Taxonomic Atlas of the Water Fleas, "Cladocera" (Class Crustacea)

Recorded at the Old Woman Creek National Estuarine Research Reserve and State Nature Preserve, Ohio

by

Jakob A. Boehler, Tamara S. Keller and Kenneth A. Krieger

National Center for Water Quality Research
Heidelberg University
Tiffin, Ohio, USA 44883

January 2012

Taxonomic Atlas of the Water Fleas, "Cladocera" (Class Crustacea) Recorded at the Old Woman Creek National Estuarine Research Reserve and State Nature Preserve, Ohio

by

Jakob A. Boehler, Tamara S. Keller* and Kenneth A. Krieger

Acknowledgements

The authors are grateful for the assistance of Dr. David Klarer, Old Woman Creek National Estuarine Research Reserve, for providing funding for this project, directing us to updated taxonomic resources and critically reviewing drafts of this atlas. We also thank Dr. Brenda Hann, Department of Biological Sciences at the University of Manitoba, for her thorough review of the final draft. This work was funded under contract to Heidelberg University by the Ohio Department of Natural Resources.

This publication was supported in part by Grant Number H50/CCH524266 from the Centers for Disease Control and Prevention. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of Centers for Disease Control and Prevention.

The Old Woman Creek National Estuarine Research Reserve in Ohio is part of the National Estuarine Research Reserve System (NERRS), established by Section 315 of the Coastal Zone Management Act, as amended. Additional information about the system can be obtained from the Estuarine Reserves Division, Office of Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 1305 East West Highway – N/ORM5, Silver Spring, MD 20910. Financial support for this publication was provided by a grant under the Federal Coastal Zone Management Act, administered by the Office of Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration, Silver Spring, MD.

Copies of this publication are available from the
Ohio Department of Natural Resources - Division of Wildlife
2514 Cleveland Road East
Huron, Ohio 44839

This publication can be downloaded at
http://www.heidelberg.edu/academiclife/distinctive/ncwqr/research/reports

* We greatly appreciate the efforts of Tammy Keller on early drafts of this publication and regret her death in December 2010.

Introduction

Both the professional field biologist and the amateur naturalist often encounter lists of animals and plants when they read published scientific reports and visit nature centers. Rarely do they have ready access to photographs for each member of the list. This document constitutes one of several chapters of a comprehensive atlas of the biota of the Old Woman Creek coastal wetland system (OWC) along the shore of Lake Erie in Ohio. This chapter provides a detailed pictorial record of a group of aquatic invertebrate animals called water fleas, also known as cladocerans.

Invertebrates of many kinds occur in great abundance in freshwater ecosystems, including Great Lakes wetlands such as the marshes and swamps that make up OWC. A few freshwater invertebrates, such as clams and aquatic beetles, are readily visible because of their relatively large size. Many others, however, including most cladocerans, are so small that special attention must be given to collecting – and seeing – them. Therefore, most invertebrates go unnoticed by casual visitors to aquatic habitats. For many groups such as the cladocerans, once collected, the ability to distinguish one kind from another requires careful observation through a compound microscope at magnifications as great as 1000X.

The term “Cladocera”, though once considered to be an order within the Class Crustacea of Phylum Arthropoda, has lost its taxonomic status. Rather, the name has been retained to refer to four orders of crustaceans that are probably not closely related phylogenetically.

***Daphnia retrocurva* with eggs**

This atlas presents detailed photographs of critical diagnostic features that permit the correct identification to species of most cladocerans reported to date at OWC.

Cladocerans are present in a wide variety of freshwater habitats, especially lakes, ponds and wetlands. They occupy an important intermediate niche in the food webs of freshwater ecosystems. Most are filter-feeders, straining bacteria, tiny algae and other particles from the water, whereas a few are predaceous on aquatic invertebrates, including other cladocerans. Cladocerans themselves are a very important food source for many fish species.

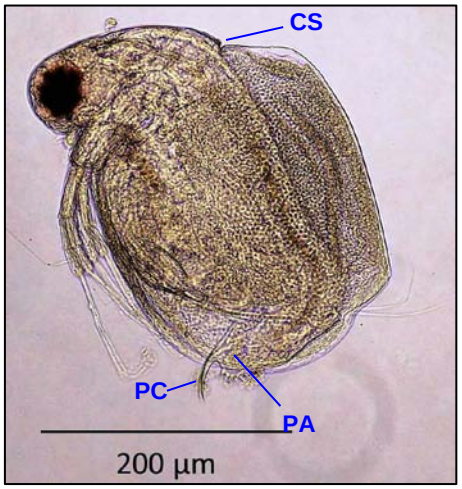
Characteristics of Water Fleas

Water fleas usually reproduce asexually through a process called parthenogenesis, in which females produce succeeding generations of females and do not mate. Males and sexual reproduction are limited to one or a few generations each year under specific environmental conditions. Detailed information on the complex life cycle of cladocerans can be read in Dodson and Frey (2001) and Pennak

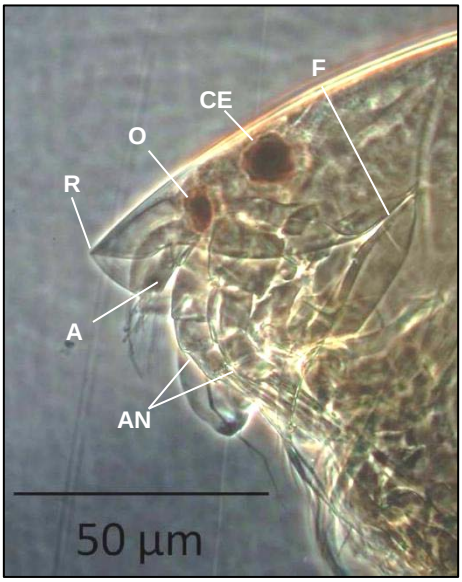
(1989). Only females are shown in this atlas unless stated otherwise. Immature cladocerans, other than being smaller, possess the same diagnostic characteristics as adults.

General features of a water flea are shown on this page. The body is divided into two obvious regions: the **head** (H) and a **carapace** ("shell"; sometimes referred to as valves) (C) that covers the remainder of the body. Head structures include the **first antennae** (or **antennules**) (A), **second antennae** (AN), **rostrum** (some cladocerans) (R), **fornix** (F) and **compound eye** (CE). Some species also have an **ocellus** (O), or simple eye. Some species, such as *Daphnia retrocurva*, have an anterior extension of the head called a **helmet** (HE). The second antennae are much larger than the antennules and are used for swimming. They have two branches known as the **dorsal ramus** (DR) and the **ventral ramus** (VR). Swimming hairs, or **setae** (S), are attached to the second antennae.

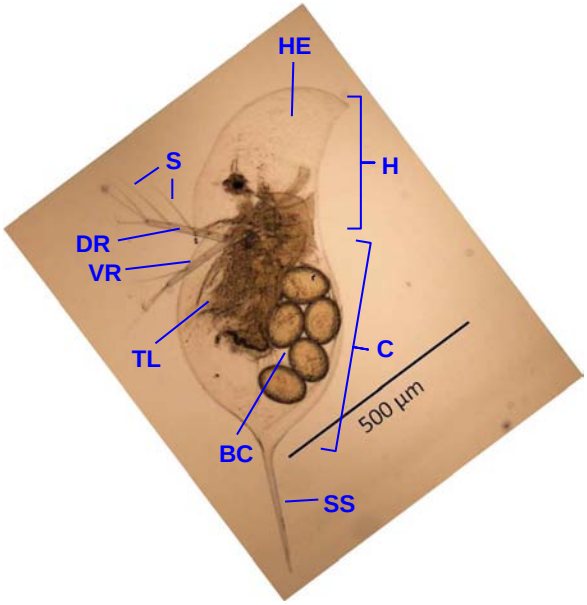
The body features **thoracic legs** (TL), a **brood chamber** (in females) (BC) and a **postabdomen** (PA). A pair of **postabdominal claws** (PC) protrudes from the end



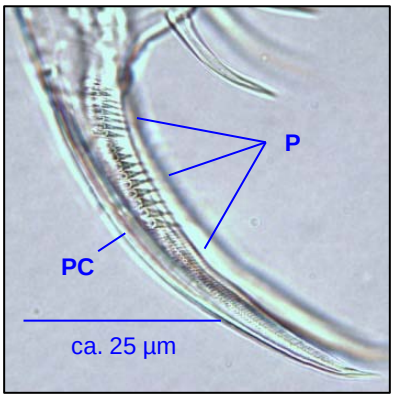
Lateral view of *Ceriodaphnia sp.*



Lateral view of *Alona sp.* (anterior end)



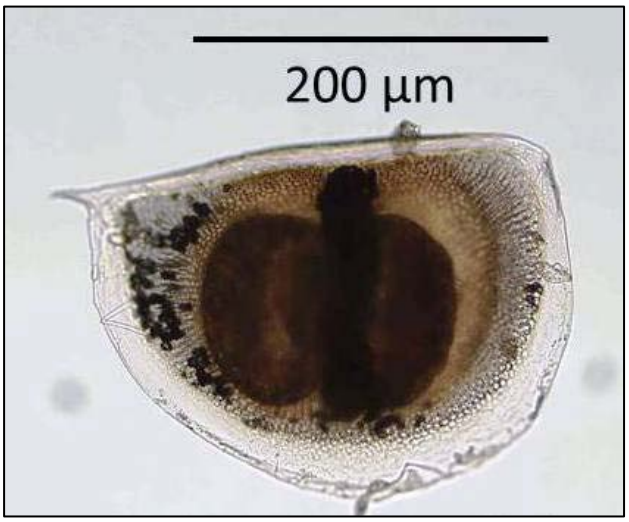
Lateral view of *Daphnia retrocurva* with eggs in brood chamber



Lateral view of *Daphnia retrocurva* postabdominal claw

of the postabdomen. Each claw may have one or more rows of minute teeth; each row is called a **pecten** (P). Some species have a **shell spine** (SS) extending from the carapace; some others have a **cervical sinus** (CS) at the dorsal juncture of the head and carapace.

Resting eggs of cladocerans are occasionally encountered in samples. One or more resting eggs are enclosed within a purse-like, thickened part of the female carapace called an **ephippium**.



Cladoceran ephippium

Layout of this Atlas

The following pages are organized alphabetically by order, family, genus and species. Investigators have identified 36 species of water fleas in eight families (Bosminidae, Cercopagidae, Chydoridae, Daphnidae, Leptodoridae, Macrothricidae, Moinidae, and Sididae) within the OWC wetland system and in the adjacent wave zone of Lake Erie. We have included one species of the exotic family Cercopagidae because they are now common in Lake Erie offshore of OWC and some day may perhaps be found in the OWC system as well.

This publication should not be used as the sole source to identify the cladocerans of OWC because it is probable that additional families, genera and species will be found in new collections. The references cited on the next page should be used to obtain definitive identifications.

Each species of water flea is illustrated and described on a single page of this atlas. Because the identifying features of the particular order, family and genus are repeated on each page, the page for each species can be used independently. Variations in the appearance of order, family and genus characteristics can be seen by comparing pages. Photographs are labeled with identifying letters and lines or brackets that indicate diagnostic structures. Some photographs show specimens collected within OWC; specimens from other ecosystems were used if they were of superior quality. The exact specimens photographed are recorded at the bottom of the page.

Beneath the descriptive features, each page lists where within OWC the species has been found. That information was derived from reports cited by Herdendorf *et al.* (2001)*. It is likely that future collections will reveal some of the species in additional habitats. The general ecology of the species is briefly summarized, including its **habit** (such as swimmers or climbers) and its **functional feeding group** (such as predator). The habit and

* Herdendorf, C.E., R.C. Herdendorf, and D.M. Klarer. 2001. *Catalogue of the invertebrate fauna of Old Woman Creek estuary, watershed, and adjacent waters of Lake Erie.* Technical Report No. 12. Old Woman Creek National Estuarine Research Reserve & State Nature Preserve, Huron, Ohio.

functional feeding group information is generalized to the family level for each species unless otherwise noted.

All taxonomic information on each page was derived from one or more of seven references, which are abbreviated as shown below followed by the page number(s):

BK&D = Balcer, M. D., N. L. Korda and S. I. Dodson. 1984. *Zooplankton of the Great Lakes: A Guide to the Identification and Ecology of the Common Crustacean species.* The University of Wisconsin Press.

B&D = Benzie, J. A. H. 2005. Cladocera: The genus *Daphnia* (including *Daphniopsis*) (Anomopoda: Daphniidae). *In*: Dumont, H. J. F. (Ed.) *Guides to the Identification of the Macroinvertebrates of the Continental Waters of the World.* Backhuys Publishers, Kenobi Productions.

B = Brooks, J. L. 1959. Chapter 27. Cladocera. *In:* W. T. Edmondson (Ed.). *Fresh-Water Biology. 2nd Ed.* John Wiley & Sons, Inc.

D&F = Dodson, S. I. and D. G. Frey. 2001. Chapter 21. Cladocera and Other Branchiopoda. *In*: J. H. Thorp and A. P. Covich (Eds.). *Ecology and Classification of North American Freshwater Invertebrates.* 2nd Ed. Academic Press.

DC&R = Dodson, S. I., Carla E. Cáceres, and D. Christopher Rogers. 2010. Chapter 20. Cladocera and Other Branchiopoda. *In*: J. H. Thorp and A. P. Covich (Eds.). *Ecology and Classification of North American Freshwater Invertebrates.* 3rd Ed. Academic Press.

P = Pennak, R. W. 1989. *Fresh-Water Invertebrates of the United States: Protozoa to Mollusca*. 3rd Ed. John Wiley & Sons, Inc.

S = Smirnov, N. N. 1996. Cladocera: the Chydorinae and Sayciinae (Chydoridae) of the World. *In*: H. J. F. Dumont, (Ed.). *Guides to the Identification of the Macroinvertebrates of the Continental Waters of the World.* SPB Academic Publishing bv.

TI&H = Taylor, D. J., C. R. Ishikane, and R. A. Haney. 2002. The Systematics of Holarctic Bosminids and a Revision that Reconciles Molecular and Morphological Evolution. *Limnology and Oceanography* 47:1486-1495.

Checklist of species of Water Fleas (Cladocerans) Reported in the OWC Wetland System

Specimens reported as collected at OWC but not identified in this atlas because of the unavailability of specimens are indicated with an asterisk (*).

Order Anomopoda

Family Bosminidae

Bosmina longirostris (O. F. Müller)
Eubosmina coregoni Baird

Family Chydoridae

Alona barbulata? Megard*
Alona cf. circumfimbriata Megard
Alona costata Sars*
Alona guttata Sars*
Alona quadrangularis (O. F. Müller)
Alona setulosa Megard
Alonella excisa (Fischer) **(**or ***Alonella exigua*** (Lilljeborg)**?)***
Alonella hamulata Birge*
Alonella nana (Baird)*
Chydorus cf. sphaericus. (O. F. Müller)
Disparalona sp.
Leydigia acanthocercoides (Fischer)*
Leydigia leydigi (Schödler)
Picripleuroxus* (=*Pleuroxus*) *denticulatus Birge
Pleuroxus procurvus Birge **(= *P. procurvatus*)**
Picripleuroxus* (=*Pleuroxus*) *striatus Schödler
Pseudochydorus globosus (Baird)

Family Daphniidae

Ceriodaphnia lacustris Birge
Ceriodaphnia megalops Sars
Ceriodaphnia quadrangula (O. F. Müller)
Ceriodaphnia reticulata (Jurine)
Daphnia galeata mendotae Birge

Family Daphniidae *(continued)*

Daphnia parvula Fordyce
Daphnia pulicaria[ø] Forbes
Daphnia retrocurva Forbes
Scapholeberis kingi Sars **(= *S. mucronata*** O. F. Müller**)**
Simocephalus serrulatus (Koch)*

Family Macrothricidae

Ilyocryptus sordidus (Liéven)
Macrothrix laticornis (Jurine)

Family Moinidae

Moina micrura Kurz

Order Ctenopoda

Family Sididae

Diaphanosoma birgei Kŏrínek
Latona setifera (O. F. Müller)*
Sida crystallina (O. F. Müller)

Order Haplopoda

Family Leptodoridae

Leptodora kindti (Focke)

Order Onychopoda

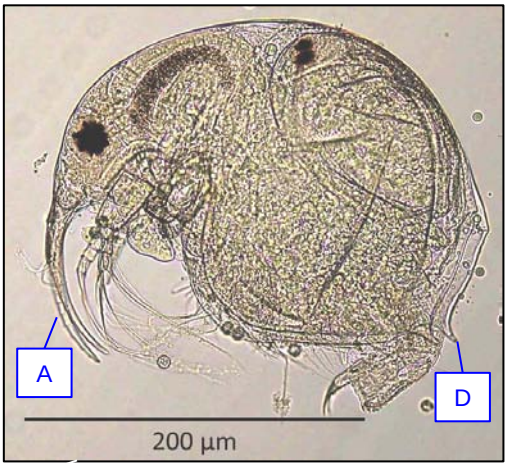
Family Cercopagidae

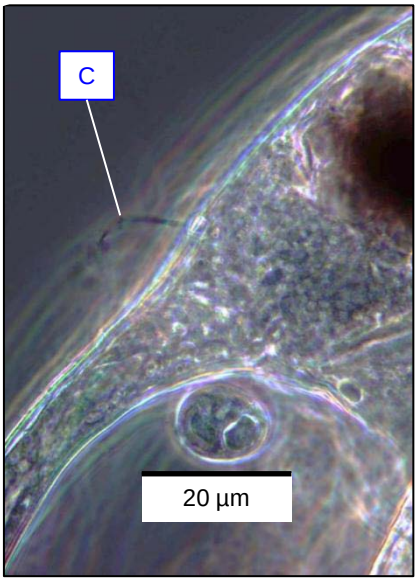
Bythotrephes longimanus[¤] **(= *B. cederstroemi*)**

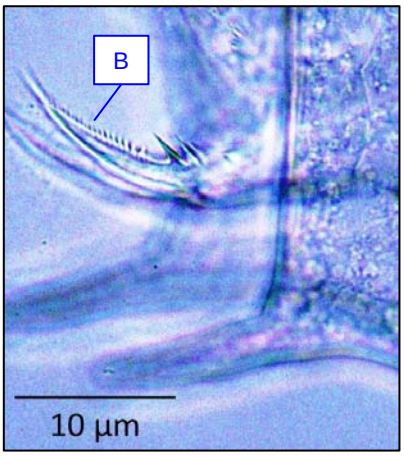
[ø] The slide of *Daphnia catawba* from Old Woman Creek was re-identified as *Daphnia pulicaria*.

[¤] *Bythotrephes longimanus* has not yet been identified in Old Woman Creek but was included on the list due to its presence in Lake Erie as an exotic species.

Crustacea: Anomopoda: Bosminidae: *Bosmina** *longirostris* Water Flea







Lateral views of *B. longirostris* (separate specimens)

Features of Order Anomopoda
Small, less than 6 mm in length
Body and legs enclosed in bivalve carapace
Five or six pairs of legs

Features of Family Bosminidae
Female antennules large, tusk-like, fixed, and inserted at ventral edge of head (A)

Features of Genus *Bosmina*
Fine distal pecten on female postabdominal claw (B)
Frontal sensory bristle about half way between eye and tip of rostrum (C)

Features of Species *longirostris*
Mucro (small spine) present on posteroventral margin of carapace (D)
According to the references used, *B. longirostris* is the only species in the genus *Bosmina*.

Where Recorded at Old Woman Creek
Sediment: open-water, lotus bed, sedge meadow, swamp pond

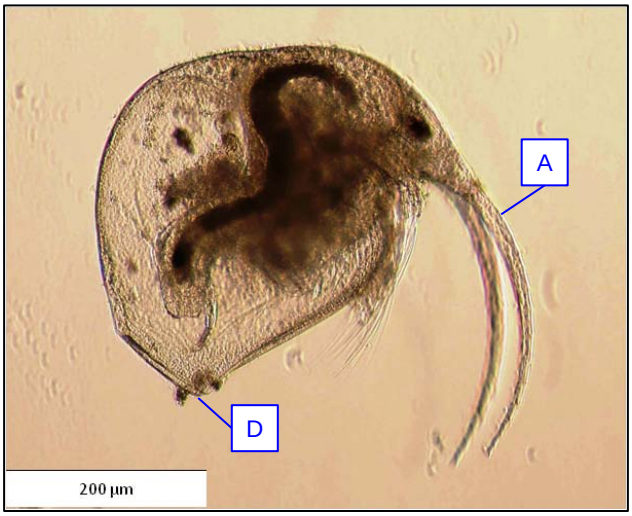
General Ecology
Habit: Swimmers
Functional feeding group: Filter feeders

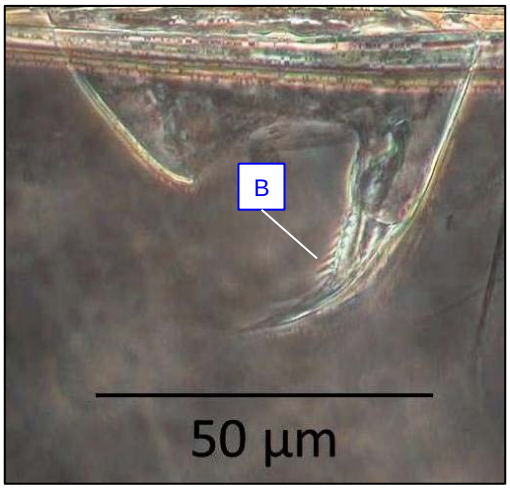
References: BK&D 24-25, 28-31, 70; D&F 885; P 386-394; B 604; TI&H 1492

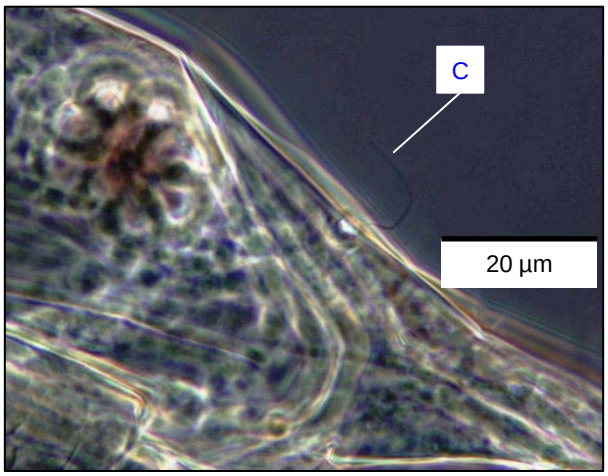
Photographs: Genex pond ,Tiffin, OH 16 Nov. 2010 64 µm mesh horizontal tow (lower image; phase contrast)
Genex Bull Farm Pond Nov. 29, 2011 (top two images; phase contrast)

* The specimens shown here are based on the classical taxonomy of the family *Bosminidae.* Many revisions of this family have occurred and use features such as the position of lateral head pores, serrations on the mucro, and the type of spines present on the postabdominal claws to determine the genera and subgenera. According to TI&H, there are two subgenera of *Bosmina* (*B. Bosmina* and *B. Sinobosmina*). However, the keys given in the revisions do not extend to the species level. Therefore, for the purpose of this report the classical taxonomy is used to show the specimens as they were reported from Old Woman Creek. Please see reference page for full citation of TI&H, as well as BK&D for a more extensive explanation of *Bosminidae* taxonomy.

Crustacea: Anomopoda: Bosminidae: *Eubosmina** *coregoni*
Water Flea







Lateral views of *E. coregoni* (different specimens)

Features of Order Anomopoda
Small, less than 6 mm in length
Body and legs enclosed in bivalve carapace
Five or six pairs of legs

Features of Family Bosminidae
Female antennules large, tusk-like, fixed, and inserted at ventral edge of head (A)

Features of Genus *Eubosmina*
Female postabdominal claw with proximal pecten only (B)
Frontal sensory bristle near tip of rostrum, near or at base of antennule (C)

Features of Species *coregoni*
Mucro (small spine) absent from posteroventral margin of carapace (D)

Where Recorded at Old Woman Creek
Open water

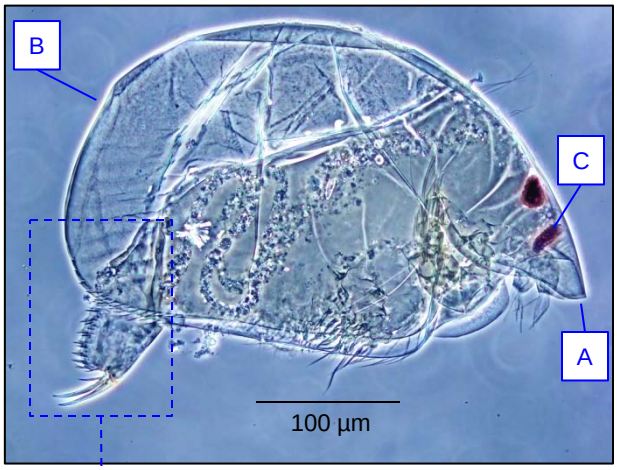
General Ecology
Habit: Swimmers
Functional feeding group: Filter feeders

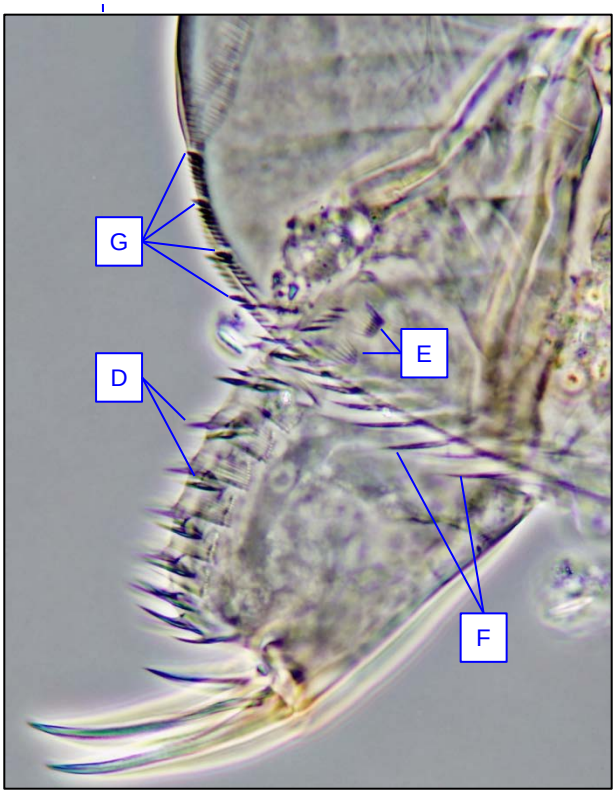
References: BK&D 24-25, 28-31, 70; D&F 885; P 386-394; B 604; TI&H 1492

Photographs: Lake Erie CE97 June 21, 1978 TK (lower photos: phase contrast)

* The specimens shown here are based on the classical taxonomy of the family *Bosminidae.* Many revisions of this family have occurred and use features such as the position of lateral head pores, serrations on the mucro, and the type of spines present on the postabdominal claws to determine the genera and subgenera. According to TI&H, there are three subgenera of *Eubosmina* (*E. Neobosmina*, *E. Eubosmina*, and *E. Lunobosmina*). However, the keys given in the revisions do not extend to the species level. Therefore, for the purpose of this report the classical taxonomy is used to show the specimens as they were reported from Old Woman Creek. Please see reference page for full citation of TI&H, as well as BK&D for a more extensive explanation of *Bosminidae* taxonomy.

Crustacea: Anomopoda: Chydoridae: *Alona* cf. *circumfimbriata* Water Flea





Lateral views of *A.* cf. *circumfimbriata*

Features of Order Anomopoda
Small, less than 6 mm in length
Body and legs enclosed in bivalve carapace
Five or six pairs of legs

Features of Family Chydoridae
Antennules covered by fornices; fornices and rostrum united into a forward-projecting beak (A)
Usually no shell spine (B)
Ocellus present (C)

Features of Genus *Alona*
Marginal (D) and lateral teeth (E) on postabdomen
Marginal teeth of postabdomen not markedly longer distally (D)

Features of Species cf. *circumfimbriata*
Fringe of setae on posterior ventral margin (F)
Up to four small teeth on ventroposterior angle of carapace (G)
Abruptly narrowed rostrum with pointed tip (A)

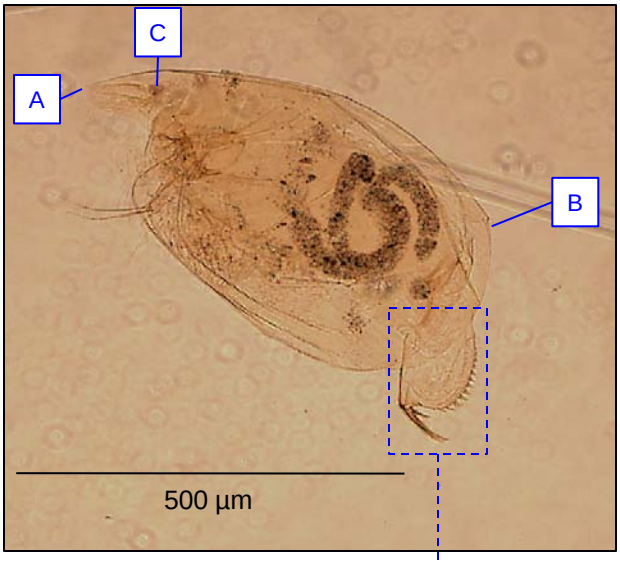
Where Recorded at Old Woman Creek
Open water

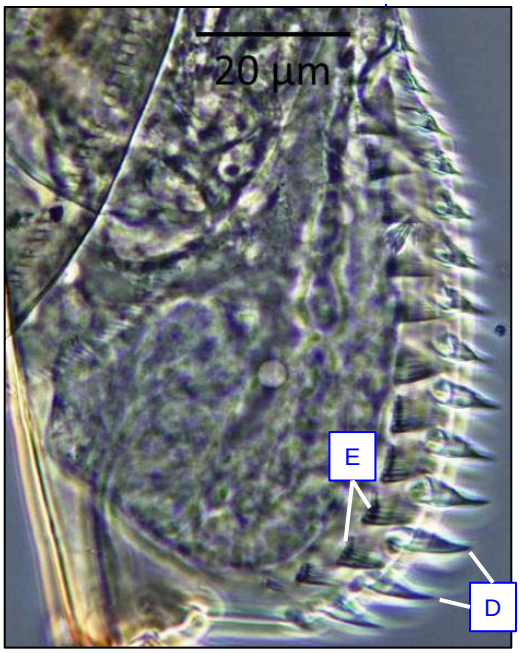
General Ecology
Habit: Crawlers and climbers
Functional feeding groups: Collectors/gatherers, scrapers and filter feeders

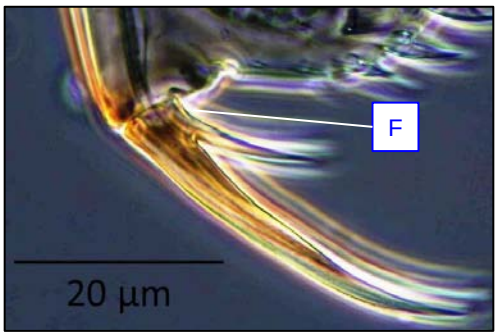
References: BK&D 24-25, 72; P 386-401; B 593, 604, 642; D&F 866

Photographs: OWC station D September 14, 1984 KK. (phase contrast)

Crustacea: Anomopoda: Chydoridae: *Alona quadrangularis* Water Flea







Lateral views of *A. quadrangularis*

Features of Order Anomopoda
Small, less than 6 mm in length
Body and legs enclosed in bivalve carapace
Five or six pairs of legs

Features of Family Chydoridae
Antennules covered by fornices; fornices and rostrum united into a forward-projecting beak (A)
Usually no shell spine (B)
Ocellus present (C)

Features of Genus *Alona*
Marginal (D) and lateral teeth (E) on postabdomen
Marginal teeth of postabdomen not markedly longer distally (D)

Features of Species *quadrangularis*
No spinules on spine at base of postabdominal claw (F)
Postabdomen with at least 14 marginal teeth (D)

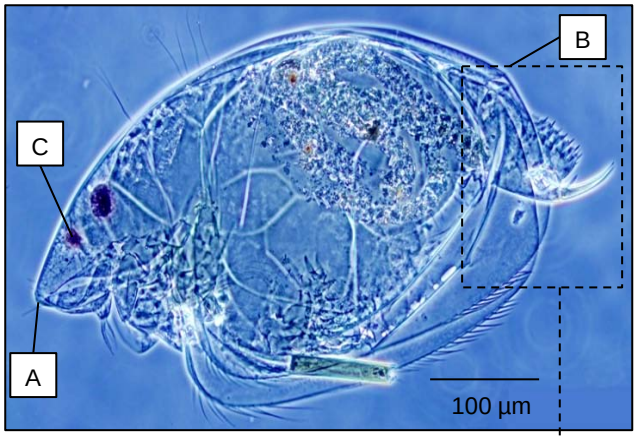
Where Recorded at Old Woman Creek
On top of sediment in open water

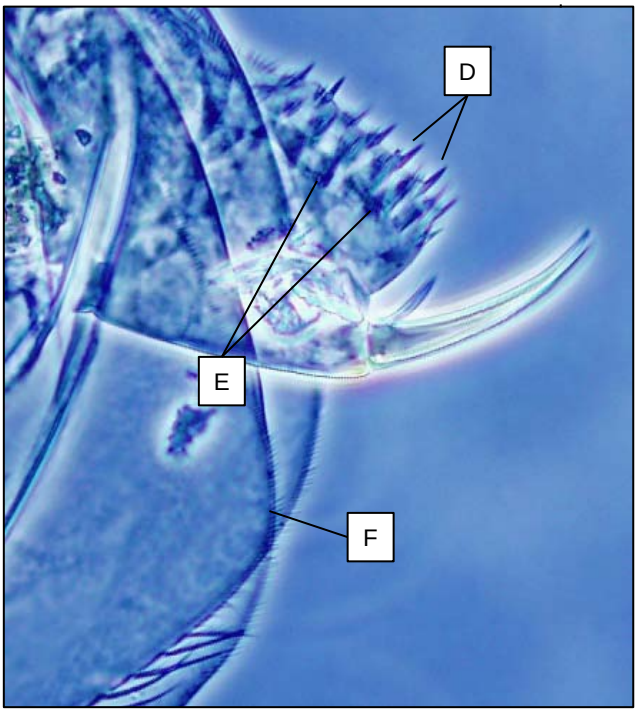
General Ecology
Habit: Crawlers and climbers
Functional feeding groups: Collectors/gatherers, scrapers and filter feeders

References: BK&D 24-25, 72; P 386-401; B 593, 604, 642; D&F 866

Photographs: Lake Erie LV63 Oct. 8, 1978 KK. (lower images, phase contrast)

Crustacea: Anomopoda: Chydoridae: *Alona setulosa* Water Flea





Lateral views of *A. setulosa*

Features of Order Anomopoda
Small, less than 6 mm in length
Body and legs enclosed in bivalve carapace
Five or six pairs of legs

Features of Family Chydoridae
Antennules covered by fornices; fornices and rostrum united into a forward-projecting beak (A)
Usually no shell spine (B)
Ocellus present (C)

Features of Genus *Alona*
Marginal (D) and lateral teeth (E) on postabdomen
Marginal teeth of postabdomen not markedly longer distally (D)

Features of Species *setulosa*
No teeth on ventroposterior angle of carapace (F)
Tip of rostrum not narrowed (A)

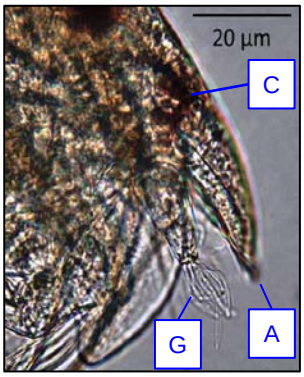
Where Recorded at Old Woman Creek
Found in Lake Erie surf zone adjacent to OWC

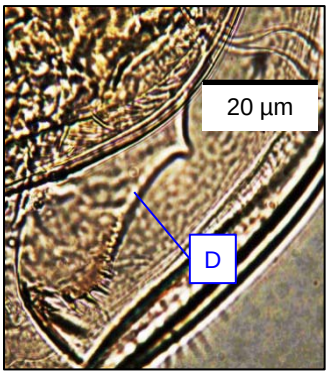
General Ecology
Habit: Crawlers and climbers
Functional feeding group: Collectors/gatherers

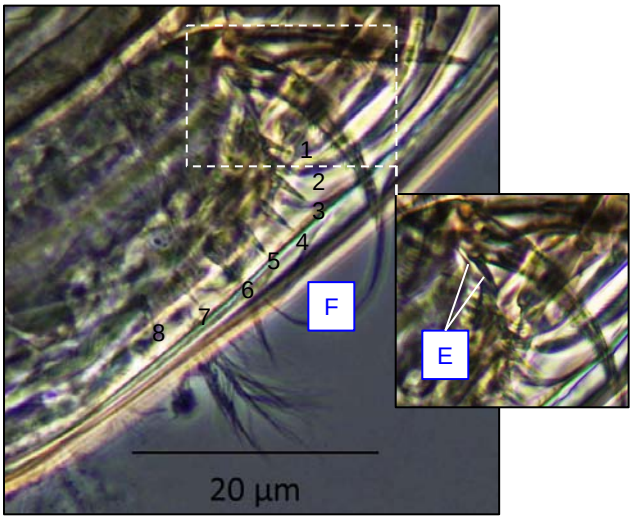
References: BK&D 24-25; P 386-401; B 593, 604, 645; D&F 866

Photographs: Lake Erie surf zone adjacent to OWC station L September 14, 1984 KK. (phase contrast)

Crustacea: Anomopoda: Chydoridae: *Chydorus cf. sphaericus** Water Flea







Lateral views of *Chydorus cf. sphaericus* (different specimens)

Features of Order Anomopoda
Small, less than 6 mm in length
Body and legs enclosed in bivalve carapace
Five or six pairs of legs

Features of Family Chydoridae
Antennules covered by fornices; fornices and rostrum united into a forward-projecting beak (A)
Usually no shell spine (B)
Ocellus present (C)

Features of Genus *Chydorus*
Postabdomen broad and short (D)
Animal ovate or spherical
Rostrum long and pointed (A)
Abdominal claw with two basal spines (proximal spine may be minute) (E)

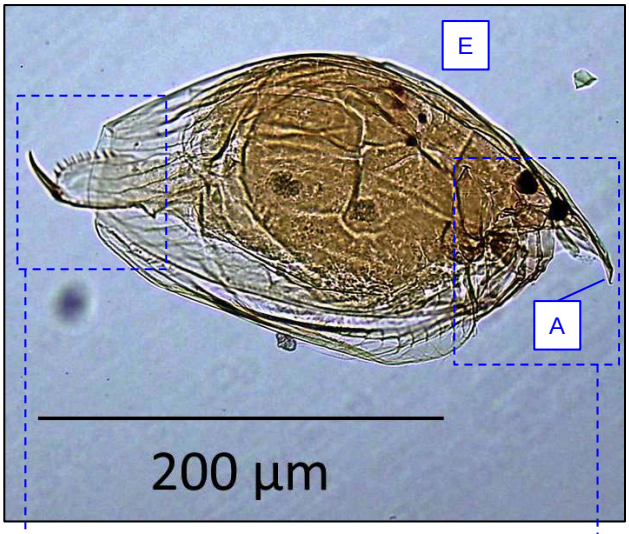
Features of Species cf. *sphaericus*
Eight or nine marginal teeth on postabdomen (F)
End of antennules bearing all the olfactory hairs (G)
Proximal basal spine of abdominal claw minute (E)

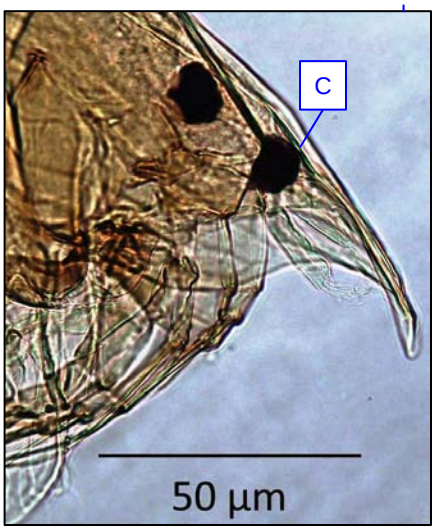
Where Recorded at Old Woman Creek
Flooded creek channel at lake level, swamp forest, *Nymphaea* surface, *Nelumbo* surface, submerged grass, open water

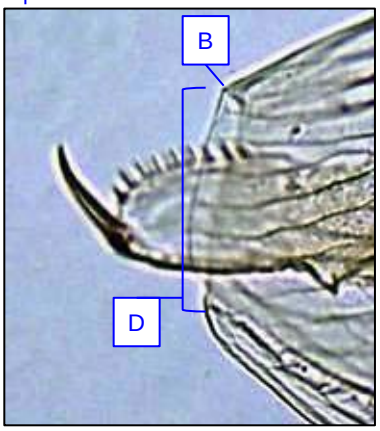
General Ecology
Habit: Crawlers and climbers
Functional feeding groups: Filter feeders and scrapers
References: BK&D 24-28, 72; P 386-404; B 604, 648-651; D&F 866, 882; DC&R 812
Photographs: Coote's Paradise Lake Ontario 24-26 Oct. 2010 (top and middle left images; phase contrast) – collected by Tori Vaccariello
OWC A July 30, 2009 (middle right-side image; phase contrast)
Lake Erie LV55 October 8, 1978 (lower two images; phase contrast)

* According to DC&R, the forms in the *Chydorus cf. sphaericus* complex are distinguishable by subtle differences in labrum plate shape, carapace, head pore position, clarity of carapace reticulation pattern, and the position of sensory setae on the first antennae. Forms of *Chydorus* within this complex may include: *sphaericus*, *brevilabris*, *linguilabris*, *canadensis*, and the circumtropical *eurynotus* and *gibbus*. For the purposes of this atlas, a representative of this group was shown and is likely either *C. brevilabris* or *C. sphaericus*.

Crustacea: Anomopoda: Chydoridae: *Disparalona sp.* Water Flea







Lateral views of *Disparalona sp.*

Features of Order Anomopoda
Small, less than 6 mm in length
Body and legs enclosed in bivalve carapace
Five or six pairs of legs

Features of Family Chydoridae
Antennules covered by fornices; fornices and rostrum united into a forward-projecting beak (A)
Usually no shell spine (B)
Ocellus present (C)

Features of Genus *Disparalona*
Posterior dorsal point (B)
Large ocellus (C)
Short posterior margin (D)
Body elongate (E)

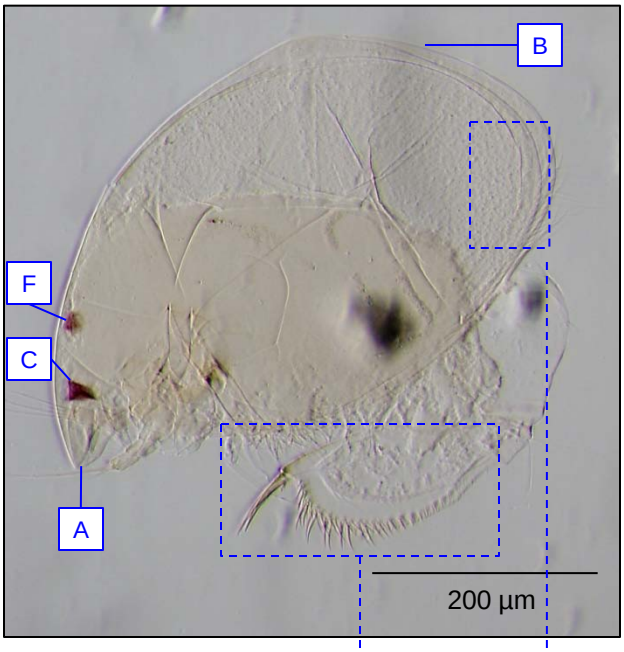
Where Recorded at Old Woman Creek
Open water

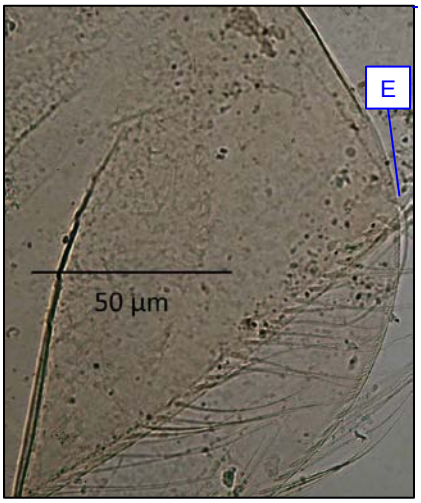
General Ecology
Habit: Crawlers and climbers
Functional feeding groups: Collectors/gatherers, scrapers and filter feeders

References: B 593; BK&D 24-25; D&F 866; P 386-401; personal communication with Brenda Hann, October 4, 2012

Photographs: Lake Erie at OWC Station L August 17, 1984 KK

Crustacea: Anomopoda: Chydoridae: *Leydigia leydigi* Water Flea





Lateral views of *L. leydigi*

Features of Order Anomopoda
Small, less than 6 mm in length
Body and legs enclosed in bivalve carapace
Five or six pairs of legs

Features of Family Chydoridae
Antennules covered by fornices; fornices and rostrum united into a forward-projecting beak (A)
Usually no shell spine (B)
Ocellus present (C)

Features of Genus *Leydigia*
Large spine clusters on postabdomen (D)
No teeth on ventroposterior angle of carapace (E)
Ocellus (C) larger than compound eye (F)

Features of Species *leydigi*
No longitudinal markings on valves

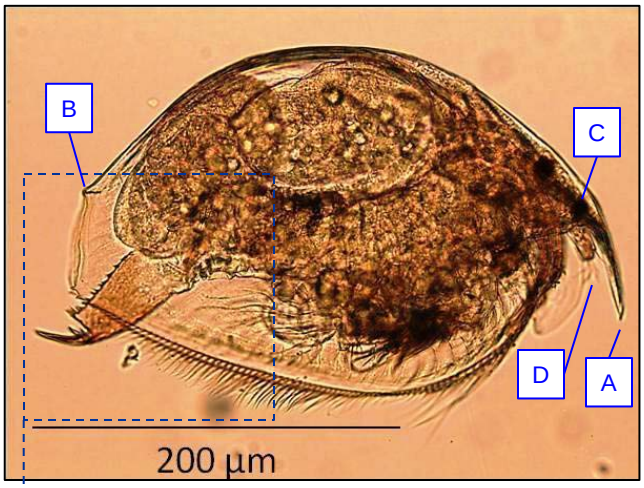
Where Recorded at Old Woman Creek
On top of sediment in open water and lotus bed; *Nymphaea* surface

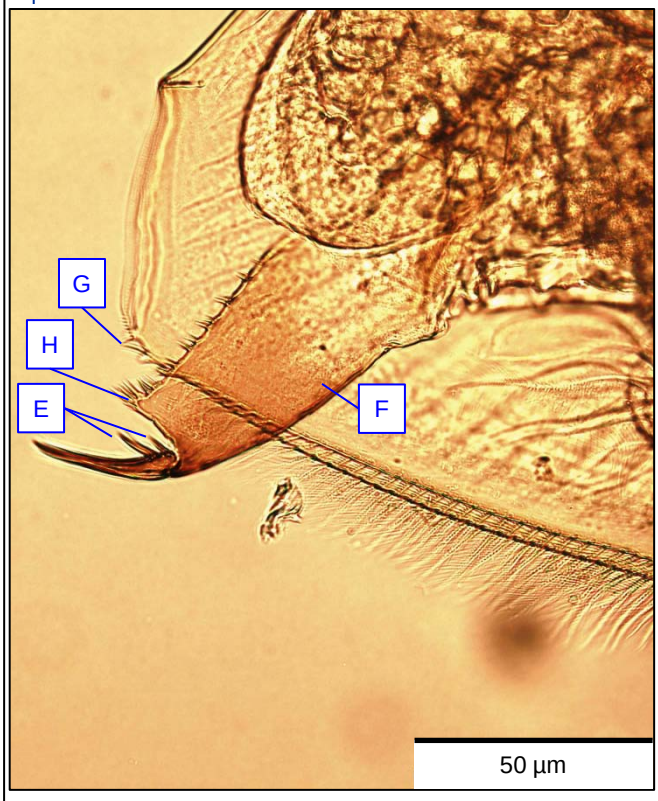
General Ecology
Habit: Crawlers and climbers
Functional feeding groups: Collectors/gatherers; scrapers and filter feeders

References: BK&D 24-25, 72; D&F 866, P 386-400; B 593, 639

Photographs: OWC station A October 16, 1984 KK; LV69 May 18, 1978 KK. (phase contrast; middle image)

Crustacea: Anomopoda: Chydoridae: *Picripleuroxus denticulatus* (=*Pleuroxus denticulatus**) Water Flea





Lateral views of *P. denticulatus*

Features of Order Anomopoda
Small, less than 6 mm in length
Body and legs enclosed in bivalve carapace
Five or six pairs of legs

Features of Family Chydoridae
Antennules covered by fornices; fornices and rostrum united into a forward-projecting beak (A)
Usually no shell spine (B)
Ocellus present (C)

Features of Genus *Picripleuroxus*
Usually with long rostrum (A) that extends past terminal olfactory hairs on antennules (D)
Two spines at base of postabdominal claw (E)
Long and somewhat bent postabdomen (F)

Features of Species *denticulatus*
Teeth on ventroposterior angle (G)
Postabdomen at sharp angle (H)
Valves not obviously striated

Where Recorded at Old Woman Creek
Open water

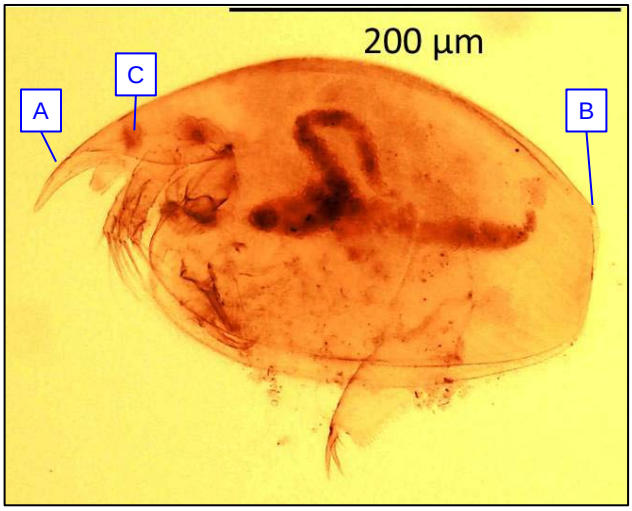
General Ecology
Habit: Crawlers and climbers
Functional feeding groups: Collectors/gatherers; scrapers and filter feeders

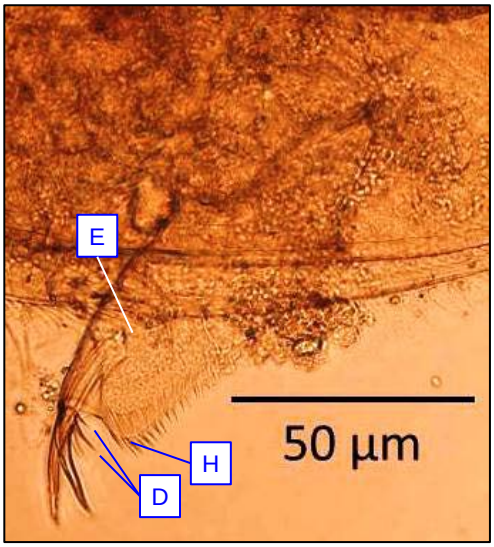
References: BK&D 24-25, 72; P 386-404; B 598-644; S 28-31; D&F 866

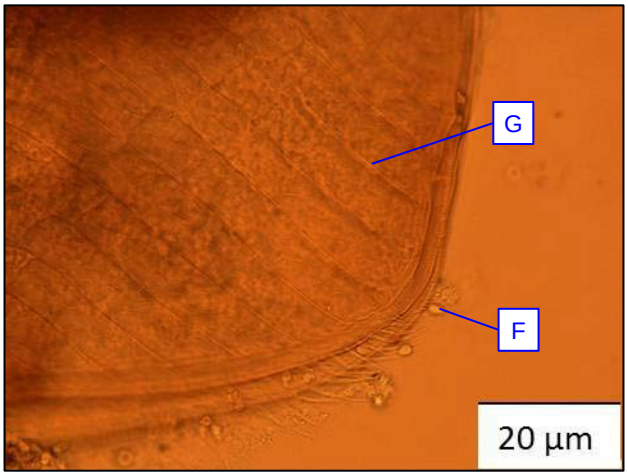
Photographs: Coote's Paradise, Lake Ontario, 24-26 Oct. 2010 (phase contrast) – collected by Tori Vaccariello

* According to Smirnov (1996), *Picripleuroxus* (once considered a subgenus of *Pleuroxus*) is now a separate genus from *Pleuroxus.*

Crustacea: Anomopoda: Chydoridae: *Picripleuroxus striatus* (=*Pleuroxus striatus**) Water Flea







Lateral views of *P. striatus*

Features of Order Anomopoda
Small, less than 6 mm in length
Body and legs enclosed in bivalve carapace
Five or six pairs of legs

Features of Family Chydoridae
Antennules covered by fornices; fornices and rostrum united into a forward-projecting beak (A)
Usually no shell spine (B)
Ocellus present (C)

Features of Genus *Picripleuroxus*
Usually with long rostrum that extends past terminal olfactory hairs on antennules (A)
Two spines at base of postabdominal claw (D)
Long and somewhat bent postabdomen (E)

Features of Species *striatus*
Carapace with rounded ventroposterior angle (possibly one small tooth in front of it; not present on this specimen) (F)
Valves obviously striated (G)
Postabdomen not at sharp angle (H)

Where Recorded at Old Woman Creek
Open water

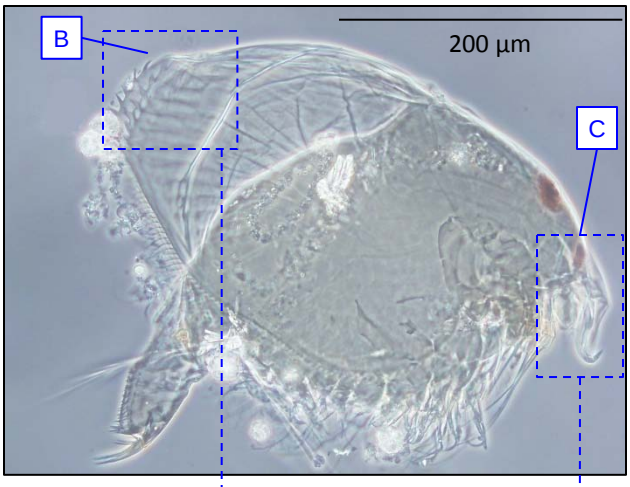
General Ecology
Habit: Crawlers and climbers
Functional feeding group: Collectors/gatherers

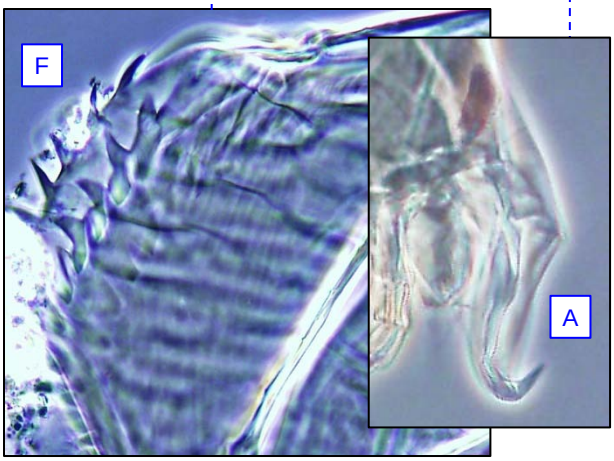
References: P402-404; B 593, 644-646; D&F 866; S 12-14

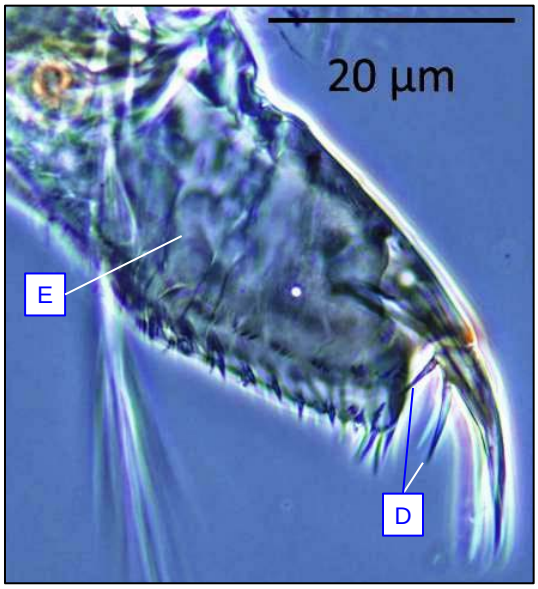
Photographs: OWC Plankton Open Water 20111011 JAB (composite photo; top two images)

* According to Smirnov (1996), *Picripleuroxus* (once considered a subgenus of *Pleuroxus*) is now a separate genus from *Pleuroxus.*

Crustacea: Anomopoda: Chydoridae: *Pleuroxus procurvus* (= *Pleuroxus procurvatus*) Water Flea







Lateral views of *P. procurvus*

Features of Order Anomopoda
Small, less than 6 mm in length
Body and legs enclosed in bivalve carapace
Five or six pairs of legs

Features of Family Chydoridae
Antennules covered by fornices; fornices and rostrum united into a forward-projecting beak (A)
Usually no shell spine (B)
Ocellus present (C)

Features of Genus *Pleuroxus*
Usually with long rostrum that extends past terminal olfactory hairs on antennules (A)
Two spines at base of postabdominal claw (D)
Postabdomen comparatively short to that of *Picripleuroxus* (E)

Features of Species *procurvus*
Rostrum hooked sharply (A)
Entire posterior margin of valves with teeth (F)

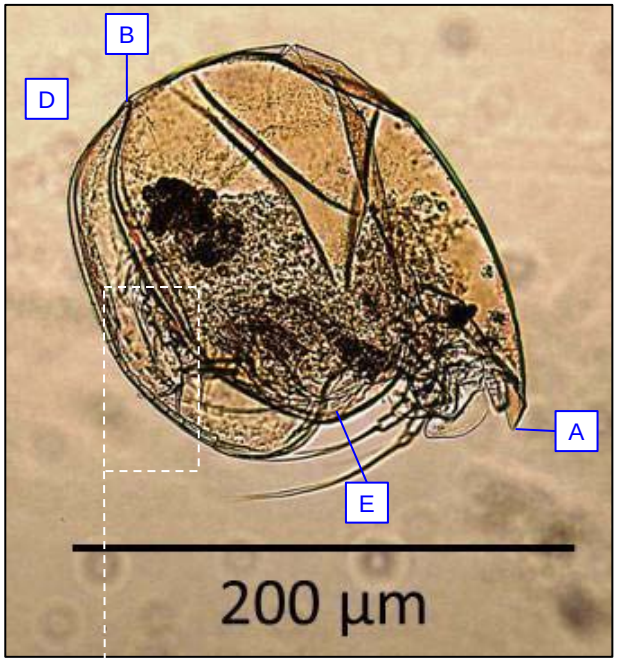
Where Recorded at Old Woman Creek
Open water

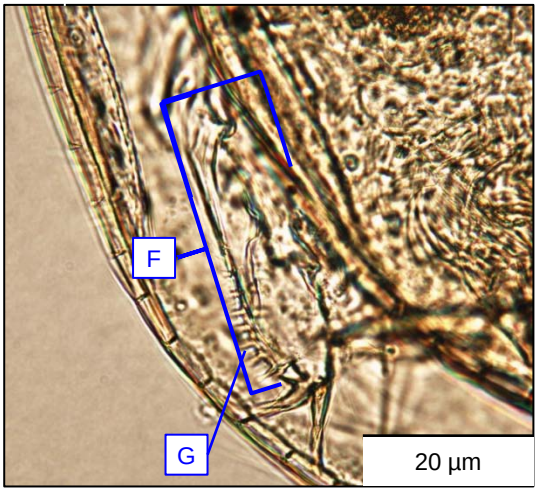
General Ecology
Habit: Crawlers and climbers
Functional feeding group: Collectors/gatherers

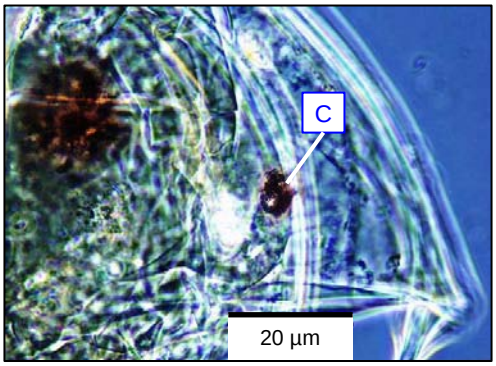
References: BK&D 24-25; P 386-404; B 593, 598-644; D&F 866

Photographs: OWC station A October 6, 1984 KK. (phase contrast)

Crustacea: Anomopoda: Chydoridae: *Pseudochydorus globosus* Water Flea







Lateral views of *P. globosus*

Features of Order Anomopoda
Small, less than 6 mm in length
Body and legs enclosed in bivalve carapace
Legs usually with flattened branchial appendages
Five or six pairs of legs
First and second leg more or less prehensile with cylindrical joints, others leaflike

Features of Family Chydoridae
Antennules covered by fornices; fornices and rostrum united into a forward-projecting beak (A) (folded over in photo)
Usually no shell spine (B)
Ocellus present (C)

Features of Genus *Pseudochydorus*
Animal oval or spherical (D)
Valves without projection at anteroventral margin (E)

Features of Species *globosus*
Postabdomen narrow and long (F)
Postabdomen with marginal teeth (G)

Where Recorded at Old Woman Creek
Open water

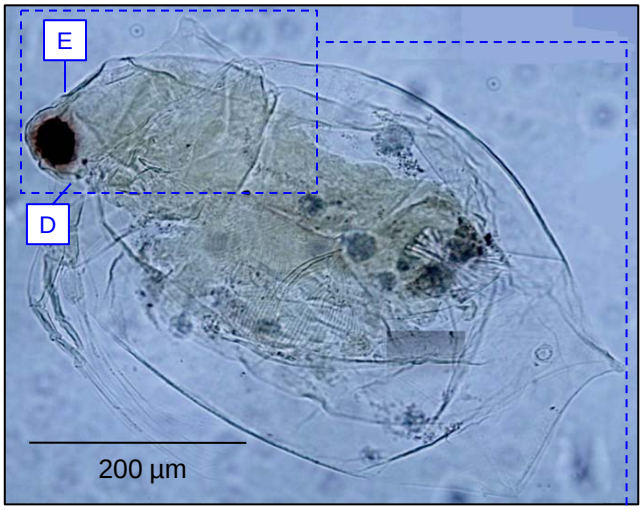
General Ecology
Habit: Crawlers and climbers
Functional feeding groups: Collectors/gatherers, scrapers and filter feeders, scavenger of dead animals

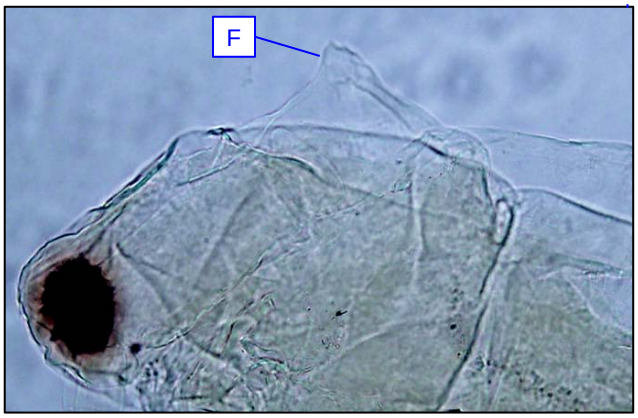
References: BK&D 24-25, 72; P 386-404; B 593, 598-64; D&F 824, 866

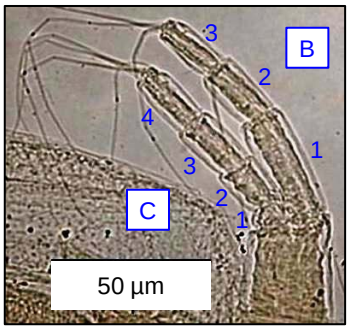
Photographs: Zooplankton – OWC West Island edge *Phragmites* bed T-1 July 2006 (phase contrast)

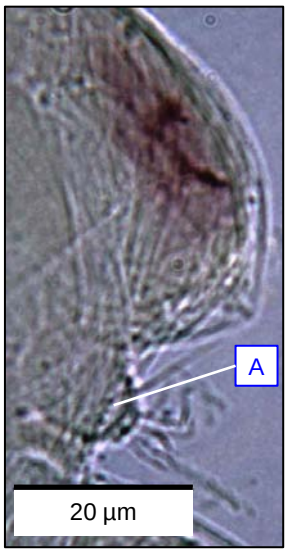
Old Woman Creek Station D July 9, 1984 KK (lower image; phase contrast)

Crustacea: Anomopoda: Daphnidae: *Ceriodaphnia lacustris* Water Flea









Lateral views of *C. lacustris*

Features of Order Anomopoda

Small, less than 6 mm in length
Body and legs enclosed in bivalve carapace
Five or six pairs of legs

Features of Family Daphnidae

Female with small antennules that are attached to the ventral side of the head and are often rudimentary (A)
Ventral ramus of second antenna 3-jointed (B); dorsal ramus 4-jointed (C)

Features of Genus *Ceriodaphnia*

No rostrum (D)
Head depressed and small (E)

Features of Species *lacustris*

Fornices projected as spine-like processes (F)
Postabdominal claws without pecten, but may have fine teeth, or denticulations (not visible on our specimens)
Postabdomen not abruptly incised below anus

Where Recorded at Old Woman Creek

Open water

General Ecology

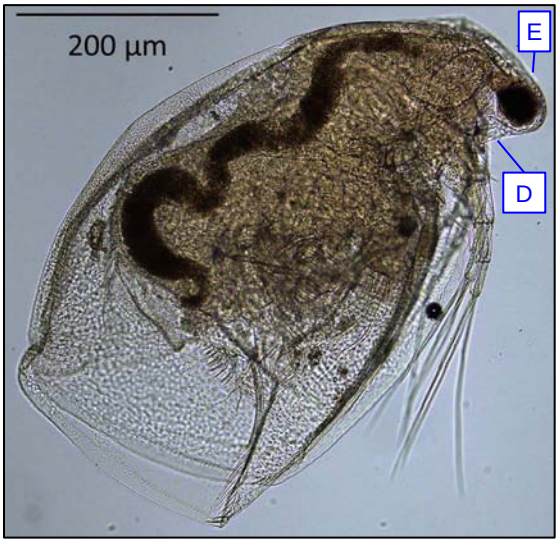
Habit: Swimmers
Functional feeding group: Filter feeders

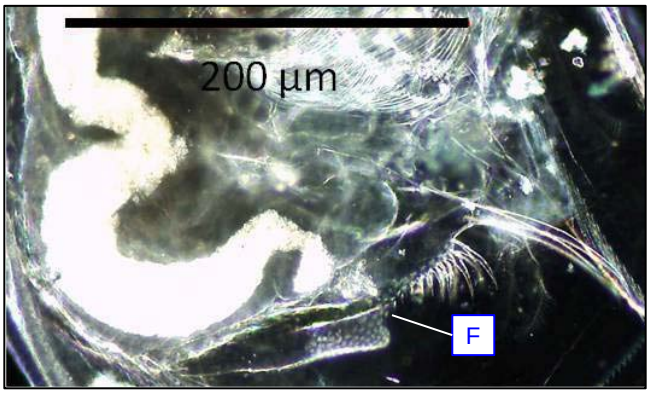
References: BK&D 24-25, 62; P 386-393; B 604

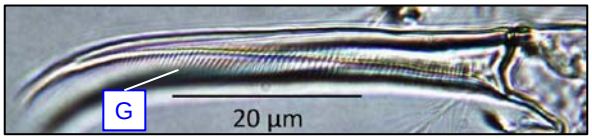
Photographs: OWC station D July 6, 1984 KK (top two images; phase contrast)

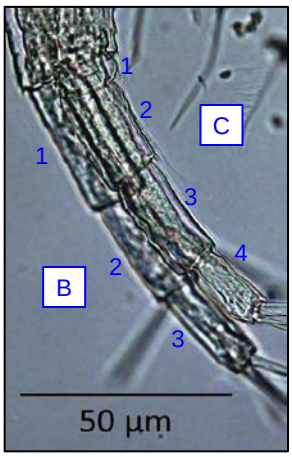
Lake Erie LV55 June 15, 1978 (lower two images)

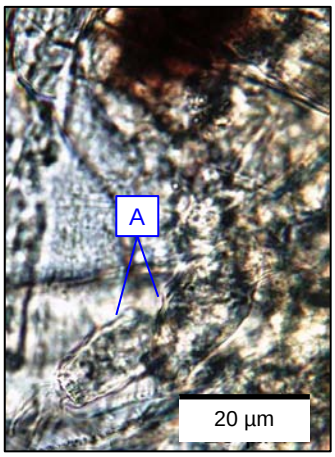
Crustacea: Anomopoda: Daphnidae: *Ceriodaphnia megalops* Water Flea











Lateral views of *C. megalops* (different specimens)

Features of Order Anomopoda

Small, less than 6 mm in length
Body and legs enclosed in bivalve carapace
Five or six pairs of legs

Features of Family Daphnidae

Female with small antennules that are attached to the ventral side of the head and are often rudimentary (A)
Ventral ramus of second antenna 3-jointed (B); dorsal ramus 4-jointed (C)

Features of Genus *Ceriodaphnia*

No rostrum (D)
Head depressed and small (E)

Features of Species *megalops*

Postabdomen abruptly incised below anus (F)
Postabdominal claws without pecten, but many fine teeth, or denticulations (fine lines on image) (G)
Fornices not projected as a spine-like process

Where Recorded at Old Woman Creek

Open water

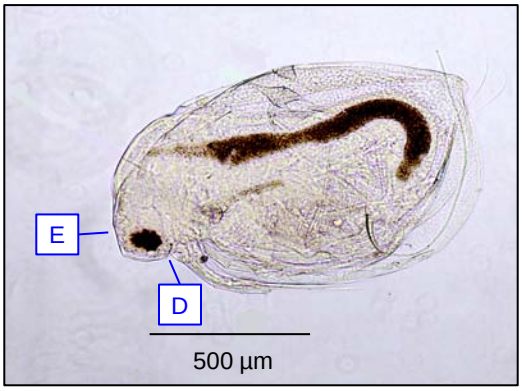
General Ecology

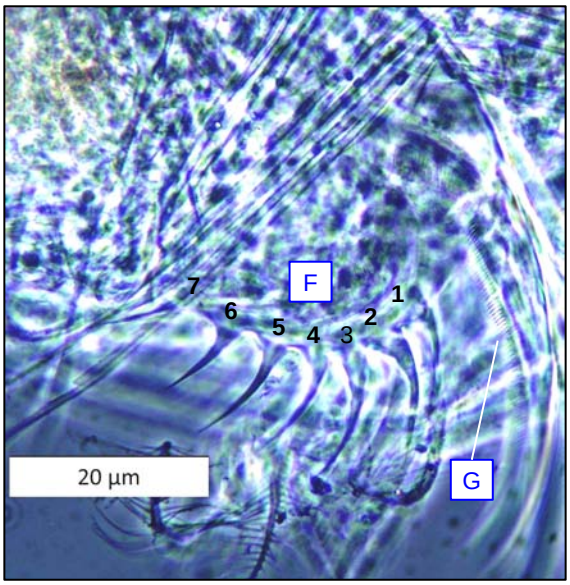
Habit: Swimmers
Functional feeding group: Filter feeders

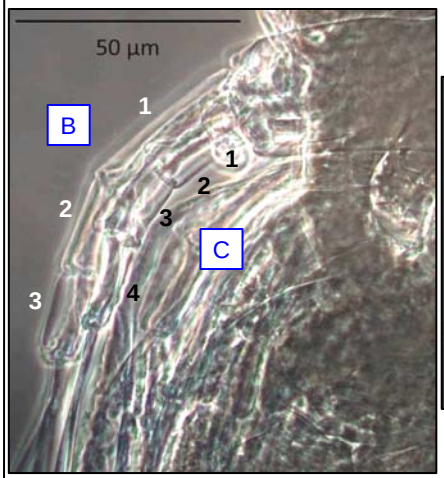
References: BK&D 24-25, 62; P 386-393; B 604, 619

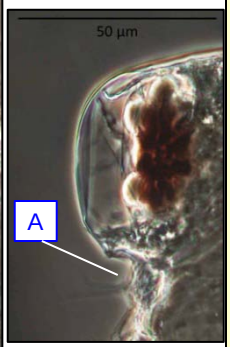
Photographs: OWC Plankton Pondweed October 11, 2011 JAB

Crustacea: Anomopoda: Daphnidae: *Ceriodaphnia quadrangula* Water Flea









Lateral views of *C. quadrangula*

Features of Order Anomopoda

Small, less than 6 mm in length
Body and legs enclosed in bivalve carapace
Five or six pairs of legs

Features of Family Daphnidae

Female with small antennules that are attached to the ventral side of the head and are often rudimentary (A)
Ventral ramus of second antenna 3-jointed (B); dorsal ramus 4-jointed (C)

Features of Genus *Ceriodaphnia*

No rostrum (D)
Head depressed and small (E)

Features of Species *quadrangula*

Seven to nine anal spines (F)
Postabdominal claws without pecten, but may have fine teeth, or denticulations (fine lines on image) (G)
Fornices not projected as spine-like processes
Postabdomen not abruptly incised below anus

Where Recorded at Old Woman Creek

Open water, swamp pond

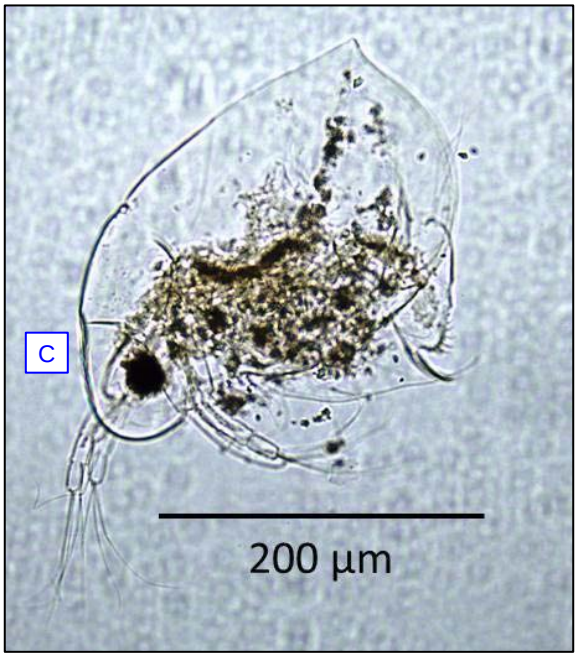
General Ecology

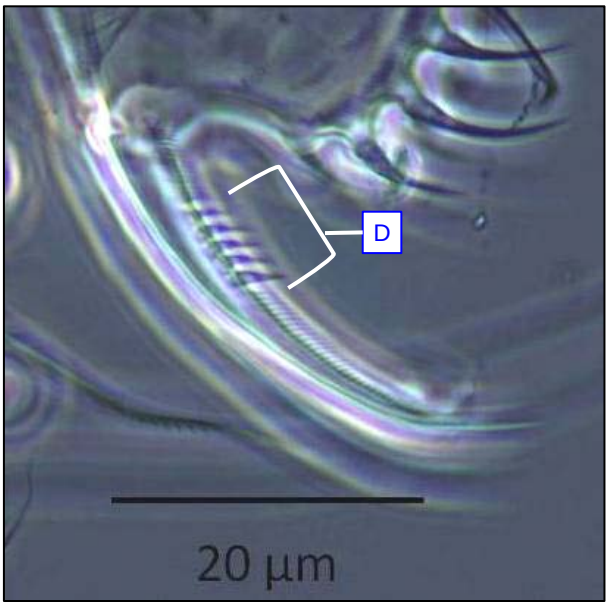
Habit: Swimmers
Functional feeding group: Filter feeders

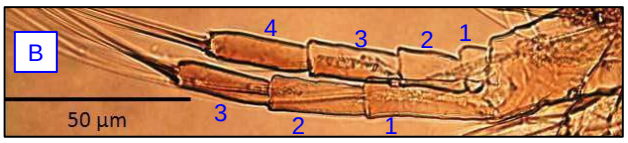
References: BK&D 24-33, 62; P 386-394; B 604

Photographs: Lake Mohawk April 22, 2008 JB.(phase contrast; lower three images)

Crustacea: Anomopoda: Daphnidae: *Ceriodaphnia reticulata* Water Flea







Lateral views of *C. reticulata*

Features of Order Anomopoda
Small, less than 6 mm in length
Body and legs enclosed in bivalve carapace
Five or six pairs of legs

Features of Family Daphnidae
Female with small antennules that are attached to the ventral side of the head and are often rudimentary (not visible in photo)
Ventral ramus of second antenna 3-jointed; dorsal ramus 4-jointed (B)

Features of Genus *Ceriodaphnia*
No rostrum
Head depressed and small (C)

Features of Species *reticulata*
Postabdominal claw with distinct triangular shaped middle pecten (D) (note fine teeth, or denticulations, on both proximal and distal ends of claw)
Fornices not projected as spine-like processes
Postabdomen not abruptly incised below anus

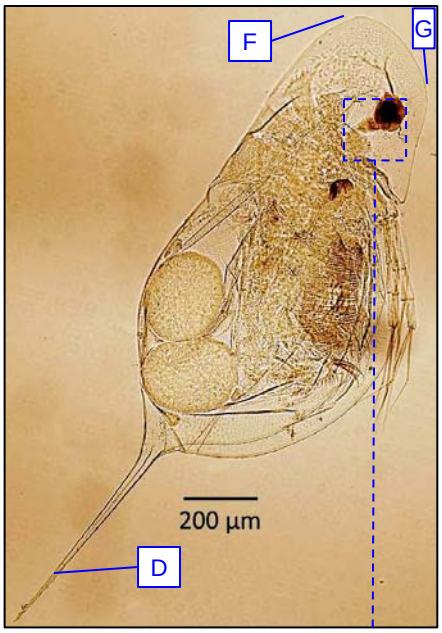
Where Recorded at Old Woman Creek
Swamp pond, open water

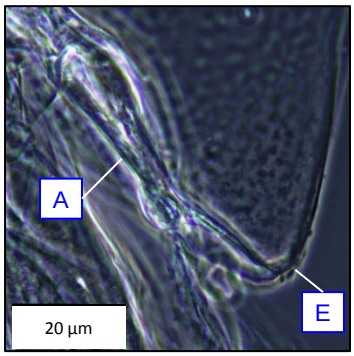
General Ecology
Habit: Swimmers
Functional feeding group: Filter feeders

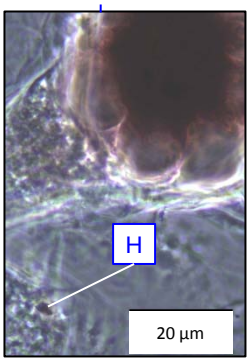
References: BK&D 24-25, 62; P 386-393; B 604-618

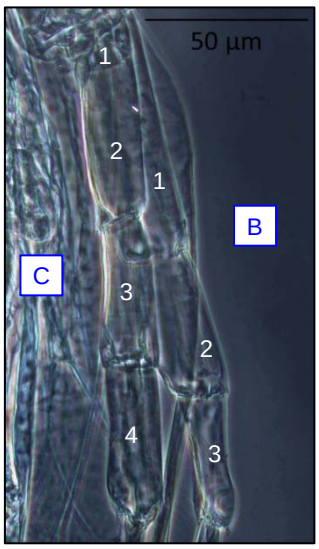
Photographs: Zooplankton OWC West Island edge of *Phragmites* bed T-1 July 2006 (phase contrast)

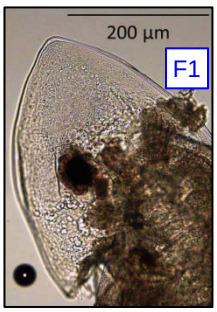
Crustacea: Anomopoda: Daphnidae: *Daphnia galeata mendotae* Water Flea

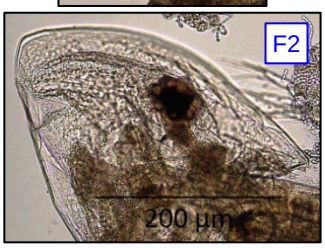












Lateral views of *D. galeata mendotae*

Features of Order Anomopoda

Small, less than 6 mm in length
Body and legs enclosed in bivalve carapace
Five or six pairs of legs

Features of Family Daphnidae

Female with small antennules that are attached to the ventral side of the head and are often rudimentary (A)
Ventral ramus of second antenna 3-jointed (B); dorsal ramus 4-jointed (C)

Features of Genus *Daphnia*

Valves with shell spine (D)
Rostrum present (E)

Features of Species *galeata mendotae*

Usually with pointed helmet (F)*
(Note variation in helmet shape in F1 and F2 on lower right images)
Dorsal margin of head not concave (G)
Shell spine more than 1/3 length of valves (D)
Greatest depth of head not more than twice its length
Ocellus present (H)

Where Recorded at Old Woman Creek

On top of sediment in open water and lotus bed

General Ecology

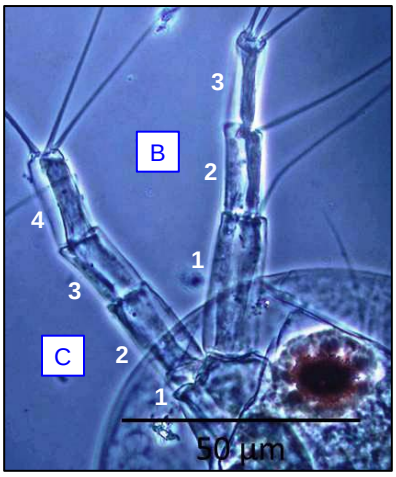
Habit: Swimmers
Functional feeding group: Filter feeders

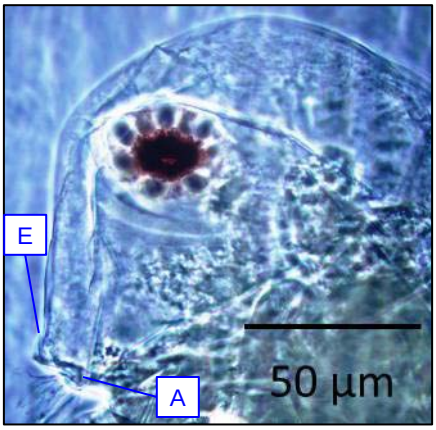
References: BK&D 24-25, 62; P 380-381, 386-392; W&W 604-610; B&D 25, 227-232

Photographs: V6 Lake Erie July 17, 2009 KK (phase contrast; middle images and lower left image)

*According to Pennak (1989), the appearance of a helmet is dependent on the season of the year. The increase in water temperature during the spring and summer causes the animal's head shape to change and become pointed. By late autumn, the head reverts to "normal."

Crustacea: Anomopoda: Daphnidae: *Daphnia parvula* Water Flea





Lateral views of *D. parvula*

Features of Order Anomopoda

Small, less than 6 mm in length
Body and legs enclosed in bivalve carapace
Five or six pairs of legs

Features of Family Daphnidae

Female with small antennules that are attached to the ventral side of the head and are often rudimentary (A)
Ventral ramus of second antenna 3-jointed (B); dorsal ramus 4-jointed (C)

Features of Genus *Daphnia*

Valves with shell spine (D)
Rostrum present (E)

Features of Species *parvula*

Head broadly rounded at anterior margin (F); sometimes with a small crest that is longest at the midline
Shell spine less than ¼ length of valves (D)
Ocellus absent

Where Recorded at Old Woman Creek

On top of sediment in lotus bed; open water

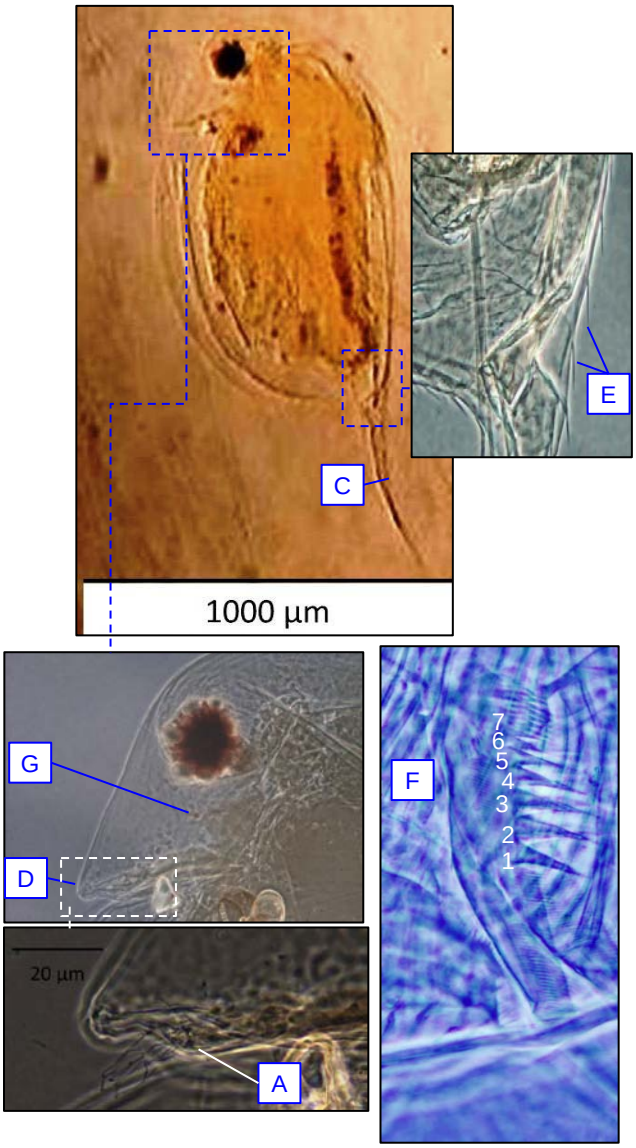
General Ecology

Habit: Swimmers
Functional feeding group: Filter feeders

References: BK&D 24-25, 62; P 386-389; B 604-611; B&D 262-265

Photographs: OWC July 15, 1984 KK. (phase contrast)

Crustacea: Anomopoda: Daphnidae: *Daphnia pulicaria**
Water Flea



Lateral views of *D. pulicaria*

Features of Order Anomopoda
Small, less than 6 mm in length
Body and legs enclosed in bivalve carapace
Five or six pairs of legs

Features of Family Daphnidae
Female with small antennules that are attached to the ventral side of the head and are often rudimentary (A)
Ventral ramus of second antenna 3-jointed; dorsal ramus 4-jointed (B)

Features of Genus *Daphnia*
Valves with shell spine (C)
Rostrum present (D)

Features of Species *pulicaria*
Large spinules on dorsal side of body, with distance between them being no more than 1½ times their length (E)
Five to seven middle pecten on postabdominal claw (F)
Ocellus present (G)

Where Recorded at Old Woman Creek
Planktonic habitats

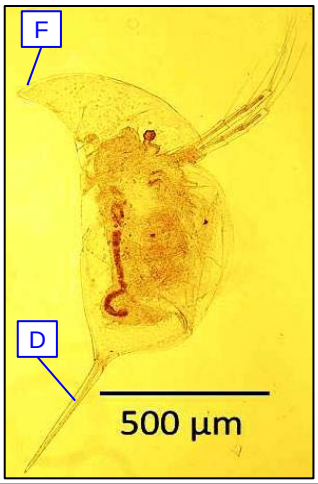
General Ecology
Habit: Swimmers
Functional feeding group: Filter feeders

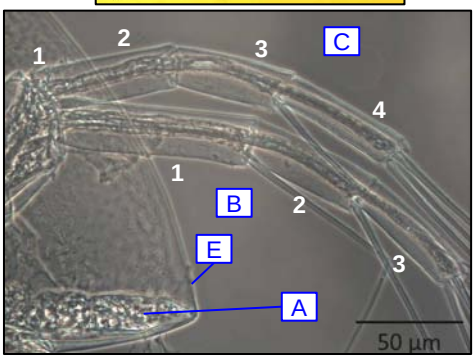
References: BK&D 24-25, 62; P 386-389; B 604-615; B&D 280-285

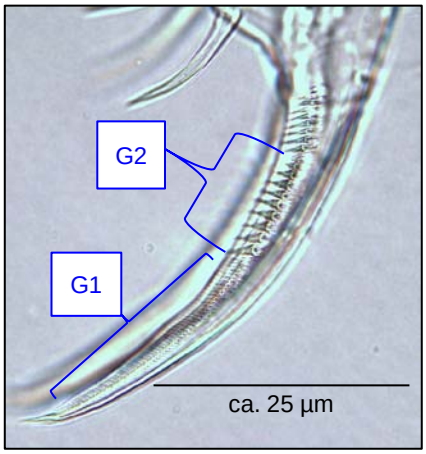
Photographs: Lake Erie at OWC station L June 8, 1984 KK. (phase contrast used except on image of entire specimen image)
Lake Erie at OWC station L August 28 1984 KK. (phase contrast)

*The single known specimen was originally identified as *Daphnia catawba* and listed as such in Old Woman Creek reports. However, we re-identified the specimen as *Daphnia pulicaria*.

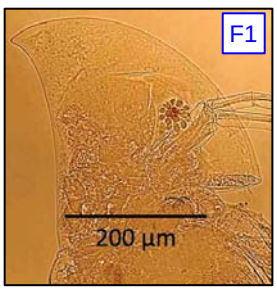
Crustacea: Anomopoda: Daphnidae: *Daphnia retrocurva* Water Flea

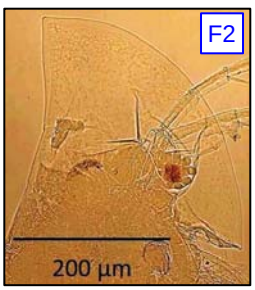






Lateral views of *D. retrocurva*





Features of Order Anomopoda

Small, less than 6 mm in length
Body and legs enclosed in bivalve carapace
Five or six pairs of legs

Features of Family Daphnidae

Female with small antennules that are attached to the ventral side of the head and are often rudimentary (A)
Ventral ramus of second antenna 3-jointed (B); dorsal ramus 4-jointed (C)

Features of Genus *Daphnia*

Valves with shell spine (D)
Rostrum present (E)

Features of Species *retrocurva*

Apex of helmet dorsal to mid-line (F) (Note variation in helmet shape in F1 and F2 on lower images.)
Shell spine at least 1/3 length of valves (D)
Teeth of distal pecten (G1) of postabdominal claw at least ½ length of middle pecten (G2)
Ocellus absent

Where Recorded at Old Woman Creek

On top of sediment in open water and lotus bed

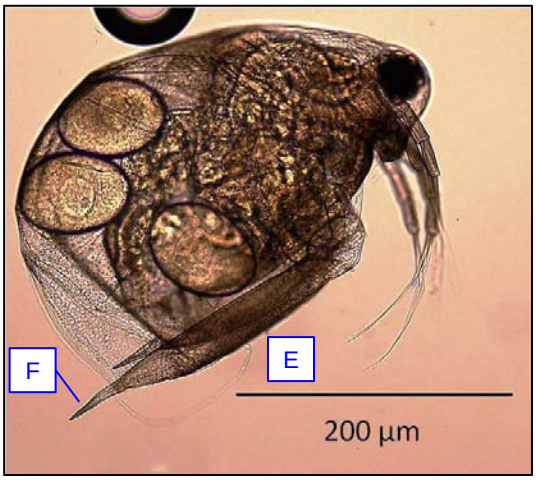
General Ecology

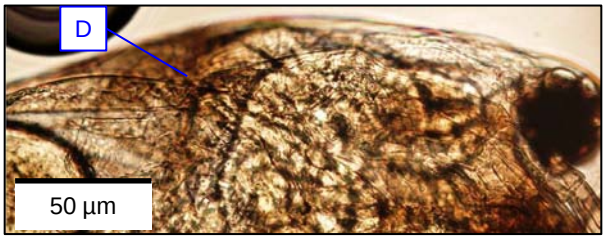
Habit: Swimmers
Functional feeding group: Filter feeders

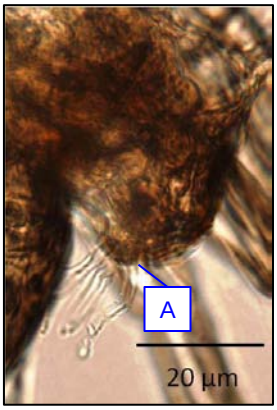
References: BK&D 24-25, 62; P 386-389; B 604-611; B&D 293-297

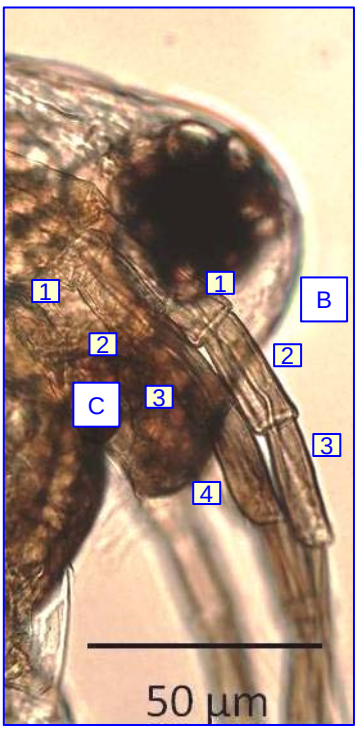
Photographs: Lake Erie CE97 June 21, 1978 TK. (phase contrast; all images but top image)(all images of different specimens)

Crustacea: Anomopoda: Daphnidae: *Scapholeberis kingi* (= *Scapholeberis mucronata**) Water Flea









Lateral views of *S. kingi*

Features of Order Anomopoda
Small, less than 6 mm in length
Body and legs enclosed in bivalve carapace
Five or six pairs of legs

Features of Family Daphnidae
Female with small antennules that are attached to the ventral side of the head and are often rudimentary (A)
Ventral ramus of second antenna 3-jointed (B); dorsal ramus 4-jointed (C)

Features of Genus *Scapholeberis*
Cervical sinus present (D)
Valves nearly rectangular; straight ventral margin (E)

Features of Species *kingi*
Large spine at posterior end of ventral margin of valves (F)

Where Recorded at Old Woman Creek
Flooded creek channel at lake level, swamp forest, swamp pond, submerged grass, open water

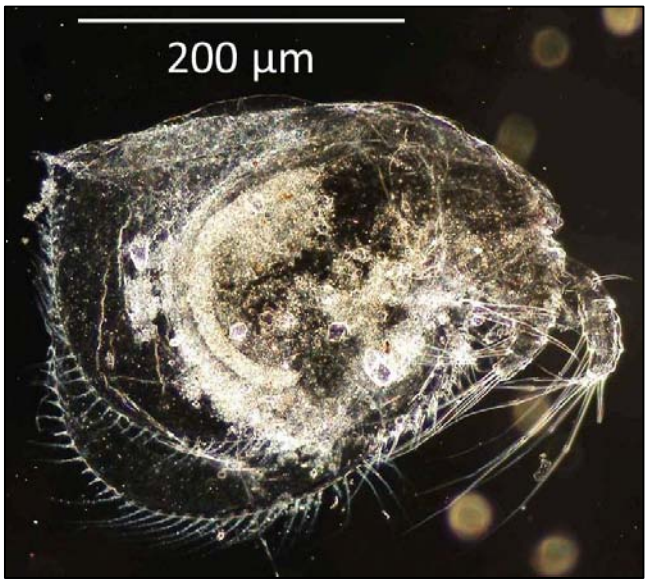
General Ecology
Habit: Swimmer
Functional feeding group: Filter feeders

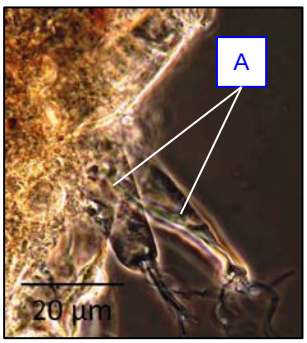
References: BK&D 24-34, 62, 111; P 386-393; B 604-616

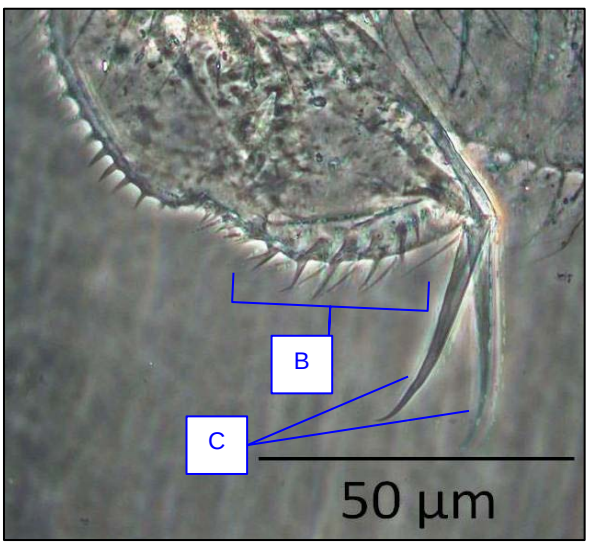
Photographs: OWC Zooplankton Lotus Bed B 20111011 JAB

* According to BK&D, *Scapholeberis mucronata* is no longer recognized. The species is now known as *Scapholeberis kingi*.

Crustacea: Anomopoda: Macrothricidae: *Ilyocryptus sordidus* Water Flea







Lateral views of *I. sordidus* (separate specimens)

Features of Order Anomopoda
Small, less than 6 mm in length
Body and legs enclosed in bivalve carapace
Five or six pairs of legs

Features of Family Macrothricidae
Female antennules freely movable and almost as long as head (A)

Features of Genus *Ilyocryptus*
Many long spines on postabdomen (B)

Features of Species *sordidus*
Postabdominal claws curved smoothly (not bent) (C)
At least eight pre-anal spines on postabdomen (B)

Where Recorded at Old Woman Creek
On top of sediment in open water and lotus bed; on top of sediment in drowned OWC channel at upper end of wetland; on top of sediment in upstream creek channel, landward side of barrier beach

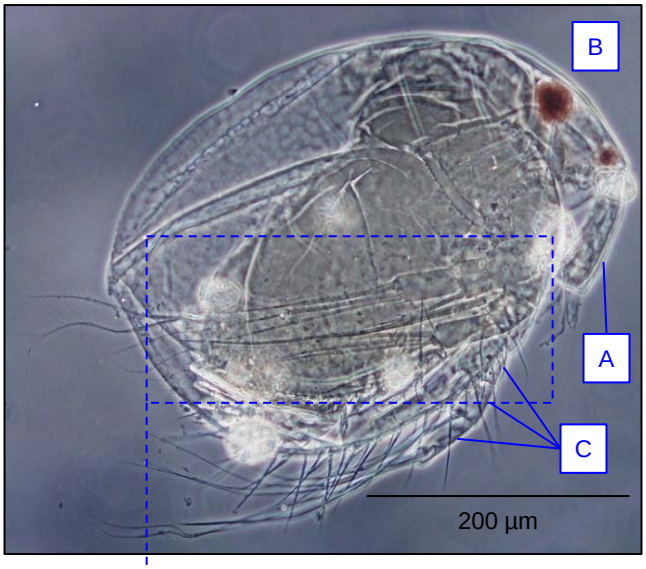
General Ecology
Habit: Crawlers and climbers
Functional feeding group: Collectors/gatherers

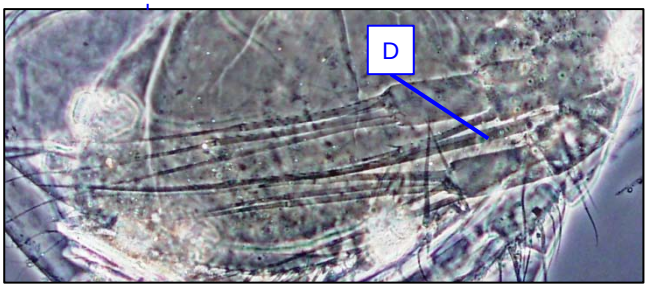
References: BK&D 24-25; P 386-404; B 593, 595, 598-604

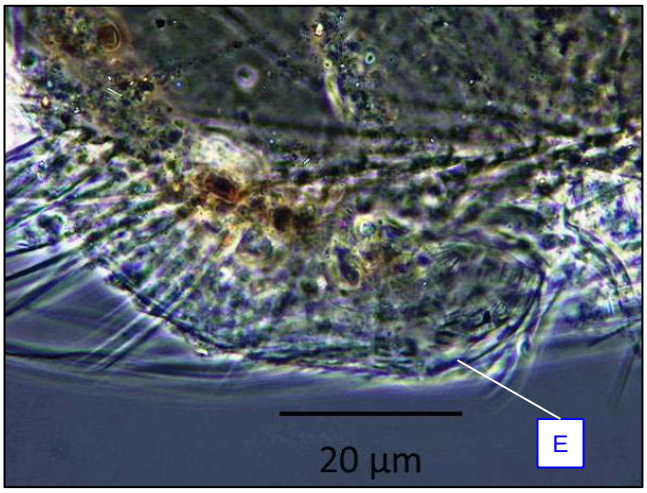
Photographs: Lake Erie at Old Woman Creek Station A Erie, Co. Ohio May 25, 1984 (bottom image; phase contrast and composite photo)

Metzger Marsh MM11 B October 5, 1994 (top two images; top image is dark field and middle image is phase contrast)

Crustacea: Anomopoda: Macrothricidae:
Macrothrix laticornis
Water Flea







Lateral views of *M. laticornis*

Features of Order Anomopoda
Small, less than 6 mm in length
Body and legs enclosed in bivalve carapace
Five or six pairs of legs

Features of Family Macrothricidae
Female antennules freely movable and almost as long as head (A) (only one antennule visible)

Features of Genus *Macrothrix*
Head evenly rounded at dorsal margin (B)
Three-jointed lower ramus of second antenna (C) with a stiff and stout basal seta (D)

Features of Species *laticornis*
Head extended; rostrum not near valve margin (B)
Postabdomen not bilobed (E)

Where Recorded at Old Woman Creek
On top of sediment in open water, lotus bed, and sedge meadow

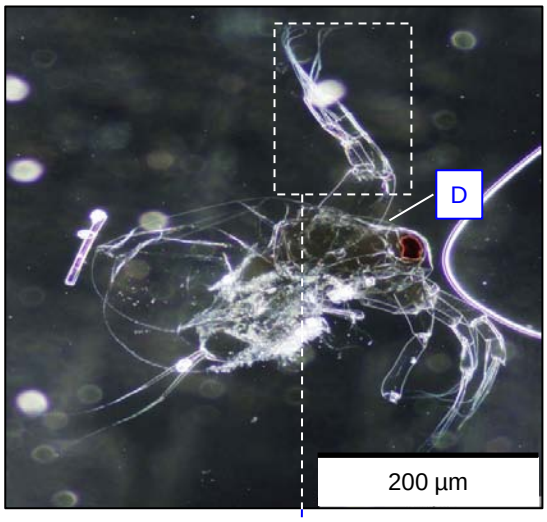
General Ecology
Habit: Crawlers and climbers
Functional feeding group: Collectors/gatherers

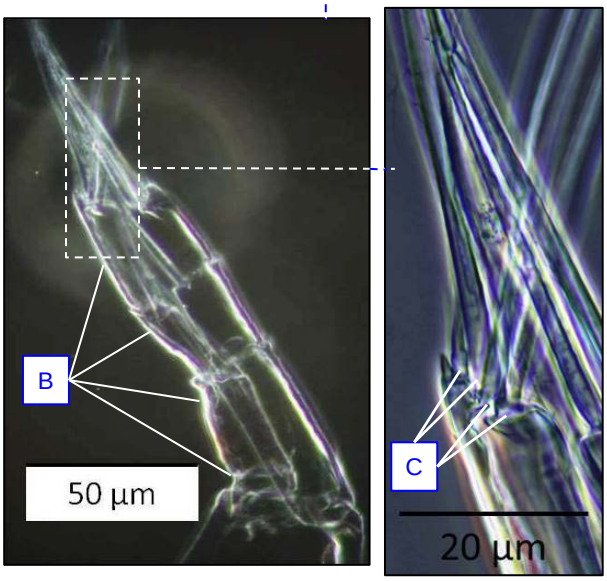
References: BK&D 24-32; P 386-398; B 593, 595, 629-633

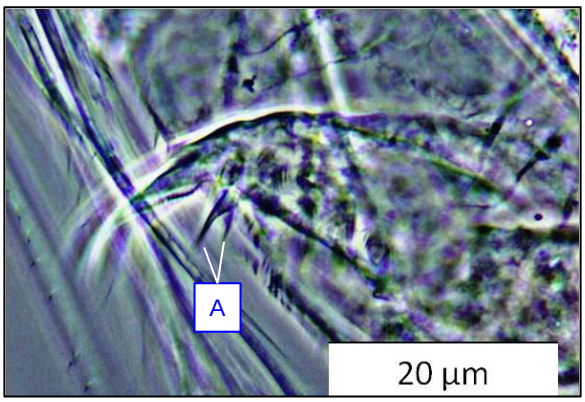
Photographs: OWC Estuary station A November 18, 1983 KK. (phase contrast)

OWC Station D 831118 KK (phase contrast)

Crustacea: Anomopoda: Moinidae:
Moina micrura
Water Flea







Lateral view of *M. micrura*

Features of Order Anomopoda
Small, less than 6 mm in length
Body and legs enclosed in bivalve carapace
Five or six pairs of legs

Features of Family Moinidae
Length of antennule similar to width of head
Posterior angle of the postabdomen usually contains a tooth with two points (A)

Features of Genus *Moina*
Four segments on the ventral branch of second antenna (B) with four terminal filaments (C)
Ocellus absent (from North American species)

Features of Species *micrura*
Head narrowed
Distinct supraocular depression found on head (D)

Where Recorded at Old Woman Creek
On top of sediment in open water and lotus bed; open water

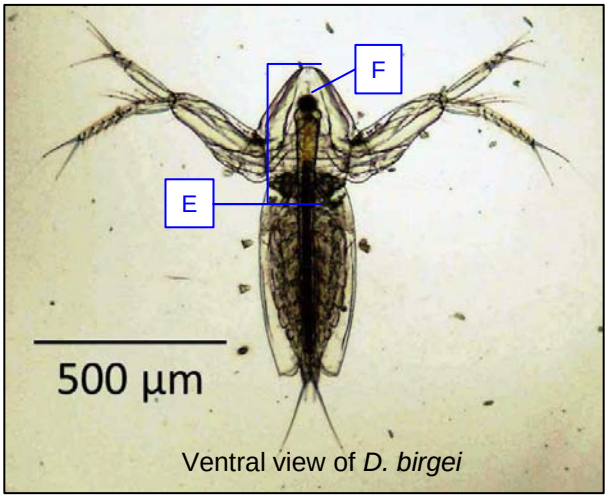
General Ecology
Habit: Swimmers
Functional feeding group: Filter feeders

References: D&F 883-885, P 394

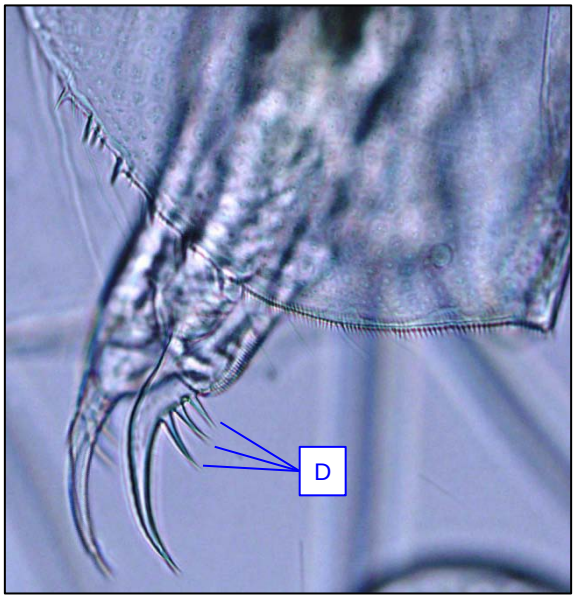
Photographs: OWC Station D June 22, 1984 (top three images; dark field and phase contrast)

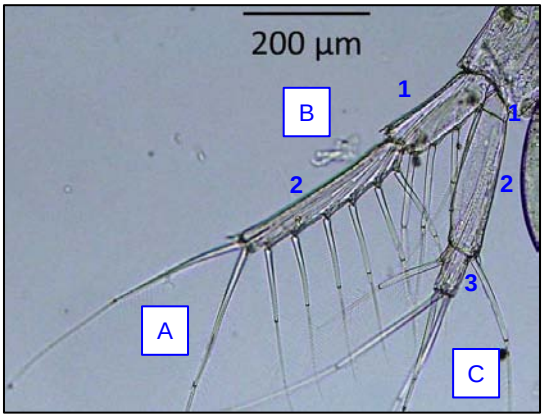
OWC Station A September 14, 1984 (bottom image; phase contrast)

Crustacea: Ctenopoda: Sididae: *Diaphanosoma birgei* Water Flea



Ventral view of *D. birgei*





Lateral views of *D. birgei*

Features of Order Ctenopoda
Small, less than 6 mm in length
Body and legs enclosed in bivalve carapace
Six pairs of legs, all similar except most posterior, all flattened

Features of Family Sididae
>10 setae in a row along one side of the dorsal branch of second antennae (A)

Features of Genus *Diaphanosoma*
Dorsal branch of second antenna 2-segmented (B)
Ventral branch of second antenna 3-segmented (C)
Postabdominal claws with three basal spines (D)

Features of Species *birgei*
Head approximately two-thirds of valve length (E)
Eye in the middle of head close to the ventral margin (F)

Where Recorded at Old Woman Creek
Open water

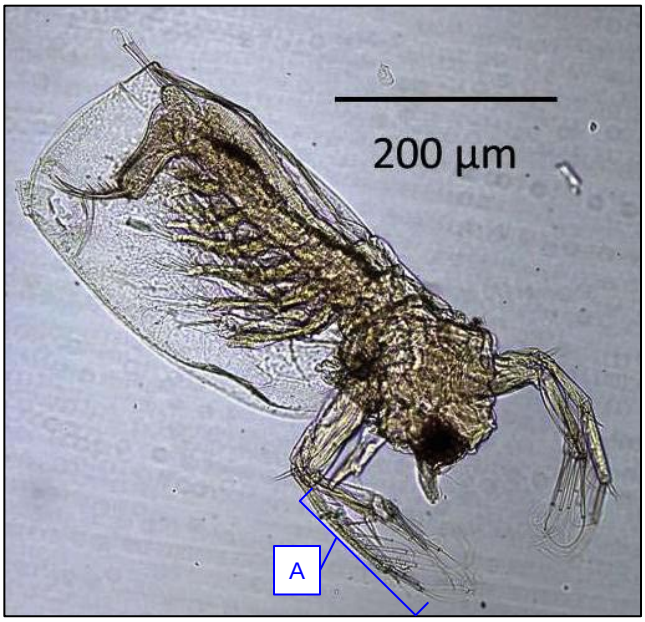
General Ecology
Habit: Swimmers
Functional feeding group: Filter feeders

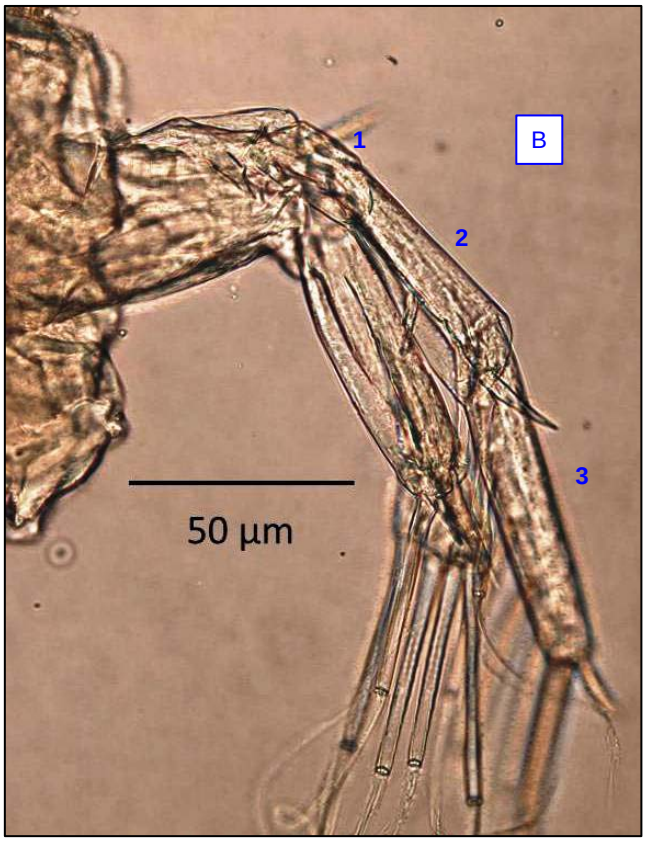
References: BK&D 24-27, 56; P 386; B 598-601

Photographs: Plankton Lake Mohawk 20120628 JAB

Zooplankton V. Tow Lake Erie LV61 October 8, 1978 Lorain (lower image; phase contrast)

Crustacea: Ctenopoda: Sididae: *Sida crystallina* Water Flea





Ventrolateral views of *S. crystallina*

Features of Order Ctenopoda
Small, less than 6 mm in length
Body and legs enclosed in bivalve carapace
Six pairs of legs, all similar except most posterior, all flattened

Features of Family Sididae
>10 setae in a row along one side of the dorsal branch of second antennae (A) (not all visible in image)

Features of Genus Sida
3-segmented dorsal ramus (one known species) (B)

Features of Species *crystallina*
Same as genus

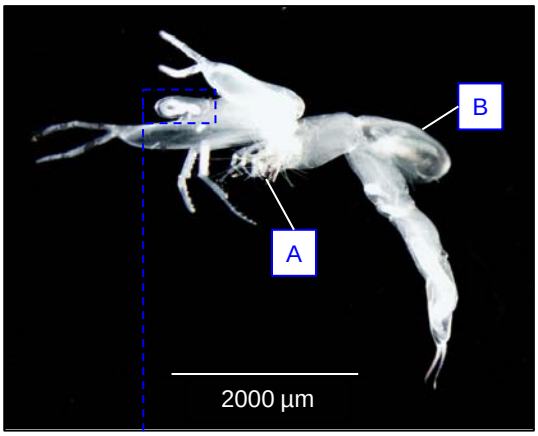
Where Recorded at Old Woman Creek
Planktonic habitats

General Ecology
Habit: Swimmers
Functional feeding group: Filter feeders

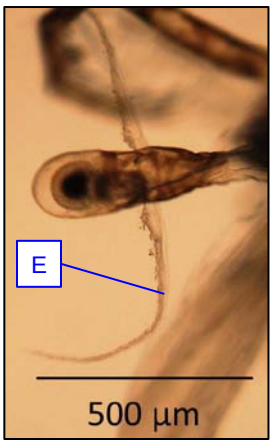
References: B 599; BK&D 28, 110; P 386

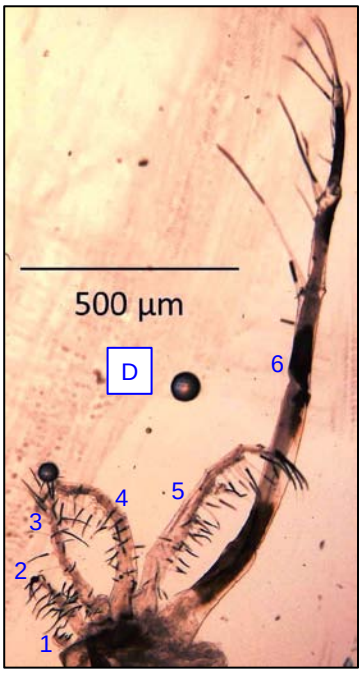
Photographs: Lake Erie near mouth of OWC Zooplankton Oct. 11, 2011 JAB

Crustacea: Haplopoda: Leptodoridae: *Leptodora kindti* Large Water Flea



Lateral views of *L. kindti*





Ventral views of *L. kindti*

Features of Order Haplopoda
Large (7-18 mm)
Body and legs not covered by bivalve carapace (A)
Carapace reduced to a small brood sac (B)
Legs not flattened, with cylindrical joints

Features of Family Leptodoridae
Same as order features

Features of Genus *Leptodora*
Head cylindrical (C)
Head height less than half of length (C)

Features of Species *kindti*
Body slender and long
Head height at least twice the width of eye
Six pairs of legs (D) (one set of six shown)
Up to 18 mm long
Male with elongate antennules (E)

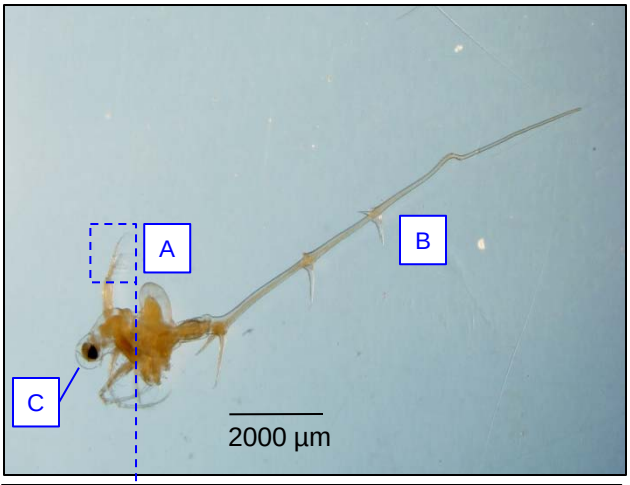
Where Recorded at Old Woman Creek
Wave zone of Lake Erie near OWC

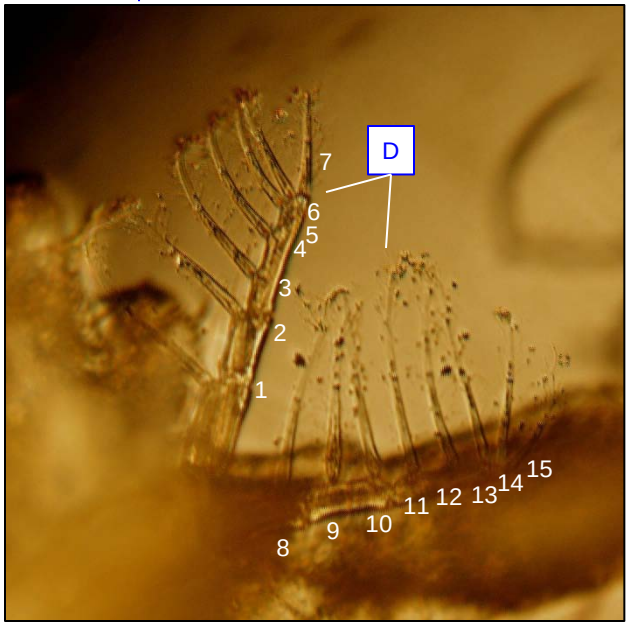
General Ecology
Habit: Swimmers
Functional feeding group: Predators

References: BK&D 24-25; D&F 889; P 372, 386, 406; B 598

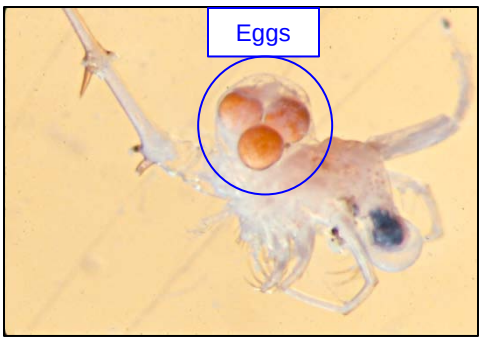
Photographs: Lake Erie IV July 17, 2009 KK (top images; dark field and female) (bottom images; male)

Crustacea: Onychopoda: Cercopagidae: *Bythotrephes longimanus* (= *Bythotrephes cederstroemi*) Spiny Water Flea





Lateral views of *B. longimanus*



B. longimanus with eggs

Features of Order Onychopoda
Four pairs of jointed appendages (legs) with sub-cylindrical joints

Features of Family Cercopagidae
Body not covered by a carapace (A)
Body (A) shorter than abdominal process (B)
Head not cylindrical (C)

Features of Genus *Bythotrephes*
Fifteen setae combined on both branches of second antennae (D)

Features of Species *longimanus*
Same as genus (only one species reported in North America)

Where Recorded at Old Woman Creek
Only recorded in nearby Lake Erie pelagic zone

General Ecology
Habit: Swimmers
Functional feeding group: Predators

October 20, 1988 (image with eggs shown)
References: D&F 866, 891

Photographs: Lake Erie KK (top two images)
Lake Erie 93C