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Contributions to the Freshwater Microfauna of Tasmania

Part 1 — Copepoda

By

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WITH 67 TEXT FIGURES

PREFACE

The following communications owe their creation to the friendly courtesy of Dr. A. G. Nicholls, who let me have the freshwater material, collected during a lengthy stay in Tasmania, for the zoogeographical evaluation. Here, too, Dr. A. Komzak should be thanked most cordially for the translation into English.

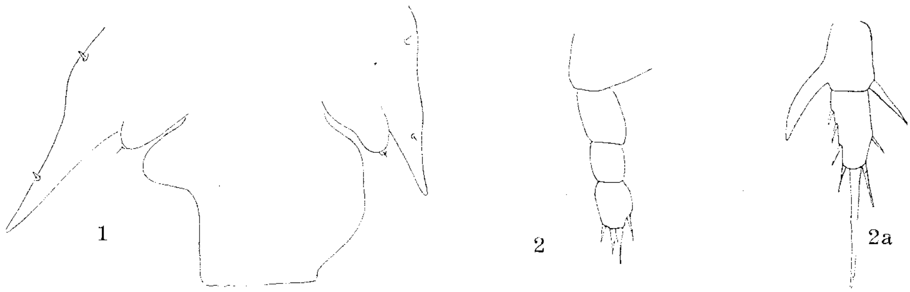
Since the evaluation of the various animal groups necessarily takes a rather long time and also the distance of the place of publishing from Europe entails considerable delays, I prefer not to wait for the completion of the whole work before the printing is begun. Instead, I propose to submit the results in three consecutive sections of which this, the first, comprises the Copepoda. The second is to deal with the remaining Entomostraca, the third with the Amphipoda as well as further animal groups and the zoogeographical results. As some samples were abundant in Diatomeae, a further communication on these is planned by Dr. Hustedt.

I wish to thank Dr. M. Beier from the Vienna Imperial Museum for the procurement of several papers. Although the zoogeographical discussion of the found species is reserved for the final section, it may be stressed already here that the species described as *nov. spec.*, and also those compiled by Smith, cannot be considered to be Tasmanian endemisms. They will certainly be found in adjacent parts of the Australian Continent.

Centropagidae

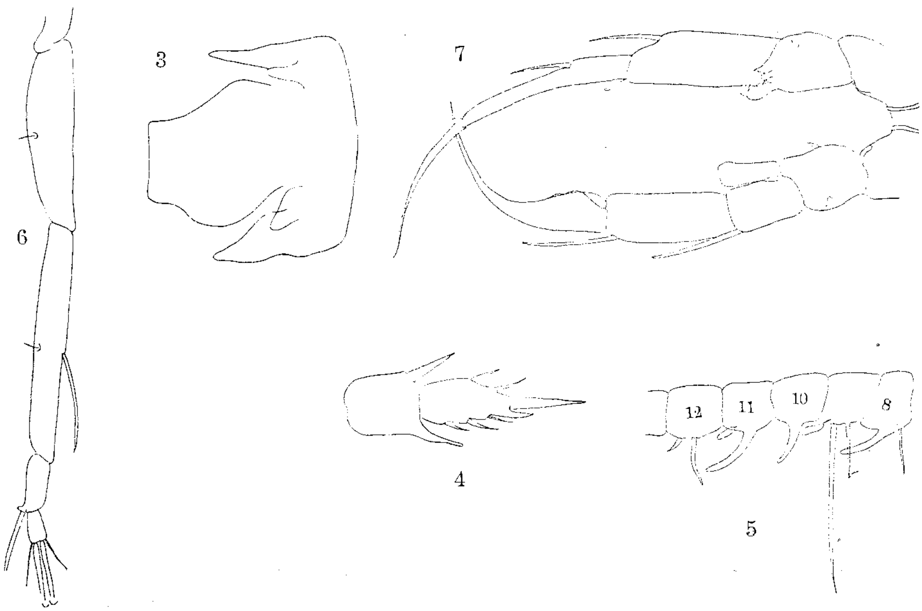
Boeckella sp. (Figures 1, 2)

The sample T 4 from Lake Dobson contained 20 specimens of a *Boeckella*, unfortunately females throughout. The lack of the male renders the safe determination impossible. The animals, about 1350 μ long, partly bore egg sacs, each containing only 4 eggs. The last thoracic segment is strongly winged, the external wings are pointed and reach up to the middle of the genital segment. The genital segment possesses on the left side a globular protuberance, the right side bulges along its entire



BOECKELLA sp.

1. End of thorax and genital segment, ♀
2. Fifth leg, exopod and endopod, ♀



BOECKELLA DENTICORNIS n. sp.

3. End of thorax and genital segment, ♀
4. Fifth leg, terminal part of exopod, ♀
5. Spine-like appendages of gripping antenna
6. Terminal portion of gripping antenna
7. Fifth pair of legs, ♂

length. The claw of the second segment of the external branch of the fifth leg is smooth, moderately large, the third segment of the external branch bears seven appendages, all of which are very small, with the exception of the terminal spine, which is quite double the length of the terminal segment. The last segment of the three-segmented endopod bears few—mostly four—quite short spines. There are, as visible in our picture, small sensory setae on both flaps of the thoracic wings.

Boeckella denticornis n. sp. (Figures 3-7)

Female: red coloured. Egg sacs consisting of about 20 eggs. Length: 1800 μ. Antennulae reaching at least up to the end of the furcal setae. Thoracic wings very long, reaching to the end of the genital segment. The genital segment asymmetrical, exhibiting on the left anterior side one, sometimes two protuberances, bulging on the right side in the middle. The exopod of the fifth leg is conspicuous by the relatively weak claw of the middle segment, which is, for that matter, smooth (exhibiting a feeble hair fringe only at great magnifications) and mostly not much stronger or longer than the spine on the external side of this segment. The terminal segment is provided with 7 appendages, of which those on both inner and outer side are conspicuous by their shortness.

Male: 1600 μ long. The thorns of the 8th and 10th segments almost equally large, that of the 11th segment mostly somewhat smaller. The 12th segment bears, distally from the sensory spine, a seta with a bulbous swelling at the base. The penultimate segment bears at the distal end of the curved side a small, tooth-like appendage, reminiscent of the tooth of the terminal segment of the antennule of *Diaptomus denticornis* *. The short terminal segment is oriented obliquely to the segment before it. The last thoracic segment is without wings and bears on each side a small sensory seta. Fifth leg on the right: second basal with a small tooth on the inner margin. The bristle on the external margin short. Beside the endopod a flap-like extension. The segments of the external branch elongate. The first exhibits, in a certain position, a hairy bulge near the inner margin. The terminal segment of the endopod is abruptly narrowed from about the middle. The proximal portion exhibits a twisted chitinous border. The endopod is distinctly three-segmented; the segments are so separated from each other, that they remind of the phalanges of a human skeleton. (A result of preserving?)

Left: Second basal with a flap-like extension near the insertion of the endopod. The first segment of the external branch exhibits, in certain positions, a hairy bulge on the basal. The endopod is short, one-segmented,

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* Smaller such tooth formations of this type are exhibited by some specimens of *Boeckella lacuna* from Brock's Dam.

and bears at the end a small point. If we take for comparison the Boeckellae described by Smith, *B. rubra* would be suitable for comparison. This is identical with our form in:

(1) the colour.
(2) the tooth-like appendage on the penultimate segment of the gripping antenna and the oblique insertion of the terminal segment of the same.
(3) the structure of the fifth leg of the female, which is conspicuous by the small size of the claw of the middle segment and by the fact that the latter exhibits a faint hair covering instead of the toothing. The claw is not much thicker than the spine of the middle segment, opposite to it.

On the other hand, our form differs from *B. rubra* in the following points:

(1) The distal inner corner of the second basal of the fifth leg of the ♂ does not possess in our form the pointed appendage, typical for *rubra*.
(2) The endopod of this leg is only two-segmented in *B. rubra*, whereas it is distinctly three-segmented in our form.
(3) In the left leg of the ♂ Smith draws, instead of the endopod, a small, hairy appendage, drawn out into a point. In our case, however, there is, besides an appendage of the second basal, a distinctly separated cylindrical endopod, bearing a small point. Furthermore, here the first segment of the external branch is, at the basal portion of the inner margin, bulged and covered with hairs. Even if we assume that Smith may have misunderstood and misinterpreted these formations, by connecting the hairy inner portion of the first segment of the external branch with the endopod, the difference caused by the absence of the extension of the second basal in our form would still remain.

In Fairbridge's table we come (because of the three-sectioned endopod of the right fifth leg of the male) to No. 23. From here because of the lack of a toothed lamella to No. 24, from here because of the shorter thoracic wings to No. 25, where we find the species *saycei* and *propinqua*. Because of the thorn—in our case actually a chitin point in the body wall—on the inner margin of the second basal of the right fifth leg the decision would be in favour of *saycei*; but our species differs from this by the cylindrical form of the endopod of the left leg, which is in our case approximately twice as long as wide, whereas with *saycei* it is not much longer than wide*.

Moreover, the endopod of the right leg is considerably longer than in *saycei*. Whether further details, which can be seen in our figures, e.g., the appearance of the terminal portion of the gripping antenna, could be considered as differences from *saycei*, will only be known after a newer detailed description of the species *saycei* from the *locus classicus*.

B. denticornis was found in sample 15: Little Waterhouse Lake.

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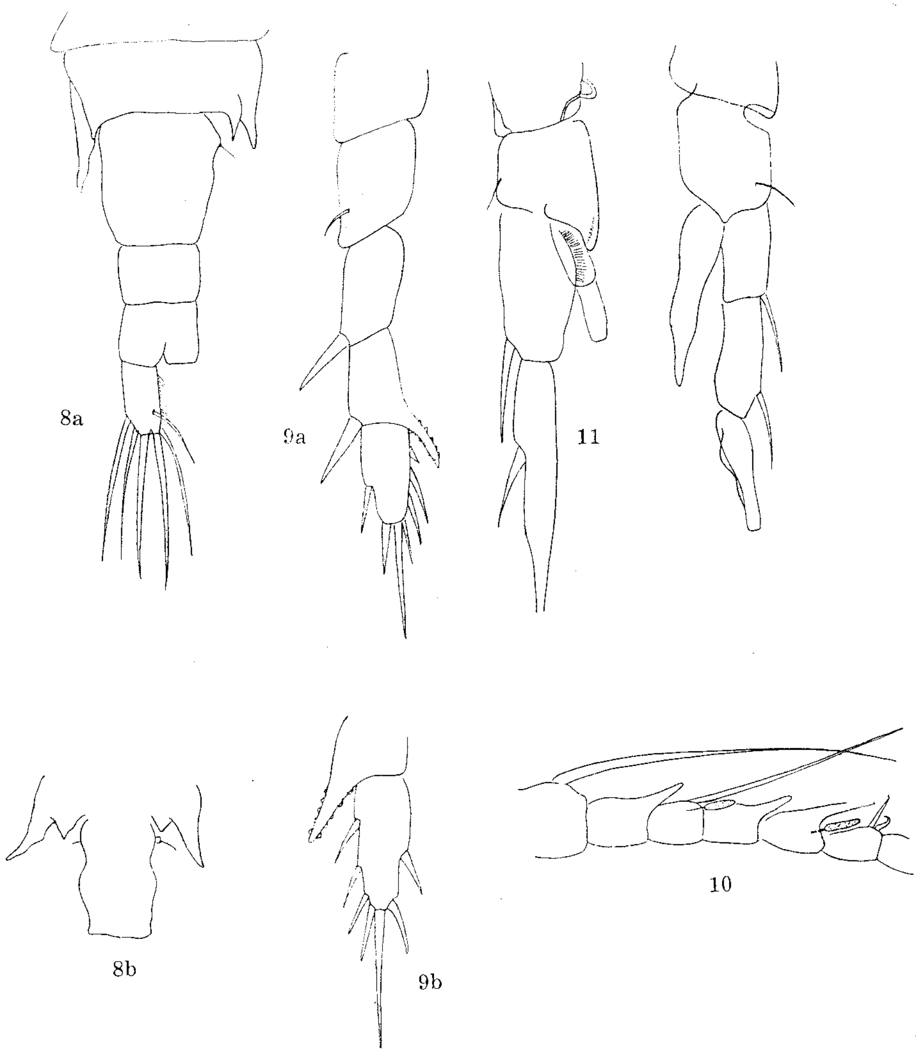
* Moreover, there is a tooth on the inner side of the base of the terminal claw of the left leg. This tooth varies from individual to individual.

Boeckella lacuna Fairbridge, 1945 (Fig. 8-11)



BOECKELLA LACUNA Fairbridge

8a. Female from roadside pond, Tunbridge
8b. Female. End of thorax and genital segment of a specimen from L. Dulverton
9a. Fifth leg, exopod. From Penna Dam
9b. Fifth leg, exopod. From L. Dulverton
10. Spine-like appendages of gripping antenna. From Rostrevor Dam
11. Fifth leg of ♂. From Rostrevor Dam

Although Fairbridge has given an adequate description of the species set up by him, provided with the necessary illustrations, a description based on the material available to me should be given here, in anticipation of the following discussions, since, particularly on account of the question of the relationship of *Boeckella* from Lake Dulverton, a familiarity with some details is necessary.

Female: length without the furcal bristle 1800 to 2000 μ. The egg sacs of the (mostly pale yellow) animals contain about 25 eggs. The antennulae reach to the end of the furcal bristle. The points of the longer wing sections of the last thoracic segment extend to the middle of the genital segment. The genital segment exhibits mostly two slight lateral swellings of which the proximal one bears a tiny sensory seta. The claw of the middle segment of the exopod of the fifth pair of legs is provided with coarse protuberances. The terminal segment has seven appendages, of which 4 belong to the inner margin. These appendages have the form of medium-sized spines. With some colonies, however, the top one on the outer side is stunted to a short spur, as Fairbridge has mentioned and depicted. Fairbridge also mentions the variability of this structure, which possessed in many of his specimens the shape of a normal spine. This also holds with our material for the specimens originating from Lake Dulverton. Male: Average size: 1650μ. The gripping antenna bears on the 8th and 10th segments two thorn-like appendages of equal and medium length, on the 11th a longer one. The 12th segment is provided with a short spine distal to the sensory seta, the thin end of which is in most specimens curved like the antlers of a chamois (Cf. Fig. 10). Fifth pair of legs: the endopod of the right leg is one-segmented, reaches well up to the second third of the second segment of the external branch. It exhibits two constrictions, which betray the quasi-three-segmented nature of it. The terminal claw has in the basal portion a squat, twisted chitin lamella, which creates two mounds in the contours of the base of the claw. Left leg: at the inner side of the first basal a small semi-circular chitin appendage. At the distal inner corner of the second basal an appendage, bearing plump small teeth, imparting to this formation the look of a mandible. The two-segmented endopod reaches almost to the end of the first segment of the external branch. The first segment of the exopod exhibits at the proximal portion of the inner margin a bulge covered with hair.

Boeckellids corresponding in essence to the characteristics given here, were found in samples 23 (roadside pond near Tunbridge), 24 (Lake Dulverton) and 29 (Rostrevor Dam near Hobart)*. Obviously the form is very frequent in Tasmania and deserves our interest, for it constitutes further evidence for the fact, stated by Prof. G. E. Nicholls, that the fauna in both western and eastern Australia exhibits many common forms, which are lacking in the intervening territory. This fact will not be altered even by the circumstances that Boeckella colonies, which I identify as *lacuna*, do not, in some details, correspond to the type *lacuna*. Even with the present material slight differences were shown, and I cannot state whether they are to be considered as individual, local or temporal variations. However, the occurrence of our form in Lake Dulverton requires a special discussion. From this lake Smith describes the occurrence of but one species of Boeckellid, viz., *Boeckella insignis*. Our sample, however, contains two species, namely a *Brunella* as the far more frequent one and *Boeckella lacuna* as the less frequent one. It is surprising that Smith does not mention the more frequent species and only described a *Boeckella*

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* Also in samples from Penna Dam (sample 9) and in the plankton from Brock's Dam (sample 8).

species which, according to his figures, cannot be identical with our species. An explanation of this discrepancy would be possible, I suppose, only on the following two assumptions:

(1) It could be assumed, that since the time of Smith's investigation at the beginning of our century the composition of the plankton of those waters should have changed to such an extent, that the formerly present *Boeckella insignis* should have become extinct and superseded by two other *Boeckellids*; and

(2) It could be assumed, that Smith overlooked the smaller, though more frequent species, or perhaps considered it to be a young stage of the older one, and that his description of *insignis* is faulty, which makes the recognition of the species impossible.

It could be stated in favour of the first assumption, that, according to Smith's account, Lake Dulverton is a shallow basin of water, which is occasionally dry. But even with the assumption that after such a periodical dryness a new "seeding" with other forms from outside should have taken place, it should be borne in mind that such periodical waters with each new filling with water are regularly populated with their own fauna, which springs out of the permanent eggs dried in its mud.

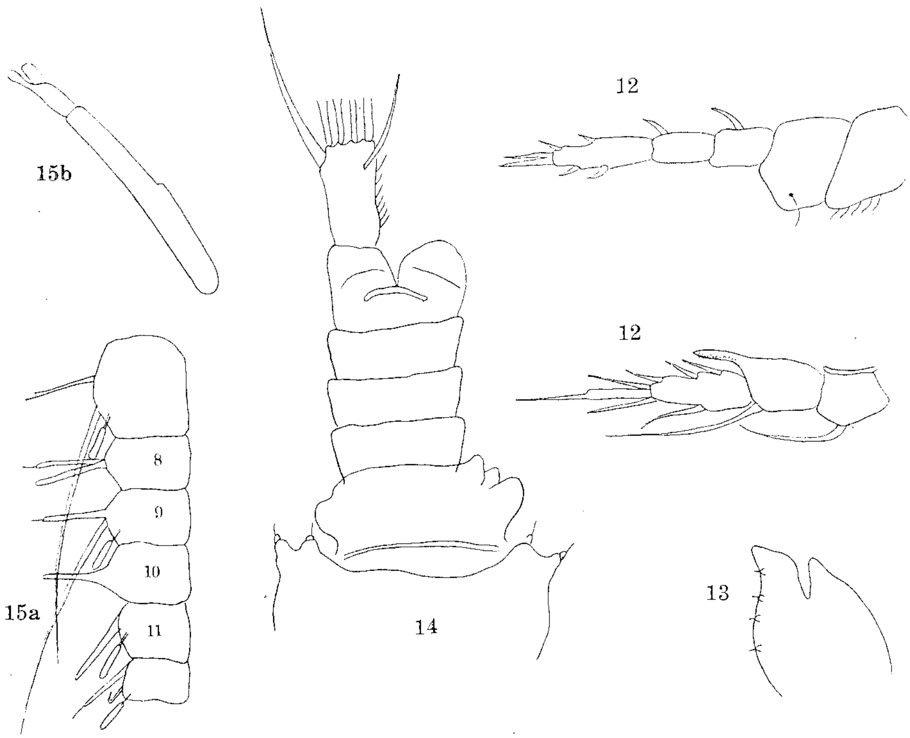
Concerning the second assumption, the fact (weighing against Smith) must be considered, that mistakes made with other species (*Ceriodaphnia hakea*) allow of the possibility, that Smith encountered our form after all, but that his observations and drawings are faulty. In this connection the attention should be particularly drawn to the circumstances of the fifth leg of the male (endopod). Even if we assume that Smith were confronted also with *B. lacuna*, it would hardly be justified to supersede, say for reasons of priority, the name *lacuna* by *insignis*. It will be best to see whether another *Boeckella*, corresponding to Smith's species *insignis* can be found in Tasmania, in which case the designation *insignis* could be retained for this form. Should this expectation not be fulfilled, the name *insignis* should be designated as a *nomen nudum*.

Boeckella pseudocheles Searle 1912 (Figures 12-17)

Although besides two well-preserved males there was but one abdomenless female, I still give a description and drawings of this peculiar species, for the description and figure given in Marsh's synopsis do not suffice to determine whether our form corresponds to the type of this species.

Female: The thorax exhibits a wing, divided into two parts by a deep narrow incision. On the margin of the longer wing point there are four sensory nodules. The small rudimentary leg possesses on the middle segment of the endopod a claw provided with 10 teeth, which grow larger and thicker distally. The terminal segment of the exopod bears seven spines.

Male: 1700 μ long, coloured intensely red. At first sight the gripping antenna appears to have four spine-like appendages. A greater magnification, however, reveals that only—as with other Boeckella—the 8th, 10th and 11th segments are provided with a spine-like appendage. These are of equal length in all three segments (they are longer than the segment is wide) and slender. What appears as a spine-like appendage at the 12th



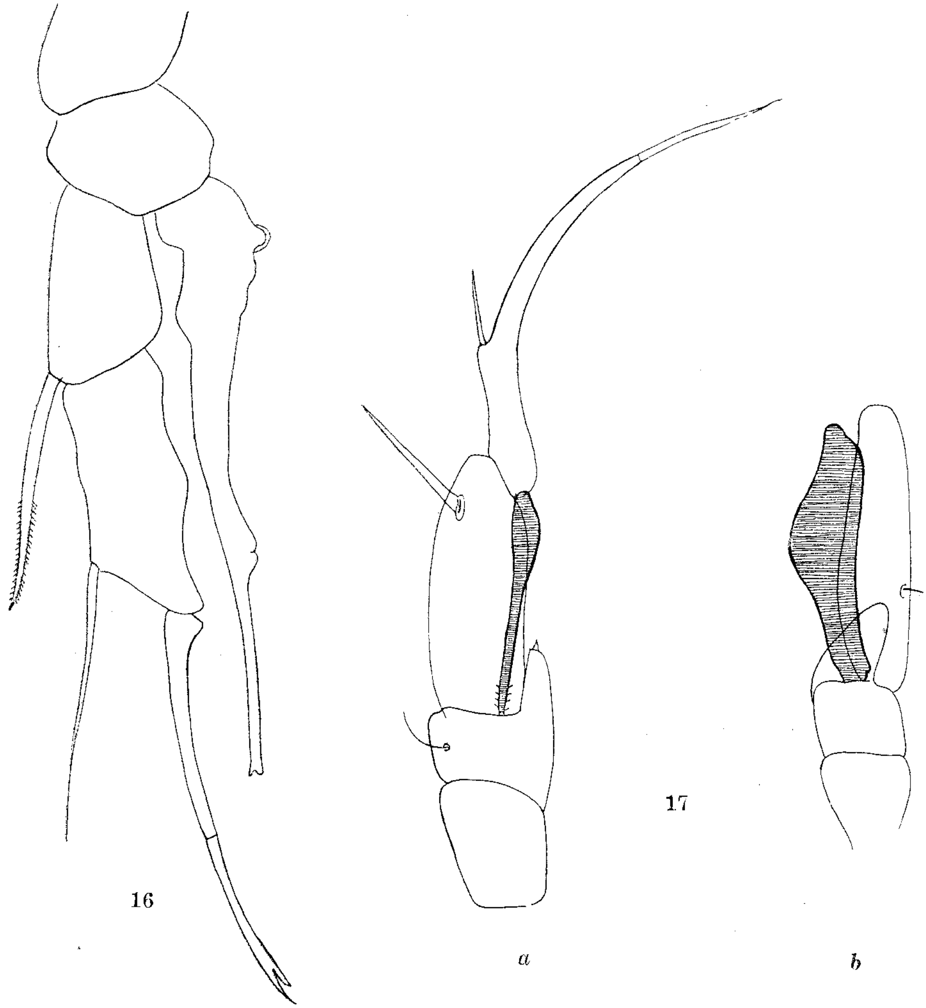
BOECKELLA PSEUDOCHELES Searle

12. Endopod and exopod of the fifth leg of ♀
13. Thoracic wing of ♀
14. Posterior portion of body of ♂
15a. Spine-like appendages of gripping antenna
15b. Terminal portion of gripping antenna

segment is actually a sensory seta resembling a spine-like appendage on account of its thickness and stronger chitinization. Further, the gripping antenna is particularly conspicuous for its last segment but one exhibits a spoon-like extension reaching over the end of the antenna. The thorax is not winged, but exhibits two flaps on either side, each of which possesses a small sensory seta. The genital segment is somewhat asymmetrical, which is due to two small bulges at the distal part of the left side.

Fifth pair of legs: right-hand-side—the endopod extraordinarily long and narrow. The basal portion exhibits a broadening ending with a chitin knob. The end of the endopod is split into two short prongs, reminiscent of the end of the body of a Gordius. Also the terminal claw of the exopod ends like a two-pronged fork with the prongs of unequal length.

Left: the second basal is extended at the terminal inner corner. The endopod, inserted beside this extension, is flattened and looks like a rod, seen from the edge, but leaf-shaped and broadened in the middle when seen frontally. The elongate first segment of the exopod exhibits a sensory knob.

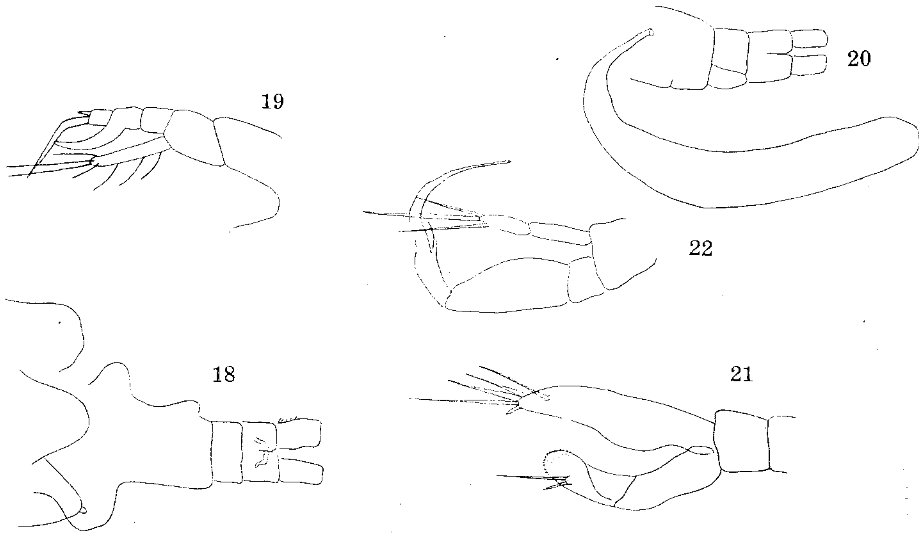


BOECKELLA PSEUDOCHELES Searle
16. Right fifth leg of ♂
17. Left leg of ♂
(a) Endopod edgewise
(b) Frontally

B. pseudocheles occurred as a few specimens in sample No. 19, bearing the designation: " from shallow roadside pond, Waverley Road, Launceston ".

Brunella gibbosa n. sp. (Figures 18-22)

Female: 950 μ long without the furcal setae. The antennulaé reach beyond the end of the furcal setae. The last thoracic segment broadly rounded, but not elongated into wings. On the genital segment on the left, proximally, a globular appendage, on the right two bulges. The



BRUNELLA GIBBOSA n. sp.

18. Posterior portion of body of ♀
19. Fifth leg of ♀
20. Posterior portion of body of ♀ with spermatophore attached
21. Left fifth leg of ♂
22. Right fifth leg of ♂

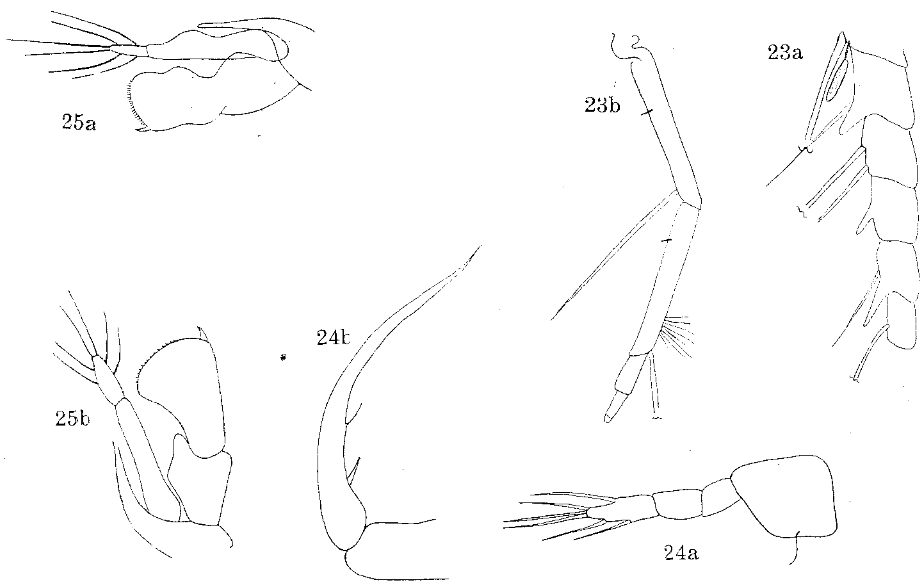
furca twice as long as it is wide, with a fringe of hair on the proximal part of the outer margin. Fifth leg: the second segment of the exopod with a large smooth claw; the end segment with a short spine and a geniculate spine. The inner branch is one-segmented and bears 7 seta-like appendages, of which 4 belong to the inner margin.

Male: 800 μ long. The gripping antenna bears on the 8th segment a spine of medium length, on the 10th and 11th two spines of equal length, larger than those of the 8th segment. Fifth leg: right side: the terminal claw of the outer branch is sinuously bent distal to the insertion of the lateral spine. The inner branch is two-segmented, the terminal segment bears three bristle-like appendages. Left side: The terminal segment of the two-segmented outer branch is extended into a round plate provided with spinules. Above the spinous area one long and one short seta are inserted. The inner branch is one-segmented, longer than the outer branch and armed with a spinule. The large, sausage-shaped and strongly bent spermatophore reaches, when attached to the female genital pore, considerably beyond the furca of the female.

This species, which should be designated *gibbosa* on account of the outgrowth on the genital segment, forms a dominating constituent of the plankton of Lake Dulverton. Since Nicholls (1944) worked out a table for the determination of the genus *Brunella,* two new species, *B. attenuata* and *B. subattenuata* have been described by Fairbridge. Nicholls referred to this fact in a footnote. Since both show a symmetrical genital segment in the female, they are out of the question for the identification of our species and we can, for the purpose of comparison, limit ourselves to the species described by Nicholls. Of these, *B. tasmanica,* first described by

Smith from Tasmania, could be considered first. However, identity with the latter should be highly improbable because of the ecologically different habitat. *B. tasmanica* was discovered in a lagoon separated from the sea only by a sand dune. In fact, there is no resemblance between the two species. By comparison with non-Tasmanian species, using the key set up by Nicholls, we find in the table of females under the species with rounded thorax that our species, on account of the one-segmented endopod of the fifth leg, belongs to the species *ampulla*. This, however, is contradicted by the position of ampulla in the key to the males, for these would also have to exhibit a one-segmented endopod on the right fifth leg, which is not the case. In the key designed for males our form would have to be sought with the last three species of the table, because of the two-segmented endopod of the right fifth leg. The species *expansa* could be considered there, but here again the female exhibits a two-segmented endopod of the fifth leg, this possibility can therefore be discarded and we come, by elimination to the conclusion, that our species is new.

Brunella tasmanica Smith 1909 (Figures 23-25)



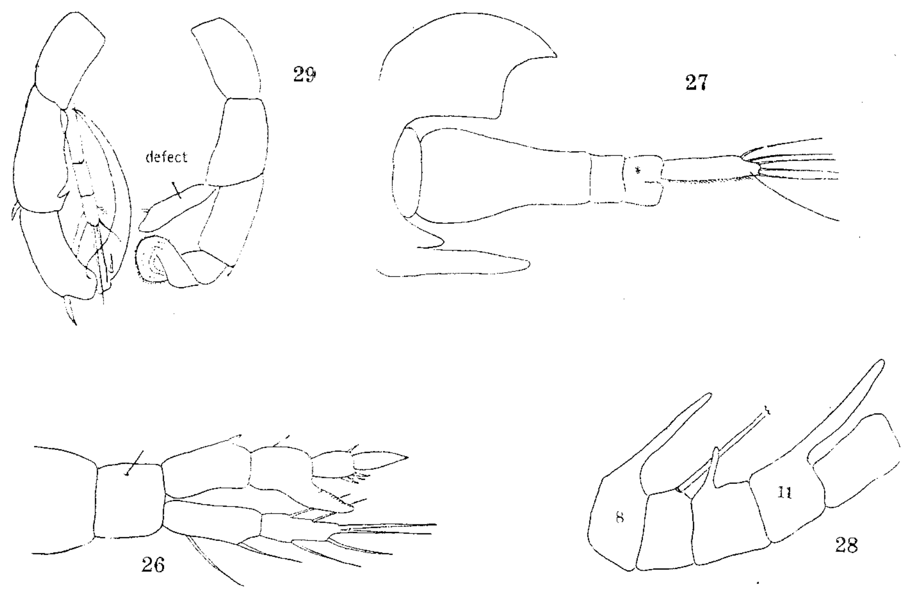
BRUNELLA TASMANICA Smith ♂

23a. Spine-like appendages
23b. Terminal part of gripping antenna
24a. Endopod of right fifth leg.
24b. Terminal claw of exopod
25. Fifth leg in two different positions

In sample 18 from Big Lake Waterhouse, there were a few male specimens, which I propose to class under Smith's species *tasmanica,* since it tallies in essential points with the description given by Smith. The remaining differences can partly be explained as observational errors, partly as local or individual variations, but chiefly by the fact, that such complicated formations as the male fifth leg are apt to show, under slight shifts of position, such conspicuous differences in the contours, that differences become apparent, even if not actually present. To supplement Smith's description, attention should be drawn first of all to the structure of the gripping antenna. The 8th and 10th segments bear each a short thorn-like appendage, the 11th segment the same structure of twice the length. The third segment from the end bears a fan, formed of about 8 setae (figures 23, a, b). The terminal claw of the right leg exhibits near the somewhat swollen base a weak lateral spine. Distal to the latter the concave side of the claw forms a prong which bears a delicate sensory seta. The endopod of this leg is provided with 6 setae, whereas Smith drew but 4. The same condition is seen on the terminal segment of the left endopod. The contour of this exhibits, according to the position, either a cylindrical form, as depicted by Smith, or two swellings (figures 25, a, b). The styliform appendage of the second basal on the left as well as the form of the last segment of the external branch of the left leg look characteristically like Smith's figures. The males, 1000 μ long, were olive green with blue extremities.

Brunella expansa Sars 1912 (Figures 26-29)

Sample 17 from Lake Waterhouse containing a *Brunella,* which I propose to classify as belonging to the species *expansa,* in spite of some differences compared with the figures given by Sars. (Copies of these



BRUNELLA EXPANSA Sars

26. Fifth leg of ♀
27. Posterior portion of ♀ ; left wing seen from above, right seen from side
28. Spine-like appendages of gripping antenna
29. Fifth leg of ♂

figures were made available to me through the courtesy of Dr. M. Beier from the Vienna Imperial Museum—I thank him here cordially for it).

The significant differences are as follows: The wings of the last thoracic segment of our form are distinctly broader and clearly bifid, which is particularly visible in the side view (cf. fig. 27 right). The latter feature is perhaps less conspicuous in Sars's figure, because this represents a purely dorsal view. On the fifth leg of the ♀ we find with Sars that the terminal segment of the exopod is on its inner margin beset with delicate setae and terminally with a slender spine, whereas our form is distinguished with shorter, spine-like structures on the inner margin and the terminal spine is shorter and thicker. On the fifth leg of the male, the backwardly directed tooth at the distal inner corner of the first segment of the endopod of the right leg is developed into a pronounced tooth in our specimens, whereas by Sars they are just hinted at. The differences in the structure of the terminal portion of the left leg may be explained as unequally shortened by perspective.

Whether the unusual length of the spinous appendages of the 8th and 11th segments of the gripping antenna, as shown in our figure 28, is stressed by Sars, is beyond my knowledge.

Gladioferens

According to the summary given by Nicholls (1944) so far 5 species of *Gladioferens* are known. Of these, however, only two—*inermis* Nich. and *gracilis* Kief.—are described in such detail, that a comparison is possible. There remain, therefore, some understandable doubts as far as the identification with these species is concerned. Nicholls allows of the possibility that *subsalaria* and *brevicornis* might be identical, and Kiefer* admits the same possibility for *gracilis* and *spinosus*.

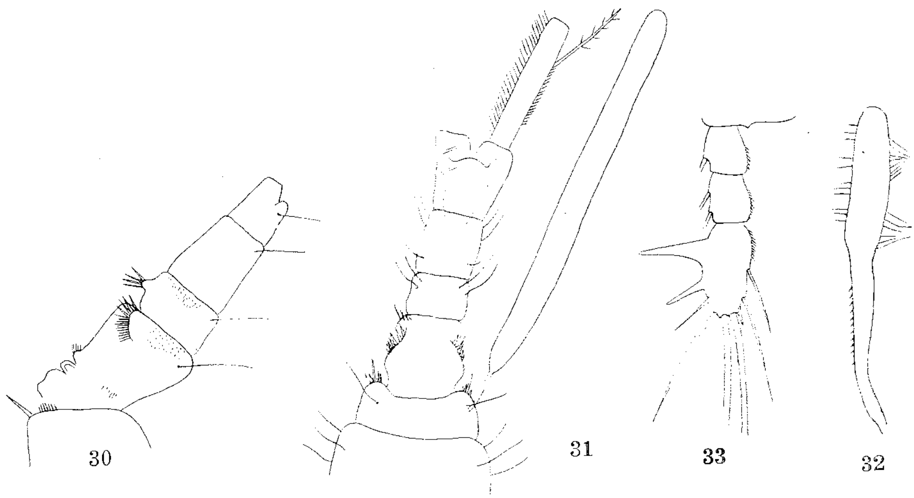
It is quite possible that the genus *Gladioferens* consists of a swarm of microspecies, the separation or partial grouping together of which will only be possible after a renewed investigation of the forms described so far. The question remains therefore open, whether the species described here is to be evalued as a " good species " or not.

Gladioferens henryae n. sp. (Figures 30-37)

Female: Egg-bearing specimens varied considerably in their size about an average of 1700 μ, whereas *gracilis* measures only 1400 μ and *inermis* as little as 1000 μ. The number of eggs is greater throughout than with *gracilis*, namely about 25. The colour is sometimes lighter, sometimes a darker yellow or orange-red. The extremities exhibit, at least at the base, blue coloration. The antennulae reach only to the end of the cephalothorax. The last thoracic segment is simply rounded off and bears terminally a large hyaline spine besides several delicate spinules. The genital segment and the third segment of the abdomen are longer than the other abdominal segments. The genital segment is constricted in the middle on both sides, the anterior half bears on both sides a group of spines, whereas the posterior half bears such a group only on the

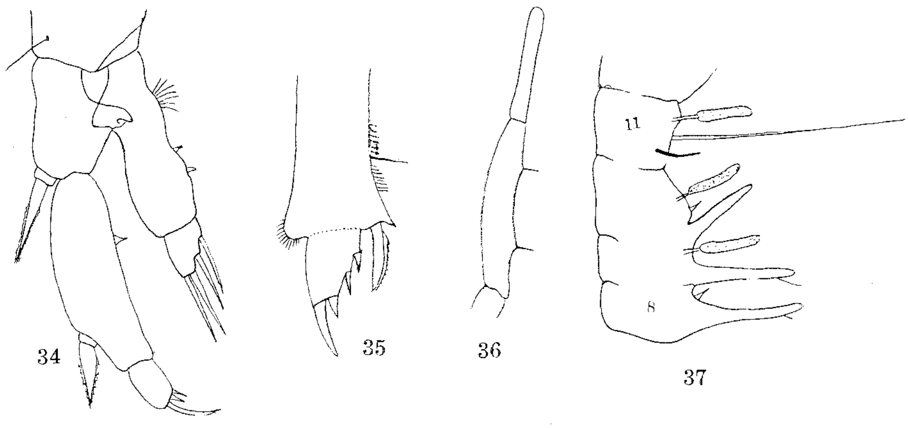
* Kiefer particularly stresses the unreliability of the conditions concerning the segmentation of the extremities; so far, however, just these have formed the key for the determination of the male *Gladioferens* species. For the females the setting-up of a key has not been possible up to the present.

right side. In contrast to the representation given by Kiefer for the species *gracilis,* our form exhibits one long sensory seta at the rear corners on both sides of the genital segment. Such are also present on the thoracic segments. In the lateral view we find areas set with tiny spinules on the genital segment and the segment following it. The furcal branches bear on the inner margin a fringe of long setae, on the outer margin they



GLADIOFERENS HENRYAE n. sp.

30. Abdomen of ♀ laterally
31. Abdomen of ♀ dorsally with spermatophore
32. " Boomerang "
33. Fifth leg of ♀



GLADIOFERENS HENRYA n. sp.

34. Right fifth leg of ♂
35. Left fifth leg of ♂ ; terminal portion of endopod
36. Terminal portion of gripping antenna
37. Spine-like appendages of gripping antenna

are set with tiny spines growing thicker distally, which imparts to this margin the look of the saw of a *Cyclops serrulatus*. The bristle of the outer margin is inserted in the last fourth, in contrast to *gracilis*, where it is inserted in the last third. The " boomerang ", typical for the fourth pair of legs is, in our form, present only in the left leg. It is much broader in the basal half than in the distal half. Again in contrast to the figures given for *gracilis* and *inermis*, it exhibits in the basal part two rows of long setae, whereas the distal part bears one row of short spines. The fifth pair of legs tallies, even in finer details, with the figure given by Kiefer for *gracilis*. Here, too, we find on the inner margin of the first segment of the external branch the small chitin protuberance, also the pointing of the terminal outer corner of the first segment of the endopod and the laterally situated appendage of the second segment of the external branch, which is in our case studded with small spines.

Male: The average length is 1550 μ. The last thoracic segment, which is rounded, bears terminally on both sides a small knob. The furca lacks the armature of the outer margin. The form of the gripping antenna corresponds to the description given for *gracilis*, which should be supplemented by our figure with the considerably bigger sensory cylinder on the middle section. The two teeth, on the margin of the penultimate segment of the antenna, visible in the figure representing *gracilis*, bear each one small sensory hair. The strong lateral spine, characteristic for the second pair of swimming legs, and set perpendicularly to the longitudinal axis of the endopod in *gracilis*, and oriented backward in *inermis*, stands in our form perpendicularly as in *gracilis*. The setae of the inner margin lying distally to this spine are here so modified, that the upper one is transformed into a spine, whilst the one beneath forms something between a spine and a bristle. Nicholls has drawn attention to the systematic value of these appendages, pointing out that with *gracilis* these two bristles are not modified, whereas with *subsalaria* only the upper one is transformed into a spine, so that, consequently, in our case there is a resemblance to *subsalaria*. On the right fifth leg the two short spines near the terminal claw of the end segment of the endopod are, in our form, set quite terminally, whereas in *gracilis* they are inserted further up and *inermis* possesses but one such spine, which is, for that matter, larger and even more proximally situated. Further, with most specimens of our form the chitin appendage on the inner margin of the first segment of the external branch of the right leg was bifid. The conspicuous size of the spermatophore, frequently attached to the female, is visible in figure 31 (Kiefer mentions explicity that no spermatophore were present in *gracilis* and I find no mention of them by Nicholls).

Gladioferens henryae* was present in samples 16, 17 and 18, from Big Lake Waterhouse. Concerning the latter locality the following details are available: " The Waterhouse Lakes (Big and Little) are situated just above sea-level, in sand dune country, near the coast to the north-east of Launceston, about 90 miles distant ".

This statement is interesting with respect to the communications made by Dr. Nicholls in his treatise " A New Calanoid Copepod from Australia " (*Ann. Mag. Nat. Hist.* Vol. 12—1945) on page 514. There he points to the

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* Dedicated to the discoverer of this genus, M. Henry.

fact, that the new genus *Sulcanus,* obviously of marine origin, is always encountered in company with *Gladioferens,* and that *Gladioferens* is typical for waters near shores of variable salt content. The samples from which *Gladioferens henryae* is described here correspond to these statements with respect to the proximity to the shores of the localities in which they were found, but surprise, on the other hand, by the fact, that the accompanying organisms are of a purely freshwater character. It seems that *Gladioferens* already displays a rather outspoken adaptation to pure fresh water.

Red Coloration in Copepoda.

In conjunction with Fairbridge's communication (*Journ. Roy. Soc. West. Austr.* Vol. 29, page 37) concerning red coloration in Boeckellids, I should like to state that I have pointed to the phenomenon of the red coloration of *Boeckella* on the occasion of the description of *Boeckella erubescens**—so called on account of its coloration; a counterpart to the Australian *B. rubra*, also in nomenclature—and that already earlier Father G. Rahm reported in the Monthly Journal for Chile (Year 13) having observed red coloration of *Boeckella* in all lakes of the Andes, from Central Chile down to Patagonia, the temperature of which never rises above 10°. But this coloration would disappear after a few days if he kept them in the lowlands in aquaria. I have discussed the problem of the red coloration somewhat more elaborately than Valkanov in *Biological Reviews* (Vol. 13, 1938), with the result that for the reason or purpose of this phenomenon 11 hypotheses had been set up, none of which enjoyed a satisfactory experimental foundation. Rahm's communications speak for a temperature effect, whereas Fairbridge's cases rather suggest a protection against insolation, as the named author elaborates. Also the conditions prevalent with the present red colony of *Boeckella* from Little Waterhouse Lake speak best in favour of Fairbridge's assumption, since this colony lived in a dune landscape scarcely above sea level. The altitude of the residential waters of the deep-red *Boeckella pseudocheles* correspond to this assumption. Fairbridge mentions the red coloration of *Boeckella opaqua* (described by him) and says in his description: " body, mouthparts and swimming legs are heavily pigmented with red. All colour disappears in a few days on preservation in formalin." It might be mentioned in this connection that when I added formalin to a sample of plankton caught in the Lake Misurina (Tyrolean Dolomites) there occurred an instantaneous change of the colour of the abundantly present *Diaptomus denticornis* into bright blue and that quite generally with certain European Diaptomids the red coloration is supplanted by blue. It may further be mentioned, that the turning of red into blue may occur also in the live animal, but little is known about the reasons and meaning of this colour change. Elster (*Zool. Anz.* Vol. 96) reports that the red specimens of *Diaptomus castor* and *superbus* turn blue with rising temperature, that here, too, the red coloration indicates a lower temperature. With *Heterocope weismanni* of Lake Constance the colour depends on the age, the

* Communications from the research travels of Professor Rahm (*Zool. Anz.* Vol. 112—1935).

young animals being blue. The Heterocopes exhibit the further peculiarity that their vertical migrations become less with the deepening of the blue coloration of the animals. Here again one would suggest protection from light—this time, however, with the blue phase of the pigment. It is certain that, just as the colorations may be based on different pigments, their physiological importance may vary, too. Evidence favouring this statement is found in the above-cited paper of mine from *Biological Reviews,* which I want to supplement briefly here.

Valkanov's assumption, mentioned by Fairbridge, that the red pigmentation might be a result of the mode of nutrition, may be valid with Vampyrellae, which does not mean to imply any statement as to whether the pigmentation is an incidental phenomenon without any consequence or whether a special physiological importance can be attached to it after all.

Valkanov mentions that out of 9 Vampyrellae known so far 8 are pigmented red. The genera *Leptophrys, Protomyxa* and *Hyalodiscus,* related to the Vampyrellae, exhibit red coloration, too. All these organisms are chlorophyll-eaters perforce; they break up the chlorophyll, from which the red pigments are formed. Quite different in nature, however, are the pigments characteristic for the flora of the high-altitude moors and their occurrence in quite different plants in the peculiar environment of the high-altitude moor is certainly not accidental: many sphagnum species, *Sarracenia purpurea,* tentacles of *Drosera,* red sheaths of *Carex caespitosa,* &c. Finally it may be added to by elaborations in *Biol. Reviews,* that Thorid Wulf stressed the vigorous formation of anthocyanins in plants at Spitzbergen and that Palladin contended as early as 1908 that anthocyanin promotes respiration and that colourful foliage is a result of accumulation of respiratory pigments. Now anthocyanin has nothing to do physiologically with the carotin pigmentation of copepods in which we are interested here; but even the carotin pigmentation of animals has been connected with respiration by several zoologists. Evidently we are just as remote from a solution of the problem broached here, as we were in 1938, when I made the above-mentioned report in *Biological Reviews.*

The work on Tasmanian Boeckellae directed my attention once again to the systematics of this genus. I expressed myself earlier to the effect that the characteristics used for the separation of the species offer no basis for the elucidation of phylogenetic relationships. This statement must be corrected in so far as the determination key designed by Fairbridge shows that all the species, of which the exopod of the fifth leg of the female exhibits only three appendages on the end segment, belong to the American fauna, whereas those with more appendages belong to the Old World. Also the circumstance, that the genus *Pseudoboeckella,* apparently separated from *Boeckella* by but insignificant characteristics, inhabits a geographically well defined area, shows that here characteristics, to which one is prone not to attach any particular significance, can be used for the erection of a natural system after all.

A further correction is required by my former statement that Marsh suspected close relationship between the species *occidentalis* (from Peru) and *orientalis* (from Mongolia). It says in Marsh's synopsis, " *Boeckella orientalis* . . . . bears a surprisingly close resemblance to *B. oblonga* found in Australia. It may be a fair question whether the differences should be considered more than varietal. In that case we are faced with the fact that a genus which, with this single exception, is confined to the southern continents, ... has one species common to southern Australia and Mongolia. This would hardly seem possible and one cannot help conjecturing whether the locality labels . . . . might not have been misplaced ".

Since Marsh wrote these lines it has been found that the understandable distrust of Marsh was not justified after all, as *B. orientalis* for instance has not only been found at its original location, but also at a location very remote from it, in Mongolia. This again raised the question, how is it possible that two almost identical forms of *Boeckella* can occur in Australia on the one hand, and in Mongolia on the other, considering that the numerous species of this genus are otherwise strictly confined to the cooler parts of South America and the Australian Region. Professor G. E. Nicholls devoted his special attention to this problem in his paper: " The Composition and biogeographical relations of the fauna of Western Australia " (*Rep. Austr. Assoc. Adv. Sci.* Vol. 21, 1933), in connection with Serventy's (1929) discovery of a *Daphniopsis* in Western Australia. As generally known, under this generic name those Daphnids have been grouped which, according to Wagler, should be placed within the genus *Daphnia*, but which also embraces a small group of species clustering around the species *tibetana*, represented on the one hand in Central Asia, on the other hand also on Kerguelen Island and on Marion Island and hence exhibit a certain similarity to the Boeckellids as far as geographical distribution is concerned. Nicholls considers the Mongolian Boeckellas to be descendants of the Western Australian Boeckellids, surmising that the Boeckellids originate from the Southern Hemisphere. According to him, the Mongolian colonies would be spearheads of a group of animals domiciled in the far south, advanced far to the north.

The proof of a closer relationship between the Mongolian Boeckella and the Australian species of this genus, stressed by Nicholls, does not contradict the possibility discused by me earlier in the paper: " On the zoogeographical conditions of the circumantarctic freshwater fauna (*Biolog. Reviews*, XI, Cambridge 1936), that Boeckellas, in spite of their present almost exclusive occurrence in the Southern Hemisphere, must have sprung from the North after all, in which case the Mongolian colonies as well as the asiatic forms of *Daphniopsis* could be considered remnant colonies. A decision in favour of either of the two possibilities is, I suppose, hardly possible, for lack of fossil evidence.

HARPACTICOIDA

Delachauxiella

Delachauxiella belongs to those genera which sprang from the Antarctic Continent, while the latter was connected with South America and the Australian Region, but not with Africa*. We therefore find species of this genus in South America, predominantly in the region of the Andes from Patagonia to Peru and then again in the Australian Region. In the latter it has so far been known in the two species from New Zealand, described by me, *D. bennetti* and *D. brehmi*. To these can be

* This is, I suppose, why the two genera *Delachauxiella* and *Chappuisiella* are absent in South Africa, instead of which a species described as *Attheyella* occurs there, (*A. capensis* Ruhe and *warreni* Brady), the exact systematic position of which remains to be elucidated.

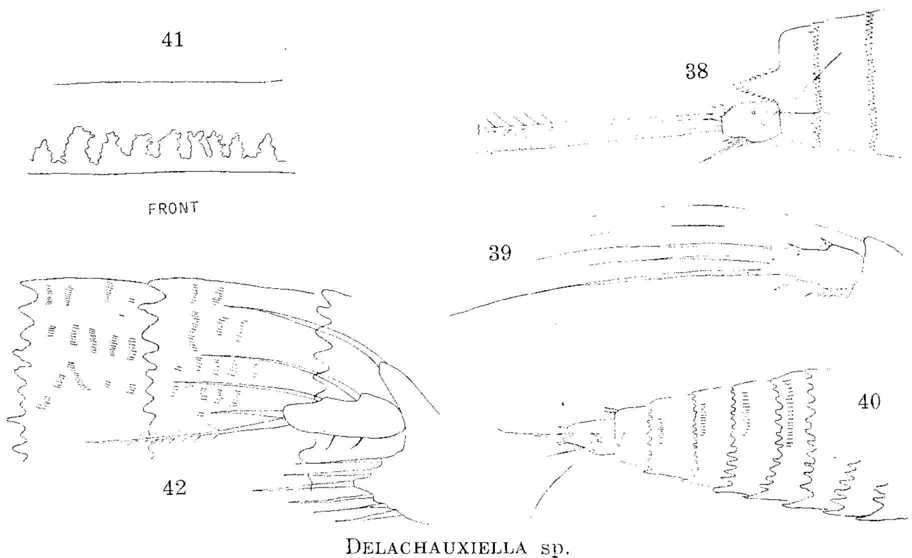
added two Tasmanian species and it can be expected that further such species will be discovered on the Australian Continent, at least in the south-eastern part adjacent to Tasmania.

Delachauxiella salvatoris n. sp. (Figures 40-45)

Female: 800 μ long. Posterior margins of the segments strongly serrated. The teeth are conspicuously large, particularly on the first cephalothoracic segment, the anterior rim of which resembles a wall provided with pinnacles. The margins of the teeth are frequently serrated themselves, exhibiting a corroded look. The number of teeth is 18-20 for each margin, it does not increase as we go forward, since with increasing width of the segments the size of the teeth and their interstices also increases (Figures 40, 41).

Towards the side the teeth grow smaller and above each row of teeth there is a row of short spines. On account of the large size of the median dorsal teeth the animal offers in the lateral view the picture of a scaled animal (*Manis*), cf. Fig. 40.

The operculum is triangular, but of varying aspect, the margin frequently slightly three-lobed, mostly very slightly ciliated, sometimes quite bald. Across its surface one or two rows of fine hairs are apt to run. The furca is about twice as long as it is wide, tapering towards its end and carrying a setose fan on the inner margin. The outer of the two large furcal setae is short (180 μ), the inner one long (700 μ). Figure 43 illustrates the other features of the furca, which are, for that matter,



DELACHAUXIELLA sp.

38. Terminal portion of body of ♀ dorsally
39. Terminal segment of fifth leg of ♀

DELACHAUXIELLA SALVATORIS n. sp.

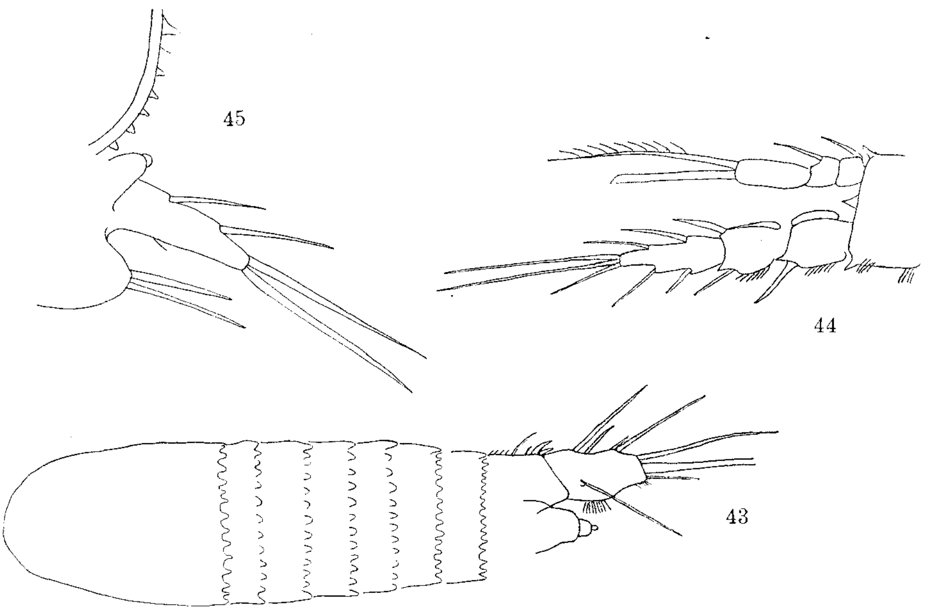
40. Posterior portion of body of ♀ laterally
41. Posterior margin of first cephalothoracic segment
42. Rudimentary leg and ornamentation of abdominal segments of ♀

somewhat variable. The coarse serration of the posterior margins of the thoracic segments as well as the look of the furca and the operculum made me suspect at first that I was confronting Henry's *Moraria longiseta*, which, as already stressed by Chappuis, has nothing to do with the genus *Moraria*. But the armature of the fifth leg alone shows that it is a different form. With Henry's form both basal and terminal segments bear five appendages each, whereas our form possesses six of them on the basal and only four on the terminal segment. The basal segment of the rudimentary leg has six appendages of almost equal size. The second segment is elongate, carries 4 appendages, of which two setae belong to the outer margin; terminally there is a seta of more than twice the length of this segment and beside it one shorter than the segment. No ornamentation on the surface of these two segments could be detected.

In the male the serration of the posterior margins of the segments is not so pronounced as in the female. The inner branch of the third leg bears at the end of the third segment besides a normal seta a pencil-like appendage, cut obliquely at its end. The rudimentary leg has two spines on its basal, and 4 appendages on the terminal segment, of which the two apical ones are almost equally long.

An attempt to include our form in the determination key of Chappuis results in the following arrangement:

9.	Furca reaching far beyond operculum	10
	Furca not reaching far beyond operculum	11
10.	Furca set with many spines	*insignis*
	Furca without spines	*salvatoris*



DELACHAUXIELLA SALVATORIS n. sp.

43. Dorsal view of ♂ 44. Third leg of ♂ 45. Fifth leg of ♂

Found at: Waverley Road, Launceston; Pools in bed of Jordan River; Big Lake Waterhouse.

Since this species was found on the selfsame day on which " Salvator " was tapped again for the first time on the Nockherberg in Munich, I named this new Harpacticoid *salvatoris,* gratefully commemorating precious hours spent there with Munich zoologists.

Delachauxiella incerta n. sp. (Figures 46-48)

Sample 28 (Lagoon of Islands) contained a specimen of a female *Delachauxiella,* unfortunately almost wholly enveloped in filamentous bacteria (*Thiothrix*?), distinguishable from the preceding species at first sight by the shape of the anal operculum. On account of the thick overgrowth with bacteria much—above all the armature of the first four legs— could not be determined with certainty. However, the few certain findings suffice for an adequate characterization. The thoracic and abdominal segments bear coarse teeth on the posterior margin dorsally; on the ventral side they exhibit instead of these one row of strong spines, which is interrupted in the middle with exception of the last row. The furcal branches are conspicuous by their shortness: they are wider than long. Of the two big terminal setae the outer one is very short and delicate. The dorsal seta could only be observed in the lateral position, on account of the disturbing overgrowth. Cf. fig. 47. The anal operculum is triangular with smooth concave lateral margins. The sharply tapering point reaches somewhat beyond the end of the furca. The rudimentary leg exhibits a habit characteristic of the genus: 6 appendages on the basal segment, 4 appendages on the second segment, of which the second from the inside is short and thin. The terminal segment possesses an ornamentation of spines on the surface.

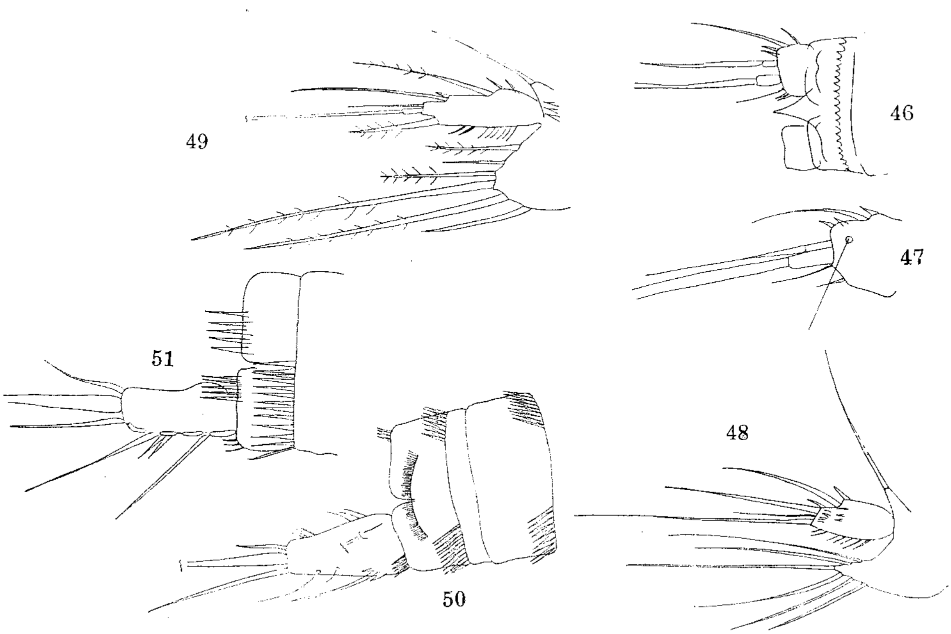
A link with the determination key designed by Chappuis could be established in the following way: The triangular operculum, the furca, not tapering terminally, the unarmed last abdominal segment would lead to number 8. Here we encounter, because of the curved lateral margins of the operculum, the species *maxima.* However, besides the difference in size between this form and ours there are so many differences, that even a remote relationship between the two is out of the question. In *maxima* the operculum is doubly curved, the furca longer than wide and differently armed, the small seta of the second segment of the fifth leg is spine-like, whereas in our form it is developed as a delicate seta and so on. Should, on account of the overgrowth of our specimen with bacteria, the armature of the last abdominal segment have remained unrecognized, we should have to go in Chappuis's table from 7 on to 11, which would take us to the Chilean species *hannae.* But our form has nothing to do with this one either, for *hannae* exhibits straight margins on the operculum, a longer furca, a more prolific surface armature of the fifth leg, to point out only a few differences. A comparison with the species mentioned would, for that matter, hardly be necessary, since they all belong to the fauna of South America, and so far not a single case has been known (the same applies to the Boeckellidae) where a species of the western sector of the circumantarctic region should at the same time be represented in the Australian fauna.

Chappuisiella australica (Sars)*. (Figures 49-55)

I should like to place in this species a Harpacticid from sample 17 (Big Lake Waterhouse), although I am not sure whether the male from the same sample, described further below, belongs at all to the female treated here. In order to decide on the classification into a genus the knowledge of the male is necessary, which alone makes possible the definite separation of the subgenera of *Attheyella*-like Harpacticid. If, based solely on the habit of the female, one decides for a classification to *Chappuisiella* the shape of the anal operculum plays an important part for with *Delachauxiella* this is almost always triangular. Moreover, since a far-reaching coincidence with the habit of the female of *Ch. australica* could be established, I decided not only to classify our form in the genus *Chapuisiella,* but also in the species *australica*. Should, however, the male described below belong to this female, this assumption would have to be revoked.

Female: 830-900 μ long without the furcal seta. Greenish yellow. The posterior margins of the abdominal segments bear on the ventral side a row of very long spines, which is not interrupted in the middle in the two

* Described in 1908 by G. O. Sars as *Attheyella australica* from Victoria.



DELACHAUXIELLA INCERTA n. sp.

46. Terminal portion of body of ♀
47. Lateral view of female furca
48. Fifth leg of ♀

CHAPPUISIELLA AUSTRALICA (Sars)

49. Fifth leg of ♀
50. Posterior portion of ♀
51. Posterior portion, seen ventrally ♀

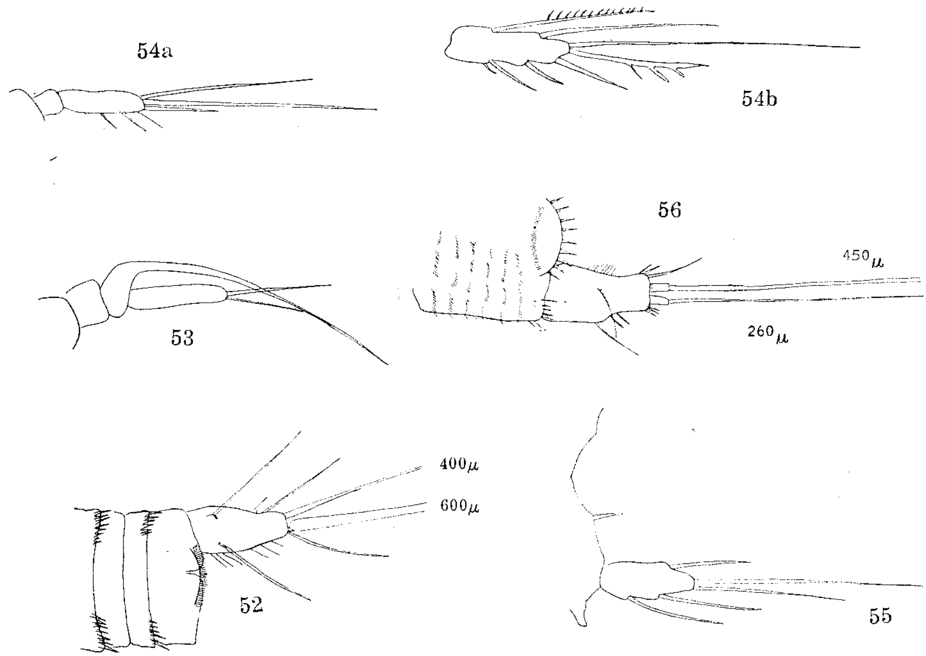
last segments, but exhibits an interruption in the middle of the preceding segments. The operculum is flat and arched and provided with a hairy fringe on the margin*. The furca is twice as long as wide, with a hairy border on the proximal inner margin. Concerning the other armature, cf. figure 50, where the broken-off dorsal seta is only marked.

The rudimentary leg has 6 appendages on the basal segment, of which the second from the outside is a short thin seta. The terminal segment has 5 appendages, two of which on the outer margin, 3 terminally. The inner margin bears but few hairs and spinules. The outermost terminal seta is short and delicate, more of a hair than a seta. No surface ornamentation was present.

One male, which doubtfully belongs to *Chappuisiella australica.*

As already mentioned, besides the just described female, there was a male, which was at first considered to be the corresponding male, on account of the operculum, which is curved and set with hairs on the margin, an assumption which is however, uncertain because of the fifth leg. This male was but 600 μ long. The spines on the lateral posterior margins of the segments are shorter than in the female. The furca is twice as long as wide; of the two large terminal setae the outer is 400, the inner 600 μ long.

* *A. australica* has an unarmed operculum!



52. Terminal portion of ♂
53. Third leg ♂
55. Fifth leg of ♂

54. Fourth leg of ♂
(*a*) endopod
(*b*) exopod

UNDETERMINED HARPACTICID from sample 21

56. Terminal portion of body of ♀

The beak-shaped outward curvature of the spur on the outer margin of the first segment of the exopod of the third pair of legs is conspicuous. The appendage of the second segment of the endopod of this leg bears no hook at its end. The terminal segment of this endopod bears two setae. The last segment of the exopod of the fourth leg is provided with two appendages. The terminal segment of the exopod of the fourth leg: beside a long, feather-like seta there is a spine, half its length, bearing three* lateral branches, standing off obliquely. This spine resembles very much the homologous formation in *Chappuisiella palustris* Chapp. from Chile, which again makes advisable the classification of this form in *Chappuisiella,* which is already warranted† by the close relationship between the South American and Australian fauna. True, one could object to the classification in the genus *Chappuisiella,* because our form exhibits but one‡ spine on the basal of the fifth leg of the male. This is surprising, for Chappuis in his work on these forms set up the alternative: spine basal or basal with at least two spines, whereby the Elaphoidellae are separated from the Attheyellae. This contrast, however, is mitigated by the fact that Chappuis himself mentions one form, which exhibits a basal with one spine, namely *Elaphoidella cliffordae.*

The second segment of the fifth leg of our form bears five seta-like appendages, of which two belong to the outer margin, one to the inner margin and two are situated terminally. With the small size and concealed way of life of the Harpacticoida, one has been always accustomed to reckon with single accidental findings, when freshwater material is investigated. It was therefore astonishing, when Delachaux described a host of new species from a few samples arising from two locations in Peru. This showed that the waters of the Andes are particularly prolific in Harpacticids, which was corroborated by later investigators.

Considering the far-reaching coincidence of the fauna conditions in the regions situated around Antarctica, it could be expected that in the ecologically similar portions of the Australian Region similar conditions would be encountered. Already my earlier published findings on the fauna of New Zealand demonstrate the justification of this assumption and the present material confirms it anew. For without specially searching after Harpacticoida, four species could be established, of which, however, two could not be identified with certainty.

To be sure, besides the two species described below, two other species were represented by one defective ♀ each, of which one certainly belongs to *Delachauxiella.* It exhibits strongly denticulate posterior margins of the segments and is conspicuous by the fact that the operculum, the tip of which reaches somewhat beyond the end of the furca, possesses deeply tasseled lateral margins. (Fig. 38). The sample came from Big Lake Waterhouse.

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* With *A. australica* there are four branches!

† Kiefer depicts a similar though perhaps more delicate, appendage with *Chappuisiella occulata* Kiefer (Zwei neue Ruderfusskrebse aus Sudamerica. *Zool. Anz.* Bd. 67, 1926).

‡ The missing second spine was not broken off, which was proved by an examination under highest magnication. It remains uncertain, whether it was an accidental variation, for there was but the one specimen.

The other animal certainly did not belong to *Delachauxiella.* Its arched operculum bore only a few long spines. The abdominal segments of the animal, (which is 600 μ long) bore a rich ornamentation in the form of rows of fine spinules. The furca was twice as long as wide and possessed two terminal setae, of which the outer one measured 260, the inner 450μ. Cf. fig. 56.

Cyclopidae.

Since Smith describes but two species of Cyclopidae from Tasmania and introduces both as new species, one might suspect that, although Tasmania is poor in Cyclopidae, it excels in a highly developed endemism of this group. However, both assumptions are incorrect. For, although our communications can only enumerate six species, it must be borne in mind, that besides these the present samples contained several stages of Cyclopidae, which certainly did not belong to the species mentioned here, the relationship of which, however, could not be determined. As for the endemisms, it should be noted that one of Smith's two species *albicans* was recognised by Kiefer as being identical with the species *Mesocyclops leuckarti,* whereas the other *dulvertonensis* is probably nothing else but *leuckarti* either, for in the plankton from Lake Dulverton, from which Smith described this form, nothing else could be found, than just *leuckarti.* Or else, the fauna of this lake must have suffered a change since Smith's time (as discussed more fully on page 39) and Smith's species might be discovered in Tasmania later. Of our species *leuckarti, albidus* and *phaleratus* are cosmopolitan, *crassicaudoides* seems to be confined to the Australian Region, but not to Tasmania, since it was discovered in New Zealand; and the two *Eucyclops* species will certainly still be discovered at least in south-eastern Australia.

Macrocyclops albidus Jur.* is rather frequent in samples 21, 25 and 23 (Cleveland Lagoon; Roadside pond, Tunbridge; pools in bed of Jordan River).

Mesocyclops leuckarti Claus.* Present in almost all samples of plankton, obviously the most frequent Cyclops of the island (cf. fig. 65).

Ectocyclops phaleratus Koch. With regard to the occurrence of very similar species in Africa it should be pointed out that the specimens from Tasmania exhibited a median spine on the endopod of the fourth leg, twice as long as the limb itself, that it is consequently the typical species which had also been reported from the Australian Continent. Occurred in sample 25 only (Pools in bed of Jordan River).

Diacyclops crassicaudoides Kief. was found only as a female, 850 μ long, the egg sacs of which contained 18 eggs each, in sample 19 (Waverley Road, Launceston). According to Kiefer, *D. crassicaudoides* is a fine example of the fact that even Cyclopidae can be used in zoogeography, when the picture of the geographical distribution, more veiled than elucidated by earlier investigations, is to some extent cleared.

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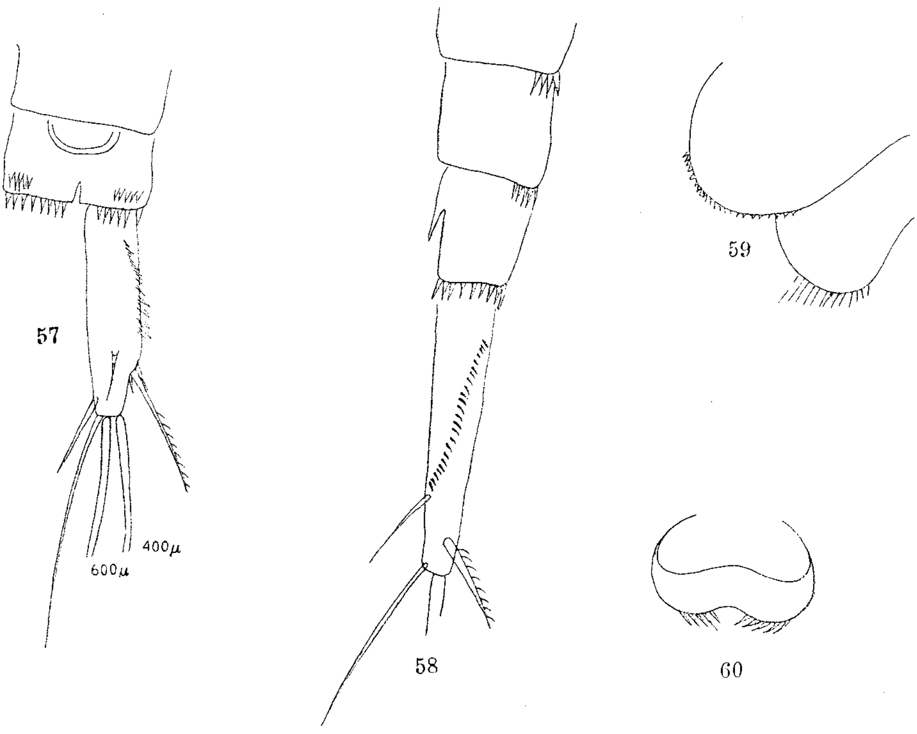
* The two species *albidus* and *leuckarti* seem to be the most frequent and most widely distributed Cyclops in Australia. For Lindberg, too, mentions in his description of *Eucyclops linderi*: " L'echantillon renfermait aussi, *Macrocyclops albidus* et *Mesocyclops leuckarti.*"

Eucyclops nichollsi n. sp. (Figures 57-64)

There were a few specimens of a *Eucyclops* of both sexes from Cleveland Lagoon and Big Lake Waterhouse as well as from pools in the bed of the Jordan River. These could not be identified with any of the known species and did not exhibit any closer relationship to the known species *Eucyclops linderi* from Australia.

Female: egg-bearing females—one egg sac contained about 20 eggs—reach a length of 1200μ. These were light yellow, the genital segment was coloured brown-orange. The terminal segment of the 12-segmented antennule bears a quite narrow, not toothed hyaline membrane. The posterior margins of the abdominal segments are without armature on the dorsal part, and on the ventral side they show a row of spines. The furca is about 4 to 5 times as long as wide, possesses a hairless inner margin and on the outer margin a saw, formed of long strong teeth, beginning at the uppermost fifth of the furca and ending in an obliquely running spiral at the last fifth of the furca. Since the teeth do not lie in a plane, they create the impression as though they increased considerably in size distally. The outer one of the two large terminal setae is 400 μ,



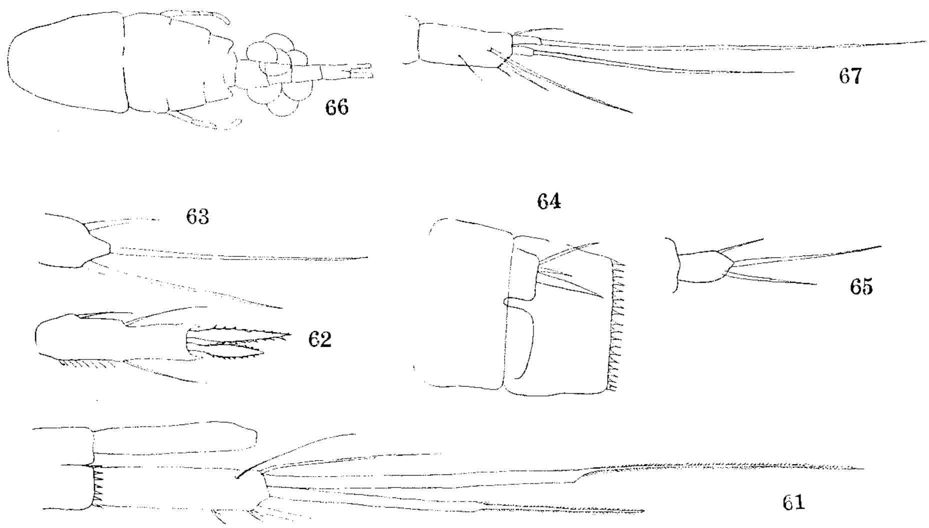
EUCYCLOPS NICHOLLSI n. sp.

57. Terminal portion of body of ♀
58. Furca of ♀ laterally
59. Terminal portion of thorax of ♀
60. Intermediate plate of fourth pair of legs

the inner one 600 μ long. The last thoracic segment is haired on the margin, the last but one exhibits on the margin a fine denticulation, visible only under high magnification. The receptaculum was not so clearly visible that its shape could be described. The intermediate plate of the fourth pair of legs exhibits at its inner part on either side five spines oriented obliquely inward. The inner spine of the terminal segment of the exopod of the fourth leg is one third longer than the outer spine. The rudimentary leg possesses a median spine, hardly wider than the adjacent seta*.

Male: Considerably smaller than the female, with a sawless furca. The spine of the outer margin of the furca is cylindrical and at the end abruptly pointed, like a pointed pencil. The two large terminal setae consist of two sharply separated portions. The basal portion is wide, cylindrical and smooth, about 2/3 of the length of the whole seta. The distal third consists of a much thinner seta, densely plumose. On the genital lappet there was innermost a spine of about the length of the segment, then a small seta about half that length and outermost again a seta. If one attempts to determine this form with the key designed by Kiefer in "Das Tierreich", the 12-segmented antennule with the sawless terminal section, the appendages of the fifth leg, the bare inner margins of the furca and the length of the saw of the furca lead to number 12. The species *semiserratus* and *speratus* which occur there are

* There was, however, one ♀, with which this spine was double the width of the seta.



EUCYCLOPS NICHOLLSI n. sp.

61. Posterior portion of body of ♂; dorsally
62. Terminal segment of endopod of 4th leg, ♂
63. Armature of terminal segment of 5th leg, ♂
64. Armature of male genital lappet

EUCYCLOPS MISER n. sp.

65. Rudimentary leg, terminal segment
66. Habit of ♀
67. Furcal branch, dorsally

out of the question on account of the length of the furca, and the latter also on account of the coarser serration of the saw. If our form were allocated to those species having a furca of medium length, the only possibility would be *van douwei* from Kameroon, which, however, differs in shape of the fourth and fifth legs.

Eucyclops speratus n. var. tasmanica

Sample 25 (pools in bed of Jordan River) contained some yellow females, 1200 μ long, with greyish-blue egg sacs which, on account of their numerous (about 50), extremely short teeth on the furca suggested their belonging to the species *speratus*. The terminal segment of the 12-segmented antennule bore a narrow, unserrated, hyaline membrane. The rudimentary leg entirely corresponds to the structure of the typical *serrulatus*. The length of the furcal branches was six times their width. The form differed from the typical *speratus* by the fact that in the latter the furcal saw extends only over half the length of the furca, whereas here (in our form) it was 5/6 of it. Whether there are further differences, remains undecided, because I had no comparison material of *speratus*. But since *speratus* so far has only been found in the Northern Hemisphere, the existence of such differences is likely and it is well justified to discriminate our form from the type as "*var. tasmanica*", if only with regard to the length of the furcal saw.

Eucyclops miser n. sp. (Figures 65-67)

Sample 21 from Cleveland Lagoon contained not infrequently a Cyclops, the egg-bearing females of which were but 600 μ long. I first believed it was a *Microcyclops,* just as Kiefer reports for the *Eucyclops indicus,* described by him. Then I suspected the latter, when I recognized a *Eucyclops* by its rudimentary leg.

But already the much longer antennules revealed that it was not identical with *indicus,* described from Himalaya. Then *Eucyclops linderi,* from Australia, occurred to me as an object for comparison. A description of our form should precede the comparison between the two mentioned species.

The picture of the habit of the ♀ (figure 66) shows a long, slender abdomen. The terminal thoracic segment bears no fringe of spines or hairs, as *Eucyclops* species frequently do.

The receptaculum was not recognizable. The 12-segmented antennule reaches beyond the end of the thorax. Its terminal segment is slightly curved inward. The egg sacs consist of but few big eggs, mostly four on each side. The furca is two and a half times as long as wide. Its armature is shown in figure 67. The median spine of the rudimentary leg is hardly thicker than the two setae of the leg.

If our form is compared with other species of *Eucyclops* those among the sawless species can be eliminated, which can be distinguished by their considerably longer furca. Those are, apart from the troglobiontic forms *graeteri* and *teras,* African throughout. A shorter furca is found in *indicus* and *linderi*. The first species, described from Himalaya, differs from ours already by its much shorter antennule. In the second species, too, the antennule is considerably shorter. The latter species is better suited for comparison, because it belongs to the Australian fauna. Besides, our form differs by the slenderness of the median spine of the fifth leg, by the ratio in the length of the most median and most lateral furcal setae and by the seta on the outer margin of the furca, which is inserted higher up.

♂ were not found. The ♀ were colourless.

On account of its small size the new species may be described as the " inconspicuous " *miser*.

Only *E. indicus* with its length of 500 μ is smaller than this.

A survey of this list demonstrates two conspicuous phenomena: (1) None of the Boeckellas found by Smith was found again—if we discard the possibility of an identity between *Boeckella lacuna* and Smith's *insignis*; apart from this questionable case all the Boeckellas collected by Nicholls were new for Tasmania. (2) The abundance of Calanoids in the island is surprising. This abundance can only be conceived if the Calanoida fauna of Tasmania is compared with that of a similar equally large territory on another Continent. Bohemia in Europe would be about the same size as Tasmania. Now whereas Bohemia (apart from the sporadic and transient occurrence of *Heterocope saliens*) is inhabited by only one single genus of Calanoids—*Diaptomus*—which is there represented by two* species *castor* and *vulgaris*, Tasmanian exhibits three genera with about a dozen species! Even if among these, as discussed with *Boeckella lacuna*, there should be synonyms, the number still remains surprisingly large, all the more as further investigations are likely to reveal in Tasmania other species, so far limited to and known from southern Australia. This abundance of species is, however, by no means a special case valid only for

Survey of the Tasmanian Copepoda known so far

	I	II	Occurrence outside Tasmania
Macrocyclops albidus Jur.	—	+	Cosmopolitan
Mesocyclops leuckarti Claus (= *albicans* Smith)	+	+	Cosmopolitan
Mesocyclops dulvertonensis Smith = *leuckarti?*	+	—	Cosmopolitan
Ectocyclops phaleratus Koch	—	+	Cosmopolitan
Diacyclops crassicaudoides Kief.	—	+	New Zealand
Eucyclops nichollsi n. sp.	—	+	—
Eucyclops speratus var. *tasmanica*	—	+	—
Delachauxiella salvatoris n. sp.	—	+	—
Delachauxiella incerta n. sp.	—	+	—
Chappuisiella australica (Sars)	—	+	Victoria
Gladioferens henryae n. sp.	—	+	The genus has so far been known from Australia and New Zealand. New for Tasmania
Brunella gibbosa n. sp.	—	+	—
Brunella tasmanica Smith	+	+	—
Brunella expansa Sars	—	+	Victoria
Boeckella robusta Sars	+	—	South Australia
Boeckella rubra Smith	+	—	—
Boeckella longisetosa Smith	+	—	—
Boeckella insignis Smith	+	—	—
Boeckella lacuna Fairbr. (= *insignis*?)	—	+	Western Australia
Boeckella pseudocheles Searle	—	+	Victoria
Boeckella denticornis n. sp.	—	+	related to *saycei* from South Australia

* A third species *denticornis* has recently become extinct.

Tasmania, but is connected with the great abundance of Calanoids in Australia at large, which is duplicated in Tasmania, as this island represents a piece of land, separated only in recent times from Australia, and offering suitable living places to numerous Calanoids through its hydrogeographical conditions.

APPENDIX

Among the material obtained from Dr. Nicholls there were also some samples from Western Australia. These, however, contained only two already known species, namely:

Boeckella pellucida Fairbr. from Kalgoorlie and from the same source the species described recently by Lindberg as *Cyclops restrictus* and recognized by the same author as synonymous with *Microcyclops sydneyensis*, which has been classified by Kiefer as *Microcyclops australis*. Lindberg's specimens, too, came from Kalgoorlie, whereas the earlier authors obtained theirs from the environments of Sydney.

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