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NORTH AMERICAN SPECIES OF
THE COPEPOD GENUS DIAPTOMUS

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INTRODUCTION

In the preparation of a new key to the calanoid Copepoda for the revised edition of Ward and Whipple's "Fresh-Water Biology," some new species of *Diaptomus* have been recognized and the status and distribution of other species have been clarified. In order that these new forms may be included in the key, the following diagnostic descriptions and notes are presented. More detailed treatment is reserved for the future monographic review of the North American species.

A considerable part of the present report deals with the species that have in one way or another been confused with *Diaptomus shoshone* Forbes. It became apparent early in the study of the subgenus *Hesperodiaptomus* that it would be necessary to establish the typical form of *D. shoshone* before it and several closely related species could be correctly separated from one another. All that remains of the original collection, which is in the Illinois State Natural History Survey, are slides consisting mostly of dissected appendages. These have been found adequate to determine both the important and unknown diagnostic characters of the type. Study of literature and other collections, particularly the Marsh and Light accessions in the U. S. National Museum, has shown that several definable forms can be unqualifiedly separated from the typical. Two of these (*D. caducus* and *D. nevadensis*) have already been distinguished by Light (1938), though he was unaware that they had been included in published records of *D. shoshone*. The others are herein described as new species.

The confusion of these species with *Diaptomus shoshone* has been largely due to the fact that certain fundamental characters of the genus have been neglected in the descriptions of North American diaptomids. Two of the most important of these are the setation of the antennules of the female, and that of the left side of the male, and the exact form of the left exopod of the male fifth leg. Both of these

characters are significant in the taxonomy of the subgenus *Hesperodiptomus*, and particularly so in the case of *D. shoshone* and its allies.

The setation of the antennule was recognized as a fundamental specific character by Schmeil (1896) in his comprehensive analysis of the genus, and its invariability has been emphasized by Gurney (1931, p. 114). The exception mentioned by Gurney has been clarified by Kiefer (1932, p. 512). I have noted, in examination of numerous American specimens, that anomalies sometimes occur in the setation, but these are very rare and are recognizable as such because they occur in isolated individuals of a sample and on only one antennule of a pair in the female. Since the subgenus *Hesperodiptomus*

TABLE I.—*Antennule setation in the subgenus Hesperodiptomus*
♀ and left side ♂

Species and sex	Segment										
	2	6	10	11	13	14	15	16	17	18	19
<i>caducus</i> ♀ ♂	4	2	2	2	2	2	2	2	2	2	2
<i>hirsutus</i> ♀	3	1	2	2	2	2	2	2	2	2	2
" ♂	3	1	1	2	1	2	2	2	2	2	2
<i>shoshone</i> ♀ ♂	3	1	1	2	1	2	1	2	1	2	1
<i>novemdecimus</i> ♀ ♂	3	1	1	2	1	2	1	2	1	2	2
<i>kenai</i> ♀ ♂	3	1	1	2	1	1	1	1	1	1	1
<i>schefferi</i> * ♀ ♂	3	1	1	2	1	1	1	1	1	1	1
<i>wardi</i> ♀ ♂	3	1	1	2	1	1	1	1	1	1	1
<i>nevadensis</i> ♀ ♂	3	1	1	2	1	1	1	1	1	1	1
<i>eiseni</i> ♀ ♂	3	1	1	2	1	1	1	1	1	1	1
<i>arcticus</i> ♀ ♂	3	1	1	2	1	1	1	1	1	1	1

* *schefferi*—♂ left may occasionally have 2 on 6, as it always has on the right.

belongs to what has been termed the "multisetaceous" group, in which the number of setae on segment 11 is 2, and on segments 13-19 is either 1 or 2, it is highly desirable that the setation of all the species be known. It is therefore presented in table 1. The subgenus differs from any group that has been recorded in literature in having a species in which 4 setae are present on segment 2. In addition, some of the proximal segments may have 2 setae rather than the customary single seta.

The preliminary consideration that has been given in this study to the structure and distribution of *Diptomus shoshone* and the forms closely allied to it suggests that the group as a whole may be valuable material for studies in variation and distribution. Such studies not only might contribute to the zoogeography of this group but also might have wider application in the much-needed evaluation of structural characters. Since the knowledge of variation and distribution is so

incomplete, no reliable analysis can be made as to the systematic status of these forms. It is therefore not superfluous to emphasize that it is of much importance that published records of *Diaptomus shoshone* and related forms be based upon accurate identification.

SYSTEMATIC DESCRIPTIONS

DIAPTOMUS (HESPERODIAPTOMUS) SHOSHONE Forbes

Figures 1-8

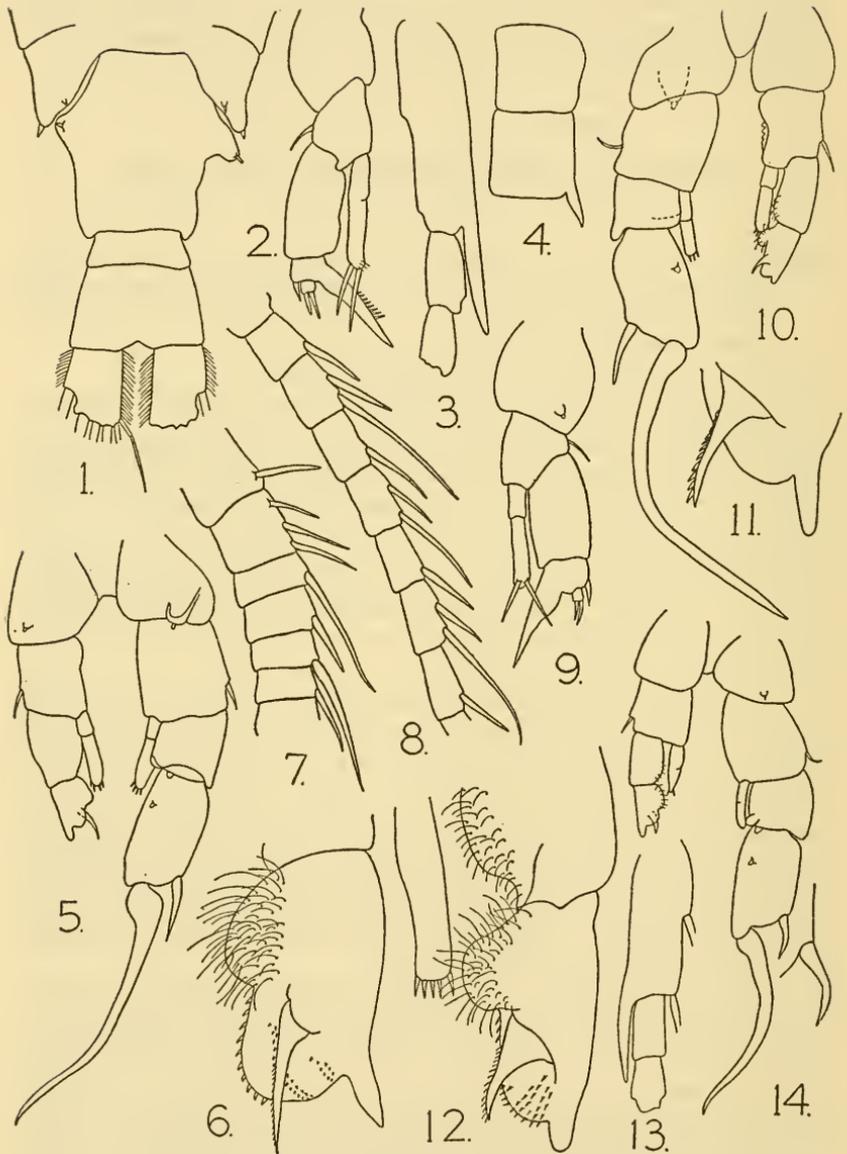
Diaptomus shoshone FORBES, 1893, p. 251, pl. 42, figs. 23-25.—SCHACHT, 1897 (in part), p. 141, pl. 26, fig. 3.—MARSH, 1907, p. 431, pl. 28, figs. 2-5; 1920 (in part), p. 8j; 1929 (in part), p. 17.—DODDS, 1915a, p. 102, fig. 9; 1915b, p. 290, fig. 65; 1917, p. 76; 1924, p. 4.

Diaptomus (Hesperodiaptomus) shoshone, LIGHT, 1938, p. 67.

Specimens examined.—The material studied consisted of slides in the type (Forbes) and Schacht collections in the Illinois Natural History Survey; specimens from all the localities reported by Marsh for which slides are available in the National Museum; unpublished records in the S. F. Light accession in the National Museum; and a recent alcoholic collection, consisting of 57 females and 31 males, collected by J. S. Stanford, Dry Lake, Cache County, Utah. This latter collection agrees with the type material in the basic characters, which have been checked on all the specimens.

The descriptive diagnosis and illustrations given here are based upon the Forbes slides, except for the habitus, which has been made from the Utah specimens inasmuch as it is desirable that study of whole specimens be made whenever possible from those that have been undistorted by cover-glass pressure. In all cases the term *typical form* refers to the type lot (Forbes did not designate an individual type specimen), or to individuals from other samples that agree with the type in the basic characters. The common variations that have been found are given in parentheses.

Diagnosis (emended).—Length (after Forbes): Female, 3.1 mm.; male 2.59 mm. (Utah specimens, female, 3.7-4.4 mm.; male, 3.0-3.5 mm.). Greatest width in both sexes in the mandibular-maxillary region, the metasome tapering sharply so that the posterior portion is noticeably narrower than the anterior. Metasomal wings of female not produced outwardly, directed posteriorly, reaching to near the end of the swollen portion of the genital segment (not bifid as stated by Forbes). Urosome of female 3-segmented. Genital segment asymmetrical, the lateral areas bearing the minute sensilla produced into prominent lobes, that of the right side larger and directed backward. Caudal rami subequal to segment 3, both margins ciliate. (The illus-



FIGS. 1-14.—(See legend on opposite page.)

trations of the female urosome given by Marsh, 1907, and by Dodds, 1915a and 1915b, agree with Forbes's description and slides and are correct. That of Schacht, 1897, pl. 26, fig. 1, is not of *D. shoshone*. It was found in checking slides in the Schacht collection that those labeled *shoshone* female were of a leptodiaptomid.)

Antennules reaching to near end of metasome, setation of female and left side of male identical, having 3 setae on segment 2, 1 seta on 6 and 10. Segments 11 and 13-19:

11	13	14	15	16	17	18	19
2	1	2	1	2	1	2	1

Right antennule of male with spines of segments 10, 11, and 13 not grossly developed; that of 10 less than width of segment, those of 11 and 13 hardly longer; that of 13 a little longer than that of 11. (These spines show considerable individual variation.) Segment 15 without spinous process. Segment 16 with a long, distally placed process (usually varying from about 30-42 percent of the length of the margin of the segment; 1 specimen examined has the extreme of 61 percent). The process of segment 23 reaching to the middle of the last segment (rarely beyond), its apex pointed (frequently rounded).

Maxilliped of both sexes grossly developed, with greatly enlarged clawlike setae on the inner side of the endopod, the terminal and outer setae much reduced in size. Leg 1 with the spine of exopod 1 long and setiform, reaching to near the end of segment 2. Leg 2 lacking Schmeil's organ.

Leg 5 of female slender. Relative lengths of the exopod and endopod of Forbes's slide 507 (fig. 2):

Exopod 1	Exopod 2 (outer)	Endopod	Endopod setae
40	36	35	19: 22

The endopod indistinctly segmented (or distinctly so), armed apically with large, flat spinules; the setae unornamented (only a few specimens show, at high magnification, scattered hairs on these setae; Schacht's figure is undoubtedly of *shoshone*, but the dense plumosity

FIGS. 1-8.—*Diaptomus (Hesperodiaptomus) shoshone* Forbes: 1, Female, metasome segments 5-6 and urosome, dorsal; 2, female, leg 5; 3, male, right antennule, apical segments; 4, male, right antennule, segments 15-16; 5, male, leg 5, posterior view; 6, male, leg 5, left exopod, segment 2, anterior view; 7, female, antennule, setae of segments 1-6; 8, female, antennule, setae of segments 13-19.

FIGS. 9-11.—*Diaptomus (H.) novemdecimus*, new species: 9, Female, leg 5; 10, male, leg 5, anterior view; 11, male, leg 5, processes of left exopod, anterior view.

FIGS. 12-14.—*Diaptomus (H.) kenai*, new species: 12, Male, leg 5, left exopod and endopod, anterior view; 13, male, right antennule, apical segments; 14, male, leg 5, posterior view, with detail of lateral spine.

of the endopod setae is an exaggeration). Length of the second exopod segment three times its greatest width, the whole of the claw very slender, evenly tapered from the area of the third exopod segment. Setae of the third exopod short, the inner the longer.

Leg 5 of male, right: Claw swollen at its base (not divided as shown by Forbes); shorter than the rest of the leg, about 25:33. Basipod 1 without inner lamella, sensillum on well-developed cuticular prominence. Basipod 2 without prominent raised ridge or protrusion. Exopod 2 nearly parallel-sided, with small spinule on inner posterior face; lateral spine straight, shorter (or a little longer) than the width of the segment. Endopod a little longer than the inner margin of exopod 1 (1- or 2-segmented).

Left leg reaching to about the middle of the right second exopod segment. Basipod 2 with the proximal inner half of the anterior face hardly protuberant (individually variable). Segment 1 of the exopod considerably longer than segment 2 (about 3:2). Inner process of distal segment a long, slender, tapering, distally directed spine whose basal portion is hardly widened and which reaches to the end of the outer process (or farther); its length more than half that of the outer margin of exopod 2 (measured to the base of distal process). The medial spinules of the distal pad very gross, those of the posterior and anterior faces very small, arranged in groups. Endopod 1-(or 2-) segmented.

Distribution.—The type locality is Lake Shoshone, Yellowstone National Park, Wyo. Other Yellowstone Park records given by Forbes are: Lewis Lake, Yellowstone Lake, Swan Lake, and an alkaline pond.

It has been determined from examination of the Marsh slide collection in the National Museum that only the following records published by Marsh (1920, 1929) are of typical *shoshone*: Yellowstone Lake, Wyo.; Corona, Irwin, and Pikes Peak, Colo.; Nioche Valley and Salinas, Wasatch Mountains, Utah. The Toronto, Canada, record is questionable; the only slide available is of a cyclopoid. All the other Marsh records and also those of Carl (1940) are referable to one or another of the species discussed below.

The Light accession contains three unpublished records of typical *shoshone*. One is an additional Rocky Mountain locality: A pond 28 miles east of Cooke, Mont., 9,000 feet, A. G. Rempel, collector. The others are from the Sierra Nevadas of California: Iceberg Lake, Madera County, 10,100 feet, P. R. Needham; Helen Lake, Fresno County, 10,896 feet, H. J. Rayner.

Dodds, whose illustrations agree with the typical form, has pointed out that in regions of the Rocky Mountains studied by him, *Diaptomus*

shoshone was found only in lakes at very high altitudes (around 9,000-12,000 feet). The elevation given for the type locality, Lake Shoshone, was 7,740 feet (Forbes, 1893, p. 214).

On the basis of present knowledge the distribution of typical *shoshone* appears to be restricted. All the authentic records are from high altitudes (6,000-12,000 feet) in the Rocky Mountains or Sierra Nevada. It is not intended to suggest here that this is proof of the altitudinal distribution of the species. It should be pointed out, however, that a trend is apparent which is worthy of investigation and which may have bearing on the zoogeography of this and some of the species discussed below.

DIAPTOMUS (HESPERODIAPTOMUS) NOVENDECIMUS, new species

Figures 9-11

Type lot.—Slides from the Light collection consisting of mounted appendages of both sexes. Temporary pond, 2 miles south of Charlo, Flathead Reservation, Mont., elevation about 3,000 feet, Gordon B. Castle, April 28, 1940. Occurring with *D. wardi*. Type slide, U.S.N.M. No. 94624.

Since only mounted appendages are available, no measurements or description of the habitus can be given. The size of the appendages indicates that the body size of both sexes is similar to that of *D. shoshone*.

Diagnosis.—Antennule setation of female and left side of male: 3 setae on segment 2, 1 on segments 6 and 10. Segments 11 and 13-19:

11	13	14	15	16	17	18	19
2	1	2	1	2	1	2	2

Right antennule of male: Spines of segments 10, 11, and 13 not long, that of 13 of irregular shape, longer than that of 11. Segment 15 lacking a process; 16 with a distally placed process, its length about 20 percent of that of the segment. Process of segment 23 stout, straight, the apex pointed, reaching to near the end of segment 25.

Leg 5 of female: Exopod 1 (outer margin) a little longer than exopod 2, 47:45. Exopod 2 wider at base than in typical *shoshone*, the width to total length, 20:45; the claw not so slender as in *shoshone*, gradually tapered beyond the middle. Endopod 2-segmented (or indistinctly so), longer than the inner margin of exopod 1. The inner seta of exopod 3 subequal to, or not as stout or long as, the outer.

Leg 5 of male: Claw not swollen at base, nearly as long as the rest of the leg, 37:35. Right basipod without modification or armature. Right exopod 2 somewhat enlarged, with a blunt spinule on inner posterior face. Right endopod 2-segmented, longer than exopod 1. Left

basipod 2 with prominent inner proximal protrusion; serrate cuticle particularly conspicuous on inner anterior face (such a serration is a rudimentary structure which may be present or absent in hesperodiptomids). Exopod 1 longer than exopod 2 (about 37:25). Inner process a stout spine with a slightly widened base, reaching to near the end of the distal process, its length a little less than one-half that of the outer margin of exopod 1 (to base of distal process).

The trivial name of this species refers to segment 19 of the antennule, which differs from that of *shoshone* in the presence of 2 setae rather than 1 seta. The question of whether *D. novemdecimus* is a subspecies of *D. shoshone* should be considered in future studies. The status of species has been given here because of the antennular setation, which has long been considered by competent authorities to be a stable specific character. In the several samples of typical *shoshone* that have been examined no individuals of either sex have been found to have 2 setae on segment 19. In addition, the two can be separated by two definable characters of the male fifth leg which also differ in other species of *Hesperodiptomus*—that is, the length and shape of the claw and the size and shape of the inner process of the left exopod. This combination of a pattern of close structural similarity and definable differences in seemingly basic characters appears to make these two species valuable for studies in the interrelationships of the hesperodiptomid group and the problem of evaluation of characters. Until adequate knowledge of variation and distribution is available, it is my opinion that any attempt at subspeciation is both arbitrary and premature.

DIAPTOMUS (HESPERODIAPTOMUS) KENAI, new species

Figures 12-17

Diaptomus shoshone, MARSH, 1920 (in part), p. 8j; 1929, p. 17.—CARL, 1940, p. 81; ? 1944, p. 30.
? *Diaptomus shoshone*, THACKER, 1923, p. 88.

Type lot.—100 specimens of both sexes. Shallow mountain pond on Palmer Creek Road, about 12.6 miles southeast of Hope, Kenai Peninsula, Alaska, Charles S. Wilson, August 24, 1949. Occurring with *D. tyrrelli*. Holotype female, U.S.N.M. No. 94632; allotype male, U.S.N.M. No. 94633.

Diagnosis.—Length (dorsal view): Female, 2.03-2.08 mm.; male, 1.87-2.04 mm.

The wings of the last metasomal segment of female a little asymmetrical, the lateral tip of each side drawn out, that of the right side larger than the left. Urosome of female 3-segmented. Genital seg-

ment symmetrical, without lateral protrusions. Third segment and caudal rami subequal in length; the greatest width of the rami a little more than one-half their length (21:35), ciliate on inner margin.

Antennules of female reaching to near the middle of the genital segment. Numerical setation: 3 on 2, 1 on 6 and 10, 2 on 11, and 1 on 13-19. The seta of segment 1 short, not reaching to the end of segment 2; all setae comparatively short, none reaching beyond the middle of the succeeding three segments. Left antennule of male with same setation as female.

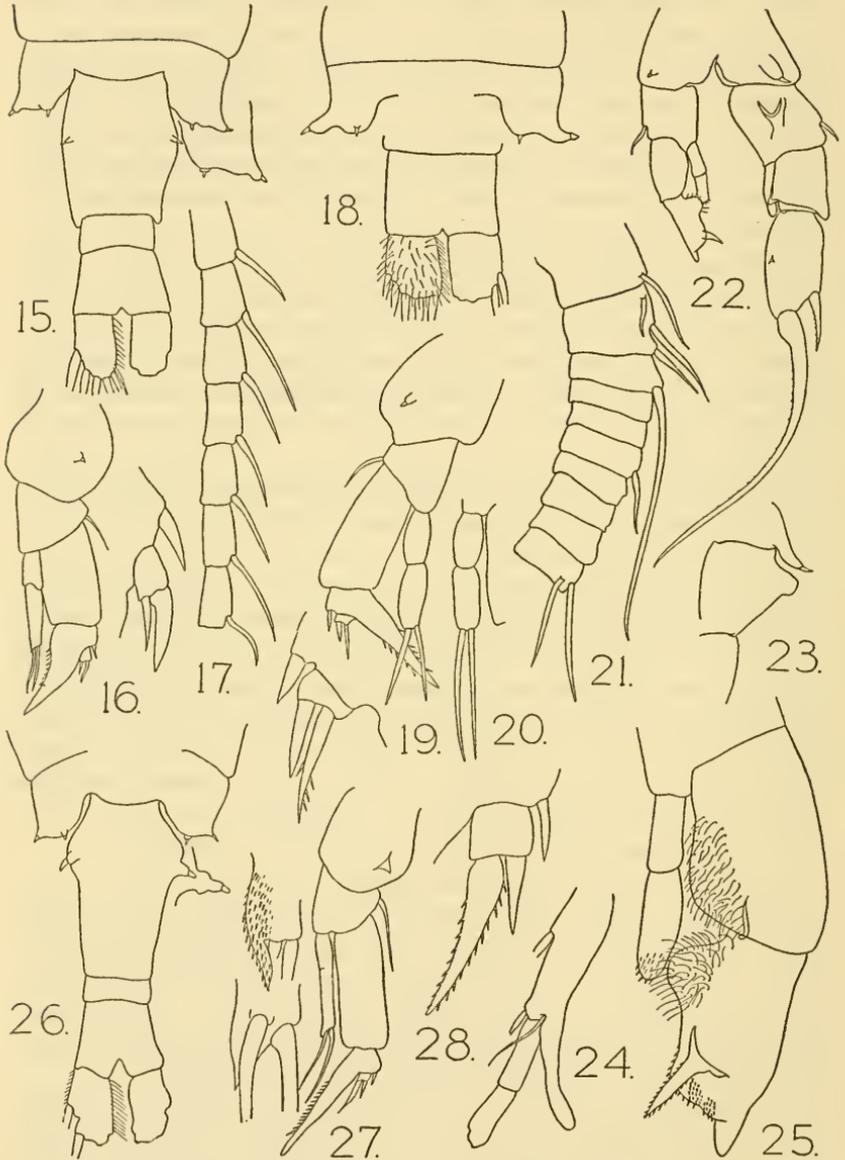
Right antennule of male with the spines of 10, 11, and 13 thick, none longer than the width of their segments, proportions to one another, 11:16:21. Segment 15 without a process; segment 16 with a distally placed process reaching beyond the end of the segment, its length about 28 percent of the length of the segment. The process of segment 23 reaching to about the middle of the last segment, straight or outcurved.

Maxilliped not so grossly developed as in *shoshone*. Setiform spine of exopod segment 1 of leg 1 only about half the length of segment 2. Leg 2 lacking Schmeil's organ.

Leg 5 of female: Exopod 1 (outer margin) a little longer than exopod 2 (35:33). Proportion of greatest width to length of exopod 2, about 15:33; this great width gradually decreased throughout the length of the "claw" to near its apex where it may be abruptly narrowed. The outer seta of exopod 3 always stouter and usually much longer than the inner. Endopod 2-segmented, as long as, or longer than, the inner margin of exopod 1. The apex more or less prolonged on the inner side, armed with a few short spinules, the length of the subterminally placed setae about half that of the endopod.

Leg 5 of male, right: Claw short, only a little longer than the exopod; its base hardly swollen. Exopod 2 with spinule on the posterior inner face; the lateral spine short, characteristically incurved on the inner side. Endopod about as long as exopod 1, 1- or 2-segmented. Left leg reaching to a little beyond the right exopod 1. First segment of exopod a little longer than the second. The inner process a broad-based spine, not reaching to the end of the distal process.

This species is the only one of the *shoshone* group that has the setation of the antennule reduced to one on segments 13-19. This character distinguishes it from all the others, and particularly from *D. caducus*, to which it would appear to be most closely allied. The female fifth leg has a distinctive shape given to it by the widening of the second exopod segment. The inner process of the left exopod of the male fifth leg is distinguished by the broadened base from which it tapers to a slender spine.



FIGS. 15-28.—(See legend on opposite page.)

Distribution.—The specimens reported as *shoshone* by Marsh from the Pribilof Islands, Alaska, and from Wheat Meadows, Calif., are referred to this species. Marsh is supposed to have identified the specimens reported by the Thackers, but slides from their British Columbia localities have not been found in the National Museum collections. They have here been questionably referred to *D. kenai* because the record falls within the distribution pattern of this species. Slides labeled *D. shoshone* by Carl and reported in the British Columbia records of his 1940 paper are in the Light accession and have been identified by me with *D. kenai*. In addition to these collections and the type lot from Alaska, a large number of collections from Oregon and California have also been examined and referred to this species. These records are extensive enough to show that the species is not altitudinally restricted. In Oregon and California it is rare on the coast but of frequent occurrence in the Cascade and Sierra Nevada mountain ranges, where it has been collected to an elevation of 9,000 feet. The species also occurs in the Cascades of Washington, having been found in a collection from Lake George, Mount Rainier National Park, referred to me by C. C. Davis.

DIAPTOMUS (HESPERODIAPTOMUS) CADUCUS Light

Diaptomus caducus LIGHT, 1938, p. 67, figs. 1-5, 23.

Diaptomus shoshone, MARSH, 1929 (in part), p. 17.

Diaptomus sicilis, CARL, 1940 (in part), p. 81.

Specimens reported by Marsh from Vancouver Island, British Columbia, are referable to this species. A slide labeled *D. sicilis* by Carl is present in the Light collection; the locality given is: Pond, Victoria, British Columbia. This specimen is clearly identifiable from the antennular setation as *caducus*.

Diaptomus caducus has been adequately described by Light, and if proper attention is given to the highly important setation of the anten-

FIGS. 15-17.—*Diaptomus (Hesperodiaptomus) kenai*, new species: 15, Female, metasome segments 5-6 and urosome, dorsal, with detail of right "wing"; 16, female, leg 5, with detail of lateral setae of exopod; 17, female, antennule, setae of segments 13-19.

FIGS. 18-25.—*Diaptomus (H.) hirsutus*, new species: 18, Female, metasomal wings and distal portion of urosome, dorsal; 19, female, leg 5, with detail of lateral setae of exopod (type lot); 20, female, leg 5, endopod with elongate setae (lot from Eldorado County, Calif.); 21, female, antennule, segments 1-10, showing setae of segments 1, 2, 3, 6, and 10; 22, male, leg 5, posterior view; 23, male, leg 5, profile of protrusions of right basipod segments; 24, male, right antennule, apical segments; 25, male, leg 5, detail left exopod and endopod, anterior view.

FIGS. 26-28.—*Diaptomus (H.) nevadensis* Light: 26, Female, metasome segments 5-6 and urosome, dorsal; 27, female, leg 5, with detail of apex of endopod, 2 different views; 28, female, leg 5, detail of lateral setae of exopod.

nules (table 1) there should be no confusion of this species with any other known hesperodiaptomid. The species is unique among known diaptomids in having 4 setae rather than the usual 3 on the second segment in both sexes, including the right antennule of the male. Occasional specimens have been found in which 2 setae are also present on segments 4-7 on one antennule of a pair, apparently an anomaly rather than a variation of the species.

Present knowledge of distribution confines this species to the Pacific coast areas from central California to British Columbia, where it characteristically occurs in temporary ponds and roadside ditches. The one mountain record given by Light is referable to the new species described below.

DIAPTOMUS (HESPERODIAPTOMUS) HIRSUTUS, new species

Figures 18-25

Diaptomus caducus LIGHT, 1938 (in part), p. 69.

A single female from Granite Lake, Amador County, Calif., was incorrectly assigned to *caducus* by Light. Another collection made at a later date from the same locality yielded numerous specimens and has been made the type lot of the new species.

Type lot.—100 specimens of both sexes. Granite Lake, Amador County, Calif., 6,800 feet, June 22, 1937, R. E. Smith. From Light collection in the U. S. National Museum. Holotype female, U.S.N.M. No. 94628; allotype male, U.S.N.M. No. 94629.

Other California mountain collections in the Light accession referable to this species are: Several ponds in Lassen National Park; pond at Columbia, Sierra County; pond near Summit Lake, Shasta County; Silver Ford, Eldorado County.

Diagnosis.—Length: Female, about 1.88 mm.; male, about 1.79 mm. Greatest width in both sexes in the middle of the cephalic segment, that of the female about 28 percent of the length. Posterior margin of metasomal wings of female slightly bifid, the outer portion produced laterally. Urosome of female 3-segmented. Genital segment symmetrical, not swollen laterally. Caudal rami shorter than segment 3 (about 29:35); their width about 71-76 percent of the length; both margins and entire dorsal surface hairy. Urosome of male symmetrical, length of caudal rami subequal to segment 5, with hairs on the inner margins only.

Antennules reaching nearly to end of metasome. Those of female having 3 setae on segment 2, 1 on 6, 2 on 10, 11, and 13-19; seta of 3 unusually long, reaching about to end of segment 10. Left antennule

of male differing from that of female in having 1 seta on segments 10 and 13 (2 on 11 and 14-19), seta of 3 reaching about to segment 8. (This sexual difference found in all the lots of specimens examined.) Right antennule of male: Length of spines of segments 10 and 11 less than the width of their segments and shorter than that of 13, which is exceedingly slender and reaches about to the middle of segment 14; segment 16 with a short, distally placed process not reaching beyond the end of the segment. Process of segment 23 spatulate, its tip always rounded, reaching to the end of 24 or to the middle of 25. Leg 2 lacking Schmeil's organ.

Leg 5 of female: Endopod 2-segmented, as long as, or longer than, exopod 1; apex truncate, with few spinules; setae subequal in length to endopod or longer.

Leg 5 of male, right: Claw subequal to (or a little longer than) the rest of the leg. Basipod 1 without prominent inner lamella. Basipod 2 with raised ridge on posterior surface, produced proximally into a rounded lobe (fig. 23 shows profile of ridge, without pressure); this structure reduced to indefinite shape by cover-glass pressure (fig. 22). Exopod 2 with small spinule on inner posterior face, lateral spine a little shorter (or longer) than width of segment. Left exopod: Segment 1 a little longer than segment 2, 19:15. Inner process a tapered spine with a narrowly expanded base. Distal pad with minute spinules arranged in groups on the anterior side; those of the posterior side larger and thickly set, extending far up on the face of the segment.

The trivial name of this species refers to the presence of hairs on the dorsal surface of the caudal rami of the female, a condition unusual in *Diaptomus*. *D. caducus* has been found to have hairs on both surfaces of the caudal rami, but they are few in number and scattered, in contrast to the numerous thickly set hairs of *hirsutus*. The two species appear to be related. They are the only ones known in which the segments of the female antennule proximal to segment 11 have some of the setae multiplied. *D. hirsutus* is clearly defined in its characters and the male is strikingly different from that of *caducus* not only in the setation of the left antennule (table 1) but in several of the characters of the fifth leg (greater length of the claw, modification of the right basipod 2, and the elongate form of the inner process of the left exopod). These characters, as well as those of the female, have been found in all the several collections examined. Present knowledge of distribution confines *caducus* to the Pacific coast area and *hirsutus* to the mountains of northeastern and north-central California.

DIAPTOMUS (HESPERODIAPTOMUS) NEVADENSIS Light

Figures 26-28

Diaptomus nevadensis LIGHT, 1938, p. 69, figs. 6-7.

Diaptomus shoshone, MARSH, 1929 (in part), p. 17.

The specimens reported by Marsh as *shoshone* from Devils Lake, N. D., are referable to this species.¹

Only males were present in the type lot from Nevada. Since publication, Light collected and identified the species from another Nevada and several California localities, as listed: An alkaline lake, Washoe County, Nev., 5,000 feet; Honey Lake and Horse Lake, Lassen County, Calif.; Middle Lake, Cedarville, Modoc County, Calif.

The above collections contained females, from which an allotype specimen has been selected for description.

The male in the new Nevada and California collections shows no significant differences from that described by Light from the type lot, except that the lateral spine of the right second exopod of the fifth leg is noticeably longer, equaling at least the width of the segment (in the type specimen, which has been examined, it is considerably less). The typical male is characterized by:

Large size (about 3.5 mm.).

Left antennule: 2 setae on 11, 1 on 13-19.

Right antennule: Spines of 10 and 11 exceptionally slender, that of 11 longer than that of 13. Short spinous processes on both segments 15 and 16. Process of segment 23 long and curving.

Leg 5: Claw comparatively short, only a little longer than the exopod; its base swollen. Right basipod 1 with prominent inner lamellar expansion. Second exopod segment of right leg greatly enlarged, with a very small spinule on inner posterior face. Left exopod: Segment 1 a little longer than segment 2; the inner process a very short, but broad-based, toothlike spine, not reaching beyond the base of the distal process. Distal pad having the spinules closely set, not arranged in groups.

The North Dakota specimens differ from the Nevada and California males in having the second exopod segment of the right leg not conspicuously enlarged, and in the absence of the short spinous process on the 15th segment of the right antennule. The female shows no differences.

Diagnosis of female.—Allotype female: U.S.N.M. No. 94627.

¹ Specimens recently reported as *D. shoshone* by J. E. Moore (Can. Journ. Zool., vol. 30, p. 422, 1952) from saline lakes in Saskatchewan have also been examined and found to be *D. nevadensis*.

Honey Lake, Lassen County, Calif., June 1938, collected and identified by S. F. Light.

The female is large but comparatively slender. Length 3.85-4.05 mm. Greatest width only 23.6 percent of length. Metasomal wings not expanded or produced laterally, symmetrical. Urosome 30 percent of total length, 3-segmented. Genital segment widened proximally with slight lateral protrusions, the sensillum of the right side borne on a larger protrusion than that of the left. Caudal rami subequal in length to segment 3, proportions of length to width about 3:2; ciliate on both margins.

Antennules reaching to the middle of the genital segment. Numerical setation: 3 on segment 2, 1 on 6 and 10, 2 on 11, and 1 on 13-19. The seta of segment 1 not elongate, hardly reaching to the middle of segment 2; that of 3 reaching to end of segment 6. All the segments extremely slender, the length of segments 17-19 are 4 to 5 times their width. Setae of segments 7, 9, and 14 exceptionally long, that of 7 the longest, reaching to middle of segment 13. Relative proportions of these setae: Segment 7: 265; segment 9: 210; segment 14: 175.

Maxilliped very gross, as in *shoshone*, the endopod shorter than the preceding basipod segment, and armed with very stout clawlike setae. Leg 2 lacking Schmeil's organ.

Leg 5 elongate and slender, the total exopod almost twice the length of the basipod. Relative lengths:

Basipod 1 + 2	Exopod 1	Exopod 2
90	90	85

The inner spine of exopod 3 much stouter and longer than the outer spine, armed with stout marginal spinules. Endopod shorter than inner margin of exopod (61:85), indistinctly 2-segmented, the inner apex produced into a sharp prolongation which is armed with coarse hairs; the terminal setae about two-thirds the length of the endopod.

Although it lacks any striking modification of the second basipod segment in the male right fifth leg, *D. nevadensis* appears to be referable to the *eiseni* rather than to the *shoshone* group of *Hesperodiaptomus*. This is evident in the male fifth leg in the regular arrangement of the spinules of the distal pad of the left exopod and the prominent inner lamellar expansion of the first basipod segment; and in the right antennule by the presence of a spinule on the fifteenth segment, which though not always present in members of the *eiseni* group, has not yet been found in those of the *shoshone* group. The fifth leg of the female is strikingly similar to that of typical *eiseni* from which it can be distinguished by the prominent prolongation of the apex of the endopod; in *eiseni* the endopod has only a minute production of the apex.

DIAPTOMUS (HESPERODIAPTOMUS) SCHEFFERI, new species

Figures 33-42

Diaptomus shoshone var. *wardi*, JUDAY AND MUTTKOWSKI, 1915, p. 23, fig. 1, A-E.

Diaptomus wardi, MARSH, 1920, p. 8j, pl. 3, fig. 10; 1929 (in part), p. 23.

This interesting Pribilof Island species was erroneously identified by Juday and Muttkowski as *wardi* Pearse, which they considered to be a variety of *shoshone*. Marsh (1920, 1929) accepted this incorrect identification but did not refer the species to *shoshone*. Study of Montana specimens which are referable to typical *wardi* (see below) show several distinctive differences between the two forms. The most striking and the one that has hitherto been misinterpreted is the structure of the protrusion of the second basipod segment of the male right fifth leg.

There has been available for study some of the original material examined by Juday and Muttkowski, now in the Marsh collection in the National Museum, and additional specimens also from the Pribilof Islands, referred to Dr. Light by Dr. Victor B. Scheffer, chief of Pribilof Fur Seal Investigations, U. S. Fish and Wildlife Service. The species is named for Dr. Scheffer.

Type locality.—Upper Ice House Lake, St. Paul Island, Pribilof Islands, Alaska. Holotype female, U.S.N.M. No. 94625; allotype male, U.S.N.M. No. 94626.

Diagnosis.—Length: Female, about 2.66 mm.; male, about 2.5 mm. Urosome of female 3-segmented, symmetrical, the sensilla borne on very slight lateral protrusions. The caudal rami longer than the third segment (15:11) with hairs only on the inner margin.

Antennules of female reaching about to the middle of the genital segment. Numerical setation: 3 on 2, 1 on 6 and 10, 2 on 11, 1 on 13-19. The seta of segment 1 reaching to the middle of segment 4; that of 3 subequal in length to that of 1, reaching to near the end of segment 6. Left antennule of male usually armed as in the female, the seta of segment 1 not so long, reaching to the middle of 2, that of 3 to the middle of 7. The right antennule differing from the left in having 2 setae on segment 6 (occasional specimens have 2 setae on the left, but this is not usual); spines of segments 10, 11, and 13 only moderately developed, the length of all less than the width of their segments, that of 11 longer than that of 13. The midportion of the antennule only moderately swollen, segment 15 lacking a process, that on 16 short, distally placed, its length about 15 percent of the length of the segment. The process of segment 23 usually long, slim, always pointed, reaching to near the end of, or beyond, the last segment, the

inner edge usually smooth, but it may have one to several rounded notches.

Leg 5 of female slender throughout. Exopod segments subequal to one another, claw of exopod 2 very slim. Lateral seta of exopod 2 shorter than third exopod segment. Outer seta of exopod 3 very short and narrow, about one-half the length of the inner which is usually stout (slim in some specimens), armed with spinules. Endopod a little shorter than the inner margin of exopod 1, indistinctly 2-segmented, or distinctly so; the apex truncated, without apical production, armed with a few stout spinules and hairs. The setae set terminally, the outer the longer; proportions of endopod to outer seta to inner seta, 38:28:17. The setae always armed with short stout hairs, often plainly visible at low power.

Leg 5 of male, right: Claw about as long as the rest of the leg, slender, curving, symmetrical throughout. Basipod 1 with moderately expanded inner protrusion. Basipod 2 with long heavy ridge on posterior face, and a rectangular lamella placed just above the middle of the inner margin; this lamella clearly not a mere continuous protrusion of the segmental body but a cuticular outgrowth consisting of a heavy medial portion and an outer membrane. Exopod 2 lacking the usual spine of the inner posterior face. Left leg: Basipod 2 with the proximal inner portion protruding. Second exopod segment a little longer than the first. Both pads large; the distal with its spinelets thickly set and not arranged in groups. The inner process a short slender spine swollen at its base, reaching a little beyond the edge of the pad.

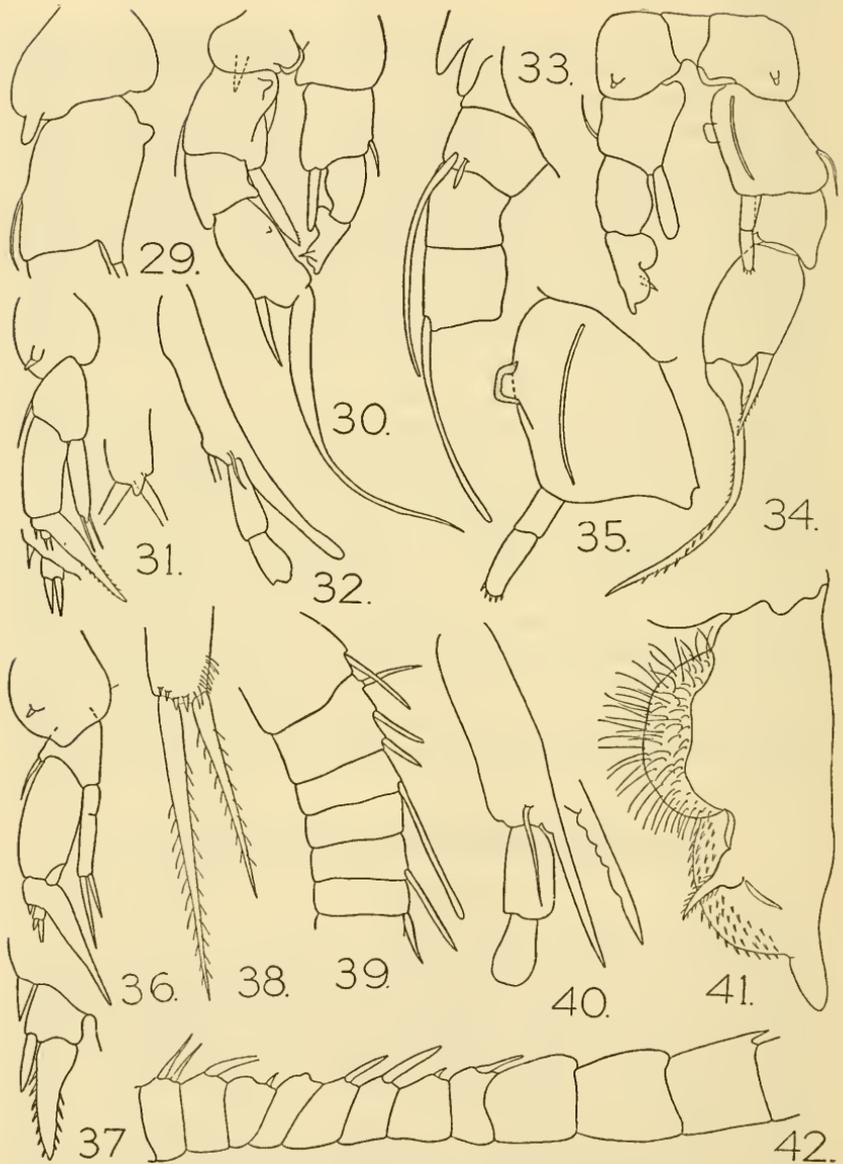
DIAPTOMUS (HESPERODIAPTOMUS) WARDI Pearse

Figures 29-32

Diaptomus wardi PEARSE, 1905, p. 148, pl. 13, figs. 1-4.

The type locality of *D. wardi* is Spokane, Wash. So far as is known, types do not exist in any available collection, although Juday and Muttkowski (1915) mentioned that they examined specimens referred to them by Pearse. Marsh's (1920) figure of *D. wardi* from Pribilof Island material is *D. schefferi*.

The confusion of these two species would be difficult to clarify without specimens of *D. wardi*. Fortunately the Light collection contains slides on which are appendages of two unidentified females (leg 5) and two males (leg 5 and antennules) which are so like Pearse's illustrations of *D. wardi* that there can be no doubt of their identity. These specimens occurred in the Montana collection with



FIGS. 29-42.—(See legend on opposite page.)

Diaptomus novemdecimus, described above. This apparently constitutes the first valid record of the species since its description.

The protrusion of the second basipod segment of the male right fifth leg is not at all like the lamella on the medial margin of *D. schefferi*, which is definitely of cuticular origin. That of *wardi* appears instead to be an outwardly projecting lobed protrusion of the proximal inner portion of the segment itself. Until unmounted appendages not distorted by cover-glass pressure can be examined, its exact structure may not be determinable, but one of the slides contained a profile view which appears to be quite natural (fig. 29). In the other mount, the outline of the protrusion is clearly visible, though flattened (fig. 30). It appears to be of the nature of that described above for *D. hirsutus*.

The Montana specimens agree with Pearse's description in other characters of the male fifth leg: The elongate cuticular prominence of the right basipod 1 which bears the minute sensillum; the very long endopod of the right leg; the extremely slender claw subequal to the rest of the leg; and the structure of the left exopod and the inner process, similar to *D. schefferi*. These characters preclude possibility of identity with *D. shoshone*. Pearse did not indicate a minute spinule on the posterior face of the second exopod, which is present in the Montana specimens. The process of segment 23 of the right antennule agrees exactly with that shown by Pearse; it reaches beyond the apex and is rounded at the tip. Segment 6 has only 1 seta, and the spines of segments 10, 11, and 13 are all longer than the width of their segments, that of segment 11 longer than that of 13; both segments 15 and 16 have minute processes, that of segment 16 is at the middle of the segment, thus differing from the usual distally placed lamelli-form process of other hesperodiaptomids. The left antennule has 2 setae on segment 11 and 1 on 13-19. Unfortunately, the antennule of the female had not been dissected, and it can only be assumed for the present that its setation is like that of the male.²

² Whole specimens of *D. wardi* have been examined since this report was first written. The number of setae on these segments of the female antennule is the

FIGS. 29-32.—*Diaptomus* (*Hesperodiaptomus*) *wardi* Pearse (Montana): 29, Male, leg 5, right basipod (profile view of inner protrusion of basipod 2); 30, male, leg 5, anterior view; 31, female, leg 5, with details of endopod apex and exopod setae; 32, male, right antennule, apical segments.

FIGS. 33-42.—*Diaptomus* (*H.*) *schefferi*, new species: 33, Female, rostral filaments and segments 1-3 of antennule (with detail of setae of segments 1 and 3); 34, male, leg 5, posterior view; 35, male, leg 5, right basipod 2 and endopod; 36, female, leg 5; 37, female, leg 5, detail of lateral setae of exopod; 38, female, leg 5, detail of endopod apex and setae; 39, male, left antennule, setae of segments 1-6; 40, male, right antennule, apical segments, with variation of process of segment 23; 41, male, leg 5, detail of left exopod segment 2, anterior view; 42, male, right antennule, segments 6-16, showing setae of 6, and spines and processes of other segments.

The female fifth leg is exactly like that illustrated by Pearse, though it appears to be more slender. The endopod has two well-developed, equal, nonplumose setae, about half the length of the endopod which is very slightly produced between them. The setae of exopod 3 are very short and subequal, that of exopod 2 is very minute.

DIAPTOMUS (ARCTODIAPTOMUS) ARAPAHOENSIS Dodds

Diaptomus arapahoensis DODDS, 1915a, p. 99, figs. 3-6.

Diaptomus bacillifer, MARSH, 1924 (in part), p. 485; 1929, p. 8.

Marsh (1920) reported the occurrence of the Eurasian species *Diaptomus bacillifer* on the Arctic coast of Canada and on St. Paul, Pribilof Islands. In 1924 he supposedly extended its range in North America by placing in synonymy with it the species *arapahoensis*, described by Dodds from the Rocky Mountains of Colorado. I have examined Marsh's specimens of *bacillifer* and find his identification to be correct. Further examination of cotypes of *arapahoensis*, which are in the U. S. National Museum, and a new collection in the Light accession, from the Rocky Mountains of Montana (Hidden Lake, G. B. Castle collector), indicates that Dodds's species is not referable to *D. bacillifer* as Marsh had supposed.

The fifth leg of the male in most groups of *Arctodiaptomus* shows, as in many species of *Hesperodiaptomus*, very close structural similarity, and it is necessary to take into consideration all the characters of the copepod when making identifications. The male fifth leg of *arapahoensis* is built on the same general plan as that of *bacillifer*. The most noticeable difference is the presence of a large, cuticular, spinelike structure on the midposterior face of the right second exopod segment. This is absent in *bacillifer* but is similar to that found in other species (*salinus*, *acutilobatus*). This process is much larger than depicted by Dodds.

The setation of the female antennules and the left male antennule of the Canadian and Alaskan specimens of *bacillifer* agrees with that given by several authors for Eurasian specimens. There are 2 setae on segments 11 and 13 and 1 on segments 14-19, and the seta of segment 1 in the female is very long. *Diaptomus arapahoensis* has been found to have the following setation in the female:

11	13	14	15	16	17	18	19
2	2	1	2	1	2	1	1

The seta of segment 1 reaches to near the end of segment 5 and is sparsely plumose, being similar in this to *bacillifer*. The male left

same as in the male. The seta of segment 1 is very long, reaching about to segment 12.

antennule differs from the female in having 1 seta on all segments 13-19. This difference exists in both the type (Colorado) and Montana collections.

D. arapahoensis bears unmistakable resemblance to the Asiatic species *D. acutilobatus* Sars (1903). The antennule setation of the female agrees with that given for this species by Gurney (1931, table, p. 115). In order that its exact identity may be known, and particularly since there is a difference in the antennule setation of the two sexes, a fact not known for *acutilobatus*, it appears best to await comparison of actual specimens of the two forms, before a decision as to their conspecificity is made.

DIAPTOMUS (LEPTODIAPTOMUS) PRIBILOFENSIS Juday and
Muttkowski

Diaptomus pribilofensis JUDAY AND MUTTKOWSKI, 1915, p. 25, figs. 1-6.

Diaptomus tyrrelli, MARSH, 1915 (in part), p. 459; 1929, p. 23.—HOOPER, 1947, p. 80.

This is a form widely spread in Alaska and western Canada and has for years been considered synonymous with *D. tyrrelli* (corrected spelling). It is closely allied to *D. coloradensis* from the Rocky Mountains and forms with it and the Asiatic species *Diaptomus angustilobus* Sars (1898) a group of seemingly allopatric species. Its supposed synonymy with *tyrrelli* has been unfortunate in obscuring the pattern of its distribution and its closer relationship to the other species of the group. Specimens reported by Hooper as *tyrrelli* from western Canada have been examined and identified as *pribilofensis*.

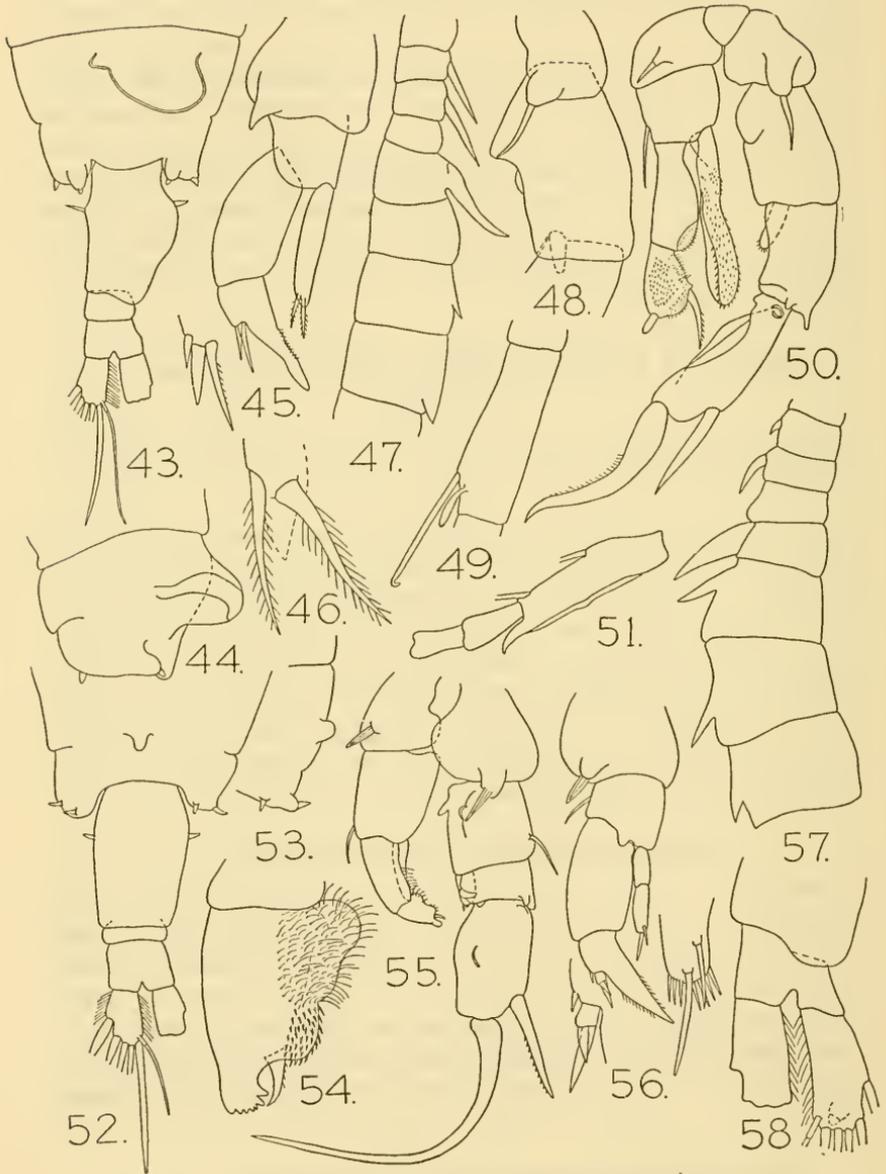
DIAPTOMUS (EUDIAPTOMUS) GRACILIS Sars

Diaptomus gracilis is a well-known Eurasian species new to North American fauna. It has been found recently in several of my Alaskan collections. It appears to be common in the Arctic regions of Alaska, having been found on the western coast (lakes of the lower Yukon River and Bristol Bay areas) and on the Arctic slope at Umiat. In south-central Alaska it occurred in collections of the Kuskokwim River area at McGrath and in Wonder Lake, Mount McKinley National Park.

DIAPTOMUS (AGLAODIAPTOMUS) MARSHIANUS, new species

Figures 43-51

Type lot.—13 females, 45 males. Lake Jackson, Leon County, Fla., April 3, 1950, Murray H. Voth collector. Holotype female, U.S.N.M.



FIGS. 43-58.—(See legend on opposite page.)

No. 94634; allotype male, U.S.N.M. No. 94635. Occurring with *D. (Arctodiaptomus) floridanus* Marsh and *D. (Skistodiaptomus) mississippiensis* Marsh.

Diagnosis.—Length, dorsal view: Female, 1.55-1.89 mm.; male, 1.3-1.58 mm. Greatest width of female in segments 2 and 3, equaling about 28 percent of the length. Metasomal segment 5 with an unusual dorsal protuberance consisting of an erect cuticular frill, placed mostly on the right side. The wings of the last segment not produced laterally, the inner portion rounded so as to form a lobe in dorsal view.

Urosome of female 3-segmented. Genital segment noticeably asymmetrical, the right side being very tumid. Caudal rami longer than segment 3, 25:20, their width 64 percent of their length, ciliate on inner margin only; the inner dorsal seta as long as the inner caudal seta.

Antennules reaching beyond the caudal rami by the last 2-3 segments. Numerical setation: 2 on segment 11, 1 on segments 13-19. The seta of segment 1 short, reaching to the middle of segment 2, that on 3 reaching to segment 6. Setae of segments 17, 19, 20, and 22 stiff and uncinata, their length less than, or equal to, that of the segment. Setation of left antennule of male like that of the female, including the uncinata setae. Right antennule of male having spines of 10 and 11 longer than the width of their segments, that on segment 13 longer than that of 11, strongly outcurved; segments 15 and 16 with spinous processes. The process of segment 23 reaching to about the middle of 24, outcurved, accompanied by a narrow membrane.

Maxilliped not grossly developed, the distal lobe of the basal segment with 3 setae in both sexes. Schmeil's organ present on the endopod of leg 2.

Leg 5 of female: Basal segment with large sensillum on broad base. Exopod 1 and 2 subequal in length, exopod 3 not separated. Seta of exopod 2 present, set closely with the setae of exopod 3; the inner seta with marginal serrations. Endopod longer than inner margin of

FIGS. 43-51.—*Diaptomus (Aglaodiaptomus) marshianus*, new species: 43, Female, metasome segments 5-6 and urosome, dorsal; 44, female, metasome segments 5-6, lateral view; 45, female, leg 5, with detail of lateral setae of exopod; 46, female, leg 5, detail of endopod setae; 47, male, right antennule, spines and processes of segments 10-16; 48, male, leg 5, right basipod (with profile of inner protrusion) and outline of endopod; 49, female, antennule, detail of uncinata seta of segment 19; 50, male, leg 5, posterior view; 51, male, right antennule, apical segments.

FIGS. 52-58.—*Diaptomus (Mastigodiaptomus) texensis*, new species: 52, Female, metasome segments 5-6 and urosome, dorsal; 53, female, metasome segments 5-6, lateral view; 54, male, leg 5, left exopod, apical segment, posterior view; 55, male, leg 5, posterior view; 56, female, leg 5, with details of exopod setae and apex of endopod; 57, male, right antennule, spines and processes of segments 10-16; 58, male, distal segments of urosome, dorsal.

exopod 1, its setae not longer than half its length, both with enlarged bases and thickly plumose.

Leg 5 of male, right: Basipod 1 with a long spinelike sensillum reaching to near the middle of the next segment. The inner proximal portion of basipod 2 with a prominent lobed protrusion accompanied distally by a small narrow hyaline lamella (fig. 48); the distal portion of the segment lacking the cuticular process present in many species of *Agladiaptomus*. The first exopod segment about as long as basipod 2, the outer distal portion produced. Proportions of exopod 1 to exopod 2, 25:40. Inner portion of exopod 2 deeply grooved, the anterior side with a protruding flange; relative length of lateral spine to exopod 2, 26:40. Claw subequal to exopod 2, very stout and curving. Endopod a little less than one-half the length of exopod 1.

Left leg: Sensillum of basipod 1 a stout spine. Exopod 1 noticeably longer than exopod 2, 24:16. Exopod 2 broadened distally, the distal process digitiform, nearly one-third the length of the outer margin of the segment; the inner process a long, curving, setiform spine, nearly 3 times the length of the distal (14:5), spinulose on its inner margin; the sclerotized marginal area of the segment produced to a point at its base. The proximal pad consisting of a hairy region on the upper inner margin; the distal pad of spinulose areas on the posterior face. The endopod very large, reaching to near the end of exopod 2, the inner portion grooved, the entire surface thickly spinulose from above the middle to the end.

Taxonomic position.—The subgenus *Agladiaptomus* was proposed by Light in 1938. The original list of included species should be revised as follows:

D. piscinae Forbes (1893) should be recognized as a synonym of *D. leptopus* Forbes (1882). The type collections of Forbes (Illinois Natural History Survey) as well as those of Schacht and Marsh have been examined, and no definable structural difference has been found. (The details of this study are reserved for future publication.) In the synonymy of *leptopus* should also be placed *D. manitobensis* Arnason (1950). I wish to acknowledge Dr. Arnason's courtesy in permitting me to examine type material of his proposed species.

Diaptomus spatulocrenatus Pearse (1906) was omitted from Light's list.

The species *Diaptomus pseudosanguineus* Turner (1921), which was omitted by Marsh (1929), should be recognized, although there are certain inadequacies in the description. The species was described from the St. Louis, Mo., area, and on the basis of the description it is not referable to any of the known species of *Agladiaptomus*. The

female of *pseudosanguineus* is described as having a pair of long, curved spines on the ventral portion of the genital segment, and the photographic illustrations show a process distad to the genital protuberance in 2 lateral views of what appear to be two separate individuals (Turner, 1921, pl. 1, fig. 3; pl. 2, figs. 1 and 2). Such a process does not occur on the genital segment of any of the species of *Aglaodiaptomus*, all of which have been examined. The male fifth leg is most comparable to that of *spatulocrenatus*, resembling it in the proportions of the segments of the left exopod which are subequal, and the endopod which is described as having a crenate inner margin. The right first exopod segment differs from *spatulocrenatus* in having the distal outer portion produced as in *conipedatus* and *marshianus*. No detail can be made out, from the illustration, of the right second basipod segment, adequate knowledge of which is extremely important in the taxonomy of this group. No type material of Turner's species is known to be in existence.

Diaptomus marshianus is distinguished in the female by the peculiar dorsal protuberance of the metasome. There is no evidence in any of the other species of *Aglaodiaptomus* of such cuticular development. There can be no question, however, of the reference of this female to *Aglaodiaptomus* and hence to the male described from this collection, because the female shows unmistakable aglaodiaptomid characters in the uncinata setae of the antennule, the presence of three rather than four setae on the distal lobe of the basal segment of the maxilliped, and the dense plumosity of the endopod setae of the fifth leg. The male fifth leg most closely resembles that of *spatulocrenatus* and *conipedatus*, from which it can be distinguished by the lack of a distal cuticular process of the right second basipod segment and by the grosser development of the left endopod. It appears to differ from *pseudosanguineus* in having the first left exopod segment considerably longer than the second.

It is a personal pleasure to give the name of Dr. C. Dwight Marsh to a distinctive American species of *Diaptomus*. In this connection, attention should be drawn to the fact that Kiefer (1936, p. 309) has shown that the species named *D. marshi* by Juday (1914) should be known as *D. colombiensis* Thiebaud. Kiefer has stated that Thiebaud's paper was actually published as a separate in 1912 instead of 1914.

Acknowledgment is due Murray Voth and Dr. Irene Boliek, of Florida State University, for specimens and information of this interesting species.

DIAPTOMUS (MASTIGODIAPTOMUS) TEXENSIS, new species

Figures 52-58

Type lot.—200 specimens of both sexes. Temporary roadside pond, county road to Bayside, about 1.5 miles west of Rockport, Aransas County, Tex., "spring" of 1945, Joel W. Hedgpeth collector. Holotype female, U.S.N.M. No. 94630; allotype male, U.S.N.M. No. 94631.

Diagnosis.—Length, dorsal view: Female, 1.5-1.6 mm. Greatest width of female in segment 3, 26-28 percent of length. Distal part of fifth metasomal segment of female usually with a small, medially placed, rounded dorsal protuberance (not always present). Wings not expanded, the left larger than that of the right side, both with spinelike sensilla, that on the inner portion of the left side usually directed outward. Urosome of female 3-segmented. Genital segment symmetrical, without lateral protrusions, lateral sensilla stout. Caudal rami longer than segment 3 (26:20); their width about 61 percent of their length; both margins ciliate; the dorsal seta about one-half to three-fourths the length of the inner caudal seta. Urosome of male asymmetrical; segment 4 produced backward on the right side; caudal rami asymmetrical, the right longer than the left, with a cuticular process on its ventral side near the base of the inner setae.

Antennules of female reaching beyond caudal rami by last two segments. Setation: 2 on segment 11, 1 on segments 13-19; seta of segment 1 short. Left antennule of male like that of female. Right antennule of male: Spine on segment 8 not enlarged, that of segment 10 hardly larger than that of 8, that of 11 nearly as long as width of its segment, that of 13 not much longer than the width of its segment, but exceedingly stout. Segments 14, 15, and 16 with stout spinous processes. Proportions of spines and processes to one another:

8	10	11	13	14	15	16
3	5	14	20	13	14	5

Segment 23 with a short, outcurved process, reaching about to the middle of segment 24.

Maxilliped slender, setation of basal segment normal; the inner setae of the endopod not clawlike, all shorter than the endopod; the outer and terminal setae longer than the endopod (40:37). Schmeil's organ present on endopod of leg 2.

Leg 5 of female stout, width of exopod 1 about half its length. Sensillum of basipod 1 a long, stout, flat spine. Exopod 1 a little longer than exopod 2 (27:25). Exopod 3 separated, its outer seta short and spinelike, closely set with and usually overlying the inner seta;

lateral seta of exopod 2 present, shorter than exopod 3. Claw with spinules on both margins. Endopod nearly as long as inner margin of exopod 1, 2-segmented, bearing 2 setae, the outer longer than the inner, which is set considerably above the tip of the endopod; tip of endopod with double row of stout hairs.

Leg 5 of male, right: Sensillum of basipod 1 a stout spine, in posterior view overlying the second basipod segment and directed toward a protrusion of the segment whose central portion consists of a crescent-shaped sclerotized lamella. The inner proximal portion with an inwardly and sometimes distally directed small marginal lamella. Exopod 1 with small lamellae on both inner and outer distal portions. Exopod 2 bulging medially, with a crescent-shaped sclerotization on the midposterior face; the lateral spine distally placed, stout and straight, its length less than that of the segment. Claw strongly curved at middle, as long as the rest of the leg.

Left leg: Sensillum of basipod 1 stout as on the right side. Inner part of basipod 2 produced proximally. Exopod 1 more than three times longer than exopod 2 (50:15). The distal process short and broad, its margins strongly serrate; the inner process spiniform, reaching to the end of the distal. Pads medial in position, the proximal the larger.

Taxonomic position.—This new species is allied to the southwestern species *D. albuquerqueensis* Herrick, the known distribution of which extends through the Rocky Mountain States from Utah to Guatemala in Central America. The only other species of the subgenus on the continent, *D. amatitlanensis* M. S. Wilson (1941), is also known from Guatemala. There are no authentic records of the group from southeastern United States. Florida specimens identified by Schacht (1897) as *D. albuquerqueensis* are undoubtedly referable to *D. floridanus* Marsh (1926). Such is also true of the specimens from Georgia listed by Humes (1950). Specimens to which Humes referred have been sent to me by Dr. M. S. Ferguson, of the United States Public Health Service, and have been found to be *D. floridanus*.

Diaptomus saltillinus Brewer, which is closely allied to *D. floridanus*, is found in Texas and some other areas where the *albuquerqueensis* group occurs. *D. saltillinus* and *D. floridanus* belong to the subgenus *Arctodiaptomus* Kiefer (1932) and the *albuquerqueensis* group to the subgenus *Mastigodiaptomus* Light (1939). There are superficial resemblances between these two groups of species, but they should not be confused with each other if careful attention is given to basic subgeneric characters such as are found in the left exopod of the male fifth leg, the armature of the endopod of the female fifth leg, and the

presence in *Mastigodiptomus* of 2 setae on segment 11 of the female and left male antennules, as contrasted to the single seta of this segment in *saltillinus* and *floridanus*.

D. texensis is distinguished from *albuquerqueensis* by several easily recognized differences in the male right fifth leg. In *albuquerqueensis* the lateral spine of exopod 2 is longer than the segment, the second basipod segment has the inner proximal portion bulging upward as does also the marginal lamella, and the distal posterior face has a characteristic sculpturing of the cuticle that is lacking in *texensis*. The females are very similar but can be separated by the lateral protrusions of the genital segment and the usual shortness of the endopod of the fifth leg of *albuquerqueensis*.

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LITERATURE CITED

- ARNASON, I. GILBERT.
 1950. A new species of diaptomid copepod from Manitoba. Journ. Elisha Mitchell Sci. Soc., vol. 66, pp. 148-155, 23 figs.
- CARL, G. CLIFFORD.
 1940. The distribution of some Cladocera and free-living Copepoda in British Columbia. Ecol. Monogr., vol. 10, pp. 55-110, 14 figs.
 1944. The natural history of the Forbidden Plateau area, Vancouver Island, British Columbia. Rep. Prov. Mus. for 1943, pp. D 18-40, 2 ills., 1 map.
- DODDS, GIDEON S.
 1915a. Descriptions of two new species of Entomostraca from Colorado, with notes on other species. Proc. U. S. Nat. Mus., vol. 49, pp. 97-102, 10 figs.

- 1915b. A key to the Entomostraca of Colorado. Univ. Colorado Stud., vol. 11, pp. 265-298, 82 figs.
1917. Altitudinal distribution of Entomostraca in Colorado. Proc. U. S. Nat. Mus., vol. 54, pp. 59-87, 10 figs., 2 pls.
1924. Notes on Entomostraca from Colorado. The Shantz collections from the Pikes Peak region. Proc. U. S. Nat. Mus., vol. 65, art. 18, pp. 1-7, 1 fig.
- FORBES, S. A.
1882. On some Entomostraca of Lake Michigan and adjacent waters. Amer. Nat., vol. 16, pp. 537-542, 640-649, 2 pls.
1893. A preliminary report on the aquatic invertebrate fauna of the Yellowstone National Park, Wyoming, and of the Flathead region of Montana. Bull. U. S. Fish Comm. for 1891, pp. 207-258, 6 pls.
- GURNEY, ROBERT.
1931. British fresh-water Copepoda. Vol. 1, 238 pp., 344 figs. Ray Society, London.
- HOOPER, FRANK F.
1947. Plankton collections from the Yukon and MacKenzie River systems. Trans. Amer. Micr. Soc., vol. 66, pp. 74-84, 1 fig.
- HUMES, ARTHUR G.
1950. Experimental copepod hosts of the broad tapeworm of man, *Dibothriocephalus latus* (L.) Journ. Parasitol., vol. 36, pp. 541-547.
- JUDAY, CHANCEY.
1914. A new species of *Diaptomus*. Trans. Wisconsin Acad. Sci. Arts and Lett., vol. 17, pp. 803-805, 2 figs.
- JUDAY, CHANCEY, and MUTTKOWSKI, R. A.
1915. Entomostraca from St. Paul Island, Alaska. Bull. Wisconsin Nat. Hist. Soc., vol. 13, pp. 23-31, 6 figs.
- KIEFER, FRIEDRICH.
1932. Versuch eines Systems der Diaptomiden (Copepoda, Calanoida). Zool. Jahrb. (Abt. Syst.), vol. 63, pp. 451-520, 88 figs.
1936. Freilebende Süß- und Salzwassercopepoden von der Insel Haiti. Arch. Hydrobiol., vol. 30, pp. 263-317, 126 figs., 1 map.
- LIGHT, S. F.
1938. New subgenera and species of diaptomid copepods from the inland waters of California and Nevada. Univ. California Publ. Zool., vol. 43, pp. 67-78, 23 figs.
1939. New American subgenera of *Diaptomus* Westwood (Copepoda, Calanoida). Trans. Amer. Micr. Soc., vol. 58, pp. 473-484, 24 figs.
- MARSH, CHARLES DWIGHT.
1907. A revision of the North American species of *Diaptomus*. Trans. Wisconsin Acad. Sci. Arts and Lett., vol. 15, pp. 381-516, 14 pls.
1915. A new crustacean, *Diaptomus virginianensis*, and a description of *Diaptomus tyrelli* Poppe. Proc. U. S. Nat. Mus., vol. 49, pp. 457-462, 7 figs.
1920. The fresh water Copepoda of the Canadian Arctic Expedition 1913-18. Rep. Canadian Arctic Exped. 1913-18, vol. 7, pt. J, pp. 1J-25J, 5 pls.
1924. A new locality for a species of *Diaptomus*. Science, vol. 59, pp. 485-486.

1926. On a collection of Copepoda from Florida, with a description of *Diaptomus floridanus*, new species. Proc. U. S. Nat. Mus., vol. 70, art. 10, pp. 1-4, 6 figs.
1929. Distribution and key of the North American copepods of the genus *Diaptomus*, with the description of a new species. Proc. U. S. Nat. Mus., vol. 75, art. 14, pp. 1-27, 16 figs.
- PEARSE, A. S.
1905. Contributions to the copepod fauna of Nebraska and other States. Stud. Zool. Lab. Univ. Nebraska, No. 65, pp. 145-160, 5 pls.
1906. Fresh-water Copepoda of Massachusetts. Amer. Nat., vol. 40, pp. 241-251, 9 figs.
- SARS, GEORG OSSIAN.
1898. The Cladocera, Copepoda and Ostracoda of the Jana Expedition. Ann. Mus. Zool. Acad. Imp. Sci. St. Pétersbourg, vol. 3, pp. 324-359, 4 pls.
1903. On the crustacean fauna of Central Asia. Pt. III. Copepoda and Ostracoda. Ann. Mus. Zool. Acad. Imp. Sci. St. Pétersbourg, vol. 8, pp. 195-232, 8 pls.
- SCHACHT, FREDERICK WILLIAM.
1897. The North American species of *Diaptomus*. Bull. Illinois State Lab. Nat. Hist., vol. 5, pp. 97-208, 15 pls.
- SCHMEIL, OTTO.
1896. Deutschlands freilebende Süßwasser-Copepoden. Pt. 3. Centropagidae. Bibl. Zool., vol. 21, pp. 1-144, 12 pls.
- THACKER, MR. and MRS. T. L.
1923. Some freshwater crustaceans from British Columbia. Can. Field-Nat., vol. 37, pp. 88-89.
- THIEBAUD, M.
1912. Voyage d'exploration scientifique en Colombie. Copépodes de Colombie et des Cordillères de Mendoza. Mém. Soc. Neuchâteloise Sci. Nat., vol. 5, pp. 160-175, 25 figs.
- TURNER, C. H.
1921. Ecological studies of the Entomostraca of the St. Louis district. Pt. 1. *Diaptomus pseudosanguineus* sp. nov. and a preliminary list of the Copepoda and Cladocera of the St. Louis district. Trans. Acad. Sci. St. Louis, vol. 24, No. 2, pp. 1-25, 4 pls.
- WILSON, MILDRED STRATTON.
1941. New species and distribution records of diaptomid copepods from the Marsh collection in the United States National Museum. Journ. Washington Acad. Sci., vol. 31, pp. 509-515, 1 fig.