



Taxonomic Atlas of the Copepods

**(Class Crustacea: Subclass Copepoda: Orders Calanoida,
Cyclopoida, and Harpacticoida)**

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

by

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Acknowledgments

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Introduction

Both the formal 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 Lake Erie in Ohio. This chapter provides a detailed pictorial record of a group of aquatic invertebrate animals called copepods.

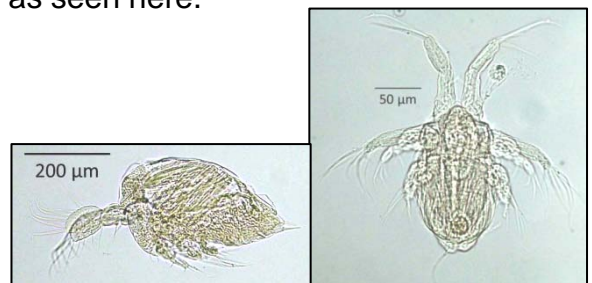
Invertebrates occur in great abundance in freshwater ecosystems, including Great Lakes wetlands such as the marshes, swamps and open water that make up OWC. A few of those invertebrates, such as freshwater mussels, grass shrimps, and giant water bugs, are easy to see because of their large size. Many freshwater invertebrates, however, including the copepods, are so small that special attention must be given to collecting – and seeing – them. Thus, most invertebrates go unnoticed by casual visitors to aquatic habitats. Furthermore, once collected, the ability to distinguish one species of copepod from another requires careful observation through a compound microscope.

Copepods, in the subclass Copepoda of the class Crustacea, are present in a wide variety of freshwater habitats with slow or no water currents, especially lakes, ponds and wetlands. Foods of copepods include detritus, bacteria, phytoplankton and other small animals, depending on the species and life stage. Copepods themselves are very important

as food for many species of larval and juvenile fishes as well as the adults of zooplanktivorous fishes. A relatively few kinds of copepods are ectoparasites of fishes rather than free-living, and those are not considered here. An extensive description of the classification, morphology, life history, and ecology of copepods is provided by Williamson and Reid (2010; see citations on page 6). This atlas presents detailed photographs of critical diagnostic features that permit the correct identification to species of most free-living copepods found at OWC.

Characteristics of Copepods

Every copepod begins its life as an egg, which is carried by the female in one or two egg sacs (see below). Following sexual reproduction, the fertilized egg (zygote) develops within the egg sac into an embryo, which hatches as a **nauplius** (pl: nauplii) larva. The nauplius bears little resemblance to an adult copepod, as seen here.

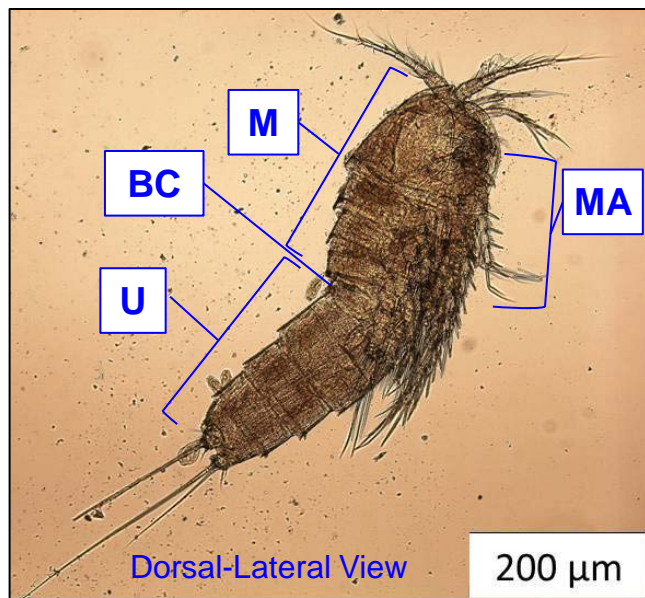


Copepod nauplii: lateral view (left) and dorsal view (right)

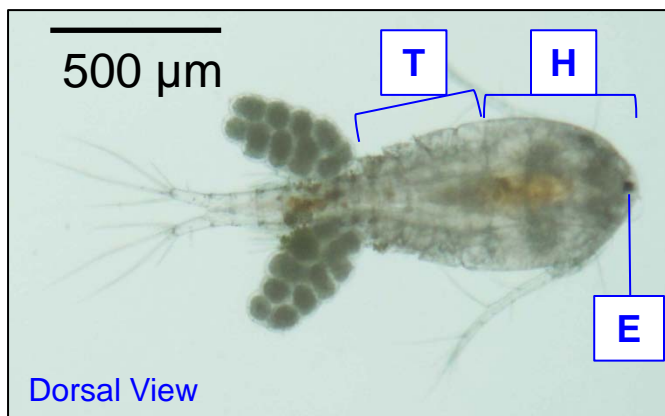
The nauplius molts five times (six naupliar stages), each time adding new appendages and adding more segments to existing appendages. Upon the sixth molt, the nauplius is transformed into a **copepodid** juvenile, which resembles an adult. The copepodid molts five times (six stages), becoming a copepodid adult (male or female) upon the final molt.

General features of a adult copepods are shown on this and the next page. The body of a copepod is elongate, cylindrical, and clearly segmented. In most copepods, the body is divided by a distinct articulation into two regions: the **metasome (M)** and the **urosome (U)**. Cyclopoid and harpacticoid copepods have a **body constriction (BC)**, or articulation, between the thoracic segments containing the fourth and fifth pairs of legs. However, calanoid copepods have a body constriction between the metasome and urosome. In the calanoids and cyclopoids the segments following the body constriction are distinctly narrower than the preceding segments. All body segments of harpacticoids are similar in size.

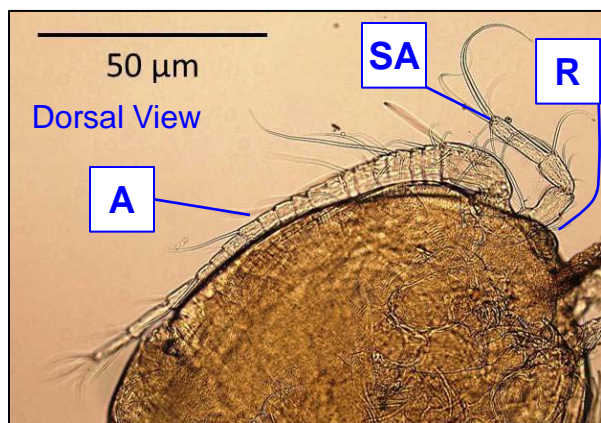
The metasome is separated into the **head (H)** and **thorax (T)** regions. The first segment of the thorax is often fused with the head forming the cephalic region. Head structures include the **first antennae (or antennules) (A)**, **second antennae (SA)**, **rostrum (R)**, **eye (E)** and **maxillipeds (mouthparts) (MA)**. The right antennule of adult male calanoids is **geniculate (abruptly bent) (GB)**, whereas both antennules are bent on adult male cyclopoids and harpacticoids. The antennules of all female copepods lack geniculation.



Harpacticoid (*Attheyella illinoisensis*)



Cyclopoid (female with two egg sacs)



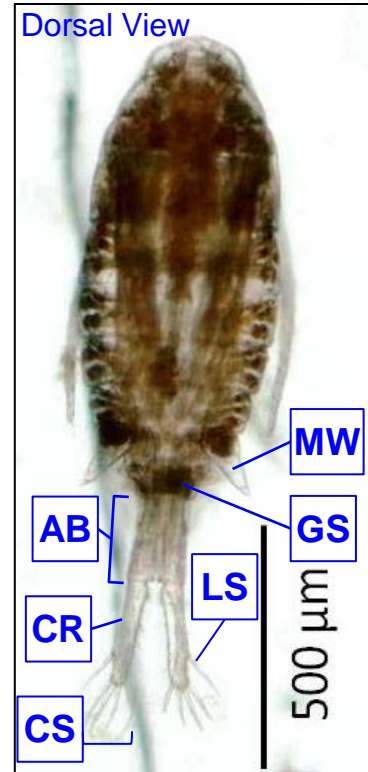
Cyclopoid (female *Macrocyclus albidus*)



Cyclopoid (male *Macrocyclus albidus*)

The thorax contains five segments, each with one of a pair of **swimming legs (SW)**. The first four pairs of swimming legs are typically biramous, consisting of an **endopod (inner branch) (EN)** and **exopod (outer branch) (EX)**. These branches of the swimming legs can have numerous **spines (SP)** and **setae (SE)** on them. The fifth pair of swimming legs is much more varied in structure than the preceding pairs and is often useful for identification purposes. For example, in some male copepods the fifth leg is modified into a hook for grasping the female during reproduction. The last thoracic segment of calanoids may have **metasomal wings (MW)**.

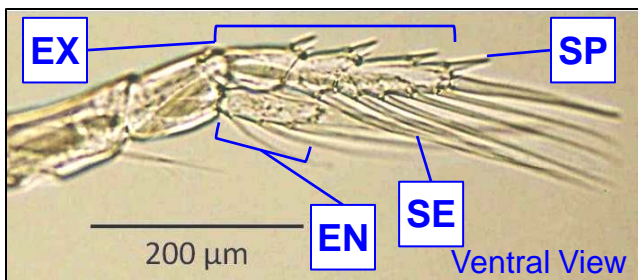
The urosome is separated into the **genital segment (GS)**, **abdomen (AB)**, and a pair of **caudal rami (singular, ramus) (CR)** that possess lateral setae (**LS**) and **caudal setae (CS)**. The genital segment of harpacticoids and cyclopoids may have a pair of vestigial sixth legs. This sixth pair of legs is typically more developed in males. Adult female calanoids and harpacticoids carry one **egg sac (ES)** ventrally on the genital segment, whereas cyclopoids carry two egg sacs ventrally. Adults of both sexes can be found with one or more **spermatophores (S)** on the genital segment, as the spermatophores are passed from the male to the female during reproduction.



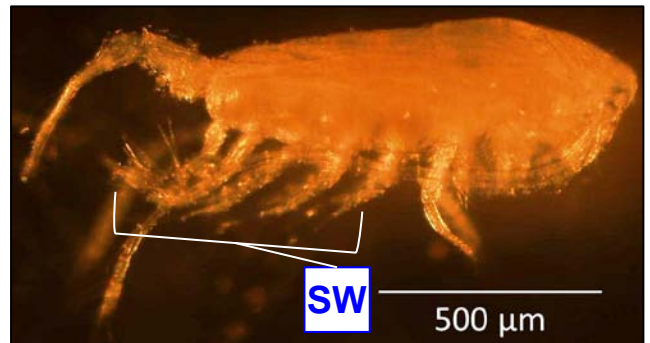
Calanoid (female *Eurytemora affinis*)



Calanoid (female *Leptodiptomus siciloides*)



Calanoid swimming leg (*Epischura lacustris*)



Calanoid

Layout of this Atlas

The following pages are organized alphabetically by order, family, genus and species. Investigators have identified 23 species of copepods in five families (Ameiridae, Canthocamptidae, Cyclopidae, Diaptomidae, Temoridae) within the OWC wetland system and nearby in Lake Erie. **This publication should not be used as the sole source to identify the copepods of OWC** because it is likely that additional families, genera, and species will be found in new collections. The references cited on this page should be used to obtain definitive identifications.

Each species of copepod is illustrated and described on a single page of this atlas. Because the identifying features of each order and the particular family are repeated on each page, the page for each species can be used independently. Each characteristic described is true of both adult males and females unless otherwise stated. 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 **habitat** (such as a swimmer or crawler) and its **functional feeding group** (such as predator)**.

All taxonomic information on each page was derived from a combination of five references, which are abbreviated as shown below followed by the page number(s):

BK&D = Balcer, Mary D., Nancy L. Korda and Stanley 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.

HRLS = Hudson, Patrick L., Janet W. Reid, Lynn T. Lesko, and James H. Selgeby. 1998. *Cyclopid and Harpacticoid Copepods of the Laurentian Great Lakes*. Ohio Biological Survey Bulletin NS 12(2).

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

SM = Suárez-Morales, Eduardo., Marcelo Silva-Briano, and Manuel Elías-Gutiérrez. 2000. Redescription and taxonomic validity of *Leptodiptomus cuauhtemoci* (Osorio-Tafall, 1941) (Copepod, Calanoida), with notes on its known distribution. *Journal of Limnology*, 59(1):5-14.

R&W = Reid, Janet W. and Craig E. Williamson. 2010. Chapter 21. *Copepoda*. In: J. H. Thorp and A. P. Covich (Eds.). *Ecology and Classification of North American Freshwater Invertebrates*. 3rd Ed. Academic Press.

* 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.

** The habit and functional feeding group information is generalized to the Order level for each specimen unless otherwise noted.

Checklist of Species of Free-Living Copepods 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 Calanoida

Family Diaptomidae

Leptodiaptomus ashlandi (Marsh)

Leptodiaptomus minutus (Lilljeborg)

Leptodiaptomus sicilis (S. A. Forbes)

Leptodiaptomus siciloides (Lilljeborg)

Skistodiaptomus oregonensis (Lilljeborg)

Skistodiaptomus pallidus (Herrick)

Family Temoridae

Epischura lacustris S. A. Forbes

Eurytemora affinis (Poppe)

Order Cyclopoida

Family Cyclopidae

Acanthocyclops vernalis sensu lato (Fischer)

(=*Acanthocyclops vernalis-robustus*
group)

Diacyclops cf. navus (Herrick)*

Diacyclops nearcticus Kiefer*

Family Cyclopidae (continued)

Diacyclops thomasi (S.A. Forbes)

Eucyclops agilis (Koch)

Eucyclops elegans (Herrick)

Macrocyclus albidus (Jurine) s.str.

Mesocyclops edax (S. A. Forbes)

Microcyclus varicans rubellus (Lilljeborg)*

Paracyclops poppei (Rehberg)

(= *P. fimbriatus poppei*)*

Tropocyclops prasinus mexicanus Kiefer

Order Harpacticoida

Family Ameiridae

Nitocra hibernica (Brady)*

Family Canthocamptidae

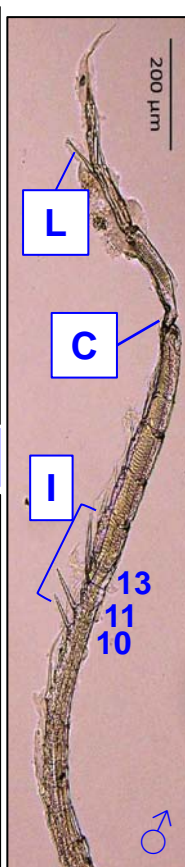
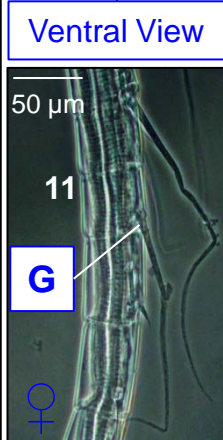
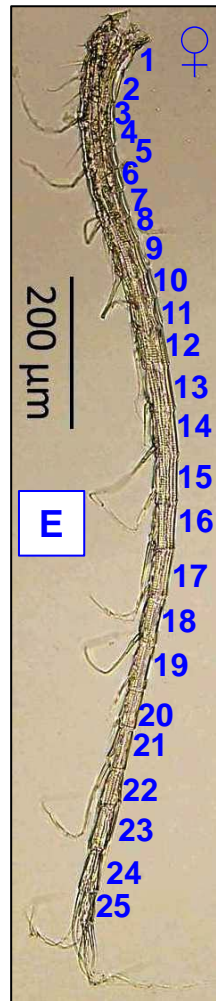
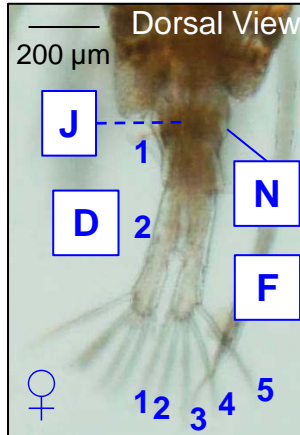
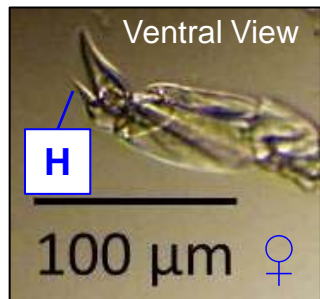
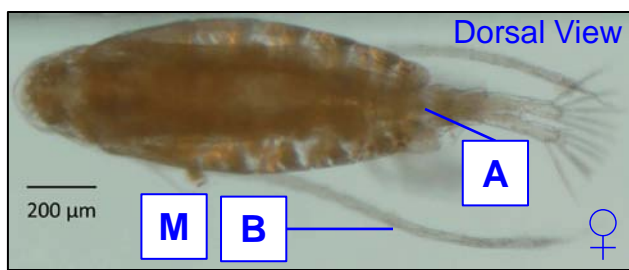
Attheyella (Neomrazekiella) illinoisensis

(S. A. Forbes)

Bryocamptus sp. Chappius, s.l.*

Canthocamptus robertcokeri M. S. Wilson

Crustacea: Copepoda: Calanoida: Diaptomidae: *Leptodiaptomus ashlandi*



Features of Order Calanoida

Distinct narrowing of the body between the genital segment and the segment bearing the fifth legs (A)
Antennules generally reach to or past caudal rami (B)
Right antennule of adult males geniculate (C)
Adult females typically with one egg sac (*not shown*)

Features of Family Diaptomidae

Female urosome 2-4 segmented (D)
Legs 1-4 with 3-segmented rami except leg 1 endopod 2-segmented (*not shown*)
Left antennule of males and both antennules of females typically 25-segmented (E)
Caudal rami terminate in 5 caudal setae of comparatively equal length (F)

Features of Genus *Leptodiaptomus*

One seta on segment 11 of left male and both female antennules (G)
Female terminal segment of exopodite of fifth leg extremely reduced (i.e., a short seta and small spine are present near the spine of exopod 2) (H)
Robust spines on segments 10, 11, and 13 of male right antennule (I)

Features of species *ashlandi*

Metasomal wings of female asymmetrical with left wing longer than right wing (J)
Male right leg 5 with large lateral spine located on the proximal 1/3rd of terminal segment (K)
Right antennule of male with a long slender projection from the antepenultimate segment (L)
Size of 0.90 to 1.4 mm long (M)
Expanded lateral projections lacking from genital segment of females (N)

Where Recorded at Old Woman Creek

Planktonic habitats

General Ecology

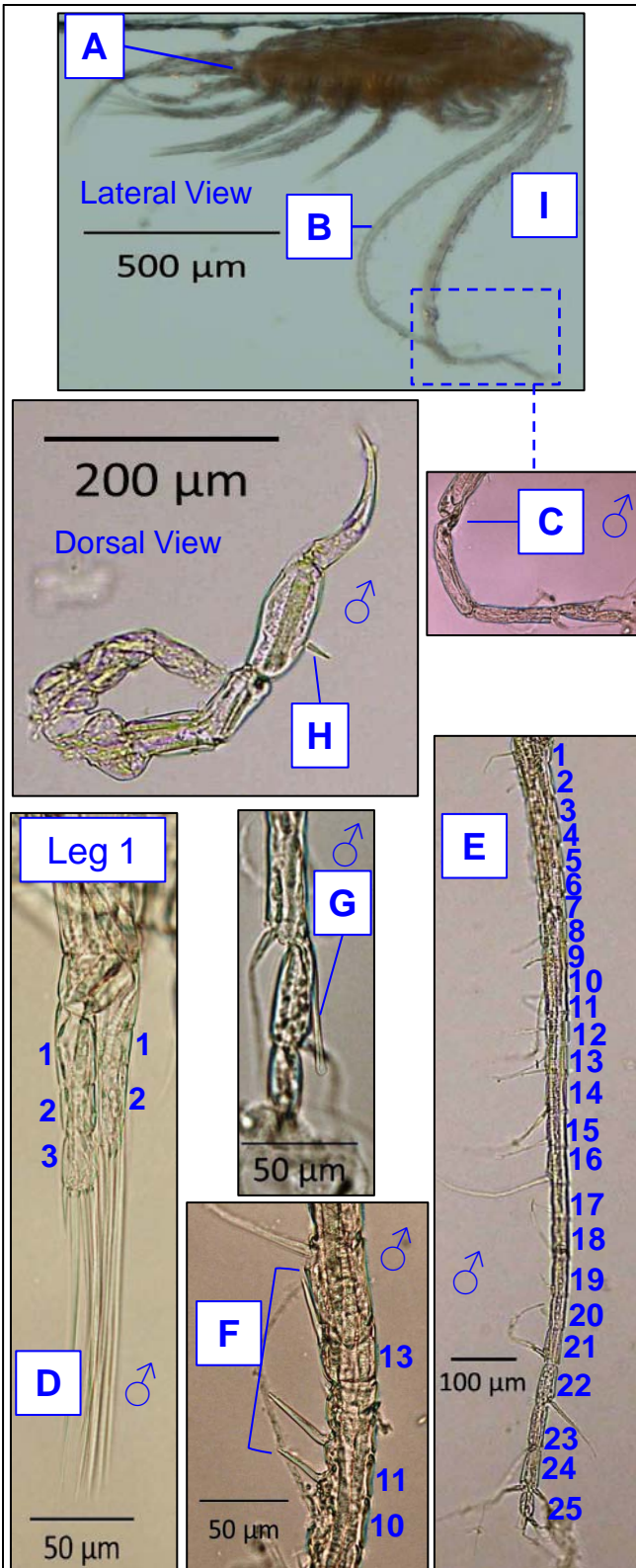
Habit: Swimmers

Functional feeding groups: Omnivores; filter feeders

References: BK&D 41-45, 82-84; P 414; SM 5; R&W 863-865

Photographs: Zooplankton CE 97 780621 CLEVE WQL (composite images: all images)

Crustacea: Copepoda: Calanoida: Diaptomidae: *Leptodiaptomus minutus*



Features of Order Calanoida

Distinct narrowing of the body between the genital segment and the segment bearing the fifth legs (A)
 Antennules generally reach to or past caudal rami (B)
 Right antennule of adult males geniculate (C)
 Adult females typically with one egg sac (not shown)

Features of Family Diaptomidae

Female urosome 2-4 segmented (not shown)
 Legs 1-4 with 3-segmented rami except leg 1 endopod 2-segmented (D)
 Left antennule of males and both antennules of females typically 25-segmented (E)
 Caudal rami terminate in five caudal setae of comparatively equal length (not shown)

Features of Genus *Leptodiaptomus*

One seta on segment 11 of left male and both female antennules (not shown)
 Female terminal segment of exopodite of fifth leg extremely reduced (i.e., a short seta and small spine are present near the spine of exopod two) (not shown)
 Robust spines on segments 10, 11, and 13 of male right antennule (F)

Features of species *minutus*

Metasomal wings of female symmetrical and rounded (not shown)
 Leg five endopods of female greatly reduced (not shown)
 Expanded lateral projections lacking from genital segment of females (not shown)
 Geniculate right antennule of males with a slender projection from the antepenultimate segment (G)
 Exopod of male right fifth leg with a small medial lateral spine (H)
 Size of 0.8 to 1.0 mm long (I)

Where Recorded at Old Woman Creek

Planktonic habitats

General Ecology

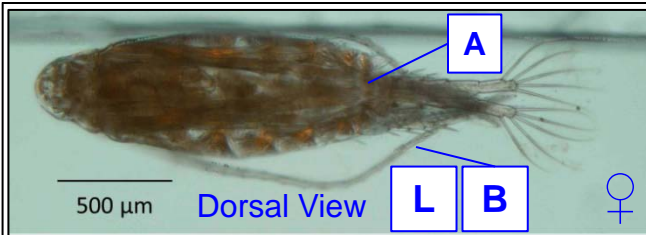
Habit: Swimmers

Functional feeding groups: Omnivores; filter feeders

References: BK&D 41-45, 84-87; P 414; SM 5; R&W 863-865

Photographs: Zooplankton CE 97 780621 CLEVE WQL (composite images: all images)

Crustacea: Copepoda: Calanoida: Diaptomidae: *Leptodiaptomus sicilis*



Features of Order Calanoida

Distinct narrowing of the body between the genital segment and the segment bearing the fifth legs (A)
Antennules generally reach to or past caudal rami (B)
Right antennule of adult males geniculate (*not shown*)
Adult females typically with one egg sac (*not shown*)

Features of Family Diaptomidae

Female urosome 2-4 segmented (C)
Legs 1-4 with 3-segmented rami except leg 1 endopod 2-segmented (D)
Left antennule of males and both antennules of females typically 25-segmented (E)
Caudal rami terminate in five caudal setae of comparatively equal length (F)

Features of Genus *Leptodiaptomus*

One seta on segment 11 of left male and both female antennules (*not shown*)
Female terminal segment of exopodite of fifth leg extremely reduced (i.e. a short seta and small spine are present near the spine of exopod two) (G)
Robust spines on segments 10, 11, and 13 of male right antennule (H)

Features of species *sicilis*

Metasomal wings pointed and triangular (I)
Expanded lateral projections lacking from genital segment of females (J)
Exopod of male right leg five with a large medial lateral spine on terminal segment (K)
Right antennule of male with a long slender projection from the antepenultimate segment (similar to that of *L. ashlandi*) (*not shown*)
Size of 1.0 to 1.9 mm long (L)

Where Recorded at Old Woman Creek

Planktonic habitats

General Ecology

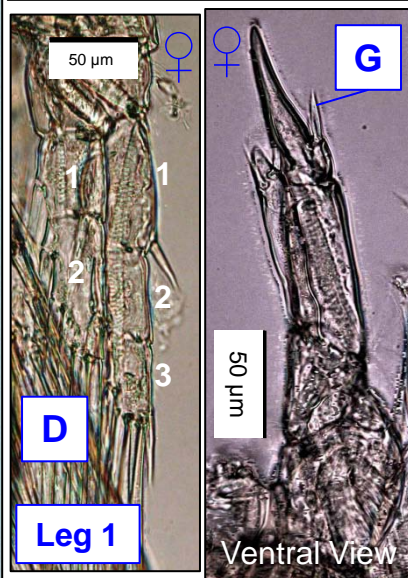
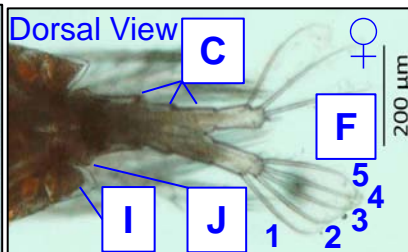
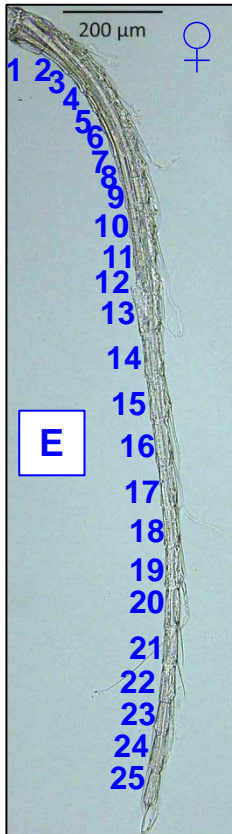
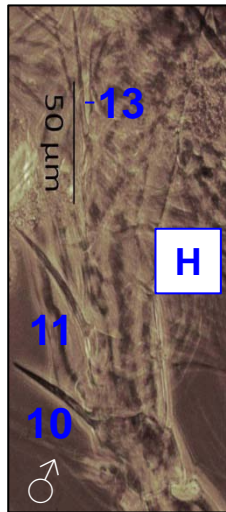
Habit: Swimmers

Functional feeding groups: Omnivores; filter feeders

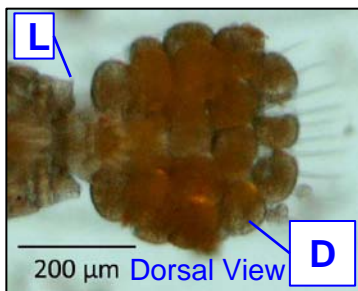
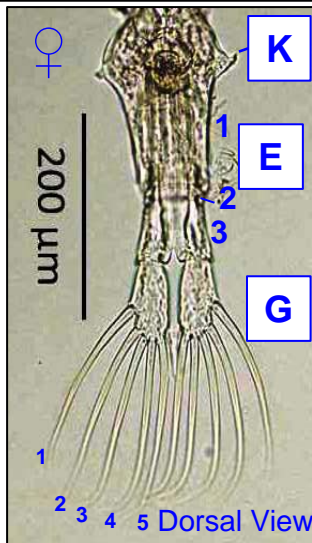
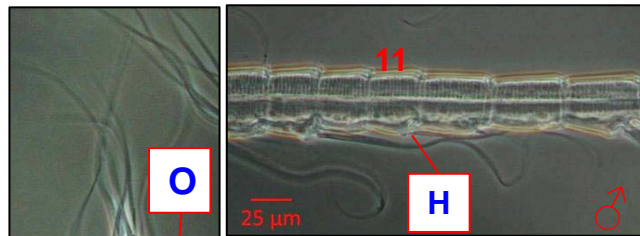
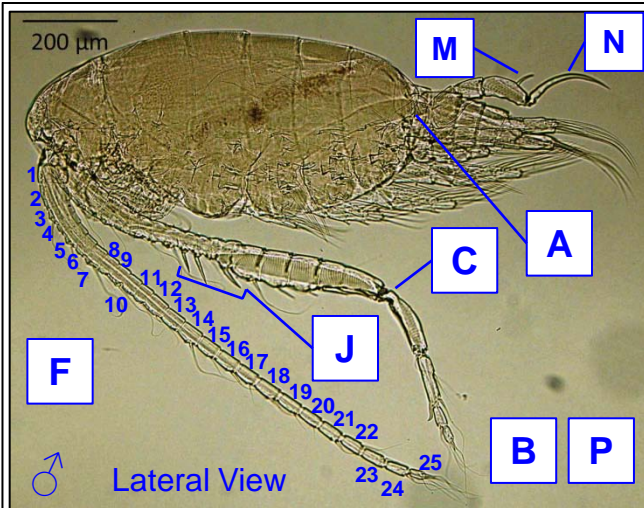
References: BK&D 41-45, 87-89; P 414; SM 5; R&W 863-865

Photographs: Lake Erie at Old Woman Creek, sta. L, Erie Co., Ohio 840427 K. Krieger (male images)

Zooplankton CE 97 780621 CLEVE WQL (female images)(composite images: top image and lower three images of E, D, and G)



Crustacea: Copepoda: Calanoida: Diaptomidae: *Leptodiaptomus siciloides*



Features of Order Calanoida

- Distinct narrowing of the body between the genital segment and the segment bearing the fifth legs (A)
- Antennules generally reach to or past caudal rami (B)
- Right antennule of adult males geniculate (C)
- Adult females typically with one egg sac (D)

Features of Family Diaptomidae

- Female urosome 2-4 segmented (E)
- Legs 1-4 with 3-segmented rami except leg 1 endopod 2-segmented (not shown)
- Left antennule of males and both antennules of females typically 25-segmented (F)
- Caudal rami terminate in five caudal setae of comparatively equal length (G)

Features of Genus Leptodiaptomus

- One seta on segment 11 of left male and both female antennules (H)
- Female terminal segment of exopodite of fifth leg extremely reduced (i.e. a short seta and small spine are present near the spine of exopod two) (I)
- Robust spines on segments 10, 11, and 13 of male right antennule (J)

Features of species siciloides

- Genital segment of female with prominent, pointed lateral wings (K)
- Metasomal wings pointed of female (L)
- 3rd urosomal segment longer than 2nd segment of female (E)
- Right leg 5 exopod of male with a large lateral spine that is medial in position (M)
- Male Right leg five terminal claw smoothly curved (N)
- Right antennule of male with short process on antepenultimate segment (O)
- Size of 1.0 to 1.3 mm long (P)

Where Recorded at Old Woman Creek

Planktonic habitats

General Ecology

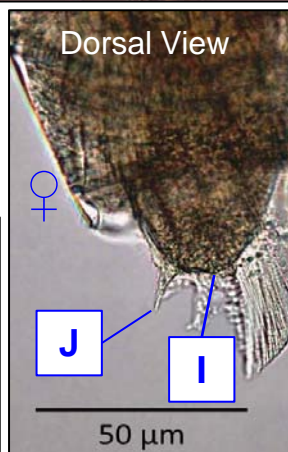
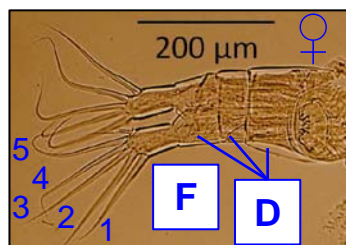
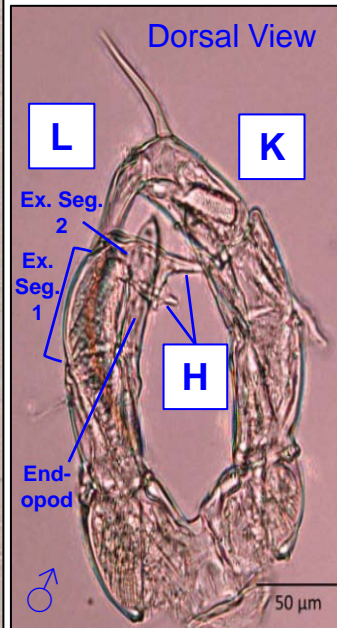
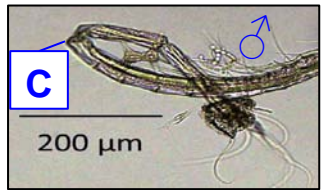
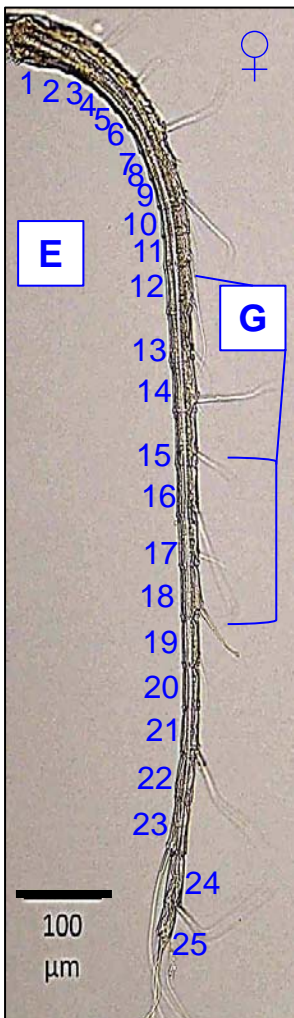
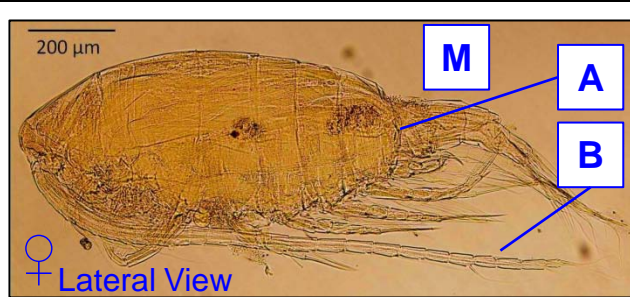
Habit: Swimmers

Functional feeding groups: Omnivores; filter feeders

References: SM 5; R&W 857-859, 863-864; BK&D 90; P 414

Photographs: Zoop-Open-3 12 July 07 (composite image: lower two images) (phase contrast: image O and H)

Crustacea: Copepoda: Calanoida: Diaptomidae: *Skistodiaptomus oregonensis*



Features of Order Calanoida

- Distinct narrowing of the body between the genital segment and the segment bearing the fifth legs (A)
- Antennules generally reach to or past caudal rami (B)
- Right antennule of adult males geniculate (C)
- Adult females typically with one egg sac (not shown)

Features of Family Diaptomidae

- Female urosome 2-4 segmented (D)
- Legs 1-4 3-segmented rami except leg 1 endopod 2-segmented (not shown)
- Left antennule of males and both antennules of females typically 25-segmented (E)
- Caudal rami terminate in five caudal setae of comparatively equal length (F)

Features of Genus *Skistodiaptomus*

- One seta on segments 11 and 15-17 of both female antennules, and left male antennule (G)
- Leg 5 of male terminal segment of exopod with processes differently shaped and one process long, the other short (H)
- Female metasomal wings not reaching level of lateral sensilla (not shown) of genital segment

Features of species *oregonensis*

- Metasomal wings of female rounded on posterior corners (I) with a small sensilla (J)
- Left leg 5 of male reaching to approximately base of apical claw of right leg five (K)
- Segment 2 of male exopod left leg 5, $\frac{1}{2}$ to $\frac{3}{4}$ length of segment 1 of leg 5 (L)
- Size of 0.97 to 1.2 mm long (M)

Where Recorded at Old Woman Creek

Planktonic and benthic habitats

General Ecology

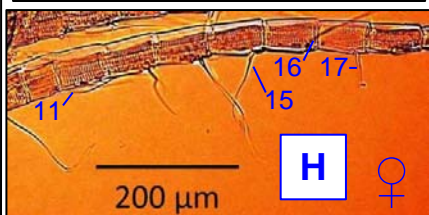
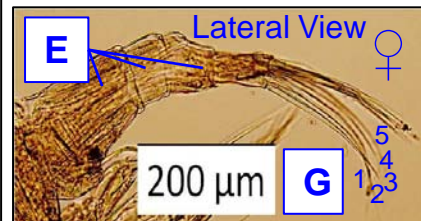
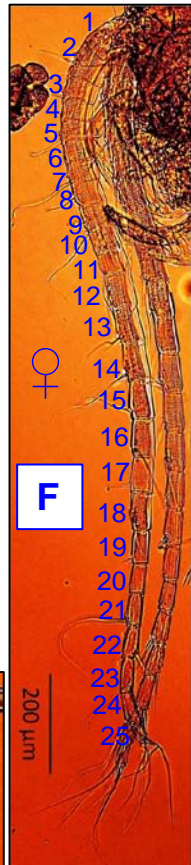
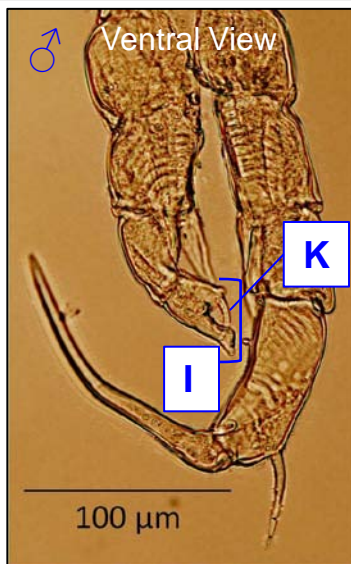
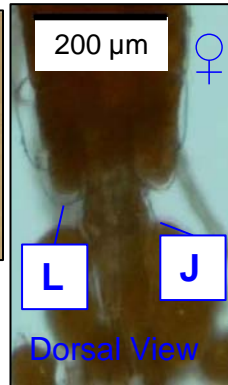
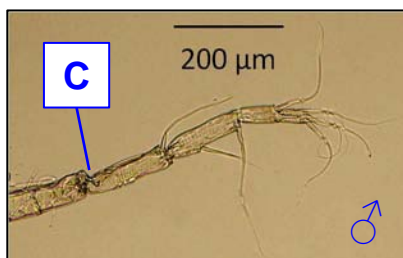
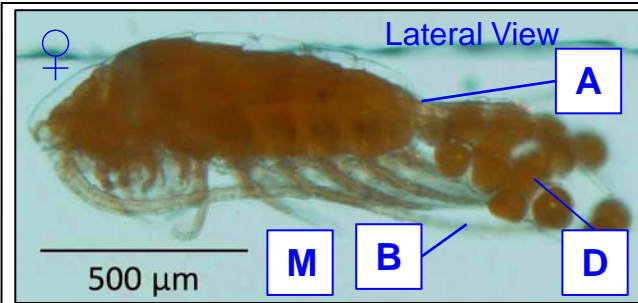
Habit: Swimmers

Functional feeding groups: Omnivores; filter feeders

References: B 782, 792-793; BK&D 42-43, 91-93; P 414, 428; R&W 858

Photographs: LTLA8 = VE4 L. Erie vertical tow 22, August 2006 (multiple specimens used for the images from same location) (composite image: middle right image)

Crustacea: Copepoda: Calanoida: Diaptomidae: *Skistodiaptomus pallidus*



Features of Order Calanoida

Distinct narrowing of the body between the genital segment and the segment bearing the fifth legs (A)
Antennules generally reach to or past caudal rami (B)
Right antennule of adult males geniculate (C)
Adult females typically with one egg sac (D)

Features of Family Diaptomidae

Female urosome 2-4 segmented (E)
Legs 1-4; 3-segmented rami except leg 1 endopod 2-segmented (not shown)
Left antennule of males and both antennules of females typically 25-segmented (F)
Caudal rami terminate in five caudal setae of comparatively equal length (G)

Features of Genus Skistodiaptomus

One seta on segments 11 and 15-17 of both female antennules, and left male antennule (H)
Leg 5 of male terminal segment of exopod with processes differently shaped and one process long, while the other is shorter (I)
Female metasomal wings not reaching level of lateral sensilla (J) of genital segment

Features of species pallidus

Left fifth leg, exopod 2 inner process long and tapered in males (K)
Female metasomal wings rounded (L)
Size of 0.7 to 1.2 mm long (M)

Where Recorded at Old Woman Creek

Planktonic and benthic habitats; sediment of open water and lotus bed

General Ecology

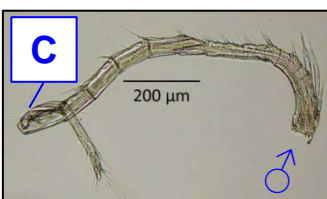
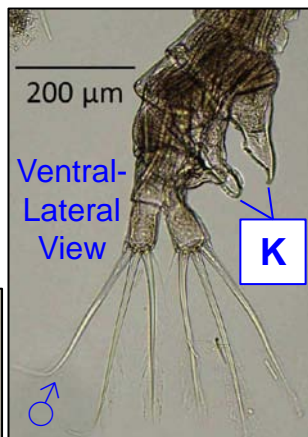
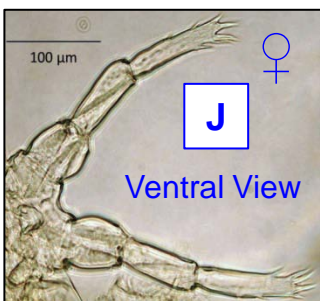
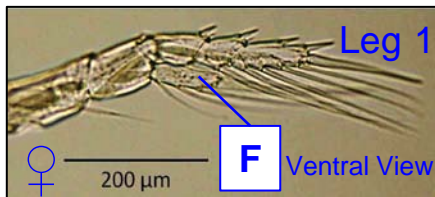
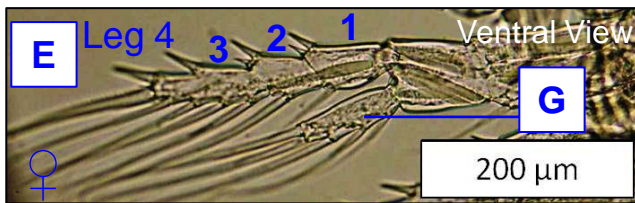
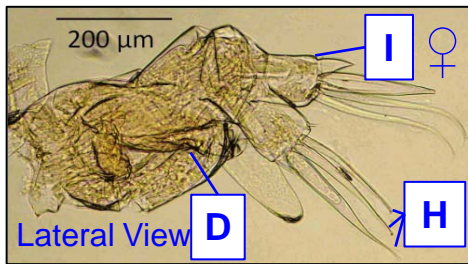
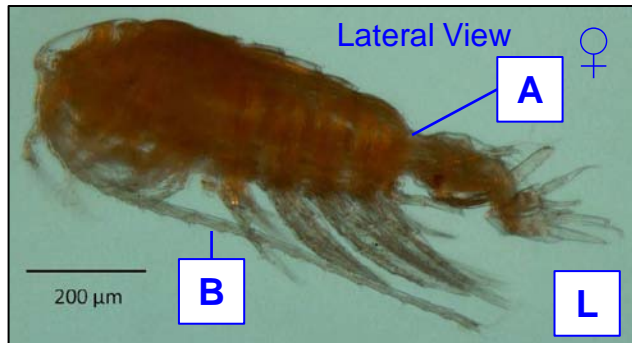
Habit: Swimmers

Functional feeding groups: Omnivores; filter feeders

References: BK&D 38-43, 115; P 414; R&W 865-866;

Photographs: Lake Mohawk 4-22-08 JB: collected by Josh Bierbaugh (composite image: middle left image)

Crustacea: Copepoda: Calanoida: Temoridae: *Epischura lacustris*



Features of Order Calanoida

Distinct narrowing of the body between the genital segment and the segment bearing the fifth legs (A)
Antennules generally reach to or past caudal rami (B)
Right antennule of adult males geniculate (C)
Adult females typically with one egg sac (not shown)

Features of Family Temoridae

Female with 3-segmented urosome (D) (twisted in image therefore segments not easily distinguished)
Antennules of females and left antennule of males 24-25 segmented (B)
Legs 1-4; 3-segmented exopods (E)
Leg 1 endopod 1-segmented (F) while legs 2-4 endopods of 1 or 2 segments (G)
Caudal rami with less than 5 caudal setae (H)

Features of Genus Epischura

Outer setae of caudal rami shorter than rami, and/or spiniform (I)
No long apical spine on last segment of female leg 5 (J) or left leg 5 of males

Features of species lacustris

Three broad terminal setae on caudal rami (H)
Twisted urosome of females (D) with short, thick spines on the outer corners of caudal rami (I)
Right side of male urosome with enlarged lateral process (K)
Size of 1.4 to 2.0 mm long (L)

Where Recorded at Old Woman Creek

Planktonic and benthic habitats

General Ecology

Habit: Swimmers

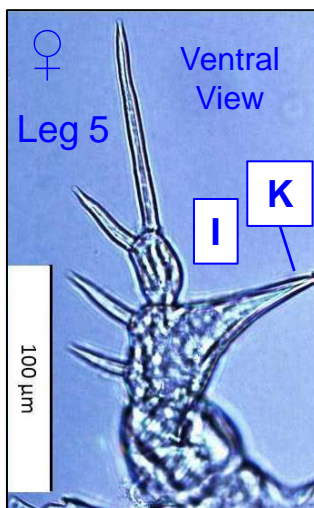
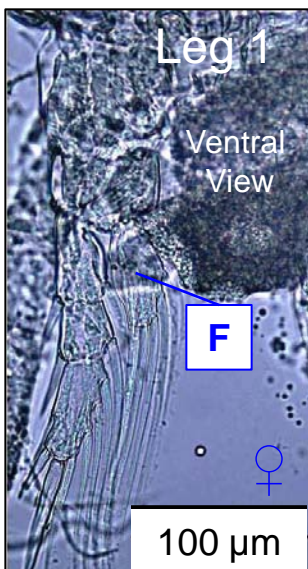
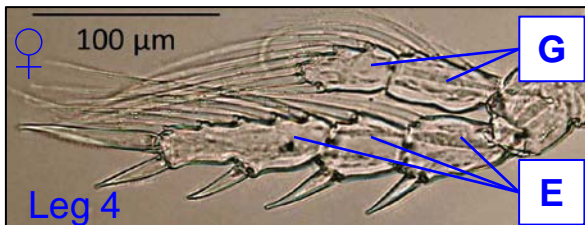
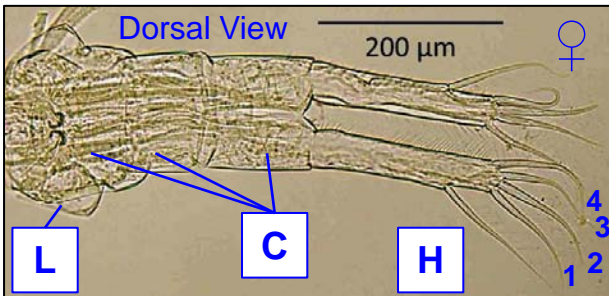
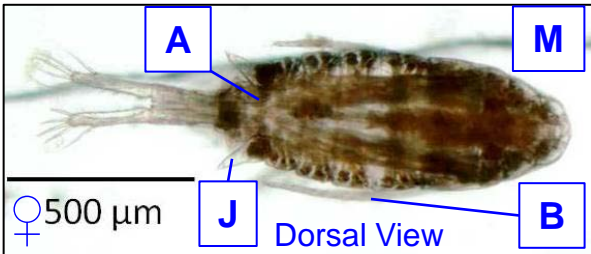
Functional feeding groups: Omnivores; filter feeders

References: BK&D 41, 78; P 414; R&W 867

Photographs: Zooplankton CW 82 78 10 11 R CLEVE (images of females)

LTLA8=VE4 L. Erie vertical tow 22 August 2006 (images of males)

Crustacea: Copepoda: Calanoida: Temoridae: *Eurytemora affinis*



Features of Order Calanoida

Distinct narrowing of the body between the genital segment and the segment bearing the fifth legs (A)
Antennules generally reach to or past caudal rami (B)
(In this genus the antenna does not reach past caudal rami.)

Right antennule of adult males geniculate (*not shown*)
Adult females typically with one egg sac (*not shown*)

Features of Family Temoridae

Female with 3-segmented urosome (C)

Antennules of females and left antennule of males 24-25 segmented (D)

Legs 1-4; 3-segmented exopods (E)

Leg 1 endopod 1-segmented (F), while legs 2-4 endopods of 1 or 2 segments (G)

Caudal rami with less than 5 caudal setae (H)

Features of Genus *Eurytemora*

Antennules not reaching tips of metasomal wings (B)

No endopods on fifth legs of males or females (I)

Leg 1 endopod one-segmented (F), whereas legs 2-4 endopods two-segmented (G)

Features of species *affinis*

Females with enlarged, pointed metasomal wings (J)

Inner process of exopod 1 of female fifth leg strongly directed backwards (K)

One pair of lateral processes present on genital segment of female (L)

Male fifth legs expanded inwardly forming a triangular shape on the inner margin of the basal second basal segment (*not shown*)

Caudal rami with four caudal setae (H)

Size of 1.0 to 1.5 mm long (M)

Where Recorded at Old Woman Creek

Planktonic habitats

General Ecology

Habit: Swimmers

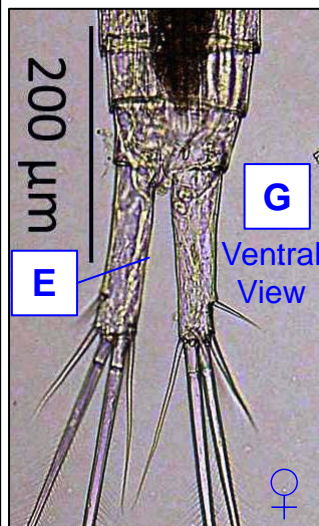
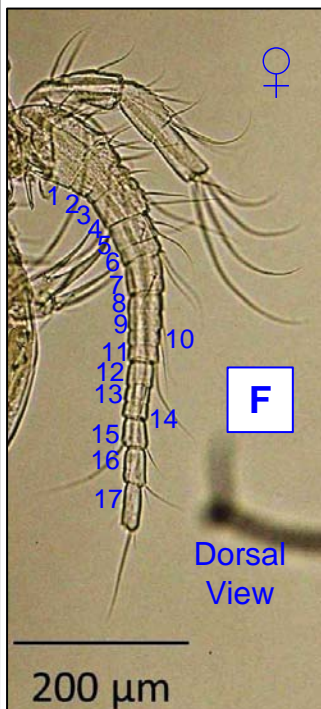
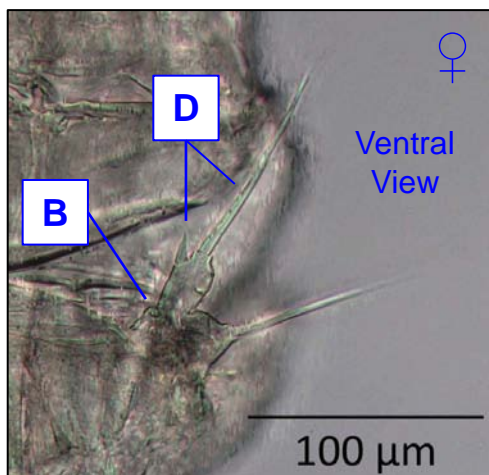
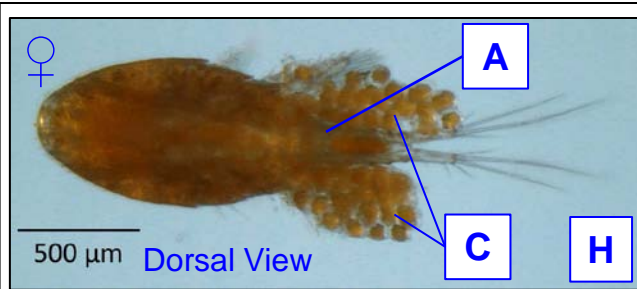
Functional feeding groups: Omnivores; filter feeders

References: P 414, 428; B 752-753; BK&D 40, 80; R&W 867

Photographs: Zooplankton vertical tow L. Erie LV61 781008 S Lorain WQL [bottom images (phase contrast) and second image]

Zooplankton CE 97 780621 CLEVE WQL

Crustacea: Copepoda: Cyclopoida: Cyclopidae: *Acanthocyclops vernalis sensu lata* (= *Acanthocyclops vernalis-robustus* group)



Features of Order Cyclopoida

- Antennules not typically reaching beyond the genital segment (*not shown*)
- Narrowing of body between segments bearing the fourth and fifth pairs of legs (A)
- Fifth leg small and first segment not enlarged on the inside margin (B)
- Both antennules geniculate in adult males (*not shown*)
- Typically adult females carry two egg sacs (C)

Features of Family Cyclopidae

- Mandibular palp either absent, or of a minute segment with one to three setae (*not shown*)

Features of Genus *Acanthocyclops**

- Segment 2 of leg 5 with an apical seta and small spine, less than ½ length of segment 2, slightly distal to middle of segment 2, or nearly apical (D)
- Inner margin of caudal ramus with or without hairs (E)
- Antennules of 11-17 segments (F)

Features of species *vernalis sensu lata***

- Female antennules 17 segmented (F)
- Inner surface of caudal ramus smooth or with tiny spinules or fine hairs (E)
- Caudal ramus greater than three times longer than wide (G)
- Large species, 1.0 to 2.0 mm long (H)

Where Recorded at Old Woman Creek

- Planktonic and benthic habitats; sediments: lotus bed, open water, and sedge meadow

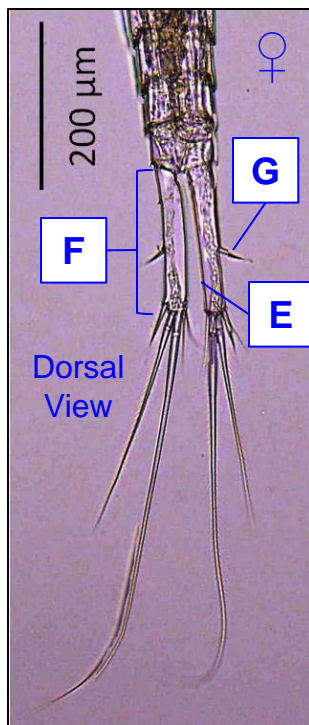
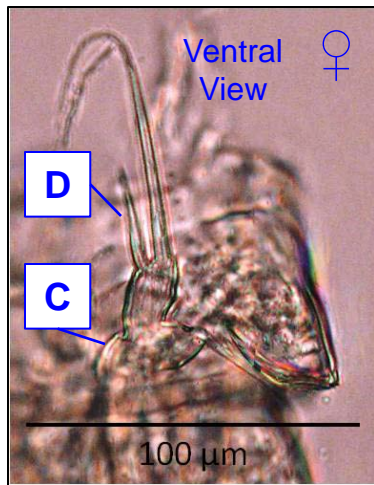
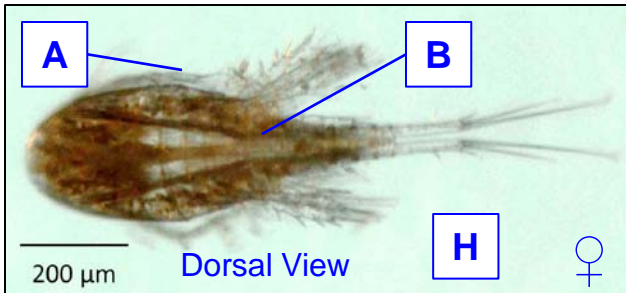
General Ecology

- Habit: Swimmers
- Functional feeding groups: Omnivores, predators, detritivores; filter feeders
- References: HRLS 18-27; BK&D 95; R&W 843-844, 869-872, 875-876; P 414
- Photographs: Plankton A Mohawk Static 9-8-98 (top and lower right images) (composite images)
- Coote's Paradise Lake Ontario 24-26 Oct. 2010 Tori Vaccariello (middle and lower left images) (composite images)

* According to R&W, *Acanthocyclops* is a cosmopolitan genus with many species. The speciose nature of this genus leads to rather generalized descriptions for the genus features listed above.

** The specimens shown on this page are members of the *Acanthocyclops vernalis-robustus* group. According to R&W, this group contains the following species: *A. vernalis*, *A. brevispinosus*, *A. carolinianus*, *A. robustus*, *A. einislei*, and *A. trajani*. The representative specimen from this group shown here is *A. robustus*.

Crustacea: Copepoda: Cyclopoida: Cyclopidae: *Diacyclops thomasi*



Features of Order Cyclopoida

- Antennules not typically reaching beyond the genital segment (A)
- Narrowing of body occurs between segments with the fourth and fifth legs (B)
- Fifth leg small and first segment not enlarged on the inside margin (C)
- Both first antennae geniculate in males (*not shown*)

Features of Family Cyclopidae

- Mandibular palp either absent, or of a minute segment with one to three setae (*not shown*)

Features of Genus Diacyclops

- Leg five with an inner subapical spine longer than segment two (D)
- Typically without hairs on the inner margins of the caudal rami (E)
- Female antennules with 17 segments (*not shown*)

Features of species thomasi

- Caudal ramus roughly six to seven times longer than wide (F)
- Lateral seta inserted about midlength of distance from base to apex of caudal ramus (G)
- Size from 0.9 to 1.4 mm long (H)

Where Recorded at Old Woman Creek

- Planktonic and benthic habitats; sediments; open water, lotus bed, drowned OWC channel at upper end of wetland

General Ecology

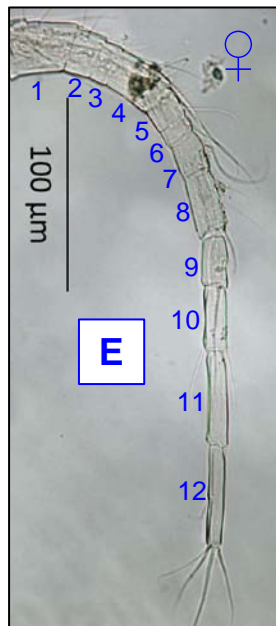
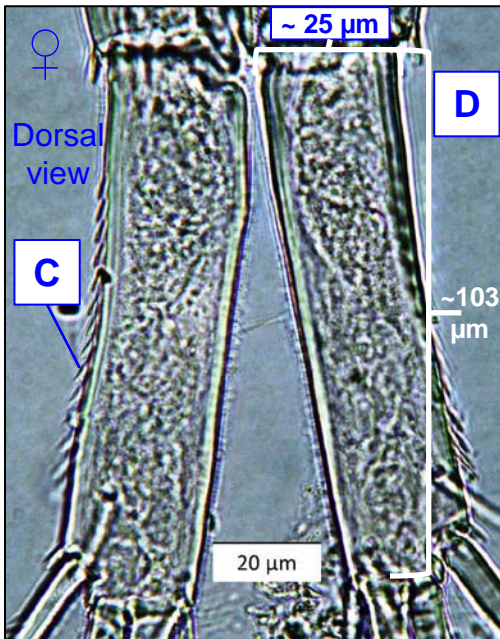
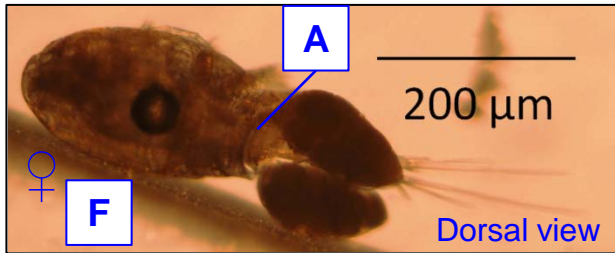
Habit: Swimmers

Functional feeding groups: Omnivores, predators detritivores, and filter feeders

References: HRLS 18-27; BK&D 45-48, 96-98;R&W 843-844, 869-872, 878-880; P 414

Photographs: Zooplankton CW 82 781011 R CLEVE WQL (composite images: all images)

Crustacea: Copepoda: Cyclopoida: Cyclopidae: *Eucyclops agilis*



Features of Order Cyclopoida

- Antennules not typically reaching beyond the genital segment (*not shown*)
- Narrowing of body occurs between segments with the fourth and fifth legs (A)
- Fifth leg small and first segment not enlarged on the inside margin (B)
- Both first antennae geniculate in males (*not shown*)

Features of Family Cyclopidae

- Mandibular palp either absent, or of a minute segment with one to three setae (*not shown*)

Features of Genus Eucyclops

- Caudal ramus of females with a row of small spines on the outer margin (C)
- Caudal ramus typically more than four times as long as wide (D)
- Antennules with 12 segments (E)

Features of species agilis

- Caudal ramus less than 5 times as long as wide (D)
- Size from 0.6 to 1.5 mm long (F)

Where Recorded at Old Woman Creek

- Sediment of open water, lotus bed, drowned OWC channel at upper end of wetland.
- Vegetated estuary: epiphytic; planktonic habitats

General Ecology

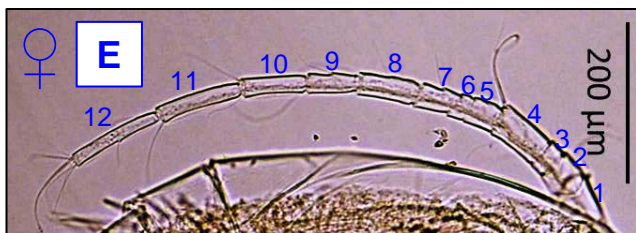
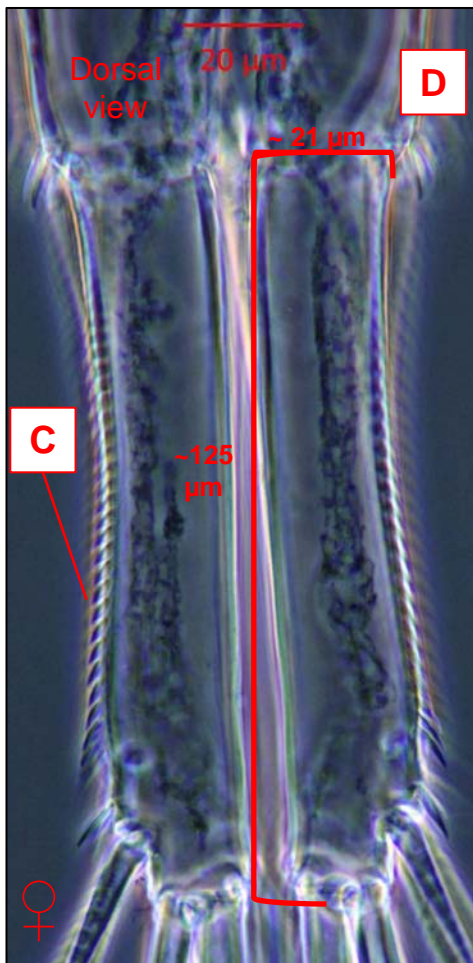
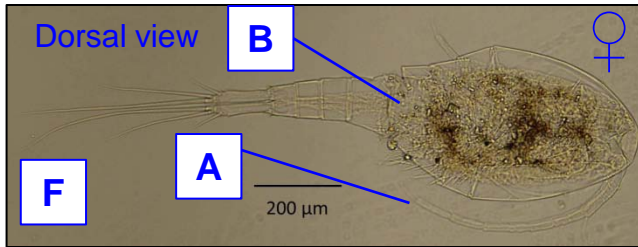
- Habit: Swimmers
- Functional feeding groups: Omnivores, carnivores, and detritivores

References: BK&D 47, 115; R&W 843-844; P 414; HRLS 18-22

Photographs: Coote's Paradise Lake Ontario 24-26 Oct. 2010 Collected by: Tori Vaccariello (top image)

OWC Plankton Lotus Bed 20111011 JAB (lower three images: phase contrast)

Crustacea: Copepoda: Cyclopoida: Cyclopidae: *Eucyclops elegans*



Features of Order Cyclopoida

- Length of first antennae not typically reaching beyond the genital segment (A)
- Narrowing of body occurs between segments with the fourth and fifth legs (B)
- Fifth leg small and first segment not enlarged on the inside margin (**not shown**) (see *E. agilis* fifth leg image as the general shape is similar with *E. elegans* having longer setae than *E. agilis*)
- Both antennules geniculate in males (**not shown**)

Features of Family Cyclopidae

- Mandibular palp either absent, or of a minute segment with one to three setae (**not shown**)

Features of Genus *Eucyclops*

- Caudal ramus of females with a row of small spines on the outer margin (C)
- Caudal ramus typically more than four times as long as wide (D)
- Antennules with 12 segments (E)

Features of species *elegans*

- Caudal ramus more than five times as long as wide (D)
- Size from 1.25 to 1.4 mm long (F)

Where Recorded at Old Woman Creek

Planktonic and benthic habitats; sediments of open water, lotus bed, drowned OWC channel at upper end of wetland

General Ecology

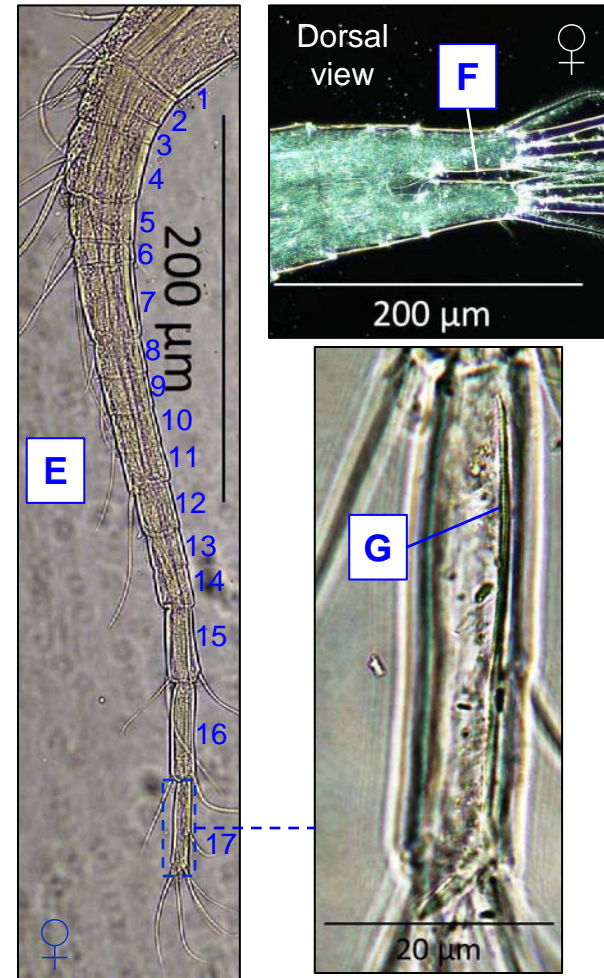
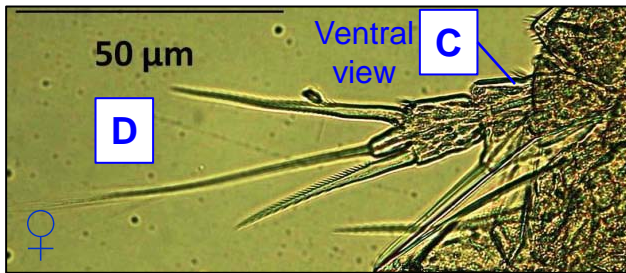
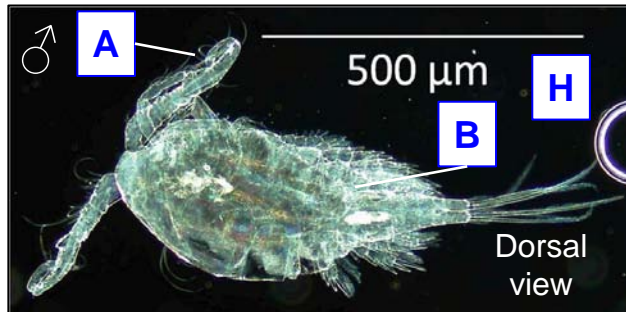
Habit: Swimmers

Functional feeding groups: Omnivores, carnivores, detritivores

References: BK&D 47, 115; R&W 843-844; P 414; HRLS 18-22

Photographs: Zooplankton OWC West Island edge of phragmites bed T-1 July 2006

Crustacea: Copepoda: Cyclopoida: Cyclopidae: *Macrocyclus albidus*



Features of Order Cyclopoida

- Length of first antennae not typically reaching beyond the genital segment (A)
- Narrowing of body occurs between segments with the fourth and fifth legs (B)
- Fifth leg small and first segment not enlarged on the inside margin (C)
- Both antennules geniculate in males (A)

Features of Family Cyclopidae

- Mandibular palp either absent, or of a minute segment with one to three setae (not shown)

Features of Genus Macrocyclus

- Fifth legs two segmented with distal segment broad and bearing three spines and/or setae (D)
- Antennules with 17 segments (E)

Features of species albidus

- Hairs absent on inner margin of caudal ramus (F)
- Hyaline membrane of antennule segment 17 with fine comb-like teeth on margin (G)
- Size from 0.79 to 2.5 mm long (H)

Where Recorded at Old Woman Creek

- Sediment of open water, lotus bed, drowned OWC channel at upper end of wetland

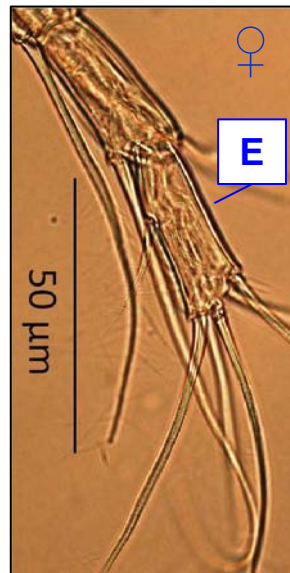
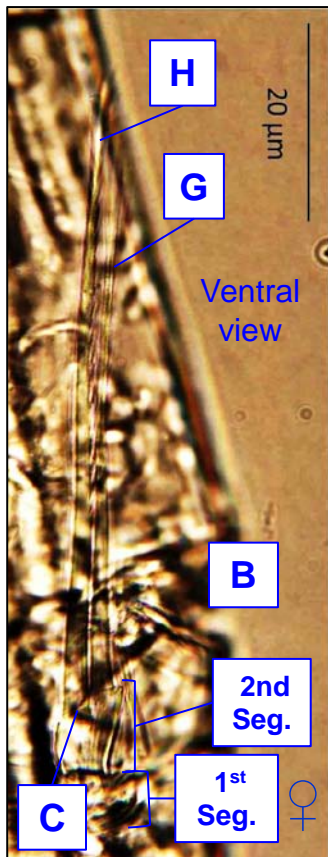
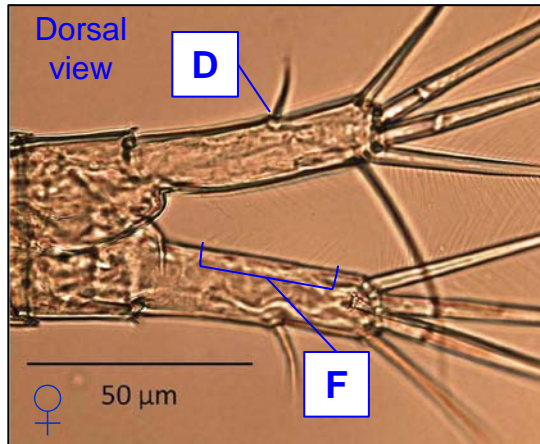
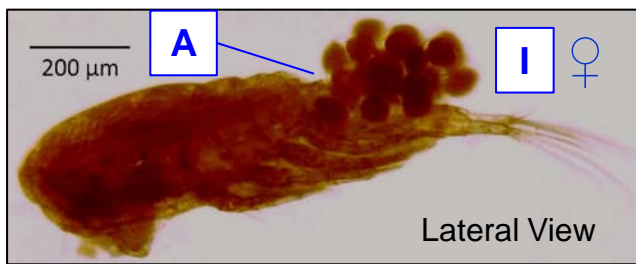
General Ecology

- Habit: Swimmers
- Functional feeding groups: Omnivores, predators, and detritivores

References: BK&D 38, 116; P 414; R&W 843-844, 854, 868-870

Photographs: TW Ackerman Ditch June 30, 2011
Ekman #1 P: ¼ (top and middle right images: dark field)

Crustacea: Copepoda: Cyclopoida: Cyclopidae: *Mesocyclops edax*



Features of Order Cyclopoida

- Length of first antennae not typically reaching beyond the genital segment (*not shown*)
- Narrowing of body occurs between segments with the fourth and fifth legs (A)
- Fifth leg small and first segment not enlarged on the inside margin (B)
- Both first antennae geniculate in males (*not shown*)

Features of Family Cyclopidae

- Mandibular palp either absent, or of a minute segment with one to three setae (*not shown*)

Features of Genus *Mesocyclops*

- Subterminal inner spine on distal segment of fifth leg, or in the middle of the margin (C)
- Lateral seta of caudal ramus in middle third of ramus (D)
- Female terminal segment (17) of antennules typically 3 or more times longer than wide (E)

Features of species *edax*

- Caudal ramus inner surface with hairs (F) and rami typically divergent
- Terminal seta (G) of leg 5 shorter than inner spine of distal segment (H)
- Size of 0.7 to 1.5 mm long (I)

Where Recorded at Old Woman Creek

- Benthic habitats; sediment of open water and lotus bed

General Ecology

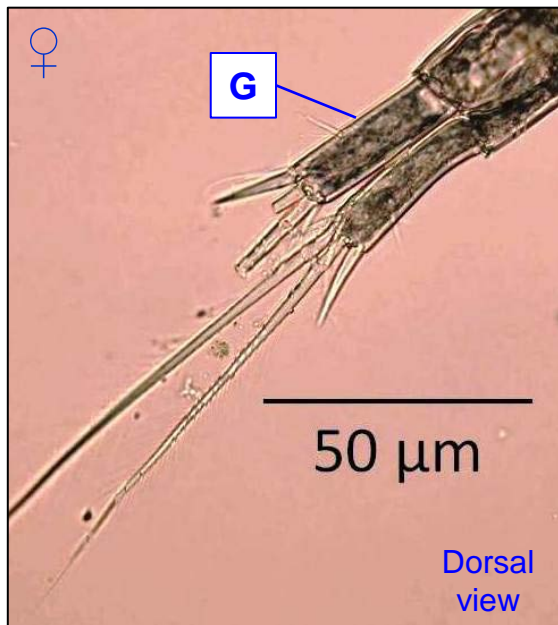
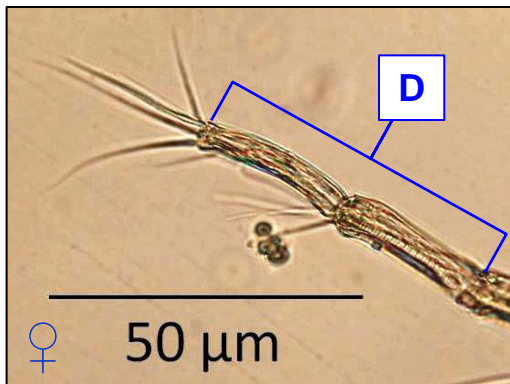
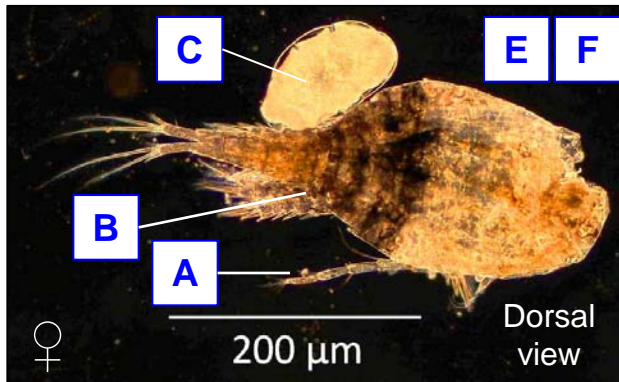
Habit: Swimmers

Functional feeding groups: Omnivores, detritivores, predators, and filter feeders

References: BK&D 100; R&W 843-844; P 414; HRLS 25

Photographs: V1 17, July 2009 Lake Erie (composite image: all images)

Crustacea: Copepoda: Cyclopoida: Cyclopidae: *Tropocyclops prasinus mexicanus*



Dorsal views of *T. pr. mexicanus*

Features of Order Cyclopoida

- Length of first antennae not typically reaching beyond the genital segment (A) (note that top right portion of this specimens head is damaged)
- Narrowing of body occurs between segments with the fourth and fifth legs (B)
- Fifth leg small and first segment not enlarged on the inside margin (**not shown**)
- Both antennules geniculate in males (**not shown**)
- Typically adult females carry two egg sacs (C) (note that the right egg sac is missing)

Features of Family Cyclopidae

- Mandibular palp either absent, or of a minute segment with one to three setae (**not shown**)

Features of Genus Tropocyclops

- Last two segments of female first antennae more than three times longer than wide (D)
- Body rounded with little sclerotization and often dark green or blue in color (E) (note that top right portion of this specimens head is damaged)
- Antennules with 12 segments (**not shown**)

Features of species prasinus mexicanus

- Small (0.5 to 0.8 mm) (F)
- 1st antennae reaches genital segment (A)
- Caudal ramus less than four times as long as wide, with no small spines on outer lateral margin (G)

Where Recorded at Old Woman Creek

- Planktonic and benthic habitats; sediments of open water and lotus bed

General Ecology

Habit: Swimmers

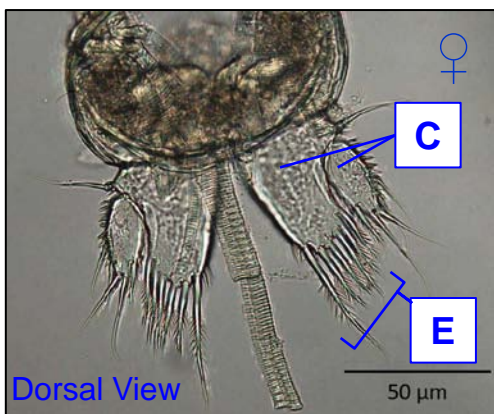
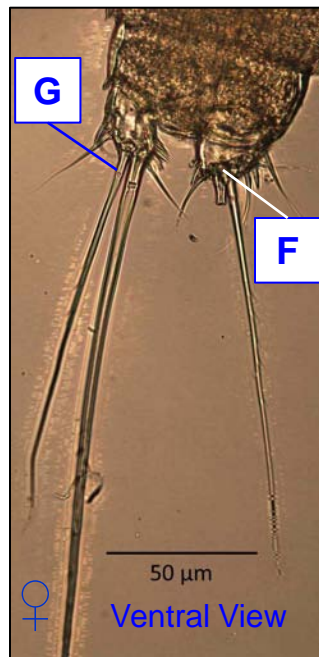
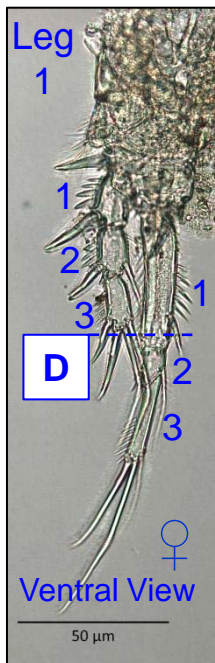
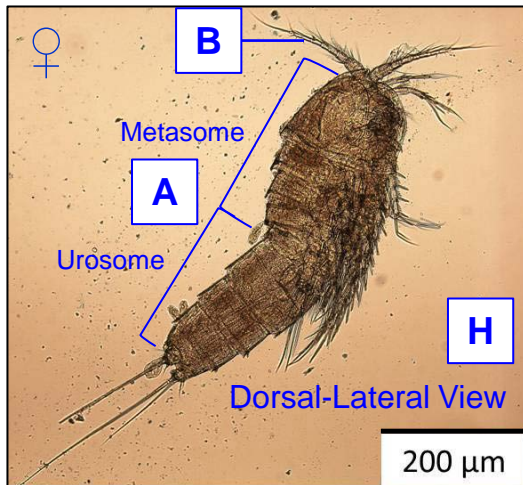
Functional feeding groups: Omnivores, carnivores, detritivores and filter feeders

References: BK&D 46, 102; HRLS 22; R&W 843-844; P 414

Photographs: OWC Zooplankton Lotus Bed 20111011 JAB (top two images)

OWC Zooplankton Near Phragmites Bed 20111011 JAB (lower image: composite photo) Note that some of the caudal setae are broken off.

Crustacea: Copepoda: Harpacticoida: Canthocamptidae: *Attheyella* (*Neomrazekiella*) *illinoisensis*



Features of Order Harpacticoida

Metasome not conspicuously distinct from the urosome (A)

Antennules shorter than the cephalic segment (B)

Features of Family Canthocamptidae

Female antennules with 6-9 segments (typically 8) (not shown)

Leg 5 of two conspicuous segments (C)

Features of Genus *Attheyella*

Leg 1 endopod segment 1 reaching to or beyond the middle of segment 3 of exopod (D)

Female endopod of legs 2 and 3, is 2 segmented (not shown)

Female with 6 setae on the basal expansion of leg 5 none of which tiny (E)

Endopod of male leg 2 is not modified (not shown)

Features of species *illinoisensis*

Outer margin of female caudal ramus not constricted in distal half (F)

Outer caudal setae not modified (G)

Leg 4 of males without modified spines on segment 3 of exopod (not shown)

Size of 0.85 to 1.0 mm long (H)

Where Recorded at Old Woman Creek

Benthic habitats; sediments of open water

General Ecology

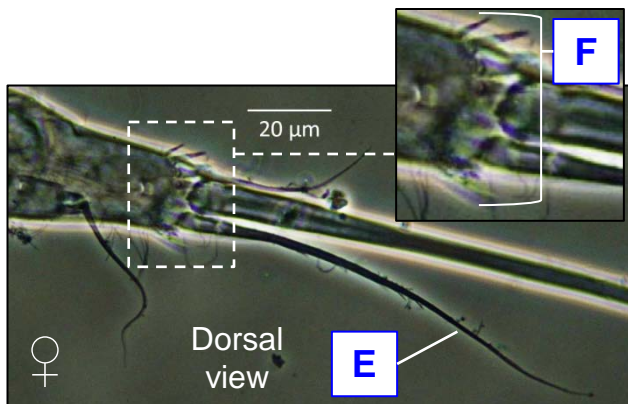
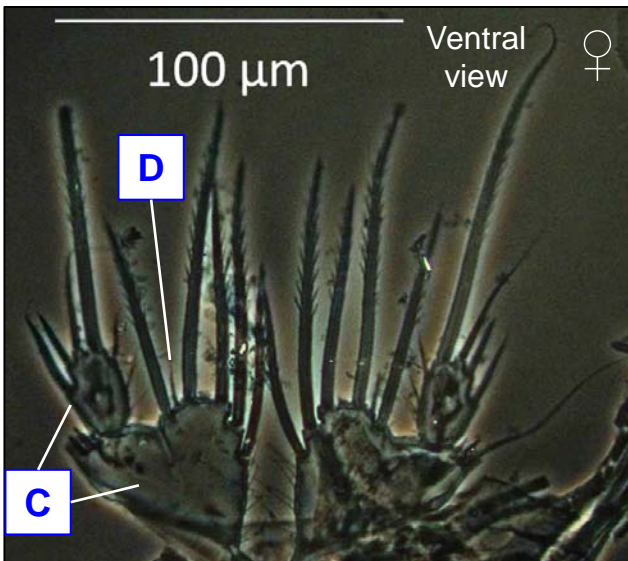
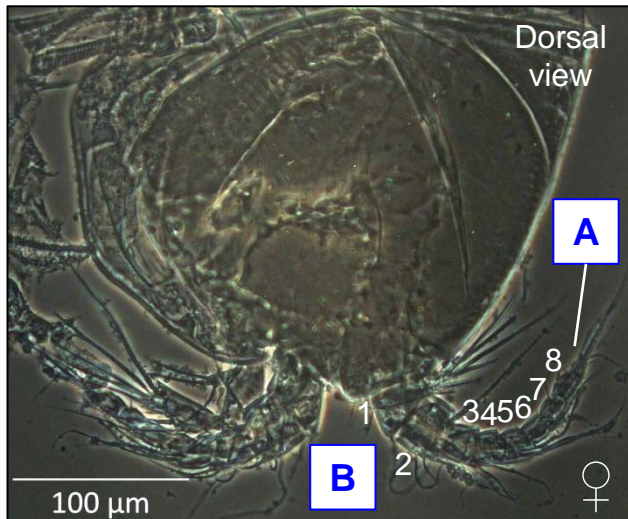
Habit: Crawlers/runners

Functional feeding groups: Omnivores; mostly scrapers or detritivores

References: BK&D 38; R&W 843-844,884-885; B 840, 846, P 414

Photographs: Snuff Ditch CR 38 Seneca County, OH Ekman #1 June 22, 2011 (composite images used for lower three images)

Crustacea: Copepoda: Harpacticoida: Canthocamptidae: *Canthocamptus robertcokeri**



Features of Order Harpacticoida

Metasome is not conspicuously distinct from the urosome (*not shown*)

1st antennae are shorter than the cephalic segment (A)

Features of Family Canthocamptidae

Female first antenna contains 6-9 segments (typically 8) (B)

Leg 5 comprised of two conspicuous segments (C)

Features of Genus *Canthocamptus*

Next from outermost seta of female leg 5 endopod tiny (D)

Spinous process on outer corner of last segment of endopod of leg 4 (male) (*not shown*)

Features of species *robertcokeri*

Outer apical seta of caudal ramus extremely slender (E) and typically smooth

Leg five male exopod with five setae (*not shown*)

Row of spines on posterior end of caudal rami (F)

Size of 0.55 to 0.80 mm long (*not shown*)

Where Recorded at Old Woman Creek

Benthic habitats; sediment of open water, lotus bed

General Ecology

Habit: Crawlers/runners

Functional feeding groups: Omnivores and detritivores

References: R&W 882-884, 893-894; P 414

Photographs: Zooplankton CE90R L. Erie 780525 (phase contrast: all images)

*Note there is no image of the entire specimen for this species.