

John Mercer

Zooplankton of the Saint John River Headponds



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FOREWORD

This study is one of a series commissioned by the Saint John River Basin Board as part of its program for preparing a water management plan for the Basin. A draft has been reviewed by members of the Board, its Advisory and Liaison Committee and Planning Office. The reviewers are satisfied that the work was conducted conscientiously by highly qualified people and that they have fulfilled their terms of reference. Although the report has been checked carefully for errors, inconsistencies and omissions, a few almost certainly remain. The Planning Office would appreciate hearing of them.

This is a report made to the Board, and the recommendations put forward in it are the author's own. Each recommendation will be carefully considered during the process of developing the comprehensive plan for the river basin. However, some recommendations made with the aim of improving conditions for one water use may not be compatible with needs of other uses. As the objective of the plan is to seek an optimum balance among all uses of the water resource, it is quite possible that the Board will not include in its final plan all the recommendations contained in this report. They are presented here, nevertheless, for public information and debate.

The Saint John River Basin Board,
Fredericton, New Brunswick,
November, 1973.

ZOOPLANKTON OF THE
SAINT JOHN RIVER HEADPONDS

A report prepared
for the
Saint John River Basin Board

by

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May 1973

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INTRODUCTION

As a first step in the ecological study of the headponds of the Saint John River Basin, a systematic catalogue of the phytoplankton community was prepared, (Watt, 1971). The present report catalogues the members of the zooplankton community of these headponds. The zooplankton are important as they are involved in the consumption, utilization and eventual transformation of phytoplanktonic organic matter in the processes of secondary production. A knowledge of the zooplankton standing stock and production is necessary for an understanding of the ability of different types of water to produce and maintain populations of particular abundance and composition. These considerations prompted the investigations into the composition of the zooplankton populations in the headponds of the Saint John River Basin.

TECHNIQUES

Zooplankton were collected from Glazier Lake and the Tobique, Grand Falls, Beechwood, Woodstock, Woolastook and Nackawic headponds. Two nets, one small (0.010m² mouth area, #20 mesh) and one large (0.049m² mouth area, #10 mesh), were employed at each station. Each net was towed three times (vertically) through the water column, and samples were collected into 8 oz. jars and preserved with formalin (10%) until examined. Prior to counting, the 10% formaldehyde solution was carefully poured off so as to retain all animals. The samples were then brought up to 100 ml with distilled water, stirred, and 2 X 10 ml subsamples removed with a Hensen-Stemple pipette. The animals present in the subsamples were identified and enumerated using a stereomicroscope for low power work and phase contrast for higher powers.

SPECIES	Occurrence						
	Glazier Lake	Tobique	Grand Falls	Beechwood	Woodstock	Nackawic	Woolastook
CLADOCERA							
Suborder Haplopoda							
Leptodora kindtii (Focke) 1844	+			+		+	+
Suborder Eucladocera							
* <u>Polyphemus pediculus</u> (Linne) 1761	+						
<u>Holopedium gibberum</u> Zaddach 1855	+			+	+	+	+
* <u>Sida crystallina</u> (O.F. Muller) 1785		+		+	+	+	+
* <u>Latona setifera</u> (O.F. Muller) 1785						+	
<u>Diaphanosoma leuchtenbergianum</u> Fischer 1850		+	+	+			+
* <u>Pseudosida bidentata</u> Herrick 1844	+			+		+	+
<u>Daphnia ambigua</u> Scourfield 1947	+		+	+	+	+	+
<u>Daphnia catawba</u> Coker 1926						+	+
<u>Daphnia dubia</u> Herrick 1895						+	+
<u>Daphnia longiremis</u> Sars 1861	+			+	+	+	+
<u>Daphnia middendorffiana</u> Fischer 1851	+		+	+	+		+
<u>Daphnia parvula</u> Fordyce 1901					+	+	+
<u>Daphnia galeata</u> Sars 1864	+	+		+	+	+	+
<u>Daphnia pulex</u> Leydig 1860	+				+	+	+
<u>Daphnia retrocurva</u> Forbes 1882						+	+
* <u>Simocephalus exspinosus</u> (Koch) 1841						+	+
* <u>Ceriodaphnia reticulata</u> (Jurine) 1820							
<u>Bosmina coregoni</u> Baird 1857	+	+	+	+	+	+	+

SPECIES	Occurrence						
	Glazier Lake	Tobique	Grand Falls	Beechwood	Woodstock	Nackawic	Woolastook
* <u>Ilyocryptus spinifer</u> Herrick 1884				+			
* <u>Eurycercus lamellatus</u> (O.F. Muller) 1785							
* <u>Camptocercus rectirostris</u> Schodler 1862				+	+		+
* <u>Leydigia quadrangularis</u> (Leydig) 1860		+		+	+	+	+
* <u>Alona</u> sp.		+					
* <u>Alona costata</u> Sars 1862			+	+	+	+	+
* <u>Alona guttata</u> Sars 1862			+			+	
* <u>Alona quadrangularis</u> (Muller) 1785		+		+	+	+	+
* <u>Alona affinis</u> (Leydig) 1860				+	+		
* <u>Pleuroxus trigonellus</u> (Muller) 1785				+			
* <u>Chydorus sphaericus</u> (Muller) 1785		+	+	+	+	+	+
* <u>Alonella acutirostris</u> (Birge) 1878		+	+	+	+		+
CALANOID COPEPODS							
<u>Diaptomus minutus</u> Lilljeborg 1889	+	+	+	+	+	+	+
<u>Diaptomus sanguineus</u> Forbes 1876	+				+	+	+
<u>Epischura lacustris</u> Forbes 1882	+	+	+	+	+	+	+
<u>Epischura nordenskioldi</u> Lilljeborg 1889	+				+	+	+
<u>Limnocalanus macrurus</u> Sars 1863		+	+	+	+	+	+

SPECIES	Occurrence						
	Glazier Lake	Tobique	Grand Falls	Beechwood	Woodstock	Nackawic	Woolastook
CYCLOPOID COPEPODS							
<u>Cyclops bicuspidatus lubbacki</u> Brady 1868	+						+
<u>Cyclops bicuspidatus thomasi</u> Forbes 1882							+
<u>Cyclops capillatus</u> Sars 1863			+	+	+	+	+
<u>Cyclops exilis</u> Coker 1934	+	+	+	+	+	+	+
<u>Cyclops navus</u> Herrick 1882		+					+
<u>Cyclops scutifer</u> Sars 1863	+		+	+	+	+	+
<u>Cyclops venustoides bispinosus</u> Yeatman 1951					+	+	+
<u>Cyclops vernalis</u> Fischer 1853		+	+	+	+	+	+
* <u>Eucyclops speratus</u> (Lilljeborg) 1901		+	+	+	+	+	+
* <u>Eucyclops agilis</u> (Koch) 1838				+	+		+
* <u>Macrocyclus albidus</u> (Forbes) 1891				+			
* <u>Mesocyclops edax</u> (Forbes) 1891	+		+	+	+	+	+
* <u>Paracyclops affinis</u> (Sars) 1863							
* <u>Paracyclops fimbriatus</u> (Fischer) 1853				+			
* <u>Paracyclops fimbriatus poppei</u> (Rehberg) 1880					+		+
<u>Tropocyclops prasinus</u> (Fischer) 1860	+		+	+	+	+	+

* littoral species

GLOSSARY OF BIOLOGICAL TERMINOLOGY

- Abdominal Process: Finger-like projection on the dorsal surface of the abdomen, which retains the eggs in the brood chamber.
- Carapace: In Cladocera, it is a cuticular fold which extends backward and downward from the dorsal side of the head.
- Carina: A keel like ridge or dorsal plate.
- Caudal Rami: Paired projections extending from the last segment of the Copepoda.
- Caudal Setae: Long slender hair-like projections borne laterally and terminally from the caudal rami.
- Endopod (endopodite): The inner branch of a biramous crustacean limb.
- Ephippium: Altered carapace during sexual egg production which when shed, protects fertilized eggs.
- Exopod (exopodite): The outer branch of a typical biramous crustacean limb.
- Fornix, Fornices: Pertaining to Cladocera, it is a ridge above the insertion of the antenna which helps to stiffen the side of the head and support the antennary muscles.
- Gnathobase: An inwardly turned masticatory process on appendages near the mouth of Crustacea.
- Hepatic Caeca: In the Cladocera, these are two sacs, often long and curved, attached to the stomach. They store and possibly digest food.
- Hypolimnion: The water between the thermocline and the bottom of lakes.
- Hypopharynx: A tongue or tongue-like structure.

- Labrum: Anterior lip of certain arthropods like Cladocera.
- Littoral: The zone of shallow water and bottom above compensation depth in lakes.
- Mandible: A paired mouth appendage.
- Metasome: Anterior of copepod; cephalothorax including head with five pairs of appendages and thorax with six pairs of appendages.
- Microphagous: Feeding on small prey.
- Mucrone: A stiff or sharp point abruptly terminating an organ; pointed keel.
- Ocellus: In the Cladocera, one of two light sensitive organs in the head; not always present and often variable.
- Parthenogenetic: Reproduction without fertilization by a male element.
- Pecten: Found in Cladocera on the post-abdominal claw; comb-like teeth between claws' large basal spines and distal denticulation.
- Postabdomen: Ordinarily jointed to the rest of the Cladoceran body and is bent forward; hence its dorsal side may come to be ventral in position.
- Rostrum: Beak or beak process.
- Urosome: Posterior division of copepod body; includes genital segment and succeeding abdominal segments.

CLASS CRUSTACEA

Crustaceans are a class of the phylum Arthropoda distinguished by 4 obvious features; (1) they are aquatic arthropods (with a few exceptions) (2) respiration occurs through gills or the general body surface (3) they all have two pairs of antennae (4) most of the body segments, or at least the more anterior ones, bear jointed paired appendages which are fundamentally biramous. There are about 30,000 known species, most of which are marine, 23 orders occur in the United States and surrounding water but only 11 are represented in the fresh water and only 3 are restricted to fresh water.

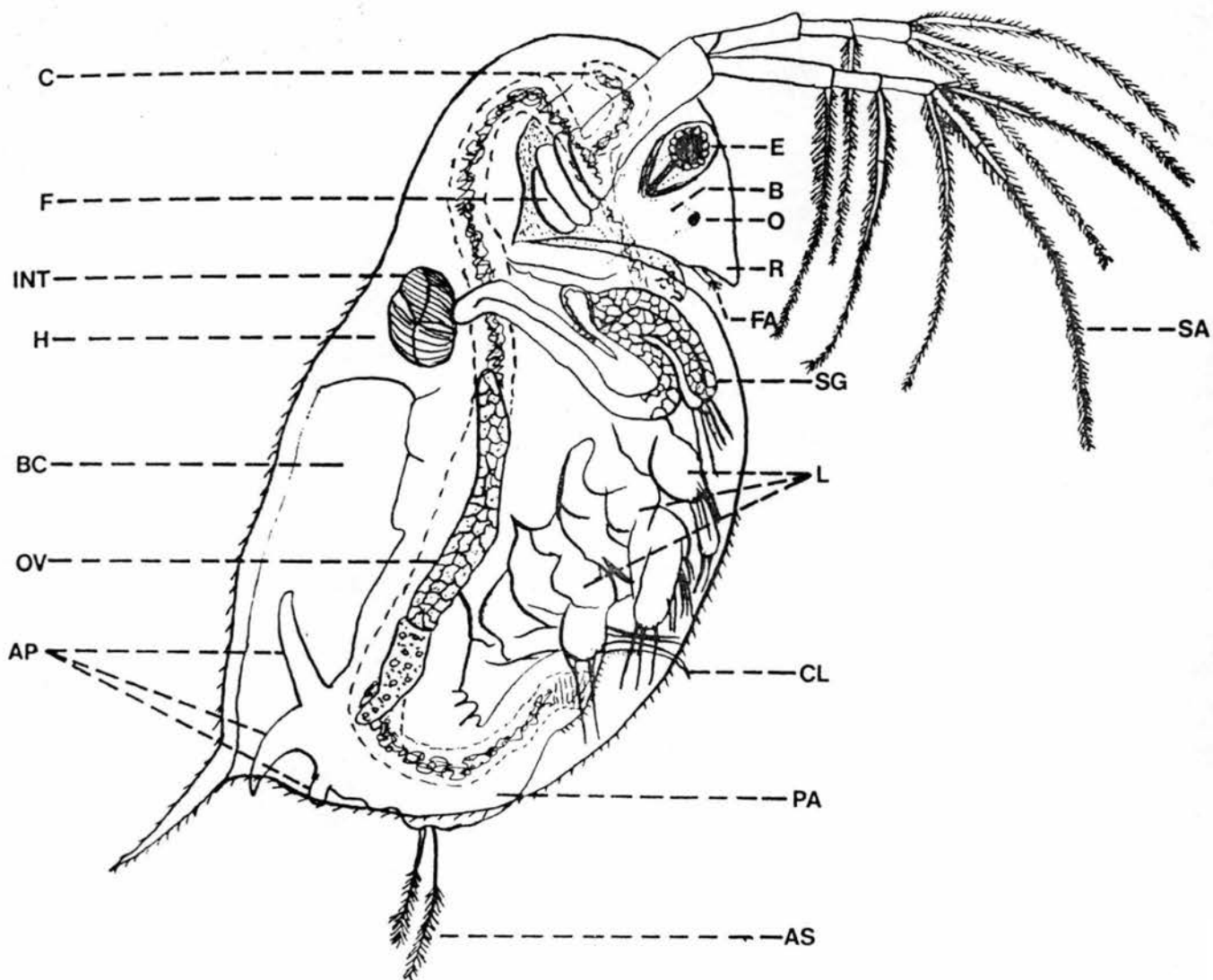
The Crustacea are divided into four subclasses: Branchiopoda, Ostracoda, Copepoda and Malacostraca. The Branchiopoda is divided into four orders, of which only one, the Cladocera, is of interest in this study. The Branchiopoda have at least ten consecutive similar appendages on the thorax serving for both locomotion and respiration. The body is flat from side to side and enclosed by a carapace in the form of two valves. The subclass Malacostraca are usually larger crustacea with a body consisting of 20 segments, five in the head, eight in the thorax and seven in the abdomen. There are two pairs of antennae, one pair of mandibles and two pairs of maxillae to the head; eight legs to the thorax, the first three sometimes divided as mouthparts; six appendages, usually swimmerets, to the abdomen, the last sometimes modified to form part of the tail fan.

The Ostracoda are smaller crustaceans with 2 or 3 pairs of thoracic appendages. The body is enclosed by a carapace having the form of 2 valves open along the ventral and hinged along the dorsal surface. All the limbs can be withdrawn within the valves, and many of the animals then have the appearance of a hamburger or tiny clam.

The Copepoda have a pear shaped body or a flat shield-like carapace. The second antennae are small and never used for locomotion. The body is obviously segmented. There are 5 or 6 pairs of thoracic appendages, the first 4 pairs being biramous; the body is small, cylindrical, and divided into a metasome and a urosome.

Key to Daphnia pulex diagram:

AS	-----	Abdominal Setae
AP	-----	Abdominal Processes
B	-----	Brain
BC	-----	Brood Chamber
C	-----	Digestive Caecum
CL	-----	Postabdominal Claw
E	-----	Compound Eye
F	-----	Fornix
FA	-----	First Antenna (antennule)
H	-----	Heart
INT	-----	Intestine
O	-----	Ocellus
OV	-----	Ovary
PA	-----	Postabdomen
R	-----	Rostrum
SA	-----	Swimming Antenna
SG	-----	Shell Gland
TL	-----	Thoracic Limbs



Anatomy of *Daphnia pulex* (DeGreer) X 70
 Diagrammatic (Greatly modified from Storch; 1925)

Order: Cladocera

General

Most members of the cladocerans are between 0.2-3 mm long. The body is not clearly segmented, and in a great majority of species the thoracic and abdominal regions are covered by a secreted shell or carapace, which has a general bivalved appearance but is actually a single folded piece which gapes ventrally. There are often surface reticulations, striations or other types of markings. In many species the posterior end has a spine or spinule, and the ventral edges of the valves usually have setae. The head is compact and does not open ventrally, but downwards. There is a large conspicuous eye.

The first antennae are on the ventral side of the head. They are inconspicuous, unsegmented, and have olfactory setae. The second antennae are large, inserted laterally, with a basal segment, segmented dorsal ramus, and a segmented ventral ramus. The rami have a variable number of plumose setae. The small mouth parts are situated near the junction of the head and body. The legs are variable, some being cylindrical, segmented or leaf-like. They are flattened with the first two more or less prehensile. The true abdomen is suppressed and there is a large postabdomen at the posterior end of the body. There are two long abdominal setae, two terminal claws, and a series of marginal and/or lateral teeth or denticles.

During the greater part of the year cladoceran populations consist almost exclusively of females, males being abundant only in autumn or spring. In many species males are rare or unknown. Anatomically, males are smaller, have larger antennules, a modified post-abdomen, and first legs armed with a stout clasping hook.

Limnetic species are usually light colored and translucent. Pond, littoral and bottom species are darker in color, ranging from light yellowish brown to reddish-brown, grayish, or almost black. There is pigmentation in both the carapace and body tissue. They feed on algae, protozoa and detritus.

Suborder: Haplopoda

Large, adult female 7 - 18 mm long, body and legs not covered by bivalve carapace. Carapace reduced to a small brood sac. The legs are not flattened, but have cylindrical joints. There are no branchial appendages.

Family: Leptodoridae (sole family)

Head elongated, slender eye filling anterior end. Body 4 jointed, antennules small, freely moveable, very long in f. * Mandibles long, slender, pointed, with 3 spires near apex. postabdomen not reflexed, with 2 short stylets.

* f=female

Genus: Leptodora (sole genus)

Species: L. kindtii Focke, 1844

Largest of the cladocera, *f.* reaches a length of 18 mm. It has six pairs of very long prehensile legs. It is predaceous, though its weak mandibles prevent it from devouring any tough plankters.

Distribution: Not uncommon in lakes of northern United States and northward.

Suborder: Eucladocera

Small, less than 6 mm in length (usually much less). Body and legs enclosed in bivalve carapace (Polyphemus is the only exception). The 5 to 6 pairs of legs are usually flattened branchial appendages.

Genus: Pseudosida

Anal spines present on post-abdomen, eye ventral or in middle of head.

Species: P. bidentata, Herrick 1884

General form like Sida but head more depressed and dorsum more arched, ocellus present, rostrum present. *m.** with antennule characteristic of family; copulatory organs; complex grasping apparatus on first leg. Colour yellowish, semi-transparent. Length *f.* to 1.8 or 2.0 mm. *m.* 0.9 mm.

Distribution: Canada, United States in lakes and pools.

Family: Sididae

Six pairs of foliaceous legs, first and second pairs not prehensile, shell of the usual type, antennae of *f.* biramous and flattened.

Genus: Sida

Dorsal ramus of antennae 3-jointed, rostrum present and pointed. Head with large gland on dorsal side; antennules of *f.* attached to side of rostrum, short, truncate,

**m=male*

Genus: Sida (Cont'd)

with short flagellum. Ventral ramus of antennae 2-jointed. Antennules of σ . very long, no copulatory organ. First leg with hook.

Species: S. crystallina O.F. Müller, 1765

Only known species. Color yellow-hyaline, sometimes with brilliant blue spots. 3-4 mm long.

Distribution: Common in lakes and ponds among weeds.

Genus: Latona

Dorsal ramus of antenna 2-jointed, lateral expansion on basal segment of dorsal ramus of antenna. Large, tongue-shaped projection on ventral side of head; its ventral surface concave. Long setae on posterior margin of valves. Eye dorsal, far from optic ganglion. m . with copulatory organ, no hook on first leg.

Species: L. setifera O. F. Müller, 1785

Antennary expansion very large, no hepatic caeca. Antennules of both sexes alike, bent. Color yellow; not transparent; old f . often with brilliant colors in late autumn. Length: f . 2.0-3.0 mm. m . ca 1.5 mm.

Distribution: Widely distributed, but rarely abundant in littoral vegetation, chiefly in Northern States and mountainous areas and Canada.

Genus: Diaphanosoma

No lateral expansion of antenna, no anal spines on postabdomen; no rostrum; forrnx or ocellus, antennule small, truncated, olfactory setae terminal, with slender flagellum. Dorsal ramus of antennae 2-jointed; ventral 3-jointed, claws with 3 basal spines. *m.* with long antennule; copulatory organ; hook on first foot.

Species: D. leuchtenbergianum Fischer, 1850

Reflexed antenna reaching or exceeding posterior margin of valves; eye not filling end of head, pigment small. Color hyaline. Length: *f.* 0.9-1.2 mm. *m.* to 0.8 mm. Distribution: Common in open waters of lakes.

Superfamily: Polyphemoidea

Family: Polyphemidae (sole North American Family)

Body very short, carapace converted into large globular sac. Caudal process long, slender, with 2 long caudal stylets or setae. Rami of antennae with 3 and 4 joints. Eye very large, no ocellus. Labrum large. Two small hepatic caeca.

Genus: Polyphemus (sole genus in inland North American waters)

Species: P. pediculus (sole species)

Carapace does not fuse with hinder part of the 'thorax'. The trunk limbs have gnathobases; body short, 4 pairs of stout legs with branchial appendages, up to 1.5 mm long. Distribution: Common throughout northern part of North American continent, in pools, marshes and margins of lakes.

Superfamily: Sidoidea

Six pairs of legs, all similar except most posterior; all flattened.

Family: Holopedidae

With 6 pairs of foliaceous legs; animal enclosed in a large, gelatinous case, formed by carapace, open ventrally and forming 2 valves; antennae of *f.* simple and cylindrical, with 3 terminal setae.

Genus: Holopedium (sole genus)

Species: H. gibberum Zaddach, 1855

Ventral margins of valves with fine spines; up to 25 anal spines and spinules; anal claws with a basal spine.

Distribution: Common in open waters of northern United States and Canada.

Superfamily: Chydoroidea

Five or six pairs of legs. First and second pair more or less prehensile with cylindrical joints, others leaf-like

Family: Daphnidae

Antennules attached to ventral side of head, not covered by fornices. Antennules of *f.* usually small, sometimes rudimentary, if large never inserted at anterior end of ventral surface of head. Five pairs of legs. Dorsal ramus of antenna 4-jointed, ventral ramus 3-jointed. Intestine simple with 2 hepatic caecae. Eye large, ocellus small, sometimes wanting.

Genus: Daphnia

Body and legs covered with bivalve shell. Antennules of female small, often rudimentary; if large, then never inserted at anterior end of ventral edge of head. Rostrum present, without cervical sinus.

Species: D. longiremus Sars, 1861

Claws without pecten. Ocellus absent, up to 1.5 mm long, sometimes larger.

Distribution: In cold waters, sometimes confined to the hypolimnion, uncommon.

D. pulex Leydig 1860, emend. Richard 1896

Claws with pecten. Distal pecten usually with less than 12 teeth, not heavy and thick bodied. Up to 3.8 mm long, highly variable and polymorphic.

Distribution: Widely distributed and common in many types of habitat.

D. ambigua Scourfield, 1947

Swimming hairs of reflexed antenna never reach posterior margin of valves in adult female; teeth of all 3 pectens of postabdominal claw small and inconspicuous, of about the same length. Ocellus present, small head and valves 1 mm or less in length. Head drawn out into a small point anteriorly

D. ambigua Scourfield, 1947 (Cont'd)

most of the year. Shell spine $< \frac{1}{2}$ length of carapace. Post-abdomen with 7-10 anal spines. Male has large antennules, longer than head. Flagellum slightly shorter than basal joint and 3-4 times as long as olfactory setae. Length: *f.* 0.75-1.0 mm. *m.* 0.9 mm.

Distribution: In ponds, deep water of stratified lakes. Southern part of continent; Central America north to New England, Ohio, Washington.

D. dubia Herrick 1895

Swimming hairs of reflexed antenna never reach posterior margin of valves in adult female. Teeth of all 3 pectens of postabdominal claw small and inconspicuous, of about the same length. Ocellus present. Large head and valves more than 1.25 mm long. Second abdominal process in mature female much smaller than first, about $\frac{1}{4}$ length of first. Spinulation extends over posterior $\frac{3}{4}$ or ventral margin of valve, at least. Anterior margin of head produced into pointed helmet with apex well dorsal of mid-line; often helmet is retrocurved. Length: *f.* 1.2-1.8 mm; *m.* 1.0 mm.

Distribution: Common in lakes in narrow belt from New England west to Wisconsin.

D. middendorffiana Fischer 1851

Cuticle of head dorsal to fornix usually light brown. Pigmentation may extend to basal joint of antenna.

D. middendorffiana Fischer 1851 (Cont'd)

Optic vesicle fills anteriormost part of head. Rostrum of variable size and shape, but ventral margin of head always distinctly concave. Dorsal margin of head without crest bulging over attachment of anterior antennal muscles. Shell spine slender, usually $1/3-1/2$ length of carapace. First abdominal process long, nearly twice as long as second. Postabdomen long and narrow. Posterior margin straight or with concavity under middle of spinate portion. Anal spines 12-14, decrease gradually in length away from the claw. Teeth of middle pecten of postabdominal claw 5-7 in number, separated at their bases, about twice as long as teeth of proximal pecten. Males are rare in high latitude populations and ephippial eggs are usually made parthenogenetically. *m.* antennule is distinctive as flagellum is expanded into cup-shaped tip. One of the largest Daphnia.

Length: *f.* 2.5-3 mm.

Distribution: Alaska, Northern Canada, south mostly in mountains to California. Ponds, lakes.

D. parvula Fordyce 1901

D. parvula always has a small rostrum and at most a rounded helmet which lengthens the head by no more than the diameter of the eye. *m.* with flagellum of antennule slightly longer than olfactory setae. Second abdominal process very small, smaller than third. Length: *f.* 0.75-1.0 mm, occasionally up to 1.2 mm. *m.* 0.6 mm.

D. Parvula Fordyce 1901 (Cont'd)

Distribution: In ponds and small lakes in southern part of continent from Central America north to southern New England, southern Saskatchewan, Washington and New Brunswick.

D. galeata Sars 1864

A large species, head produced anteriorly into a broad helmet except in very early spring. This helps to distinguish it from D. dubia where the helmet is posterior to mid-line. Helmet may be sharp or bluntly pointed, of various shapes. Optic vesicle well removed from ventral margin of head. Valve a broad oval < $1\frac{1}{2}$ times as long as wide. Shell spine at least half as long as valves. First abdominal process longer than second; second longer than third. Postabdomen with 9-11 anal spines. Teeth in all 3 pectens on claw about same size. Male with pointed helmet. Basal joint of antennule relatively short, flagellum about length of olfactory setae.

Distribution: In lakes of northern part of continent, especially common in lakes of glaciated regions. Infrequent in mountainous regions of United States, Canada, but present in some mountain lakes of Central America.

D. retrocurva Forbes 1882

Large, usually retrocurved helmet, no or minute ocellus. Greatest extension of helmet dorsal to the mid-line. Shell spire long, ca $\frac{2}{3}$ length of carapace. Post abdomen has 6-10 (usually 8) anal apines. Teeth of middle pecten, 6-20 all about same size. Teeth of proximal pecten about as long as

D. retrocurva Forbes 1882 (Cont'd)

those of middle, but finer and usually slightly less numerous. *m.* with helmet less well developed than in *f.* of same body size. Length of carapace of mature *f.* 0.8-0.9 mm, length of head and carapace may be up to 1.6 mm; length *m.* 0.8 mm.

Distribution: In lakes of Northern North America, except Alaska and Arctic Canada, south to New England, Wisconsin and Washington.

D. Catawba Coker 1926

Small species 1.0-1.5 mm long. Ventral edge of large optic vesicle never reaches the margin of the head. Head always with a slight rounded crest. Eye and ocellus moderate size. Median carina on posterior surface of head continues between tips of antennules, and is nearly as high as, or higher than, tips of antennules as it passes between them. Valves broadly oval, sometimes nearly circular. Spinulation on ventral edge continues well forward onto anterior half. Posteriorly spinulation stops before base of shell spine; shell spine $1/3 - 1/2$ length of carapace. 1st - 4th abdominal process of gradually decreasing length. 2nd and 3rd with very sparse pubescence. Postabdomen with 8 - 11 anal spines, teeth in distal half of series being much the longer. Middle pecten of claw with 2 - 4 large, widely separated teeth. 5-10 teeth in proximal comb, $1/4 - 1/5$ as long as longest teeth of middle comb, and only slightly longer than those of distal comb.

m. flagellum of antennule relatively short, only $1\frac{1}{2}$ times length of olfactory setae. 2nd abdominal process of mature male

D. Catawba Coker, 1926 (Cont'd)

rudimentary, smaller than 3rd. Body on dorsal surface not well marked.

Distribution: Pond and lakes. S. E. United States north to New England, southern Saskatchewan and southern Canada.

Genus: Simocephalus

The rostrum and cervical sinus are present. The head and rostrum are small. Valves large, with transverse striations. Two abdominal processes, placed far apart. Post-abdomen large, broad, truncate, posterior and emarginate and bearing the anal spines. Antennules of *m.* like those of *f.* but with 2 lateral sense-hairs. First leg without flagellum and with small hook.

Species: S. expinosus Koch, 1841

Postabdominal claw with a pecten, ocellus rhomboidal or round. Claw with pecten of 8-12 teeth at its base and with a row of fine teeth distal to the pecten.

Length: *f.* to 3.0 mm. *m.* to 1.3 mm.

Distribution: Uncommon, reported in scattered localities over most of the North American continent.

Genus: Ceriodaphnia

Rostrum absent, cervical sinus present. Head small and depressed. Antennules small. Valves oval or round, no post-anal extension of postabdomen. Small, rarely longer than 1 mm. Antennules of *m.* with long, stout seta, a modification of flagellum; first leg with hook and long flagellum. Free swimming.

Species: C. reticulata Jurine 1820

Head without spine, claws with pecten of 6-10 teeth and denticulate. Color varies in shades of red and yellow. Length, *f.* 0.6 - 1.4 mm. *m.* 0.4 - 0.8 mm. Distribution: Common, widely distributed.

Suborder: Calyptomera

Super family: Chydoroidea

Family: Bosminidae

The family Bosminidae is similar to the Daphnidae except that the antennules of the female are large, fixed, and inserted at the anterior end of the ventral edge of the head. There are six pairs of legs and no hepatic caeca. Animals are small, rarely exceeding 0.5 mm.

Genus: Bosmina

The antennules of the female are approximately parallel to each other and curve backward, olfactory setae are on the side, usually near the base. *m.* smaller than *f.* with short, blunt rostrum; large free antennules, hook and long flagellum on first leg. The long, sharp, slightly bent rostrum is one of the distinguishing features of Bosmina *f.*

Species: B. coregoni Baird 1857

Proximal pecten of postabdominal claw with 5 to 6 large spines, and numerous fine spinules in distal pecten. Small sensory hair near the base of the antennule, mucrones are long, but, like the antennules, are very variable.

Distribution: Littoral and limnetic, common in ponds and lakes throughout the continent.

Family: Macrothricidae

Antennules attached to ventral side of head, not covered by fornices, antennules of female large, inserted at anterior end of ventral edge of head. Antennules of female freely moveable.

Abdominal process is rarely present, except in the case of *Ilyocryptus*.

Genus: Ilyocryptus

Intestine simple, no hepatic caeca, postabdomen various. No wide crest on dorsal margin of valves. Postabdomen has numerous long spines.

Species: *I. spinifer* Herrick, 1884

Five to seven preanal spines; antennary setae ordinarily very long. *m.* unknown. Yellow or reddish.

Length: *f.* to 0.8 mm. Usually found creeping about on substrate

Distribution: Common throughout continent.

Family: Chydoridae

Fornices extended to over antennules partly or completely. Unite with rostrum into a beak, projecting ventrally in front of antennules.

Sub-family: Eurycercinae

Anus terminal, 2 hepatic caeca. Summer and ephippial eggs numerous.

Sole genus: Eurycercus

Body stout and heavy, broad oval in lateral view. Antennae short and powerful. Postabdomen very large, flattened, general form quadrangular. Six pairs of legs, dorsal margin of postabdomen with 80-120 sawlike teeth.

Species: E. lamellatus O. F. Müller, 1785

Antennule short and thick with sense hair near middle. Dorsal margin has nearly 100 or more teeth. Length: *f.* to 3.0 mm or more; *m.* to 1.4 mm.

Distribution: Absent in far north, but common elsewhere in shallows, in permanent pools or margins of lakes among weeds.

Subfamily: Chydorinae

Anus on dorsal side of postabdomen, postanal portion of which has denticles. No hepatic caeca. Two summer eggs; 1 ehippial egg. *m.* with strong hook on first leg.

Genus: Camptocercus

Compound eye present, eye and ocellus of usual size. Posterior margin of valves not greatly less than maximum height. Claws with secondary tooth in middle, secondary tooth sometimes very small, postabdomen with both marginal and lateral denticles. Postabdomen relatively narrow. Anterior portion of valves not swollen.

Species: C. rectirostris Schødler, 1862

Postabdomen with 15-17 marginal denticles. Head extended or depressed. Crest on head and valves. *m.* without denticles.

Distribution: Common everywhere among weeds in margins of lakes, etc.

Genus: Leydigia

Claws without secondary tooth in the middle. Rostrum abruptly narrowed and pointed near tip. Ventro-posterior angle without teeth. Postabdomen with clusters of large spines. Claws long and slender, yellow color.

Species: L. quadrangularis Leydig, 1860

Valves without markings. Keel of labrum with minute setae. Claws with basal spine. Length *f.* to 0.9 mm. *m.* about 0.7 mm. Distribution: Widely distributed but uncommon; found singly among weeds.

Genus: Alona

Postabdomen without clusters of large spines, and with marginal and lateral denticles. The marginal denticles are not longer distally.

Species: A. guttata Sars, 1862

Postabdomen with 8-10 marginal denticles only. Much like A. costata but smaller and dorsal margin less arched. Valves smooth, striate or tuberculate. Postabdomen short, broad, slightly tapering toward apex, truncate, angled, with longest marginal denticles at angle. Length: *f.* around 0.4 mm. *m.* 0.3 - 0.35 mm. Distribution: Common everywhere.

A. costata Sars 1862

Postabdomen with both marginal and lateral denticles. With less than 14 marginal denticles. Up to 0.5 mm long. Lateral denticles not extending beyond dorsal margin of postabdomen. Distribution: Common everywhere.

A. quadrangularis Müller, 1785

Postabdomen with both marginal and lateral denticles. With 14 or more marginal denticles, up to 1 mm long. Without spinules at base of claw; larger than first two species described. Distribution: In vegetation of littoral and on bottom in deeper water; common everywhere.

A. affinis Leydig, 1860

Postabdomen with both marginal and lateral denticles, with 14 or more marginal denticles; up to 1 mm long. With a cluster of fine spinules at base of claw; also larger than first two species described. Distribution: Abundant everywhere in vegetation of littoral regions.

Genus: Pleuroxus

Eye and ocellus of usual size. Body elongated. Posterior margin without teeth along entire length; without teeth at the ventroposterior angle; claws with 2 basal spines.

Species: P. trigonellus Müller, 1785

Postabdomen of moderate length, angle of postabdomen rounded, with row of marginal denticles longer than anal emargination; Color yellowish, transparent, postabdomen often dark.

Length, *f.* 0.6 mm. *m.* 0.4 mm.

Distribution: Uncommon, widely distributed in U. S. and Canada.

Genus: Chydorus

Body not long and elongated, postabdomen ordinarily short with prominent preanal angle. Antennules short and thick. Rostrum long and acute. Claws with 2 basal spines, the proximal often very minute but rarely absent. *m.* with short rostrum. Thick antennule, hook on first leg, postabdomen often very narrow.

Species: C. sphaericus Leach, 1843

Fornices gradually narrowing into rostrum. All olfactory setae on end of antennule. Long and elongated, body spherical or broadly ellipsoidal. No spine at ventro-posterior angle. Valves with no projection at anteroventral margin. Postabdomen with prominent preanal angle. Postabdomen short, broad, shell not deeply sculptured. Ventral edge of keel of labrum smooth. Dorso-anterior surface of head and valves not flattened. All olfactory setae inserted at end of antennules; *f.* 0.3-0.5 mm long; *m.* 0.2 mm long.

Distribution: One of the most common of all Cladocera, widely distributed.

Genus: Alonella

Species: A. acutirostris Birge, 1878

General form something like that of a Pleuroxus of the striatus type. 9-12 small marginal denticles. No teeth at ventroposterior angle. One minute basal spine. Postabdomen with marginal denticles only. Rostrum long, slender, recurved. Color yellow or brown, usually rather dark. Length: *f.* approximately 0.5 mm. long; *m.* approximately 0.4 mm. Distribution: Rather rare, most of United States.

Key to Copepod Diagrams:

F	-----	First Antenna
G	-----	Genital Segment
M	-----	Metasome
R	-----	Caudal Ramus
S	-----	Egg Sac
U	-----	Urosome
W	-----	Metasomal Wing

The Calanoid and Cyclopoid Copepods are drawn to approximately 30 X life size.

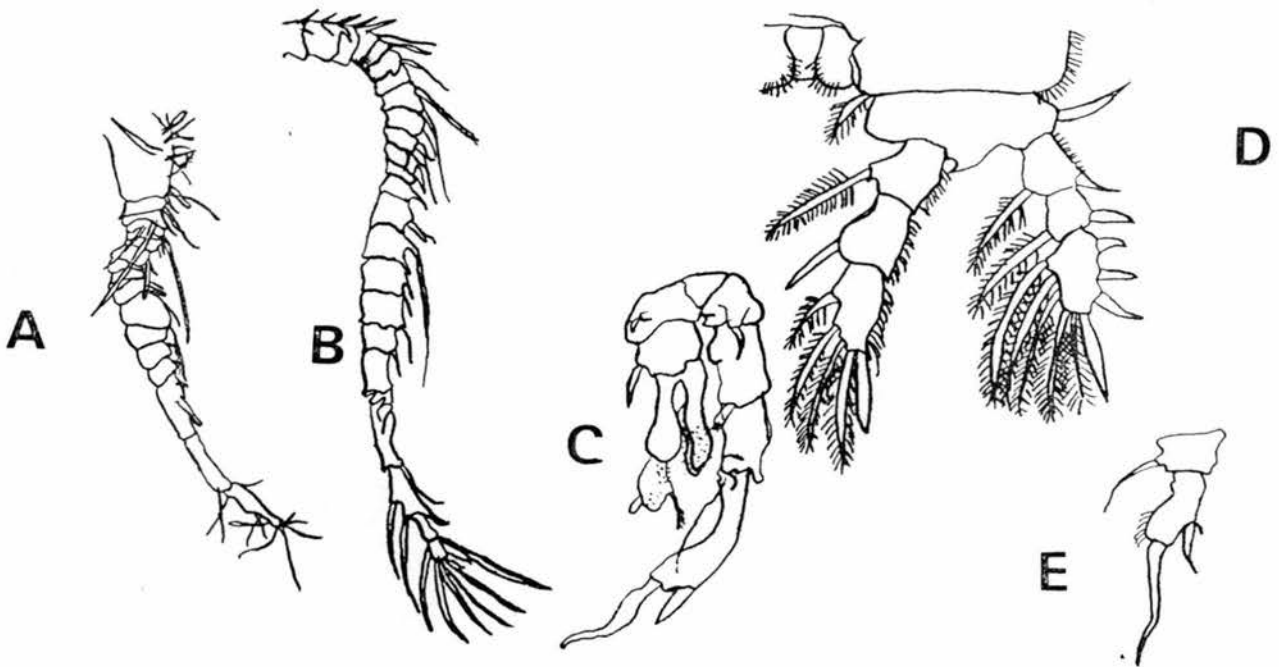
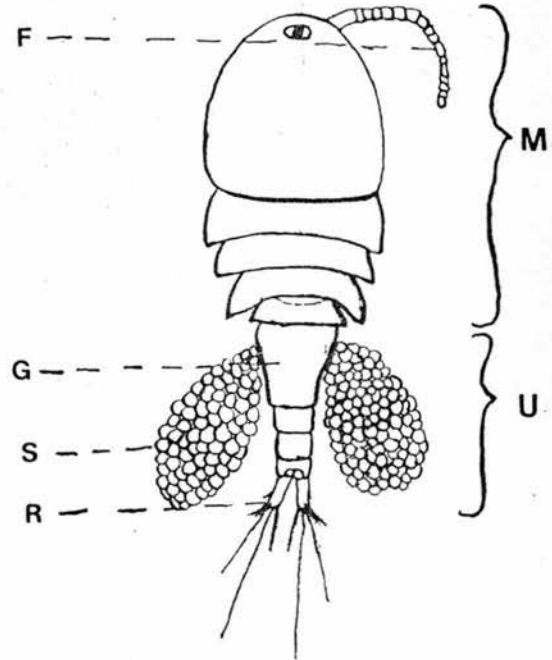
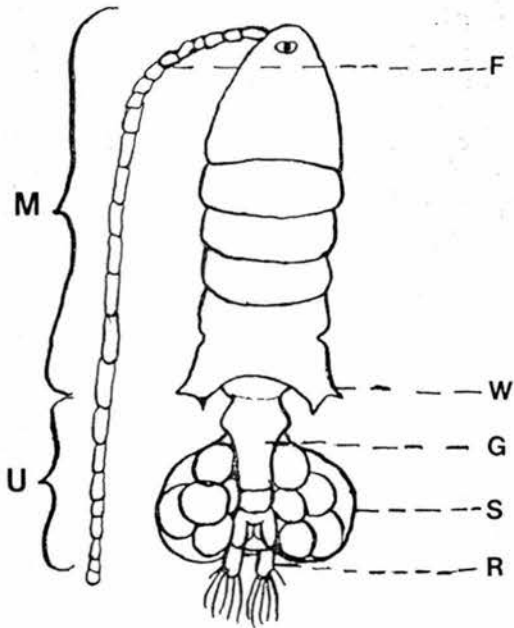
Copepod Appendages (~300X)

- A. First antenna of a male cyclopoid, *Mesocyclops*.
- B. Right antennule of a calanoid, *Diaptomus*.
- C. Fifth leg of a male *Diaptomus*.
- D. Typical swimming leg of *Cyclops*.
- E. Fifth leg of *Cyclops* *scutifer*.

CALANOID COPEPOD

CYCLOPOID COPEPOD

Diagrammatic



Copepod

Appendages (diagrammatic)

Subclass: Copepoda

Order: Eucopepoda

Suborder: Calanoida

Free or parasitic crustaceans without compound eyes or carapace typically 6 pairs of thoracic limbs of which the first is always, and the 6th is often uniramous, the rest biramous. No limbs situated on the abdomen.

Body length ranges from 0.36 to 3.2 mm. Anterior part of body much broader than posterior, marked constriction between somite of 5th leg and genital segment. Urosome (female) 2, 3, or 4 segmented. Urosome (male) 5 segmented. Caudate setae equal or not in length. One egg sac, carried medially. Spermatophore elongate, 1 or more may be attached to female genital protuberance. The 1st antennae reach from near end of metasome to near end of caudal setae. *f.* 23-25 segments. *m.* left similar to *f.* *m.* geniculate or not. Leg 5 is similar to other legs or modified. Basal portion 2 segments. Exopod 2 or 3 segments, endopod present or not, 3-segmented or modified. *f.* symmetrical, *m.* asymmetrical. Distribution: Planktonic, rarely littoral, lakes, ponds, ditches.

Family: Centropagidae

Genus: Limnocalanus

Endopod of 1st segment 3-segmented. Cephalic segment *f. m.*, lateral view, maxillipeds elongate, (about 2X body width in lateral view). Leg 5 *f. m.*, with endopods.

Species: L. macrurus Sars, 1863

Caudal rami 6-7 times longer than wide. Cephalic segment with dorsal depression. Length: *f.* 2.2-3.15 mm, *m.* 2.2-2.78 mm.

Distribution: Found only in deep cold lakes such as the Great Lakes, Finger Lakes, and Green Lake, Wis. Usually considered a relict marine species in Great Lakes.

Family: Temoridae

Genus: Epischura

Caudal ramus *f. m.*, outer seta shorter or spiniform (length < that of ramus); urosome *m.* asymmetrical, the right side with various processes. No apical spine on apex of leg 5 *f.* and left leg *m.*

Species: E. lacustris Forbes, 1882

Endopod of 1st leg with 1 segment. Abdomen of male asymmetrical; 1.3 to 1.6 mm long. Female abdomen bent to the right; *f.* 1.8-2.0 mm.

Distribution: Deep cold waters of Great Lakes region.

Species: E. nordenskiöldi Lilljeborg, 1889

Female abdomen straight. Last abdominal segment of male with one dorsal projecting process: terminal segment of female 5th leg armed with 5 spines. Length: *f.* 1.64-1.99 mm., *m.* 1.1-1.6 mm.

Distribution: Lakes, ponds, Quebec east to coast, south to N. C.

Family: Diaptomidae

Caudal ramus *f. m.* with 5 setae not elongate. Right first antenna of *m.* geniculate. Leg 5 *f., m.*, endopods modified, 1 or 2 segmented, with 0-2 apical setae, leg 5 *m.* right leg ending in single claw.

Genus: Diaptomus Lilljeborg, 1889

First antennae *f.* and *m.*, left side, 2 setae on segment 11, setae on segments 17, 19, 20 and 22 with the end stiffly hooked.

Species: D. minutus

Endopod of first leg 2-segmented, 0.9-4.5 mm long but usually 1.2-2.5 mm long. Antepenultimate segment of male 1st right antenna with slender process. Slender process not grooved and spatulate. Slender process straight. Process longer than the penultimate segment. Antennae reaching beyond the distal end of the caudal rami. Lateral spine of 2nd segment of male right 5th exopod short; right endopod rudimentary.

Distribution: Common in cold waters in N. E. States, very rare west of Mississippi River.

Species: D. sanguineus S.A. Forbes, 1876

Similar to D. minutus except slender process not straight but curved. Process shorter than the penultimate segment. Both terminal processes of male left 5th exopod not digitiform and blunt. Male left 5th endopod not marked with transverse striae. Male right 5th endopod not rudimentary. One of the terminal processes of the male left 5th exopod distinctly falciform. Male right 5th endopod shorter than 1st segment of exopod. Terminal segment of male right 5th exopod of the usual proportions. Male left 5th leg not attaining the end of the 1st exopod segment of the right leg.

Distribution: Common in eastern states, rare elsewhere.

Suborder: Cyclopoida

Anterior part of body much broader than posterior. Marked constriction between somites of 4th and 5th legs. Urosome *f.* 4-segmented. Urosome *m.* 5-segmented. Caudal setae unequal in length. Two egg sacs, carried laterally, spermatophore kidney shaped; 2 may be attached to *f.* genital protuberance. First antennae reach from proximal 1/3 of cephalic segment to end of metasome. *f.* 6 to 17 segments. *m.* both left and right geniculate; leg 5 not like other legs, vestigial, 1,2,3, segmented. Basal segment not enlarged on inner margin. Endopod lacking. Symmetrical, alike in *f.* and *m.* Distribution: Littoral, few species planktonic. Mostly around shores of lakes, or in ponds and ditches.

Family: Cyclopidae

Second antennae small, without a large apical claw. 0.6-3.0 mm long.

Genus: Cyclops

With a moveable articulation between the 5th and 6th thoracic segments, depressed or cylindrical; parasitic, commensal, free-swimming or benthic. Body not greatly flattened dorso-ventrally; abdominal segments not fused; 5th and often 6th legs present. Less than 3 mm. long. All genera free living except Ergasilus. Metasome much wider than urosome, basal segment of 5th legs without inner expansion; first antennae with no more than 17 segments.

Species: C. bicuspidatus lubbocki Brady, 1868

Both rami of 4th legs 3-segmented, rami of first legs 3-segmented. 5th leg made up of 2 segments. Last segment of 5th leg with 2 setae or 1 seta and a spine or spur; inner seta of terminal segment of 5th leg spine-like, much shorter than outer. Caudal rami without longitudinal dorsal ridges. 2nd segment of 5th leg with an apical seta and a long slender spine. 1st antennae 14-segmented. Terminal segment of 4th endopod about 3 or 4 X as long as broad; *f.* about 1 mm., *m.* about 0.8 mm.

Distribution: Eastern Canada.

Species: C. bicuspidatus thomasi Forbes, 1882

Outer terminal spine of endopod of leg 4 about twice as long as inner terminal spine, next to last thoracic segment with papilliform posterolateral process. *f.* 0.9-1.17 mm., *m.* about 0.8 mm.

Distribution: Widely distributed and common in North America.

Species: C. capillatus Sars, 1863

Second segment of leg 5 with apical seta and inner spine just distal to the middle of the segment or almost apical; caudal ramus with or without hairs on inner margin; spine formula of terminal segments of exopods of legs 1-4; 2,3,3,3, or 3,4,4,4, or very variable.

First antenna 12-segmented, inner margin of caudal ramus without hairs. Length: *f.* 1.8-2.2 mm.

Distribution: Rare, Alaska; Eastern Canada.

Species: C. exilis Coker, 1934.

Similar to C. capillatus except 1st antenna of 11 segments. Length: *f.* 0.78-0.88 mm., *m.* 0.7 mm.

Distribution: In small streams in N. C. and N. Y. and Eastern Canada. Uncommon.

Species: C. venustoides bispinosus Yeatman, 1951

First antenna 12 segments. Inner margin of caudal ramus with small hairs. Setae formula of terminal segments of exopods of legs 1-4: 4,4,4,4. Posterolateral angles of next to last thoracic segment not produced. Often with an outer as well as an inner subapical spine on the second segment of leg 5. Length: *f.* 1.6-1.9 mm., *m.* 1.56 mm.

Distribution: Ohio, Quebec, New Brunswick

Species: C. vernalis Fischer, 1853.

First antenna of 17 segments (occasionally 18). Inner margin of caudal ramus without hairs.

Length: *f.* 0.99-1.8 mm., *m.* 0.8-1.5 mm.

Distribution: Very variable and abundant in N. America.

Subgenus: Diacyclops

Species: C. navus Herrick, 1882

Second segment of leg 5 with apical seta and inner subapical, long slender spine; caudal ramus without hairs. First antenna of 17 segments. Outer lateral caudal seta attached at a point $3/4$ - $4/5$ of the distance from base to apex of ramus.

Species: C. navus Herrick, 1882 (Cont'd)

Terminal segment of endopod of leg 4 with 2 spines at distal end. Terminal segment of endopod of leg 4 from $2\frac{1}{2}$ -3 X as long as wide; outer terminal spine of this segment longer than inner terminal spine. Length: *f.* 0.9-1.16 mm, *m.* about 0.86 mm. Distribution: Temporary ponds, wells, small lakes; Canada, Northern U. S., N. C.

Subgenus: Cyclops

Species: C. scutifer Sars, 1863

Three distal segments of 1st antenna with row of fine hyaline spines (not conspicuous); caudal ramus usually with longitudinal, dorsal ridge and inner margin hairy, second segment of leg 5 with apical seta and a large spine attached at middle of inner side of segment. First antenna of 16 or 17 segments.

Spine formula of terminal segments of exopods of legs 1-4:

3,4,3,3. Fourth and 5th metasomal segments (somites of legs 4-5) laterally expanded into pointed wings; caudal ramus usually 4 X as long as broad; outer lateral seta attached at a point 65-73% of distance from base to apex of caudal ramus.

Length: *f.* 1.29-1.9 mm., *m.* 1.0-1.4 mm.

Distribution: Common limnetic species in Canada, Alaska, New York.

Genus: Eucyclops

First antenna of 12 segments (N. A. species). Leg 5 consisting of 1 distinct, broad segment and armed with an inner spine and 2 outer setae. Caudal ramus of female with spinules on outer margin.

Species: E. speratus Lilljeborg, 1901

Caudal ramus at least 4 X as broad in males and females. First antenna reaching beyond hind margin of 1st body segment and usually to hind margin of 2nd body segment. Caudal ramus usually more than 5 X as long as broad, lateral spinules very small; inner corner seta usually shorter than ramus in male and female. Length: *f.* 1.0-1.6 mm; *m.* 0.75-0.8 mm.

Distribution: Found in shallow water. Not common but widespread in N. A.

Species: E. agilis Koch, 1838

Similar to *E. speratus* except caudal ramus usually not more than 5 X as long as broad. Lateral spinules conspicuous; inner corner seta slightly longer to considerably longer than caudal ramus in male and often in female. Length: *f.* 0.8-1.5 mm., *m.* 0.68-0.8 mm.

Distribution: Probably the commonest littoral cyclopoid copepod in N. A.

Genus: Macrocyclops

Species: M. albidus Jurine, 1820

Distal segment of leg 5 armed with 2 long spines and a median seta. First antenna of 17 segments. Both rami of 4th legs 3-segmented. Rami of 1st legs 3-segmented. 5th leg of 2 segments. Last segment of 5th leg with 3 setae. Lamella on last segment of antenna of female smooth and forming a lappet at tip of segment.

Distribution: In shallows among vegetation or on bottom; widely distributed.

Genus: Mesocyclops

Species: M. edax Forbes, 1891

Similar to Macrocylops except last segment of 5th leg with 2 setae or 1 seta and a spine or spur. Setae of terminal segment of 5th leg unequal in length. Hyaline membrane on each of last 2 segments of 1st antennae. Fifth leg with inner seta on median side of 2nd segment; caudal rami with hairs on inner margins. Length: *f.* 1.0-1.5 mm., *m.* 0.75-0.9 mm.
Distribution: Very common, widespread, limnetic.

Genus: Paracyclops

Species: P. affinis Sars, 1863

Both rami of 4th legs 3-segmented. Rami of 1st legs 3-segmented. Fifth leg made up of a single distinct segment. First antenna 11-segmented. Length: *f.* 0.6-0.85 mm., *m.* 0.56 mm.
Distribution: Rare, creeping species found in weeds in shallow water and also in water of pitcher plant leaves in Quebec.

Species: P. fimbriatus Fischer, 1853

As for P. affinis except 1st antennae 8-segmented. Caudal ramus 4-6 times as long as wide with short transverse row of spinules next to lateral seta. Length: *f.* 0.7-0.9 mm., *m.* 0.74-0.85 mm.

Distribution: Widely distributed.

Species: P. fimbriatus poppei Rehberg, 1880

Caudal ramus 3 to 4 X as long as wide with longitudinal dorsal row of spinules. Length: *f.* 0.70-0.9 mm., *m.* 0.7-0.85 mm.

A creeping species.

Distribution: Found in shallow water. Common and widespread in North America.

Genus: Tropocyclops

Species: T. prasinus Fischer, 1860

Leg 5 consisting of 1 distinct, broad segment and armed with an inner spine and 2 outer setae. First antenna of 12 segments (in N. A. species). Caudal ramus of female without spinules on outer margin; caudal ramus about 3 X as long as broad in males and females. Dorsal caudal seta < 2 X as long as outermost terminal caudal seta; inner terminal spine of inner end segment of leg 4 < 2X as long as segment. Length: *f.* 0.5-0.9 mm., *m.* 0.55-0.6 mm.

Distribution: Very common and widespread limnetic species in N. A.

Benthic Fauna Occurring in the Plankton

On occasion, animals normally benthic in nature were captured during zooplankton tows. Their occurrence in the nets was probably accidental, a result of being removed from the bottom by currents or being disturbed in those instances when the net scraped the bottom. Nevertheless, since they were found in varying quantities in the plankton samples, their taxonomy is described in this section.

Order: Copepoda

Suborder: Harpacticoida

Anterior part of body usually little broader than posterior, slight or no constriction between somites of 4th and 5th legs. Urosome *f.* 4-segmented, urosome *m.* 5-segmented. Caudal setae unequal in length. Usually 1 egg sac carried medially. Spermatophore elongate; 1 or more may be attached to *f.* genital protuberance. First antennae reach from proximal 5th to end of cephalic segment. *f.* 5-9 segments, *m.* both left and right geniculate. Leg 5 not like other legs, vestigial. Two segments or segments fused. Basal segments enlarged on inner margin into broad expansion usually bearing spines and setae. Symmetrical, more developed in *f.* than *m.*

Distribution: Extremely littoral; shores of lakes, ponds, ditches, on vegetation, in mud, debris, wet moss above water, between sand grains on damp beaches.

Family: Canthocamptidae

Genus: Canthocamptus

Leg 1 *f.m.*, exopod 3-segmented. Exopod segment 3 with total of 4 spines and setae. Leg 1 *f. m.*, exopod segment with 2 inner seta. Leg 1 *f. m.*, endopod 3-segmented; and rostrum small to moderately developed, not extending beyond segment 1 of first antenna. First antenna *f.* 7-9 segmented (usually 8); leg 3 *m.* with hypophysis (stout spiniform process arising from inner margin or base of 2nd segment or its equivalent and extending beyond apex of endopod). Leg 5 *f.*, seta 2 of basal expansion very reduced, not more than and usually less than $\frac{1}{4}$ the length of seta 1. Leg 4 *m.*, outer corner of apical endopod segment produced as spinous process.

Species: C. vagus Coker and Morgan, 1940

Leg 2 *f. m.*, endopod with 1 distal inner seta. Caudal ramus *f. m.*, outer apical seta stout, spiniform. Leg 5 *f.*, mid-portion of basal expansion bearing setae 2-4 produced beyond the rest of the segment. Leg 4 *f.* outer apical seta of endopod much longer than outer spine. (*m.* unknown). Caudal ramus *f.* typically with small spinules along entire inner margin, placed somewhat ventrally so not visible in dorsal view. Anal operculum with 8-12 spinules. Length *f.* about 1 mm. Distribution: Type locality in N. C., Wash.

Genus: Tendipes (Chironomus)

some species of Tendipes that inhabit lakes where there is an O₂ deficiency have one or 2 pairs of finger-like gills on the penultimate abdominal segment. Many species are blood red. They are herbivorous and microphagous, and build flimsy tubes of organic detritus, algae or small sand grains and silt lined with a silky substance from salivary secretion. Usually attached, but in a very few species they are moveable.

Antennae not retractile, usually short, 3rd antennal segment not annulated; paralabial plates present, radially striated, labial plate toothed in center, antennal blade at distal end of basal segment, antennae not mounted on tubercles or prominences, shorter, usually straight, and 5 paralabial plates broadly separated, preanal papillae shorter, labial plate with an odd number of teeth. Ventral gills on 11th segment.

Class: Insecta

Order: Diptera

Family: Tendipedidae (midges)

Subfamily: Pelopiinae

The larvae of the subfamily Pelopiinae are found in ponds, lakes, streams, and rivers. They do not build cases, but are sometimes found in the cases of other tendipedids. They are predaceous, with other insect larvae forming a large part of the diet. Larvae are elongated, cylindrical, slender,; range from 2-30 mm. They have a pair of prolegs on both the first thoracic and last abdominal segments. Spiracles are absent, but sometimes there are anal gills on the lateroventral surface of the penultimate abdominal segment.

Genus: Procladius

Antennae retractile, usually elongated, prolegs long and stilt-like, anterior pair with a common base. Segments of body with a longitudinal hair fringe on each side; head rather broad; ventral pair of anal gills attached to base of prolegs remote from anus. Head never more than 1/3 longer than broad; antennae $\frac{1}{4}$ or $\frac{1}{3}$ as long as head; 4 anal gills, lingua of hypopharynx with 5 teeth, larva whitish, yellowish or reddish, somewhat mottled with brownish spots.

Phylum: Annelida

Class: Clitellata

Subclass: Oligochaeta

Order: Haplotaxida

Family: Naididae

The Naididae are small oligochaete worms that inhabit the bottom sediments and swim about immediately above the bottom. The species occurrence is reported by Watt et al (1973).

Genus: Nais

Eyes normally present. Anterior segments usually pigmented. Ventral setae of II - V mostly well differentiated from those of following segments; dorsal setae beginning in VI, hairs and double - or simple pronged needles. Coelomocytes present. Clitellum extends from half of V to VII, absent between the male pores; spermathecae immediately above atrial ducts; penial setae present; two species.

Species: N. elinguis Müller, 1773

Anterior end reddish brown. Hairs and needles 1-3 per bundle; hairs 150-305 μ long. Swim with lateral movements.

Distribution: Northern United States and Canada.

Genus: Dero

Subgenus: Aulophorus Schmarda, 1861

Dorsal chaetae present from IV, V or VI, onwards; ventral chaetae of II-V different or not different in shape from those of following segments. Posterior border of branchial fossa projecting into two palps. Coelomocytes present or absent. Spermathecae rarely absent; vasa deferentia joining atria at anterior side; no prostate glands; budding or fragmentation.

Species: A. furcatus Müller, 1773

Dorsal chaetal bundles beginning in V, consisting of 1 hair, 85-200 μ long and 1 needle, 45-62 μ long; distal tooth of these thinner and shorter than proximal; ventral chaetae 2-5 per bundle. Branchial fossa with fairly long thin palps and 3 (or 4) pairs of finger-shaped gills, the foremost pair sometimes very short; in attached or portable tubes and swimming with transverse, horizontal undulations. Fresh water. Distribution: United States and Canada.

Genus: Stylaria

A long proboscis present. Eyes present. Dorsal chaetae beginning in VI, a few hairs and straight simple-pointed needles without nodulus in each bundle; ventral chaetae all of one shape. Stomach dilating suddenly in VII or VIII. Clitellum absent around male pores; vasa deferentia with or without prostate on their most distal part; atria without prostate; penial chaetae present.

Species: S. lacustris Linnaeus, 1767

Proboscis projecting from a notch between two lateral lobes. Hairs 1-3 per bundle, 465-1050 μ long, finely serrated; needles 3-4 per bundle. Swim lying on one side, with rapid beats in a horizontal plane. Fresh and brackish water.

Distribution: Southern United States up into Canada.

Species: S. fossularis Leidy, 1852

Proboscis projecting from the tip of the pointed prostomium. Dorsal chaetae 2 hairs, and 1-3 short hairs per bundle; ventral chaetae 5-14 per bundle. Swim with sagittal movement in the horizontal plane.

Distribution: Southern United States up into Canada.

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