mandible fits very closely with the lower one, something after the fashion of scissors, and they are therefore well adapted to their work of feather-trimming.

On closer inspection of the shaft, we find that traces of a web still remain, showing that it did not come so by a natural growth; so that after a careful examination of the structure of the bill, and considering the unevenness of the missing webs as well as the time of its disappearance, we must conclude that what nature does not do by narrowing the feather, the bird by its natural instinct of beauty and symmetry does with its bill.

A CONTRIBUTION TO THE HISTORY OF THE FRESH-WATER COPEPODA.

1883

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The study of the fresh-water Copepods, or oar-footed *Crustacea*, of North America, has, until recently, been quite neglected. Within a few years the diligence of two or three naturalists, mainly of Professor Forbes, of the Illinois State Laboratory of Natural History, has given us substantial contributions to the knowledge of this interesting part of our fauna.

As early as 1818, Say described an American species of Cyclops; but his description, like those of Haldeman, Dana, and several later authors, is imperfect and not of specific value.

The free-swimming *Copepoda* known to inhabit inland waters are as follows: *Centropages*, *Osphranticum*, *Diaptomus*, *Heterocope*, *Epischura*, *Limnocalanus*, *Temora*, *Cyclops*, *Tachidius*, *Canthocamptus*, and *Attheyella*. Of these eleven genera, four—*Diaptomus*, *Limnocalanus*, *Cyclops*, and *Canthocamptus*—have been recorded as common to the fresh waters of the Old World and the New. I add *Heterocope* on the authority of my friend, Mr. William Patten, who informs me that a species is common in Watertown, Massachusetts.

Tachidius, in the Old World is known only in waters made salt or brackish by the ocean; but a species has been found by Mr. V. T. Chambers at Big Bone Springs, Kentucky, in moss wet with the mineral water.

Temora, in the Old World has been found in both salt water and fresh; but in America has not yet been discovered in fresh water.

Osphranticum and *Epischura* are known only in North America, having been described recently from Lake Michigan and Normal, Ill., by Professor Forbes.

Attheyella is as yet known only in Great Britain, one of its species living in the damp roof of a coal mine.

would this account for the mutilation, even were the conditions of the nest favorable; for the web of the feather is arranged laterally upon the shaft of the feather, which would require a vertical motion to wear it away, while the motion of the bird's tail is transverse to its own body, as also to the nest—a motion only calculated to wear away the shaft from beneath.

Some of the Momotidæ are very tame, and seem to have no fear of man, but rather to prefer his company, making their nests in his wells and in his cellars. Such is the *Eumomotus superciliaris*, a species whose habits I have studied more than all others.

During my residence of nearly four months in the city of Temax, near the north coast of Yucatan, about twenty of these birds lived in a well from which I used water every day. The water was drawn by means of two buckets attached each to the end of a rope, which played over an iron pulley. The well was almost forty feet deep, had been cut through a porous shell-limestone, and its walls contained many cavities into which a man could crawl many feet, but was obliged to back out. Within these cavities live the motmots, and oftentimes very venomous little reptiles, called "canchæ" by the natives. But, risking the poisonous serpents, I have frequently gone many yards into these caverns to investigate the home of the saw-bills and their work therein, and I have always come out feeling well repaid for all the danger, having invariably seen something new and interesting. At one time I have found only the nest, with four or six roundish, white eggs, with the shell so thin and transparent that the yolk was plainly visible; at another, I have found the young birds in almost every state of development—those with the tail feathers just starting being always the most interesting. The feathers all seem to grow alike to a certain point, except the middle ones, which are always a little broader towards the end; there all cease to grow except the two middle ones, which soon pass the others by about an inch and a half. Up to this point the webs of these two feathers are just the same throughout, except the subterminal portion, which is much narrower. Thus far no mutilation has taken place, but as soon as these feathers exceed the others a little more, the web begins to disappear, and the outer web of each feather is generally taken off first. This, however, is not always the case, as the inner web sometimes goes first. In very few cases have I ever seen a web trimmed farther up than just to the ends of the other tail feathers; and just as these pass the shorter ones, so are they trimmed until their growth ceases.

I have never seen the bird arrange its feathers, and especially not its tail, when above-ground, though I have seen them work for a long time with the bill, arranging the tail, while they were in the well—catching hold of it and drawing it around, first on one side, then upon the other, always using the point and not the whole of the bill.

On examining the bill, it is found to be dentated in the middle portion and smooth at the tip and base. The smooth portion of the tip of the upper

Centropages is an oceanic genus, but has been found also in the fresh-water lakes of Kerguelen's Island.

The genus *Cyclops* appears to have been the *bête noire* of American naturalists. Comprising upwards of sixty valid species, many of which are described in Latin, German, Danish or Dutch, and several of which have been locked up in the Russian language, and the separation of species usually depending, not upon single gross characters, but upon sets of microscopic and often recondite details, it is hardly strange that American naturalists should have neglected this genus for the study of others promising their labor larger and quicker returns. We are not surprised, then, to find that but three valid species of *Cyclops* have as yet been recorded from North America, and that in our latest and best zoölogical text-book, written by something of a specialist in insects and *Crustacea*, the long-since defunct and quartered "*Cyclops quadricornis*" is cited as type of the *Entomostraca*.

I have given some time, during a part of the last two years, to the study of the free-swimming *Copepoda* of the fresh waters about Cambridge, Mass., and the present paper gives the major part of the results of those studies, together with a translation of the descriptions of *Cyclops* by Poggenpol, published in the Bulletin of the Friends of Natural History, 1874, vol. X, part 2, page 70 *et seq.* The translation has been made, so far as practicable, a literal one, and is the work of Mr. Ivan Panin, A. B., of Concord, Mass., to whom the Russian language is native, and whose thorough knowledge of English and Latin has made it possible to obtain an accurate translation of the technical terms.

Before passing to the list of species, I would note the occurrence of *Lagenella mobilis*, Rehb. in North American *Cyclops*. Before Rehberg's description of *Lagenella mobilis* (Abhandl., vom naturwissch. Vereine zu Bremen, Band VII, Heft 1, 1880, p. 68, Taf. IV) came under my notice, I had observed and made drawings of this curious gregarine, parasitic in *Cyclops*, at Cambridge, Mass. Though only described in 1880, it appears to have been previously noticed by Vernet (Observations Anat. et Physiol. sur le Genre *Cyclops*), and doubtless has the same cosmopolitan distribution as does the genus, its host.

In the list which follows, the dimensions given are those of females, unless otherwise stated. The apical caudal setæ are numbered outward.

Cyclops elongatus, Cls. (Pl. I, figs. 1 and 19–23.)

Observed sparingly in a rain-pool near the Cambridge Museum of Comparative Zoölogy.

Cyclops signatus, Koch, var. nov. *fasciacornis*. (Pl. II, fig. 15.)

The ditches near Glacialis Pond yield a *Cyclops* which agrees well in structural characters with *C. signatus*, Koch, but which differs from the European *signatus* so markedly in coloration as to constitute a distinct variety. The color-pattern appears constant for localities about Cambridge.

The general ground color is a pale blue-green, and is for the most part hidden by blotches of shining brown. The caudal segments and the alimentary tract are of a beautiful blue. The antennæ, for the most part colorless, have the basal joint brown, the distal portion of the fourth and all of the fifth stained less deeply with the same color, the thirteenth and fourteenth tinged with a still lighter shade of the same, and the apical joint also showing a faint tinge of it.

Length, exclusive of caudal setæ, 1.65–1.71 mm.

Cyclops tenuicornis, Cls. (Pl. II, figs. 1–14.)

This species is quite common about Cambridge. Agreeing in all its gross structural characters with the European descriptions of *tenuicornis*, it still seems to differ from the same in some of the finer details of its armature. These details, if actually lacking in European representatives of the species, are sufficient to characterize the American type as a distinct variety; but I strongly suspect that they have been overlooked in the European type, and shall therefore merely point them out, leaving the question of identity to be settled by those who command European specimens.

Either side of the fifth thoracic segment is furnished with three transverse rows of serrulations, of which the posterior one is marginal; and each of these is continued by a fainter line of more minute serrulations, which extends across the upper side of the segment. The second maxillipeds have, beside the large setæ and the small cilia of the anterior and posterior margin, a ring-like cluster of very flexible cilia, which possibly constitute a special sensory organ, on one of the broader sides (that next the (?) median line of the body) of the basal joint near its distal end, and a smaller and somewhat similar cluster nearer the base of the same joint. A small area at the base of the mandible is thickly studded with sharp points which resemble rapidly tapering cones.

Length, exclusive of caudal setæ, 1.74 mm.

Cyclops viridis, Fischer. (Pl. IV, figs. 8-16.)

Cambridge. Taken from the pond in the Botanic Garden.

Cyclops pulchellus, Koch. (Pl. I, figs. 2-8.)

Cambridge. I have seen but a few specimens; these from a rain-pool near the Museum of Comparative Zoölogy.

Cyclops Thomasi, Forbes. (Pl. III, figs. 1-13.)

Body slender. Sides of the fourth segment postero-laterally produced into recurved angles, a slight approach to which angulation is seen in the second and third segments. Lateral angles of the fifth, pinched into a slight fold or notch just back of the apex. (In the male, none of the segments are produced into angles at the sides.) In the first abdominal segment, a lateral indentation marks off the much-dilated anterior from the tapering posterior portion. The last three abdominal segments do not taper individually, nor scarcely as series. Posterior border of the last abdominal segment set with a fine

pectinate fringe. Caudal rami slender; six to seven times as long as broad; fully equal in length to the two and a half segments immediately preceding. Each ramus bearing six finely-plumose setæ, and on the outer side, at about one-fourth its length from the base, a short transverse row of six to eight point-like spines, similar to those which constitute the pectinate fringe of the last abdominal segment. Of the four apical setæ, the first is much shorter than the furca, the fourth still shorter, the second fully three times as long as the furca, and the third about half as long as the second. The webs of the second and third extend well toward the ramus. First antennæ, seventeen-jointed, scarcely reaching the third body-segment. (Nearly reaching the fourth segment in the male.) Labrum usually with eleven teeth. The armature of the swimming-feet is as follows:

FIRST FOOT.

(*a.*) *Outer branch.*		(*b.*) *Inner branch.*	
Basal joint.....	exteriorly, one spine. interiorly, " seta.	Basal joint.....	ex., unarmed. in., one seta.
Middle joint..	exteriorly, one spine. interiorly, " seta.	Middle joint..	ex., unarmed. in., two setæ.
Apical joint...	exteriorly, two spines. apically, " setæ. interiorly, " setæ.	Apical joint...	ex., one seta. ap., one spine, one seta. in., three setæ.

SECOND FOOT.

Outer branch.		*Inner branch.*	
Basal joint.....	ex., one spine. in., " seta.	Basal joint.....	ex., unarmed. in., one seta.
Middle joint..	ex., one spine. in., " seta.	Middle joint..	ex., unarmed. in., two setæ.
Apical joint...	ex., two spines. ap., one spine, one seta. in., three setæ.	Apical joint...	ex., one seta. ap., one spine, one seta. in., three setæ.

THIRD FOOT.—Like second foot.

FOURTH FOOT.

Outer branch.		*Inner branch.*	
Basal joint.....	ex., one spine. in., one seta.	Basal joint.....	ex., unarmed. in., one seta.
Middle joint...	ex., one spine. in., one seta.	Middle joint...	ex., unarmed. in., two setæ.
Apical joint...	ex., two spines. ap., one spine, one seta. in., three setæ.	Apical joint...	ex., one seta. ap., two spines. in., two setæ.

Inner of the two apical spines of the inner branch of the fourth foot half the length of the outer. Fifth foot composed of two joints, of which the apical is well developed and about half as wide as the basal; the basal bearing at its outer angle a rather short seta, the apical bearing one rather short and one long seta. Ovisacs small, broadly elliptical, with major axes parallel to the sides of the abdomen, which they partly cover. Each ovisac contains from thirteen to twenty-two (usually sixteen to twenty) large eggs. Animal yellowish white, or sometimes particolored in yellow and white. (In the male, the yellow first abdominal segment contrasts with a lighter-colored segment preceding and following.) Ovaries often colorless, but becoming darker as the eggs approach maturity. Ovisacs varying from dark blue-gray in the earlier to almost colorless in the later stages of the development of the contained eggs.

Length of animal, exclusive of caudal setæ, 1.11 mm. (Male, .92 mm.)

The present species differs from *Leuckartii* in having shorter antennæ, whose last three joints are subequal; in the size and armature of the apical joint of the fifth foot; in having more slender caudal rami, the relative lengths of whose apical setæ are different from those of *Leuckartii;* in the possession of a very characteristic transverse row of point-like spines on the outer side of the caudal ramus; and in lacking a crenulate contour for the dorso-basal margin of the second maxilliped. From *abyssorum, lacustris,* and *scutifer* of Sars, it differs in the armature of the swimming-feet, caudal rami, etc.; from *simplex,* Pogg., in the form of the body, first abdominal segment, fifth foot, and caudal rami. I have studied it at intervals for over two years, and had given it the manuscript name "*urbanus,*" in allusion to its abundance in cities; but it is clearly identical with the recently described *C. Thomasi,* Forbes. Prof. Forbes has the honor of having published the first new and valid species of *Cyclops* that has yet been recorded from North America.

I have most commonly observed *C. Thomasi* in the water-supplies of Boston and Cambridge, Mass. It is (in winter and spring, at least) easily obtainable in any house of either city, greatly outnumbering all other species of *Cyclops* that pass through the faucets.

Cyclops magnoctavus, sp. nov. (Pl. III, figs. 14–23.)

Cephalothorax subelliptical. None of its segments angulated at the sides. Its first segment longer than the rest of the thorax plus the first two segments of the abdomen. Its last segment, which is not wider than the first of the abdomen, is set apart from the rest so as to seem like an abdominal segment, and bears at either postero-lateral margin a fringe of delicate hairs. Posterior part of first abdominal segment slightly tapering; anterior part not dilated. Posterior margin of last abdominal segment bearing a pectinate fringe. Caudal segments about four times as long as broad, and bearing two superior and four apical setæ. Of the apical setæ, the first is longer than the spine-like fourth, but shorter than the furca; the second about as long as the last three abdominal segments plus the furca; the third but little shorter than the second. Webs of the second and third composed of delicate cilia, which extend well down toward the ramus. Eye large, dark red; deeply divided by a median constriction posteriorly. First antennæ composed of twelve joints and reaching, when reflexed, beyond the cephalothorax —sometimes nearly to the middle of the first abdominal segment. Their eighth and ninth joints are both longer than either of the last three, the eighth being the longest of all. Each of the last three bears a plain longitudinal ridge. Last joint of second antennæ considerably more slender than the others. Labrum with ten to thirteen teeth. The armature of the basal and middle joints of the swimming-feet is like that of *C. Thomasi;* that of the apical joints is as follows:

First Foot.

Outer branch: ex., three spines. ap., two setæ. in., three setæ.
Inner branch: ex., one seta. ap., two setæ. in., three setæ.

Second Foot.

Outer branch: ex., three spines. ap., one spine, one seta. in., four setæ.
Inner branch: ex., one seta. ap., two setæ. in., three setæ.

Third Foot.

Outer branch: ex., three spines. ap., one spine, one seta. in., four setæ.
Inner branch: ex., one seta. ap., two setæ. in., three setæ.

Fourth Foot.

Outer branch: ex., two spines. ap., one spine, one seta. in., four setæ.
Inner branch: ex., one seta. ap., one seta-like spine, one seta. in., two setæ.

Fifth foot uni-articulate, trisetose. Ovisacs small, sub-oval, nearly or quite meeting above the abdomen, and usually containing from five to eight eggs.

Animal dirty blue-green; antennæ lighter. Dark green pigment-masses are scattered beneath the integument in various places, particularly along the anterior side of the first antennæ.

Length, exclusive of setæ, .68 to .78 mm.

A very distinct species, belonging to that section of the genus which includes *Cyclops serrulatus*, Fischer, *C. varicans* and *macrurus* of Sars, and *C. alajensis*, Uljanin.

Cambridge. Very abundant in the dirty water of the blind ditches connected with the artificial pond known as "Glacialis."

Cyclops pectinifer, sp. nov. (Pl. IV, figs. 1–7.)

Closely allied to *serrulatus*, from which it differs in having the posterior margin of the last thoracic segment ciliated at the sides, the third apical caudal seta not more than half as long as the second, and the first antennæ, when reflexed, covering about three and a half segments. There is also an epaulette of minute cilia on the basal joint of the first antennæ, a mark which Claus seems to have noticed in the European *serrulatus* and intended to represent in figure 1, taf. I of "Das Genus Cyclops," though omitting it in his text. The color is usually a shining yellowish brown.

Length, exclusive of caudal setæ, 1 mm.

This species is common in ponds, ditches, and rain-pools about Cambridge.

Cyclops uniangulatus, nov. sp. (Pl. IV, fig. 17.)

Cephalothorax suboval. First four segments not angulated, nor separated at the sides. Fifth produced into a strong and somewhat recurved angle at either side. Anterior portion of first abdominal segment much swollen, and almost angulated at the sides; not marked off from the posterior portion by the conspicuous lateral indentation seen in certain other species. Last abdominal segment posteriorly fringed with exceedingly minute spines. Caudal stylets somewhat slender; plain, except for the usual six plumose setæ. Of the four terminal caudal setæ, the first—considerably shorter than the caudal segment—is longer than the fourth; the second, about one and a fourth times as long as the third. Pinnæ of web of two intermediate terminal cau-

dal setæ fine, short, and sparsely set. First antennæ seventeen-jointed, and about as long as the first body-segment. The armature of the basal and middle joints of the swimming-feet is the same as in the *C. Thomasi*. That of the apical joints is as follows:

First Foot.

Outer branch	ex., two spines. ap., two setæ. in., three setæ.	Inner branch	ex., one seta. ap., ? ?. in., ? ?.

Second Foot.

Outer branch	ex., three spines. ap., one spine, one seta. in., three setæ.	Inner branch	ex., one seta. ap., one spine, one seta. in., three setæ.

Third Foot.

Outer branch	ex., three spines. ap., one spine, one seta. in., three setæ.	Inner branch	ex., one seta. ap., two subequal spines (inner shorter). in., three setæ.

Fourth Foot.

Outer branch	ex., three spines. ap., one spine, one seta. in., three setæ.	Inner branch	ex., one seta. ap., two subequal spines. in., two setæ.

Fifth foot bi-articulate. Basal joint wide and bearing a rather long plumose seta at its outer angle. Apical joint small and narrow, bearing a long plumose seta, and interior to the same a small seed-shaped spine shorter than the joint itself. Ovisacs large, ellipsoidal, diverging, reaching posteriorly to a point about even with the end of the furca, and containing many (about (?) ninety) eggs. The color of the animal is dirty-white. Length, exclusive of caudal setæ, 1.55 mm. Cambridge, from a pool near the Museum of Comparative Zoölogy.

Cyclops perarmatus sp. nov. (Pl. I, figs. 9–18.)

First body-segment somewhat narrowed in front, and about as long as the four and a half segments following. Posterior border of penultimate segment of thorax furnished at the sides with a minutely pectinate fringe. Sides of the last thoracic segment finely ciliate, the stout spines of the fifth feet projecting from beneath them. Abdominal and caudal segments greatly foreshortened. Two small lateral protuberances at the anterior end of the scarcely tapering first abdominal segment mark the situation of the vulvæ. Posterior border of last abdominal segment bearing a strong pectinate fringe. Caudal segments about twice as long as broad, and sown on their inner sides with short cilia, certain of which on either segment are placed in a double row running obliquely outward and forward across the dorsal surface. Outer of the two superior caudal setæ quite short and remote from the apex of the segment. Of the four apical setæ, the first and fourth are very short; the second rather longer than the third, and about as long at the cephalothorax. The first and fourth are ciliate-plumose. The second is plain at the base; then sparsely and briefly spino-plumose, the pinnæ becoming gradually feebler toward the tip. The third is on the inner side, ciliate-plumose, excepting the plain basal portion, and on the outer side ciliate-plumose at the base; distad to this briefly spino-plumose as in the second. Eye large, dark red, deeply notched in front. First antennæ eleven-jointed; reaching about to

the posterior third of the first body segment. Second antennæ and mouth parts composed of short and wide joints. Labrum with eight teeth. First and second maxillipeds bearing a transverse row of setæ on the second joint; the second bearing also a cluster of three or four similar setæ on the basal joint. The apical joints of the posterior swimming-feet, as compared with those of the anterior, are much less narrowed than is usual in *Cyclops*. The swimming-feet have, in addition to the *ordinary* armature of setæ and spines, a closely set row of much smaller spines along the outer side of each ramus. Their *ordinary* armature I have not yet ascertained in detail.

The fifth foot is a simple flange-like process of the inflected border of the fifth body segment. It has three obtuse angles, which are truncated for the reception of the three stout, subequal setæ. Of these setæ, the innermost is plumed on all sides with short, stout cilia, the second with slenderer cilia, while the outermost is nearly or quite plain. A line of distinct serrulations extends from one fifth foot to the other.

Color, dirty-white.

Length, exclusive of caudal setæ, 1.15 mm.

Allied to *C. phaleratus*, Koch, from which it differs in the number of joints in the first antennæ, and in some of the details of its armature. The seventh joint of the first antennæ of the present species corresponds with the seventh and eighth of *phaleratus*.

This species is abundant in Glacialis Pond, Cambridge. It is easily recognized by the peculiar habit, which it shares with *phaleratus*, of leaving the drop of water in which it may have been placed, and nervously hitching itself along on the dry glass, where it will remain and perish by drying, if not rescued.

POGGENPOL'S NEW SPECIES OF CYCLOPS.

*Cyclops simplex.** The length of the body, as far as the tail setæ, is 1.5 mm. The antennæ of the first pair are seventeen-jointed, and extend to the third thoracic segment. The body is of an oval form, somewhat pointed posteriorly. The abdominal segments, except the first, are one and a half times as long as broad. These segments are almost square. The furca is somewhat longer than the last abdominal segment. The three terminal segments of the first pair of antennæ are but little longer than the preceding ones; the longest and thickest basal segment is provided with six to eight heavy bristles; it has no hair nor serrulations. The fourth and seventh segments are almost twice as long as the rest, and are furnished with several bristles, while all the segments, beginning with the eighth, have each only one bristle. The fifteenth and sixteenth segments are each provided with

*The identification of *Cyclops Leenwenhockii* of Hoek with *C. simplex* of Poggenpol does not seem to me to be warranted by the study of both text and plates of the two authors. The first antennæ of *Leenwenhockii* reach to the base of the abdomen, while those of *simplex* cover only the first two segments of the body. The basal joint of the fifth foot, also, is short and broad in the former, and long and narrow in the latter. It is probable, too, that Poggenpol would have seen and mentioned a longitudinal ridge on the first antennæ of *simplex*, had one existed as in *Leenwenhockii*, since he describes the joints of these antennæ and their furniture at considerable length.

two bristles; but the last has from five to six long bristles and one spine. The second pair of antennæ consist of four segments of equal length. The first two segments are provided on the interior surface with little hairs. The mandible consists of one plastinated segment, and is similar to the mandible described under *C. Clausii.* Near the little terminal tooth itself there is a rather long segmented bristle; but on the basal part of the mandible there are two long and one short bristle. The maxilla is the same as in *C. Clausii*, but is entirely without the stout spine which is beset with a few setæ, which is distinguished at the base of the two large terminal spines on the mandible of *C. Clausii.* The fifth pair of feet consist of two segments. The basal segment has one long bristle; the second has two, of which one is situated on the summit of the segment, and the other on a small side-elevation. These bristles are plain, not plumose. In the first abdominal segment there is a cemental gland, which consists of three parts; the posterior, not divided, and two front ones. The branches of the furca are each provided with six plumose bristles. The longest of these is three times as large as the furca. The last abdominal segment is posteriorly furnished with a row of thin serrulations. The color is dirty yellow, and the pigment of the eye is dark red.

Cyclops Clausii. The length of the body in female is 1.9 mm.; with tail-bristles, 2.4 mm. The body is longer and narrower than that of *Cyclops simplex.* The first antennæ are very long, and reach as far as the middle of the fourth thoracic segment, and consist of seventeen joints. The last three segments are very long. The basal segment has several bristles and sharp teeth, in form and disposition on the segment entirely corresponding with the same little teeth of *C. tenuicornis*, Claus. The fourth and seventh segments are longest; the twelfth segment, besides the usual bristle, has also a very transparent blade-like appendage. The fifteenth and sixteenth segments are each provided with two bristles. The longitudinal ridge of the seventeenth segment is compressed, and is also, as in *C. coronatus*, Claus, serrated. All the segments, except the last three, are also provided with little teeth, which are disposed longitudinally and transversely; the transverse rows are disposed in the same manner as in *C. coronatus*, Cl., namely, on the front edges of the segments, commencing with the fifth, and consist of quite large teeth; the longitudinal rows consist of very small teeth, which are distributed sometimes in separate groups. The second antennæ consist of four lengthened segments furnished in places with rows of setæ. The basal segment is also provided with a very long and plumose bristle, exactly like the one in *Cyclops tenuicornis.* On the second segment there is to be seen a transverse, obliquely disposed row of sharp little spines. The remaining segments are the same as in *C. coronatus*, with a row of setæ. The labrum is, as in the case of *C. coronatus*, furnished with thirteen blunt teeth. The mandible is the same as that of *tenuicornis*, but its lateral depression is not so deep, and both bristles, which are situated near this depression, are

shorter. The second pair of maxillipeds are distinguished by a very strong development of the spine, which is situated on the jaw-feeler, and it is also distinguished by the presence of a peculiar spine near the top of the maxilliped. This spine is also provided with three or four thick hairs. The maxillipeds of the first pair have only this peculiarity, that all their bristles and spines are thickly covered with long hairs, and besides, at the base of the larger branch of the fifth foot, there is a long, plumed bristle. The swimming-feet have all plumose setæ. The first two segments are provided with transverse rows of teeth. The fifth pair are of two segments, and are provided with four bristles. The basal segment is furnished with a row of hair and has one long, plumose seta. The terminal segment is furnished also with three plumose setæ, of which the middle is the longest and the other the shortest. The first segment of the abdomen is very long and contains a cemental gland, which is divided crosswise into two halves. The remaining segments are quite short and have no furniture whatever, with the exception of the last, which has on its posterior border a row of long spines. The furca is shorter than that of *C. simplex*, and is not longer than the last segment of the abdomen. In each of its branches there is an oblique row of teeth. The inner edges of the branches are plain, without hair. The tail-bristles are plumose. The largest caudal seta is almost six times as long as the furca. The color of the body is green.

Cyclops latissimus. The length of the female is 1.85 mm. without the caudal setæ. This *Cyclops* is easily distinguished by its unusual width of body, which has the appearance of a disc slightly flattened at the sides. The rostrum is very large and somewhat bent, so that it is visible even when the *Cyclops* lies on its abdominal surface. The first abdominal segment is so long that, in spite of the shortened form of the other abdominal segments, the whole abdomen is almost equal in length to the front broad part of the body. (The length of the abdomen with the furca is .78 mm.) The anterior antennæ are very long, namely, 1.2 mm., and being composed of seventeen segments, reach almost to the first abdominal segment. The last three segments are just as short as those of *C. simplex;* the basal, fourth and seventh are the longest; they have several bristles, but, like the others, are destitute of teeth. On the twelfth segment there is an oar-shaped organ. The distinguishing characteristic of the antennæ of *C. latissimus* is this: The fourth segment has a very long and thick pale bristle, which is similar to the same pale bristles on the antennæ of *C. serrulatus*, Fisch. The terminal segment has six to seven long bristles and one short one. The second pair of antennæ consists of quite long segments, having neither setæ nor spines. Of all the segments of the body, only the fifth thoracic segment has furniture. In the middle of this segment, both on the dorsal and the ventral surface, there is a transverse line of quite small teeth. The lateral edges of the segments are furnished on each side with six strong spines, of which three are directed forward and three backward. The rudimentary feet consist of

a basal segment, which has a short plain bristle, and of a terminal segment which has three plain bristles, of which the middle one is somewhat longer than the lateral ones. The cemental gland is exactly the same as that of *C. Clausii*, and is contained in the massive first segment of the abdomen. The fourth abdominal segment has a row of slender spines on its posterior edge. The branches of the fork are thick, and are provided, in addition to the six usual bristles, with one more small spine, which is situated on the exterior side of the branches. The bristles on the corners of the branches are very short, and are slightly furnished with sparse hairs; the other bristles are quite long; on the two main bristles the plumosity begins at quite a distance from its base. Both of the middle bristles are longer than the whole trunk; one is .93 mm. and the other is .87 mm. long. The eye is situated at the base of the long rostrum. The front and the lateral edges of the pigmental spot are convex, and the other is concave.

Cyclops ornatus. Length of the female, 2.4 mm.; male, 1.8 mm. The front, broadened part of the body is twice as long as the abdomen. The posterior edges of all the segments, except the first and fifth of the thorax, are furnished with blunt teeth. The anterior antennæ are very short, and do not reach to the posterior edge of the anterior thoracic segment. The first segment is the longest. The third, seventh and eighth are almost of the same length as the basal segment. The three terminal segments are short. The terminal segment has five or six large and one small bristle; the eighth, ninth and tenth have each two bristles. The posterior antennæ are very short, and consist of four short segments. The rudimentary foot consists of one segment, which has three very short bristles. The first abdominal segment is concave, short, and has at the sides two quite long plumose bristles. The other abdominal segments are very short, so that the whole abdomen, without the furca, is somewhat longer than the three posterior thoracic segments. The fourth abdominal segment has on its posterior edge two kinds of spines: firstly, long slender ones, situated along the whole lower edge of the segment; secondly, two groups of thick spines of three each. The furca is twice as long as the last abdominal segment; its branches are thickly covered with long hair on its interior edges. The caudal setæ are plumose, equal in length almost to the entire abdomen. (The length of the abdomen is .67 mm., and the length of the middle bristle is .62 mm.) The plumosity of the large caudal setæ begins at quite a distance from their base. The color is yellowish green.

Cyclops longicaudatus. Length of the whole body, 1.39 mm., of which .66 is taken up by the abdomen and the furca. The trunk seems still longer, because all the thoracic segments, beginning with the third, get suddenly narrow and become almost of the same width as the abdominal segments. In consequence of this form of the segments, it seems as if the body proper consisted in all of two segments, (to wit, of the first thoracic and the head segments, which had been fused, and of the second free thoracic segment,) and

the other eight segments (seven only in the female) made up the abdomen. The anterior antennæ are very short, and do not reach to the posterior edge of the cephalothorax; the three terminal segments are shorter than the others, but proportionately broader, and at their center, from right and left, are fastened bristles, one on each side. The first, third, seventh and eighth segments are the longest and each has several bristles, while the other segments have each only one or two bristles. The eleventh has six or seven bristles. The second antennæ consist of four quite long segments, which have only setæ, but no hair or teeth. The segments of the body are destitute of furniture. The third thoracic segment, as has already been said, gets suddenly narrower, so that the preceding segment forms quite a projecting edge. The rudimentary foot consists of one segment and three long, plain bristles. All the bristles are fastened to small stump-like processes, but do not form a continuation of the segment itself, such as we saw in the case of *C. ornatus*. The first abdominal segment is twice as long as those that follow it. The last abdominal segment is furnished on the posterior edge with small teeth. The furca is equal in length to the two last abdominal segments, and has quite short bristles. Two of these at the very end of the segment are so small that they might rather be called spines, which even are not plumose; the other bristles are furnished with sparse and quite stout hair; the largest bristle is but a little longer than the furca itself.

Cyclops lascivus. Length of body without furca, 1.5 mm. The fore part of the body is somewhat drawn out and pointed at the end. The segments of the thorax are without projecting edges. The first antennæ have ten segments. The first antennæ of the female, both in the length and in the form of the segments, resemble those of *C. canthocarpoides*, Fisch.; but the antennæ of the male are different, to wit: The *C. canthocarpoides* has the two terminal segments longer than the rest, which are provided with bristles turned forward, but this species has its last two segments almost twice as long as the others, and their bristles are distributed in a very peculiar manner; the terminal segment has a whole tuft of quite long bristles, in a direction perpendicular to the longitudinal axis of the segment, and the tuft itself is not on the top of the segment, but deviating somewhat from it. On the posterior third of the segment there is a bristle turned forward; on the ninth segment there are three bristles, one of which is turned forward and is situated on the small projection of the segment, but the other two are turned backward. The second antennæ consist of very long segments, while the *C. canthocarpoides* has short ones, which are furnished on the inner surface with groups of teeth. Characteristic of the described species is the presence on the terminal segment of a long bristle which does not exist in *C. canthocarpoides* Fisch. The mouth-parts of *C. lascivus*, as it seems, are not materially different from those of *C. canthocarpoides*. The rudimentary feet consist of three bristles, which form an immediate continuation of the fifth thoracic segment. The posterior edges of the abdominal segments are furnished with hairs, but the furca has

none at all: a fact which again distinguishes this Cyclops from *C. canthocarpoides*, whose furca-branches are furnished with a number of teeth and hairs. The tail-bristles are thickly plumose, and only nearer to their roots are observed spines, with which the bristles of *C. canthocarpoides* are covered along its entire length. The front edge of the pigmental spot is convex, the posterior concave. This species, and particularly its female, resembles at first sight *C. canthocarpoides*, but is undoubtedly distinguished from it by the marks pointed out above.

C. igneus. Length of body .8 mm., very long and narrow. The first antennæ are ten-jointed, and reach to the second thoracic segment. The first, third, sixth and seventh segments are the longest, the fourth has a very long and stout bristle by which this species is easily distinguished from the other *Cyclops* of the same group. The three terminal segments are very short and broad; and each, except the last, which has on the top six or seven bristles, has two bristles. The second antennæ are shorter than those of *C. lascivus;* their terminal segment has no long bristle, but has quite a stout spine. There are no teeth or hair on the segments. The segments of the body and of the trunk are also without any furniture. The rudimentary foot is the same as in *C. longicaudatus; i. e.*, it is a simple elevation of the fifth thoracic segment, on which are situated three simple spines, the middle one of which is shortest. The first abdominal segment is scarcely longer than the following ones. The fourth segment on the posterior edge has a row of spines; the furca is twice and a half as long as the last segment of the abdomen. Of the tail-bristles, but two are long. The others are short. The long bristles are, at the base, furnished with sparse hairs; but their ends are thickly plumose. The front and side edges of the pigmental spot are concave, but the posterior is convex. The lenses are remarkable for being exceedingly convex. The whole body, particularly its front part, is full of orange-red, fat-globules; but the real color of the *Cyclops* is yellow.

C. Fischeri. Length of the male, 1 mm.; female, 1.2 mm. The first antennæ are six-jointed and very short; they reach only to the posterior part of the cephalothorax. Segments one and three are the longest, and are furnished with a large number of short bristles. The sixth segment is somewhat longer than the preceding ones. The male's last segment is very long, and has the shape of a cone; on its very tip there are no bristles at all, but instead a very large bristle, turned not forward but backward, is situated on its lateral edge, on which are found several additional short bristles. The antennæ of both the first and second pair have no hair and no teeth. The thoracic segments have very strongly projecting posterior edges. The fourth segment has on each side a row of small hairs, and the fifth has long teeth on its posterior edge. The rudimentary foot consists of two stout bristles, which are covered with short hair, and which are situated on the small elevation of the fifth thoracic segment. The rudimentary foot of the female consists of three bristles. All the abdominal segments are beset, on the pos-

terior edge, with long teeth; but the first segment, in addition to this, has also on each side one large plumose bristle and two small ones. The position and shape of these bristles strongly remind one of those bristles of the fifth thoracic segment which compose the rudimentary foot. The fourth abdominal segment is furnished on the posterior edge with stout, long spines; but on the dorsal surface it has a delta-shaped figure which consists of small teeth. The branches of the furca are adorned with seven parallel rows of teeth The middle tail-bristles consist, as it were, of three parts—first, the basal, naked; second, the middle, furnished with sparse teeth; and third, the terminal, thickly covered with hair. The largest bristle is equal in length to the whole abdomen; the other two bristles are very short. On the external edge of the branches of the furca are three spines each. The color is reddish-yellow.

EXPLANATION OF PLATES.

[NOTE.—Separate dissections of the same species were often necessarily drawn under different powers. In fig. 4, plate III, both sides of the third caudal seta should have been represented as webbed. In fig. 2, plate IV, the ridge on the apical joint of the first antenna should have been represented by a double line, as in the two joints preceding.]

PLATE I.

Fig. 1. *Cyclops elongatus*, Cls. Adult female seen from above.
" 2. *C. pulchellus*, Koch. Swimming-foot of the fourth pair.
" 3. *C. pulchellus*, Koch. Apical joint of outer branch of a foot of the second pair.
" 4. *C. pulchellus*, Koch. Apical joint of inner branch of a foot of the second pair.
" 5. *C. pulchellus*, Koch. Apical joint of outer branch of a foot of the third pair.
" 6. *C. pulchellus*, Koch. Apical joint of inner branch of a foot of the third pair.
" 7. *C. pulchellus*, Koch. Apical joint of outer branch of a foot of the first pair.
" 8. *C. pulchellus*, Koch. Apical joint of inner branch of a foot of the first pair.
" 9. *C. perarmatus*, sp. n. Adult female from above.
" 10. *C. perarmatus*, sp. n. First antenna. (This and the following dissections of *perarmatus* are from the female.)
" 11. *C. perarmatus*, sp. n. Fifth foot.
" 12. *C. perarmatus*, sp. n. Second antenna.
" 13. *C. perarmatus*, sp. n. First abdominal segment, broadened a trifle by mechanical pressure, and slightly turned to one side.
" 14. *C. perarmatus*, sp. n. Labrum.
" 15. *C. perarmatus*, sp. n. Second maxilliped.
" 16. *C. perarmatus*, sp. n. First maxilliped.
" 17. *C. perarmatus*, sp. n. Maxilla.
" 18. *C. perarmatus*, sp. n. Mandible and palp.
" 19. *C. elongatus*, Cls. Second maxilliped.
" 20. *C. elongatus*, Cls. Second antenna.
" 21. *C. elongatus*, Cls. First antenna of female.
" 22. *C. elongatus*, Cls. First maxilliped.
" 23. *C. elongatus*, Cls. Caudal rami and its furniture.

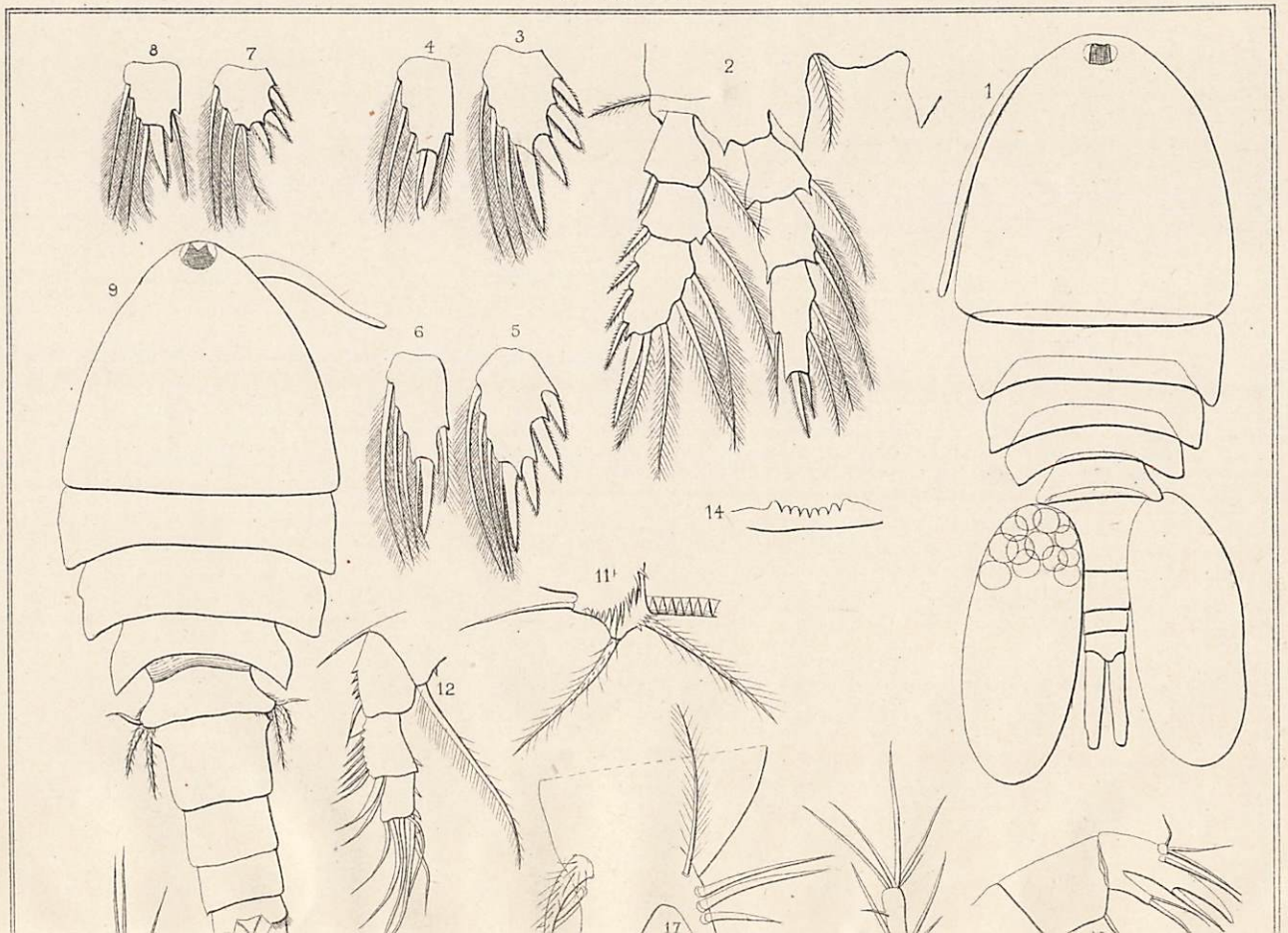
PLATE II.

Fig. 1. *Cyclops tenuicornis*, Cls. Adult female from above.
" 2. *C. tenuicornis*, Cls. Second antenna.
" 3. *C. tenuicornis*, Cls. Caudal rami and furniture, with last abdominal segment.
" 4. *C. tenuicornis*, Cls. Swimming-foot of the (? fourth) pair.
" 5. *C. tenuicornis*, Cls. First antenna.
" 6. *C. tenuicornis*, Cls. Maxilla.
" 7. *C. tenuicornis*, Cls. Second maxilliped.
" 8. *C. tenuicornis*, Cls. Portion of labrum with eleven teeth.
" 9. *C. tenuicornis*, Cls. First maxilliped.
" 10. *C. tenuicornis*, Cls. Complete labrum with nine teeth.
" 11. *C. tenuicornis*, Cls. Mandible and palp.
" 12. *C. tenuicornis*, Cls. Fifth foot.
" 13. *C. tenuicornis*, Cls. Last thoracic segment.
" 14. *C. tenuicornis*, Cls. Diagrammatic outline of cemental gland.
" 15. *C. signatus*, Cls. Second maxilliped.

PLATE III.

Fig. 1. *Cyclops Thomasi*, Forbes. First abdominal segment of male from side.
" 2. *C. Thomasi*, Forbes. First antennæ of male from side.
" 3. *C. Thomasi*, Forbes. Adult male from above.
" 4. *C. Thomasi*, Forbes. Adult female from above, drawn to the same scale as fig. 3, to show relative size of the sexes.
" 5. *C. Thomasi*, Forbes. Fifth foot of a male.
" 6. *C. Thomasi*, Forbes. Just hatched nauplius.
" 7. *C. Thomasi*, Forbes. Fifth foot of a female.
" 8. *C. Thomasi*, Forbes. First antenna of female.
" 9. *C. Thomasi*, Forbes. First abdominal segment of female, showing the cemental gland from above, and the anterior constriction dividing the segment into two portions, (homologues of the first and second abdominal segments of the male?)
" 10. *C. Thomasi*, Forbes. Labrum.
" 11. *C. Thomasi*, Forbes. Caudal ramus from outer side.
" 12. *C. Thomasi*, Forbes. First abdominal segment of female from the side (and partly from below), showing the cemental gland and the male capsules (spermatophores) attached to the vulvæ.
" 13. *C. Thomasi*, Forbes. First maxilliped.
" 14. *C. magnoctavus*, sp. n. Adult female from above.
" 15. *C. magnoctavus*, sp. n. First antenna of female.
" 16. *C. magnoctavus*, sp. n. A portion of the abdomen, with caudal rami and furniture.
" 17. *C. magnoctavus*, sp. n. Fifth foot.
" 18. *C. magnoctavus*, sp. n. Labrum.
" 19. *C. magnoctavus*, sp. n. Ovisac with minimum number of eggs.
" 20. *C. magnoctavus*, sp. n. Second antenna.
" 21. *C. magnoctavus*, sp. n. Apical joint of inner branch of a foot of the first pair.
" 22. *C. magnoctavus*, sp. n. Apical joint of outer branch of a foot of the first pair.
" 23. *C. magnoctavus*, sp. n. Second maxilliped.

PLATE I.



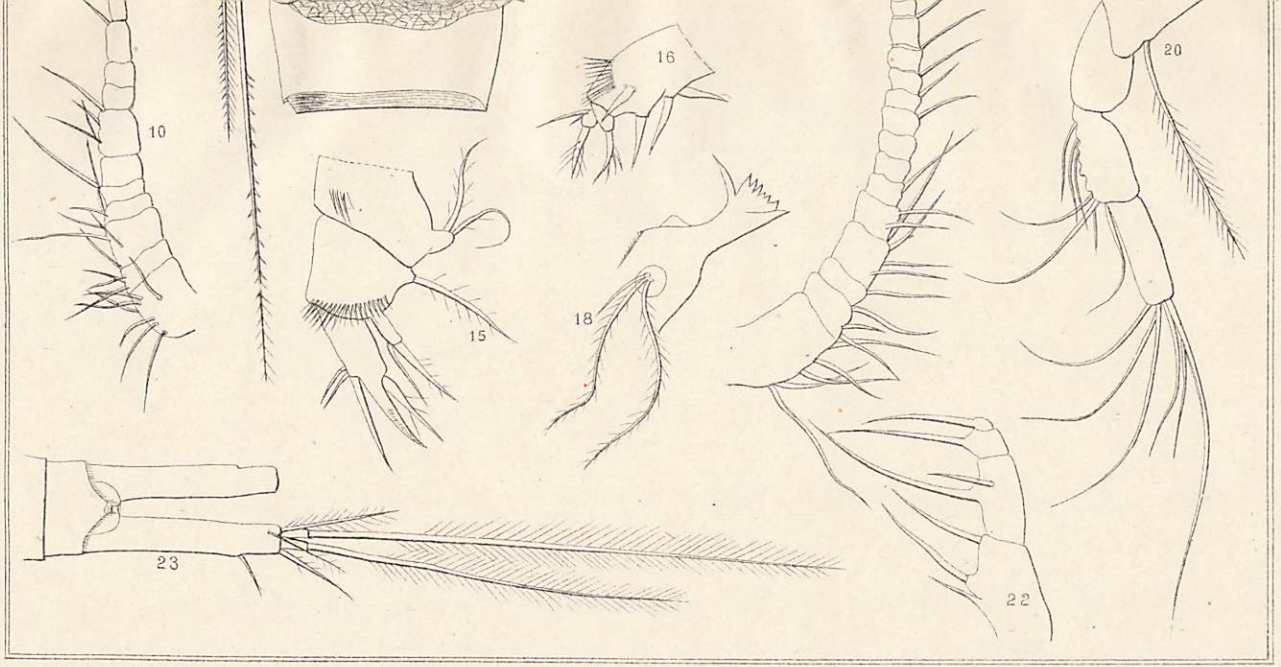


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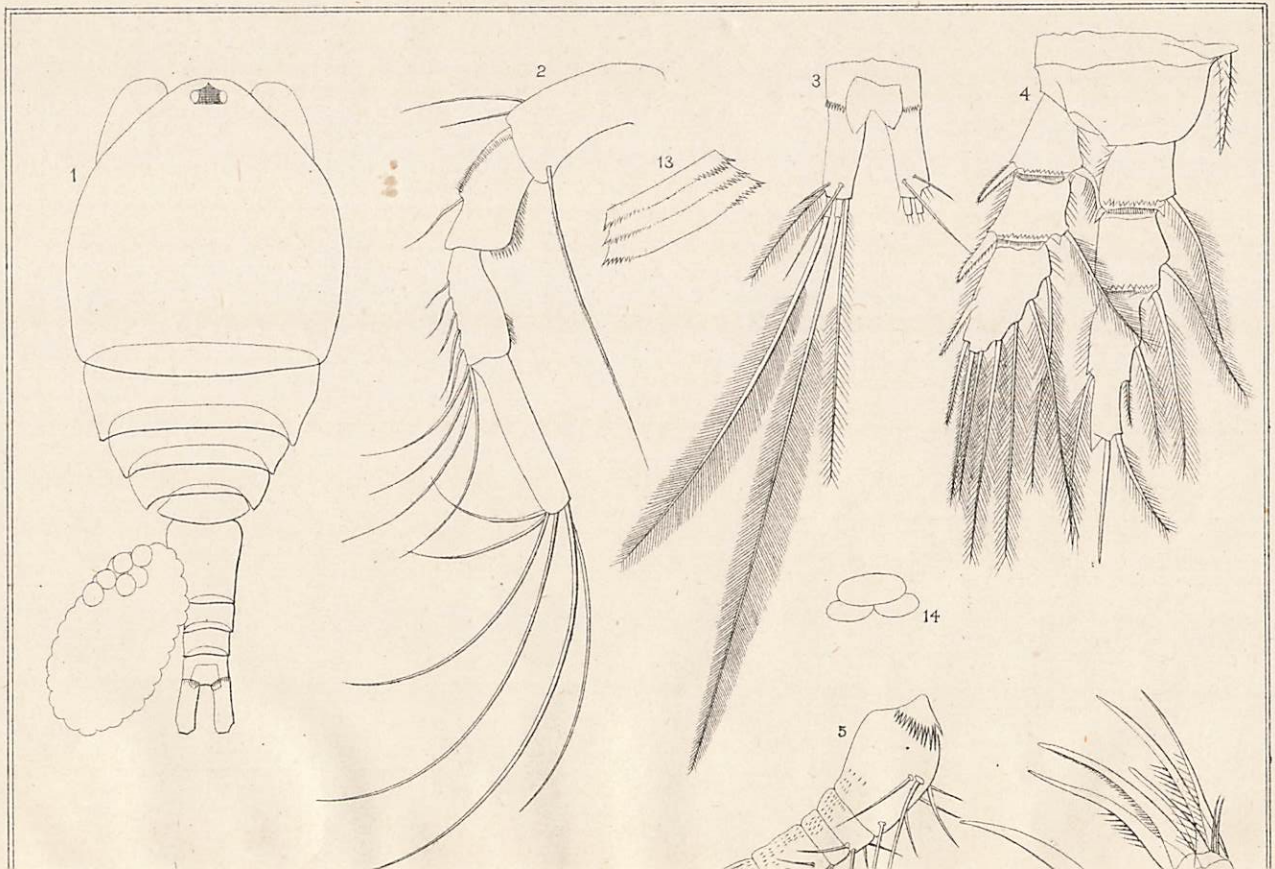
PLATE II.



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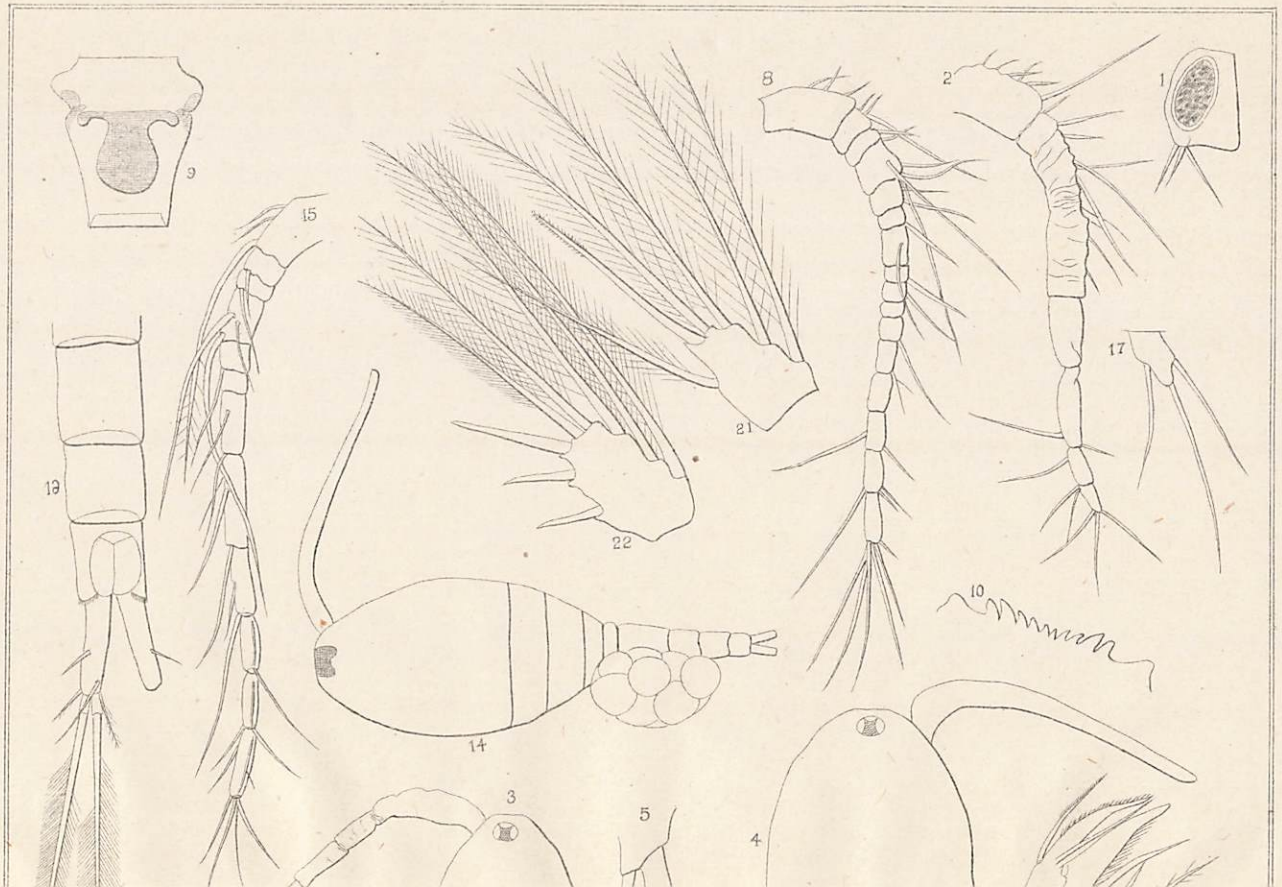
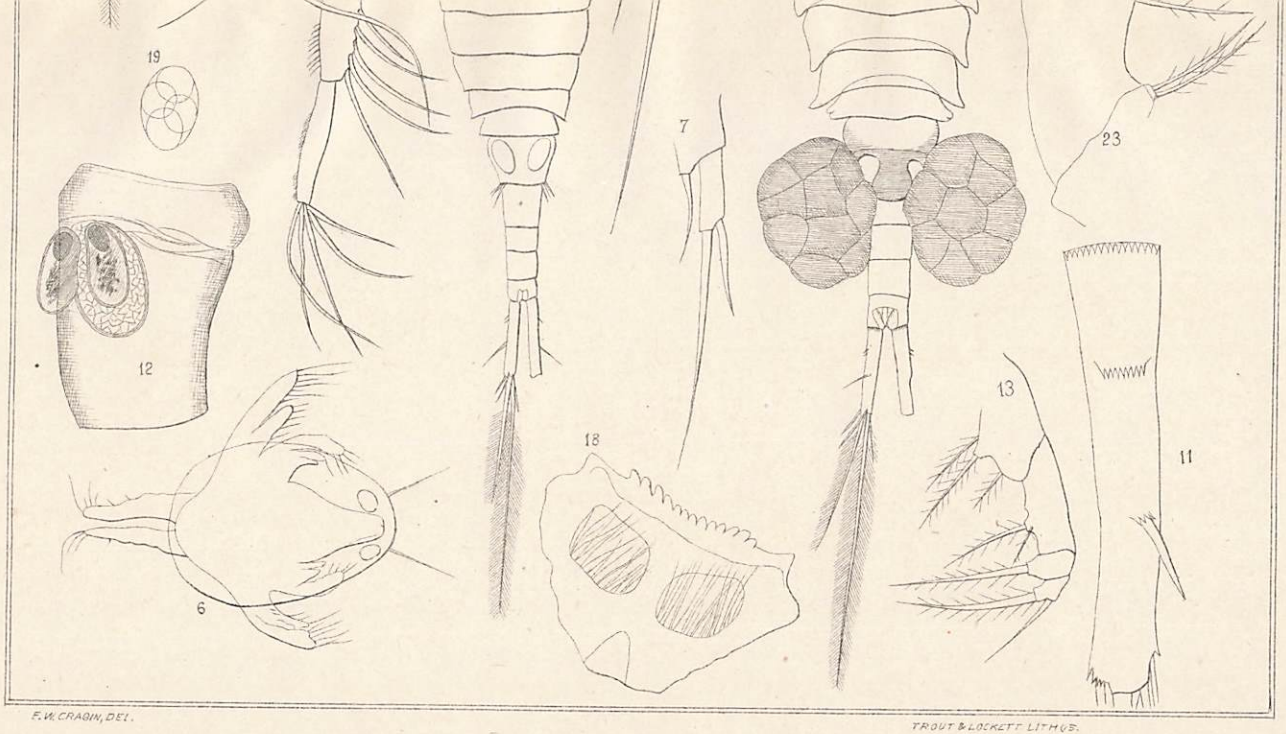
TROUT & LUCKETT, LITHO

PLATE. III.





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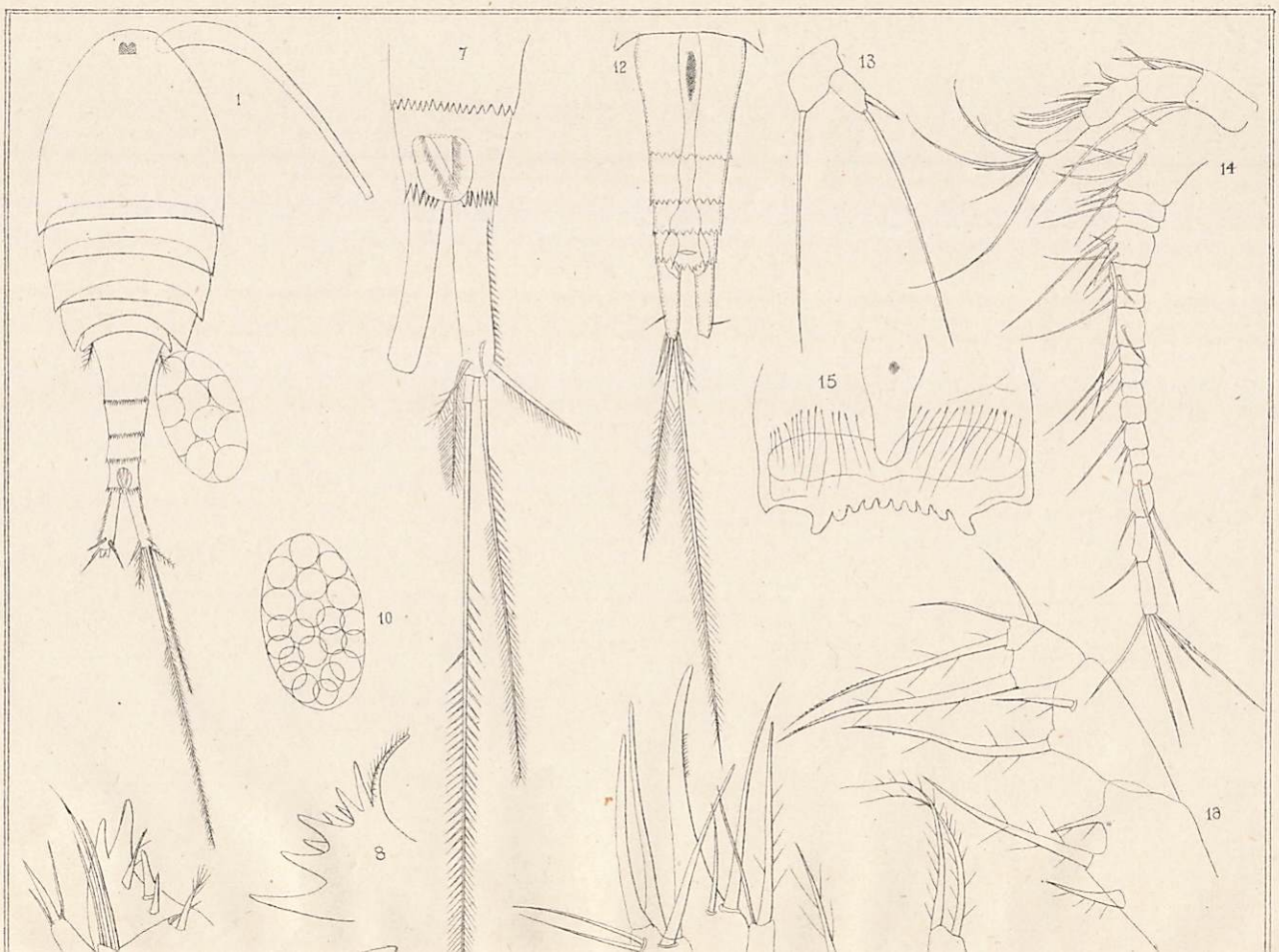
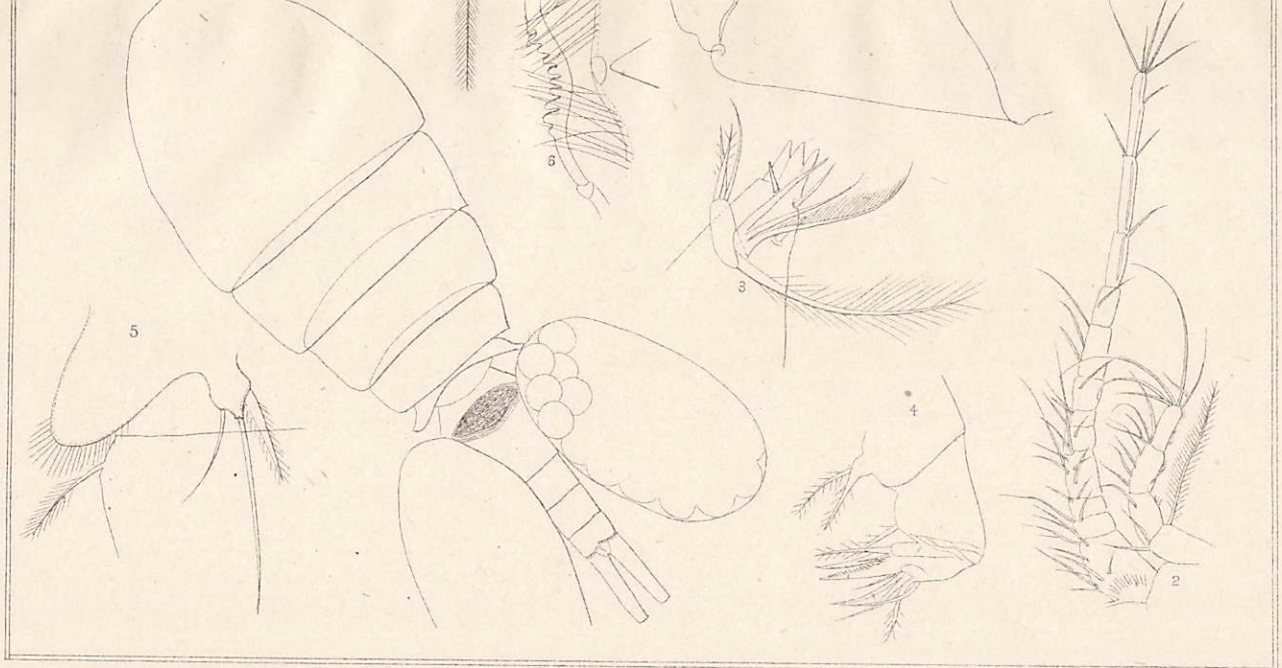
TROUT & LOCKETT LITHOS.

PLATE IV.





E.W. CRAGIN, DEL.

TROUT & LOCKETT LITHOS.

PLATE IV.

Fig. 1. *Cyclops pectinifer*, sp. n. Adult female from above.
" 2. *C. pectinifer*, sp. n. First and second antennæ of female.
" 3. *C. pectinifer*, sp. n. Maxilla.
" 4. *C. pectinifer*, sp. n. Second maxilliped.
" 5. *C. pectinifer*, sp. n. Fifth foot and adjacent border of the body.
" 6. *C. pectinifer*, sp. n. Labrum.
" 7. *C. pectinifer*, sp. n. End of abdomen with caudal rami and furniture.
" 8. *C. viridis*, Fischer. Mandible.
" 9. *C. viridis*, Fischer. Maxilla.
" 10. *C. viridis*, Fischer. Ovisac filled with eggs.
" 11. *C. viridis*, Fischer. Second maxilliped.
" 12. *C. viridis*, Fischer. Abdomen and tail.
" 13. *C. viridis*, Fischer. Fifth foot.
" 14. *C. viridis*, Fischer. First and second antennæ.
" 15. *C. viridis*, Fischer. Labrum.
" 16. *C. viridis*, Fischer. First maxilliped.
" 17. *C. uniangulata*, sp. n. Adult female from above.

METEOROLOGICAL SUMMARY FOR THE YEAR 1882.

PREPARED BY PROF. F. H. SNOW, OF THE UNIVERSITY OF KANSAS, AT LAWRENCE.

The weather of 1882 abounded in superlatives. It had the highest mean temperature, the highest maximum barometer, the smallest and best distributed rainfall, the coolest summer, the warmest autumn, and, with one exception (1877), the warmest winter months upon our 15 years' record. Notwithstanding the extremely small rainfall, crops of all kind were abundant, in most cases surpassing all previous yields. This furnishes further confirmation of the statement of our reports of 1871 and 1875, that a comparatively small amount of rain, well distributed, is more desirable than a larger amount unfavorably distributed.

TEMPERATURE.

Mean temperature of the year, 54.94°, which is 1.51° above the mean of the 14 preceding years. The highest temperature was 105°, on September 12th; the lowest was 6.5° below zero, on the 7th of December, giving a range for the year of 111.5°. Mean at 7 A. M., 49.21°; at 2 P. M., 63.95°; at 9 P. M., 53.30°.

Mean temperature of the winter months, 35.19°, which is 5.18° above the average winter temperature, of the spring, 54.67°, which is .72° above the average; of the summer, 72.92°, which is 3.69° below the average; of the autumn, 56.97°, which is 3.81° above the average.

The coldest month of the year was December, with mean temperature

31.25°; the coldest week was January 16th to 22d, mean temperature 25.01°; the coldest day was December 7th, mean temperature 3.2°. The mercury fell below zero only once, on December 7th, not having previously touched zero since February 19th, 1881.

The warmest month was June, with mean temperature 74.14°; the warmest week was June 27th to July 3d, mean 82.83°; the warmest day was June 28th, mean 84.2°; the warmest hour was 2:30 to 3:30 P. M., September 12th, mean 105°. The mercury exceeded 100° on two days—September 12th and 13th—and reached or exceeded 90° on 40 days, viz.: 1 in May, 12 in June, 9 in July, 11 in August, and 7 in September.

The last hoar frost of spring was on May 22d; the first hoar frost of autumn was on October 19th, giving an interval of 150 days, or nearly five months, entirely without frost.

The last severe frost of spring was on March 24th; the first severe frost of autumn was on the 11th of November; giving an interval of 232 days, or nearly eight months, without severe frost. This is the longest period of immunity from severe frost in the past 15 years. No frost during the year caused damage to fruit buds or trees. The hoar frost of May 22d injured strawberries in some localities.

RAIN.

The entire rainfall, including melted snow, was 27.60 inches, which is the smallest annual rainfall on our 15 years' record, and is 7.12 inches below the average. Either rain or snow, or both, fell on 102 days—one less than the average. On 14 of these days the quantity was too small for measurement.

The longest drouth in the 15 years of observation, was from July 30th to September 18th, during which period of 7 weeks less than a tenth of an inch of rain was registered. This drouth was not disastrous, because the staple crops were already well matured before the drouth began.

The number of thunder showers was 26. Hail fell on 7 days.

SNOW.

The entire depth of snow was 18 inches, which is 3.31 inches below the average. Of this amount, 2 inches fell in January, 2 in February, 9 in March, and 5 in December.

Snow fell on 14 days. The last snow of spring was on March 9th; the first snow of autumn was on November 16th.

FACE OF THE SKY.

The average cloudiness of the year was 45.41 per cent., which is 1.08 per cent. above the average. The number of clear days (less than one-third cloudy) was 162; half-clear (from one to two-thirds cloudy), 103; cloudy (more than two-thirds), 100. There were 80 days on which the cloudiness reached or exceeded 80 per cent. There were 53 entirely clear and 47 entirely cloudy days. The clearest month was August, with a mean of 32.37