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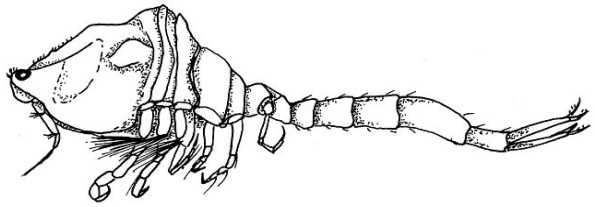
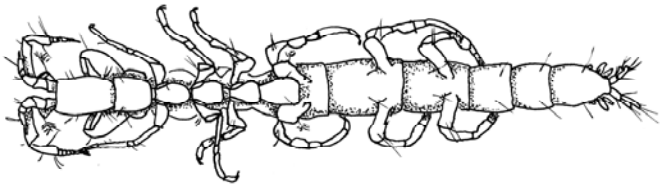
Key to the Freshwater Malacostraca (Crustacea) of the Mid-Atlantic Region





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Key to the Freshwater Malacostraca (Crustacea) of the Mid-Atlantic Region

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Contents

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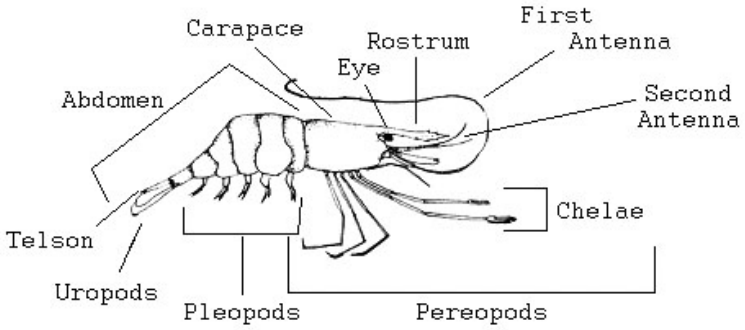
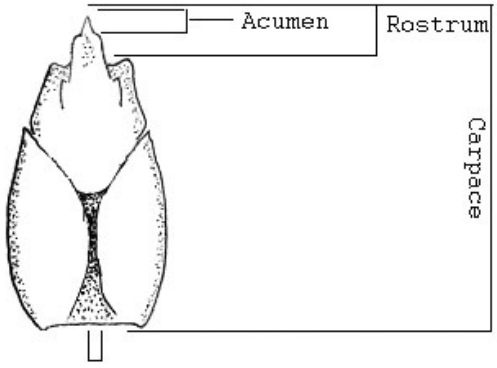
Introduction

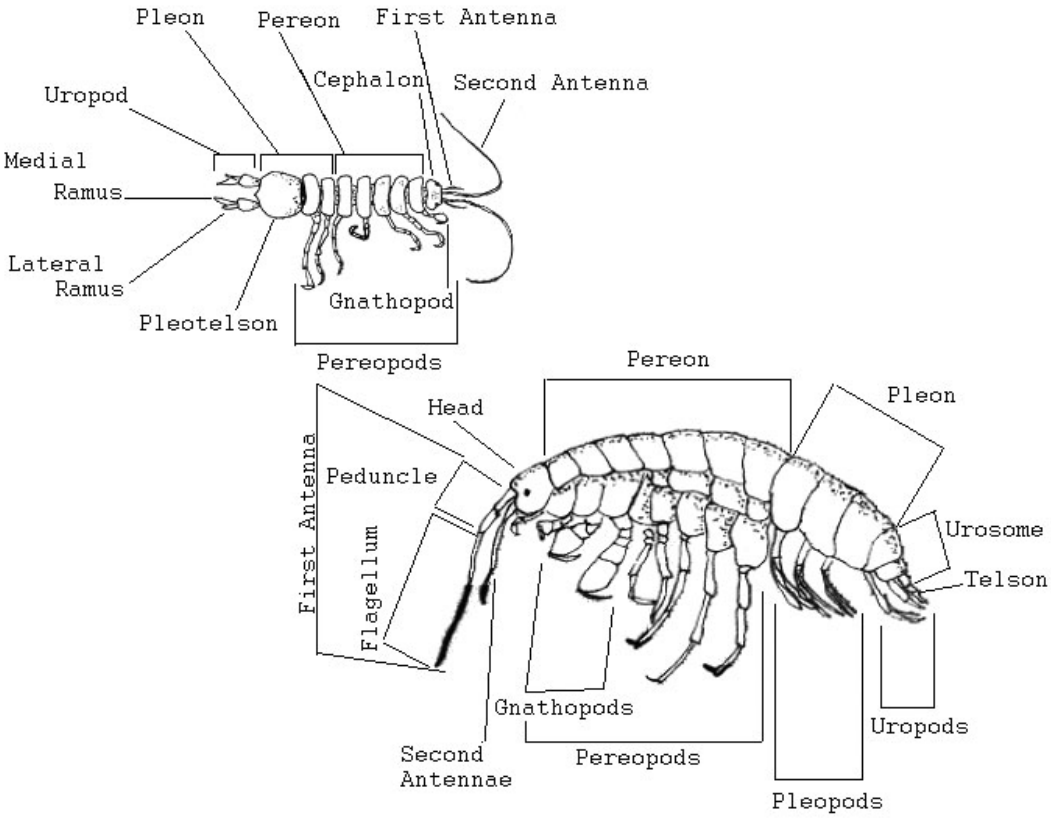
This dichotomous key was developed as a tool to promote and increase macroinvertebrate identification accuracy among diagnosticians in US EPA Mid-Atlantic states. The intended audience for this tool is those conducting bioassessment in wadeable lotic and perennial lentic habitats. This document focuses on the malacostracan Crustacea reported from lakes, rivers, and perennial streams and springs in Pennsylvania, Delaware, West Virginia, Virginia, Maryland, and Washington, District of Columbia, and is specifically focused on the Crustacea typically found during the course of instream bioassessment. This key is divided into several sections, with the first section covering the classes (and some subclasses) of freshwater crustaceans for the region described above. Key B separates the orders of malacostracans, with each subsequent key covering an individual order. It is important to note that new taxa will be discovered from and introduced to this region in the future, and will not be identifiable with these keys. Therefore the user should be aware that it is very likely they will find creatures not identifiable with this tool alone.

The taxonomic keys below are designed to identify freshwater syncarids, peracarids, and decapods to genus or species where appropriate. These keys were built using the primary literature and /or actual material of the taxa covered. Many groups have unresolved species complexes, or far too many undescribed taxa to make a key beyond genus or subgenus meaningful, such as in *Crangonyx*. All other crustacean taxa are identified as far as is currently possible. The taxonomy primarily follows Martin & Davis (2001) and McLaughlin *et al.* (2004).

Figure 1. Basic morphological terminology.

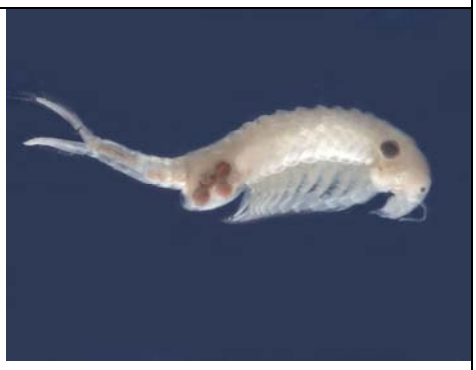




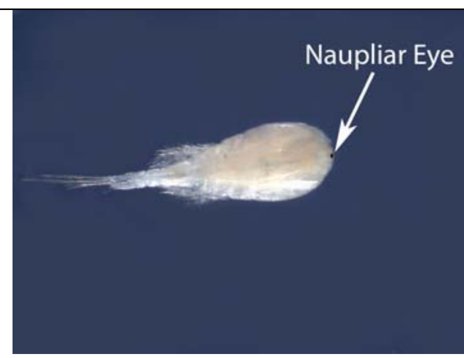


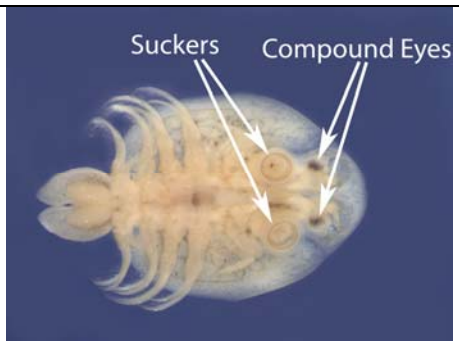
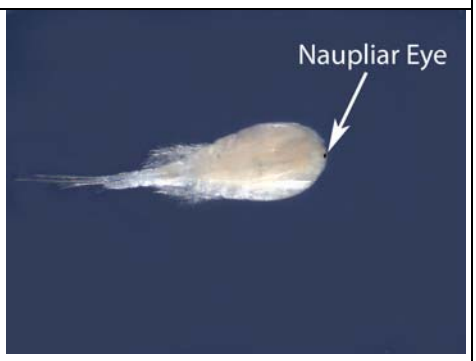
A. Key to the Classes of North American Freshwater Crustacea (and subclasses of Maxillopoda).

This key assumes the user can recognize crustaceans. Its purpose is to separate the Malacostraca from the other crustacean classes. The class Branchiopoda is not typically found during bioassessment, except cladocerans are occasionally encountered. Only the genus *Ilyocryptus* is a stream benthic taxon, all other species of permanent aquatic habitats being planktonic. Ostracods are entirely benthic, and many copepods are as well.

1a. Thoracopods segmented, never lamellar; carapace bivalved or not or carapace absent 2	
1b. Thoracopods lamellar, not segmented; carapace bivalved or not, or absent, **or** if thoracopods are segmented, then bivalved carapace greatly reduced . . . . . **Class Branchiopoda**	

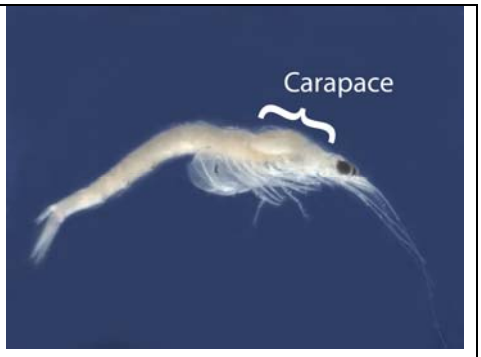
2a (1a).Carapace not bivalved. 3	
2b. Carapace bivalved, enclosing entire animal . . . . Class **Ostracoda**	

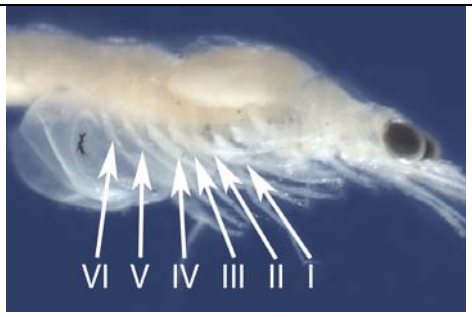
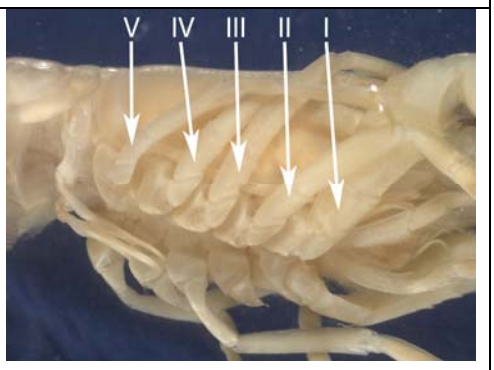
3a (2a). Naupliar eye present; telson and uropods always absent. . . . . . Class **Maxillopoda** 4	
3b. Naupliar eye absent in adults; telson or pleotelson present, uropods present or absent . . . . Class **Malacostraca** (See Key B, page 4)	

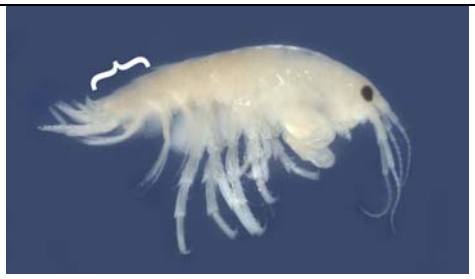
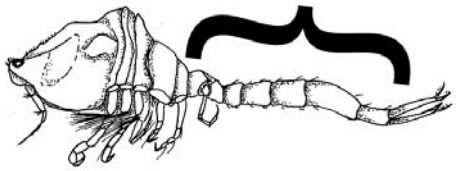
4a (3a). Compound eyes present; body flattened and broad; four thoracopod pairs; pair of large anterioventral suckers present, ectoparasite of fish . . . . . Subclass **Branchiura,** Order **Arguloida** . . . . . Genus ***Argulus***	
4b. Compound eyes absent; naupliar eye only; suckers absent . . . . . Subclass **Copepoda**	

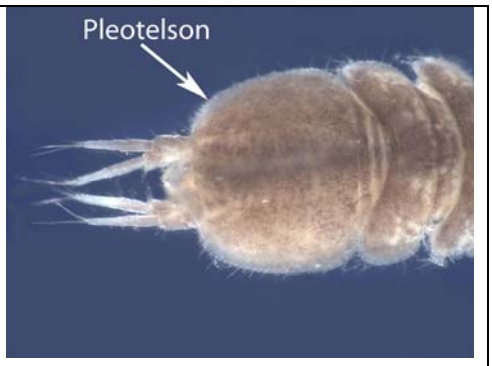
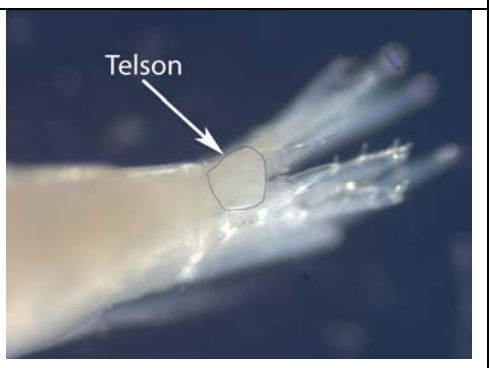
B. Key to the Malacostracan Orders

Five out of seven North American malacostracan orders occur in freshwaters in the Mid-Atlantic. The Thermosbanaecea are represented in the USA by a single species in Texas, and the Bathynellacea by twelve localized species found in the west and south.

1a. Carapace large, obvious 2	
1b. Carapace reduced or absent 3	

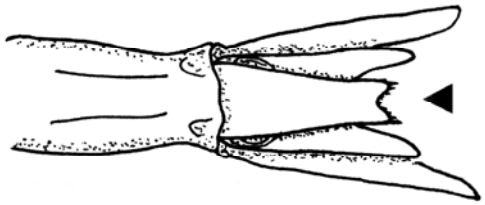
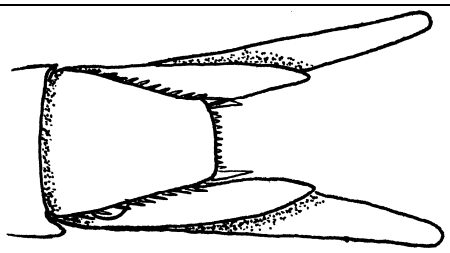
2a (1a). Six or more pairs of ambulatory legs . . . . . Order **Mysida** (See Key C, page 7)	
2b. Five pairs of walking legs, including chelae . . . . . Order **Decapoda** (See Key F, page 32)	

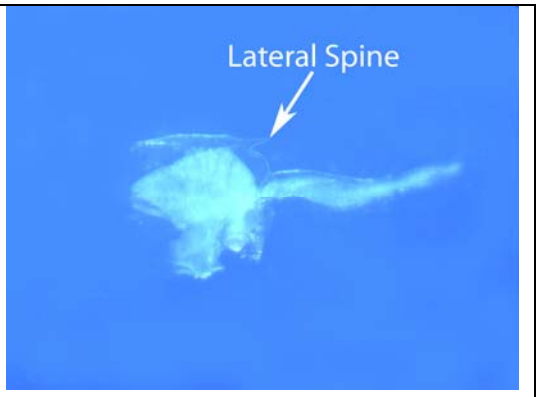
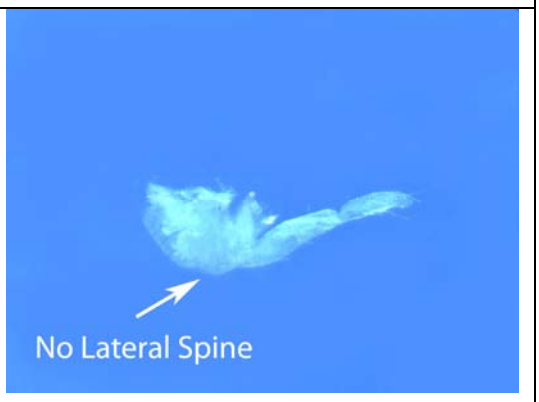
3a (2a). Abdomen not especially narrower than thorax; thoracopods uniramous; body laterally or ventrally compressed 4	
3b. Abdomen many times narrower than thorax; thoracopods biramous; body laterally compressed; . . . . . Order **Cumacea** . . . . . ***Almyracuma proximoculi*** Jones & Burbanck, 1959 Occurs in deep coastal rivers, often collected as much as 170 miles upstream.	

4a(3a). Telson and final abdominal segments fused into a pleotelson subequal in width to body. . . . . .Order **Isopoda** (See Key D, page 9)	
4b. Telson projecting from abdomen, telson small, narrower than body . . . . . Order **Amphipoda** (See Key E, page 22)	

C. Key to the Freshwater Mysida

Thirteen Mysid species have been reported from freshwaters in the US. Of that number, six are Eurasian invasives. Of the two species in the Mid-Atlantic, *Hemimysis anomala* is an invader, rapidly spreading from the Great Lakes into adjacent areas.

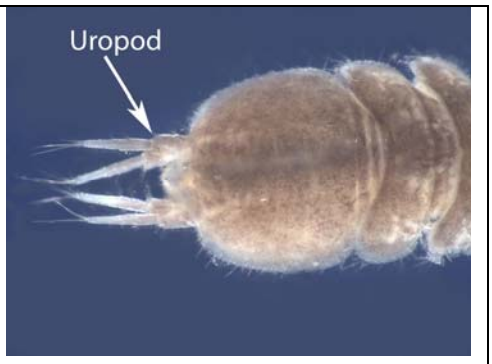
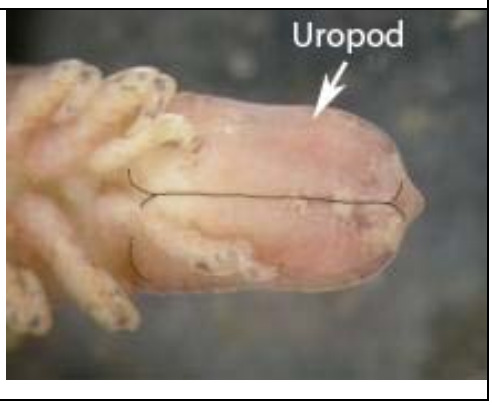
1a. Telson cleft 2	
1b. Telson entire. . . . . ***Hemimysis anomala*** (Sars, 1907) A nonnative, invasive Pontocaspian species, first detected in Great Lakes region, probably spreading.	

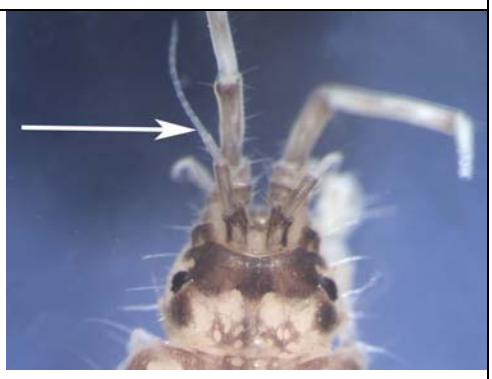
2a. Mandible with a lateral spine; male pleopod III biramous, ... ***Taphromysis louisianae*** Banner, 1953 Occurs in rivers in the Mississippi Drainage system.	
2b.Mandible lacking a lateral spine; male pleopod III uiramous . . . . . ***Mysis diluviana*** Audzijonyte & Väinölä, 2001 Native to North American subarctic and alpine lakes, widely introduced in lakes throughout Canada and the USA. Treated as *M. relicta* until 1986. *M. relicta* is now known only from Eurasia	

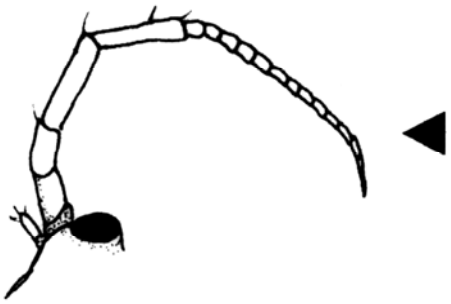
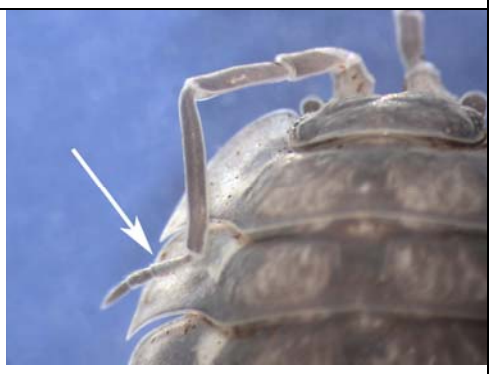
D. Key to the Freshwater Isopoda

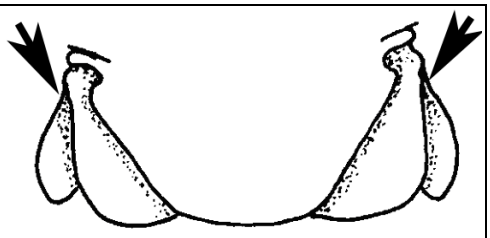
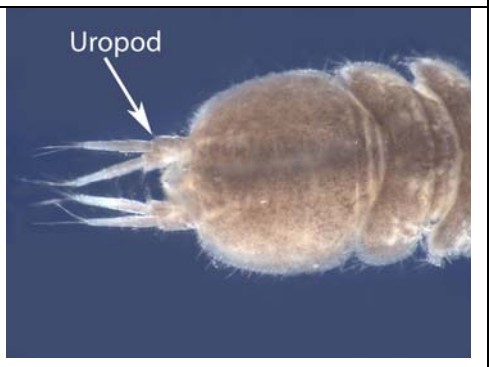
Isopods are difficult to identify due to their proclivity for losing appendages and because mature males are typically required for species level identification. Another difficulty occurs when terrestrial taxa fall into aquatic habitats. This key allows the user to separate terrestrial taxa from aquatic ones. One federally protected species does occur in this area and the appropriate federal permits must be obtained before this species may be collected. The genera *Lirceus* and *Caecidotea* are particularly difficult and only mature males can be reliably identified past genus level. Both genera contain undescribed species, and more species will certainly be discovered.

1a. Adults free living or fish parasites; body bilaterally symmetrical 2	
1b. Obligatory parasites of decapod crustaceans; females asymmetrical, males small symbionts living on the female . . . . . Suborder **Epicaridea,** Family **Bopyridae** . . . . . .Genus ***Probopyrus*** Three described species, possibly some undescribed species as well. Found in Atlantic and Gulf states.	

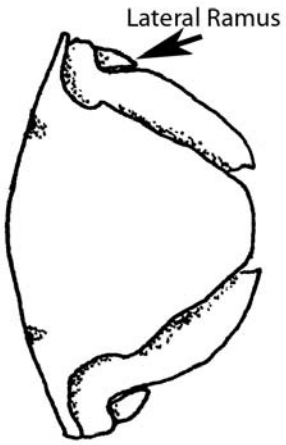
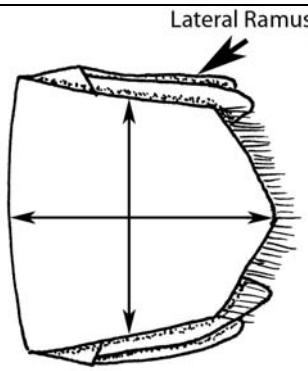
2a (1a). Uropods lateral or terminal, but visible dorsally (may be broken off) 3	
2b. Uropods ventral . . . . . .Suborder **Valvifera,** Family **Chaetiliidae**. . . . . .***Chiridotea almyra*** Bowman, 1955 Occurs in deep freshwater rivers east of Appalachian Mountains. ***NOTE:*** the species pictured here is not *Chiridotea*, but the structures are sufficiently similar to allow for identification.	

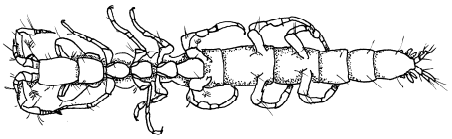
3a (2a). First antennae vestigial . . Suborder **Oniscidea** 4	
3b. First antennae normal or reduced, but not vestigial 5	

4a (3a). Second antennal flagellum with ten or more antennomeres, ... Family **Ligiidae** . . . . . ***Ligidium elrodii*** (Packard, 1873) Amphibious and typically found in vegetation along and in watercourses. ***NOTE:*** this is a complex genus with undescribed species. This genus is in need of a revision. Please use caution when identifying material past genus level.	
4b. Second antennal flagellum with five or fewer antennomeres . . . . . terrestrial taxa	

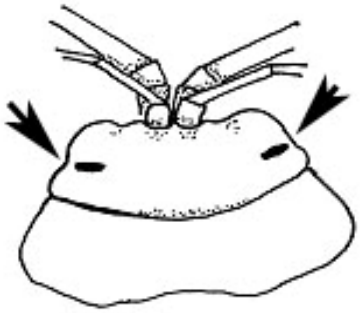
5a (3b). Uropods lateral 6	
5b. Uropods terminal . . . . . Suborder **Asellota** 8	

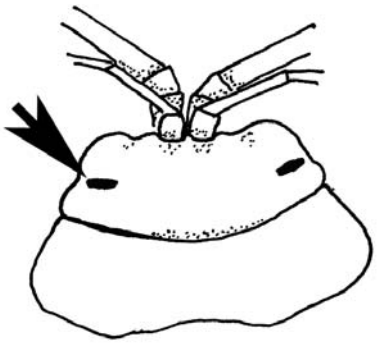
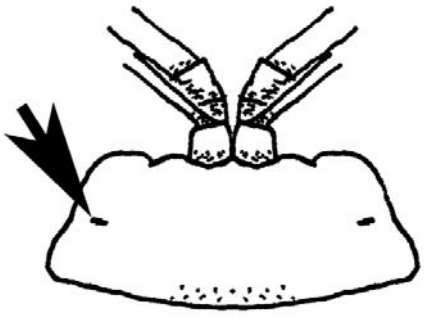
6a (5a). Body normal, typically capable of rolling into a ball . . . . . Suborder **Flabellifera** 7	
6b. Body vermiform, not capable of rolling into a ball, uropod lateral ramus curving dorsally over pleotelson . . . . Suborder **Anthuridea,** Family **Anthuridae** . . . . . ***Cyathura polita*** (Stimpson, 1855) Distributed among freshwater and brackish lowland rivers and streams east of Appalachian Mountains, south into Florida.	

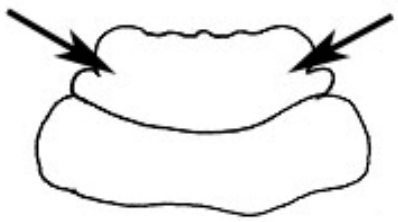
7a (6a). Pleotelson broader than long, uropod with lateral ramus reduced, lying in an emargination of the medial ramus. . . . . Family **Sphaeromatidae** . . . . . ***Cassidinidea ovalis*** (Say, 1818) A coastal freshwater species.	
7b. Pleotelson longer than broad, Pereopod I subchelate, II and III simple, pleopod II lateral ramus one segmented, pleopod III - V with medial ramus one segmented . . . . . .Family **Cirolanidae** . . . . . ***Antroloana lira*** Bowman, 1964 Found in phreatic waters of in West Virginia and Virginia. This species is Federally listed as Threatened.	

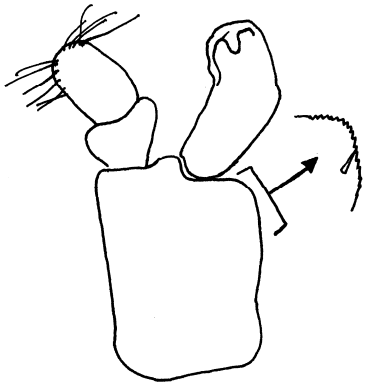
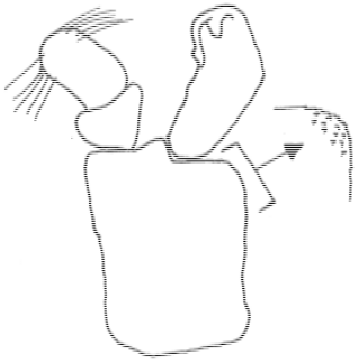
8a (5b). Body normal; dorsoventrally flattened. 9	
8b. Body vermiform; hypogean species . . . . . Family **Microcerberidae** . . . . . .***Microcerberus carolinensis*** Wägele et al., 1995	

9a (8a). Cephalothorax anterior margin between bases of antennae, with a medial tubercle or carina . . . . . Genus ***Lirceus*** . . . . . 10 ***NOTE:*** this is a complex genus with many undescribed species. Only mature, intact males can be identified with any real confidence. Males are separable from females by the presence of a modified second pleopod	
9b. Cephalothorax anterior margin without a medial tubercle or carina. . . . . Genus ***Caecidotea*** . . . . . 17 ***NOTE:*** this is a complex genus with many undescribed species. Only mature, intact males can be identified with any real confidence. Males are separable from females by the presence of a modified second pleopod.	

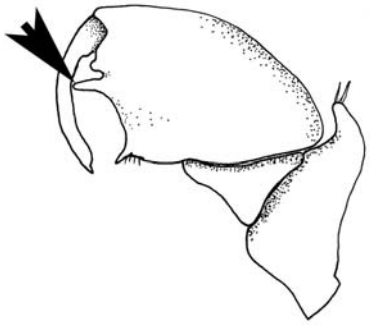
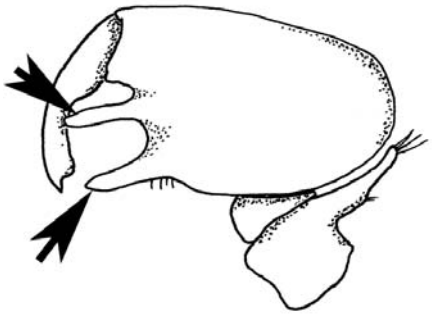
10a (9a). Head without lateral invaginations 11	
10b. Head with lateral invaginations 12	

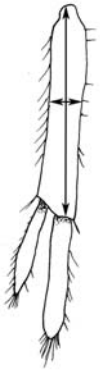
11a (10a) Animal pigmented; eyes normal; epigean . . . . ***Lirceus brachyurus*** (Harger, 1876)	
11b. Animal with no or very faint pigment; eyes reduced; troglobitic. . . . . ***Lirceus* sp. B** Holsinger & Bowman, 1973	

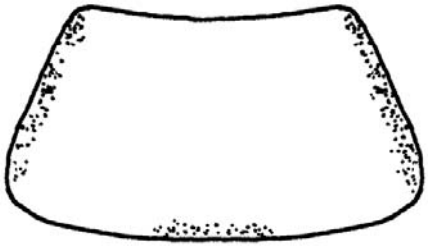
12a (10b). Eyes absent; animal without pigment 13	
12b. Eyes present (may be reduced); animal pigmented, but may be very pale 14	

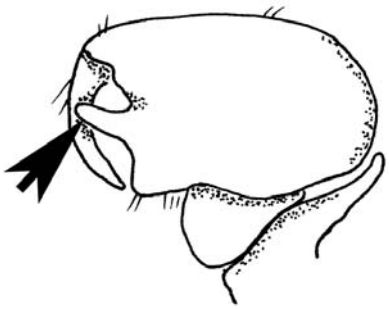
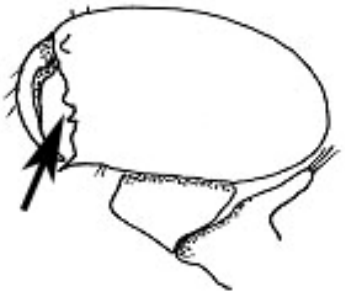
13a (12a). Pleopod 2 peduncle medial margin microserrate and bearing a subapical aciculate spine directed laterodistally . . . . . ***Lirceus usdagulun*** Holsinger & Bowman, 1973	
13b. Pleopod 2 peduncle medial margin not serrate, bearing subapical denticles, aciculate spines lacking . . . . . ***Lirceus culveri*** Estes & Holsinger, 1976	

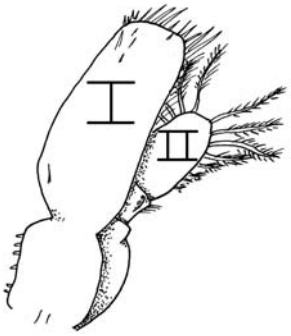
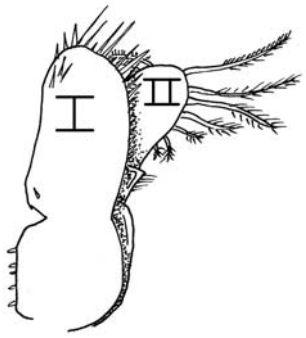
14a (12b). Lateral margins of the head normal 15	
14b. Lateral margins of the head produced laterally into small lobes, eyes reduced, body lightly pigmented . . . . ***Lirceus* sp. A** Holsinger & Bowman, 1973	

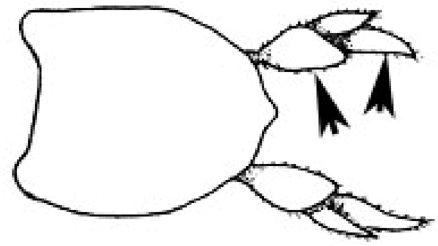
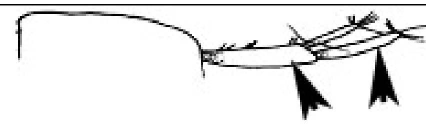
15a (14a). Gnathopod palm with one major tooth and one or two smaller teeth 16	
15b. Gnathopod palm with two major subequal teeth with one smaller tooth . . . . . ***Lirceus hargeri*** Hubricht & Mackin, 1949	

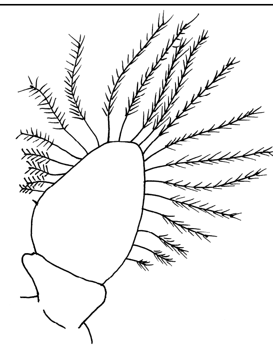
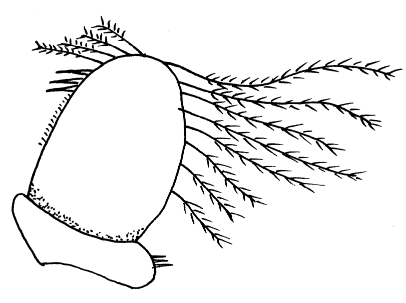
16a (15a). Uropod peduncle three times as long as wide . . . . . .***Lirceus fontinalis*** Rafinesque, 1820	
16b. Uropod peduncle five or more times as long as wide . . . . . .***Lirceus lineatus*** (Say, 1818)	

17a (9b). Eyes present; animal well pigmented; epigean species 18	
17b. Eyes absent; pigment absent or obsolete; troglobitic and hypogean . . . . . not keyed further . . . ***Caecidotea* sp.** ***NOTE:*** There are numerous troglobitic taxa, including a number of undescribed species, and many of the described species need to be redescribed using modern methods.	

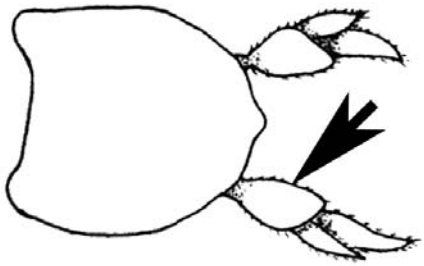
18a (17a). Gnathopod palm with a triangular projection 19	
18b. Gnathopod palm without a triangular projection . . . 25	

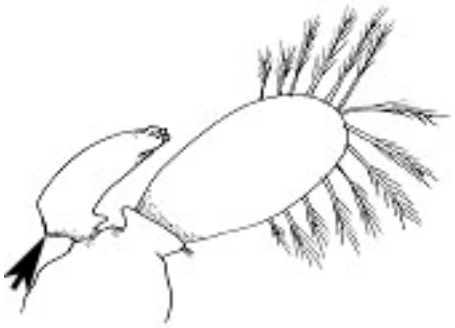
19a (18a). Pleopod I longer than pleopod II 20	
19b. Pleopod I subequal in length to pleopod II 23	

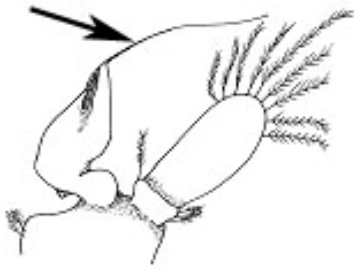
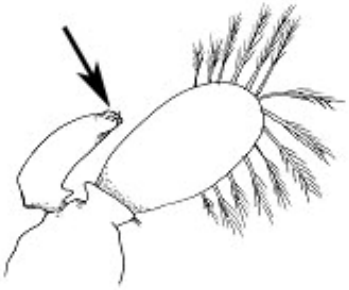
20a (19a). Uropod medial ramus shorter or subequal to peduncle 21	
20b. Uropod with medial ramus longer than peduncle . . 22	

21a (20a). Pleopod II lateral ramus with long plumose setae on distal half along lateral, apical and medial margins, longest setae are apical . . . . ***Caecidotea racovitzai racovitzai*** (Williams, 1970)	
21b. Pleopod II lateral ramus with long plumose setae along lateral margin with short plumose setae subapically on mesal margin, just distad to three simple spines, mesal margin with scattered fine, short, setulae. . . . .***Caecidotea scrupulosus*** (Williams, 1970)	

22a (20b). Pleopod II medial ramus not twisted, ventral groove clearly visible in ventral view . . . . . ***Caecidotea kenki*** (Bowman, 1967)	
22b. Pleopod II medial ramus apex subject to torsion, ventral groove not visible in ventral view . . . . ***Caecidotea nodulus*** (Williams, 1970)	

23a (18b). Uropod peduncle length approximately 1.5 times width 24	
23b. Uropod peduncle length approximately three times width . . . . . .***Caecidotea attenuatus*** (Richardson, 1900)	

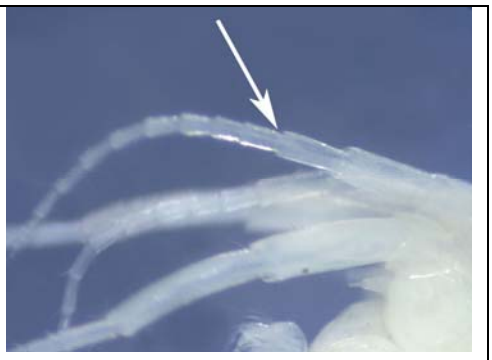
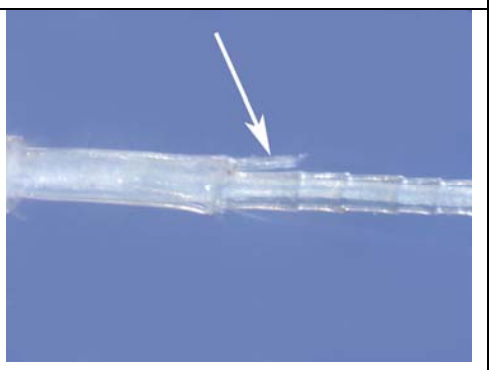
24a (23a). Pleopod II medial ramus with a proximal, mesal, rounded projection . . . ***Caecidotea communis*** (Say, 1818)	
24b. Pleopod II medial ramus without a proximal, mesal, projection . . . . . ***Caecidotea forbesi*** (Williams, 1970)	

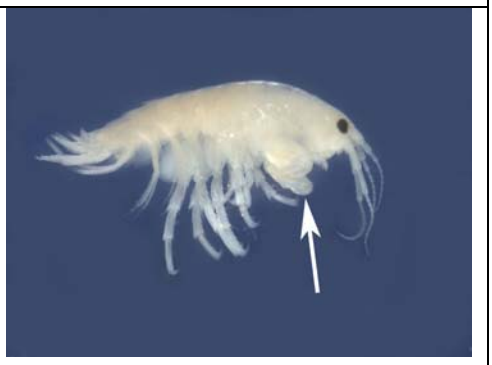
25a (18b). Pleopod II medial ramus apex elongate, terminating in a filiform process . . . . . ***Caecidotea bowmani*** Lewis, 1980	
25b. Pleopod II medial ramus apex with two short projections, neither is filiform . . . . . ***Caecidotea cumberlandensis*** Lewis, 2000	

E. Key to the Freshwater Amphipoda

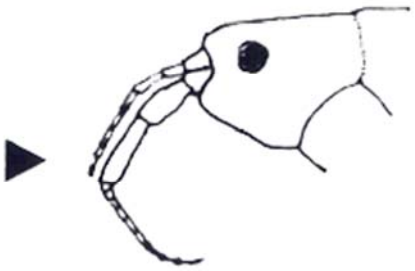
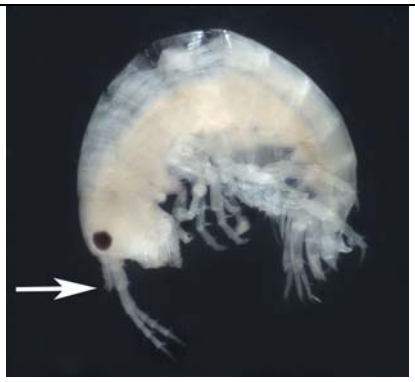
The Amphipoda is a large and complex order. Numerous undescribed species can be found across North America. Originally, it was thought that *Hyalella azteca* was a widespread species ranging throughout the Americas. Now it is known that *H. azteca* is restricted to the type locality, Aztec Well in México, and that the others represent numerous undescribed species, sometimes as many as three cöoccurring in the same habitat. The genera *Crangonyx* and *Stygobromus* also have numerous undescribed species. Three terrestrial taxa that frequent wet areas have been widely introduced through the horticultural industry.

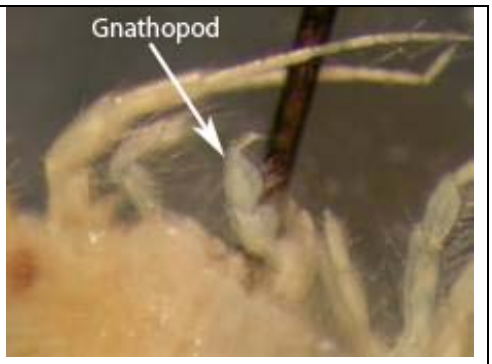
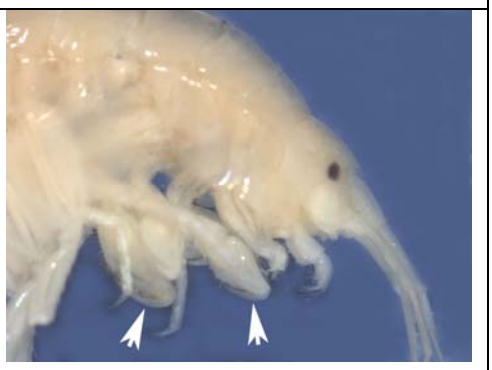
1a. Body laterally flattened; urosome segments not fused. 2	 
1b. Body subcylindrical; urosome segments fused . . . . . Family **Corophiidae** . . . ***Apocorpohium lacustre*** (Vanhöffen, 1911) Ranges from brackish to freshwater along the Atlantic coast, and is arguably introduced into upper Mississippi River system, with records as far north as Illinois and Indiana.	 

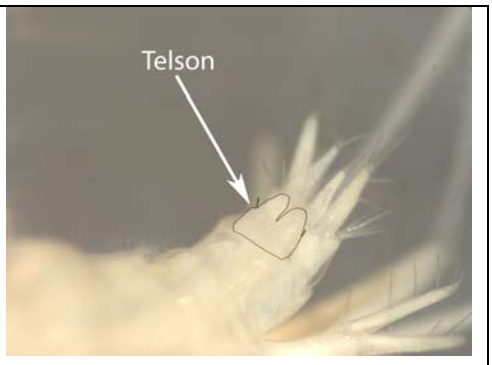
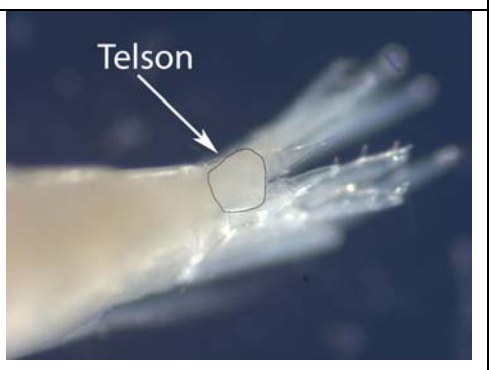
2a (1a). First antenna lacking an accessory flagellum . . . 3	
2b. First antenna bearing an accessory flagellum 6	

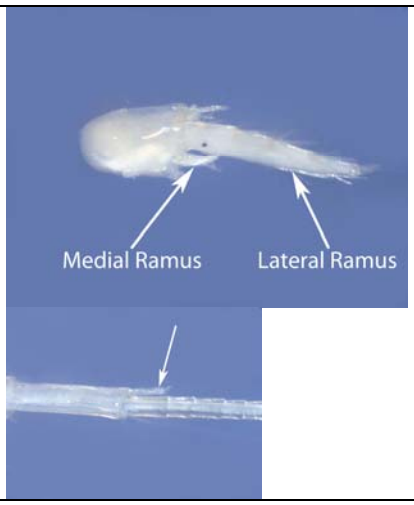
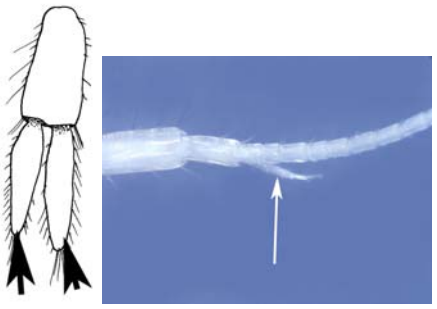
3a (2a). Pereopod I simple; pereopod II a gnathopod or subchelate . . . . . .Family **Talitridae** 4	
3b. Pereopod I and II gnathopods; many species, widespread . . . . . Family **Hyalellidae** . . . Genus ***Hyalella*** Originally thought to be one widespread species, it is now known to be a complex of many potentially undescribed species (Gonzalez & Watling, 2002 (and literature cited therein); Welborn & Cothran, 2004).	

4a (3a). Pereopod I with article six shorter than article five; pereopod IV shorter than pereopod III; pleopod I and II subequal in length . . . . . Genus ***Talitroides***. . . . . 5 Two terrestrial or semiamphibious species native to Australia, widely introduced through horticulture.	
4b. Pereopod I with article six and five subequal; pereopod III and IV subequal; pleopod II smaller than pleopod I . . . . . .***Arcitalitrus sylvaticus*** (Haswell, 1879) A terrestrial to semiamphibious Australian species introduced through horticulture.	

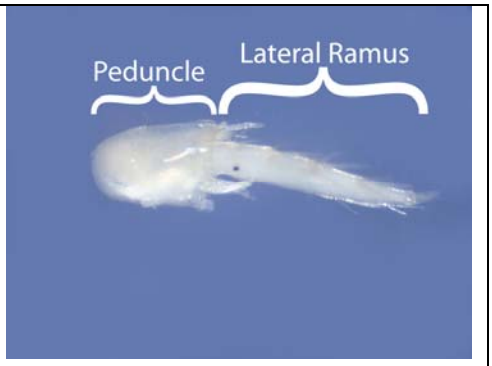
5a (4a). First antennae reaching end of second antennal peduncle; pereopod VI with gill bent 90˚ . . . . . .***Talitroides topitotum*** Burt, 1934	
5b. First antennae reaching middle of second antennal peduncle; pereopod VI with gill curved . . . . . .***Talitroides alluaudi*** Chevreux, 1898	

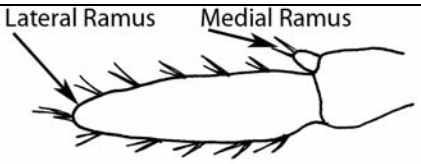
6a (2b). Gnathopods small, simple . . . . . Family **Pontoporeiidae** . . . . . 7 A planktonic and burrowing species, that occurs in large northern lakes.	
6b. Gnathopods large, normal 8	

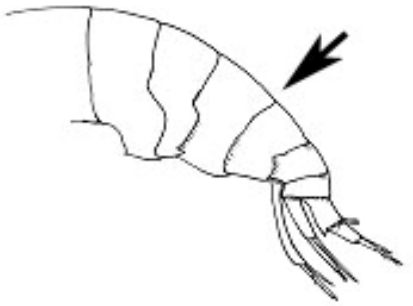
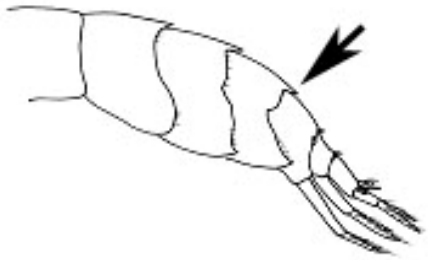
7a (6a). Telson cleft, eyes black . . . . . .***Monoporeia affinis*** (Lindstrom, 1855) Occurs in northern lakes and ponds.	
7b. Telson entire, eyes red in life . . . . . Genus ***Diporeia*** Six species found in large northern lakes, and possibly some undescribed species in the Great Lakes region.	

8a (6b). Uropod III with medial ramus shorter than lateral ramus or absent; first antenna accessory flagellum consisting of one distinct flagellomere and one reduced terminal flagellomere, or just one conical flagellomere. . . . . Family **Crangonyctidae**. 9	
8b. Uropod III with both rami subequal; first antenna accessory flagellum consisting of two to seven distinct flagellomeres . . . . . Family **Gammaridae** 11	

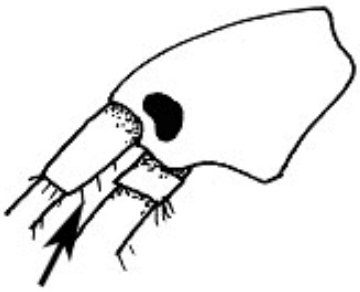
9a (8a). Pereopods VI and VII coxal plates subequal in depth to corresponding body segments 10	
9b. Pereopods VI and VII coxal plates deeper than corresponding body segments . . . . .Genus ***Stygobromus*** Around 150 hypogean and epigean described species and numerous possibly undescribed species.	

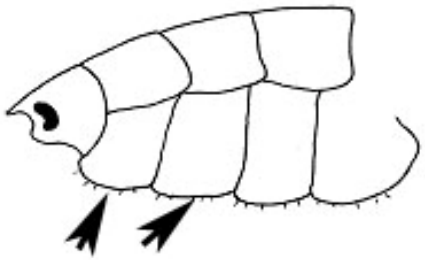
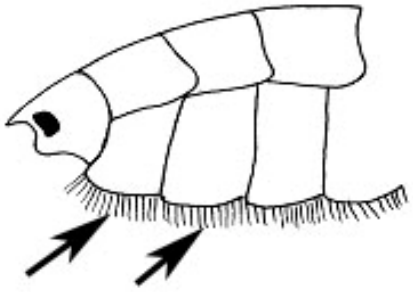
10a (9a). Uropod III lateral ramus longer than peduncle . . . . . .Genus ***Crangonyx*** Numerous epigean and troglobitic species, as well as many possibly undescribed species.	
10b. Uropod III lateral ramus shorter than peduncle. . . . . ***Synurella chamberlaini*** (Ellis, 1941)	

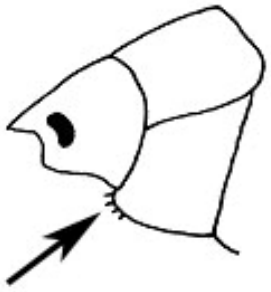
11a (8b). Uropod III with medial ramus 0.40 times the length or more lateral ramus. . . . Genus ***Gammarus***. . . 12	
11b. Uropod III with medial ramus 0.2 times the length or less lateral ramus; invasive species in the Great Lakes . . . . . ***Echinogammarus ischnus*** Stebbing, 1899	

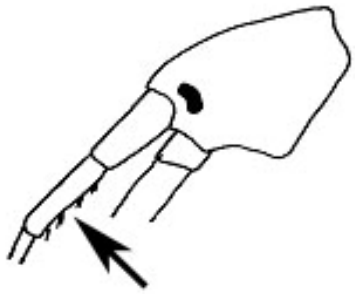
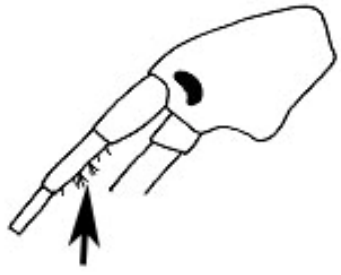
12a (11a). Pleonites dorsally smooth 13	
12b. Pleonites with mid-dorsal margin produced into a spine . . . . . .***Gammarus mucronatus*** Say, 1818 Occurs in tidally influenced fresh and brackish water in estuaries.	

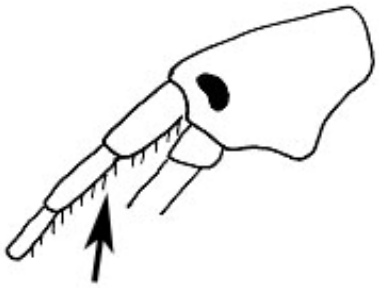
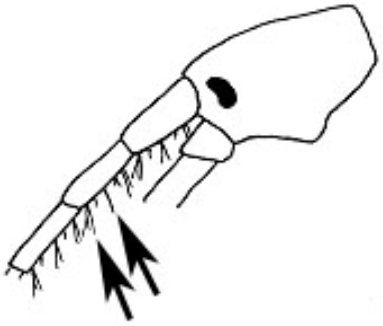
13a (12a). Pereopod 7 coxal plate with distoposterior margin forming a free lobe or corner, away from the insertion of segment III 14	
13b. Pereopod 7 coxal plate with distoposterior margin not forming a free lobe or corner, distoposterior margin tapering directly to base of segment III, and at juncture with a dense setal tuft 15	

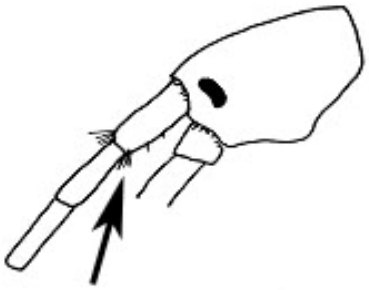
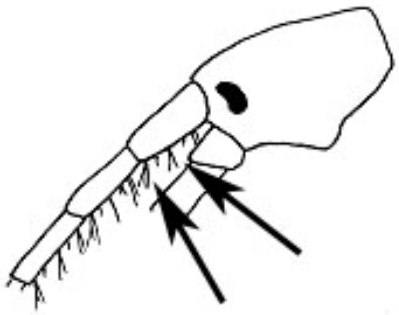
14a (13a). Antenna I, first peduncle antennomere ventral surface with setal tufts. . . . . .***Gammarus duebeni*** Liljeborg, 1851 Found in brackish water, tidal spray pools and ocean beach streams.	
14b. Antenna I, first peduncle antennomere ventral surface without setal tufts . . . . . ***Gammarus minus*** Say, 1818 Occurs in freshwater.	

15a (13a). Coxal plates II – IV with distal margin not fringed with long setae, although some long setae may be present on anterior and posterior margins 16	
15b. Coxal plates II – IV with distal margin fringed with long setae . . . . . ***Gammarus lawrencianus*** Bousfield, 1956 Found in tidally influenced freshwater and brackish estuaries.	

16a (15a). Coxa I anteriodistal margin with five or more long setae 17	
16b. Coxa I anteriodistal margin with five or less short spines 19	

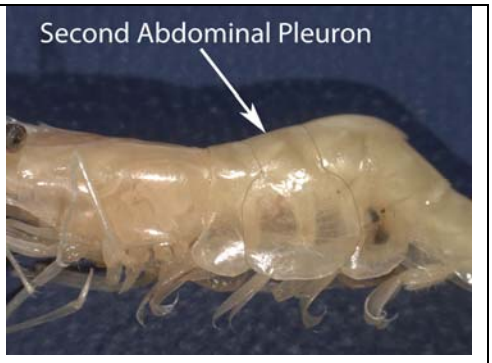
17a (16a). Antenna I peduncular antennomere 2 with 3 – 5 ventral, setal clusters; antenna II flagellum with curly setae; pleonites laterally with submarginal spines 18	
17b. Antenna I peduncular antennomere 2 with a ventral, central setal cluster; curly setae lacking; pleonite lateral margins with setae . . . . . ***Gammarus fasciatus*** Say, 1818 Occurs in freshwater.	

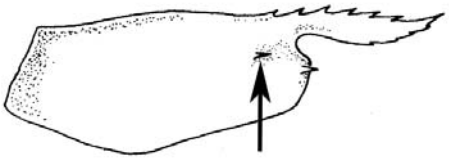
18a (17a). Antenna I peduncle with ventral setae all shorter than the width of the peduncle . . . . . ***Gammarus tigrinus*** Sexton, 1939 Tidally influenced freshwater and brackish estuaries	
18b. Antenna I peduncle with ventral alternate setae longer than twice the width of the peduncle. . . . . .***Gammarus daiberi*** Bousfield, 1969 Tidally influenced freshwater and brackish estuaries	

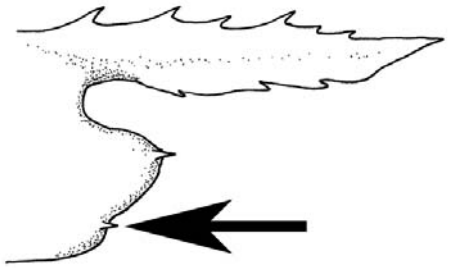
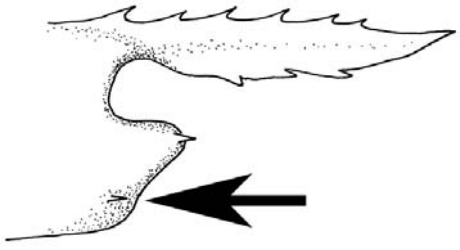
19a (16b). Antenna I, peduncular antennomere I, with one or two ventral single setae and one ventroapical setal cluster. . . . . ***Gammarus palustris*** Bousfield, 1969 Tidally influenced freshwater and brackish estuaries	
19b. Antenna I, peduncular antennomere I, with several ventral setae along distal 50% . . . . . ***Gammarus setosus*** Dementieva, 1931 Tidally influenced freshwater and brackish estuaries	

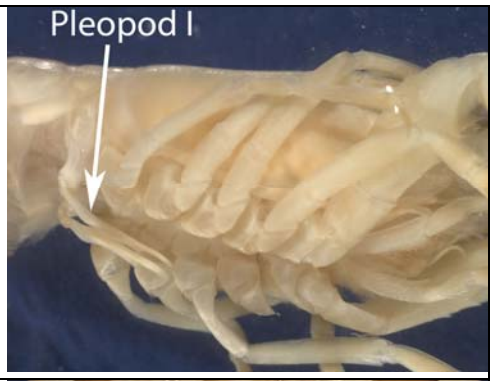
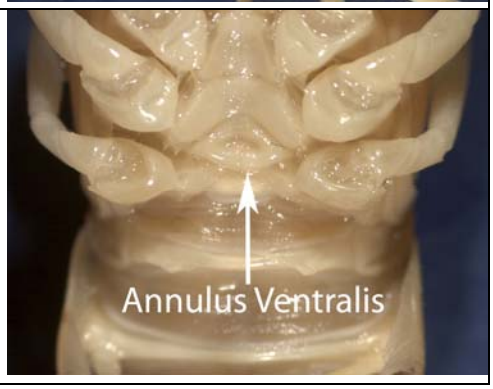
F. Key to the Freshwater Decapoda

The USA has the greatest crayfish (crawfish, crawdads, yabbies, mudbugs, et cetera) diversity in the world. The form of the male first pleopod is the only reliable method to separate crayfish species and often genera as well. However, most users will be using this key in support of bioassessment, and thus most material will be juvenile specimens, and probably must be left at genus or family level. Some local keys may be of further use, however a species level key to all life crayfish stages in the Mid-Atlantic region (particularly the genus *Cambarus*) is not feasible at this time due to variation within certain taxa and putative undescribed species.

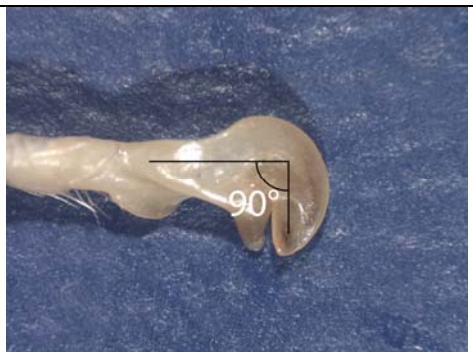
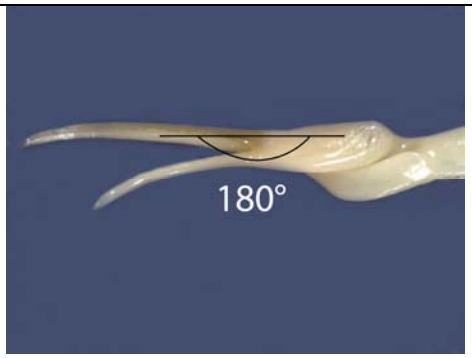
1a. Second abdominal pleuron with anteriolateral margin overlapping first abdominal pleuron; rostrum flattened laterally(shrimp) . . . . . Family **Palaemonidae** 2	
1b. Second abdominal pleuron not overlapping first abdominal pleuron; rostrum flattened dorsoventrally (crayfish, crawdads, mudbugs) . . .Family **Cambaridae** . . 4	

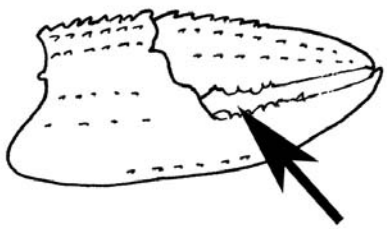
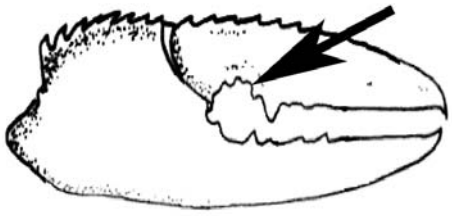
2a (1a). Hepatic spine absent 3	
2b. Hepatic spine present . . . . . ***Macrobrachium ohione*** (Smith, 1874)	

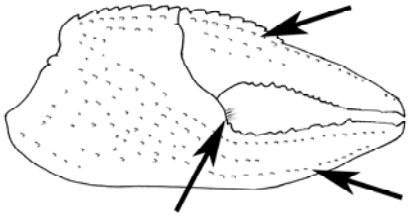
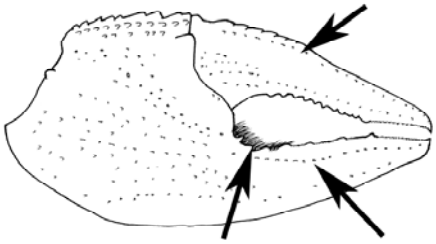
3a (2a). Branchostegial spine at carapace margin . . . . . ***Palaemonetes paludosus*** Gibbes, 1850 Occurs in freshwater in the Atlantic drainages.	
3b. Branchostegial spine set back from carapace margin . . . . . ***Palaemonetes kadiakensis*** Rathbun, 1902 Found throughout the Mississippi drainage system.	

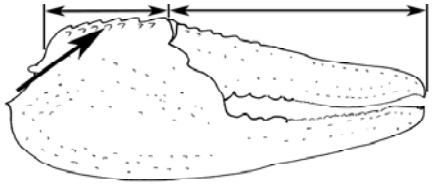
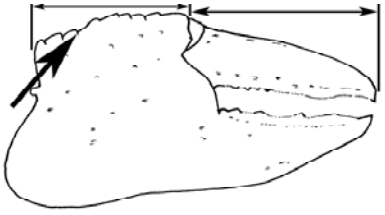
4a (1b). Pleopod I modified for sperm transfer; one or more pairs of pereopods II through IV with proximal hooks; annulus ventralis absent (males). . . . . 5 ***NOTE:*** Identifying crayfish past genus and sometimes family level is very difficult and typically requires large, mature, sexually reproductive (form I) males. Some form II males can be identified with this key (unless otherwise stated). Form II males have pleopod I soft, flexible, and more blunt. The form I pleopod I is rigid and cornified (hardened).	
4b. Pleopod I not modified or absent; hooks absent from one or more pairs of pereopods II through IV; annulus ventralis present (females) . . . . . not keyed further . . . . . Family **Cambaridae**	

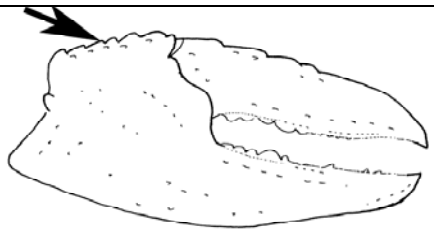
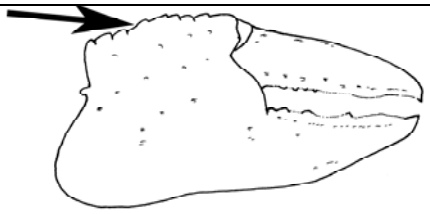
5a (4a). Pleopod I terminating in two processes 6	
5b. Pleopod I terminating in more than two processes . . . . . .Genus ***Procambarus***. 30	

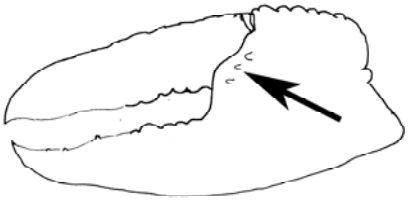
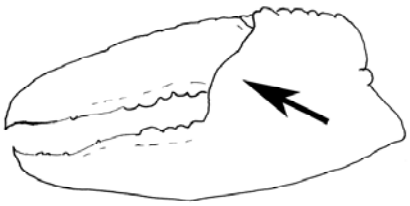
6a (5a). Pleopod I with apex bent at least 90 degrees mesad, both apical processes directed medially 7	
6b. Pleopod I with apex directed distally, although apical processes may arc medially . . . . .Genus ***Orconectes*** . . 20 ***NOTE:*** Only form I male *Orconectes* may be keyed here. Form I males have pleopod I hard and rigid. Form II males have pleopod I soft and flexible. Form II *Orconectes* pleopod I also tend to be apically thicker and more rounded.	

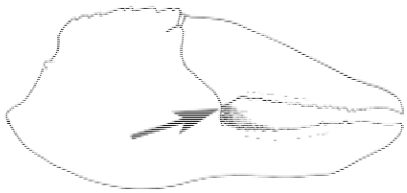
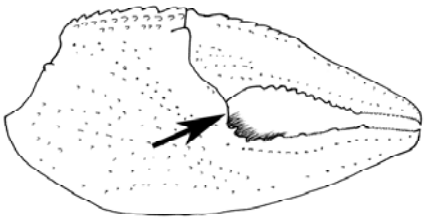
7a (6a). Chela dactyl without an abrupt proximal excision . . . . . Genus ***Cambarus*** 8	
7b. Chela dactyl with opposable margin bearing a proximal excision, separated from the distal half of the margin by a large tubercle . . . . . ***Fallicambarus uhleri*** (Faxon, 1884)	

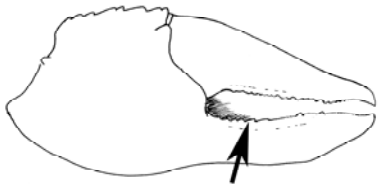
8a. (7a). Chela fingers dorsal surfaces with prominent longitudinal ridges of tubercles; base of dactyl without a dense setal patch or setal patch small, reduced, not extending onto fixed finger 9	
8b. Chela fingers dorsal surfaces without or with weak prominent longitudinal ridges of tubercles; base of dactyl with a dense setal patch extending onto fixed finger or setal patch sparse to absent . . . . . .Subgenus ***Hiaticambarus*** 12	

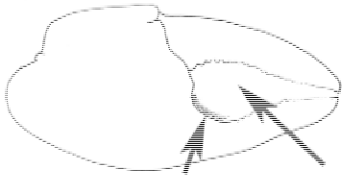
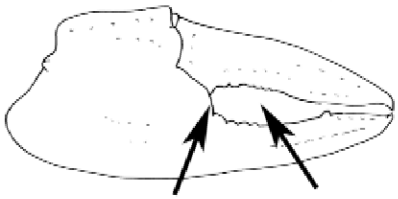
9a. (8a). Chela palm mesal margin with tubercles in two or more rows, **OR** dactyl length twice palm mesal margin length. 10	
9b. Chela palm mesal margin with tubercles in one row, or in one row with a poorly developed secondary row; dactyl length always less than twice palm mesal margin length. . . . . Subgenera ***Jugicambarus*** and ***Cambarus sensu stricto*** 15	

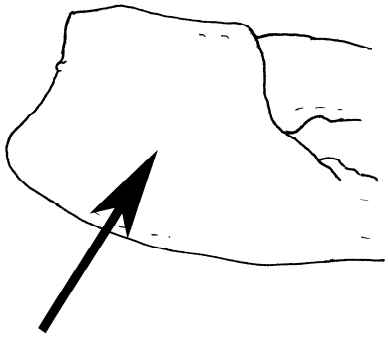
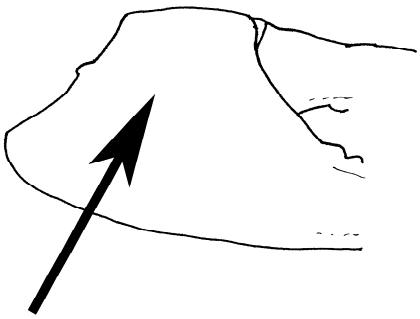
10a. (9a). Chela palm mesal margin with a row of less than eight tubercles 11	
10b. Chela palm mesal margin with a row of eight or more tubercles. . . . . .Subgenus ***Puncticambarus*** 17	

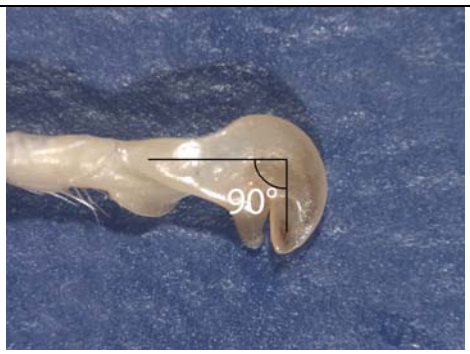
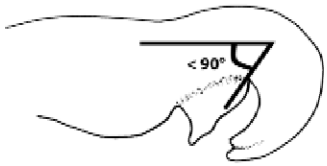
11a. (10a). Chela palm ventral surface with 1 – 3 tubercles; chela palm mesal and dorsomesal surfaces with two distinct tubercle rows, with a third row extending to the dactyl basal knob, and with accessory tubercles between second and third rows; dactyl 1.9 or more times the palm length . . . . . Subgenus ***Lacunicambarus*** . . . . . .***Cambarus* (*Lacunicambarus*) *diogenes*** complex This taxon is currently under investigation and probably consists of several species.	
11b. Chela palm ventral surface without tubercles; chela mesal and dorsomesal one fourth to one third surface with small tubercles; dactyl 1.8 or less times the palm length . . . . . .Subgenus ***Tubericambarus*** . . . . ***Cambarus* (*Tubericambarus*) *thomai*** Jezerinac, 1993	

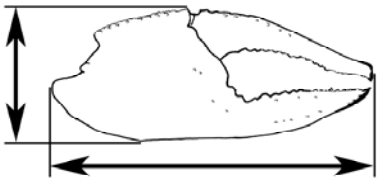
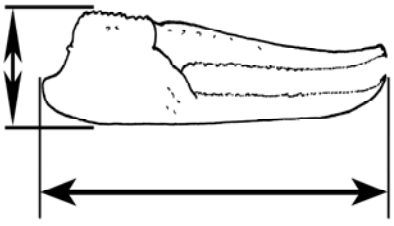
12a. (8b). Chela fixed finger with a proximedial setal patch, setae reaching base of dactyl when chela is closed 13	
12b. Chela fixed finger without a proximedial setal patch or if present, very small, setae not reaching base of dactyl when chela is closed 14	

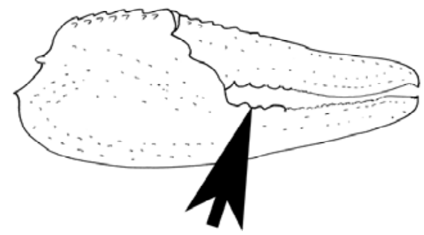
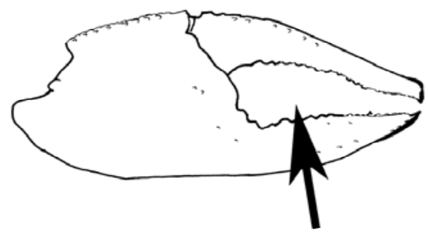
13a. (12a). Chela setal patch extending at least half the length of fixed finger and extending dorsally onto the fixed finger . . . . . ***Cambarus* (*Hiaticambarus*) *longulus*** Girard, 1852	
13b. Chela setal patch extending less than one third the length of fixed finger, not extending dorsally onto the fixed finger . . . . . ***Cambarus* (*Hiaticambarus*) *longirostris*** Faxon, 1885	

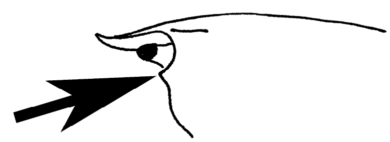
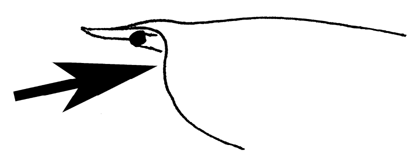
14a. (12b).Chelae gaping, dactyl slightly arcuate; proximal setal patch typically present, reduced . . . . . .***Cambarus* (*Hiaticambarus*) *chasmodactylus*** James, 1966	
14b. Chelae gaping slightly, dactyl not arcuate; proximal setal patch absent, or limited to a few setae (more prominent in juveniles) . . . . . ***Cambarus* (*Hiaticambarus*) *elkensis*** Jezerinac & Stocker, 1993	

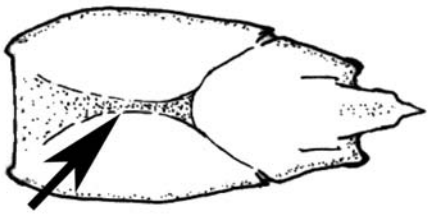
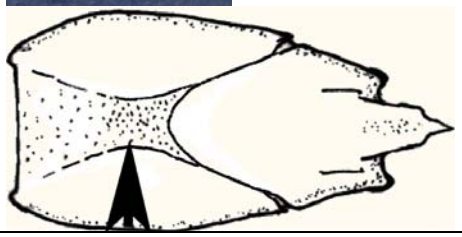
15a. (9b) Chela palm in dorsal view suboval in outline 16	
15b. Chela palm in dorsal view subtriangular in outline . . . . . Subgenus ***Jugicambarus*** . . . . . .***Cambarus* (*Jugicambarus*) *dubius*** complex This species complex includes: *C.dubius*, *C. monongalensis* and others. Characters that separate these species are not consistent across their ranges, and undescribed species may be present.	

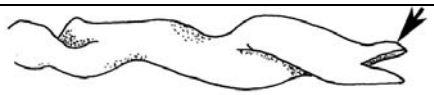
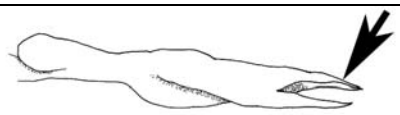
16a. (15a). Form I male pleopod I mesal process curved no more than 90 degrees (form II may be curved more than 90 degrees). . . . . .***Cambarus* (*Cambarus*) *bartonii*** complex This species complex includes: *C.carinirostris*, *C. bartonii*, *C. angularis*, and *C. cavatus*. Characters that separate these species are not consistent across their ranges, and undescribed species may be present	
16b. Pleopod I mesal process curved more than 90 degrees . . . . . ***Cambarus* (*Jugicambarus*) *jezerinaci*** Thoma, 2000	

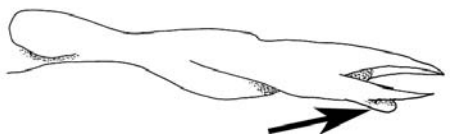
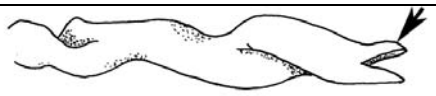
17a. (10b). Chela palm width not less than one fourth the entire chela length; eyes normal; living in surface waters 18	
17b. Chelae gracile, chela palm width one fifth or less entire chela length; eyes reduced; West Virginia, Greenbrier County, Matt's Black Cave. . . . . .***Cambarus* (*Puncticambarus*) *nerterius*** Hobbs, 1964	

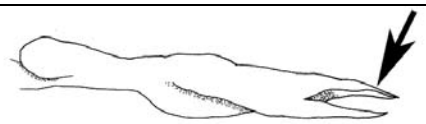
18a. (17a). Chelae not gaping 19	
18b. Chelae gaping . . . . ***Cambarus* (*Puncticambarus*) *veteranus*** Faxon, 1914	

19a. (18a). Carapace with suborbital angle present . . . . ***Cambarus* (*Puncticambarus*) *robustus*** complex This taxon is currently under investigation and probably consists of several species.	
19b. Carapace without a suborbital angle . . . .***Cambarus* (*Puncticambarus*) *acuminatus*** complex This taxon is currently under investigation and probably consists of several species.	

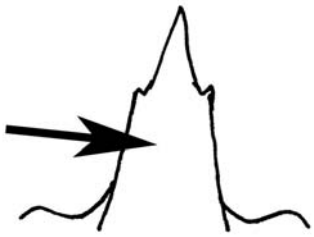
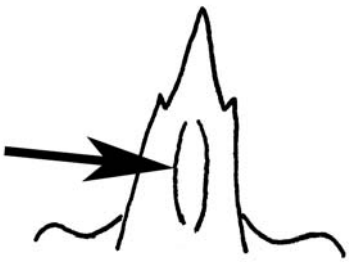
20a. (6b). Areola 4 to 18 times longer than wide 21	
20b. Areola 3.5 times longer than wide; first pleopod with distal projections more than 25% the length of the pleopod **and** apices divergent . . . . .Subgenus ***Gremicambarus*** . . . . . .***Orconectes* (*Gremicambarus*) *virilis*** (Hagen,1870) Nonnative invasive species. Native to portions of Canada and the Midwestern USA, east to Maine and New York, south to Arkansas. Introduced to Maryland and West Virginia.	 

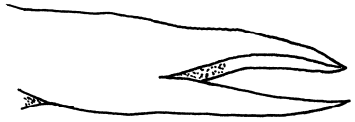
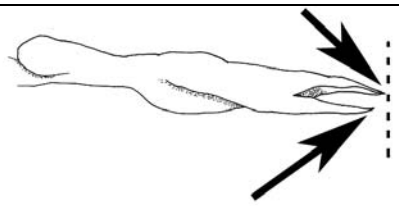
21a (20a). Pleopod I terminal processes less than 20% the length of the pleopod 22	
21b. Pleopod I terminal processes more than 25% the length of the pleopod; hepatic region (carapace on each side of head) with rounded tubercles or smooth 23	

22a (21a). Pleopod I mesal process caudal (posterior) surface with an accessory lobe; hepatic region (carapace on each side of head) with rounded tubercles or smooth . . . . . .Subgenus ***Crockerinus*** . . . . . ***Orconectes* (*Crockerinus*) *sanbornii*** Faxon, 1884	
22b. Pleopod I mesal process caudal (posterior) surface without an accessory lobe; hepatic region with at least three apically acute spines . . . . Subgenus ***Faxonius*** . . . . . ***Orconectes* (*Faxonius*) *limosus*** (Rafinesque, 1817)	

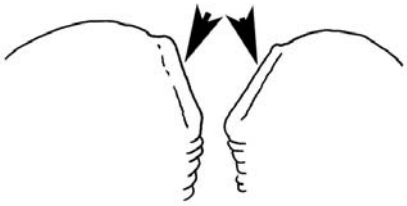
23a (21b). Pleopod I terminal processes 30 to 35% the length of the pleopod . . . . Subgenus ***Crockerinus*** 24	
23b. Pleopod I terminal processes more than 35% the length of the pleopod . . Subgenus ***Procericambarus*** 28	

24a (23a). Pleopod I cephalic (anterior) surface without an angular “shoulder” just proximal to the terminal process 25	
24b. Pleopod I cephalic (anterior) surface bearing an angular “shoulder” just proximal to the terminal process . . . . . ***Orconectes* (*Crockerinus*) *obscurus*** (Hagen,1870)	

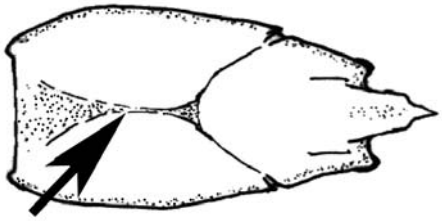
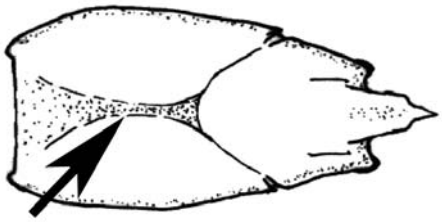
25a (24a). Rostrum lacking a medial carina 26	
25b. Rostrum with a medial carina . . . . . .***Orconectes* (*Crockerinus*) *propinquus*** (Girard,1852)	

26a (25b). Pleopod I distal processes equal in length . . 27	
26b. Pleopod I distal processes unequal in length . . . . . .Orconectes (Crockerinus) virginiensis Hobbs, 1951	

27a (26a). Pleopod I central projection at least one fifth the length of the pleopod. . . . . .Orconectes (Crockerinus) erichsonianus (Faxon, 1989)	
27b. Pleopod I central projection less than one fifth the length of the pleopod . . . . . Orconectes (Crockerinus) sanbornii sanbornii (Faxon, 1884)	

28a. (22a). Mandible with incisor region bearing a serrated or dentate edge 29	
28b. Mandible with incisor region bearing a straight edge . . . . ***Orconectes* (*Procericambarus*) *rusticus*** (Girard, 1852)	

29a (28a). Pleopod I with a shoulder on the cephalic (anterior) surface . . . . . ***Orconectes* (*Procericambarus*) *cristivarius*** Taylor, 2000	
29b. Pleopod I without a shoulder on the cephalic (anterior) surface . . ***Orconectes* (*Procericambarus*) *forceps*** (Faxon, 1884)	

30a (5b.) Carapace with areola obliterated . . . .***Procambarus* (*Ortmannicus*) *acutus*** species complex Includes *P. acutus acutus* (Girard, 1852) which is native to parts of Maryland, but invasive in other parts of the Mid-Atlantic, and *P. zonangulus* Hobbs & Hobbs, 1990 which is invasive in Maryland.	
30b. Carapace with areola narrow, but not obliterated. . . . . . ***Procambarus* (*Scapulicambarus*) *clarki*** (Girard, 1852) Native to northern México, and the southeastern and midwestern United States. Introduced in many areas of North America, Hawaii, Eurasia and Africa. Introduced to Maryland.	

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Glossary

Aciculate Needle like. From the Latin *aciculus* (needle).

Antenna Articulated mobile sensory appendages anterior to, or below the eyes at the front of the head. Crustaceans have two pairs: the first and second antennae.

Antennomere The individual articles of the antenna.

Bivalved Composed of two complementary and equal halves, i.e.; the shell of a clam.

Carapace A sheet of cuticle extending back from the head to enclose the dorsal and lateral parts of the thorax.

Cephalothorax A structure formed by the fusion of the head with the anterior thoracic somites.

Chela A thoracopod (typically the first, or the first and second) where the dactyl is capable of clasping against the enlarged anteriorly projected penultimate article. A claw.

Dactyl The terminal article of a thoracopod. In decapods, the dactyl is the movable finger of the chela.

Denticle A small, tooth shaped spine.

Epigean Above ground.

Filiform Drawn out into a filament like extension.

Flagellomere The articles of the flagellum.

Flagellum The antennomeres after the first three, each typically smaller than the peduncular antennomeres.

Gnathopod A thoracopod (typically the first, or the first and second) where the dactyl is capable of folding backwards against an enlarged penultimate article for the purpose of clasping.

Hypogean Subterranean.

Naupliar eye A simple, median eye, typically consisting of 3 photoreceptor units (up to 7 in taxa where it persists in the adult) and first appearing in the nauplius larval stage. It is secondarily reduced or lost in many taxa.

Peduncle The first three antennomeres of an antenna, typically larger than the remaining antennomeres, OR the basal article of a pleopod or uropod.

Pereopod A thoracopod that is used in locomotion, not modified as a mouthpart.

Phreatic Ground water below the static water table.

Pleonite A somite of the abdomen or pleon.

Pleopod An appendage attached to an abdominal segment.

Pleotelson A structure formed by the fusion of one or more abdominal somites with telson.

Pleuron A lateral overhanging plate on an abdominal somite.

Plumose Resembling a feather.

Ramus A branch of an appendage.

Rostrum An anterior projection of the carapace that projects anteriorly between the eyes

Serrate A linear row of flattened spines like the blade of a saw. From the Latin *serra* (saw).

Seta (setae) An extension of the cuticle that resembles a hair.

Setule A very short seta or bristle.

Somite A segment of the body.

Telson Terminal appendix attached to the sixth (terminal) abdominal segment and not considered as a true segment.

Thoracopod A limb depending from any thoracic somite.

Troglobitic Lives in caves.
Tubercle A rounded, raised portion of the cuticle.
Uropod An appendage of the last abdominal segment.
Urosome The last three somites of an amphipod, each bearing a uropod.
Vermiform Shaped similarly to a worm, from the Latin, *vermis* (worm).