Studies on the New Zealand Amphipodan Fauna
No. 4. The Family Gammaridae, Including a Revision of the Freshwater Genus *Phreatogammarus* Stebbing

By D. E Hurley,
Portobello Marine Biological Station, Port Chalmers.

[Read by title before Otago Branch on May 5, 1953, received by Editor, May 15, 1953.]

Summary

A checklist and keys are given for genera and species of the Family Gammaridae recorded from New Zealand. The species of *Elasmopus* and *Maera* are separated generically according to the character of the mandibular palp as proposed by Schellenberg. The species *Phreatogammarus francisii* (Chilton), *P. helmsii* Chilton and *P. propinquus* Chilton are redescribed and figured.

Introduction and Acknowledgments

Of the seven genera and fifteen species of this family recorded from New Zealand, some four species are freshwater (two of them subterranean) and the remaining eleven are marine. This paper revises and describes more adequately the freshwater genus *Phreatogammarus* and gives keys to the genera *Elasmopus* and *Maera*. The latter genera have still to be revised fully, but because of considerable systematic confusion all of the New Zealand species were examined and ascribed generically according to Schellenberg's mandibular palp criterion (Schellenberg, 1938, p. 38). This has necessitated some changes in nomenclature. There is still some confusion in these genera which must await fuller revision.

I am greatly indebted to the Canterbury University College Council and to Professor E. Percival for allowing me the use of the Chilton collection of material and literature. I am especially grateful to Professor L. R. Richardson, of Victoria University College, under whose supervision this work was carried out.

Family Gammaridae Leach.

Gammaridae Stebbing, 1906: 364.

"Body more or less slender, pleon segments 4–6 usually well defined Antennae generally rather slender and, as a rule, but little different in the two sexes; accessory flagellum of antenna 1, often greatly developed, may dwindle sometimes to a single joint or tubercle, or disappear entirely. Mouthparts normal. Upper lip with a rounded, entire or only slightly emarginate distal border; lower lip with inner lobes well developed, slightly indicated or absent. Mandible with dentate cutting edge and accessory plate, spine-row, molar and 3-jointed palp (only in one genus 2nd joint smaller than 1st). Maxilla 1 with inner and outer plate and 2-jointed palp (only exceptionally 1st joint as large as 2nd). Maxillipeds with inner and outer plates and palp well developed Gnathopods 1 and 2 generally rather powerful, rarely less than subchelate, seldom both weak; sometimes stronger and larger in male than in female. Peraeopods more or less

* This study is part of an investigation carried out at Victoria University College, Wellington, with the aid of a New Zealand University Research Fund Fellowship.

Transactions of the Royal Society of New Zealand
Vol. 81, Part 4, pp. 601–618, 4 Text-figs, March, 1954
slender, sometimes stout, sometimes 2nd segment in peraeopods 3–5 little expanded. Pleopods lose only by exception one ramus and uropod 3 one or both of the rami. Uropod 3, rami more or less foliaceous, projecting beyond uropods 1 and 2; uropod 3 and telson never hooked. Telson either with entire margin or eleft to the base, sometimes strikingly different in the two sexes.” (Stebbing.)

In constructing keys for this family, my suspicion that the New Zealand representatives need considerable revision was amply confirmed. However, most of the species are readily identifiable with the aid of Chilton’s and Stephensen’s papers.

**Key to New Zealand Genera of Gammaridae**

(Adapted from Stebbing, 1906).

1. Pleopods with single ramus  
   Pleopods with two rami  
   **Paracrangonyx**
   2

2. Telson entire  
   Telson cleft  
   **Parapherusa**
   3

3. Uropod 3, rami very unequal  
   Uropod 3, rami not very unequal  
   **Melita**
   4

4. Body with dorsal groups of spinules on pleon. Freshwater  
   Body without dorsal groups of spinules on pleon. Marine  
   **Phreatogammarus**
   5

5. Maxilla 1 and 2, inner plates very setose  
   Maxilla 1 and 2, inner plates not very setose  
   **Ceradocus**
   6

6. Mandible with slender palp, 3rd segment straight, tipped only with a few setae  
   Mandible, 3rd segment of palp usually falcate, and pectinate with spinules  
   **Maera**
   7
   **Elasmopus**

**Checklist of Species**

The following list of species does not claim to be definitive, but in the absence of full revision it gives some clue to the tortuous synonymies and the more important literature.

**Phreatogammarus fragilis** (Chilton), 1882. See below.

**Phreatogammarus helmsii** Chilton, 1918. See below.

**Phreatogammarus propinquus** Chilton, 1907. See below.

**Ceradocus (Denticeradocus) chiltoni** Sheard, 1939. Chilton, 1883, as **Maera spinosa**; 1916 as **C. rubromaculatus**. See also Pirlot, 1936 (fide Schellenberg, 1938). Two New Zealand species have been confused under **C. rubromaculatus**. The second is recorded from Australia by Chilton (1884) as **Moera festiva** and from New Zealand (1916) as **Melita festiva**. Stephensen, 1945, refers this to **C. rubromaculatus** Stimpson, but the figures given by Sheard, 1939, for the latter are at obvious variance with Chilton’s given under **Melita festiva** in 1916. That there are two species is beyond question; what the generic and specific names of the second should be is still in some doubt.

**Paracrangonyx compactus** (Chilton), 1882. As **Crangonyx compactus**; also Chilton, 1894. Chilton, 1909a, as **P. compactus**.

**Parapherusa crassipes** (Haswell), 1880. Chilton, 1883, as **Harmonia crassipes**. Chilton, 1916a; Stephensen, 1949.

**Melita gayi** (Nicolet), 1849. Thomson, 1880, 1880a, as **Melita tenuicornis**; Chilton, 1909, as **Melita inaequistyli**; Schellenberg, 1931 and Stephensen, 1945, as **M. gayi**.
Maera viridis Haswell, 1880. Chilton, 1883, as Moera incerta; Chilton, 1916, as Maera viridis; Stephensen, 1927, as Elasmopus viridis. See also Schellenberg, 1938.

Maera carnleyi (Stephensen), 1927 As Elasmopus carnleyi in Schellenberg, 1938.

Maera subcarinata (Haswell), 1880. Thomson, 1882, as Moera petriei; Stebbing, 1888, as Elasmopus subcarinata; Chilton, 1915, as E. subcarinatus; Schellenberg, 1938, as Maera subcarinatus.


**KEY TO SPECIES OF Elasmopus**

1. Urosome 1st segment with single dorsal carina; 3rd pleon segment acutely produced posterodistally
   Urosome 1st segment dorsally smooth; 3rd pleon segment posterodistally rectangular, not produced
   
   **E. neglectus**

   **E. bollonsi**

2. Uropod 3, reaching some distance past uropods 1 and 2
   Uropod 3, not reaching very far past uropods 1 and 2
   
   **M. subcarinata**

3. Sideplate 1, front corner produced; acute; 3rd epimeral plate, posterior margin smooth, inferior margin smooth or obscurely serrate posteriorly; posterodistal angle acute and slightly produced
   Sideplate 1, front corner produced to rounded lobe; 3rd epimeral plate, lower portion of posterior margin serrate, inferior margin with 2 setae but not serrate
   
   **M. inaequipes**

   **M. mastersii**

4. Peraeopods 3-5, meorus and carpus extremely broad
   Peraeopods 3-5, meorus and carpus not extremely broad
   
   **M. carnleyi**

   **M. viridis**

Both Stebbing (1906) and Barnard (1940), in keys to this last genus, separate *M. inaequipes* from *M. mastersii* by an early dichotomy which credits *M. inaequipes* with “uropod 3, scarcely or not at all extending beyond uropod 1,” a fact which is at obvious variance with Chilton’s figures for the New Zealand specimens and suggests that Chilton was not dealing with *M. inaequipes* at all but another species. This will have to await detailed investigation. For the meantime, the above key will separate out specimens described from New Zealand as *M. inaequipes* by Chilton.

On the basis of Schellenberg’s distinction between Elasmopus and Maera (Schellenberg, 1938, p. 38) I have examined type slides and specimens of *Maera mastersii*, *M. inaequistas* and *M. viridis*. All have the mandible palp slender and setose as in *Maera*, not pectinate as in *Elasmopus*. This justifies Chilton’s belief that *viridis* belongs in *Maera*. On the same basis, as Schellenberg points out, *Elasmopus carnleyi* and *E. subcarinatus* should be considered as species of *Maera*. *Elasmopus bollonsi* and *E. neglectus* have stout pectinate 3rd segments to the mandibular palp and are rightly placed in *Elasmopus*. 
Genus Phreatogammarus Stebbing

Stebbing, 1899 (sp. type P. fragilis), p. 427.
Chilton, 1918, p. 83.

"Near to Gammarus. First joint of mandibular palp not very short. First and second pereaeopods shorter than third, fifth the longest. Third uropod long, with two one-jointed cylindrical rami."

(Chilton, 1918.)

N.B.—My reprint copy contains a rubber-stamped correction to this generic definition, the phrase "with second one-jointed cylindrical rami" being corrected as above.

KEY TO SPECIES OF Phreatogammarus

1. Lacking eyes; pereaeopods greatly attenuated; dactylos of p1 3–5 with short terminal nail and row of about 6 small spines preceding nail; mandibular palp, 1st, 2nd and 3rd segments
   strongly setose
   
   Eyes present; pereaeopods normal, p1 3–5 dactylos with only small single spine on inner margin; mandibular palp, 2nd segment with several setae distally, 3rd with inner margin distally pectinate
   
   P. fragilis
   
   2

2. Pereaeopod 2, male, dactylos bidentate, p1 3–5, basos long, distally narrow, proximally lobed; Gn 1 and 2 similar
   
   Pereaeopod 2, male, dactylos simple; pr 3–5, basos ovate, not greatly narrowed distally; Gn 1 broadest distally. Gn 2, broadest proximally
   
   P. helmsii

P. propinquus

Since this genus was first erected, the number of species has been increased from one to three, with a consequent whittling down of the generic description (cf. Chilton, 1918). The time is perhaps opportune to raise the question of whether the genus should still stand. I ask this, not because of any marked similarity to any other one genus of the family, but rather the possible similarity to a wide number of the many European genera from freshwater and subterranean regions. In view of the number of these species, the generic definition of Phreatogammarus seems remarkably indefinite. There is, no doubt, considerable advantage to be gained from keeping a small endemic group such as this as a separate identity from similar groups elsewhere, but there are also disadvantages. The original species, Phreatogammarus fragilis, was no doubt well isolated from the species of other genera, but the two later described species have considerably reduced that isolation. It would be useful to have the comments of a person well acquainted with the European genera of Gammaridae and their very extensive and, in this part of the world, often inaccessible literature on the present validity of the genus. Nevertheless, it should be emphasised that the three species, as a unit of the New Zealand fauna, stand quite separate from the other New Zealand genera of Gammaridae.

The species are quite easily separated amongst themselves. Apart from those features used in the above key, P. fragilis differs in the shape of the gnathopods, the marked urosome spination as compared with P. propinquus; the maxilliped, which shows some differences from P. helmsii; the uropods, which differ from P. helmsii (and probably from P. propinquus); and the length of the 5th pereaeopod. P. helmsii shows the peculiar bidentate form of the 2nd pereaeopod (but only in the male); and the gnathopods are very distinctive. The accessory flagellum of P. propinquus with 4 segments is intermediate in length between P. helmsii (with 2 segments) and P. fragilis (with about 8). P. helmsii shows a proximal lobe-formation of the basos posterior surface in pereaeopods 3–5 which
is not obvious in the other species. The second gnathopod sideplate differs from *P. fragilis*. *P. propinquus* material is not sufficiently complete to allow full comparison, but differences from the other two species in the 1st and 2nd gnathopods are quite easily seen from the figures.

**Phreatogammarus fragilis** (Chilton), 1882. (Figs. 1–34.)

*Gammarus fragilis* Chilton, 1882. 179; pl. 9, figs. 11–18. Chilton, 1894. 227; pl. 21, figs. 1–25.

*Phreatogammarus fragilis* (Chilton) Stebbing, 1906 454 Chilton, 1909a 56.

Chilton, 1918: 83–84.

Colour in spirit, white. Eyes absent. Pleon segments with fine bristles sparsely along dorsum; each urosome segment with 6 or so strong spines dorsally on posterior margin. Length, 13½ mm.; depth, 3 mm.; width, 2⅓ mm.

**Antennae. First:** Length, 11 mm., reaching 3rd peraeon segment. Flagellum much longer than peduncle, of about 60 segments, proximal ones wider than long, distally vice versa, distal margins bristled; accessory flagellum 8-segmented. Peduncle, 1st segment distally and inferiorly spined and setose, length more than 3 times width; 2nd narrower, shorter, width ⅓ length, tufts of 3 or 4 setae distally, on margins and surface, inferior tufts with one or two spines; 3rd distally setose, length twice width, a little more than ⅓ length 2nd. **Second:** Length about 7 mm., reaching ⅓ along antena 1 flagellum; flagellum about 35-segmented, not much longer than peduncle. Peduncle, 2nd segment wider than long, glandcone produced ⅔ along 3rd; 3rd subsquare, inferodistal angle spinose and setose; 4th narrower, width less than ⅓ length, length more than 4 times 3rd; tufts of strong setae and, especially superiorly, spines on margins; 5th slightly shorter, narrower, strong tufts of 2 to 8 strong setae on margins and surface.

**Mouthparts. Lower Lip:** Outer lobes strongly bristled. **First Maxillae:** Inner plate ovate, distally rounded, outer margin straight, inner convex, fringed by about 20 plumose setae; ⅔ length outer plate, which is squarish, has 9 strong toothed distal spines. Palp longer than outer plate; 1st segment small, subsquare; 2nd as wide, 4 times as long, distally rounded, 8 stout spines distally, a strong single seta below outermost. **Second Maxillae:** Subequal plates distally rounded with strong distal setae; inner has strong fringe of setae along inner margin distally arcing a little across surface, single plumose seta near outer margin at ⅓; inner surfaces finely bristled proximally. **Mandibles:** Palp, 1st segment width ⅗ greatest length, several strong setae on inner distal angle; 2nd ⅔ as long again as 1st; inner margin, distal ⅓ fringed with long strong setae; 3rd with margins slightly convex, distally rounded, ⅔ length 2nd, inner margin distal ⅔ fringed with short strong plumose setae, several very long fine setae on end, about 10 very long setae singly and paired on surface mediately. **Right:** Cutting edge, upper plate of 4 teeth, lower butterfly-shaped with lateral edges of wings finely incised; spine row of 6 strong, scabrous spines; molar process finely spined and granulose, at outer proximal angle a long strong plumose seta, between molar process and spine row a tuft of very fine plumose setae. **Left:** Upper plate of 5 teeth, lower of 4; spine row of 7 strong spines with smaller interspersed fine plumose setae; molar process distally and proximally has comparatively long plumose setae developed from process margins. **Maxillipeds:** Inner plate short, distally convex, reaching end of merus; outer margin slightly convex, 5 short strong spines distally, surrounded and masked by long plumose
TEXT-FIG. 1.—Phreatogammarus fragilis (Chilton). Female 1—Adult. 2—Antenna 1. 3—Lower lip. 4—Right mandible. 5—Right mandible, cutting edge and spine-row. 6—Left mandible, cutting edge and spine-row. 7—Mandible, palp, 3rd segment inner margin. 8—Maxilla 1. 9—Maxilla 2. 10—Maxilliped, right side. 11—Peraeopod 1 dactylos. 12—Peraeopod 2 sideplate. 13—Peraeopod 5. 14—Peraeopod 5. 15—Peraeopod 5 dactylos. 16—Peraeopod 5 sideplate. 17—Urosole in side view. 18—Telson.
setae reaching $\frac{1}{4}$ down inner margin, a few surface setae. Outer plate reaching $\frac{1}{4}$ along carpus, distally rounded, convex outer margin has 4 or 5 plumose long setae distally, row of about 19 short stout spines on straight inner margin, a few setae below and alongside them. Basos has several long fine surface setae, inner $\frac{1}{4}$ of distal margin has numerous long fine setae; ischiun similar; merus has a few short setae on inner distal angle; inner merus margin as long as ischiun, $\frac{3}{4}$ length merus outer margin, distal margin oblique. Carpus width $\frac{2}{3}$ length carpus, has 2 inner margins, face between them concave, each strongly fringed with setae, inner face has 2 long setae on convex outer margin at $\frac{2}{3}$; long setae on outer distal angle; outer face inner surface is strongly setose. Dactylos strong, $\frac{3}{4}$ propod length, strong terminal nail, inner margin and nail base with several fine setae.

**Gnathopods** First: Sideplate subsquare, tending to trapezoid; angles rounded except sharp posterodistal one, which has 2 small spines; ventral has several fine setae; posterior straight Basos stout, proximally constricted, width nearly $\frac{1}{4}$ length, several very long fine setae $\frac{1}{4}$ down posterior margin; a few shorter setae on anterodistal angle, transverse series of long setae on posterodistal angle. Ischiun subtriangular, posterior margin slightly longer than width and $\frac{3}{4}$ basos length; very strong fringe of setae on posterodistal angle. Merus as long, posterior margin slightly convex, distal concave medially with strong fringe of long setae. Carpus subtriangular, length $\frac{1}{3}$ basos, greatest width $\frac{3}{4}$ basos length, anterior margin convex, several strong setae on anterodistal angle, 1 or 2 on surface, posterior free margin produced as small lobe between propod and merus; lobe and distal margin with strong fringe of long setae. Propod ovate, anterior margin barely convex, posterior strongly so distally; length $\frac{1}{2}$ more than basos, greatest width proximally $\frac{1}{2}$ basos length; anterior margin has 1 or 2 pairs of small setae, anterior surface has (including distal angle) 6 slightly oblique rows of 2 to 10 long setae; posterior margin has about 6 ranks of long setae proximally, inside these 4 strong spines, remaining $\frac{1}{2}$ of margin has double row of short stout seta-tipped spines, in all about 40, this region corresponding to palm; a few very short scattered surface setae. Strongly curved dactylos as long as basos, reaching $\frac{1}{3}$ along propod posterior margin, inner margin toothed throughout, about 8 surface groups of 2 or 3 fine setae. **Second:** Sideplate as wide as deep; lateral margins straight, rounding regularly to convex ventral margin, ventral and posterior with fine setae. Other segments as in Gn. 1, except: Basos length 3 times width, anterior margin has long fine setae regularly along anterior margin; posterior has very long setae in irregular groups of 2 or 3 proximally, 3 ranks of short setae distally. Ischiun nearly $\frac{1}{2}$ basos length, merus not greatly widening distally, length $\frac{1}{2}$ basos, anterodistal angle produced as small, blunt boss. Carpus greatest width $\frac{1}{4}$ basos length, barely shorter than basos. Propod greatest width $\frac{1}{4}$ to $\frac{1}{3}$ basos length, slightly longer than basos, posterior margin convex proximally and distally, slightly concave where dactylos impinges on palm between $\frac{1}{4}$ and $\frac{1}{2}$ along. Dactylos $\frac{4}{5}$ basos length.

**Peraeopods** First: Sideplate subrectangular, deeper than wide, distal angles rounded, a few setae distally on lateral margins, setae centrally. Gills ovate, reaching $\frac{1}{2}$ along basos, subrectangular broodplate as long as basos, nearly as wide.
Basos width less than \( \frac{1}{2} \) length. Margins with long setae proximally, distal \( \frac{3}{4} \) marginally spined, spines anteriorly slightly the larger. Ischium small, about \( \frac{3}{4} \) basos length, setae posterodistally. Mersus \( \frac{3}{4} \) basos length, width \( \frac{1}{4} \) length, anterior margin has 4 groups of a few fine setae and usually a single strong spine to each group; posterior has 4 tufts of several fine setae. Carpus width \( \frac{1}{4} \) length, length \( \frac{3}{2} \) merus; anterior margin has small tuft of setae at \( \frac{3}{4} \), similar tuft on angle; posterior has \( \frac{3}{2} \) small tufts of setae, distal 2 have small spine each. Propod width \( \frac{1}{2} \) length, as long as merus; anterior margin has 3 small setae tufts; posterior has 4 groups of 3 or so short strong spines. Daeytlos stout, about \( \frac{3}{2} \) propod length, proximal \( \frac{1}{2} \) linear, posterior margin then interrupted by 2 small spines, then narrowing sharply to small curved nail. Second: Sideplate wider than deep; angles rounded, ventral margin and angles setose, posterior margin deeply concave proximally so sideplate excavate, otherwise like Pr 1. Third: Broodplate small. There appear to be two gills to each of Pr. 3, 4, 5; a narrow anterior and wide ovate posterior one. Sideplate, anterior lobe slightly the larger and deeper; posterior margin of posterior has 3 strong spines; anterior lobe has several setae ventrally. Basos ovate, narrowing distally, greatest width \( \frac{1}{4} \) length; slightly convex anterior margin has about 9 groups of setae each with single spine; posterior has numerous single setae. Shorter than but otherwise like Pr. 4, 5. Fourth: Sideplate anterior lobe deeper and much narrower than posterior, ventral margin no more than rounded angle; anterior margin has 4 spines proximally and a few single setae, posterior lobe, ventral margin rounding to posterior which has 3 stout spines. Basos posterior margin has small spines replacing setae of Pr. 3; otherwise like Pr 5, but shorter. Fifth: Sideplate anterior lobe the larger, ovate, 2 spines on anterior and 3 on posterior margin; posterior lobe small, subrectangular, posterior margin has 3 stout spines. Basos ovate, narrowing distally, length more than twice greatest width; anterior margin has about 8 single spines. Sometimes 1 or 2 fine setae with spines; anterodistal angle, like ischium, has tuft of several setae; posterior margin serrate, about 14 single spines. Ischium \( \frac{1}{4} \) basos length, subsquare. Mersus width less than \( \frac{3}{4} \) length, length \( \frac{3}{2} \) basos, anterior margin has 4 groups of a few setae plus a strong spine; posterior has 4 groups of 2 spines, some setae, margins indented by spine insertions, distal margin has spine and setae. Propod much the longest segment, slightly narrower than carpus, basos length \( \frac{3}{4} \) that of propod; propod basically linear, but margins indented by spine groups; anterior margin has 6 groups and posterior 7, each of 3 or more stout spines and setae. Daeytlos \( \frac{1}{4} \) propod length, linear most of length, distally narrowing to short curved nail, row of 6 small fine spines on anterior margin preceding nail.

Epimeral Plates. Subrectangular, angles rounded, margins slightly convex. First: Posterior margin with 4 strong spines, slightly convex, ventral margin straight. Second: As wide as deep, anterior margin straight, others slightly convex, ventral has 3 strong spines anteriorly set in their length from margin, posterior has 9 or 10. Third: Wider than deep, 4 spines ventrally, 9 or 10 posteriorly.

Pleonods. Rami longer than peduncles, inner the longer, peduncle may have 1 or 2 spines or setae marginally and on inner distal angle, 2 or 3 strong coupling spines; rami have 16 to 22 plumose segments, shorter outer ramus usually has the more segments.
UROPODS. **First**: Rami shorter than peduncle, outer slightly the longer, has 4 spines on inner dorsal margin, 2 on outer, 4 at end; inner has 5 spines on inner distal margin, 2 on outer, 1 small and 3 very strong spines on end. Peduncle inner dorsal margin has 4 slender spines, outer has 7 small stout ones, both upper distal angles have a long very stout spine projecting outside corresponding ramus. **Second**: Peduncle barely longer than subequal rami; 4 or 5 spines on dorsal margins, on inner one distally. Inner ramus has 2 spines on outer dorsal margin, about 12 on inner; 2 or 3 strong and 1 small end spines. Outer ramus has 2 spines on outer dorsal margin, 4 to 6 on inner—these may be single, paired or tripled; 1 strong and 4 smaller spines on end. **Third**: Much longer than 1st; both longer than 2nd. Rami longer than peduncle, peduncle dorsal margins each with 4 or 5 spines; rami have terminal cirelets of 7 to 9 stout spines; outer ramus has 4 groups of 3 to 5 spines on spine-Indented outer margin; inner margin has 6 single spines, 1 or 2 long, slender plumose setae beside each; inner ramus has 5 single spines on outer margin each with 2 or 3 long plumose setae, 6 groups of single or paired spines on inner, 1 to 4 long fine plumose setae to each group. **Telson**: Two ovate lobes tending to subsquare; each lobe has 9 to 11 strong setatipped spines on distal margin and surface.

**LOCALITIES.** West Eyteton; Leeston, Winchester and Ashburton in Canterbury, New Zealand, in wells; Selwyn River, where crossed by Christchurch-Southbridge railway line, coll. B. Wisely, 18/11/51.

**TYPOTYPE.** Slides C.37.

**DISCUSSION**

This species is taken in wells in the Canterbury region. The specimen I have figured and described is from a 40-foot well, West Eyteton (the type locality), and is from the Chilton collection but taken some 39 years later than the type (May, 1921). None of Chilton’s material seems to contain adult males or even recognisable juvenile males.

I recently received specimens from Mr. Baughan Wisely collected ‘where the Selwyn River crosses under the Christchurch-Southbridge railway line. At this point, which is readily accessible by road, the shingle is rounded and covered with a fine coating of algae; these specimens were found buried in this shingle down to a depth of 6 inches’

This is the first record, then, from a stretch of open water; Chilton’s earlier records from such localities were later proved to have been *P. helmsii* or *P. propinquus*. I understand, however, that the Selwyn River passes underground, at least partially, in various places, and this may account for the occurrence of *P. fragilis* in open reaches. The specimens are typical of *P. fragilis* in having the eyes entirely absent.

**Phreatogammarus propinquus** Chilton, 1907. (Figs. 35–41.)

- Chilton, 1907: 388, pl xi, figs 1-6
- Chilton, 1909a. 56 (in part).
- Chilton, 1918: 84, figs 2-4.

**Length, 5 mm.** Urosome segments with only 1 or 2 long slender setae dorsally.

**ANTENNAE.** **First**: Longer than second; accessory flagellum of 4 segments. Peduncle, 3rd segment 1/4 length 2nd, narrower; 2nd 3/4 length 1st; each has a few setae distally. Flagellum about twice peduncle length, of about 20 segments, all longer than wide and with a few long bristles distally. **Second** Flagellum
11-segmented, reaching at least 3⁄4 along 1st antenna flagellum; segments as above. Peduncle, 5th segment slightly shorter than 4th; 2nd as long as 3rd, 3⁄4 length 4th; gland-cone prominent; bristles on margins of all segments.

MOUTHPARTS. Not dissected out and mostly obscured; only mandibular palp clear enough to figure. First segment small, a single (?) strong seta on distal margin; 2nd, inner margin convex, about 5 long strong setae on distal 3⁄4, more than twice length 1st, width 1⁄3 length; 3rd 3⁄4 length 2nd; distally truncate; oblique truncate portion has 10 to 11 setae, end 3 or 4 long, remainder short.

GNATHOPODS. First: Sideplates not dissected. Basos widening distally, greatest width 3⁄5 length; long setae on margins especially posterior. Ischium 2⁄3 basos length; strong fringe of long setae posterodistally. Merus subrectangular, width slightly less than length, length 1⁄4 basos; posterodistal angle rounded, distal margin fringed with long setae. Carpus with nearly 1⁄3 length; length 1⁄4 basos; convex anterior margin has 2 long single setae, about 3 at distal angle; posterior margin more or less straight, mostly fringed with long setae. Propod subtriangular, distal width slightly less than greatest length; length 1⁄2 basos; slightly convex anterior margin has about 2 pairs of long setae, a strong tuft on distal angle; posterior margin more or less straight, naked; transverse palm at right angles with posterior margin, but posterodistal angle rounded; palm has several long setae, about 5 short seta-tipped spines; row of 4 short setae posteriorly. Strong dactylos as long as palm, inner margin has a few bristles, 4 or 5 very oblique teeth. Second: Sideplate deeper than wide, lateral margins straight, rounding to convex ventral margin, a few long fine setae ventrally and posteriorly. Basos widening slightly distally, width 1⁄4 length, long setae on margins. Ischium 1⁄3 basos length, about 3 long setae on posterodistal angle. Merus subrectangular, slightly longer than wide, slightly shorter than ischium, long setae on end margin. Carpus subtriangular, greatest width slightly more than length, length 2⁄3 basos; anterodistal margin slightly convex, sharp angle has 1 or 2 long setae; posterior free margin small, produced between merus and propod as small, rounded, strongly-setose lobe; setae on end margin. Propod subtriangular, almost basos length, greatest width proximally, 3⁄4 length; margins strongly convex proximally, straight for rest of length; anterodistal angle has tuft of long setae; a few setae anteriorly; posterior margin rounded proximal 1⁄2 has 3 ranks of numerous long setae; palm defined only by presence of about 14 palmar spines singly or in pairs on remaining 3⁄4 of margin, each spine has strong terminal seta; proximal 5 spines the strongest; long fine setae scattered on margin. Curved dactylos 3⁄4 propod length, a few fine surface setae, 8 or 9 very oblique teeth on inner margin.

PERAEOPADS. First: Sideplate not easily distinguished. Basos constricted proximally, width 1⁄4 length, both margins setose. Ischium subsquare, about 1⁄4 basos length, 2 or 3 setae posterodistally. Merus anterior margin slightly convex, has 3 strong single spines; width 1⁄4 length, length 3⁄4 basos, posterior margin has about 4 pairs of long setae. Carpus width 1⁄4 length, length 1⁄2 basos; seta or 2 anterodistally, posterior margin has 2 long single spines, a few setae. Propod nearly 3⁄4 basos length, width less than 3⁄4 length; posterior margin has 3 or 4 small spines. Strong dactylos 3⁄4 propod length, a single seta posteriorly. Fourth. Basos ovate, width 3⁄5 length, margins slightly convex, anterior has about 7 groups of 1 or 2 spines or setae; posterior has about 8 single fine setae. Ischium less than 3⁄4 basos length, spine and seta on anterodistal angle. Merus narrowing a little
TEXT-FIG. 3.—*Phreatogammarus propinquus* Chilton. Female. 39—Antenna 1. 40—Gnathopod 1. 41—Gnathopod 2. *Phreatogammarus helusi* Chilton. 42—Left mandible, spine-row and cutting edge. 43—Mandibular palp. 44—Gnathopod 1, male. 45—Gnathopod 2, male. 46—Gnathopod 2, sideplate ventral margin. 47—Pereopod 1, male. propod and dactylos. 48—Pereopod 1, female. 49—Pereopod 1, female. dactylos. 50—Pereopod 2 sideplate. 51—Pereopod 3 basos. 52—Pereopod 5 basos.
proximally, width \( \frac{2}{3} \) length, length \( \frac{1}{3} \) basos, both margins have 2 single spines. Anterodistal angle has 2 spines, posterodistal has 1, a few setae beside spines. Carpus width less than \( \frac{1}{3} \) length, barely shorter than merus, margins with groups of 2 or 3 spines medially; distal angles with spine and a few setae. Propod \( \frac{2}{3} \) basos length; width about \( \frac{1}{2} \) length; linear; both margins with 2 groups of 2 or 3 long spines, distal margin has several very long spines. Stout slightly-curved dactylos \( \frac{2}{3} \) propod length.

Urosome First segment with a strong single spine ventrally just anterior to 1st uropod insertion

Uropods. Second reaching no farther than 1st; 1st, peduncle longer than rami, 4 spines on outer dorsal margin, very strong spine at outer distal angle; 2nd, rami and peduncle subequal; rami of both appear to have 1 spine or possibly 2 in middle of ramus; several strong end spines; peduncle has 1 or 2 spines on outer dorsal margin. Telson Long fine spines on end.

Locality Mount Anglem, Stewart Island, New Zealand.

Discussion

Only one specimen of this species has so far been found, a female from “a small pool near the top of Mount Anglem, 2800 feet above sea-level, Stewart Island, N.Z. (J. Crosby Smith)”. This specimen, with one or two of the appendages dissected off, is mounted in Chilton’s slide collection. I had hoped to expand his description further and to make further comparisons with the other two species of Phreatogammarus, but short of remounting the specimen, a course I am loath to take, this does not seem possible. I have been able to make one or two additions to the description, but there are other features which Chilton figured and I am unable to—e.g., the third uropods. The only one visible on the slide is rather hopelessly mixed up with the peraeopods.

It is not possible to make out with any certainty the absence or presence of eyes. One of the broodplates is quite obvious, making it fairly certain this is a female

Phreatogammarus helmsii Chilton, 1918 (Figs 42–65.)

Phreatogammarus propinquus Chilton, 1909a: 56 (in part).
Phreatogammarus helmsii Chilton, 1918: 85-86, fig. 5-10

Length (Q. Charlotte specimen) \( \frac{4}{5} \) mm, depth, 1 mm.; width, 1 mm. Eyes black, small, reniform.

Antennae. First Length, 2 mm. Like P. fragilis but proportions slightly different, shorter; flagellum of about 24 segments; accessory of 2. Peduncle, 3rd segment slender, \( \frac{1}{2} \) length 2nd; \( \frac{1}{2} \) length 1st; width of 1st about \( \frac{2}{3} \) length. Second: Length 1\( \frac{1}{2} \) mm. Flagellum of 13 segments, like P. fragilis but peduncle less strongly bristled; 2nd segment has prominent gland-cone; 3rd slightly wider than long, less than \( \frac{1}{3} \) length 4th; 4th barely shorter than 5th.

Mouthparts Not greatly differing from P fragilis. Mandibles: Spine row of about 5 (left) and 3 (right) scabrous spines. Palp, 1st segment short; 2nd, length 3 times width, long setae on distal \( \frac{1}{3} \) of inner margin and on end; 3rd, convex margins taper bluntly, width less than \( \frac{1}{4} \) length, length \( \frac{1}{2} \) 2nd segment, short setae on distal \( \frac{3}{4} \) of inner margin, 2 or 3 very long setae on end, 2 or 3 on surface, inner surface strongly bristled. Maxilliped (Female specimen, Kenepuru): Basos, 2 or 3 long setae on inner surface proximally, 2 on outer distal
angle; series of long setae on inner portion of distal margin. Ischium has single seta just below merus inner proximal angle, outer margin very short. Inner plate subrectangular, outer distal angle rounded, distal margin wide; outer margin slightly convex, reaching ⅓ along carpus; 3 stout teeth on inner ⅔ of end margin, fine plumose setae on margin, beside and below teeth also; about 6 longer plumose setae on cleft margin; outer very finely bristled. Outer plate reaching end of carpus, convex outer margin has 4 or 5 long plumose setae distally; inner margin nearly straight, about 10 stout blunt teeth in row down margin to just below end of inner plate; a double row of short setae inside teeth and extending slightly further down plate. Merus inner margin ⅓ length outer, width ⅔ greatest length. Carpus greatest length twice merus, width ⅔ length, margins parallel, outer has pair of setae medially, 3 or 4 long setae on distal angle; inner and end margins fringed with usually-paired setae most of length, 2 or 3 ranks of setae on inner margin. Propod ⅔ carpus length; slightly narrower, margins slightly convex; distal ⅔ of inner setose, end margin on one surface and distal ⅔ of outer margin have long setae. Stout curved dactyllos has a strong nail, 1 or 2 setae on outer margin, length ⅓ propod.

**Gnathopods. First:** Sideplate subrectangular, angles rounded, width ½ length, setae on ventral and anterodistal margins, 2 long spines on posterior near distal angle (margin in these specimens inversely crenulate). Basos widening slightly distally, width ⅔ length; anterior margin has short single setae, posterior has long setae medially, short strong setae distally, tuft of long setae on distal angle. Ischium ⅓ basos length, posterodistal angle setose. Merus ⅔ basos length, ovate, 2 or 3 setae on anterior margin, long setae on distal ⅔ of posterior, greatest width ⅔ length. Carpus subtriangular, anterior margin ⅓ basos length, distal width ⅔ length, a few ranks of 2 or 3 setae on surface, anterior margin has 3 groups of setae, posterior strongly indented twice for tufts of long setae; distal angle strongly setose; end margin has median rank of about 6 plumose setae, rank of smaller plumose setae posteriorly. Propod somewhat ovate, widening slightly distally, greatest width more than ⅔ length; length ⅔ basos; anterior margin has 5 tufts of long setae, posterior has 2, several setae on surface; palm oblique (partly due to mounting) and slightly convex, has strong fringe of long setae, about 6 short spines on each surface of palm. Stout curved dactyllos not reaching end of palm; inner margin has very oblique teeth; outer has single seta proximally, about 3 small setae across end surface. **Second:** Sideplate subrectangular, deeper than wide, angles broadly rounded, ventral margin and distal portions of lateral margins setose as in Gn. 1 (inversely crenulate in these specimens). Gillis large, ovate; broodplates very large with long marginal setae. Basos, merus and ischium very like Gn. 1; basos width ½ length; ischium ⅔ basos length; merus width ⅔ length, length ⅔ basos. Carpus width ⅔ length, length ⅔ basos, setae on distal margin not obviously plumose. Propod ovate, greatest width ½ length, length ⅔ basos, setose as in Gn. 1, but palm much more oblique, defined only by single large spine at outer margin, as long as free posterior margin; stout dactyllos almost reaching end of palm, inner margin very obliquely toothed.

**Pereaeopods First:** Sideplate subrectangular, ventral margin convex, lateral margins parallel, deeper than wide, margin setose as above and (in these) inversely crenulate. Basos and ischium as in Gn. 2, basos has slender spines distally on margins. Merus ⅔ basos length, width ⅔ length; 3 long spines and 1 or 2 short
ones on anterior margin, 5 groups of 2 or 3 short spines on posterior. Carpus slender, width \( \frac{1}{3} \) length, length \( \frac{2}{3} \) basos; about 4 groups of 2 or 3 spines posteriorly, 2 or 3 fine setae on anterodistal angle. Propod as wide, \( \frac{1}{2} \) basos length, anterior margin has single seta medially, several on angle; posterior has about 6 short single spines. Stout dactylos \( \frac{1}{4} \) propod length, a short strong seta on inner margin, finer one on surface. Second: Sideplates basically subrectangular, angles rounded, posterior margin shallowly excavate, distal \( \frac{1}{2} \) of margin oblique, with setae; ventral margin and distal \( \frac{1}{2} \) of anterior also setose. Third, Fourth and Fifth: Sideplates difficult to discern but basically similar to \( P. \) fragilis. Basos ovate, narrowing distally, posterior margin proximally tending to expand in convex lobe; width between \( \frac{1}{3} \) and \( \frac{1}{4} \) length; anterior margin has 6 or 7 groups of 1 or 2 short spines, several fine setae proximally, about 10 or 12 small spines posteriorly. Third: (Kenepuru). Ischium \( \frac{1}{3} \) basos length, spined anterodistally. Merus \( \frac{3}{4} \) basos, linear, width \( \frac{4}{3} \) length; margins spined. Carpus narrower, as long as merus, each margin has 3 or 4 groups of spines. Propod a little longer, very slender, margins spined. Stout dactylos more than \( \frac{1}{4} \) propod length, seta on inner margin.

Epimeral Plates. First: Somewhat ovate, single spine anterodistally, ventrally rounded, deeper than wide, convex posterior margin has about 4 finer spines. Second: Subrectangular, almost as wide as deep, anterodistal angle rounded, 2 or 3 strong spines ventrally, 6 or 7 spines on more or less straight posterior margin. Third: Subrectangular, wider than deep, anterior margin slightly concave, anterodistal angle rounded, convex ventral margin has 4 or 5 strong spines anteriorly, posterior margin has 6 or 7 spines, more or less straight.

Pleopods. As in \( P. \) fragilis.

Uropods. First: Rami shorter than peduncle, 3 single spines on outer dorsal margin, 3 on inner, 2 at outer angle; rami with 5 or 6 end spines, 2 on each dorsal margin except outer margin of inner ramus which has 1. Second: Peduncle as long as rami; inner dorsal margin has 2 single short spines; outer distal angle has 2 spines together; inner ramus has 4 stout end spines, 1 on each dorsal margin, 6 on end. Third: Rami much longer than peduncle, dorsal and distal peduncle margins strongly spined. Rami each with end circket of about 6 strong spines; margins have 2 to 5 groups of 1 to 3 strong spines, usually with a long seta, not obviously plumose; fewer spines on median than other margins. Telson: Ovate, tending to subsquare, cleft to base, about 4 spines on end margin of each lobe, a pair on surface.

Male

(Kenepuru specimen, 4 mm. long.)

 Gnathopods. First: Sideplates deeper than wide. Basos margins with a few setae, posterior ones the stouter or longer. Ischium as long as merus, less than \( \frac{1}{4} \) basos; anterodistal angles of both have long setae; merus width \( \frac{2}{3} \) length, anterior \( \frac{1}{4} \) of distal margin has long setae. Carpus subtrangular, as wide as long, nearly \( \frac{1}{3} \) basos length, strong tuft of setae at anterodistal angle; plumose setae on middle of end margin. Propod ovate, width distally \( \frac{3}{4} \) length, almost as long as basos; short setae at anterodistal angle; a few short setae on posterior surface; posterior margin has a few long setae distally; slightly oblique convex palm has row of about 12 short seta-tipped spines on each side of margin, several long setae also, anterodistal angle defined by the end of these spine rows; pos-
terior free margin more than ½ length anterior. Stout daeytlos as long as palm, very oblique teeth on inner margin, setae on outer near base, daeytlos about ⅓ length. Second. Sideplate ventrally convex, with setae (and inversely crenulate). Basos width ⅓ length, a few marginal spines and setae. Ischium ⅓ basos length, pair of setae posterodistally. Merus trapezoid, posterior margin nearly ⅓ basos length; posterodistal angle has tuft of 2 or 3 setae. Carpus subtriangular, distally almost as wide as long, length ⅔ basos, a pair of setae anterodistally, series of setae on end margin posteriorly. Propod ovate, greatly expanded, narrowing distally to daeytlos, as long as basos; straight anterior margin has 1 or 2 setae. Tuft at distal angle: posterior margin regularly convex, palm occupying distal 3, defined only by short, stout seta-tipped palmar spines of which there are 2 rows of about 20 each, a few long setae; a few short setae on surface Long curved daeytlos ⅔ length anterior margin, seta on outer margin proximally, inner obliquely toothed, a few small surface setae

Peraeopods. First: Stout daeytlos ⅔ propod length, a strong tooth along inner margin so daeytlos almost bidactylar, 1 or 2 setae between tooth and tip

Localities. Kenepuru Sound, col 1, Chilton: Waikawa and Torea Bays. Queen Charlotte Sound; Rona Bay, Wellington Harbour; Greymouth, col. R. Helms; Akaroa coll C. Chilton "At mouth of fresh-water streams near high-water mark."

Hypotypes. Slides C.38 (Queen Charlotte Sound) and C.41 (Kenepuru) female. Slides C.40 (Kenepuru), male.

Discussion

The mounted specimens of P. helmsii in the Chilton collection are not particularly helpful in giving a complete picture of the species from specimens from any one locality. The preserved specimens are in most cases incomplete, the appendages being very brittle, and it is impossible to find specimens in perfect condition for dissection For that reason I have had to describe and figure a mounted specimen from Queen Charlotte Sound, and to amplify the description with details from specimens from the adjacent Kenepuru Sound The specimens were collected in June, 1910; most of them have the peraeopods broken off at the basos or ischium, and the third uropods missing.

All of the known specimens come from freshwater streams about the high-water mark—i.e., really from brackish waters, although Chilton says of the Queen Charlotte and Kenepuru specimens that some were "collected in the freshwater higher up the stream, but others between tide marks". (1918: 82.)

Literature Cited


