEECHES

Phylums: Nematoda & Annelida



Leslie J. Mehrhoff, University of Connecticut, Bugwood.org Leeches

Worms have no obvious head, no legs and a long, slender, segmented body. Some worms can reproduce asexually. A variety of worms and leeches can be found swimming in the Teton River in many different habitats. Getting leeches on your body is fairly common with extended exposure in the main stem of the river. Aquatic worms can be fairly tolerant of pollution.

Functional Feeding Groups

Predator/Parasitic- can feed on smaller invertebrates or parasitize a larger animal

Known Families in the Teton River Drainage:

- Enchytraeidae
- Lumbriculidae
- Naididae
- Pisidiidae
- Planariidae

Non-Insects: MOLLUSKS & SNAILS

Phylum: Mollusca, Order: Gastropoda



Photo Credit: Mike Gangloff, bugwood.org

Mollusks and snails are easy to identify by the presence of a shell and a lack of appendages. Inside the shell is a mucous-producing, slug of sorts. They are found more abundantly in the lake-like portions of the Teton river. Mollusks can be fairly tolerant of pollution.

Functional Feeding Groups

Filterer- uses appendages to filter food from flowing water

Collector-Gatherer- gathers or collects food and stores it or eats immediately

Scraper- scrapes rocks or plant matter for nutrients and food

Shredder- shreds plant detritus, an important part of the ecosystem

Predator- eats smaller invertebrates for food

Known Families in the Teton River Drainage:

- Sphaeriidae

Non-Insect Arthropods: CRUSTACEANS

Class: Crustacea, Order: Amphipoda



Common species of freshwater crustaceans include the scuds (right photo), seed shrimp (left photo), and aquatic sowbugs. They have exoskeletons like insects, but more than six legs. They look like small shrimp and swimming roly-polys. Scuds turn orange when dead. They appear lighter white or pink in color when alive. Swimming is the main mode of transport. The immatures look like small versions of the adults. Crustaceans are moderately tolerant of pollution and low oxygen levels.

Functional Feeding Groups

Filterer- uses mouthparts or other adaptation to filter food from flowing water

Collector-Gatherer- gathers or collects food and stores it or eats immediately

Scraper- scrapes rocks or plant matter for nutrients and food

Shredder- shreds plant detritus, an important part of the ecosystem

Predator- eats smaller invertebrates for food

Known Species in the Teton River Drainage:

- *Ostracoda* sp.

Non-Insect Arthropods: WATER MITES

Class: Arachnida, Order: Acari



Photo Credit: Troutnut.com

Water mites are often missed in collecting due to their microscopic size. They look like small ticks with eight legs. The immatures look like small versions of the adults. They can be a very important indicator of water quality because they are very sensitive to pollution.

Functional Feeding Groups

Predator/Parasitic- parasitizes and preys on other insects and arthropods through piercing mouthparts

Known Species in the Teton River Drainage:

- *Atractides* sp.
- *Lebertia* sp.
- *Testudacarus* sp.

Glossary

Beak- A modified mouthpart structure used by insects for piercing or sucking up their meals. It is long and straw-like and typically rests in a groove on the ventral side of the insect.

Brachypterous- Shortened or abbreviated wings, not developed enough for flight. Occurs in many stonefly species.

Dun (Subimago)- The first adult phase of a mayfly. Wings are opaque and the mayfly is not sexually mature.

Elytra- the hardened front wing of Coleoptera and Hemiptera

Exoskeleton- the hardened outer “shell” skeleton of arthropods that is made of chitin and must be shed to grow

Haltere- small, round “hindwing” in Diptera that acts as a stabilizing mechanism during flight

Hemolymph- insect plasma that acts as their blood

Instar- name for phases in between molts of immature insects

Molt- the act of shedding the exoskeleton

Nymph- an immature insect that undergoes incomplete metamorphosis

Naia- an immature aquatic insect that undergoes incomplete metamorphosis.

Prolegs- Non-jointed, fleshy, leg-like appendages on many Diptera and Lepidoptera larvae

Plastron- the air bubble created underwater in beetles by the hairs and textured elytra that allow them to breathe

Plumose- being very plume or feather-like in appearance

Spinner (Imago)- The second and final adult phase of a mayfly that occurs after a final molt. The mayfly has clear wings and is sexually mature. This phase usually lasts for a few days maximum.

Turbinate- shaped like an inverted cone

Vestigial- an appendage or body part that has become useless through evolution. Ex. Zadult mayfly mouthparts and the human appendix.

Voltinism- the number of generations of offspring produced per year. Can be Semivoltine, Univoltine, Bivoltine, or Multivoltine.

Bibliography

Brown, W. S. (2005). Aquatic Insects of Gunnison County, Colorado. Retrieved September 4, 2017, from <http://www.gunnisoninsects.org/>.

Bugguide.net. Retrieved October 12, 2017, from <https://bugguide.net/>.

Cummins, K. W., & Merritt, R. W. (2008) *An Introduction to the Aquatic Insects of North America*. Dubuque, IA: Kendall/Hunt Pub. Co.

Goforth, C. L. (2016). The Dragonfly Woman. Retrieved February 2, 2018, from <https://thedragonflywoman.com/>.

Hafele, R., & Hughes, D. (1981). *The Complete Book of Western Hatches: An Angler's Entomology and Fly Pattern Field Guide*. Portland, OR: Frank Amato Publications.

Hafele, R., & Hughes, D. (2004). *Western Mayfly Hatches: From the Rockies to the Pacific*. Portland, OR: Frank Amato Publications.

Hamrsky, J. (2018). Macro photography of Freshwater Invertebrates. Retrieved February 4, 2018, from <http://lifeinfreshwater.net/>.

LaFontaine, G. (1996). *Caddisflies*. New York: Lyons & Burford.

McCafferty, W. P. (1998). *Aquatic Entomology: The Fishermen's and Ecologists' Illustrated Guide to Insects and Their Relatives*. Sudbury, MA: Jones and Bartlett.

Minshall, G. W., Andrews, D. A., & Manuel-Faler, C. Y. (1983). Application of Island Biogeographic Theory to Streams: Macroinvertebrate Recolonization of the Teton River, Idaho. *Stream Ecology*, 279-297.

Mullen, G. R., & Durden, L. A. (2002). *Medical and Veterinary Entomology*. New York, NY: Elsevier.

Neuswanger, J. (2004). Troutnut.com Aquatic Insect Encyclopedia. Retrieved August 18, 2017, from <http://www.troutnut.com/>.

Newell, R. L., & Minshall, G. W. (1976). An Annotated List of the Aquatic Insects of Southeastern Idaho. Part I. Plecoptera. *Great Basin Naturalist*, 36(4), 501-504.

Newell, R. L., & Minshall, G. W. (1977). An Annotated List of the Aquatic Insects of Southeastern Idaho, Part II: Trichoptera. *Great Basin Naturalist*, 37(2), 253-257.

Newell, R. L., & Minshall, G. W. (1978). An Annotated List of the Aquatic Insects of Southeastern Idaho, Part III. Ephemeroptera. *Great Basin Naturalist*, 38(1), 55-58.

Newell, R. L., & Minshall, G. W. (1979). Aquatic Invertebrates of Southeastern Idaho I. Plecoptera (Stoneflies). *Journal of the Idaho Academy of Science*, 15(1), 6-20.

Newell, R. L., & Minshall, G. W. (1979). Aquatic Invertebrates of Southeastern Idaho II. Trichoptera (Caddisflies). *Journal of the Idaho Academy of Science*, 15(2), 33-51.

North American Dipterists Society. Retrieved January 25, 2018, from <http://www.uoguelph.ca/>.

Retallic, K., & Barker, R. (2002). *Flyfisher's Guide to Idaho* (2nd ed.). Belgrade, MT: Wilderness Adventures Press.

Romoser, W. S., & Stoffolano, J. G. (1998). *The Science of Entomology*. Boston, MA: WCB McGraw-Hill.

Schollmeyer, J. (1997). *Hatch Guide for Western Streams*. Portland, OR: Frank Amato Publications.

Solomon, L., & Leiser, E. (1990). *The Caddis and the Angler*. New York, NY: Lyons & Burford.

Thomason, A. (2017). *Bugwater: A Fly Fishers Look Through the Seasons at Bugs in Their Aquatic Habitat and the Fish That Eat Them*. Lanham, MD: Stackpole Books.

Tronstad, L. M., & Barber, B. R. (2016). *Wyoming's Stream Macroinvertebrates*. Laramie, WY: Univ. of Wyoming Biodiversity Institute.

Watson-Ferguson, K., Han, C., McGarvey, J., & Miller, L. (2006). *A Guide to Aquatic Insects and Crustaceans*. Mechanicsburg, PA: Stackpole Books.

Weamer, P. (2017). *The Bug Book: Flyfisher's Guide to Trout Stream Insects*. Boiling Springs, PA: Headwaters Books.

Whitlock, D. (1992). *A Guide to Aquatic Trout Foods* (2nd ed.). Guilford, CT: The Lyons Press.

Disclaimer: This is not intended to be a comprehensive list of every species in the Teton River drainage and it mainly includes the species of the highest abundance and environmental importance. Some groups with less than 15 individuals reported were not included.

Special Thanks

To people that helped to make this guidebook possible: University of Nebraska at Lincoln, Teton Valley Lodge, Idaho State University, Friends of the Teton River, Dr. Colden Baxter, Dr. Wayne Minshall, Idaho Fish & Game, State of Idaho Department of Environmental Quality, Jesse Cole Lara, The Dragonfly Woman-Chris Goforth, Jason Neuswanger with Troutnut.com, Ken Retallic, Howard Cole, Brad Schwarm, Scott Sanchez, Dixie Conner, Paul Conner, Susan Conner, Conner Jordan, Liz Tedder, Hunter Heumann and all of my fishing buddies that have helped me catch bugs over the years.

About the Author



Maggie was born and raised in the Appalachian foothills of North Alabama and was drawn to the outdoors from as far back as she can remember. She grew up on a farm, where she had hundreds of acres to freely roam, and it was there she discovered her passion for insects and the natural world. At the age of 8, her father told her that if she truly loved insects, that she needed to learn to fly fish. They drove out West that summer, stopping at Cabela's in Nebraska, where she got her first fly rod. Maggie has been "hooked" on fly fishing and aquatic insects ever since.

Upon graduation from Auburn University, Maggie followed her heart West, by way of Fort Collins, Colorado, and Jackson Hole, Wyoming, ultimately landing in Victor, Idaho. In Victor, all aspects of the outdoors continue to be a part of her everyday life, whether it be fishing, hunting, skiing or hiking. Since moving West, her appreciation for, and access to, public lands has increased exponentially. She will graduate with her Master's degree in Entomology from the University of Nebraska-Lincoln in May 2018.

Maggie's husband is a Navy Veteran and fly-fishing guide/ski-instructor in Idaho, and she is the buyer for a local outdoor store in Jackson Hole. She volunteers several times a year to teach entomology classes. They currently reside in Teton Valley, Idaho with their two dogs Bug and Missy.

*All uncredited photos were taken by the author using an iphone.