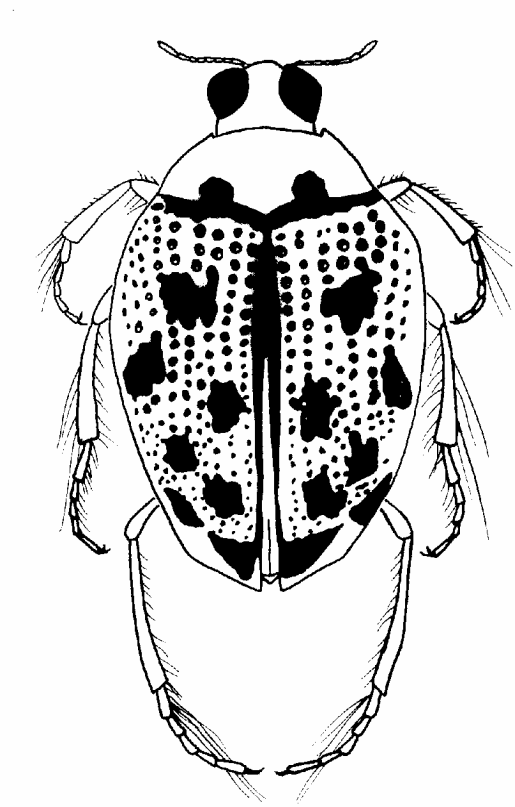
CHAPTER 12

COLEOPTERA
(Aquatic Beetles)



Citation:

Bouchard, R.W., Jr. 2004. Guide to aquatic macroinvertebrates of the Upper Midwest. Water Resources Center, University of Minnesota, St. Paul, MN. 208 pp.

12 ORDER COLEOPTERA
Aquatic Beetles

The order Coleoptera is a huge order, of which the majority of members are terrestrial. However, there are still a great number of beetles adapted to an aquatic existence encompassing a large diversity of habitats and life histories. Aquatic beetles can be found in nearly any aquatic habitat, but beetles reach their greatest diversity in lentic habitats such as wetlands and pond margins. Part of the reason for their success in aquatic habits is the ability of the adults to enter or leave the water to search for mates or if conditions are not optimal. Some beetles are aquatic as both larvae and adults, while others are aquatic as adults or as larvae. However, almost all aquatic and semiaquatic Coleoptera pupate terrestrially with the exception of a few taxa that are not dealt with in this guide. The Coleoptera key does not include semiaquatic taxa which may be collected in aquatic invertebrate samples, but it will be sufficient for the major groups. A more inclusive key to aquatic and semiaquatic Coleoptera can be found in Merritt and Cummins (1996).

Coleoptera Morphology

Larvae: Larvae of aquatic Coleoptera can be recognized by the presence of a sclerotized head, three pairs of segmented thoracic legs, and the absence of wing pads (Fig. 12.1). Characters such as the number of tarsal claws, number of leg segments, body shape, and antennal length are diagnostic characters for Coleoptera larvae.

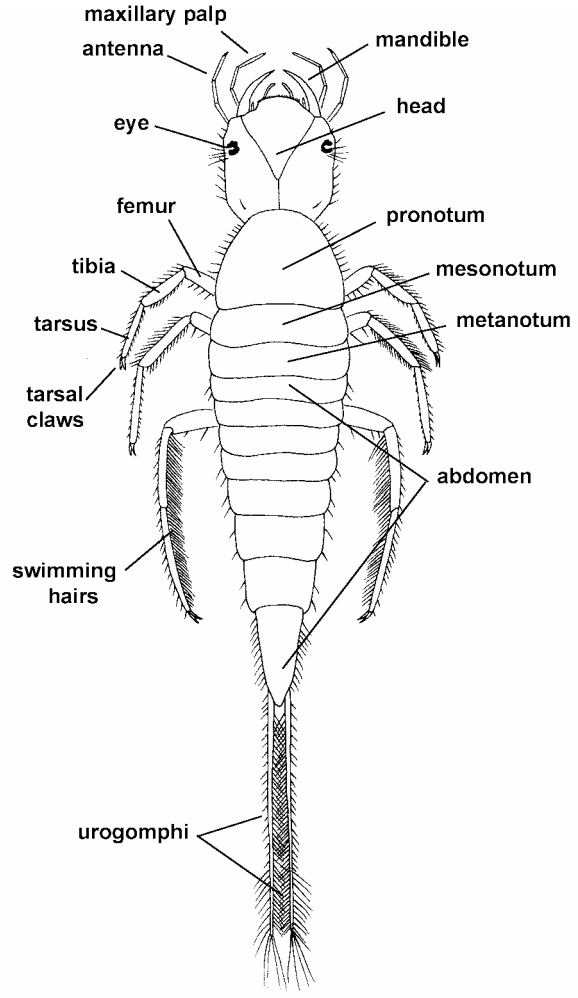


Figure 12.1: Dorsal view of coleopteran larva.

Adults: Coleoptera adults can be recognized primarily by the presence of heavily sclerotized fore wings (elytra) which lack veins and cover the membranous hind wings (Fig. 12.2). In addition, the entire body is generally hardened and three pairs of segmented legs are present. Adult Coleoptera families can be separated by characters such as the shape of the eye, the hind coxae, and the antennae (Figs 12.2, 12.3).

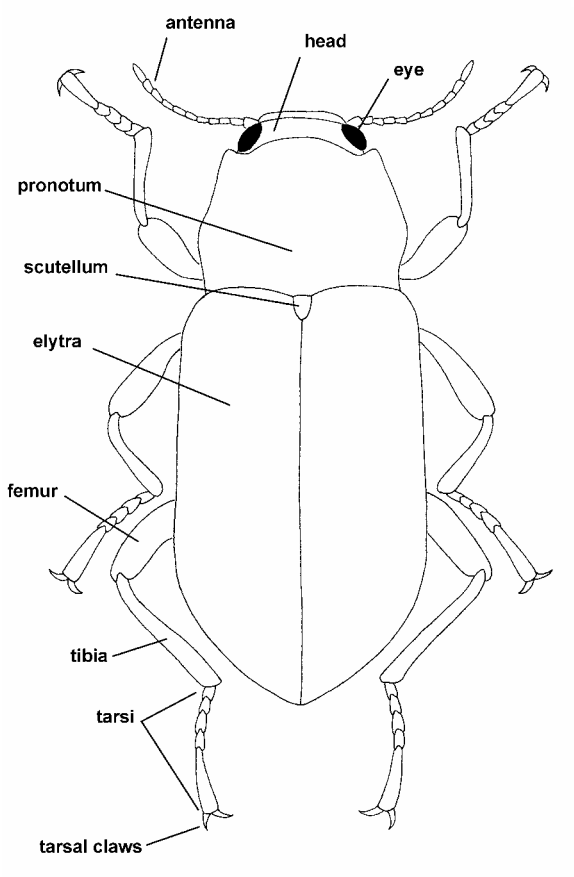


Figure 12.2: Dorsal view of coleopteran adult.

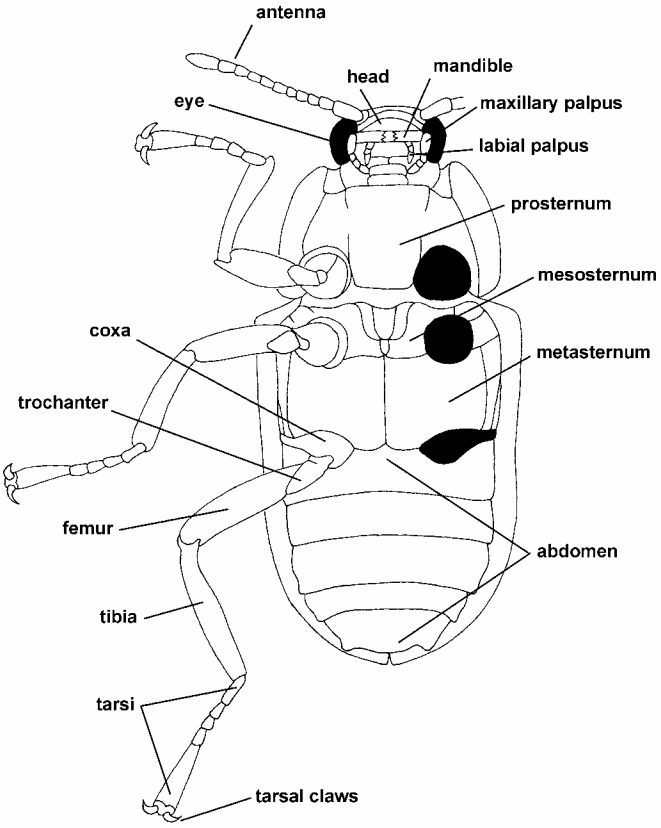


Figure 12.3: Ventral view of coleopteran adult.

Key to Coleoptera Families (Larvae)*

1. Two tarsal claws at end of leg (Fig. 12.4).....2

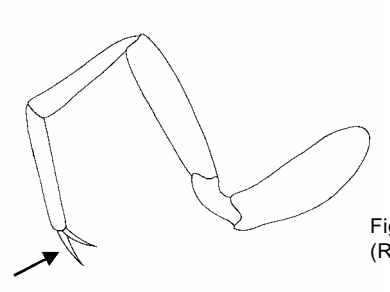


Figure 12.4: Leg of *Rhantus* sp. (Rhantus) larva, Dorsal View.

1'. A single tarsal claw at end of leg (Fig. 12.5).....3

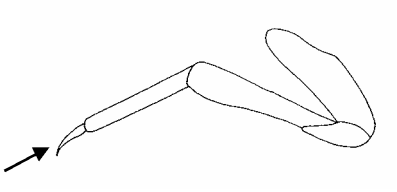


Figure 12.5: Leg of *Hydrochara* sp. (Hydrophilidae) larva.

2(1). Abdominal segment 10 with 2 pairs of hooks (Fig. 12.6); 10 pairs of lateral filaments on abdomen.....**Gyrinidae *p. 154***

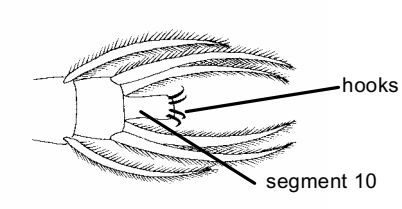


Figure 12.6: Terminal abdominal segments of Gyrinidae larva.

2'. Hooks absent on abdominal segment 10 (Fig. 12.7); lateral filaments usually absent from abdomen although terminal filaments are often present (Fig. 12.7).**Dytiscidae *p. 152***

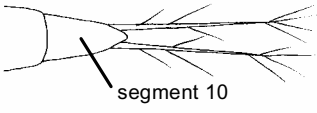


Figure 12.7: Terminal abdominal segments of Dytiscidae larva.

3(1'). Legs with 5 segments (not counting tarsal claw) (Fig. 12.8); abdomen terminating with 1-2 long filaments..... **Haliplidae *p. 155***

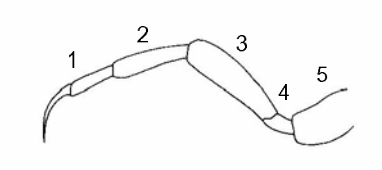


Figure 12.8: Leg of Haliplidae larva.

3'. Legs with 4 segments (not counting tarsal claw) (Fig. 12.9); abdomen not terminating in 1-2 long filaments..... 4

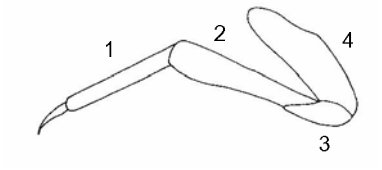


Figure 12.9: Leg of *Hydrochara* sp. (Hydrophilidae) larva.

4(3'). Mandibles large and easily seen from above (Fig. 12.10)..... **Hydrophilidae *p. 156***

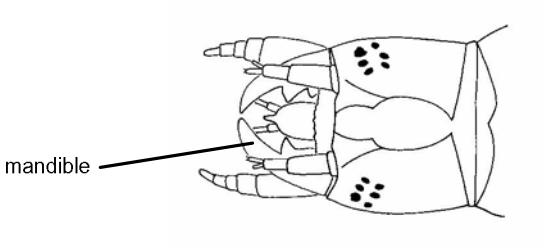


Figure 12.10: Head of *Enochrus pygmaeus nebulosus* (Hydrophilidae) larva, Dorsal View.

4'. Mandibles not easily seen from above..... 5

5(4'). Antennae longer than head (Fig. 12.11)..... **Scirtidae *p. 158***

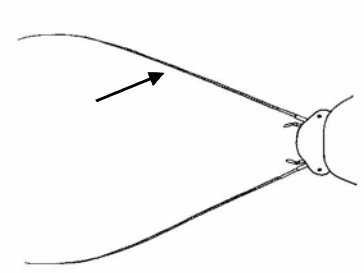


Figure 12.11: Head of *Scirtes tibialis* (Scirtidae) larva, Dorsal View.

5'. Antennae shorter than head..... 6

6(5'). Body flattened with thoracic and abdominal segments expanded so that legs and head are obscured from above (Fig. 12.12) .....**Psephenidae *p. 157***

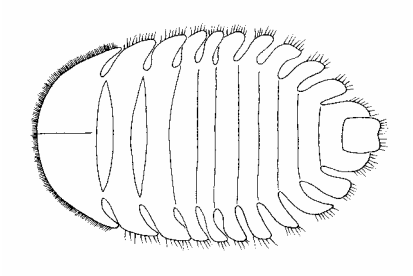


Figure 12.12: *Ectopria* sp. (Psephenidae) larva, Dorsal View.

6'. Body cylindrical or sub-cylindrical; head and legs visible from above (Fig. 12.13)..... .....**Elmidae *p. 153***

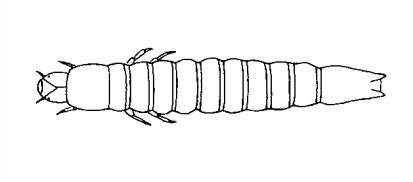


Figure 12.13: *Stenelmis* sp. (Elmidae) larva, Dorsal View.

* The family Dryopidae is not included in the Coleoptera larva key because these larvae live in riparian areas and are not generally collected in aquatic samples.

Key to Coleoptera Families (Adults)*

1. Compound eyes divided and appearing to have 2 pairs of eyes (Fig. 12.14)..... ..... **Gyrinidae *p. 154***

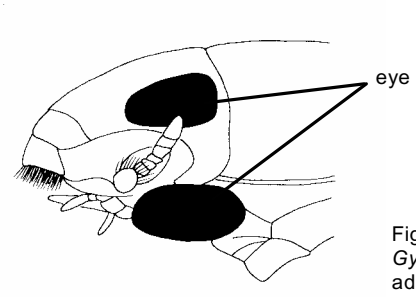


Figure 12.14: Head of *Gyrinus* sp. (Gyrinidae) adult, Lateral View.

1'. Compound eyes undivided (Fig. 12.15) 2

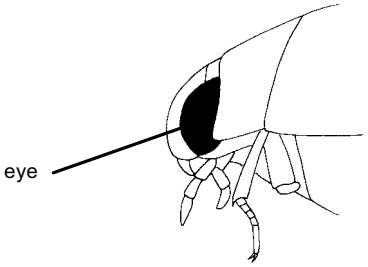


Figure 12.15: Head of *Laccophilus* sp. (Dytiscidae) adult, Lateral View.

2(1'). Hind coxae expanded into plates that cover abdominal segments 1-2 or 3 and bases of metafemora (Fig. 12.16)..... **Haliplidae *p. 155***

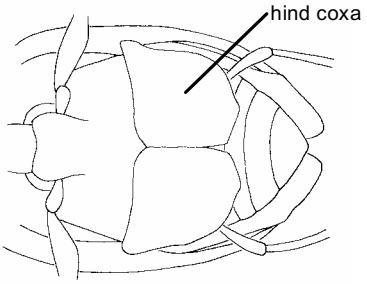


Figure 12.16: Metathorax and abdomen of *Peltodytes* sp. (Haliplidae) adult, Ventral View.

2'. Hind coxae not expanded into plates (Figs. 12.17, 12.18)..... 3

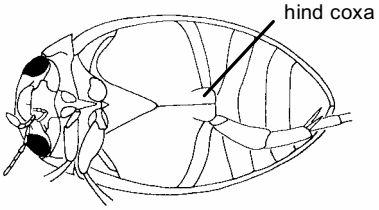


Figure 12.17: *Laccophilus* sp. (Dytiscidae) adult, Ventral View.

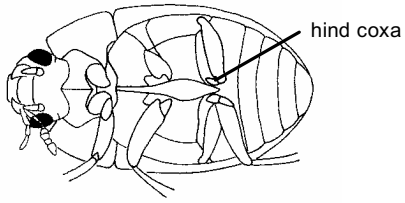


Figure 12.18: *Hydrochara* sp. (Hydrophilidae) adult, Ventral View.

3(2'). Hind coxae extending posteriorly and dividing abdominal segment 1 into two sections (Fig. 12.19).....**Dytiscidae *p. 152***

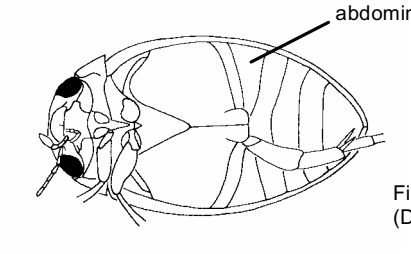


Figure 12.19: *Laccophilus* sp. (Dytiscidae) adult, Ventral View.

3'. Hind coxae not extending posteriorly and dividing abdominal segment 1 into two sections (Fig. 12.20) 4

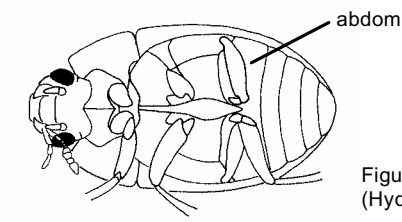


Figure 12.20: *Hydrochara* sp. (Hydrophilidae) adult, Ventral View.

4(3'). Antennae clubbed with a cup-like segment at the base of 3-segmented club (Fig. 12.21).... .....**Hydrophilidae *p. 156***

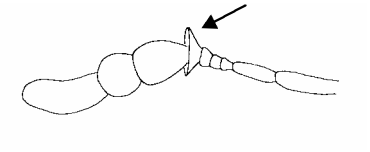


Figure 12.21: Antennae of Hydrophilidae adult.

4'. Antennae variable but not with a cup-like segment at the base of 3-segmented club (Figs. 12.22, 12.23) 5

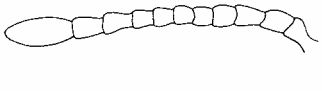


Figure 12.22: Antenna of *Optioservus* sp. (Elmidae) adult.

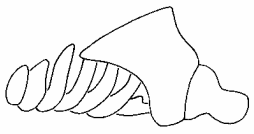


Figure 12.23: Antenna of Helichus sp. (Dryopidae) adult.

5(4'). Antennae short with a pectinate (comb-like) club; body size 5-6.5 mm long (Fig. 12.24).... .....**Dryopidae *p. 151***

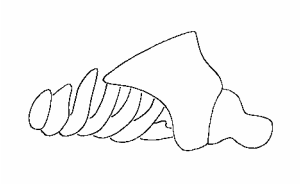


Figure 12.24: Antenna of Helichus sp. (Dryopidae) adult.

5'. Antennae without pectinate club; body size < 4.5 mm long (Fig. 12.25)..... .....**Elmidae *p. 153***

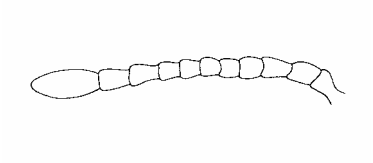


Figure 12.25: Antenna of *Optioservus* sp. (Elmidae) adult.

* The families Psephenidae and Scirtidae are not included in the adult key as the adults of these families are not aquatic and are therefore not commonly collected in aquatic samples.

Coleoptera Family Descriptions

Dryopidae

Common Name: Long-Toed Water Beetles
Feeding Group: Scrapers
Tolerance Value: 5 (Moderate)
Habitat: Dryopid adults occur in the swift portions of streams and are generally collected under rocks and logs.
Size: **Adults:** Small (5-6.5 mm)
Characteristics: **Adults:** Hard bodied; antennae short with a pectinate club; hind coxae not extending posteriorly and dividing first abdominal segment into two sections.
Notes: Dryopid adults resemble elmids; however, dryopids tend to be larger. The antennae are difficult to see because they are shortened pectinate clubs that are sometimes concealed with a portion of the head under the enlarged pronotum. This family of beetles is unique because the larvae are generally terrestrial (sometimes semiaquatic) whereas the adults are aquatic.

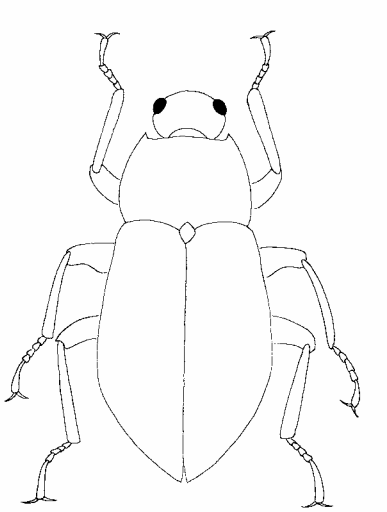


Figure 12.26: *Helichus* sp. (Dryopidae) adult, Dorsal View.

Dytiscidae

Common Name: Predaceous Diving Beetles
Feeding Group: Predators
Tolerance Value: 5 (Moderate)
Habitat: Dytiscid beetle adults and larvae can be found in nearly any habitat, but they are most common and diverse in standing or slow-flowing waters where there is a lot of vegetation.
Size: **Larvae:** Small to large (2-70 mm).
Adults: Small to large (2-25 mm)
Characteristics: **Larvae:** Two claws on each leg; legs 5-segmented; abdomen usually terminates in a pair of urogomphi.
Adults: Antennae slender; hind coxae extending posteriorly and dividing first abdominal segment into two sections.
Notes: Dytiscids are a very common and diverse family of aquatic beetles. They are well suited for aquatic existence and are very good swimmers. Most larvae and adults need to breathe atmospheric oxygen, which means they can be found in habitats with low levels of dissolved oxygen. The adults break the water surface with the tip of their abdomen in order to refill their air supply stored under their wings.

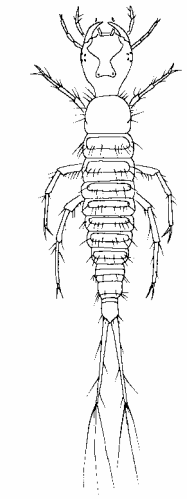


Figure 12.27: *Laccophilus testaceus* (Dytiscidae) larva, Dorsal View.

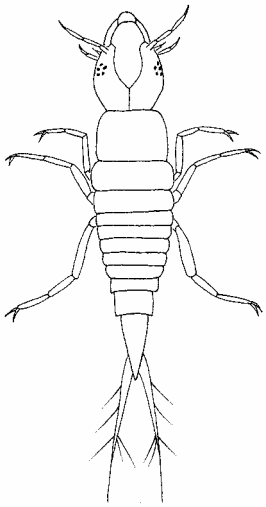


Figure 12.28: *Hydroporus niger* (Dytiscidae) larva, Dorsal View.

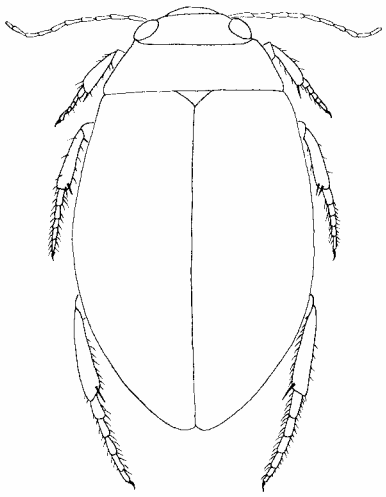


Figure 12.29: *Dytiscus verticalis* (Dytiscidae) adult, Dorsal View.

Elmidae

Common Name: Riffle Beetles
Feeding Group: Scrapers
Tolerance Value: 5 (Moderate)
Habitat: Elmid beetles occur in the swift areas of streams (most commonly in cool waters) generally under rocks or logs. They are also sometimes found along the wave washed shores of lakes.
Size: **Larvae:** Small (3-8 mm).
Adults: Small (1-8 mm)
Characteristics: **Larvae:** Legs with four segments and terminating in a single claw; 9 abdominal segments; abdominal segment with cavity containing gills that is protected by hinged lid. **Adults:** Hard bodied; antennae usually slender (sometimes clubbed); elytra with rows of indentations; legs are long compared to body.
Notes: Riffle beetles are one of the few beetle groups that live completely underwater in all life stages. They are sometimes difficult to see in the field due to their small size and slow movements. After emerging, the adults generally fly for a short period of time before returning to the water. Once the adults enter the water they do not fly again and over time their wings waste away. Because elmids do not breathe atmospheric oxygen, many species require waters with high oxygen contents. These species are usually limited to fast-flowing streams with cool waters.

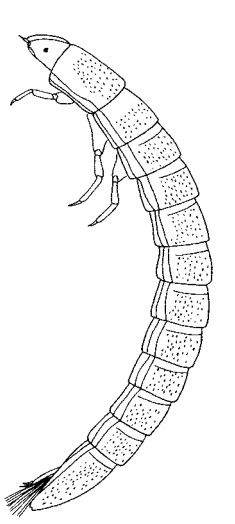


Figure 12.30: Elmidae larva, Lateral View.

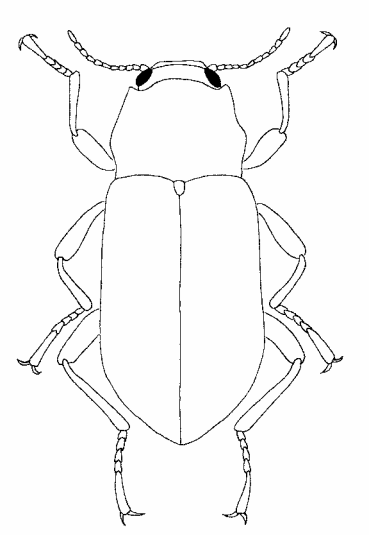


Figure 12.31: *Ordobrevia* sp. (Elmidae) adult, Dorsal View.

Gyrinidae

Common Name: Whirligig Beetles
Feeding Group: Predators
Tolerance Value: 4 (Moderate)
Habitat: The larvae and adults of gyrinids occur in the areas of calm water in streams, rivers, lakes, and ponds. The larvae are found underwater among aquatic vegetation while the adults are generally observed on the surface.
Size: **Larvae:** Small to Medium (6-30 mm).
Adults: Small to Medium (3-16 mm)
Characteristics: **Larvae:** Two claws on each leg; legs 5-segmented; abdominal segment 10 with 2 pairs of hooks; 10 abdominal segments; 10 pairs of lateral filaments on abdomen (1 pair each on segments 1-8 and 2 pairs on segment 9). **Adults:** Compound eyes divided and appearing to have 2 pairs of eyes; antennae clubbed; mid and hind legs paddle-like.

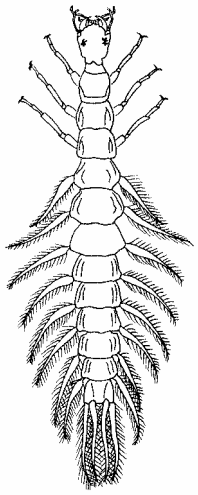


Figure 12.32:
Dineutus sp. (Gyrinidae) larva, Dorsal View.

Notes: The larvae of whirligig beetles can be confused with Megaloptera larvae due to the presence of abdominal filaments. Examination of the terminal segment can be used to easily separate these two groups. Whirligig beetles get their name from the circular swimming motions of the adults. The adults have divided eyes, which allow them to see underwater and above water at the same time while they are swimming on the surface. Although the adults are conspicuous on the water surface, they have few predators due to the production of distasteful secretions. In some species these secretions smell like ripe apples, hence another common name, "apple beetles".

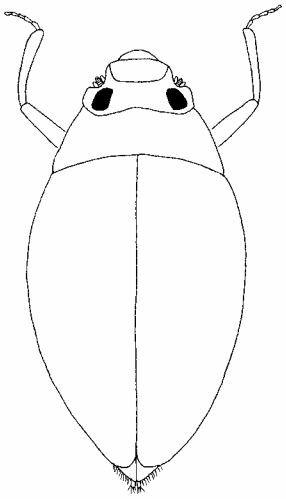


Figure 12.33:
Dineutus americanus (Gyrinidae) adult, Dorsal View.

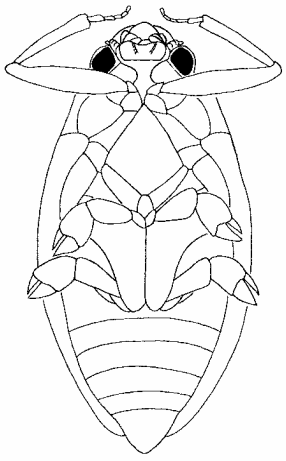


Figure 12.34:
Dineutus americanus (Gyrinidae) adult, Ventral View.

Haliplidae

Common Name: Crawling Water Beetles
Feeding Group: Shredders
Tolerance Value: 7 (High)
Habitat: Haliplid beetle larvae and adults most commonly occur in standing and slow-moving waters in lakes, ponds, marshes, and streams. They are usually found associated with dense vegetation.
Size: **Larvae:** Small (5-12 mm).
Adults Small (2-6 mm)
Characteristics: **Larvae:** Legs with 5 segments; one claw at end of each leg; abdomen terminating in 1-2 long filaments. **Adults:** Antennae long and slender; elytra with indentations; legs lined with swimming hairs; hind coxae expanded into plates that cover abdominal segments 1-2 or 1-3 and bases of metafemora.
Notes: Like most aquatic beetles the adults store air under their wings, but haliplid beetles are unique in having enlarged coxal plates that are also used to retain air. The air stored under the coxal plates is probably used less as an oxygen source than a means of maintaining buoyancy, allowing the adult to float to the surface rather than swim. The larvae spend most of their life underwater obtaining oxygen from the water. Haliplid adults and larvae are not very good swimmers and spend most of their time crawling among vegetation. The larvae move very slowly and will play dead when disturbed. Some kinds of the larvae are very distinctive with several long projections half as long as the body extending from most segments.

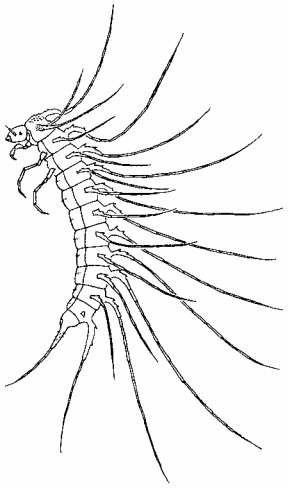


Figure 12.35:
Peltodytes sp. (Haliplidae) larva, Lateral View.

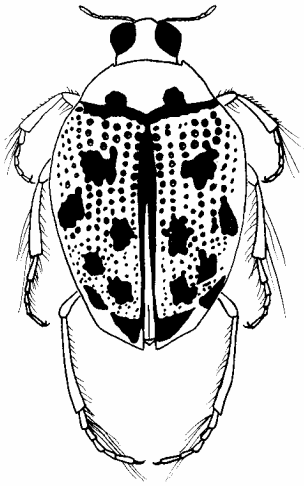


Figure 12.36:
Peltodytes sp. (Haliplidae) adult, Dorsal View.

Hydrophilidae

Common Name: Water Scavenger Beetles
Feeding Group: Larvae: Predators. Adults: Collector/Gatherers
Tolerance Value: 5 (Moderate)
Habitat: The larvae and adults of water scavenger beetles most commonly occur in the standing and slow-moving waters of lakes, ponds, marshes, streams, and rivers; however, they occur in nearly any water body. They are usually found amongst aquatic vegetation.
Size: **Larvae:** Small to large (2-60 mm).
Adults: Small to large (1-40 mm)
Characteristics: **Larvae:** Mandibles large; legs with 4 segments; legs terminating in a single claw; end of abdomen generally blunt. **Adults:** Antennae clubbed with a cup-like segment at the base of 3-segmented club; hind coxae not extending posteriorly and dividing abdominal segment 1 into two sections.
Notes: Hydrophilid beetles are the second most common and diverse family of beetles behind the dytiscids. Hydrophilid larvae and adults are good swimmers although not as good as dytiscids. Like dytiscid beetles, both larvae and adult hydrophilid beetles breathe atmospheric oxygen. The adults break the water surface head first in order to refill air stores under the wings. This is in contrast to dytiscid beetles, which break the water surface with their abdomen to refill their air supply.

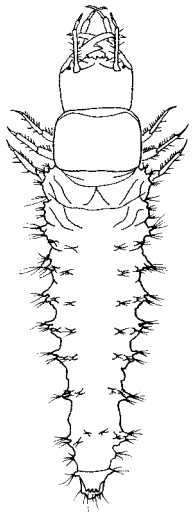


Figure 12.37: *Tropisternus* sp. (Hydrophilidae) larva, Dorsal View.

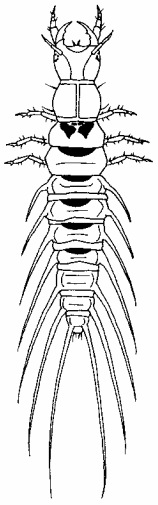


Figure 12.38: *Berosus* sp. (Hydrophilidae) larva, Dorsal View.

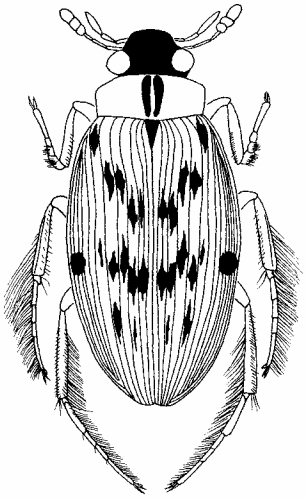


Figure 12.39: *Berosus* sp. (Hydrophilidae) adult, Dorsal View.

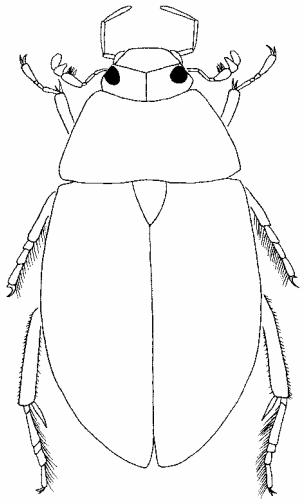


Figure 12.40: *Hydrobiomorpha* sp. (Hydrophilidae) adult, Dorsal View.

Psephenidae

Common Name: Water Pennies
Feeding Group: Scrapers
Tolerance Value: 4 (Moderate)
Habitat: Psephenid larvae occur in fast- to moderately fast-flowing streams in riffle areas. They are found attached to rocks.
Size: **Larvae:** Small (3-10 mm)
Characteristics: **Larvae:** Body flattened with thoracic and abdominal segments expanded so that legs and head are obscured from above; legs with four segments and terminating in a single claw.
Notes: The larvae of psephenids are well adapted for scraping algae from the surfaces of rocks in swift waters. The larvae spend the day under rocks and at night, move to the top of the rocks to feed. The flattened body of a psephenid larva functions as a suction cup and allows it to cling to rocks in swift currents. This body shape and their brown color give them their common name "water pennies". Adult water pennies are terrestrial.

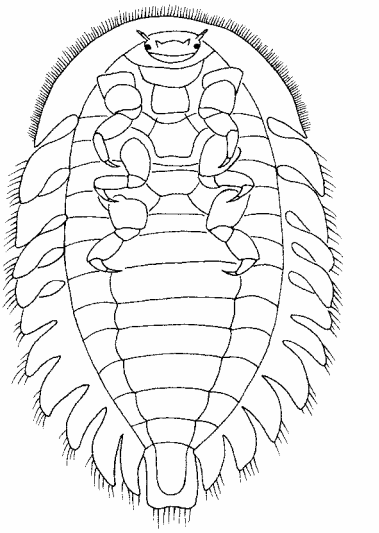


Figure 12.41:
Ectopria sp.
(Psephenidae) larva,
Ventral View.

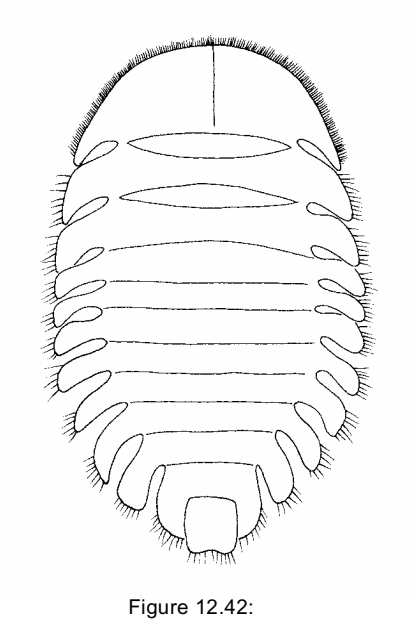


Figure 12.42:
Ectopria sp.
(Psephenidae) larva,
Dorsal View.

Scirtidae

Common Name: Marsh Beetles
Feeding Group: Scrapers, Collector/Gatherers, Shredders
Tolerance Value: 7 (High)
Habitat: Scirtid larvae are most commonly collected in standing and slow-moving waters in streams, ponds, and marshes. They usually occur in vegetated margins of ponds and marshes or at the edges of streams in overhanging vegetation.
Size: **Larvae:** Small to medium (5-15 mm)
Characteristics: **Larvae:** Antennae longer than head; legs with four segments and terminating in a single claw.
Notes: Marsh beetles are most diverse in the tropics, but are not very diverse in North America. Adult marsh beetles are terrestrial. Some of the larvae are found in tree holes and other temporary water bodies.

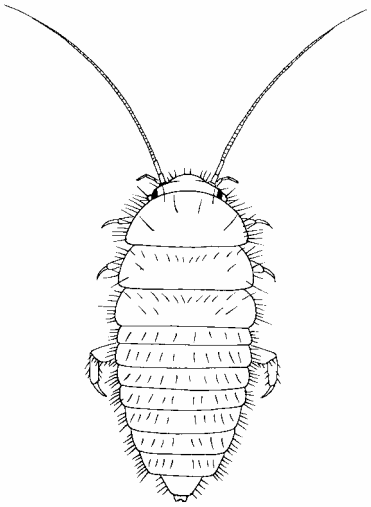


Figure 12.43:
Scirtes sp. (Scirtidae) larva, Dorsal View.