KEY TO THE MAJOR GROUPS OF NORTH AMERICAN FRESHWATER INVERTEBRATES

Key A guides you to three other keys. Larger (macroscopic) taxa are identified by Key D, while smaller (microscopic and near microscopic organisms) by Key C. There will obviously be overlap among these keys. Some taxa are found in both keys. Key B includes sessile organisms that are attached to substrate; sessile organisms do not fall easily into micro- and macroscopic categories because colonies may be large but composed of small inconspicuous individuals.

- The keys exclude some marine and brackish water groups that have a few representatives capable of inhabiting freshwaters only within coastal rivers and coastal lakes.
- The keys exclude taxa that are exclusively parasitic.
- The keys should be useful generally throughout North America.
- Drawings can not possibly include all variations within a given taxa; drawings are most useful in comparing the two descriptions within a couplet.
- Start from the beginning until you are very familiar with each key. The characteristics that describe a taxon in its final couplet are not a complete description. The complete description includes all the preceding couplet descriptions that have directly led to that final couplet.

**Taxonomic nomenclature for invertebrate groups in this key**

Phylum Porifera (sponges)
Phylum Cnidaria (jellyfish, hydra, sea anemones, and corals)
  Class Hydrozoa
Phylum Rotifera
Phylum Entoprocta
  (moss animalcules)
Phylum Bryozoa
Phylum Platyhelminthes (Flatworms)
  Class Turbellaria
Phylum Annelida (earthworms, polychaete worms, and leeches)
  Subclass Hirudinea (leeches)
  Subclass Oligochaeta
  Subclass Aeolosomatida
Phylum Mollusca (bivalves, snails, cephalopods)
  Class Gastropoda (snails)
    Subclass Prosobranchia
    Subclass Pulmonata
  Class Bivalvia (mussels and clams)
    Family Unionidae
    Family Dreissenidae
    Family Corbiculidae
    Family Sphaeriidae
Phylum Arthropoda (insects, crustaceans, spiders, etc.)
  Class Crustacea
    Subclass Branchiopoda
      Order Cladocera (water fleas)
      Order Anostraca (fairy shrimp)
      Order Notostraca (tadpole shrimp).
      Order Conchostraca (clam shrimp)
    Subclass Ostracoda (seed shrimp)
    Subclass Malacostraca
      Order Isopoda (aquatic sow bugs)
      Order Amphipoda (scuds, sideswimmers)
      Order Decapoda (crayfish, freshwater shrimp)
      Order Mysidacea (opossum shrimp)
    Subclass Copepoda
      Order Harpacticoida
      Order Cyclopoida
      Order Calanoida
  Class Arachnoidea –
    Order Acari (water mites)
Class Insecta (Hexapoda) (insects)
  Order Odonata (dragonflies and damselflies)
  Order Ephemeroptera (mayflies)
  Order Plecoptera (stoneflies)
  Order Trichoptera (caddisflies)
  Order Megaloptera (alderflies, dobsonflies, fishflies)
  Order Coleoptera (beetles)
  Order Hemiptera (true bugs)
  Order Diptera (true flies)
  Order Lepidoptera (moths)
  Order Neuroptera (spongillaflies)
Phylum Nematoda (roundworms)
Phylum Nematomorpha (horsehair or gordian worms)
Phylum Nemertea (ribbon worms)
Phylum Gastrotricha
Phylum Tardigrada (water bears)
KEY A
INTRODUCTORY KEY TO FRESHWATER INVERTEBRATES

A1  Firmly attached to substrate (sessile)  
     ... ...  Key B

     -- Not as above; planktonic, crawling,  
     swimming, tube dwelling, or attached  
     temporarily by means of suckers,  
     claws or hooks ... ...  A2

A2  Truly planktonic in open water, or  
     benthic (or near benthic) and generally  
     <2 mm in length (i.e. organisms too  
     small to easily be collected by hand  
     picking in the field) ... ...  Key C

     -- benthic and generally >2 mm in length  
     ... ...  Key D
KEY B
FRESHWATER SESSILE (ATTACHED)
INVERTEBRATES

B1 Without bivalve shell ...... B2

- Bivalve shell attached to substrate with byssal threads; shell with black zigzag markings ...... zebra mussels DREISSENACEA

B2 Amorphous (without symmetry) and externally simple; microscopic spicules (siliceous skeleton structures) observable when tissue is digested with acid ...... sponges PORIFERA

Note: All species of freshwater sponges are classified within a single family Spongillidae. Freshwater sponges are inconspicuous and variable in size, shape, and color (even within a single species)

- With tentacles (though may be retracted especially in preserved specimens); radial or bilateral symmetry at level of individual... B3

B3 Few tentacles (typically <8) surrounding mouth and solitary, or tentacles scattered along body and colonial forming branches ...... CNIDARIA

- Numerous tentacles arranged in a well-organized (tight) circular or U-shaped crown and extending from a protective tube or case (zooecium) that may be thin to massive and gelatinous to tough; tubes often connected in a branched twiglike manner or some form thick encrusting colonies ... B4
B4 Zooecium stalked and composed of stacked urn-shaped segments with 1-6 stalks arising from a basal plate; lophophore composed of circularly-arranged short tentacles that are not retractable; anus lies within ring of tentacles...

ENTOPROCTA

Note. Only a single freshwater species in North America, *Urnatella gracilis*.

Zooecium without stalks, or with stalks that are not externally segmented; tentacles are retractable into zooecium; anus lies outside of ring of tentacles...

moss animals

BRYOZOA (Ectoprocta)
C5  Spindle- or tenpin-shaped, ventrally flatten; more or less distinct head, bearing sensory cilia; cuticle usually ornamented with numerous small spines or scales ....

GASTROTRICHA

- Semi-rigid cuticle (sometimes with external annulations) or armored; sometimes with a few large spines; apical end with ciliated corona and muscular pharynx may be visible ....

ROTIFERA

Note. Rotifers are common in open water lake systems, but many species are benthic.

C6  Body unsegmented ....

- Body segmented ....

  Segmented worms

  ANNELEIDA ....

C7  Worm-like body flattened; mouth opens on ventral surface and no proboscis; body length usually <1 mm though some can exceed 10 mm ....

  flatworms

  TURBELLARIA

- Worm-like body round ....

  roundworms

  NEMATODES

C8  Numerous hair setae present in both dorsal and ventral bundles; body often with numerous minute, pigmented globules (red, green, yellow, or orange); anterior end often appears bulbous; length usually 1-2 mm, but chains may be found as long as 10mm ....

AEOLOSOMATIDA

(Aphanoneura)
- Hair setae not present in ventral bundles; anterior end not ciliated; pigmented globules absent ....

**OLIGOCHAETA**

**C9** Body fused into single piece with no obvious segmentation with easily viewed appendages (generally 3 or 4 pair) ....

**C10** Body obviously segmented or covered with carapace that encloses appendages ....

**ACARI**

Note. *Acari* is a subclass of the arthropod class *Arachnida*. Often body is brightly colored red or green and small (0.4 - 3 mm).

**C10** Posterior of body rounded; adults generally with 4 pair of legs and usually legs are as long or longer than width of body; antennae absent; ....

**Water mites**

**Crustacean nauplius**

Note. The nauplius is the larval stage of many crustacean taxa. In lakes it is likely to be the earlier stages of either calanoid or cyclopid copepods.

**C11** Usually more than 3 pair of legs; 2 pair of antennae ... **CRUSTACEA** ... **C12**

Note. This key excludes two extremely rare taxa of crustacea (Thermoshaenacea and Bathyellacea) found in some interstitial waters of springs and caves).

-- Three pair of legs, or lacking jointed legs; 1 pair of antennae ....

**INSECTA**

In lake plankton, likely *Chaoborus* of the order *Diptera* (pictured on far right) .... otherwise go to Key D
C12 Jointed leg-like appendages of thorax distinctly different than abdomen with abdominal appendages more simple (pleopods) and appendages never completely covered by carapace ......

MALACOSTRACA

In lake plankton, likely Mysis of the order Mysidacea (pictured on right) otherwise Go to Key D

- Appendages (of body excluding head) not obviously different among anterior and posterior regions of body and may be absent along posterior sections; carapace may completely cover (envelop) these appendages ...

C13

C13 Completely enveloped in laterally compressed, bivalved carapace (without growth lines on carapace); thorax with 3 or fewer pairs of appendages .... seed shrimp

OSTRACODA

- Not as above .... C14

C14 Carapace wraps mostly or completely around body and appendages with distinct head region from anterior end of carapace; predominant eye; antennae large; < 28 pairs of appendages (one exception is Leptodora where carapace is present as brood chamber only; pictured lower right) ...

water fleas

CLADOCERA

- Not as above .... C15
C15 No carapace; shield-like carapace, or bivalve (clam-like) carapace with growth lines; appendages flattened and leaf-like (10-60 pairs) and fairly uniform along body ... 

Go to Key D

- Cylindrical body; two caudal rami with setae (on posterior end of abdomen); single, simple eye ....
  COPEPODA.....C16

C16 Abdomen not much narrower than thorax ....
  HARPACTICOIDS

- Abdomen much narrower than thorax .... C17

C17 Antennae long (23-25 segments; extending near length of body); cephalothorax torpedo shaped; females with one egg sac ....
  CALANOIDA

- Antennae shorter than cephalothorax; cephalothorax more tapered posteriorly; females with two egg sacs ....
  CYCLOPOIDAE
KEY D

FRESHWATER BENTHIC MACRO-INVERTEBRATES
(modified in part from Guide to the Freshwater Invertebrates of the Midwest and from Ecology and Classification of North American Freshwater Invertebrates, Thorp, J. H. and A. P. Covich)

D1 Jointed legs usually present, or no jointed legs but with head capsule or wing pads .......

ARTHROPODS ... D13

-- No jointed legs; wing pads absent, head capsule absent .......

NON-ARTHROPODS ... D2

D2 Body segmented .... Segmented worms

ANNELIDA ... D3

-- Body unsegmented .... D4

D3 Body with suckers at anterior and posterior ends; body dorsoventrally flattened; without setae projecting from body wall; length from 5-300 mm .......

Leeches

HIRUDINEA

-- Body without suckers; cylindrical in shape; setae almost always present on most segments ....... OLIGOCHAETA

Note. If <5 cm, may be an aeolosomatid annelid; see Key C.

D4 Body in or under a definite shell .......

snails & clams

MOLLUSCA ... D5

Note. The taxa of molluscs and annelids considered in this key do not include some brackish water groups that sometimes extend into coastal freshwaters.

-- No true external shell; body worm-like .......

D10
D5  Shell consisting of one piece ... ... snails and limpets
     GASTROPODA ... D6

     Shell consisting of two pieces (valves)
     clams
     PELOPSIDA (PELECYPODA) ... D7

D6  Operculum present in the shell
     aperture; gills in dorsal mantle ... ...
     PROSOBRANCHIA

       Without operculum; mantle cavity
       modified into lung, or false gill
       present outside mantle cavity ... ...
       PULMONATA

D7  Shell hinge ligament is external ... D8

       Shell hinge ligament is internal; hinge
       without teeth; anterior end of shell
       reduced and pointed; shell with black
       zigzag markings; attached to substrate
       with byssal threads ... ...
       DREISSENACEA

Note. The only true freshwater species in the
U.S. is the introduced genus Dreissena, the
zebra mussel, whose range has rapidly
expanded during the 1990's.

D8  Shell with lateral teeth extending
     anterior and posterior of true cardinal
teeth ... ... CORBICULACEA ... D9

       Shell without cardinal teeth; when
       present, lateral teeth occur only
       posterior to usually well-developed
       pseudocardinal teeth, pseudocardinal
       teeth may be absent or vestigial; shells
       of adults are generally large (>25 mm
       in shell length) ... ... UNIONACEA
CORBICULIDAE

Note. The only true freshwater species in the U.S. is the introduced and widespread genus Corbicula, the Asiatic clam.

-- Shells generally small (maximum adult shell length >25 mm), thin and generally fragile

SPHAERIIDAE

D10 Worm-like body flattened

D12 Worm-like body round

D11 Anteriorly oriented mouth, eversible proboscis may be observable in live specimens; body length 10-40 mm

ribbon worm

NEMERTEA

-- Mouth opens on ventral surface and no proboscis; body length usually <1 mm though some can exceed 10 mm

flatworms

TURBELLARIA

D12 Elongated and threadlike, long (>6cm in length); leathery body wall, range in color from light brown to black

horsehair worms

NEMATOMORPHA

-- Not threadlike and less than 1 cm, or threadlike and less than 6 cm

roundworms

NEMATODES
D13 Usually more than 3 pairs of legs; 2
     pair of antennae .......
     CRUSTACEA ... D14
     
     Three pair of legs or lacking jointed
     legs; 1 pair of antennae .......
     INSECTA ... D19

D14 Jointed leg-like appendages of thorax
     distinctly different than appendages of
     abdomen with abdominal appendages
     more simple (pleopods) .......
     MALACOSTRACA ... D15
     
     Appendages flattened and leaf-like
     and fairly uniform along body ...
     BRANCHIPODA ... D17

D15 Body dorsoventrally depressed; 5-25
     mm length .......
     ISOPODA
     
     Body laterally compressed or
     cylindrical in form .......
     D16

D16 Body laterally compressed; length 5-25
     mm; eyes not stalked, or absent; no
     carapace covering thoracic segments
     as a unit .......
     scuds
     AMPHIPODA
     
     Body cylindrical or laterally
     compressed; length 15-150 mm; eyes
     stalked; single carapace covering head
     and all thoracic segments; pinchers
     present on end of first 2 or 3 pairs of
     legs .......
     crayfishes and shrimps
     DECAPODA

D17 No carapace; eyes on stalks; 11-17
     pairs of leafy appendages .......
     fairy shrimp, brine shrimp
     ANOSTRACA
     
     Carapace present .......
     D18
D18 Bivalve (clam-like) carapace with growth lines; 10-28 pairs of flatten appendages; thorax with 10 or more pairs of appendages ...

clam shrimp
CHONCHOSTRACA

- Carapace shield-like; 40-60 pairs of flatten appendages ...

  tadpole shrimp
NOTOSTRACA

D19 Thorax without segmented legs... D20

  Thorax with three pairs of segmented legs ...

D20 Mummy-like, with developing wings, legs, and other adult structures; in a case, which is often silk-cemented and contains vegetable or mineral matter ...

  insect pupae (no keys)

  Not mummy-like; not sealed in a case, motile larvae, mostly with prolegs or pseudopods on one or more segments ...

  Diptera

D21 With large functional wings (though outer wings may form harden cover) ...

D22

  Wingless, or with developing wings (wing-pads) or brachypterous (very short or rudimentary) wings ...

D24
D22 All wings completely membranous, with numerous veins ....

   terrestrial insects
   or ovipositing adults of species with aquatic larvae

D23 Mesothoracic (outer) wings hardened and shell-like, or leather-like in basal half .... D23

D23 Mesothoracic wings hard, shell-like; chewing mouthparts .... Coleoptera

   Mesothoracic wings hardened in basal half; sucking mouthparts formed into a broad or narrow tube .... Heteroptera (Hemiptera)

D24 With two or three very long, filamentous terminal appendages attached to posterior end of abdomen .... D25

   Terminal appendages absent or short, not many-segmented, and not segmented .... D26

D25 Tarsi (terminal segments of appendages) with one claw; sides of abdomen with plate-like, feather-like, or leaf-like gills; usually with three tail filaments, occasionally only two ...

   Ephemeroptera

   Tarsi with two claws; gills absent from middle abdominal segments; two tail filaments; .... Plecoptera
D26 Labium formed into an elbowed, extensile grasping organ; abdomen terminating in three lamellae (leaf-like gills) or five triangular points

Odonata

---

Sucking or chewing mouthparts, not elbowed; abdomen not terminating in three lamellae or five triangular points

D27

D27 Mouthparts sucking, formed into a broad or narrow tube or a pair of long stylets

D28

---

Mouthparts not sucking, not formed into a tube or pair of stylets

D29

D28 Mouthparts a pair of long stylets; all tarsi with one claw; preys on sponges

Neuroptera

---

Mouthparts a broad or narrow tube; mesotarsi with at least two claws

Heteroptera

(Hemiptera)

D29 Ventral prolegs on middle abdominal segments, each with a ring of fine hooks

Lepidoptera

---

Abdomen without ventral prolegs on middle segments

D30

D30 Antennae extremely small, inconspicuous, one-segmented

Trichoptera

---

Antennae elongate, with three or more segments

D31
D31  A single claw on each tarsus .... Coleoptera

- Each tarsus with two claws .... D32

D32 Without conspicuous lateral filaments Coleoptera

- With conspicuous lateral filaments projecting outward from abdomen ...

D33 Abdomen terminating in two slender filaments or a single median proleg with four hooks .... Coleoptera

- Abdomen terminating in a single slender filament, or in two prolegs, each with two hooks ... Megaloptera