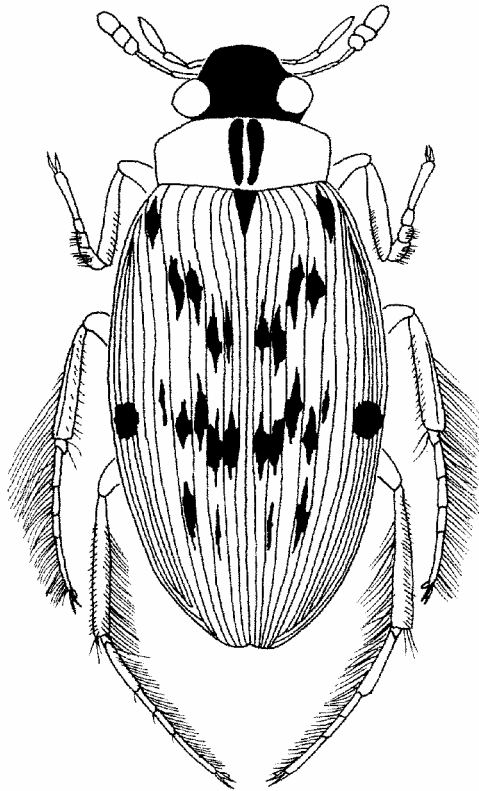


CHAPTER 3

INSECTA

(Aquatic Insects)



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.

3

SUBCLASS INSECTA

Aquatic Insects

Aquatic insects are a very abundant and diverse group that inhabits a variety of aquatic environments. These organisms are an important component of aquatic (and sometimes terrestrial) food webs because they break down and process organic matter and provide food for invertebrates and vertebrates (*e.g.*, fish, birds). Despite their importance in aquatic ecosystems, very few insects spend their entire lives submerged in water. Most aquatic insects undergo an aquatic immature stage followed by a terrestrial adult (*e.g.*, Ephemeroptera, Odonata, Plecoptera, Trichoptera, Megaloptera). Even in cases where both the larva and adult are aquatic, often the adult can exit the water and/or the pupal stage is terrestrial. In rare cases, the larva is terrestrial and the adult is aquatic (*e.g.*, Dryopidae). Additionally, many species considered are semiaquatic and are only associated with aquatic and semiaquatic vegetation, the water's surface, or the margins of water habitats.

Insect Morphology

Adult insects are characterized by the presence of three pairs of segmented legs and the presence of wings in most species (Figure 3.3 - *the fore wings are modified into hardened protective coverings that conceal the membranous hind wings*).

Many aquatic insect larvae possess three pairs of segmented legs (Figs. 3.1, 3.2), but in some groups segmented legs are absent (*e.g.*, Diptera [see Fig 3.4]). Characteristics are often related to the type of metamorphosis a group undergoes.

For example, insects with incomplete metamorphosis have immature stages that appear relatively similar to the adult (*e.g.*, Ephemeroptera, Odonata, Plecoptera, and Hemiptera). These taxa can be identified by the presence of three segmented legs and generally the presence of wing pads in mature larvae (Figure 3.1).

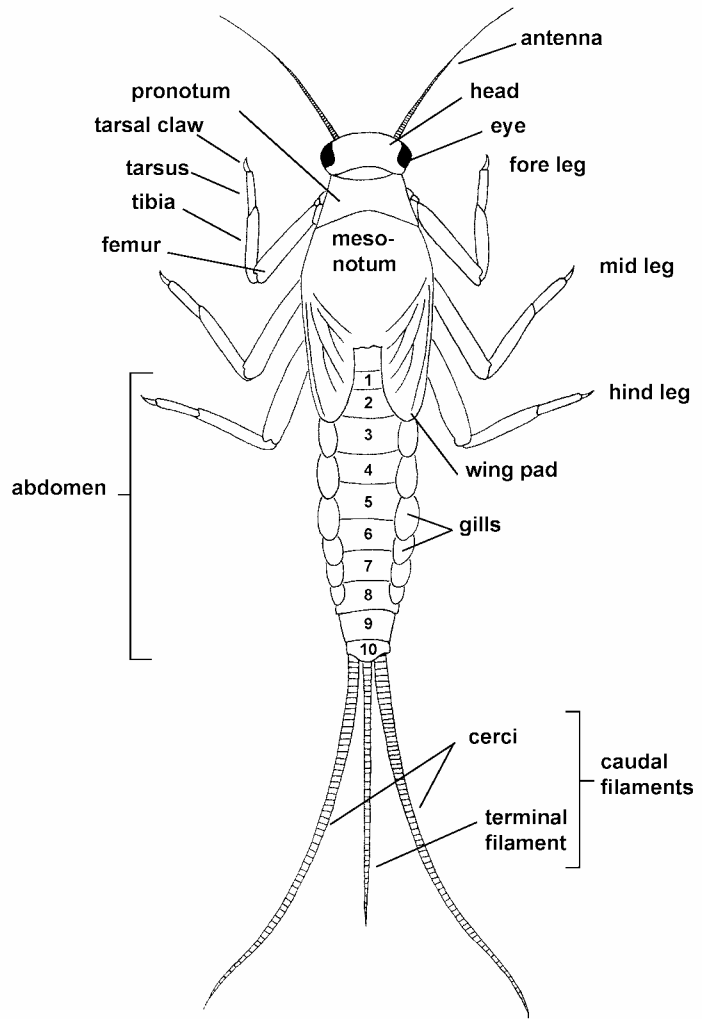


Figure 3.1: Dorsal view of ephemeropteran larva.

INSECTA

Most of these groups have aquatic larvae and terrestrial adults. However, many Hemiptera and Coleoptera do not follow this generalization. Insects with complete metamorphosis possess immature stages that are very different than the adults (*e.g.*, Trichoptera, Diptera, Coleoptera, Neuroptera, Megaloptera, Hymenoptera, and Lepidoptera).

In these groups there are no wing pads present in the immature stages and segmented legs may or may not be present (Figures 3.2, 3.4). In some cases the larvae of holometabolous insects have reduced head structures and appear worm-like. Holometabolous adults are also usually terrestrial although many beetles (Coleoptera) are aquatic as adults.

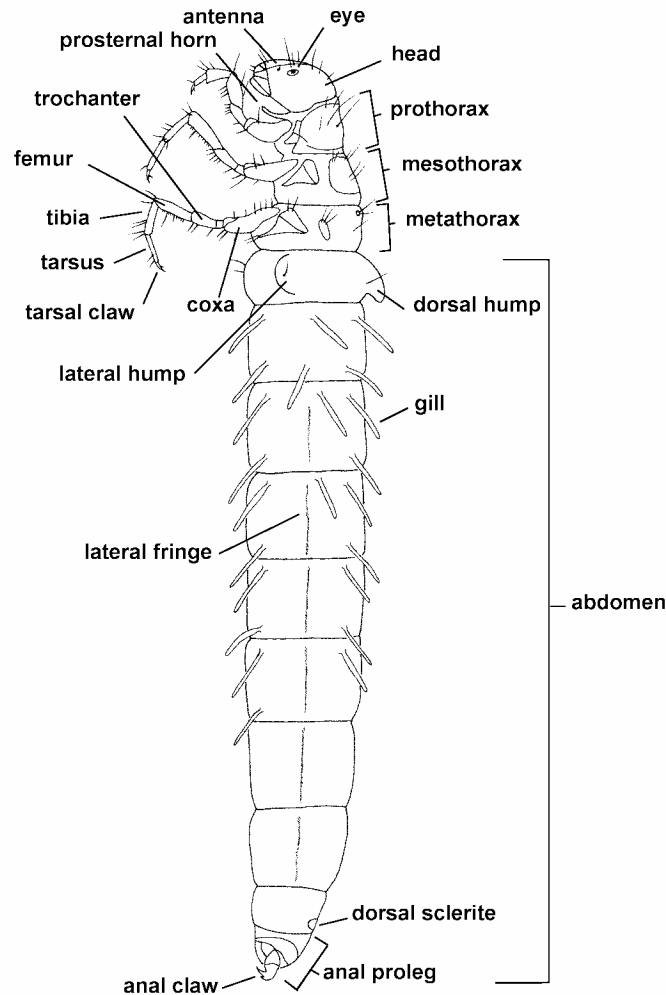


Figure 3.2: Lateral view of trichopteran larva.

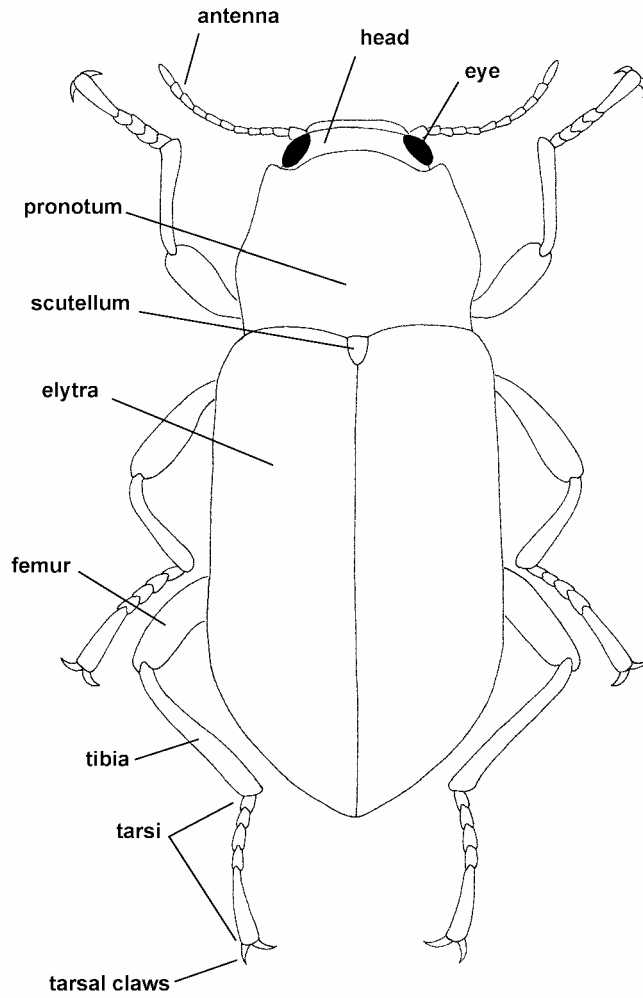


Figure 3.3: Dorsal view of coleopteran adult.

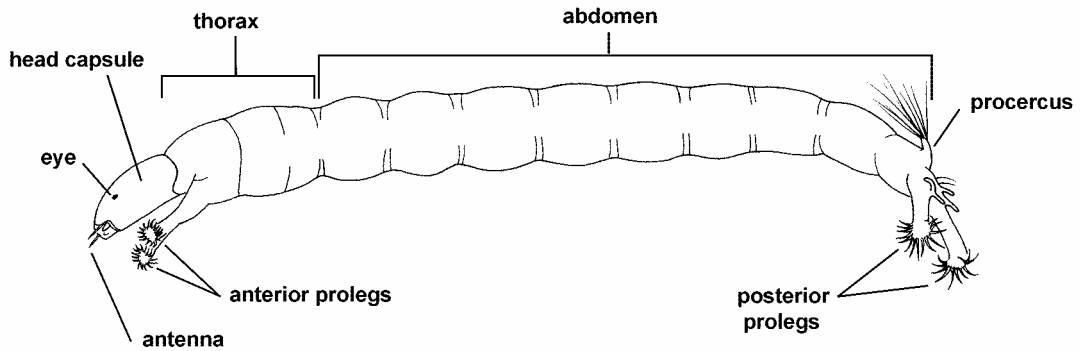


Figure 3.4: Lateral view of dipteran larva.

Key to Insecta Orders

1. Thorax with three pairs of segmented legs (Figs. 3.5-3.8)..... 2

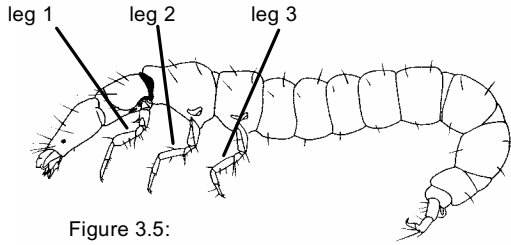


Figure 3.5:
Chimarra sp.
(Philopotamidae) larva,
Lateral View.

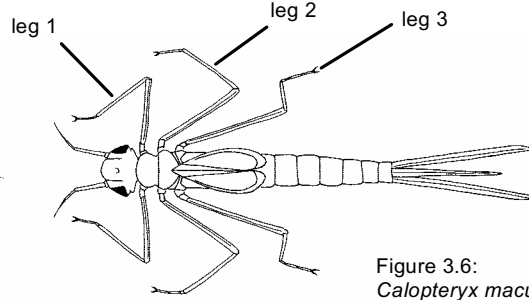


Figure 3.6:
Calopteryx maculata
(Calopterygidae), larva,
Dorsal View

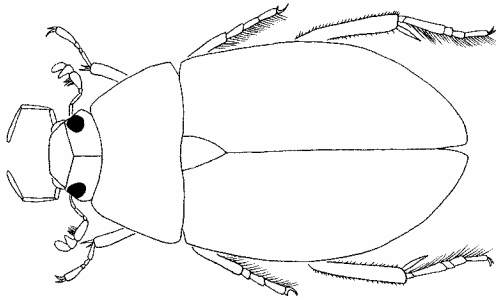


Figure 3.7: *Hydrobiomorpha* sp.
(Hydrophilidae) adult, Dorsal View.

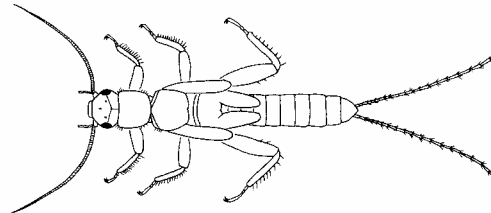


Figure 3.8: *Leuctra* sp.
(Leuctridae) larva,
Dorsal View.

1'. Thorax lacking segmented legs (Figs. 3.9-3.11)
..... **Diptera - larvae and pupae [in part]**
(aquatic & semiaquatic true flies) p. 159

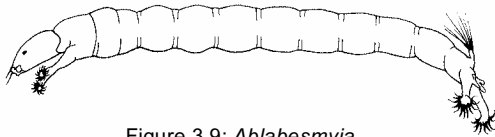


Figure 3.9: *Ablabesmyia*
sp. (Chironomidae) larva,
Dorsal View.

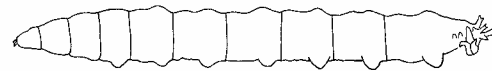


Figure 3.10: *Tipula abdominalis*
(Tipulidae) larva, Lateral View.

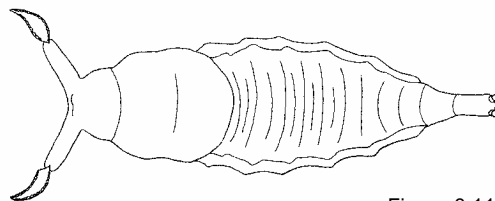


Figure 3.11: *Brachydeutera*
prob. *argentata* (Ephydriidae)
pupa, Ventral View.

- 2(1). Fully developed membranous hind wings present – *note: the fore wings are often hardened so you may have to lift up the fore wings to see the membranous hind wings* (Figs. 3.12, 3.13).....3

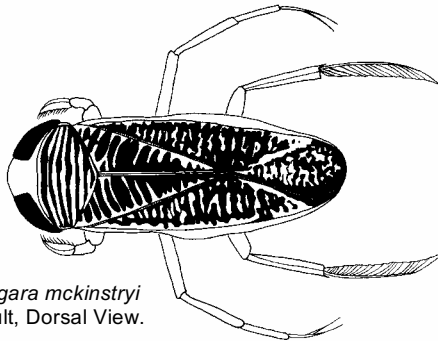


Figure 3.12: *Sigara mckinstryi* (Corixidae) adult, Dorsal View.

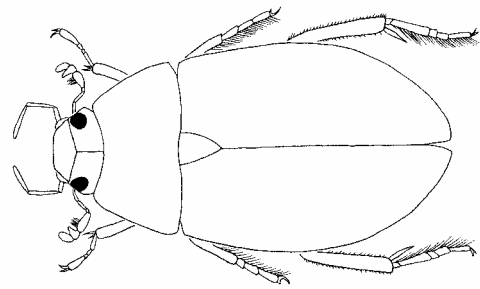


Figure 3.13: *Hydrobiomorpha* sp. (Hydrophilidae) adult, Dorsal View.

- 2'. Fully developed membranous hind wings absent – *note: wing pads may be present in some taxa* (Figs. 3.14, 3.15).....4

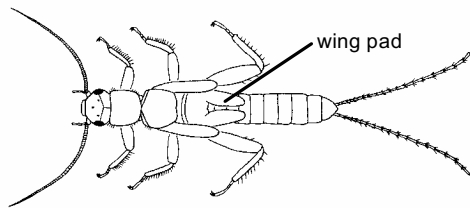


Figure 3.14: *Leuctra* sp. (Leuctridae) larva, Dorsal View.

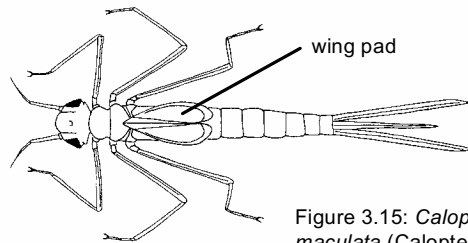


Figure 3.15: *Calopteryx maculata* (Calopterygidae), larva, Dorsal View.

- 3(2). Sucking mouthparts present (Fig. 3.16); a portion of the fore wing usually membranous – *note: all of fore wing is hardened in the family Pleidae* (Fig. 3.17)
...Hemiptera - adults [in part] (aquatic & semiaquatic true bugs) p. 87

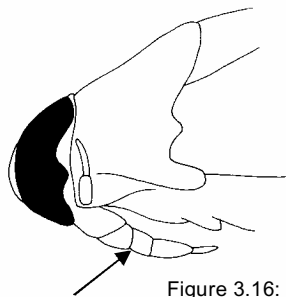


Figure 3.16: Head of Notonectidae adult, Lateral View.

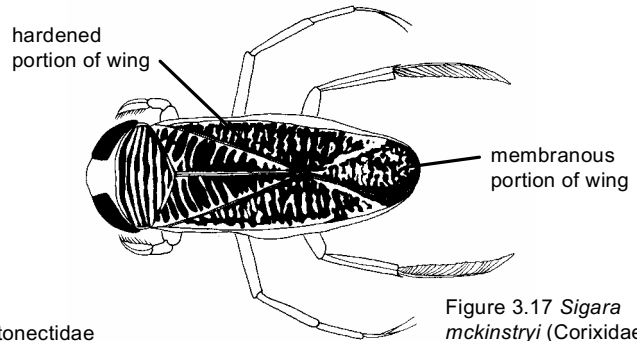


Figure 3.17 *Sigara mckinstryi* (Corixidae) larva, Dorsal View.

- 3'. Sucking mouthparts absent (Fig. 3.18); entire fore wing hardened (Fig. 3.19).....
.....Coleoptera – adults (aquatic beetles) p. 141

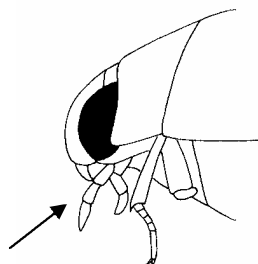


Figure 3.18: Head of *Laccophilus* sp. (Dytiscidae) adult, Lateral View.

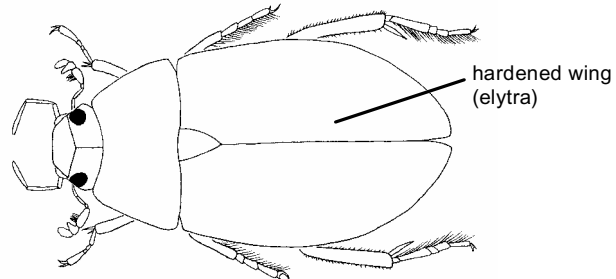


Figure 3.19: *Hydrobiomorpha* sp. (Hydrophilidae) adult, Dorsal View.

4(2'). Abdomen ending in 2-3 many-segmented tails (Figs. 3.20, 3.21) 5

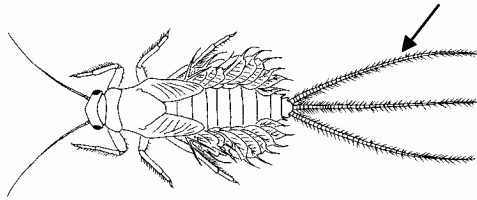


Figure 3.20: *Leptophlebia* sp. (Leptophlebiidae) larva, Dorsal View.

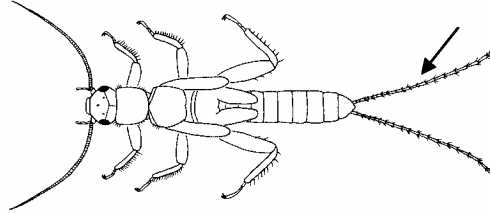


Figure 3.21: *Leuctra* sp. (Leuctridae) larva, Dorsal View.

4'. Multisegmented tails usually absent (Fig. 3.22); if tails are present, then only 1-2 tails are present consisting of only 1-2 segments (Figs. 3.23, 3.24) 6

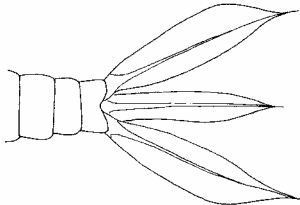


Figure 3.22: Apex of abdomen of *Argia extranea* (Coenagrionidae) larva, Dorsal View.

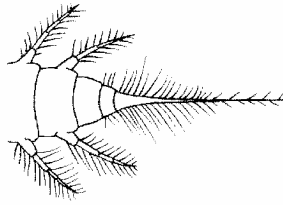


Figure 3.23: Terminal abdominal segments of *Sialis* sp. (Sialidae) larva, Dorsal View.

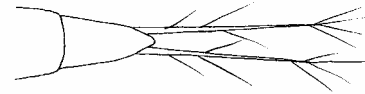


Figure 3.24: Terminal abdominal segments of Dytiscidae larva, Dorsal View.

5(4). Abdomen usually ending in 3 tails; if only two tails present then lateral abdominal gills present (Figs. 3.25, 3.26); 1 tarsal claw present at the end of each leg
.....

Ephemeroptera – larvae (mayflies) p. 47

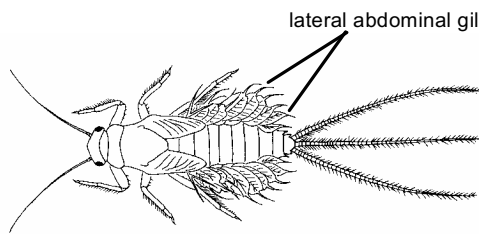


Figure 3.25: *Leptophlebia* sp. (Leptophlebiidae) larva, Dorsal View.

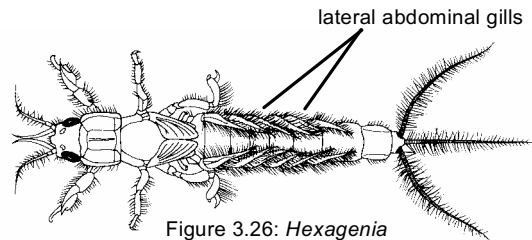


Figure 3.26: *Hexagenia limbata* (Ephemeridae) larva, Dorsal View.

5'. Abdomen ending in 2 segmented tails; lateral abdominal gills absent (Figs. 3.27, 3.28); two tarsal claws present at the end of each leg.. **Plecoptera – larvae (stoneflies) p. 75**

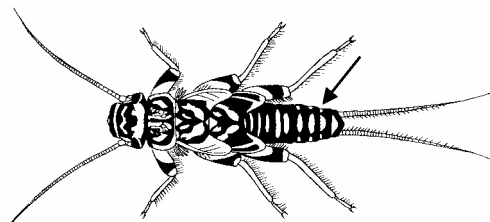


Figure 3.27: *Acroneuria carolinensis* (Perlidae) larva, Dorsal View.

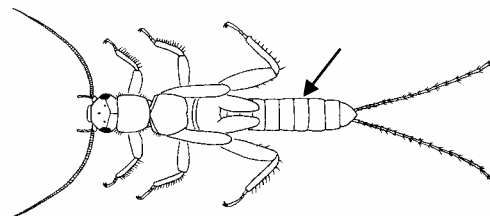


Figure 3.28: *Leuctra* sp. (Leuctridae) larva, Dorsal View.

- 6(4'). Labrum (lower lip) forming an extendable mask-like or scoop-like covering which covers other mouth parts (Fig. 3.29 - shaded); abdomen ending in 3 gills (Fig. 3.30) or 5 points (Fig. 3.31) - note: gills are sometimes lost.....
**Odonata – larvae (dragonflies & damselflies) p. 63**

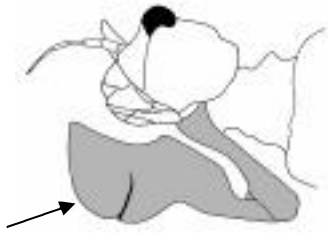


Figure 3.29: Head of *Macromia* sp. (Libellulidae) larva, Lateral View.

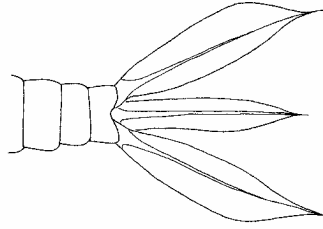


Figure 3.30: Apex of abdomen of *Argia extranea* (Coenagrionidae) larva, Dorsal View.

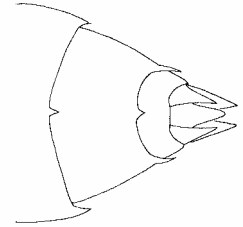


Figure 3.31: Apex of abdomen of *Dromogomphus* sp. (Gomphidae) larva, Dorsal View.

- 6'. Not as above.....7

- 7(6'). Sucking (beak-like) mouthparts present (Figs. 3.32, 3.33, 3.34)8

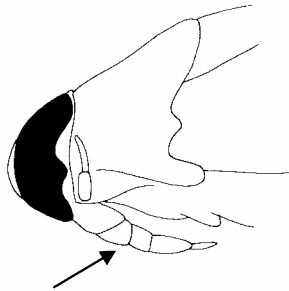


Figure 3.32: Head of Notonectidae adult, Lateral View.

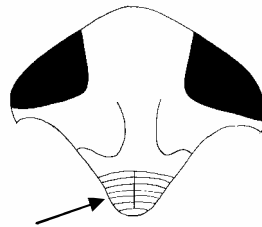


Figure 3.33: Head of *Corisella* sp., adult (Corixidae) Ventral View.

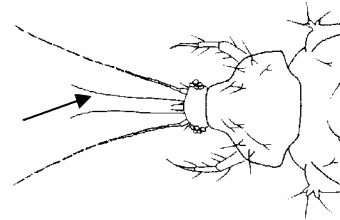


Figure 3.34: Head of *Climacia areolaris* (Sisyridae) larva, Dorsal View.

- 7'. Sucking mouthparts absent (Figs. 3.35, 3.36).....9

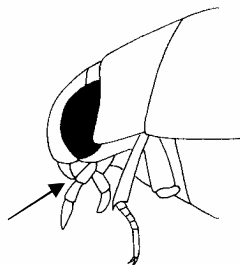


Figure 3.35: Head of *Laccophilus* sp. (Dytiscidae) adult, Lateral View.

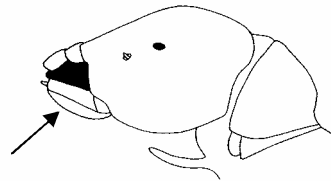


Figure 3.36: Head of *Ironoquia* sp. (Limnephilidae) larva, Lateral View.

- 8(7). Mouthparts consist of two slender rods held together and projecting forward (Fig. 3.37) ..
 **Neuroptera (Sisyridae) – larvae (spongillafly) p. 111**

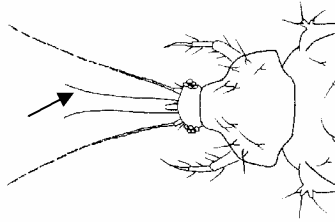


Figure 3.37: Head of *Climacia areolaris* (Sisyridae) larva, Dorsal View.

- 8'. Mouthparts consist of a beak held under the head (Figs. 3.38, 3.39).....
 **Hemiptera - larvae and adults [in part] (aquatic & semiaquatic true bugs) p. 87**

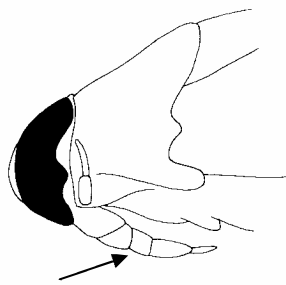


Figure 3.38: Head of Notonectidae adult, Lateral View.

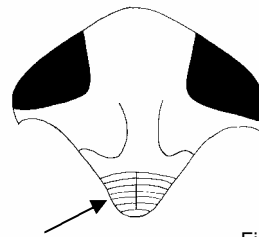


Figure 3.39: Head of *Corisella* sp., adult (Corixidae) Ventral View.

- 9(7'). Wing pads absent (Figs. 3.40, 3.41); larvae with freely movable legs (Figs. 3.40, 3.41).... 10

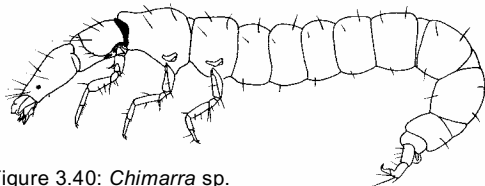


Figure 3.40: *Chimarra* sp. (Philopotamidae) larva, Lateral View.

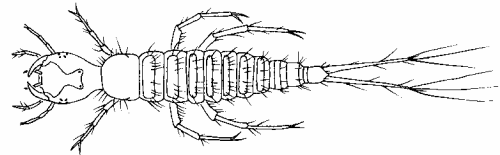


Figure 3.41: *Laccophilus testaceus* (Dytiscidae) larva, Dorsal View.

- 9'. Wing pads present (Figs. 3.42, 3.43); body mummy-like with legs and wing pads held close to body; sometimes in cocoon or case (Figs. 3.42, 3.43) (pupae)..... 13

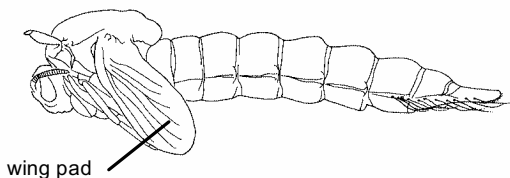


Figure 3.42: *Procladius* sp. (Chironomidae) pupa, Lateral View.

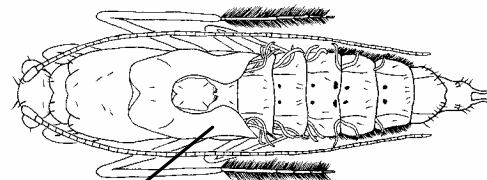


Figure 3.43: Limnephilidae pupa, Dorsal View.

- 10(9). Abdomen with pairs of leg-like protuberances (ventral prolegs) ending in tiny hooks (crochets) (Fig. 3.44) **Lepidoptera – larvae (aquatic moths) p. 137**

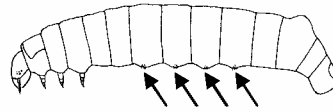


Figure 3.44: *Nymphula* sp., larva (Pyrilidae) larva, Lateral View.

- 10'. Leg-like protuberances absent from abdomen (Fig. 3.45, 3.46); hooks may be present on last abdominal segment (Fig. 3.45) 11

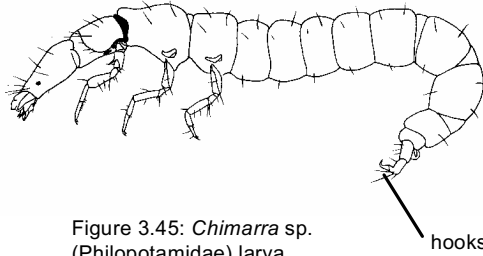


Figure 3.45: *Chimarra* sp. (Philopotamidae) larva, Lateral View.

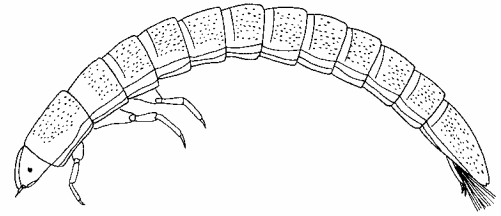


Figure 3.46: Elmidae larva, Lateral View.

- 11(10') Antennae extremely small and one segmented (Fig. 3.47); last abdominal segment ending in a pair of prolegs with a hook on each (prolegs are sometimes fused) (Fig. 3.48) **Trichoptera - larvae (caddisflies) p. 115**

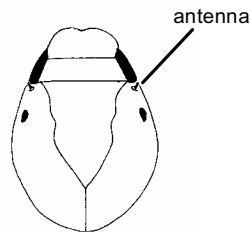


Figure 3.47: Head of *Agrypnia* sp. (Phryganeidae) larva, Dorsal View.

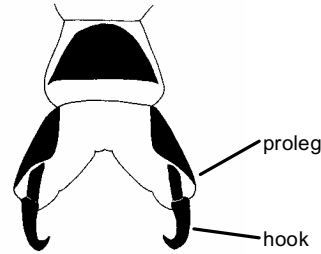


Figure 3.48: Terminal abdominal segments of *Rhyacophila* sp. (Rhyacophilidae) larva, Dorsal View.

- 11'. Antennae elongate with more than 3 segments (Figs. 3.49, 3.50); if hooks are present on last abdominal segment then a total of four hooks are present (Fig. 3.51) 12

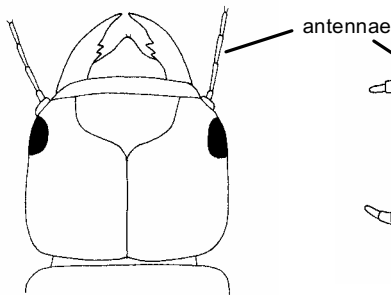


Figure 3.49: Head of *Sialis iola* (Sialidae) larva, Dorsal View.

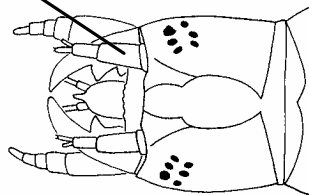


Figure 3.50: Head of *Enochrus pygmaeus nebulosus* (Hydrophilidae) larva, Dorsal View.

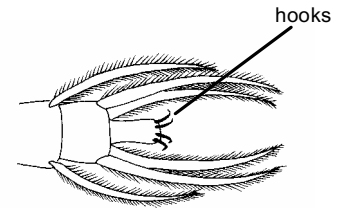


Figure 3.51: Terminal abdominal segments of Gyrimidae larva, Dorsal View.

- 12(11'). Tarsi ending in a single claw (Fig. 3.52); if two claws are present then the abdomen ends in two slender filaments (Fig. 3.53) or four hooks are present on single proleg (Fig. 3.54) .
 **Coleoptera – larvae (aquatic beetles) p. 141**

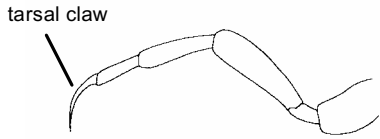


Figure 3.52: Leg of Haliplidae larva.

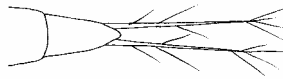


Figure 3.53: Terminal abdominal segments of Dytiscidae larva, Dorsal View.

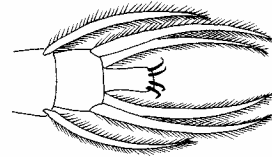


Figure 3.54: Terminal abdominal segments of Gyrinidae larva, Dorsal View.

- 12'. Tarsi ending in two claws (Fig. 3.55); and abdomen either ending in a pair of prolegs each with two hooks (Fig. 3.56) or a single slender filament (Fig. 3.57)
 **Megaloptera – larvae (dobsonflies, fishflies & alderflies) p. 105**

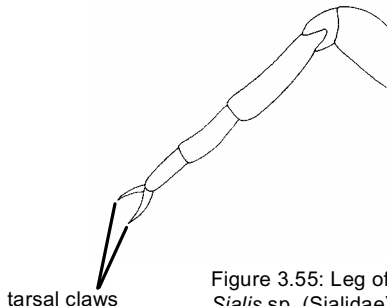


Figure 3.55: Leg of *Sialis* sp. (Sialidae) larva, Dorsal View.

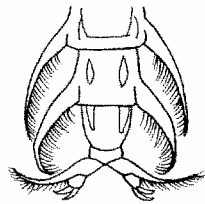


Figure 3.56: Terminal abdominal segments of *Corydalus cornutus* (Corydalidae) larva, Dorsal View.

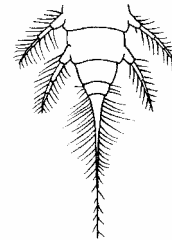


Figure 3.57: Terminal abdominal segments of *Sialis* sp. (Sialidae) larva, Dorsal View.

- 13(9'). One pair of wing pads present (Figs. 3.58, 3.59); mandibles if present not extending forward **Diptera - pupae [in part] (aquatic & semiaquatic true flies) p. 159**

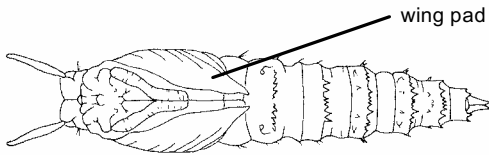


Figure 3.58: *Psychoda alternata* (Psychodidae) pupa, Ventral View.

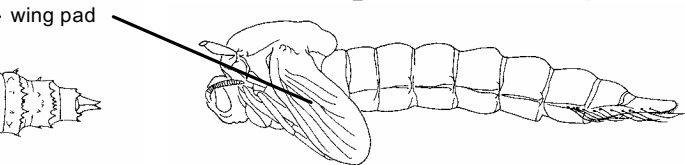


Figure 3.59: *Procladius* sp. (Chironomidae) pupa, Lateral View.

- 13'. Two pairs of wing pads present (Fig. 3.60); curved mandibles present extending forward (Fig. 3.61) **Trichoptera – pupae (caddisflies) p. 115**

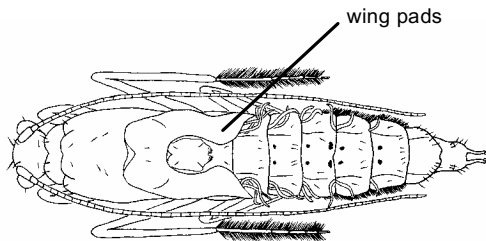


Figure 3.60: Limnephilidae pupa, Dorsal View.

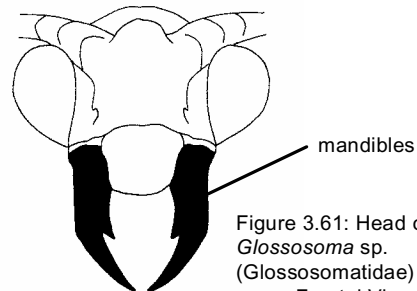


Figure 3.61: Head of *Glossosoma* sp. (Glossosomatidae) pupa, Frontal View.