

A General Guide to Dragonfly Exuviae

When a larval dragonfly or damselfly climbs out of the water and emerges as a flying adult, it leaves its larval exoskeleton – or skin - behind. These skins are called exuviae and many can be identified to species. Exuviae are useful in three regards: 1) they provide proof that a species has successfully completed its life cycle in an area, 2) they can be counted in standardized ways to obtain estimates of population size, and 3) they can indicate the presence of species that are extremely difficult to find or capture as adults.

Step 1: Separating dragonflies from everything else.

Dragonflies aren't the only insects that leave behind exuviae. It is not uncommon to encounter the skins of mayflies and stoneflies along local rivers, and knowing how to distinguish these from dragonflies will ultimately be very helpful. Although the NH Dragonfly Survey is interested in damselflies, their exuviae can be very difficult to identify, and are best left to experts. Even then, important features are sometimes distorted in such a way that identification is impossible. In other words, don't worry too much about damselfly exuviae!

The pictures below show dragonflies (left column) and a selection of other immature aquatic insects (right column). Note that the dragonflies lack long "tails" at the end of their abdomens. They also tend to be thicker-bodied and average significantly larger (far larger than most damselflies, mayflies, and stoneflies).



Darnier (dragonfly)



Damselfly



Emerald (dragonfly)



Stonefly



Clubtail (dragonfly)



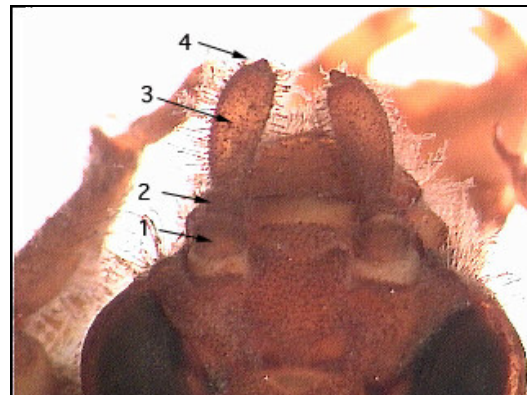
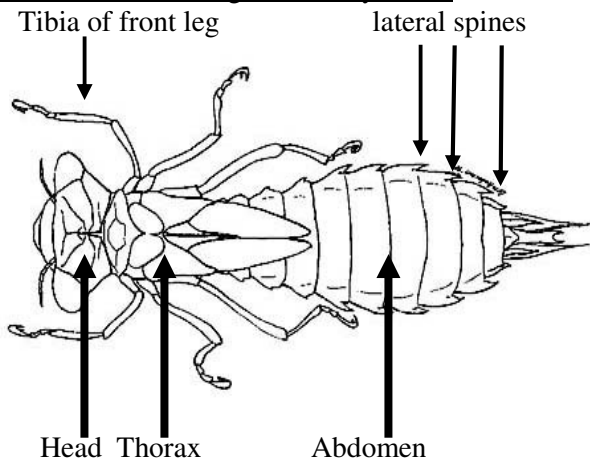
Mayfly

Interlude: Basic anatomy of larval dragonflies

From the pictures on the previous page, it is clear that dragonfly larvae can come in many shapes, and this variation is important in identification. To aid this process it is necessary to provide an overview of larval anatomy – with a focus on the features used to distinguish among families and species.

The diagrams below illustrate the important features of larval dragonflies used in this guide. All insects are divided into three body regions: 1) head, 2) thorax, and 3) abdomen, and features found on the head and abdomen are of particular usefulness in identifying exuviae. On the head, pay attention to the shape of the ANTENNAE and of the LABIUM. The labium is an extendable “lower lip” that is used to catch prey. It can be either a) flat or b) scoop-shaped when viewed from the side. At the end of the labium are a pair of PALPAL LOBES that are folded together in exuviae. Pay attention to the shape of the BLADE, including the size and number of TEETH. On the abdomen, note the overall shape, plus the size and shape of DORSAL HOOKS and LATERAL SPINES.

Darner larva showing basic body areas:



antennae of clubtail showing wide third segment (compare to slender antennae on diagram to left)



scoop-shaped labium (skimmer)



flat labium (darner)



close-up of palpal lobes showing teeth (clubtail)

Step 2: Separating Dragonflies into Families

There are six families of dragonflies in New Hampshire, and while separating most exuviae into the right family is relatively easy (with practice!), it is by no means a consistently straightforward task. The descriptions below cover the major points, but are by no means completely foolproof. The only way to get more proficient is continued practice and the use of more technical guides than this one!

A) Darners: Darners are relatively large dragonflies, with most exuviae 30-40 mm long. In general shape they are long and somewhat cylindrical, with a slightly narrowed waist and the ABDOMEN ENDING IN THREE POINTED TERMINAL APPENDAGES. They have a FLAT LABIUM (like clubtails), and their head resembles a pentagon when viewed from above.

B) Clubtails: Clubtails are highly variable in shape, but easily told from other families by having relatively BROAD FLATTENED ANTENNAE, as opposed to thin pointed antennae in the other families. Clubtails (and darners) also have a FLAT LABIUM, whereas that of cruisers and emeralds is scoop-shaped. In addition, most clubtails have rather triangular-looking heads when viewed from above.

C) Spiketails: Spiketails have body shapes like darners, but are unique in having highly IRREGULAR CRENELLATIONS on the palpal lobes of their scoop-shaped labium. They are also covered in fine hairs.

D) Cruisers: Cruisers are broad-bodied (like some emeralds) and most notable for their VERY LONG LEGS, giving them a spider-like appearance. They also have a distinct “HORN” BETWEEN THE EYES. Cruisers, emeralds, and skimmers all have a SCOOP-SHAPED LABIUM.

E) Emeralds: Emeralds are generally wide-bodied, with the abdomen somewhat ROUNDED OR FLATTED AT THE END. In all the river species, there are also two LONG LATERAL SPINES that extend beyond the tip of the abdomen. Several emeralds also have distinct DORSAL HOOKS on many abdominal segments.

F) Skimmers: Skimmers closely resemble emeralds, and separation often requires the use of somewhat subjective clues. In general they are usually more tapered and LACK both long lateral spines and dorsal hooks on the abdomen. Exceptions abound however, and even the experts get frustrated by this family.

It is hoped that this brief overview will allow you to place an exuvia into the right family. Once you have placed your specimen into a family, you can move on to the next step, identifying it to genus and species! At this point this guide will focus entirely on river and stream species, and will not help much at all if you have specimens from marshes or bogs. This is because the latter dragonflies' exuviae are much more difficult to identify (most are darners and skimmers) and beyond the scope of this guide. To this end, we will shift focus to only four families: Darners, Clubtails, Cruisers, and Emeralds.



Spiketail exuvia from the front showing crenellated labium

DARNERS (Family Aeshnidae)

There are only two species of darners likely to be encountered in large rivers, and they are relatively easy to distinguish from each other using a combination of color, size, and shape of the labial palps.

- 1) Fawn Darner (*Boyeria vinosa*). The large exuvia (35 mm, top photo) of this species is usually dark gray in color, with a distinct pale spot on the eighth abdominal segment. The blades on the palpal lobes are square-tipped. This is a late flying species whose exuviae are more prevalent in July and August. The similar Ocellated Darner (*B. grafiana*) is a more northern species of smaller streams, and can be EXTREMELY DIFFICULT to distinguish from the more common Fawn Darner.



- 2) Springtime Darner (*Basiaeschna janata*). This is a smaller species (exuviae 30 mm long, bottom photo) that tends to be paler in color than the Fawn Darner. The blades on the palpal lobes are pointed. As the name implies, this species emerges early in the season, and exuviae are most likely to be encountered in May and June

CRUISERS (Family Macromiidae)

As with darners, there are only two species to worry about in large rivers, and indeed in all of New England. Their exuviae are fairly similar, but distinguishable with practice. Compare them with the exuvia of the Prince Baskettail, which is similar but more likely in slower stretches of rivers.

- 1) Swift River Cruiser (*Macromia illinoiensis*). This is by far the more common of the two species on large rivers, and tends to emerge later in the summer (July). It is told from the next species by the following characters:
 - a. small dorsal hook on abdominal segment 10
 - b. lateral spines on segment 9 do not extend beyond the abdomen tip
 - c.
- 2) Stream Cruiser (*Didymops transversa*). This species tends to occur along smaller streams and emerges early in the season (May and June). It lacks a dorsal hook on segment 10 and has much longer spines on segment 9.



Swift River Cruiser (left) and Prince Baskettail (right)

EMERALDS (Family Cordulidae)

Identification starts getting trickier with this family, but there are still only a few species to worry about. Key features to look at are the top of the head and the lateral spines on the abdomen. Size can also be useful in some cases.

- 1) Prince Baskettail (*Epitheca princeps*). This is a large species, with exuviae around 25 mm long. It can often be recognized immediately by the large curved dorsal hooks on the abdominal segments. There are also two small bumps (tubercles) on top of the head behind the eyes.
- 2) Shadowdragons (genus *Neurocordulia*). There are two species in this genus in NH, the Umber Shadowdragon (*N. obsoleta*) and the Stygian Shadowdragon (*N. yamaskanensis*). Their exuviae are small (22 mm) and dark, and like the preceding species have two tubercles on the top of the head. Their dorsal hooks tend to be rounded or reduced, and can be quite variable. Separating the two species is quite difficult – based on the shape of the hooks and length of lateral spines – and is best left to an expert.
- 3) Common Baskettail (*Epitheca cynosure*). Unlike its larger relative, this small species (18 mm) lacks tubercles on the head and has less obvious dorsal hooks. It is also more slender than either of the previous three species. Other small baskettails are almost identical, but do not occur on rivers.
- 4) Uhler's Sundragon (*Helocordulia uhleri*). This species is similar to the previous one in size and overall shape. It differs in having much smaller lateral spines on segment 9: usually less than half the length of the segment and not projecting to the end of the abdomen.



Prince Baskettail (top and side)



Shadowdragon (left) and Common Baskettail (right)

CLUBTAILS (Family Gomphidae)

Over half the dragonflies typical of rivers are in this family, and while identification of most is still relatively easy, the number of species involved can be somewhat overwhelming to the beginner. For this reason it is useful to apply a “dichotomous key” as a means of narrowing down choices more efficiently. To use the key, simply chose one of the two options at each stage and follow the numbers until you arrive at an identification. With practice, you will be able to forego the early stages of the key and get right down to genus or even species.

- 1a) Very large (40 mm), abdomen wide and flat:
Dragonhunter (*Hagenius brevistylus*)

- 1b) Abdomen more cylindrical or pointed:
Go to #2

Dragonhunter



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- 2a) Small exuvia (20 mm), third segment of antennae widened and flat:
Go to #3

- 2b) Exuviae usually larger, third antennal segment long and cylindrical: Go to #4

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- 3a) Third antennal segment somewhat triangular and tapering toward tip: Eastern Least Clubtail
(*Stylogomphus albistylus*)

- 3b) Third antennal segment rounded and wider near tip: pygmy clubtails (Genus *Lanthus*)
Pygmy clubtails are typical of intermittent forest streams, and very unlikely to be encountered on rivers. The two species are almost indistinguishable and best left to experts.

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- 4a) From below, bases of middle legs closer together than those of front legs; abdomen tapers to fine point:
Common Sanddragon (*Progomphus obscurus*)

- 4b) Middle legs not closer together than front legs:
Go to #5



Common Sanddragon (30 mm)

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- 5a) Distinct hook at end of tibia on front legs: Go to #6

- 5b) No hook at end of front tibia: Genus *Stylurus* (go to #8)

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- 6a) End of abdomen with distinct ridge on segments 8-9. Dorsal spine on segment 9 is horizontal and extends over part of segment 10:
Black-shouldered Spinylegs
(*Dromogomphus spinosus*)

- 6b) Usually no dorsal ridge, but if present the spine on segment 9 projects upward:
Go to #7



Black-shouldered Spinylegs (30-35 mm)

7a) Teeth on palpal lobes very tiny, wing pads always divergent (see below) = snaketails (genus *Ophiogomphus*) (go to #9)

7b) Noticable teeth on palpal lobes, wing pads parallel or only slightly divergent = genus *Gomphus* (go to #10)

Note on wing pads: this character is most useful in living larvae, since in exuviae the wing pads are often displaced in the process of the adult emerging. It is safe to say that NON-DIVERGENT pads are NOT *Ophiogomphus*, but this feature should be used with caution.

8) Genus *Stylurus*. To recap, these are clubtails with tapering abdomens that lack a burrowing hook on the tibia of the front legs. The three species in NH are easily distinguished from one another:

- a) Riverine Clubtail (*S. amnicola*). A small species (30 mm, left).
- b) Zebra Clubtail (*S. scudderi*). A large and robust species (35 mm), that looks a lot like a large version of the Riverine Clubtail (middle)
- c) Arrow Clubtail (*S. spiniceps*). An elongate species (38-40 mm, right) that is immediately recognizable because of its very long 9th abdominal segment.



9) Snaketails (*Ophiogomphus*). Separating snaketail exuviae to species is very difficult, and in some cases impossible even for experts. Identification requires careful scrutiny of dorsal abdominal hooks, shape of labium, and shape of the third antennal segment.

- a) Pygmy Snaketail (*O. howei*). Very small species (20-22 mm) that lacks both dorsal and lateral abdominal spines (top)
- b) Maine Snaketail (*O. mainensis*). Third antennal segment broad, only twice as long as wide
- c) Rusty Snaketail (*O. rupinsulensis*). This and the following two species can be VERY difficult to distinguish from one another, and details will not be given in this key. The Rusty Snaketail is the most likely species to occur on larger rivers.
- d) Brook Snaketail (*O. aspersus*)
- e) Riffle Snaketail (*O. carolus*)



Pygmy (top) and Rusty (below) Snaketails

10) Genus *Gomphus*. This large group can be further divided into three “sub-genera” based on morphological features that are easily seen on exuviae.

- a) Small species (< 27 mm) with flattened abdomens. This group includes two species that are almost indistinguishable:
 - a. Spine-crowned Clubtail (*G. abbreviatus*): tends to be ≤ 24 mm long
 - b. Mustached Clubtail (*G. adelphus*): tends to be ≥ 26 mm long

- b) Small to medium species with distinctly tapered abdomens. Most members of this group are found in ponds, with only the three below occurring in rivers to any extent:
 - a. Rapids Clubtail (*G. quadricolor*). VERY RARE. Poorly-developed teeth on palpal lobes
 - b. Lancet Clubtail (*G. exilis*). Large end hook on palpal lobes, 25-26 mm
 - c. Harpoon Clubtail (*G. desertus*). Small end hook on palpal lobes, largest of the group at 28-30 mm.

- c) Medium-sized (26-28 mm) species with abdomen ending more bluntly. These are river specialist clubtails, and easily separated by examining the palpal lobes:
 - a. Cobra Clubtail (*G. vastus*). Only 3-5 teeth on palpal lobes, with large end hook
 - b. Skillet Clubtail (*G. ventricosus*). 7-9 teeth on palpal lobes, with small end hook (rare)



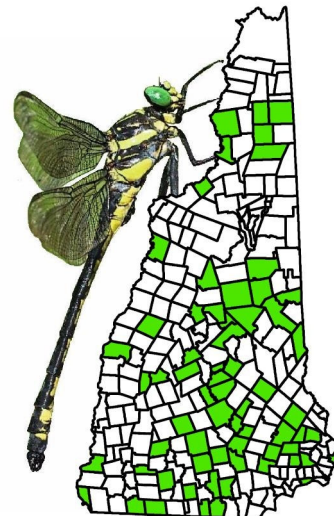
Gomphus clubtails (not to scale): left to right = 1) Spine-crowned, 2) Skillet, 3) Cobra, 4) Lancet



Side view of Spine-crowned (left) and Skillet (right) Clubtails

For more information and additional resources, contact:

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