

# A Beginners' Guide to Identifying the Exuviae of Wisconsin Odonata to Family

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The identification of the exuviae (and nymphs) of Wisconsin dragonflies and damselflies to family group is relatively easy once the distinguishing features are known. The ability to recognize these family characters will provide a solid foundation for exploring the more challenging realm of species-level identification. The purpose of this article is to highlight the key family features, and to share some useful resources for further study. A simplified identification key and photo glossary have also been included. We've focused on exuviae because the handling and study of these empty shells does not result in harm to living organisms.

Wisconsin has approximately 165 species of Odonata. Dragonflies form the larger group, with 117 recorded species within 6 overarching families. The Damselflies are represented by 48 species in 3 families. The overview is easily remembered as 'six plus three rhymes with family.'

The six dragonfly (Anisoptera) families are:

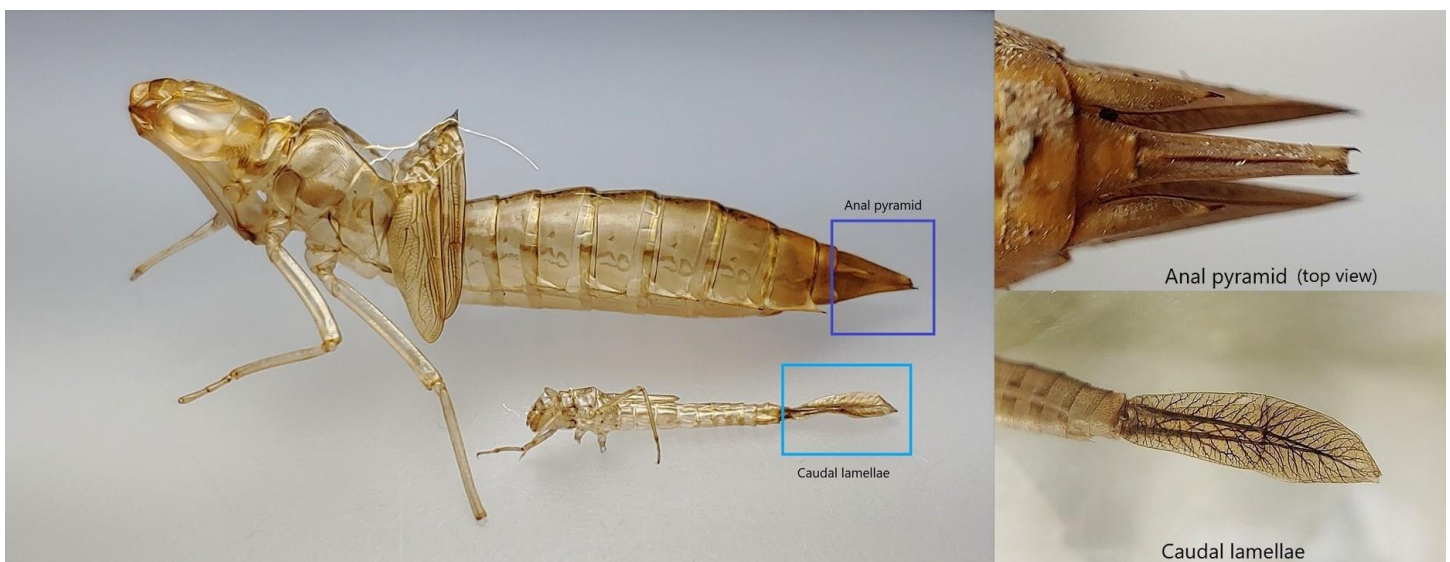
1. Darners (Aeshnidae)
2. Clubtails (Gomphidae)
3. Spiketails (Cordulegastridae)
4. Emeralds (Corduliidae)
5. Skimmers (Libellulidae)
6. Cruisers (Macromiidae)

The three damselfly (Zygoptera) families are:

1. Broad-winged Damsels (Calopterygidae)
2. Spreadwings (Lestidae)
3. Pond Damsels (Coenagrionidae)

## Distinguishing between dragonfly and damselfly exuviae:

Despite the variability in the shape and size of our dragonfly species, they are distinctly more robust than damselfly species. The abdomen of a dragonfly nymph ends in what is referred to as the **anal pyramid** (comprised of two paraprocts, two cerci and an epiproct); damselfly nymphs on the other hand, have three leaf-like gills called **caudal lamellae** at the tip of the abdomen.



Photos by Freda van den Broek

# Overview of the Dragonfly and Damselfly Families of Wisconsin

## Dragonflies (Anisoptera)



Note that Cruisers are characteristically long-legged when the exuvia is intact.

## Damselflies (Zyoptera)

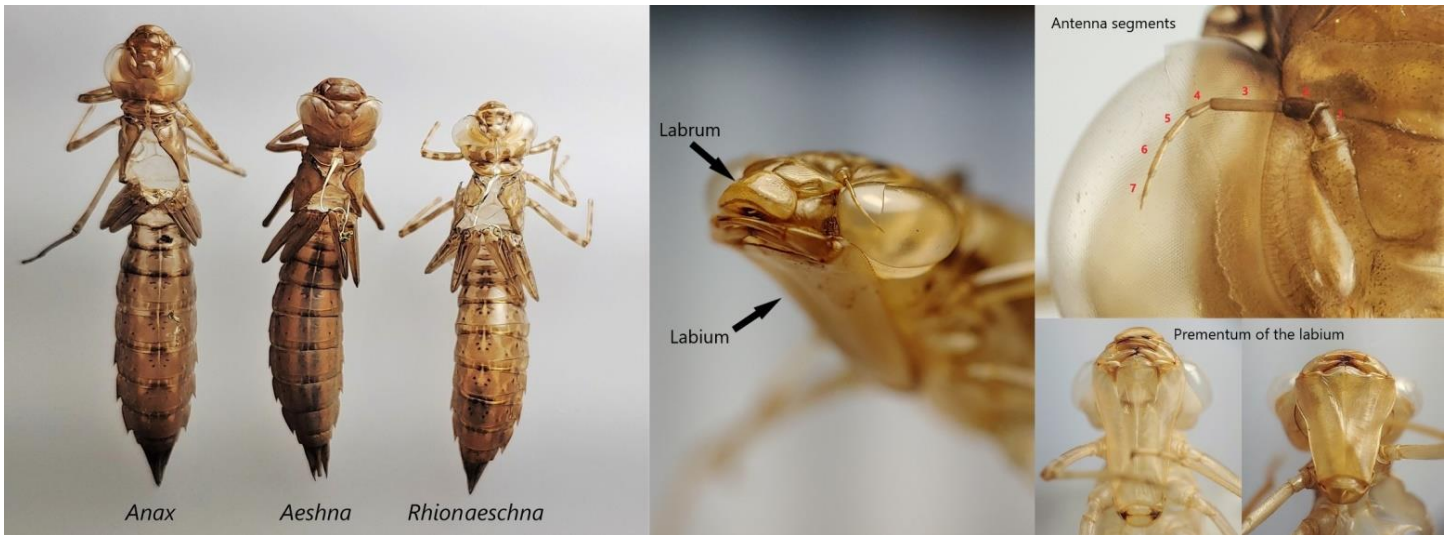


Photos by Walter Sanford (Cordulegastridae, Macromiidae and Broad-winged Damselfly) and Freda van den Broek



## 1. Darners (Family Aeshnidae)

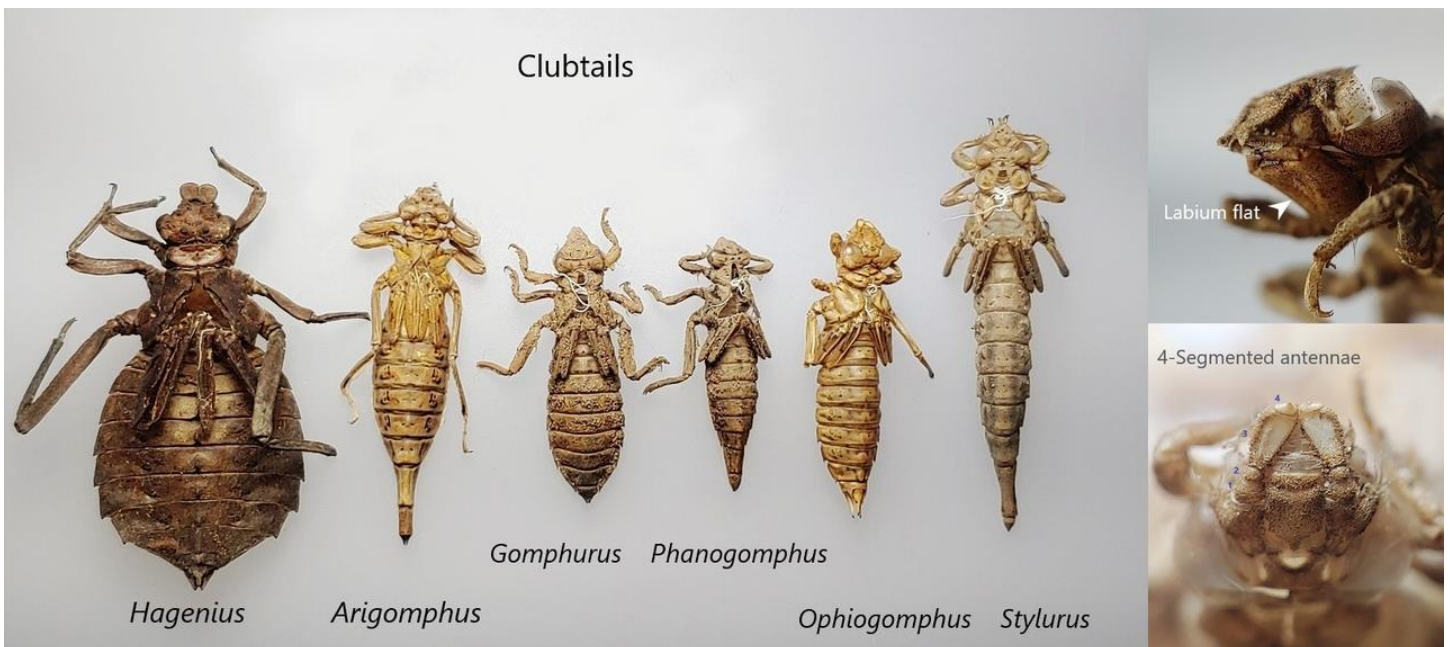
Darners typically have a long, cylindrically shaped body and large compound eyes. The antennae have 6- or 7 segments; each segment is called an antennomere. The labium, which is the prey-catching mechanism (also thought of as the combined knife, fork, and dinner plate) is characteristically flat and doesn't cover the labrum, an upper-lip-like structure.



Photos by Freda van den Broek

## 2. Clubtails (Family Gomphidae)

Although Clubtails vary in size and shape, they all have 4-segmented antennae. The 3<sup>rd</sup> antennomere is the largest and it varies in shape. Because of their burrowing habit the antennae are often covered in sediment, making it difficult to see the segments clearly. The labium is flat, and the face is somewhat triangular in shape. The Dragonhunter (*Hagenius brevistylus*) (first image on the left) is an outlier in terms of its unusually large size and rounded, flattened shape. Note also that not all *Stylurus* species have an equally long, pointed abdomen. Clubtails prefer habitats with clean, flowing water; their presence is an indicator of good water quality.



Photos by Freda van den Broek

### 3. Spiketails (Family Cordulegastridae)

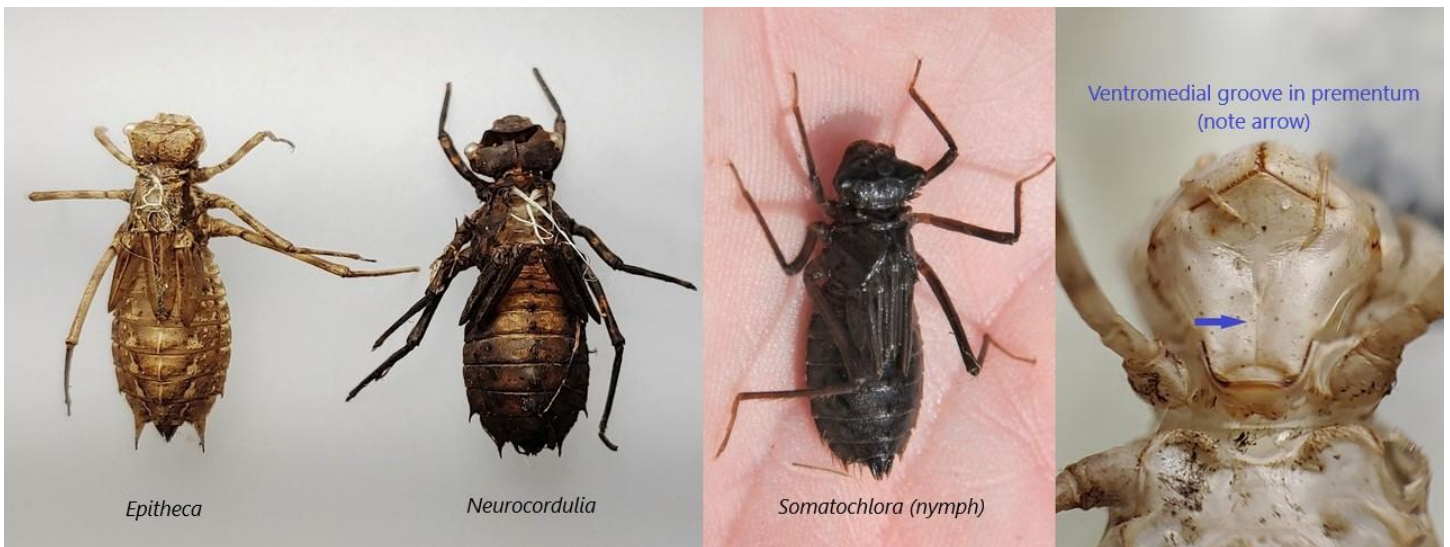
Spiketails have a scoop- or mask-shaped labium with deeply incised, irregular crenulations in the palpal lobes. This gives them a unique and easily recognizable appearance. Spiketails are habitat specialists that favor small streams and rivulets.



Photos by Walter Sanford

### 4. Emeralds (Family Corduliidae)

Emeralds have a scoop-shaped labium, with a ventromedial groove in the prementum. This groove is the most distinct character shared by all Emeralds. However, it is not always easy to see when there is debris or sediment coating the labium. On a cautionary note, one of our Skimmers, the Eastern Amberwing (*Perithemis tenera*) sometimes has a groove in the prementum. Therefore, some care is required when considering all of the characteristics. Emeralds have relatively long legs (a characteristic that is more clearly visible in the *Somatochlora* nymph shown below).

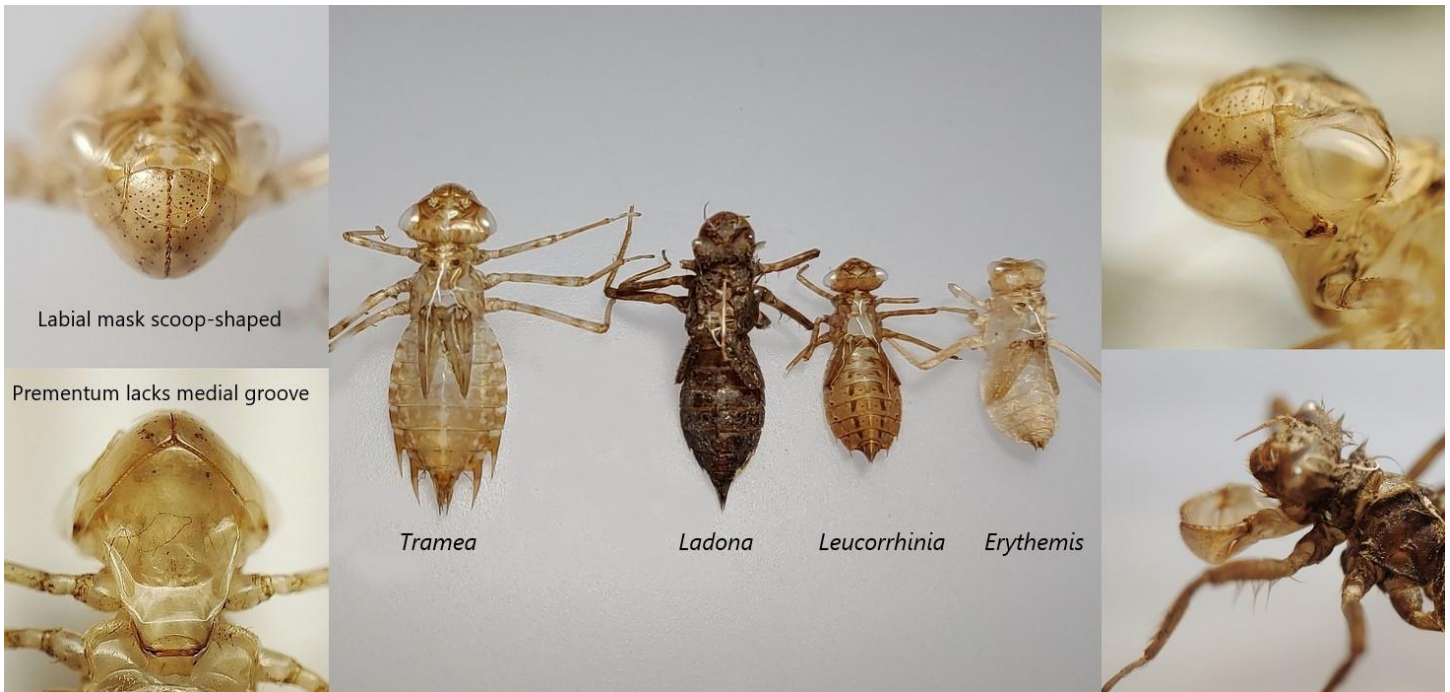


Photos by Freda van den Broek



## 5. Skimmers (Family Libellulidae)

Skimmers have a scoop- or mask-shaped labium that lacks a ventromedial groove. As mentioned above, the only possible exception to this is the Eastern Amberwing (*Perithemis tenera*). The crenulations in the labial palps are shallow and regular compared to those of the Spiketails. Their legs are relatively shorter and stouter than those of the Emeralds.



Photos by Freda van den Broek

## 6. Cruisers (Macromiidae)

Cruisers are most readily identifiable by the long legs and broad abdomen which gives them a spider-like appearance. In addition to the scoop-shaped labium, they also have a horn-like projection on the head – a feature shared only with *Neurocordulia molesta* (in the family Corduliidae) in our region.



Photo by Walter Sanford

Photo by Kate Redmond

Photo by Freda van den Broek

## Damselfly Families (Zygoptera)

### 1. Broad-winged Damsels ( Family Calopterygidae)

Broad-winged Damsels (our Jewelwings and Rubyspots) can be separated from other damselfly families by their distinctly long and pointed antennae. The first antenna segment is longer than all the remaining segments combined. The prementum of the labium has an opening or cleft that is unique to this family.



Photos by Walter Sanford

### 2. Spreadwings (Family Lestidae)



Wisconsin Spreadwings have a noticeably long, stalked labium, reminiscent of a long-handled spoon or a rattle. The labial palps have a characteristic forked opening in the lower portion of the palp.

Photos by Freda van den Broek

### 3. Pond Damsels (Family Coenagrionidae)



This family group represents the largest number of our damselfly species. They're noticeably smaller in size than members of the other two family groups. The prementum of their labium is relatively shorter and more broadly triangular (shaped like a keystone).

Photos by Freda van den Broek

#### Recommended Resources

- For a clear, user friendly key, see the article entitled "Identifying Odonata Nymphs to Family" by Marla Garrison and Ken Tennesen in the March 2021 edition of **Argia**. <https://www.dragonflysocietyamericas.org/s/Argia-v33i1-Free-page.pdf> (Paid membership in the Dragonfly Society of the Americas is usually required to download the journal.)
- Ken Tennesen's book **Dragonfly Nymphs of North America: An Identification Guide** is our main resource; it is available as hardcover or e-book via Springer Publications or Amazon.
- Walter Sanford's Photoblog <https://waltersanford.wordpress.com/odonate-exuviae/>
- For an excellent video entitled "Identifying Dragonfly Larva to Family" see [https://vimeo.com/76713446?fbclid=IwAR3ZiLr01CzJ9\\_M3Y\\_AM3\\_EKQ3cQWJ9QadNtHle87tkOWMBSGegitmvQA1w](https://vimeo.com/76713446?fbclid=IwAR3ZiLr01CzJ9_M3Y_AM3_EKQ3cQWJ9QadNtHle87tkOWMBSGegitmvQA1w)
- Facebook Group **Odonate Larvae and Exuviae** <https://www.facebook.com/groups/odonate.larvae.and.exuviae/>
- The downloadable key by Ken Soltesz is very useful even though some of the names are dated. <http://dragonfliesnva.com/My%20Documents/KevinPDF/pdf/identify/Dragonfly%20Larvae%20Key-FINAL.pdf>
- For information on the Petaltails (Petaluridae), a North American dragonfly family not represented in Wisconsin, see <https://waltersanford.wordpress.com/2018/02/14/tachopteryx-thoreyi-exuvia/>

With thanks to Bob DuBois for helpful suggestions and encouragement.



## Simplified Key to Identifying Dragonfly Exuviae to Family

### 1. Is the labium flat or scoop-shaped?

If flat, it could be a Darner (Aeshnidae) or a Clubtail (Gomphidae).

(If you're out of state, it could also be a Petaltail (Petaluridae. See resource list.)



If scoop- or mask-shaped, it could be a Spiketail (Cordulegastridae), a Cruiser (Macromiidae), an Emerald (Corduliidae) or a Skimmer (Libellulidae).



### 2. If the labium is flat, are the antennae thin, threadlike and 6- or 7 segmented?

If yes, it's a Darner (Aeshnidae).

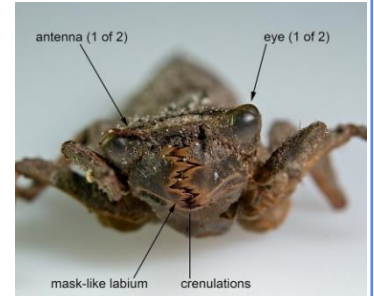


If no, (the antennae are thicker and 4-segmented) then it's a Clubtail (Gomphidae).



### 3. If the labium is scoop- or mask-shaped, are the crenulations jagged or even?

If jagged, it's a Spiketail (Cordulegastridae).



If even, but with a prominent frontal horn, it's a Cruiser (Macromiidae).



If even, with no frontal horn, it's either an Emerald (Corduliidae) or a Skimmer (Libellulidae); check for a groove in the prementum.



### 4. Is there a ventromedial groove in the prementum or not?

If yes, it's an Emerald (Corduliidae).



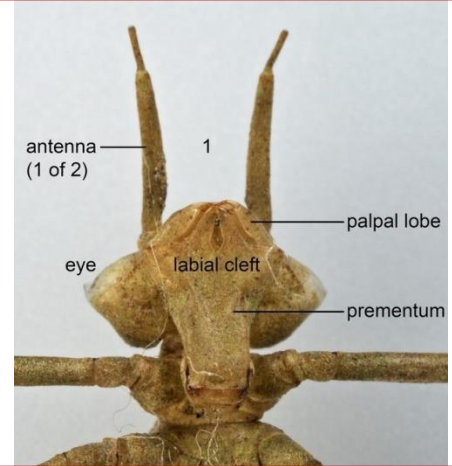
If no, it's a Skimmer (Libellulidae).





## Simplified Key for Identifying Damselfly Exuviae to Family

1. Is there an opening or cleft in the prementum?  
Is antenna segment 1 as long as, or longer than the remaining segments?  
If yes, it's a Broad-winged Damselfly (Calopterygidae).



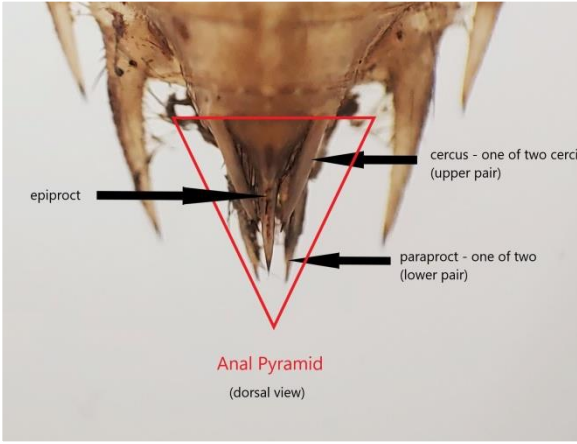
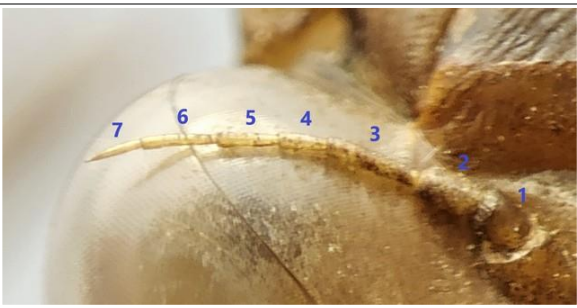

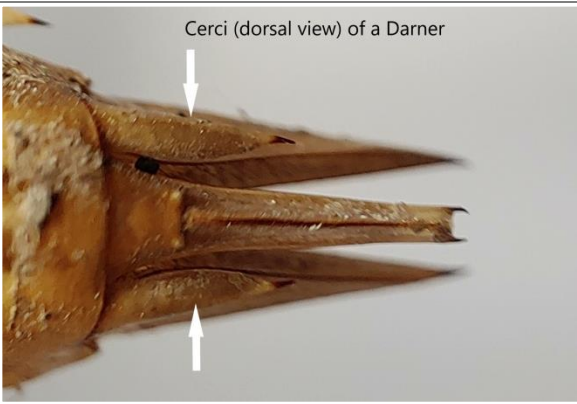
2. Is the prementum long, narrow and stalked?  
If yes, it's a Spreadwing (Lestidae).



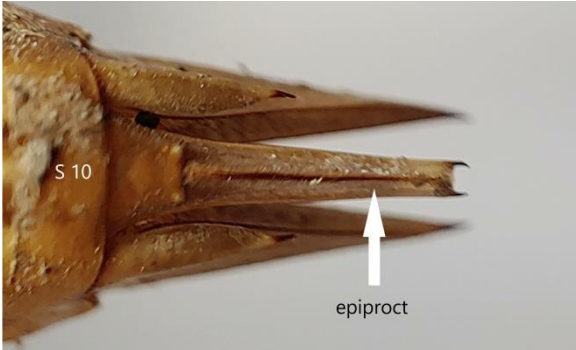

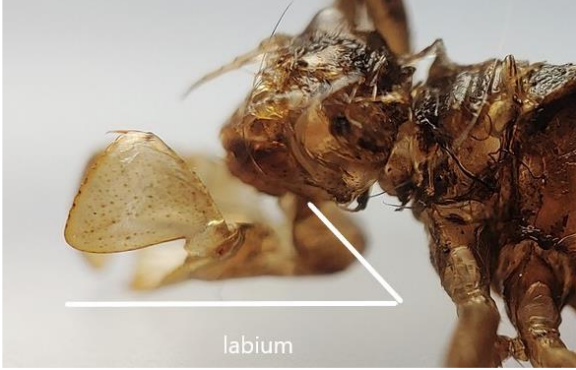



3. Is the prementum short and broadly triangular, lacking cleft or opening?  
If yes, it's a Pond Damselfly (Coenagrionidae).


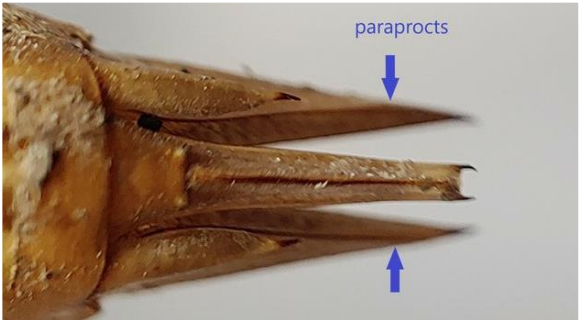
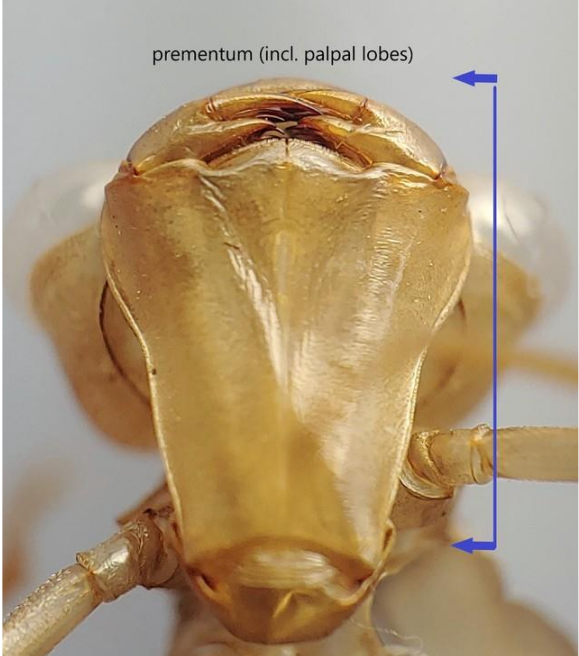



## Glossary

<p>anal pyramid:</p>	<p>Triangle-shaped group of terminal appendages including two cerci, one epiproct, and two paraprocts.</p>	
<p>antennomere(s):</p>	<p>Segment(s) of an insect antenna. Source Credit: <a href="https://bugguide.net/node/view/110174">https://bugguide.net/node/view/110174</a></p>	
<p>appendages:</p>	<p>Structures at the end of the abdomen: 3 in damselfly nymphs (called caudal lamellae); 5 in dragonfly nymphs (see anal pyramid).</p>	<p>See caudal lamellae and anal pyramid</p>
<p>caudal lamellae:</p>	<p>“Three leafy appendages at rear of abdomen in damselflies, for respiration and locomotion; also called caudal gills”. Source Credit: <a href="https://www.pugetsound.edu/academics/academic-resources/slater-museum/biodiversity-resources/dragonflies/glossary/">https://www.pugetsound.edu/academics/academic-resources/slater-museum/biodiversity-resources/dragonflies/glossary/</a></p>	
<p>cercus (pl. cerci:)</p>	<p>Superior appendages; “Paired appendages at the tip of the abdomen.”; part of the anal pyramid, on either side of the epiproct. Source Credit: <a href="https://bugguide.net/node/view/114114">https://bugguide.net/node/view/114114</a></p>	
<p>crenulations:</p>	<p>Pattern of “teeth” where the edges of mask-like labium meet, either smooth/rounded or rough/jagged. Crenulate refers to smaller, more even, perhaps tooth-like, projections (Gordh and Headrick)”. Source Credit: <a href="https://bugguide.net/node/view/485257">https://bugguide.net/node/view/485257</a></p>	<p>See next page.</p>

		 <p>crenulations</p> <p style="writing-mode: vertical-rl; transform: rotate(180deg);">Photo by Kate Redmond</p>
dorsal:	Refers to the upper side (back) of an exuvia Resource: <a href="https://bugguide.net/node/view/150117">https://bugguide.net/node/view/150117</a>	
epiproct:	Superior caudal appendage; a single appendage projecting from the tenth abdominal segment, at the center of the anal pyramid.	 <p>S 10</p> <p>epiproct</p>
exuvia(e):	“Cast skin from any larval molt ” Source Credit: <a href="https://www.pugetsound.edu/academics/academic-resources/slater-museum/biodiversity-resources/dragonflies/glossary/">https://www.pugetsound.edu/academics/academic-resources/slater-museum/biodiversity-resources/dragonflies/glossary/</a>	
labium:	“Lower ‘lip’ of larva that is extended during prey capture” Source Credit: <a href="https://www.pugetsound.edu/academics/academic-resources/slater-museum/biodiversity-resources/dragonflies/glossary/">https://www.pugetsound.edu/academics/academic-resources/slater-museum/biodiversity-resources/dragonflies/glossary/</a> <a href="https://bugguide.net/node/view/111029">https://bugguide.net/node/view/111029</a>	 <p>labium</p>
nymph (pl. nymphs)/larva (pl. larvae):	“Immature stage of Odonata” Source Credit: <a href="https://www.pugetsound.edu/academics/academic-resources/slater-museum/biodiversity-resources/dragonflies/glossary/">https://www.pugetsound.edu/academics/academic-resources/slater-museum/biodiversity-resources/dragonflies/glossary/</a> Note that the term "larva (pl. larvae)" is used worldwide. "Nymph(s)" is the term preferred by some but not all Odonata experts in the USA.	



palpal lobe (s)	One of two lobes at the leading edge of the prementum for dragonfly families with a flat labium, one of two halves of the face mask for families with a scoop- or mask-like labium.	
paraproct(s):	Inferior appendages (lower pair) of the anal pyramid.	
prementum:	<p>The labium (also called the mentum) is a two-segment hinged "jaw" that is used to grab food: the prementum is the segment of the labium closer to the mouth; the postmentum is the segment closer to the base of the head. Usually, only the prementum can be seen when looking at the ventral side of odonate exuviae.</p> <p>"The part of the insect labium lying in front of the mentum and bearing a pair of lobes"</p> <p>Source Credit: <a href="https://www.merriam-webster.com/dictionary/prementum">https://www.merriam-webster.com/dictionary/prementum</a>.</p>	
ventral	Refers to the underside (of an exuvia). Resource: <a href="https://bugguide.net/node/view/150121">https://bugguide.net/node/view/150121</a>	
ventromedial groove:	Shallow groove running lengthwise along the middle of the ventral side of the prementum.	