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| Title       | ADDITIONAL REPORT ON CALANOID COPEPODS FROM THE IZU REGION -PART 5. EUAUGAPTILUS- |
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**ADDITIONAL REPORT ON CALANOID COPEPODS  
FROM THE IZU REGION  
PART 5. *EUAUGAPTILUS***

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*With Text-figures 1-33*

Today, *Euaugaptilus* includes about 60 species. From Sagami and Suruga Bays Tanaka (1964) reported the occurrence of the following 16 species: *E. angustus* Sars, *E. bullifer* Giesbrecht, *E. facilis* (Farran), *E. farrani* Sars, *E. filigerus* (Claus), *E. hecticus* (Giesbrecht), *E. laticeps* Sars, *E. longimanus* Sars, *E. magnus* (Wolfenden), *E. marginatus* Tanaka, *E. mixtus* Brodsky, *E. nodifrons* Sars, *E. nudus* Tanaka, *E. oblongus* Sars, *E. palumboi* (Giesbrecht) and *E. rigidus* Sars. In addition, *E. matsuei* was described by us (Tanaka and Omori, 1967). In the present paper the occurrence of 31 species including 4 new and 2 unidentified species is reported (Table 1). Also a single species of *Haloptilus* is reported as it was accidentally left out of our previous report (Tanaka and Omori, 1971). In all, 14 species are recorded for the first time in the

Table 1. List of species.

|  |   |
|--|---|
| 1. <i>Euaugaptilus angustus</i> (Sars) | 17. <i>E. magnus</i> (Wolfenden)        |
| 2. <i>E. bullifer</i> (Giesbrecht)     | 18. <i>E. matsuei</i> Tanaka et Omori   |
| 3. <i>E. elongatus</i> (Sars)          | 19. <i>E. maxillaris</i> Sars           |
| 4. <i>E. facilis</i> (Farran)          | 20. <i>E. niveus</i> sp. nov.           |
| 5. <i>E. fecundus</i> sp. nov.         | 21. <i>E. nodifrons</i> (Sars)          |
| 6. <i>E. filigerus</i> (Claus)         | 22. <i>E. oblongus</i> (Sars)           |
| 7. <i>E. gracilis</i> (Sars)           | 23. <i>E. palumbii</i> (Giesbrecht)     |
| 8. <i>E. graciloides</i> Brodsky       | 24. <i>E. perodiosus</i> sp. nov.       |
| 9. <i>E. hecticus</i> (Giesbrecht)     | 25. <i>E. ? propinquus</i> Sars         |
| 10. <i>E. ? humilis</i> Farran         | 26. <i>E. rectus</i> Grice et Hulsemann |
| 11. <i>E. hyperboreus</i> Brodsky      | 27. <i>E. squamatus</i> (Giesbrecht)    |
| 12. <i>E. indicus</i> Sewell           | 28. <i>E. sublongiseta</i> Park         |
| 13. <i>E. laticeps</i> (Sars)          | 29. <i>E. tenuispinus</i> Sars          |
| 14. <i>E. latifrons</i> (Sars)         | 30. <i>E. species 1</i>                 |
| 15. <i>E. longimanus</i> (Sars)        | 31. <i>E. species 2</i>                 |
| 16. <i>E. luxus</i> sp. nov.           | 32. <i>Haloptilus fons</i> Farran       |

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waters surrounding Japan. All drawings are prepared by the specimens in our collections.

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Recently the family Augaptilidae was reviewed by Matthews (1972). Using the methods of numerical taxonomy Matthews divided the genus *Euaugaptilus* into

Table 2. Definition of structural characters for use in identification of the species of *Euaugaptilus*.

- 
1. Total body length, in mm  $\times 10$ .
  2. Ratio of endopod to exopod of 2nd antenna, (1:)X  $\times 10$ .
  3. Number of distinct teeth (including marginal spine) on mandibular gnathobase. Very small ones are excluded.
  4. Number of setae on 1st inner lobe of 1st maxilla.
  5. Number of setae on 2nd inner lobe of 1st maxilla.
  6. Number of setae on 3rd inner lobe of 1st maxilla.
  7. Number of setae on 2nd basal segment of 1st maxilla.
  8. Number of setae on endopod of 1st maxilla.
  9. Number of setae on exopod of 1st maxilla.
  10. Number of setae on outer lobe of 1st maxilla.
  11. Number of setae on 1st lobe of 2nd maxilla.
  12. Number of setae on 2nd lobe of 2nd maxilla.
  13. Number of setae on 3rd lobe of 2nd maxilla.
  14. Number of setae on 4th lobe of 2nd maxilla.
  15. Number of setae on 5th lobe of 2nd maxilla.
  16. Number of setae on 6th lobe of 2nd maxilla.
  17. Number of setae on endopod of 2nd maxilla.
  18. Number of setae on basal segments of maxilliped.
  19. Number of setae on endopod of maxilliped.
  20. Segmentation of swimming legs. 1, endopod of 1st reduced; 2, 3-segmented on both rami; 3, both rami of 5th reduced.
  21. Details of head structure. 0, no rostral filaments; 1, rostral filaments present.
- 

two groups which are defined polythetically and named after a typical member, *E. affinis* and *E. squamatus* respectively. The most satisfactory definition of these two groups is based on the structure of the 1st maxilla. When his paper was in press, our study was progressing into the final stage. We were developing a similar method of classification of the genus, and selected 21 basic characters of the genus for use in the identification of species from the Izu region (Tables 2 and 3). We show our respect for Dr. Matthews' effort and agree that his method of classification using principal coordinates analysis possesses several advantages. For practical identification of

specimens, however, a modification of Sewell's (1947) system of subdivision seems to be useful. Based on the structure of the 1st maxilla and the arrangement of setae on the various lobes and rami of the same appendage, we divided a total of 33 species from the Izu region into five groups. The following key for identification includes only those females hitherto recorded from the Izu region. As there is much intraspecific variation in the genus *Euaugaptilus*, the strict use of key may cause confusion in identification. However, we think the key will be useful for those who need to sort out a number of representative species of the genus.

Group I. 1st maxilla with setae on the outer lobe, exopod, endopod, 2nd basal segment (basis), and 3rd to 1st inner lobes. 2nd basal segment may lack the setae in some species.

- 1 (12) Rostrum with 2 filaments.
- 2 (11) Endopod of 2nd maxilla with 7-8 setae.
- 3 (6) Both rami of 2nd antenna are equal or subequal in length.
- 4 (5) Endopod of 1st leg 2-segmented. .... *E. farrani*
- 5 (4) Endopod of 1st leg 3-segmented. .... *E. elongatus*
- 6 (3) Endopod of 2nd antenna is nearly twice length of exopod.
- 7 (10) Body length 5.0 mm or more. Mandible with 7 teeth including marginal seta.
- 8 (9) Mandibular teeth sharp. Number of setae on lobes of 2nd maxilla; 3, 2, 2, 3, 2, 3. .... *E. maxillaris*
- 9 (8) Mandible with grinding teeth. Number of setae on lobes of 2nd maxilla; 3, 3, 3, 3, 3, 3. .... *E. indicus*
- 10 (7) Body length 2.0 mm or less. Mandible with 5 teeth including marginal seta. .... ? *E. humilis*
- 11 (2) Endopod of 2nd maxilla with 14-15 setae. .... *E. hyperboreus*
- 12 (1) Rostral filaments absent. .... *E. nodifrons*

Group II. 1st maxilla with setae on outer lobe, exopod, 2nd basal segment and 3rd to 1st inner lobes. Endopod fused with 2nd basal segment. 2nd basal segment or 3rd inner lobe may lack setae in some species.

- 1 (8) Rostrum with 2 filaments.
- 2 (3) Number of setae on lobes of 2nd maxilla; 1, 1, 2, 3, 2, 3. .... *E. filigerus*
- 3 (2) Number of setae on lobes of 2nd maxilla; 3, 2, 2, 3, 2, 3.
- 4 (5) Genital segment as long as wide. Rostral filaments thick. .... *E. squamatus*
- 5 (4) Genital segment 1.5 times as long as wide. Rostral filaments slender.
- 6 (7) Outer lobe of 1st maxilla with 4 setae. .... *E. perodiosus* sp. nov.
- 7 (6) Outer lobe of 1st maxilla with 8-9 setae. .... *E. laticeps*
- 8 (1) Rostral filaments absent.
- 9 (10) Rostrum with rounded papillae. .... *E. magnus*
- 10 (9) Rostrum with rigid spines.
- 11 (12) Both rami of 2nd antenna are equal or subequal in length. ... *E. tenuispinus*

Table 3. Values of characters defined in Table 2 for all species of *Euaugaptilus*, female, found in the Izu region.

| Species name                 | Characters |    |    |       |   |   |     |     |     |     |    |    |    |    |    |    |    |    |    |    |    |
|------------------------------|------------|----|----|-------|---|---|-----|-----|-----|-----|----|----|----|----|----|----|----|----|----|----|----|
|                              | 1          | 2  | 3  | 4     | 5 | 6 | 7   | 8   | 9   | 10  | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| <i>Euaugaptilus angustus</i> | 59-78      | 16 | 4  | 11    | 1 | 0 | 3   | 0   | 9   | 4   | 2  | 2  | 2  | 2  | 2  | 3  | 7  | 11 | 17 | 2  | 0  |
| <i>bullifer</i>              | 53-56      | 15 | 7  | 3     | 0 | 0 | 1-2 | 0   | 2   | 4   | 1  | 1  | 2  | 3  | 2  | 1  | 7  | 9  | 15 | 2  | 1  |
| <i>elongatus</i>             | 57-60      | 10 | 7  | 11    | 2 | 1 | 3   | 3   | 7   | 9   | 3  | 2  | 2  | 3  | 2  | 3  | 8  | 11 | 15 | 2  | 1  |
| <i>facilis</i>               | 57-59      | 10 | 7  | 8     | 1 | 0 | 1   | 0   | 3   | 4   | 3  | 2  | 2  | 3  | 2  | 3  | 7  | 11 | 17 | 2  | 1  |
| <i>farrani</i>               | ca. 55     | 13 | 7  | 11    | 2 | 2 | 3   | 2   | 6   | 8   | 3  | 2  | 2  | 3  | 2  | 3  | 7  | 11 | 17 | 1  | 1  |
| <i>fecundus</i>              | 58         | 26 | 7  | 6     | 0 | 0 | 0   | 0   | 2   | 3   | 1  | 0  | 0  | 2  | 0  | 2  | 19 | 6  | 17 | 1  | 1  |
| <i>filigerus</i>             | 52-76      | 22 | 4  | 8     | 1 | 1 | 1   | 0   | 10  | 6   | 1  | 1  | 2  | 3  | 2  | 3  | 7  | 10 | 17 | 2  | 1  |
| <i>gracilis</i>              | 62         | 13 | 6  | 8     | 1 | 0 | 1   | 0   | 4   | 3-4 | 3  | 2  | 2  | 3  | 2  | 3  | 7  | 11 | 18 | 2  | 1  |
| <i>graciloides</i>           | 67         | 10 | 5  | 8     | 1 | 0 | 1   | 0   | 6   | 0   | 3  | 2  | 2  | 3  | 2  | 3  | 7  | 11 | 17 | 2  | 1  |
| <i>hecticus</i>              | 24-27      | 14 | 2  | 4     | 0 | 0 | 1   | 0   | 5   | 3   | 0  | 0  | 1  | 2  | 2  | 1  | 7  | 7  | 16 | 3  | 1  |
| <i>humilis</i>               | 16         | 16 | 5  | 8     | 1 | 1 | 3   | 4   | 8   | 6   | 3  | 2  | 2  | 3  | 2  | 2  | 7  | 11 | 18 | 2  | 1  |
| <i>hyperboreus</i>           | 62-74      | 14 | 7  | 10-11 | 2 | 2 | 4   | 1-2 | 7-8 | 8-9 | 3  | 2  | 2  | 3  | 3  | 4  | 15 | 11 | 15 | 2  | 1  |
| <i>indicus</i>               | 77         | 18 | 10 | 10    | 2 | 1 | 2   | 1   | 9   | 9   | 3  | 3  | 3  | 3  | 3  | 3  | 7  | 12 | 18 | 2  | 1  |
| <i>laticeps</i>              | 71-74      | 17 | 7  | 10-11 | 2 | 2 | 3   | 0   | 6-7 | 9   | 3  | 2  | 2  | 3  | 2  | 3  | 7  | 11 | 17 | 2  | 1  |
| <i>latifrons</i>             | 56         | 25 | 7  | 6     | 0 | 0 | 0   | 0   | 2   | 4   | 1  | 0  | 1  | 2  | 6  | 8  | 15 | 7  | 17 | 1  | 0  |
| <i>longimanus</i>            | 53-58      | 10 | 7  | 3     | 1 | 0 | 1   | 0   | 3   | 5   | 1  | 1  | 1  | 3  | 2  | 2  | 7  | 11 | 9  | 2  | 1  |
| <i>luxus</i>                 | 80         | 13 | 8  | 3     | 0 | 0 | 0   | 0   | 2   | 5   | 1  | 1  | 1  | 3  | 2  | 2  | 7  | 9  | 17 | 2  | 1  |
| <i>magnus</i>                | 70-80      | 16 | 6  | 9-10  | 1 | 1 | 1-2 | 0   | 2-3 | 8-9 | 3  | 1  | 2  | 3  | 2  | 3  | 7  | 11 | 17 | 2  | 0  |

|                      |       |    |    |    |   |   |     |   |     |   |   |   |   |   |   |   |    |    |    |   |   |
|----------------------|-------|----|----|----|---|---|-----|---|-----|---|---|---|---|---|---|---|----|----|----|---|---|
| <i>marginatus</i>    | 23    | 10 | 5  | 7  | 1 | 0 | 3   | 0 | 7   | 3 | 3 | 2 | 2 | 3 | 2 | 1 | 7  | 11 | 15 | 2 | 1 |
| <i>matsuei</i>       | 99    | 10 | 7  | 6  | 0 | 0 | 1   | 0 | 3   | 6 | 1 | 1 | 2 | 3 | 3 | 5 | 15 | 10 | 17 | 2 | 1 |
| <i>maxillaris</i>    | 56-67 | 18 | 7  | 10 | 1 | 2 | 5   | 5 | 8   | 9 | 3 | 2 | 2 | 3 | 2 | 3 | 7  | 11 | 18 | 2 | 1 |
| <i>niveus</i>        | 46    | 13 | 7  | 9  | 1 | 0 | 1   | 0 | 4   | 6 | 2 | 1 | 2 | 3 | 2 | 3 | 7  | 11 | 18 | 2 | 1 |
| <i>nodifrons</i>     | 54-95 | 27 | 10 | 10 | 1 | 1 | 0-1 | 2 | 4-5 | 9 | 3 | 3 | 3 | 3 | 3 | 3 | 7  | 12 | 17 | 2 | 0 |
| <i>nudus</i>         | 42    | 20 | 7  | 9  | 1 | 0 | 2   | 0 | 5   | 4 | 1 | 1 | 2 | 2 | 2 | 3 | 9  | 10 | 18 | 2 | 0 |
| <i>oblongus</i>      | 60-63 | 17 | 4  | 11 | 1 | 2 | 2   | 0 | 2   | 9 | 3 | 1 | 2 | 3 | 2 | 3 | 7  | 11 | 16 | 2 | 0 |
| <i>palumboi</i>      | 21-27 | 14 | 7  | 8  | 1 | 0 | 1   | 0 | 4   | 1 | 3 | 2 | 2 | 3 | 2 | 1 | 7  | 10 | 16 | 1 | 1 |
| <i>placitus</i>      | 99    | 19 | 7  | 11 | 1 | 2 | 3   | 0 | 6   | 4 | 3 | 2 | 2 | 3 | 2 | 3 | 7  | 11 | 18 | 2 | 1 |
| <i>propinquus</i>    | 40    | 15 | 7  | 7  | 1 | 0 | 1   | 0 | 6   | 7 | 2 | 1 | 2 | 2 | 2 | 1 | 7  | 10 | 18 | 2 | 1 |
| <i>rectus</i>        | 68-93 | 15 | 6  | 10 | 1 | 0 | 2   | 0 | 4   | 9 | 2 | 1 | 2 | 3 | 2 | 3 | 7  | 11 | 18 | 2 | 0 |
| <i>rigidus</i>       | 55    | 10 | 7  | 4  | 0 | 0 | 0   | 0 | 2   | 3 | 2 | 1 | 1 | 3 | 2 | 2 | 7  | 10 | 16 | 2 | 1 |
| <i>squamatus</i>     | 72-74 | 18 | 7  | 11 | 2 | 2 | 3   | 0 | 7   | 9 | 3 | 2 | 2 | 3 | 2 | 3 | 7  | 11 | 18 | 2 | 1 |
| <i>?sublongiseta</i> | 23    | 10 | 5  | 9  | 1 | 0 | 3   | 0 | 7   | 6 | 3 | 2 | 2 | 2 | 2 | 2 | 7  | 11 | 17 | 2 | 1 |
| <i>tenuispinus</i>   | 53    | 10 | 7  | 10 | 1 | 1 | 3   | 0 | 6   | 9 | 3 | 2 | 2 | 3 | 2 | 3 | 7  | 11 | 16 | 2 | 0 |
| species 1            | 32    | 10 | 3  | 9  | 0 | 0 | 2   | 0 | 6   | 6 | 3 | 2 | 2 | 3 | 2 | 2 | 7  | 11 | 14 | - | 1 |
| species 2            | 48    | 11 | 7  | 6  | 0 | 0 | 1   | 0 | 3   | 9 | 1 | 1 | 2 | 2 | 2 | 2 | 7  | 10 | 9  | - | 0 |

12 (11) Endopod of 2nd antenna is more than 1.5 times the length of exopod. .... *E. oblongus*

Group III. 1st maxilla with setae on outer lobe, exopod, 2nd basal segment, 1st inner lobe and 2nd (or 3rd) inner lobe. Endopod and 3rd (or 2nd) inner lobe lack seta. Outer lobe may lack setae in some species.

- 1 (16) Rostrum with 2 filaments.
- 2 (3) Endopod of 1st leg 2-segmented. .... *E. palumboi*
- 3 (2) Endopod of 1st leg 3-segmented.

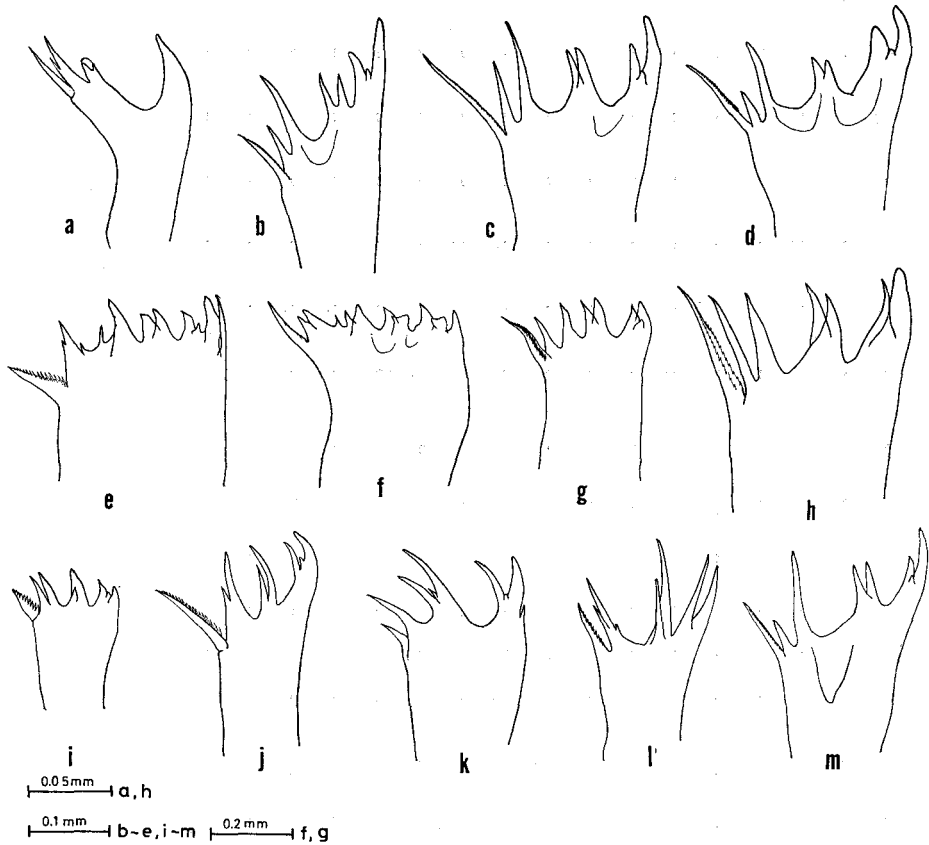


Fig. 1. Mandibular teeth of *Euauagaptilus*, female, from the Izu region: a, *E. ?humilis*; b, *E. elongatus*, c, *E. hyperboreus*; d, *E. maxillaris*; e, *E. nodifrons*; f, *E. indicus*; g, *E. matsuei*; h, *E. bullifer*; i, *E. rigidus*; j, *E. fecundus*; k, *E. luxus*; l, *E. latifrons*; m, *E. farrani*.

- 4 (7) 3rd exopodal segment on 3rd and 4th legs with swellings on outer margin.
- 5 (6) Outer lobe of 1st maxilla with 4 setae. .... *E. facilis*
- 6 (5) Outer lobe of 1st maxilla without setae. .... *E. graciloides*
- 7 (4) 3rd exopodal segment on 3rd and 4th legs without swellings on outer margin.
- 8 (13) Body length more than 3.5 mm. Mandible with 7 or more teeth including

- marginal seta.
- 9 (10) 1st inner lobe of 1st maxilla with 5-7 setae. Number of setae on lobes of 2nd maxilla; 2, 1, 2, 2, 2, 1. .... *E. propinquus*
  - 10 (9) 1st inner lobe of 1st maxilla with 8-9 setae.
  - 11 (12) Outer lobe of 1st maxilla with 3-4 setae. .... *E. gracilis*
  - 12 (11) Outer lobe of 1st maxilla with 6 setae. .... *E. niveus* sp. nov.
  - 13 (8) Body length less than 2.5 mm. Mandible with 5 teeth.

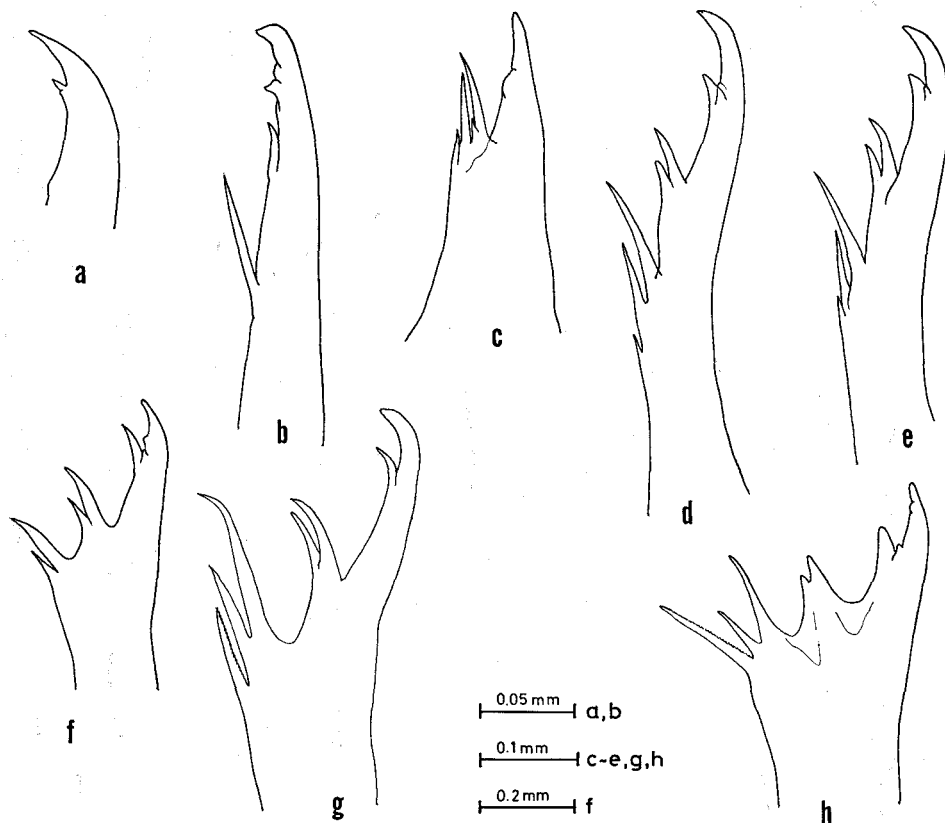


Fig. 2. Mandibular teeth at *Euaugaptilus* female, from the Izu region a, *E. hecticus*; b, *E. filigerus*; c, *E. oblongus*; d, *E. squamatus*; e, *E. laticeps*; f, *E. magnus*; g, *E. perodiosus*; h, *E. tenuispinus*.

- 14 (15) 1st antenna extends beyond furca by distal 8 segments. .... *E. marginatus*
- 15 (14) 1st antenna extends beyond furca by distal 3 segments.....*E.? sublongiseta*
- 16 (1) Rostral filaments absent.
- 17 (18) Rostrum pointed. .... *E. rectus*
- 18 (17) Rostrum rounded.
- 19 (20) 3rd exopodal segment of 1st leg with 1 outer marginal spine. ... *E. angustus*
- 20 (19) 3rd exopodal segment of 1st leg with 2 outer marginal spines. ... *E. nudus*



Group IV. 1st maxilla with setae on outer lobe, exopod, 2nd basal segment and 1st inner lobe. Endopod, 2nd inner lobe and 3rd inner lobe lack setae.

- 1 (2) Both rami of 5th leg 2-segmented. .... *E. hecticus*
- 2 (1) Both rami of 5th leg 3-segmented.

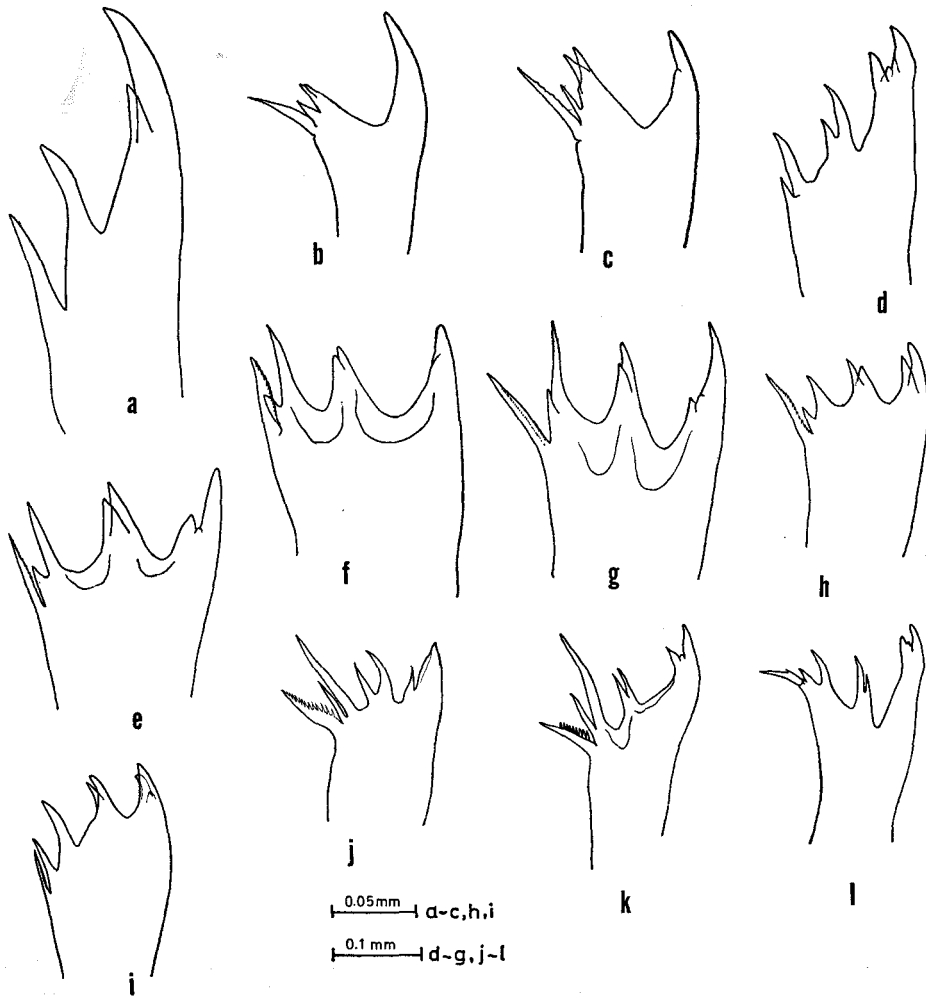


Fig. 3. Mandibular teeth of *Euaugettilus* female, from the Izu region: a, *E. angustus*; b, *E. marginatus*; c, *E. ?sublongiseta*; d, *E. rectus*; e, *E. facilis*; f, *E. graciloides*; g, *E. glacialis*; h, *E. palumbii*; i, *E. propinquus*; j, *E. longimanus*; k, *E. niveus*; l, *E. nudus*.

- 3 (4) Maxilliped unusually elongated. .... *E. longimanus*
- 4 (3) Maxilliped of usual structure for genus.
- 5 (6) Number of setae on lobes of 2nd maxilla; 1, 1, 2, 3, 2, 1: endopod with 7 setae. .... *E. bullifer*

- 6 (5) Number of setae on lobes of 2nd maxilla; 1, 1, 2, 3, 3, 5: endopod with 15 setae. .... *E. matsuei*
- Group V. 1st maxilla lacks setae on endopod, 2nd basal segment, 2nd inner lobe and 3rd inner lobe.
- 1 (2) Endopod of mandibular palp of usual structure (2-segmented).  
..... *E. luxus* sp. nov.
- 2 (1) Endopod of mandibular palp is rudimentary or entirely absent.
- 3 (4) Endopod of 1st leg 3-segmented. .... *E. rigidus*
- 4 (3) Endopod of 1st leg 2-segmented.
- 5 (6) Rostral filaments present. .... *E. fecundus* sp. nov.
- 6 (5) Rostral filament absent. .... *E. latifrons*

From the standpoint of caenogenesis, we attempted to compare the shape of the mandibular teeth of the above 33 species (Figs. 1-3). Generally, the teeth are coarse and stout in species living in the upper layers of the ocean, and become fine and small with increasing depth of distribution. The close relationship between the structure of the mandibular teeth and the vertical distribution of the species will be discussed elsewhere.

EUAUGAPTILUS Sars, 1920

*Euaugaptilus angustus* (Sars, 1905)

(Figs. 3a, 4a-d)

*Augaptilus angustus* Sars, 1905, p. 10.

*Euaugaptilus angustus* (Sars).—Sars, 1925, p. 281, pl. 91; Sewell, 1947, p. 222, fig. 60e; Tanaka, 1964b, p. 56, fig. 201.

*Occurrence*: Sta. 83, 1 ♀; Sta. 107, 1 ♀; Sta. 109, 2 ♀; Sta. 116, 1 ♀, 1 ♂; Sta. 117-2, 1 ♀.

*Descriptive notes*: Male, 5.48 mm. The abdominal segments and furca have the following proportional lengths:

|         |    |    |    |    |    |       |      |
|---------|----|----|----|----|----|-------|------|
| segment | 1  | 2  | 3  | 4  | 5  | furca |      |
|         | 25 | 13 | 11 | 11 | 11 | 29    | =100 |

The left 1st antenna is modified; the segments have the following proportional lengths:

|         |     |    |    |    |          |       |    |    |       |    |    |    |    |
|---------|-----|----|----|----|----------|-------|----|----|-------|----|----|----|----|
| segment | 1-2 | 3  | 4  | 5  | 6        | 7     | 8  | 9  | 10    | 11 | 12 | 13 | 14 |
|         | 90  | 31 | 38 | 38 | 38       | 37    | 31 | 38 | 37    | 41 | 45 | 53 | 45 |
|         | 15  | 16 | 17 | 18 | 19-20-21 | 22-23 | 24 | 25 |       |    |    |    |    |
|         | 48  | 48 | 53 | 50 | 96       | 74    | 41 | 28 | =1000 |    |    |    |    |

Segment 17 has 1 spine and 2 setae on the anterior distal margin; segment 18 has 1 seta and 1 long sensory filament; segments 19, 20 and 21 are fused; segment 19 having a long spine, which extends to the distal margin of segment 21, and a large sensory filament; segment 20 has rows of tube-like small filaments; segment 21 has 1 strong spine, 1 seta and 1 sensory filament on the distal margin. The right 1st antenna has segments in the following proportional lengths;

|         |    |    |    |    |    |    |    |    |    |    |         |    |    |    |
|---------|----|----|----|----|----|----|----|----|----|----|---------|----|----|----|
| segment | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11      | 12 | 13 | 14 |
|         | 56 | 20 | 27 | 31 | 36 | 36 | 34 | 31 | 35 | 33 | 39      | 45 | 52 | 49 |
|         | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25      |    |    |    |
|         | 47 | 49 | 53 | 52 | 47 | 37 | 42 | 36 | 39 | 42 | 32=1000 |    |    |    |

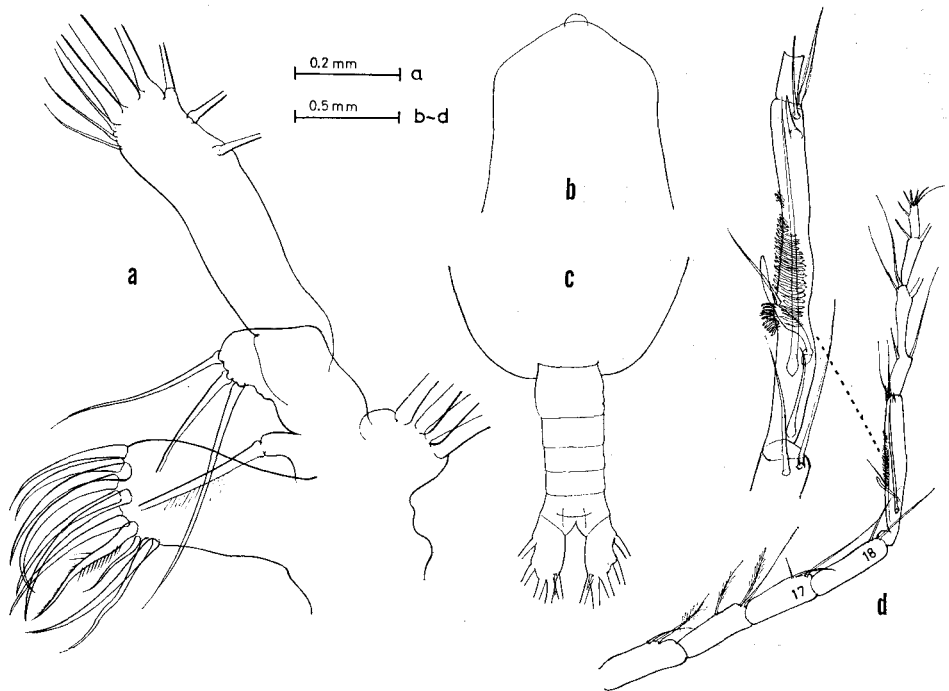


Fig. 4. *Euaugaptilus angustus*, female: a, 1st maxilla. male: b, head, dorsal view; c, last thoracic segment and abdomen, dorsal view; d, distal part of 1st antenna.

The endopod of the 2nd antenna is 2.1 times the length of the exopod; the exopod is 8-segmented. The mandibular palp is slender; the endopod has 4 setae on the distal margin. The 1st and 2nd maxillae and maxilliped have a structure similar to that of the female. The 5th pair of legs agrees well with the figure given by Sars (1925).

*Remarks:* The female specimens agree with Sars' (1925) description and figures. The 1st maxilla has the following number of setae on the various lobes: 4 on the outer lobe, 9 on the exopod, 3 on the 2nd basal segment, 1 on the 2nd inner lobe, and 11 on the 1st inner lobe.

*Distribution and size variation:*

| Author                | Locality            | Depth (m) | Length (mm) |      |
|-----------------------|---------------------|-----------|-------------|------|
|                       |                     |           | ♀           | ♂    |
| Sars, 1925            | North of Azores Is. | 0-1000    | 7.90        | —    |
| Sewell, 1932          | Laccadive Sea       | 0-1280    | —           | —    |
| Sewell, 1947          | Arabian Sea         | 0-1500    | —           | —    |
| Wilson, 1950          | North of Easter Is. | 0-540     | —           | —    |
| Tanaka, 1964b         | Sagami Bay          | 0-1000    | 6.47        | —    |
| Vervoort, 1965        | Gulf of Guinea      | 0-600     | 6.10        | —    |
| Roe, 1972             | off Canary Is.      | 660       | 5.44-5.76   | 5.12 |
| <i>Present record</i> | Izu region          | 0-680     | 5.91-7.83   | 5.48 |

*Euaugaptilus bullifer* (Giesbrecht, 1889)

(Figs. 1h, 5a-e)

*Augaptilus bullifer* Giesbrecht, 1889, p. 813; Giesbrecht, 1892, p. 400, pl. 28 figs. 6, 21, 24, pl. 39 fig. 46. *Euaugaptilus bullifer* (Giesbrecht).—Sars, 1925, p. 272, pl. 85; Tanaka, 1964b, p. 67 fig. 207; Owre and Foyo, 1967, p. 83 figs. 567, 568, 577.

*Occurrence:* Sta. 84-2, 1 ♀; Sta. 94, 1 ♀; Sta. 108, 1 ♀; Sta. 114, 2 ♀, 1 ♂; Sta. 116, 1 ♀; Sta. 121-2, 3 ♀; Sta. 122, 1 ♀.

*Descriptive notes:* Male, 5.04 mm. The cephalothorax and abdomen have proportional lengths 75:25. The abdominal segments and furca have the following proportional lengths:

| segment | 1  | 2  | 3  | 4  | 5  | furca  |
|---------|----|----|----|----|----|--------|
|         | 23 | 18 | 16 | 11 | 11 | 21=100 |

The furca is twice as long as wide.

The left 1st antenna is geniculated; segments 17 and 18 are armed coarsely with denticles on the anterior margin; the right antenna extends beyond the end of the furca by 3 segments; the segments have the following proportional lengths:

| segment | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11      | 12 | 13 | 14 |
|---------|----|----|----|----|----|----|----|----|----|----|---------|----|----|----|
|         | 49 | 20 | 20 | 21 | 25 | 25 | 29 | 29 | 32 | 34 | 37      | 48 | 54 | 58 |
|         | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25      |    |    |    |
|         | 56 | 58 | 59 | 57 | 53 | 42 | 42 | 42 | 46 | 39 | 25=1000 |    |    |    |

The 2nd antenna is robust; the exopod is 8-segmented; the endopod is 1.6 times the length of the exopod. The remaining mouth appendages have a structure similar

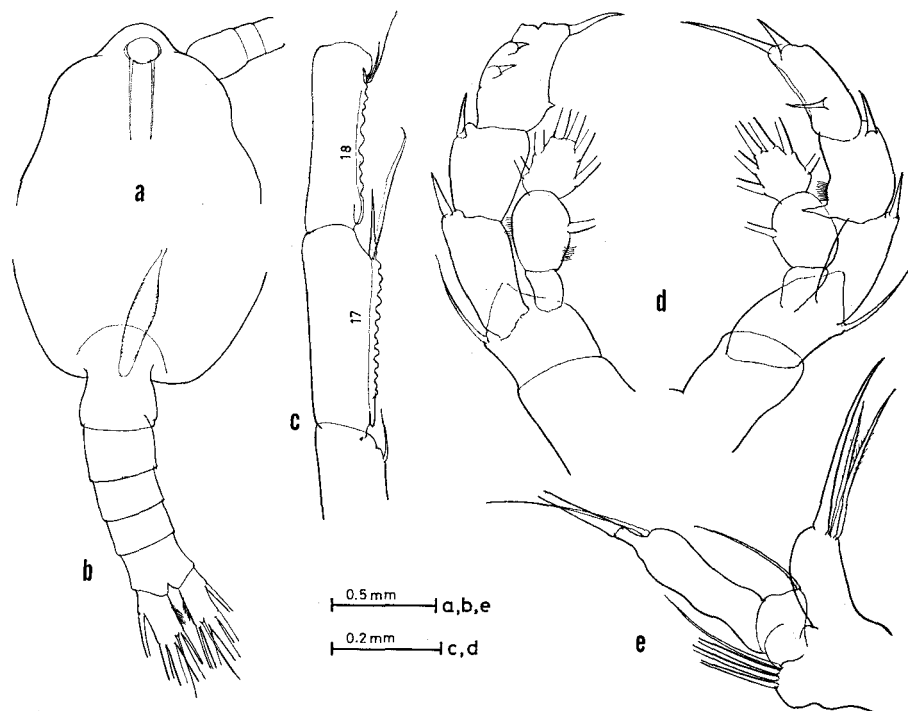


Fig. 5. *Euaugaptilus bullifer*, male: a, head, dorsal view; b, last thoracic segment and abdomen, dorsal view; c, geniculated segments of 1st antenna; d, 5th pair of legs. female: e, 1st maxilla.

to those in the female.

*Remarks:* Female specimens agree well with *E. bullifer* described and figured by Sars (1925). On the 1st leg the outer marginal spines of the exopod are provided with a row of small spines at their bases. However, some specimens differ in the number of setae on the exopod of the 2nd antenna and the 2nd basal segment of the 1st maxilla. One specimen, measuring 5.37 mm, has the 2nd antenna with a small spine on the 7th segment of the exopod; the another specimen, measuring 5.27 mm, has 2 setae on the 2nd basal segment of the 1st maxilla.

*Distribution and size variation:*

| Author                    | Locality                | Depth (m) | Length (mm) |      |
|---------------------------|-------------------------|-----------|-------------|------|
|                           |                         |           | ♀           | ♂    |
| Giesbrecht, 1892          | off Hawaii              | 0-1500    | 4.4         | —    |
| A. Scott, 1909            | Malay Archipelago       | 0-750     | —           | —    |
| Sars, 1925                | Gulf of Gascogne        | 0-1800    | 4.90        | —    |
| Sewell, 1947              | Arabian Sea             | 0-1500    | —           | —    |
| Tanaka, 1964b             | Sagami Bay              | 0-1000    | 4.92        | 4.70 |
| Grice and Hulsemann, 1967 | Equatorial Indian Ocean | 1000-2000 | —           | —    |
| Owre and Foyo, 1967       | Florida Current         | 584       | —           | —    |
| <i>Present record</i>     | Izu region              | 0-740     | 5.26-5.57   | 5.04 |

*Euaugaptilus elongatus* (Sars, 1905)

(Figs. 1b, 6a-j)

*Augaptilus elongatus* Sars, 1905, p. 13; Farran, 1908, p. 71.*Euaugaptilus elongatus* (Sars).—Sars, 1925, p. 270, pl. 84; Sewell, 1947, p. 203, fig. 52.*Occurrence*: Sta. 107, 1 ♀; Sta, 121-2, 1 ♀, 1 ♂.

*Descriptive notes*: Female, 5.80 mm. The cephalothorax and abdomen have proportional lengths 77:23. The cephalothorax is 1.3 times as long as wide. The frontal margin of the head is evenly rounded when viewed laterally. The lateral corners of the last thoracic segment are narrowly rounded. The rostral filaments are stout and long.

The abdominal segments and furca have the following proportional lengths:

|         |     |    |    |       |      |
|---------|-----|----|----|-------|------|
| segment | 1-3 | 4  | 5  | furca |      |
|         | 45  | 13 | 17 | 25    | =100 |

The genital segment is 1.6 times as long as wide; the genital protuberance is large; the furca is twice as long as wide.

The 1st antenna, 7.33 mm in length, extends beyond the end of the furca by 5 segments; the segments have the following proportional lengths:

|         |    |    |    |    |    |    |    |    |    |    |       |    |    |    |
|---------|----|----|----|----|----|----|----|----|----|----|-------|----|----|----|
| segment | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11    | 12 | 13 | 14 |
|         | 47 | 17 | 23 | 23 | 25 | 25 | 25 | 29 | 30 | 30 | 34    | 41 | 47 | 50 |
| 15      | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |       |    |    |    |
| 51      | 54 | 60 | 63 | 58 | 44 | 49 | 44 | 51 | 47 | 33 | =1000 |    |    |    |

On the 2nd antenna the exopod and endopod are about the same length; the exopod is 8-segmented; the 1st to 7th segments each have a seta; the endopod has 6 setae on the outer lobe and 7 setae on the inner lobe. The mandible is well developed; the endopod has 1 seta on the 1st segment and 5 setae on the 2nd segment; the exopod has 6 setae; the gnathobase has 8 teeth including an inner marginal spine. The 1st maxilla has the following number of setae on the various lobes: 9 on the outer lobe, 7 on the much elongated exopod, 3 on the endopod and 2nd basal segment, 1 on the 3rd inner lobe, 2 on the 2nd inner lobe, 11 on the 1st inner lobe. The 2nd maxilla has the following number of setae on the lobes and endopod:

|       |   |   |   |   |   |   |    |
|-------|---|---|---|---|---|---|----|
| lobe  | 1 | 2 | 3 | 4 | 5 | 6 | Ri |
| setae | 3 | 2 | 2 | 3 | 2 | 3 | 8  |

The maxilliped has the following number of setae on the lobes and endopod:

| lobe  | B1 |   |   | B2 |   | segment | Ri |   |   |   |   |
|-------|----|---|---|----|---|---------|----|---|---|---|---|
|       | 1  | 2 | 3 | 1  | 2 |         | 1  | 2 | 3 | 4 | 5 |
| setae | 1  | 3 | 3 | 2  | 2 |         | 4  | 3 | 3 | 2 | 3 |

Distal setae on the 2nd maxilla and maxilliped have button-like organs.

On the exopod of the 1st leg, the outer marginal spine of the 2nd segment extends beyond the base of the 2nd marginal spine on the 3rd segment. On the 5th leg the

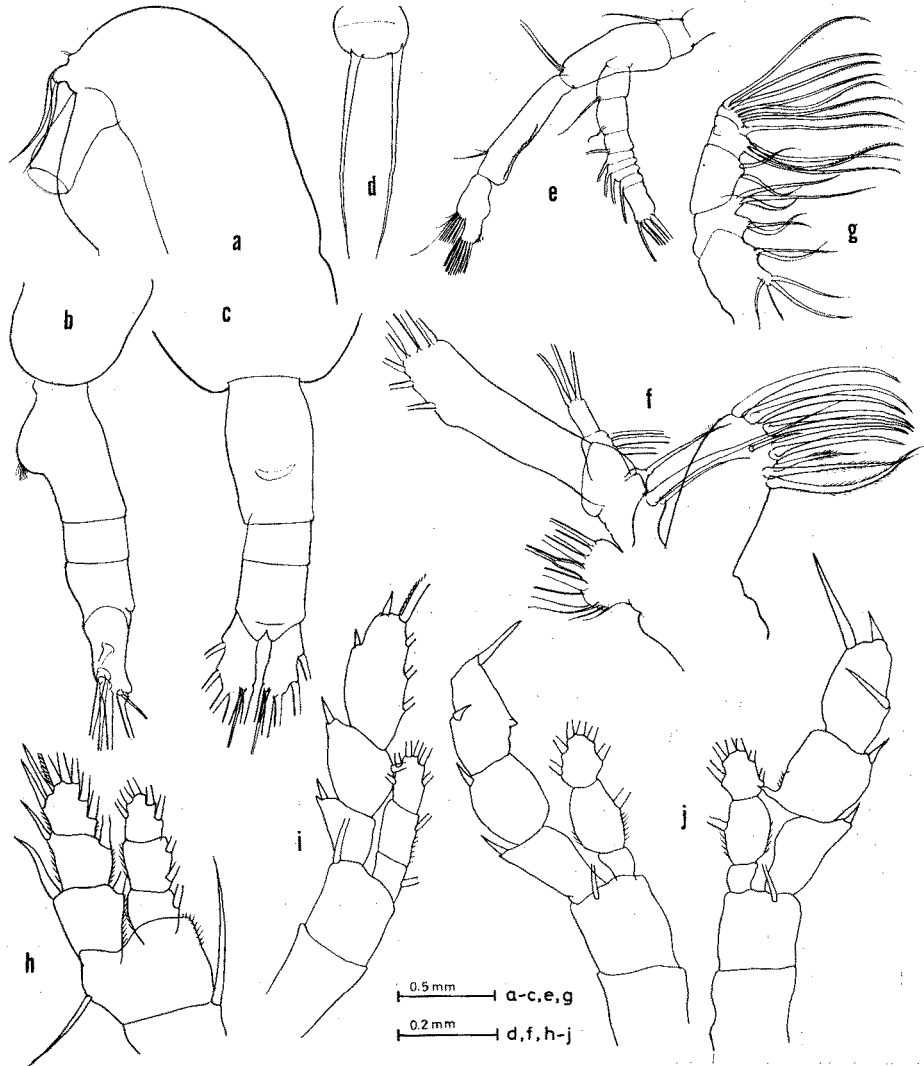


Fig. 6. *Euaugetilus elongatus*, female: a, head, lateral view; b, abdomen, lateral view; c, the same, dorsal view; d, rostrum; e, 2nd antenna; f, 1st maxilla; g, 2nd maxilla; h, 1st leg; i, 5th leg, male; j, 5th leg.

2nd basal segment has a very long seta which is about twice the length of the exopod.

Male, 5.70 mm. The cephalothorax and abdomen have proportional lengths 72:28. The abdominal segments and furca have the following proportional lengths:

| segment | 1  | 2  | 3  | 4  | 5  | furca |      |
|---------|----|----|----|----|----|-------|------|
|         | 19 | 15 | 14 | 12 | 14 | 26    | =100 |

The furca is about 3 times as long as wide.

The left 1st antenna is modified; the articulation lies between segments 17 and 18; segment 18, 19 and 20 are fused. The mouth appendages have a structure similar to those of the female. The 5th pair of legs agree with the figure given by Sars (1925).

*Remarks:* Sars' (1925) specimen shows that the 2nd maxilla has 3, 2, 2, 2, 2, and 3 setae on the 1st to 6th lobes respectively, but all 3 specimens of the present collection have 3, 2, 2, 3, 2, and 3 setae. This is the first record of occurrence in Japanese waters.

*Distribution and size variation:*

| Author                      | Locality             | Depth (m) | Length (mm) |      |
|-----------------------------|----------------------|-----------|-------------|------|
|                             |                      |           | ♀           | ♂    |
| Farran, 1908                | Irish Atlantic slope | 0-1080    | —           | —    |
| Sars, 1925                  | off Morocco          | 0-1800    | 6.70        | —    |
| Wilson, 1936                | Bermuda area         | 0-1800    | —           | —    |
| Lysholm and Nordgaard, 1945 | 30°08'N, 31°19'W     | 500-1000  | —           | —    |
| Sewell, 1947                | Arabian Sea          | 0-850     | 5.00        | —    |
| Wilson, 1950                | off Fiji Is.         | 0-72      | —           | —    |
| Vervoort, 1965              | Gulf of Guinea       | 0-600     | 5.30        | —    |
| Roe, 1972                   | off Canary Is.       | 720       | 5.28-6.72   | —    |
| <i>Present record</i>       | Izu region           | 0-1100    | 5.70-6.00   | 5.70 |

*Euaugaptilus facilis* (Farran, 1908)

(Figs. 3e, 7a-g)

*Augaptilus facilis* Farran, 1908, p. 73, pl. 3, figs. 23, 24, pl. 8 figs. 1-6; Wolfenden, 1911, p. 343, text-fig. 75, pl. 38 figs. 1, 2.

*Euaugaptilus facilis* (Farran).—Sars, 1925, p. 273, pl. 86; Tanaka, 1964b, p. 62, fig. 204.

*Occurrence:* Sta. 108, 1 ♀; Sta. 115-2, 1 ♀; Sta. 121-2, 1 ♀.

*Remarks:* This species can be easily identified by the characteristic structure of the 3rd and 4th legs. The following specific features are observed in the present specimens. The rostral protuberance is large and has a pair of small filaments. The furca is 1.8 times as long as wide. The 1st antenna, 7.97 mm in length, extends beyond the end of the furca by 6 segments. The 1st maxilla has the following number of setae on the various lobes: 4 on the outer lobe, 3 on the exopod, 1 on the 2nd basal segment, 1 on the 2nd inner lobe, and 8 on the 1st inner lobe. The 2nd maxilla has



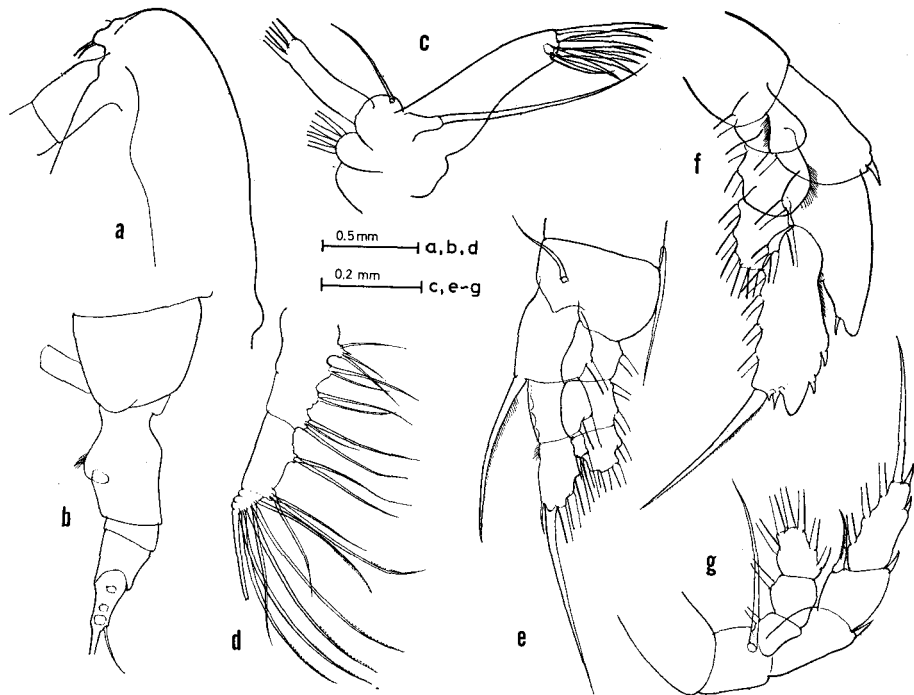


Fig. 7. *Euaugaptilus facilis*, female: a, head, lateral view; b, last thoracic segment and abdomen, lateral view; c, 1st maxilla; d, 2nd maxilla; e, 1st leg; f, 4th leg; g, 5th leg.

the following number of setae on the lobes and endopod:

| lobe  | 1 | 2 | 3 | 4 | 5 | 6 | Ri |
|-------|---|---|---|---|---|---|----|
| setae | 3 | 2 | 2 | 3 | 2 | 3 | 7  |

Distal setae are fringed with delicate button-like organs. On the 3rd and 4th legs the outer distal margin of the 2nd and 3rd segments of the exopod is produced into rounded lobe. The 5th leg has 2 marginal spines on the 3rd segment of the exopod, as figured by Sars (1925).

*Distribution and size variation:*

| Author                    | Locality                         | Depth (m) | Length (mm) |      |
|---------------------------|----------------------------------|-----------|-------------|------|
|                           |                                  |           | ♀           | ♂    |
| Farran, 1908              | Irish Atlantic slope             | 0-1220    | 5.4         | —    |
| Wolfenden, 1911           | between St. Helena and Ascension | 0-200     | 4.0         | —    |
| Sars, 1925                | off Canary Is.                   | 0-300     | 5.90        | —    |
| Sewell, 1932              | Laccadive Sea                    | 0-1280    | —           | —    |
| Sewell, 1947              | Arabian Sea                      | 0-850     | —           | —    |
| Wilson, 1950              | near Galapagos Is                | 0-550     | —           | —    |
| Tanaka, 1964b             | Sagami Bay                       | 0-1000    | 5.78        | —    |
| Vervoort, 1965            | Gulf of Guinea                   | 0-600     | 4.90-5.28   | —    |
| Grice and Hulsemann, 1967 | Arabian Sea                      | 1050-1980 | —           | —    |
| Roe, 1972                 | off Canary Is.                   | 940       | 5.17-5.76   | 4.86 |
| <i>Present record</i>     | Izu region                       | 0-1000    | 5.72-5.91   | —    |

*Euaugaptilus fecundus* sp. nov.

(Figs. 1j, 8a-k)

*Occurrence:* Sta. 117-1, 1 ♀.

*Descriptive notes:* Female, 5.82 mm. The cephalothorax and abdomen have proportional lengths 80:20. The cephalothorax is 2.5 times as long as wide. In lateral view the frontal margin of the head is evenly rounded; the distal margin of the thoracic segment is narrowly rounded. The rostrum is composed of 2 short spines.

The abdominal segments and furca have the following proportional lengths:

|         |     |    |    |       |      |
|---------|-----|----|----|-------|------|
| segment | 1-3 | 4  | 5  | furca |      |
|         | 40  | 13 | 20 | 27    | =100 |

The genital segment is about as long as wide; the genital protuberance is large, with hairs in front of the aperture; the furca is twice as long as wide.

The 1st antenna, 6.40 mm in length, extends beyond the end of furca by 2 segments; the segments have the following proportional lengths:

|         |    |    |    |    |    |    |    |    |    |       |    |    |    |    |    |
|---------|----|----|----|----|----|----|----|----|----|-------|----|----|----|----|----|
| segment | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10    | 11 | 12 | 13 | 14 | 15 |
|         | 80 | 24 | 30 | 30 | 30 | 30 | 30 | 29 | 36 | 39    | 42 | 48 | 54 | 53 | 51 |
| 16      | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |       |    |    |    |    |    |
| 51      | 50 | 50 | 40 | 30 | 30 | 29 | 38 | 38 | 38 | =1000 |    |    |    |    |    |

It is noticeable that the distal 3 segments are about the same length.

The endopod of the 2nd antenna is 2.6 times as long as the exopod; the exopod is 8-segmented and has 8 seta in all the 1st and 3rd segments lack a seta; the endopod has 5 setae on the outer lobe and 3 long and 4 small setae on the inner lobe. The endopod of mandible is entirely absent; the exopod is 5-segmented; the gnathobase has 7 teeth and a strong inner marginal spine. The 1st maxilla has the following number of setae on the various lobes: 3 long on the outer lobe, 2 on the exopod, 6 on the 1st inner lobe; the 2nd basal segment is considerably reduced and has a small process; the 2nd and 3rd inner lobes are absent. The 2nd maxilla is very characteristic in the number of setae on the lobes and endopod:

|       |   |   |   |   |   |   |    |
|-------|---|---|---|---|---|---|----|
| lobe  | 1 | 2 | 3 | 4 | 5 | 6 | Ri |
| setae | 1 | 0 | 0 | 2 | 0 | 2 | 19 |

The two basal segments of the maxilliped are about the same length; the number of setae on the lobes and endopod is as follows:

|       |    |   |    |   |   |         |   |   |   |   |   |
|-------|----|---|----|---|---|---------|---|---|---|---|---|
|       | B1 |   | B2 |   |   | Ri      |   |   |   |   |   |
| lobe  | 1  | 2 | 3  | 1 | 2 | segment | 1 | 2 | 3 | 4 | 5 |
| setae | 0  | 0 | 2  | 2 | 2 |         | 4 | 4 | 3 | 3 | 3 |

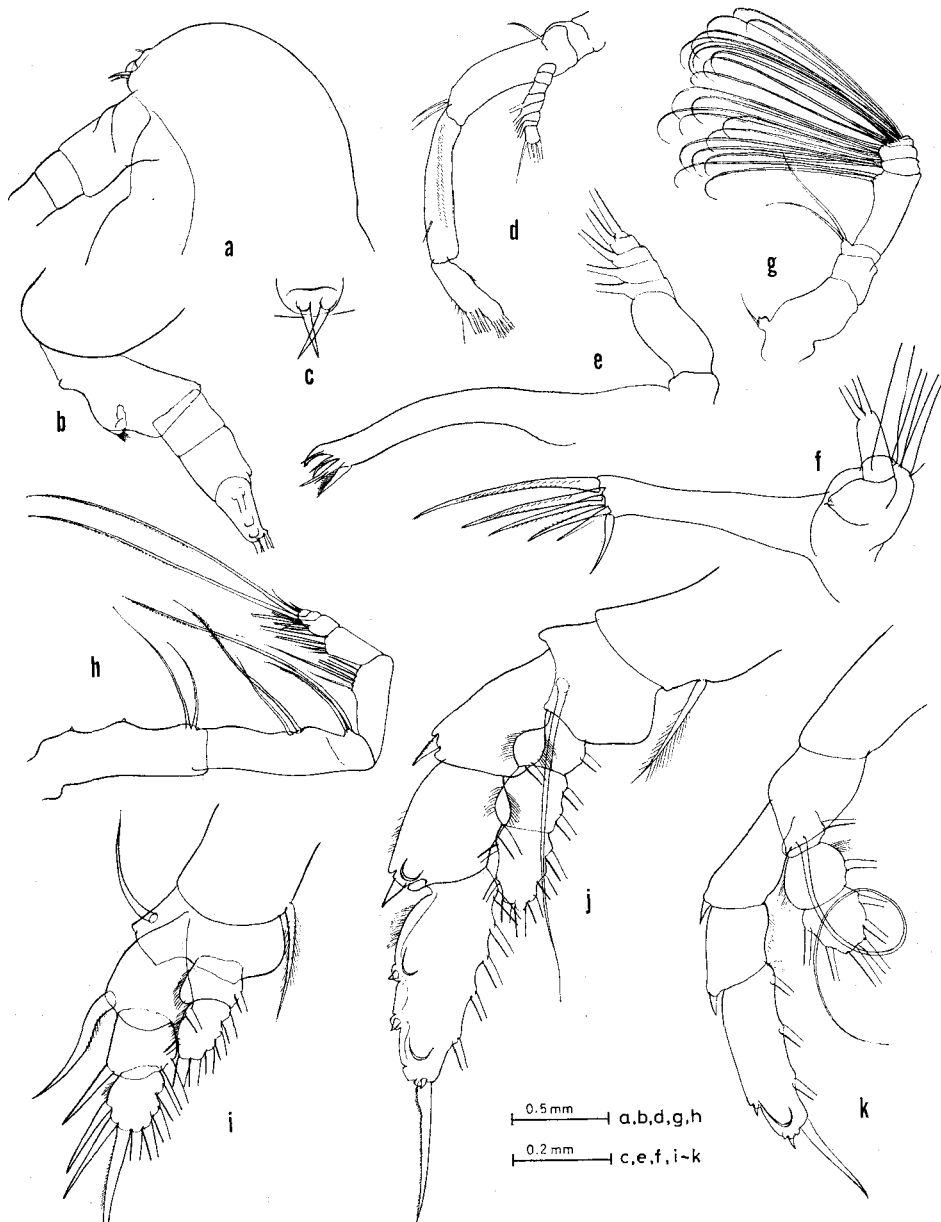


Fig. 8. *Euangaptilus fecundus*, sp. nov., female: a, head, lateral view; b, last thoracic segment and abdomen, lateral view; c, rostrum; d, 2nd antenna; e, mandible; f, 1st maxilla; g, 2nd maxilla; h, maxilliped; i, 1st leg; j, 4th leg; k, 5th leg.

Distal setae on the 2nd maxilla and maxilliped are fringed with delicate buttons.

The 1st leg has a 3-segmented exopod and 2-segmented endopod; the outer marginal spine on the 1st segment of the exopod reaches the distal margin of the 3rd segment of the exopod; other outer marginal spines on the exopod are long. The 2nd to 4th legs each have a 3-segmented exopods and endopods. The endopod of the 2nd leg has 6 setae on the 3rd segment; the 3rd and 4th legs both have 7 setae on the same segment. On the 3rd leg the 2nd segment of the exopod has a ridge, rounded in shape, near the base of the outer marginal spine; the 3rd segment has 3 ridges near the base of the outer marginal spines. The 4th leg has 2 similar ridges, one at the base of the proximal outer marginal spine, and the another near the distal margin of the 3rd segment of the exopod; the seta on the 2nd basal segment is long. On the 5th leg the ridge is found near the distal margin of the 3rd segment of the exopod; the seta on the 2nd basal segment is longer than the exopod.

*Remarks:* This species belongs to group IV, but is easily distinguished from the other members of the group by the structure of the mandibular palp and the number of setae on the 1st and 2nd maxillae. The structure of the 1st to 5th swimming legs is also characteristic.

*Euaugaptilus filigerus* (Claus, 1863)

(Figs. 2b, 9a, b)

*Hemicalanus filigerus* Claus, 1863, p. 179.

*Augaptilus filigerus* (Claus).—Giesbrecht, 1892, p. 400, pl. 3 fig. 3, pl. 27 fig. 34, pl. 28, figs. 4, 10, 13, 14, 20, 26, 29, 36, pl. 29 fig. 26, pl. 39 fig. 49; Wilson, 1932, p. 135, fig. 92.

*Euaugaptilus filiger (us)* (Claus).—Sars, 1925, p. 279, pl. 90; Rose, 1937, p. 165, figs. 7–12; Tanaka, 1964b, p. 51, fig. 198; Vervoort, 1965, p. 137.

*Augaptilus depressus* Esterly, 1913, p. 187, figs. 11, 20, 26, 33, 38, 42, 44, 54.

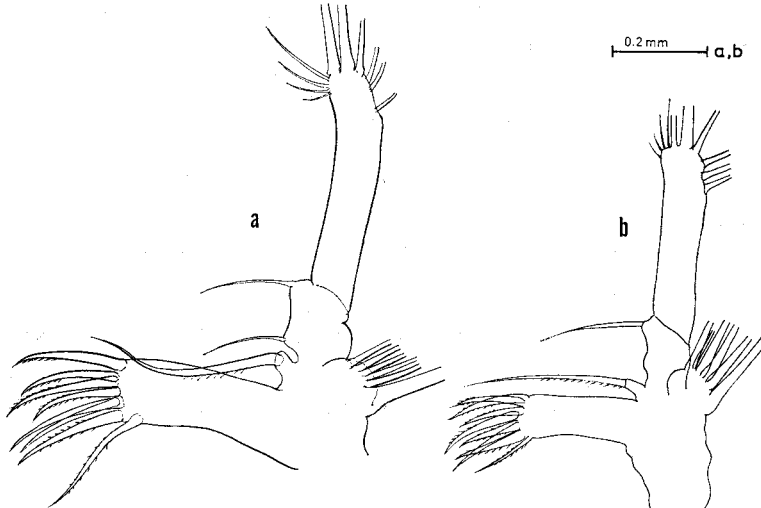


Fig. 9. *Euaugaptilus filigerus*, female; a, 1st maxilla; b, the same (5.30 mm).

*Occurrence:* Sta. 83, 1 ♀; Sta. 84-2, 1 ♀; Sta. 107, 2 ♀; Sta. 108, 4 ♀; Sta. 109, 1 ♀; Sta. 111-1, 1 ♀; Sta. 114, 4 ♀; Sta. 115-1, 2 ♀; Sta. 115-2, 1 ♂; Sta. 117-2, 1 ♀; Sta. 121-1, 1 ♀.

*Remarks:* Although the body length of the present female specimens varies from 5.15 to 7.64 mm, there is no structural difference between the small and large specimens. The 1st maxilla has the following number of setae on the various lobes: 6 on the outer lobe, 10 on the exopod, of which the distal 3 are very long, 1 on the 2nd basal segment, 1 on each of the 2nd and 3rd inner lobes, and 8 on the 1st inner lobe. However, a female 5.30 mm in length, has a 1st maxilla which lacks a seta on the 3rd inner lobe (Fig. 9b). The 2nd maxilla has the following number of setae on the lobes and endopod:

| lobe  | 1 | 2 | 3 | 4 | 5 | 6 | Ri |
|-------|---|---|---|---|---|---|----|
| setae | 1 | 1 | 2 | 3 | 2 | 3 | 7  |

*Distribution and size variation:*

| Author                | Locality                         | Depth (m) | Length (mm) |           |
|-----------------------|----------------------------------|-----------|-------------|-----------|
|                       |                                  |           | ♀           | ♂         |
| Giesbrecht, 1892      | Mediterranean Sea                | —         | 4.9         | 4.1-4.5   |
| Esterly, 1913         | San Diego region                 | —         | 5.3         | —         |
| Sars, 1925            | North of Azores Is.              | 0-1200    | 6.80        | —         |
| Farran, 1929          | off New Zealand                  | 0-100     | 5.75        | —         |
| Sewell, 1932          | off Maldive Is.                  | 0-366     | 6.6         | —         |
| Wilson, 1932          | off Long Is.                     | —         | 4.5-4.9     | 4-4.5     |
| Farran, 1936          | Outside of Great<br>Barrier Reef | 0-600     | 5.40        | —         |
| Rose, 1937            | off Alger                        | 0-400     | 5.10        | —         |
| Tanaka, 1964b         | Sagami Bay                       | 0-1000    | 5.02        | 4.14      |
| Vervoort, 1965        | Gulf of Guinea                   | 125-600   | 4.50-6.57   | 4.50-5.30 |
| Roe, 1972             | off Canary Is.                   | 150-720   | 5.24-7.20   | 4.80-5.76 |
| <i>Present record</i> | Izu region                       | 0-680     | 5.15-7.64   | 4.58      |

*Euaugaptilus gracilis* (Sars, 1905)

(Figs. 1b, 10a-j)

*Augaptilus gracilis* Sars, 1905, p. 12.

*Euaugaptilus gracilis* (Sars).—Sars, 1925, p. 278, pl. 89; Grice and Hulsemann, 1967, p. 18.

*Occurrence:* Sta. 146-5 (30°15'N, 135°49'E), 1 ♀.

*Descriptive notes:* Female, 6.20 mm. The cephalothorax and abdomen have proportional lengths 74:26. The rostrum has 2 small filaments. The abdominal segments and furca have the following proportional lengths:

| segment | 1-3 | 4 | 5  | furca  |
|---------|-----|---|----|--------|
|         | 47  | 9 | 19 | 25=100 |

The genital segment is 1.7 times as long as wide; the genital protuberance is small the furca is 3.5 times as long as wide.

The 1st antenna, 7.51 mm in length, extends beyond the end of the furca by 4 segments; the segments have the following proportional lengths:

|         |    |    |    |    |    |    |    |    |    |    |       |    |    |    |    |
|---------|----|----|----|----|----|----|----|----|----|----|-------|----|----|----|----|
| segment | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11    | 12 | 13 | 14 | 15 |
|         | 48 | 9  | 16 | 20 | 20 | 23 | 27 | 27 | 33 | 37 | 43    | 53 | 53 | 53 | 49 |
|         | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |       |    |    |    |    |
|         | 50 | 52 | 52 | 58 | 52 | 52 | 47 | 48 | 47 | 31 | =1000 |    |    |    |    |

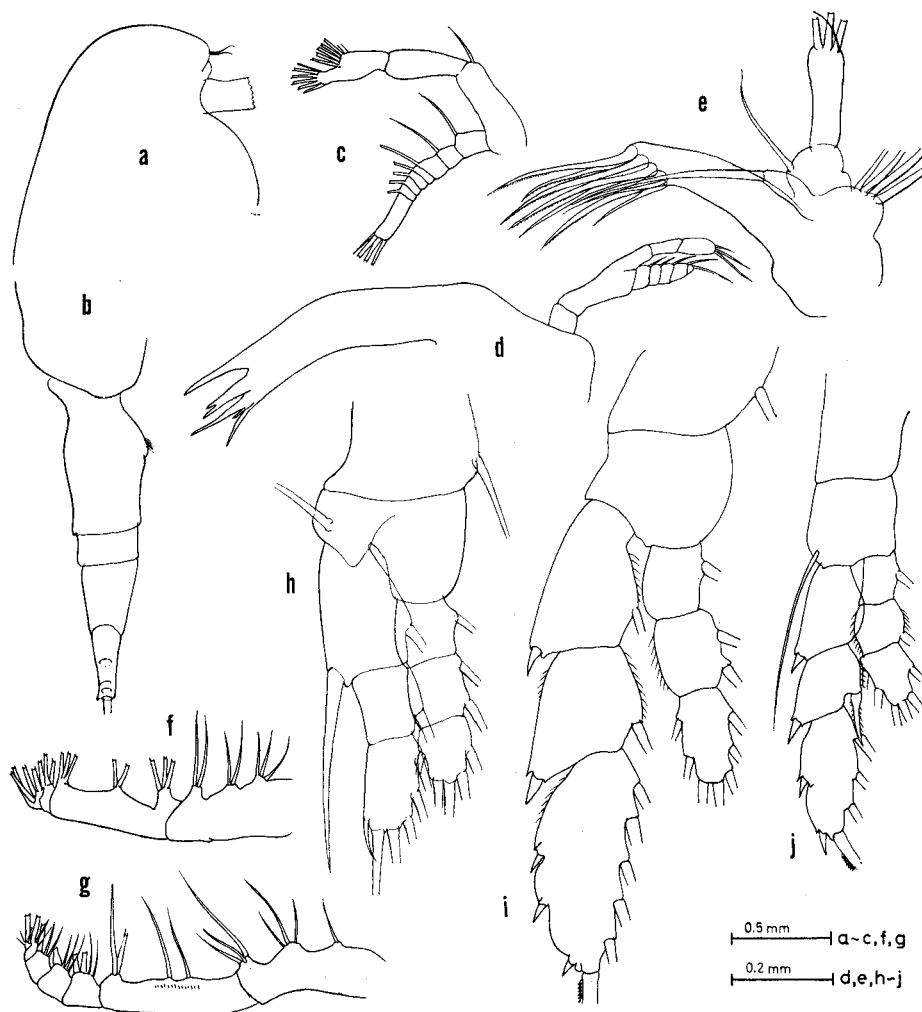


Fig. 10. *Euaugaptilus gracilis*, female: a, head, lateral view; b, last thoracic segment and abdomen, lateral view; c, 2nd antenna; d, mandible; e, 1st maxilla; f, 2nd maxilla; g, maxilliped; h, 1st leg; i, 4th leg; j, 5th leg.

The endopod of the 2nd antenna is 1.3 times the length of the exopod; the endopod has 6 setae on the outer lobes and 5 large and 2 minute setae on the inner lobe; the exopod is 8-segmented; the 1st to 7th segments each have 1 seta, and the 8th has 4 terminal setae. The mandible has a slender palp; the exopod is 5-segmented and has 5 setae in all; the endopod has 4 terminal setae on the 2nd segment. In the outer lobe of the 1st maxilla has 3 setae on the left side and 4 setae on the right side; the exopod has 3+1 setae; the 2nd basal segment has 1 seta; the 2nd inner lobe has 1 seta; the 1st inner lobe has 8 setae. The 2nd maxilla has the following number of setae on the lobes and endopod:

|       |   |   |   |   |   |   |    |
|-------|---|---|---|---|---|---|----|
| lobe  | 1 | 2 | 3 | 4 | 5 | 6 | Ri |
| setae | 3 | 2 | 2 | 3 | 2 | 3 | 7  |

Distal setae have delicate button-like organs. The two basal segments of the maxilliped are about the same length; the lobes and endopod have the following number of setae:

|       |    |   |    |   |   |         |   |   |   |   |   |
|-------|----|---|----|---|---|---------|---|---|---|---|---|
|       | B1 |   | B2 |   |   | Ri      |   |   |   |   |   |
| lobe  | 1  | 2 | 3  | 1 | 2 | segment | 1 | 2 | 3 | 4 | 5 |
| setae | 1  | 3 | 3  | 2 | 2 |         | 4 | 4 | 3 | 3 | 4 |

Large distal setae have delicate button-like organs.

On the 1st leg the 1st segment of the exopod has a long marginal spine which extends beyond the tip of the 3rd segment of the exopod; the 2nd segment of the exopod lacks any spine; the 3rd segment has only 1 marginal spine. The 2nd to 4th leg are of usual structure. The 5th leg agrees with the figure given by Sars (1925).

*Remarks:* Although Sars (1925) figured the 2nd maxilla having only 1 seta on the 2nd lobe, there are 2 setae in the present specimen. *E. gracilis* has been reported from deep water of the temperate Atlantic and Indian Oceans. This is the first record of occurrence in the Pacific Ocean. Sampling data is given by Tanaka and Omori (1967).

*Distribution and size variation:*

| Author                      | Locality          | Depth     | Length (mm) |
|-----------------------------|-------------------|-----------|-------------|
| Sars, 1925                  | North Atlantic    | 0-1000    | 5.80        |
| Lysholm and Nordgaard, 1945 | North Atlantic    | 0-2000    | —           |
| Grice and Hulsemann, 1967   | Arabian Sea       | 2000-3000 | —           |
| <i>Present record</i>       | off Kii Peninsula | 1800-1900 | 6.20        |

*Euaugaptilus graciloides* Brodsky, 1950

(Figs. 3f, 11 a-n)

*Euaugaptilus graciloides* Brodsky, 1950, p. 381, fig. 270.

*Occurrence:* Sta. 115-2, 1 ♀.

*Descriptive notes:* Female, 6.70 mm. The cephalothorax and abdomen have proportional lengths 73:27. The cephalothorax is 2.6 times as long as wide. The head is slightly produced laterally. The lateral margin of the last thoracic segment is narrowly rounded. The rostral filaments are very fine and slender; they are not easy to see.

The abdominal segments and furca have the following proportional lengths:

|         |     |    |    |        |
|---------|-----|----|----|--------|
| segment | 1-3 | 4  | 5  | furca  |
|         | 45  | 10 | 18 | 27=100 |

The genital segment is 1.8 times as long as wide: the genital area is slightly produced ventrally; the furca is long, more than 3 times as long as wide.

The 1st antenna extends beyond the end of the furca by 4 segments; the right antenna and segment 25 of the left antenna are broken off; the left antenna is 8.53 mm in length except the segment 25; the segments have the following lengths measured in 0.01 mm.

|         |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|---------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| segment | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 |
|         | 44 | 12 | 16 | 16 | 20 | 20 | 22 | 25 | 28 | 30 | 35 | 44 | 45 | 46 | 42 |
| 16      | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |    |    |    |    |    |    |
| 44      | 44 | 45 | 50 | 47 | 46 | 41 | 48 | 43 | —  |    |    |    |    |    |    |

On the 2nd antenna the endopod is equal in length to the exopod; the exopod is 8-segmented; the 1st to 7th segments each have 1 seta; the endopod has 6 setae on the outer lobe and 8 setae on the inner lobe. The mandibular palp is slender; the exopod is longer than the endopod, and bears 5 setae; the endopod has 4 distal setae. The 1st maxilla has the following number of setae on the various lobes: 3+3 on the exopod, 1 on the 2nd basal segment, 1 on the 2nd inner lobe, and 8 on the 1st inner lobe: the outer lobe lacks setae. The 2nd maxilla has the following number of seta on the lobes and endopod:

|       |   |   |   |   |   |   |    |
|-------|---|---|---|---|---|---|----|
| lobe  | 1 | 2 | 3 | 4 | 5 | 6 | Ri |
| setae | 3 | 2 | 2 | 3 | 2 | 3 | 7  |

The two basal segments of the maxilliped are about the same length; the lobes and endopod have the following number of setae:

|      |    |   |    |   |   |         |   |   |   |   |   |
|------|----|---|----|---|---|---------|---|---|---|---|---|
|      | B1 |   | B2 |   |   | Ri      |   |   |   |   |   |
| lobe | 1  | 2 | 3  | 1 | 2 | segment | 1 | 2 | 3 | 4 | 5 |
|      | 1  | 3 | 3  | 2 | 2 |         | 4 | 4 | 3 | 3 | 3 |



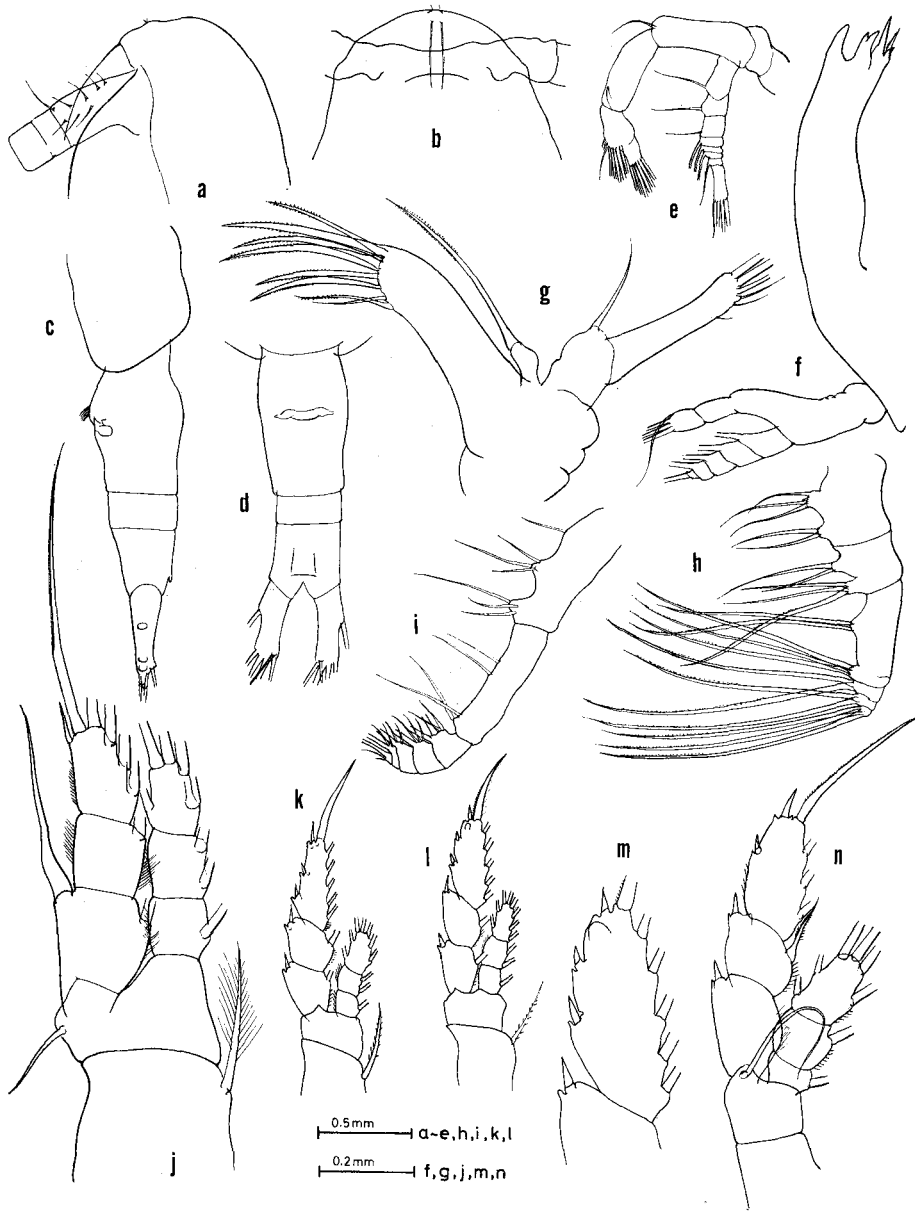


Fig. 11. *Euaugaptilus graciloides*, female: a, head, lateral view; b, the same, dorsal view; c, last thoracic segment and abdomen, lateral view; d, the same, dorsal view; e, 2nd antenna; f, mandible; g, 1st maxilla; h, 2nd maxilla; i, maxilliped; j, 1st leg; k, 2nd leg; l, 3rd leg; m, 3rd exopodal segment of 4th leg; n, 5th leg.

Certain setae on the 2nd maxilla and maxilliped are fringed with delicate buttons.

On the 1st leg the 1st exopodal segment has a long outer marginal spine which extends to the end of the 3rd exopodal segment the 2nd segment of the exopod lacks a spine; the 3rd segment has 1 spine on the outer distal margin; the 2nd basal segment has an outer marginal seta. The 3rd and 4th legs each have a round swelling at the distal part of the 3rd exopodal segment. The 5th legs have a structure similar to that of *E. gracilis*.

*Remarks:* As the description and figures of the type specimen (Brodsky, 1950) are not complete, we referred partially to the results of re-examination by Matthews (1972: table 5). The present specimen differs from the Brodsky's in the existence of an outer marginal spine on the 3rd exopodal segment of the 1st leg. The type specimen lacks the outer marginal spine on the 3rd exopodal segment of the 1st leg. This species closely resembles *E. gracilis*, but is easily separated from it by the delicate rostral filaments and the absence of setae on the outer lobe in the 1st maxilla.

*Distribution and size variation:*

| Author                | Locality             | Depth (m) | Length (mm) |   |
|-----------------------|----------------------|-----------|-------------|---|
|                       |                      |           | ♀           | ♂ |
| Brodsky, 1950         | Northwestern Pacific | 1000-4000 | 6.4         |   |
| <i>Present record</i> | Izu region           | 0-2500    | 6.70        |   |

*Euaugaptilus hecticus* (Giesbrecht, 1899)

(Fig. 2a)

*Augaptilus hecticus* Giesbrecht, 1889, p. 814; Giesbrecht, 1892, p. 400, pl. 1 fig. 3, pl. 27 fig. 30, pl. 28 figs. 5, 9, 16, 30, 33, 37, pl. 29 fig. 18, pl. 39 fig. 45.

*Euaugaptilus hecticus* (Giesbrecht).—Wilson, 1950, p. 205, pl. 21 figs. 297, 299; Tanaka, 1964b, p. 71, fig. 209.

*Occurrence:* Sta. 98, 1 ♀.

*Remarks:* This species can be distinguished easily from other members of the genus by its slender body, characteristic shape of the genital segment and longer inner furcal seta. Both rami of the 5th leg of female are 2-segmented.

*Distribution and size variation:*

| Author                | Locality          | Depth (m) | Length (mm) |           |
|-----------------------|-------------------|-----------|-------------|-----------|
|                       |                   |           | ♀           | ♂         |
| Giesbrecht, 1892      | Gulf of Naples    | —         | 2.45-2.75   | 2.4       |
| A. Scott, 1909        | Malay Archipelago | 0-750     | —           | —         |
| Wolfenden, 1911       | Tropical Atlantic | 0-1200    | —           | —         |
| Farran, 1926          | Bay of Biscay     | 270-630   | 2.85        | 2.4       |
| Farran, 1929          | off New Zealand   | 30        | —           | 2.28      |
| Sewell, 1932          | Laccadive Sea     | 0-1281    | —           | —         |
| Wilson, 1950          | off Easter Is.    | 0-540     | —           | —         |
| Tanaka, 1964b         | Sagami Bay        | 0-1000    | 2.63        | 2.28      |
| Owre and Foyo, 1967   | Florida Current   | 82-350    | —           | —         |
| Roe, 1972             | off Canary Is.    | 40-400    | 2.36-2.74   | 2.28-2.43 |
| <i>Present record</i> | Izu region        | 0-970     | 2.66        | —         |

*Euaugaptilus ? humilis* Farran, 1926

(Figs. 1a, 12 a-j)

*Euaugaptilus humilis* Farran, 1926, p. 289, pl. 10 figs. 4-10; Grice, 1963, p. 498, fig. 1 h-j.*Occurrence:* Sta. 111-1, 1 ♀.*Descriptive notes:* Female, 1.63 mm. The cephalothorax and abdomen have proportional lengths 77:23. The rostral filaments are slender. The abdominal segment and furca have the following proportional lengths:

segment 1-3 4 5 furca 47 16 16 21=100

The genital segment is symmetrical; the furcae are equal in length.

The 1st antenna, 1.95 mm in length, extends beyond the end of furca by 4 segments; the segments have the following proportional lengths:

|         |    |    |    |    |    |    |    |    |         |    |    |    |    |    |    |
|---------|----|----|----|----|----|----|----|----|---------|----|----|----|----|----|----|
| segment | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9       | 10 | 11 | 12 | 13 | 14 | 15 |
|         | 54 | 20 | 30 | 23 | 25 | 25 | 30 | 30 | 32      | 32 | 40 | 48 | 55 | 54 | 53 |
| 16      | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25      |    |    |    |    |    |    |
| 49      | 48 | 50 | 48 | 38 | 40 | 38 | 50 | 48 | 40=1000 |    |    |    |    |    |    |

The endopod of the 2nd antenna is 1.6 times as long as the exopod which is 7-segmented; the setae arising from the 4th and 5th segments are strong; the endopod has 4 setae each on the outer and inner lobes. The mandibular palp is slender; the endopod is a little longer than the exopod, and bears 6 setae on the distal segment. The 1st maxilla has the following number of setae on the various lobes: 6 on the outer lobe, 8 on the exopod, 4 on the endopod, 3 on the 2nd basal segment, 1 on the 3rd inner lobe, 1 on the 2nd inner lobe, and 8 on the 1st inner lobe. The 2nd maxilla has the following number of setae on the lobes and endopod:

|       |   |   |   |   |   |   |    |
|-------|---|---|---|---|---|---|----|
| lobe  | 1 | 2 | 3 | 4 | 5 | 6 | Ri |
| setae | 3 | 2 | 2 | 3 | 2 | 2 | 7  |

The two basal segments of the maxilliped are about the same length; the lobes and endopod have the following number of setae:

|       |    |   |    |   |   |         |   |   |   |   |   |
|-------|----|---|----|---|---|---------|---|---|---|---|---|
|       | B1 |   | B2 |   |   | Ri      |   |   |   |   |   |
| lobe  | 1  | 2 | 3  | 1 | 2 | segment | 1 | 2 | 3 | 4 | 5 |
| setae | 1  | 3 | 3  | 2 | 2 |         | 4 | 4 | 3 | 3 | 4 |

Distal setae on the 2nd maxilla and maxilliped are fringed with delicate buttons.

Both rami of the 1st to 5th legs are 3-segmented. On the 1st leg the outer marginal spine of the 1st exopodal segment extends to the base of the 2nd outer marginal spine on the 3rd segment; there is a small projection at the base of outer marginal

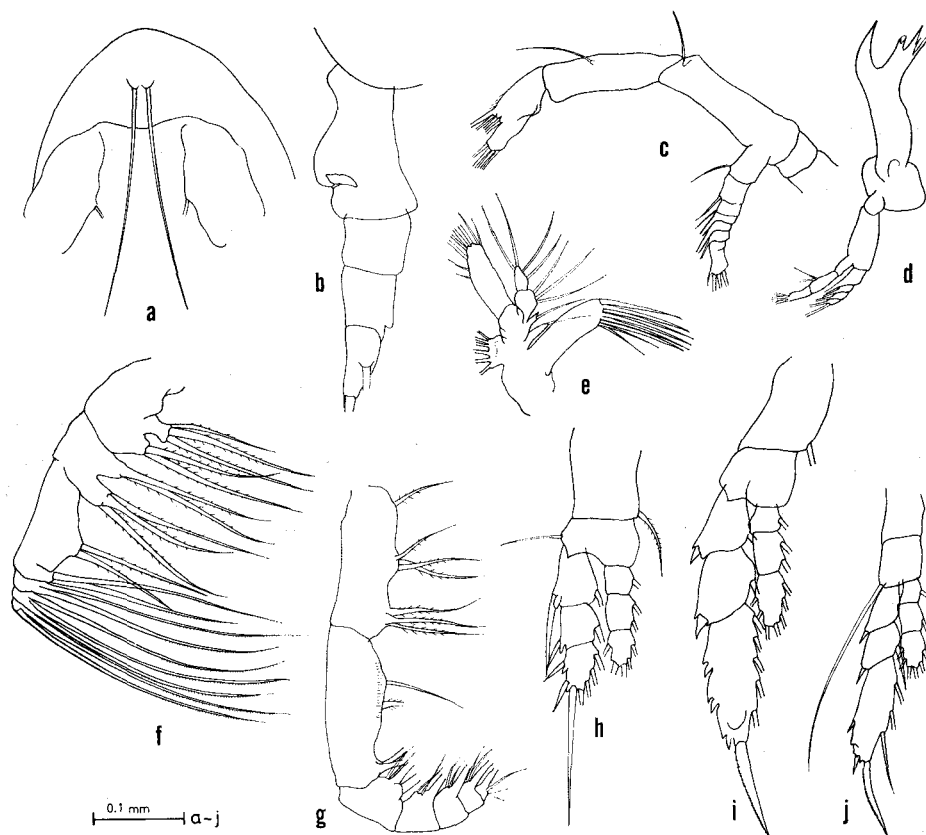


Fig. 12. *Euaugaptilus humilis*, female: a, head, ventral view; b, last thoracic segment and abdomen, lateral view; c, 2nd antenna; d, mandible; e, 1st maxilla; f, 2nd maxilla; g, maxilliped; h, 1st leg; i, 4th leg; j, 5th leg.

spines of the exopod. The 3rd and 4th legs each have a round swelling at the distal part of the 3rd exopodal segment. On the 5th leg the 2nd basal segment bears a long seta which extends slightly beyond the tip of the 3rd segment of the exopod.

*Remarks:* The present specimen agrees more closely with the description of Grice's (1963) specimens from the western North Atlantic than that of Farran's (1926) type specimen. Farran's specimen lacks rostral filaments and the 2nd inner lobe of the 1st maxilla: there are no button-like organs on the setae of the 2nd maxilla and maxilliped. There is a possibility that these parts were overlooked by Farran. The male is unknown. This is the first record of occurrence in the Pacific Ocean.

*Distribution and size variation:*

| Author       | Locality              | Depth (m) | Length (mm) |
|--------------|-----------------------|-----------|-------------|
| Farran, 1926 | Bay of Biscay         | 640       | 1.54        |
| Grice, 1963  | Northwestern Atlantic | 600-1000  | 1.52, 1.84  |

|                           |                               |          |      |
|---------------------------|-------------------------------|----------|------|
| Grice and Hulsemann, 1967 | Western North<br>Indian Ocean | 750-2000 | —    |
| Park, 1970                | Caribbean Sea                 | 980-1900 | —    |
| Roe, 1972                 | off Canary Is.                | 720      | 1.67 |
| <i>Present record</i>     | Izu region                    | 0-1000   | 1.63 |

*Euaugaptilus hyperboreus* Brodsky, 1950

(Figs. 1c, 13a-o)

*Euaugaptilus hyperboreus* Brodsky, 1950, p. 383, fig. 272.

*Occurrence*: Sta. 107, 1 ♀; Sta. 115-2, 3 ♀, 1 ♂; Sta. 121-2, 2 ♀.

*Descriptive notes*: Female, 7.35 mm. The general appearance resembles that of *E. elongatus* Sars. The cephalothorax and abdomen have proportional lengths 74:26. The cephalothorax is 3 times as long as wide. The frontal margin of the head is broadly rounded and slightly constricted on the dorsal surface when viewed laterally. The lateral distal margin of the thoracic segment is narrowly rounded. The rostral filaments are very slender.

The abdominal segments and furca have the following proportional lengths:

|         |     |    |    |        |
|---------|-----|----|----|--------|
| segment | 1-3 | 4  | 5  | furca  |
|         | 47  | 11 | 14 | 28=100 |

The genital segment is 1.6 times as long as wide; the genital protuberance is produced ventrally the furca is 2.2 times as long as wide.

The 1st antenna, 8.51 mm in length, extends beyond the end of the furca by 3 segments; the proportional lengths of the segments are as follows:

|         |    |    |    |    |    |    |    |    |         |    |    |    |    |    |    |
|---------|----|----|----|----|----|----|----|----|---------|----|----|----|----|----|----|
| segment | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9       | 10 | 11 | 12 | 13 | 14 | 15 |
|         | 69 | 15 | 19 | 22 | 27 | 26 | 29 | 24 | 35      | 30 | 35 | 43 | 46 | 48 | 51 |
| 16      | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25      |    |    |    |    |    |    |
| 51      | 56 | 61 | 55 | 46 | 46 | 43 | 48 | 43 | 32=1000 |    |    |    |    |    |    |

The endopod of the 2nd antenna is 1.4 times as long as the exopod; the exopod is 8-segmented; the 1st to 7th segments each have a marginal seta; the endopod has 8 setae on the outer lobe and 6 setae on the inner lobe. The mabidbular palp is small; the both rami are of about equal length; the gnathobase has 6 teeth including marginal seta; the setting of the teeth is more transverse than that of *E. elongatus*. The 1st maxilla has the following number of setae on the various lobes: 9 on the outer lobe, 7 on the exopod, 2 on the endopod, 4 on the 2nd basal segment, 2 and a minute spine on the 3rd inner lobe, 2 on the 2nd inner lobe, and 11 on the 1st inner lobe. The 2nd maxilla has the following number of setae on the lobes and endopod:

|       |   |   |   |   |   |   |    |
|-------|---|---|---|---|---|---|----|
| lobe  | 1 | 2 | 3 | 4 | 5 | 6 | Ri |
| setae | 3 | 2 | 2 | 3 | 3 | 4 | 15 |

The two basal segments of the maxilliped are about the same length; there is knob-like projection on the lower posterior margin of the 1st basal segment; the setation on the lobes and endopod is as follows:

|       |    |   |    |   |   |         |   |   |   |   |   |
|-------|----|---|----|---|---|---------|---|---|---|---|---|
|       | B1 |   | B2 |   |   | Ri      |   |   |   |   |   |
| lobe  | 1  | 2 | 3  | 1 | 2 | segment | 1 | 2 | 3 | 4 | 5 |
| setae | 1  | 3 | 3  | 2 | 2 |         | 4 | 4 | 3 | 1 | 3 |

Distal setae are fringed with small button-like organs.

The 2nd basal segment of the 1st leg has an outer marginal seta; the outer marginal spine of the 2nd exopodal segment does not extend beyond the base of 2nd outer spine of the 3rd segment; there is a rugged ridge on the base of outer spines on the 2nd and 3rd segments. The 5th leg has a long seta on the 2nd basal segment.

Male, 5.45 mm. The cephalothorax and abdomen have proportional lengths 74:26. The cephalothorax is 2.9 times as long as wide.

The abdominal segments and furca have the following proportional lengths:

|         |    |    |    |   |    |       |      |
|---------|----|----|----|---|----|-------|------|
| segment | 1  | 2  | 3  | 4 | 5  | furca |      |
|         | 22 | 14 | 12 | 9 | 14 | 29    | =100 |

The furca is 2.4 times as long as wide.

The left 1st antenna, 6.62 mm in length, extends beyond the end of the furca by distal 2 segments; the segments have the following proportional lengths:

|         |    |    |    |    |    |    |    |    |    |       |    |    |    |    |    |
|---------|----|----|----|----|----|----|----|----|----|-------|----|----|----|----|----|
| segment | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10    | 11 | 12 | 13 | 14 | 15 |
|         | 61 | 20 | 22 | 27 | 26 | 29 | 27 | 27 | 33 | 29    | 33 | 41 | 45 | 45 | 47 |
| 16      | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |       |    |    |    |    |    |
| 50      | 59 | 62 | 53 | 44 | 45 | 44 | 53 | 47 | 31 | =1000 |    |    |    |    |    |

The right antenna is modified; the articulation lies between the segments 17 and 18; the anterior margin of the segments 16 and 17 are coarsely serrated.

The mouth appendages and the 1st to 4th swimming legs are quite similar to those of the female. The 5th pair of legs has a 3-segmented exopod and endopod; the terminal spine on the exopod of the right leg is equal in length to that of the 3rd segment of the exopod; the terminal spine on the exopod of the left leg is half the length of the 3rd segment of the exopod.

*Remarks:* This species closely resembles *E. elongatus* but can be distinguished from it by the slender rostral filaments, number of setae on the endopod of the 1st and

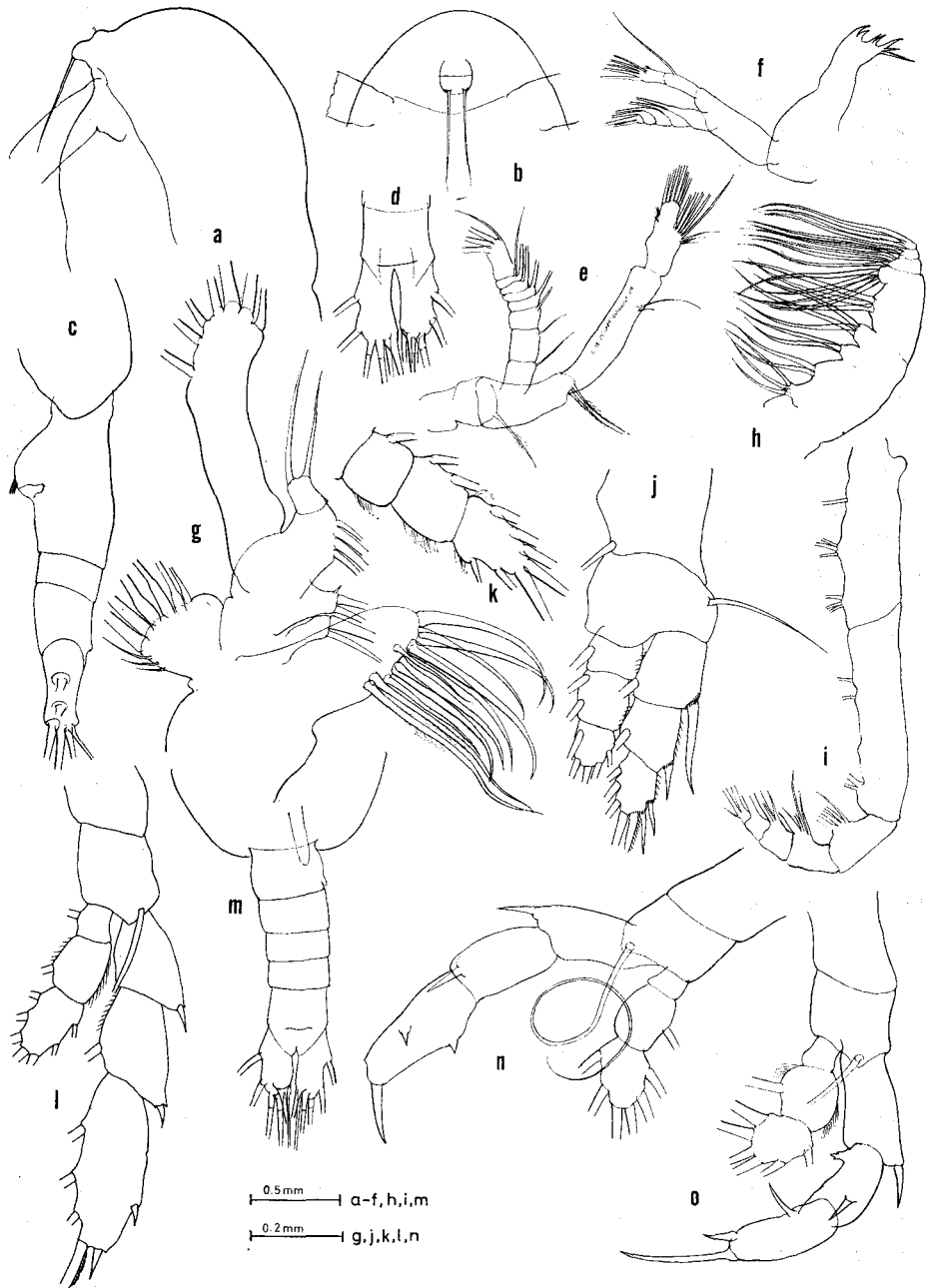


Fig. 13. *Euaugaptilus hyperboreus*, female: a, head, lateral view; b, rostrum; c, last thoracic segment and abdomen, lateral view; d, furca; e, 2nd antenna; f, mandible; g, 1st maxilla; h, 2nd maxilla; i, maxilliped; j, 1st leg; k, endopod of 2nd leg; l, 5th leg. male: m, last thoracic segment and abdomen, dorsal view; n, 5th leg, left; o, the same, right.

Table 4. Variation of body length and number of setae on 1st maxilla, 2nd maxilla and maxilliped in *Euaugaptilus elongatus* and *E. hyperboreus*.

| Species                         | Sample        | Characters |    |    |   |   |   |   |    |    |    |    |    |    |    |    |    |    |
|---------------------------------|---------------|------------|----|----|---|---|---|---|----|----|----|----|----|----|----|----|----|----|
|                                 |               | 1          | 4  | 5  | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| <i>E. elongatus</i><br>female   | Sars, 1905    | 67         | 11 | 2  | 2 | 3 | 3 | 6 | 8  | 3  | 2  | 2  | 2  | 2  | 3  | 7  | 11 | 15 |
|                                 | Farran, 1908  | —          | 10 | 2  | 2 | 3 | 3 | 7 | 9  | —  | —  | —  | —  | —  | —  | —  | —  | —  |
|                                 | Sewell, 1947  | 50         | 11 | 2  | 2 | 4 | 3 | 7 | 9  | 3  | 2  | 2  | 3  | 2  | 3  | 9  | —  | —  |
|                                 | Sta. 107      | 58         | 11 | 2  | 1 | 3 | 3 | 7 | 9  | 3  | 2  | 2  | 3  | 2  | 3  | 8  | 11 | 15 |
|                                 | Sta. 121-2    | 60         | 11 | 2  | 2 | 3 | 3 | 7 | 8  | 3  | 2  | 2  | 3  | 2  | 3  | 8  | 11 | 15 |
| male                            | Sta. 121-2    | 57         | 10 | 2  | 2 | 3 | 3 | 7 | 8  | 3  | 2  | 2  | 3  | 2  | 3  | 8  | 11 | 14 |
| <i>E. hyperboreus</i><br>female | Brodsky, 1950 | 74         | 11 | 2  | 2 | 4 | 2 | 7 | 7  | 2  | 2  | 2  | 3  | 3  | 3  | 14 | 11 | 11 |
|                                 | Sta. 107      | 62         | 11 | 2  | 2 | 4 | 1 | 7 | 8  | 3  | 2  | 2  | 3  | 3  | 3  | 15 | 11 | 15 |
|                                 | Sta. 115-2    | 67         | 10 | 2  | 2 | 4 | 2 | 8 | 8  | 3  | 2  | 2  | 3  | 3  | 4  | 15 | 11 | 15 |
|                                 | Sta. 115-2    | 72         | 11 | 2  | 2 | 4 | 2 | 8 | 9  | 3  | 2  | 2  | 3  | 3  | 4  | 15 | 11 | 15 |
|                                 | Sta. 115-2    | 74         | 11 | 2  | 2 | 4 | 2 | 7 | 9  | 3  | 2  | 2  | 3  | 3  | 4  | 15 | 11 | 15 |
|                                 | Sta. 121-2    | 64         | 11 | 2  | 2 | 4 | 2 | 7 | 8  | 3  | 2  | 2  | 3  | 3  | 3  | 15 | 11 | 15 |
|                                 | Sta. 121-2    | 68         | 11 | 2  | 2 | 4 | 1 | 7 | 8  | 3  | 2  | 2  | 3  | 3  | 3  | 15 | 11 | 15 |
|                                 | male          | Sta. 115-2 | 55 | 11 | 2 | 2 | 4 | 2 | 8  | 9  | 2  | 2  | 2  | 3  | 3  | 3  | 15 | 11 |



2nd maxillae, and rugged ridges at the bases of the outer marginal spines on the 2nd and 3rd exopodal segments of the 1st leg. Table 4 shows values of characters defined in Table 2 for all adult specimens of *E. elongatus* and *E. hyperboreus* from the Izu region. Although setation on some parts shows variation, the above four characters are constant.

Dr. Brodsky (personal communication) kindly compared the present specimens with his *E. hyperboreus* (type specimen) from the Arctic Ocean, and stated that the present specimens are *E. hyperboreus*. The occurrence of the species is apparently the first record in the Pacific Ocean.

*Distribution and size variation:*

| Author                | Locality             | Depth (m) | Length (mm) |      |
|-----------------------|----------------------|-----------|-------------|------|
|                       |                      |           | ♀           | ♂    |
| Brodsky, 1950         | Central Arctic Ocean | 200       | 7.4         | 6.8  |
| <i>Present record</i> | Izu region           | 0-1100    | 6.22-7.44   | 5.45 |

*Euaugaptilus indicus* Sewell, 1932

(Figs. 1f, 14a-i)

*Euaugaptilus indicus* Sewell, 1932, p. 319, text-fig. 105; Sewell, 1947, p. 201, fig. 51.

*Occurrence:* Sta. 115-2, 1 ♀.

*Descriptive notes:* Female, 7.70 mm. The cephalothorax and abdomen have proportional lengths 77:23. The frontal margin of the head is evenly rounded in dorsal view. The head and 1st thoracic segment are separated; the 4th and 5th thoracic segments are fused together. The rostrum has 2 slender, delicate filaments.

The abdominal segments and furca have the following proportional lengths:

| segment | 1-3 | 4  | 5  | furca |      |
|---------|-----|----|----|-------|------|
|         | 40  | 10 | 17 | 33    | =100 |

The genital segment is a little longer than wide; the ventral surface of the segment is swollen considerably; the furca is 2.5 times as long as wide.

The 1st antenna, 8.84 mm in length, extends beyond the end of furca by 2 segments; the segments have the following proportional lengths:

| segment | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11    | 12 | 13 | 14 | 15 |
|---------|----|----|----|----|----|----|----|----|----|----|-------|----|----|----|----|
|         | 53 | 16 | 25 | 23 | 25 | 27 | 28 | 27 | 35 | 32 | 37    | 45 | 53 | 54 | 54 |
|         | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |       |    |    |    |    |
|         | 54 | 57 | 55 | 55 | 45 | 44 | 39 | 50 | 43 | 24 | =1000 |    |    |    |    |

The endopod of the 2nd antenna is 1.8 times the length of the exopod; the endopod has 6 setae on the outer lobe and 7 setae on the inner lobe; the exopod is

8-segmented. The mandibular palp is small; the exopod is 1.5 times the length of the endopod; the exopod is 5-segmented, each of which bears 1 seta; the endopod is 2-segmented, of which the distal segment bears 3 setae; the setting of the teeth on gnathobase is transverse. The 1st maxilla has the following number of setae on the

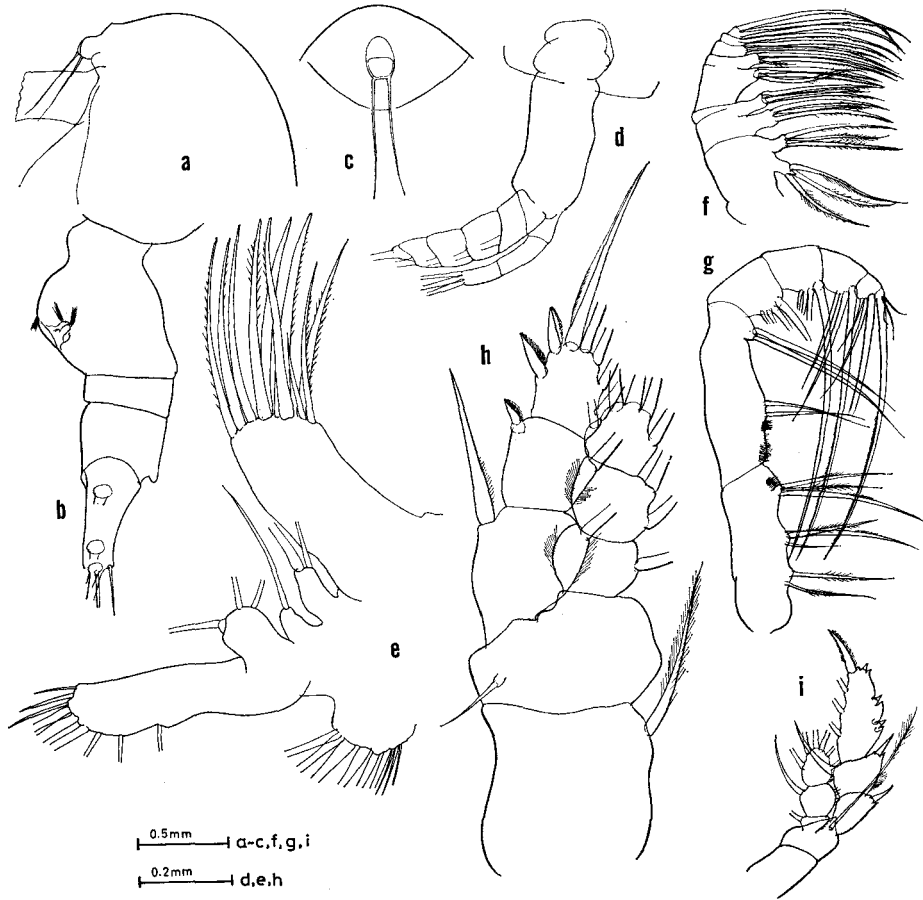


Fig. 14. *Euaugaptilus indicus*, female: a, head, lateral view; b, last thoracic segment and abdomen, lateral view; c, rostrum; d, mandibular palp; e, 1st maxilla; f, 2nd maxilla; g, maxilliped; h, 1st leg; i, 5th leg.

various lobes: 6 large and 3 small on the outer lobe, 9 on the exopod, 1 on the very small endopod, 2 on the 2nd basal segment, 1 on the 3rd inner lobe, 2 on the 2nd inner lobe, and 10 on the 1st inner lobe. The 2nd maxilla has the following number of setae on the lobes and endopod:

| setae | 1 | 2 | 3 | 4 | 5 | 6 | Ri |
|-------|---|---|---|---|---|---|----|
| lobe  | 3 | 3 | 3 | 3 | 3 | 3 | 7  |

The 1st lobe has 3 setae and 1 minute pointed process. The maxilliped has the following number of setae on the lobes and endopod:

| setae | B1 |   | B2 |   | segment | Ri |   |   |   |   |
|-------|----|---|----|---|---------|----|---|---|---|---|
|       | 1  | 2 | 3  | 1 |         | 2  | 1 | 2 | 3 | 4 |
| lobe  | 2  | 3 | 3  | 2 | 2       | 4  | 4 | 3 | 3 | 4 |

Some setae have fine spinules; the two basal segments are about the same length.

The 1st leg has an outer marginal seta on the 2nd basal segment; the 1st exopodal segment has a long outer marginal spine which extends to the base of the 1st outer marginal spine on the 3rd exopodal segment. The 5th legs have 3 marginal spines on the 3rd exopodal segment.

*Remarks:* The present specimen differs from the description of Sewell (1932, 1947) in number of setae on the exopod of the 1st maxilla; it is slightly larger than Sewell's specimen. Sewell states that the exopod of the 1st maxilla of his specimen has 5 or 6 setae. This is the first record of occurrence in the Pacific Ocean.

*Distribution and size variation:*

| Author                    | Locality        | Depth (m) | Length (mm) |
|---------------------------|-----------------|-----------|-------------|
| Sewell, 1932              | Off Maldive Is. | 0-366     | ♀<br>6.68   |
| Sewell, 1947              | Arabian Sea     | 0-850     | 6.47 (V)    |
| Grice and Hulsemann, 1967 | Arabian Sea     | 1050-1980 | —           |
| <i>Present record</i>     | Izu region      | 0-2500    | 7.70        |

*Euaugaptilus laticeps* (Sars, 1905)

(Figs. 2e, 15a-e)

*Augaptilus laticeps* Sars, 1905, p. 11.

*Euaugaptilus laticeps* (Sars). —Sars, 1925, p. 264, pl. 80; Tanaka, 1964b, p. 50, fig. 197; Vervoort, 1965, p. 136.

*Occurrence:* Sta. 84-2, 2 ♀; Sta. 97-2, 1 ♀; Sta. 98, 1 ♂; Sta. 107, 3 ♀; Sta. 108, 1 ♀; Sta. 111-2, 1 ♀, 1 ♂; Sta. 115-2, 2 ♀; Sta. 121-2, 2 ♀.

*Remarks:* This species can be separated from *E. perodiosus* sp. nov. by the structure of the mandibular palp and 1st maxilla. In *E. laticeps* the mandible has 5 setae. The 1st maxilla has the following number of setae on the various lobes: 6 large and 3 small on the outer lobe, of which the 6th setae is the largest; 6-7 on the exopod; 3 on the 2nd basal segment including the endopod; 2 on the 2nd and 3rd inner lobes; 10-11 on the 1st inner lobe. The male specimens have the 1st maxilla exactly same as that of the females.

*Distribution and size variation:*

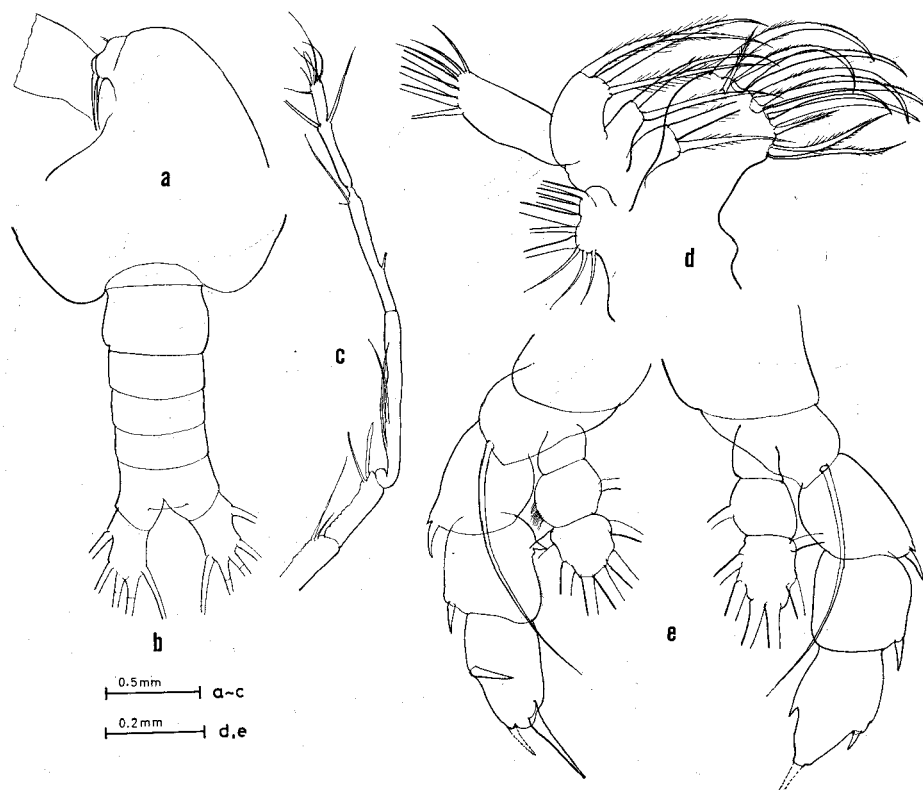


Fig. 15. *Euaugaptilus laticeps*, male: a, head, lateral view; b, last thoracic segment and abdomen, dorsal view; c, distal part of 1st antenna; d, 1st maxilla; e, 5th pair of legs.

| Author                | Locality             | Depth (m) | Length (mm) |           |
|-----------------------|----------------------|-----------|-------------|-----------|
|                       |                      |           | ♀           | ♂         |
| Farran, 1908          | Irish Atlantic slope | 720-2370  | —           | —         |
| Sars, 1925            | North Atlantic       | 0-1500    | 7.60        | —         |
| Farran, 1926          | Bay of Biscay        | 900-1350  | 7.68        | —         |
| Tanaka, 1964b         | Suruga Bay           | 0-1000    | 7.43        | —         |
| Vervoort, 1965        | Gulf of Guinoa       | 0-600     | 6.90-7.20   | 6.30-6.80 |
| Roe, 1972             | off Canary Is.       | 720-950   | 6.60-8.00   | —         |
| <i>Present record</i> | Izu region           | 0-740     | 7.10-7.40   | 6.80-7.30 |

### *Euaugaptilus latifrons* (Sars, 1907)

(Figs. 11, 16a-j)

*Augaptilus latifrons* Sars, 1907, p. 22.

*Euaugaptilus latifrons* (Sars).—Sars, 1925, p. 295 pl. 101; Sewell, 1932, p. 323, text-fig. 106; Vervoort, 1965, p. 144.

*Occurrence*: Sta. 119, 1 ♀.

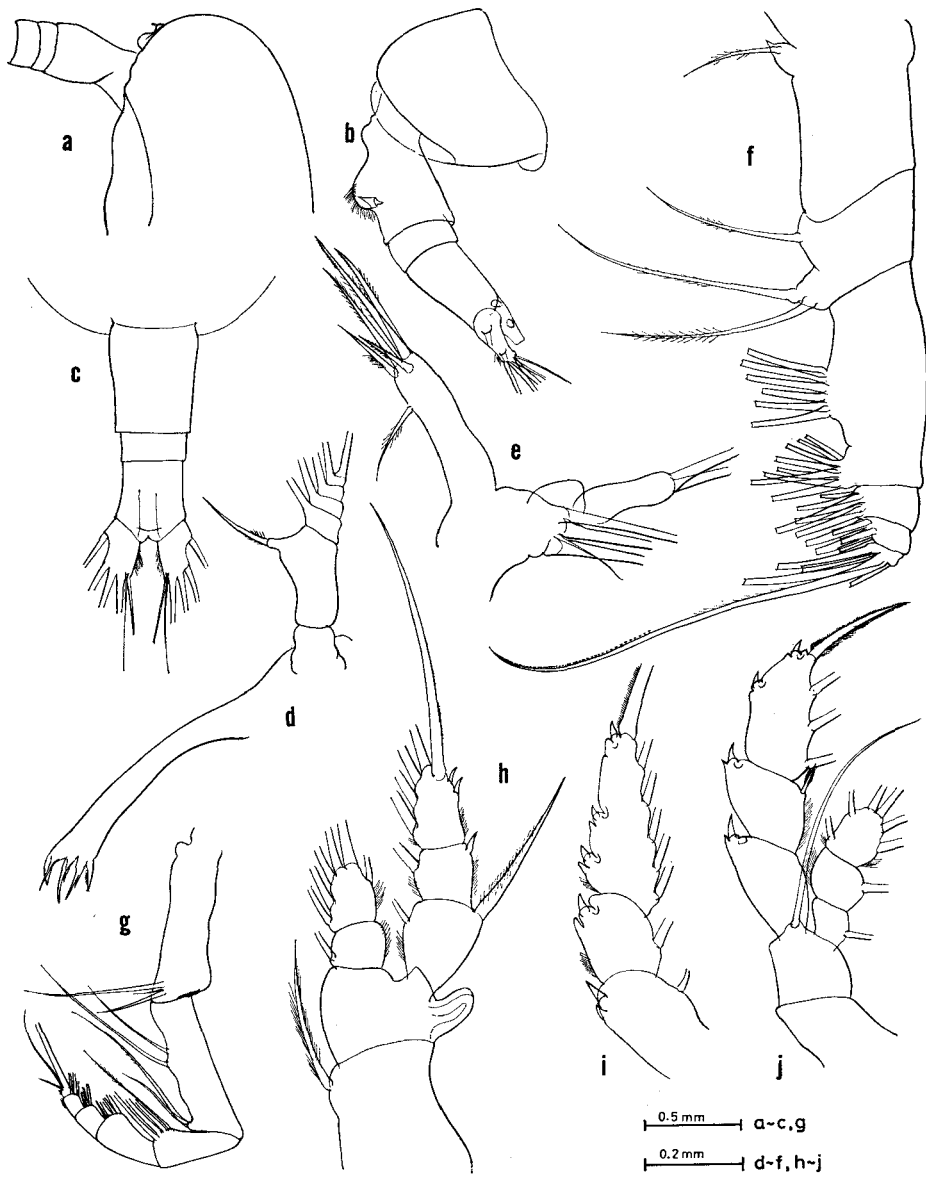


Fig. 16. *Euauaptilus latifrons*, female: a, head, lateral view; b, last thoracic segment and abdomen, lateral view; c, the same, dorsal view; d, mandible; e, 1st maxilla; f, 2nd maxilla; g, maxilliped; h, 1st leg; i, exopod of 2nd leg; j, 5th leg.

*Descriptive notes:* Female, 5.64 mm. The cephalothorax and abdomen have proportional lengths 77:23. In lateral view the frontal margin of the head is broadly rounded. The lateral distal margin of the last thoracic segment is rounded; the rostrum is represented by a round knob without filaments.

The abdominal segments and furca have the following proportional lengths:

|         |     |    |    |       |      |
|---------|-----|----|----|-------|------|
| segment | 1-3 | 4  | 5  | furca |      |
|         | 41  | 11 | 25 | 23    | =100 |

The genital segment is 1.3 times as long as wide; the genital boss is situated about the middle of the segment; the furca is about twice as long as wide.

The 1st antenna, 5.55 mm, reaches to the tip of the furca; the segments have the following proportional lengths:

|         |    |    |    |    |    |    |    |    |    |    |       |    |    |    |    |
|---------|----|----|----|----|----|----|----|----|----|----|-------|----|----|----|----|
| segment | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11    | 12 | 13 | 14 | 15 |
|         | 75 | 17 | 22 | 22 | 22 | 26 | 29 | 29 | 38 | 39 | 48    | 51 | 58 | 59 | 55 |
|         | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |       |    |    |    |    |
|         | 57 | 57 | 55 | 43 | 29 | 34 | 31 | 41 | 34 | 29 | =1000 |    |    |    |    |

On the 2nd antenna the endopod is about 2.5 times the length of the exopod; the exopod is 8-segmented; segments 4, 5, 6 and 7 each have 1 seta; segment 8 has 3 long setae and 1 minute seta; the endopod has 6 setae on the outer lobe and 4 long and 4 small setae on the inner lobe. The mandible has a rudimentary endopod; the exopod has 5 setae in all; The 1st maxilla has the following number of setae and the various lobes: 3 large and 1 small on the outer lobe, 2 on the exopod, 6 on the 1st inner lobe; the 2nd basal segment lacks seta; the 2nd and 3rd inner lobes are entirely absent. The 2nd maxilla has the following number of setae on the lobes and endopod:

|       |   |   |   |   |   |   |    |
|-------|---|---|---|---|---|---|----|
| lobe  | 1 | 2 | 3 | 4 | 5 | 6 | Ri |
| setae | 1 | 0 | 1 | 2 | 6 | 8 | 15 |

The two basal segments on the maxilliped are about the same length; the 1st segment of the endopod is as long as the combined lengths of the following two segments; the lobes and endopod have the following number of setae:

|       |    |   |    |   |   |         |   |   |   |   |   |
|-------|----|---|----|---|---|---------|---|---|---|---|---|
|       | B1 |   | B2 |   |   | Ri      |   |   |   |   |   |
| lobe  | 1  | 2 | 3  | 1 | 2 | segment | 1 | 2 | 3 | 4 | 5 |
| setae | 0  | 0 | 3  | 2 | 2 |         | 4 | 4 | 3 | 3 | 3 |

Distal setae have button-like organs.

The 1st leg has a 3-segmented exopod and 2-segmented endopod; the outer marginal spine on the 1st exopodal segment is large and extends to the end of the

3rd exopodal segment; the 2nd basal segment has a large projection on the outer margin. The 5th leg agrees exactly with Sars' (1925) figure of the same leg; the inner marginal seta arising from the 2nd exopodal segment is small, and reaches only to the base of the 1st inner marginal seta of the 3rd exopodal segment.

*Remarks:* The specimen from the Izu region differs in some details from *E. latifrons* described and figured by Sars (1925) and Sewell (1932). According to Sars (1925), the 5th and 6th lobes of the 2nd maxilla have 2 and 3 setae respectively; Sewell (1932) describes that the 2nd basal segment and the endopod of the 2nd maxilla bear a remarkable number of setae, some 35 in all. Sars figured that the lobes on the two basal segments of the maxilliped have 0, 1, 2, 2, and 2 setae. Our specimen agree more closely with Sewell's specimen than Sars'. A specimen from Atlantide Sta. 139 (Vervoort, 1965), which was kindly provided by Dr. Vervoort, has 26 setae in all on the 2nd basal segment and the endopod of the 2nd maxilla: the two basal segments of the maxilliped have 0, 0, 2, 2, and 2 setae. This is the first record of occurrence in the Pacific Ocean.

*Distribution and size variation:*

| Author                         | Locality         | Depth (m) | Length (mm) |
|--------------------------------|------------------|-----------|-------------|
| Sars, 1925                     | off Madeira Is.  | 0-4000    | ♀<br>4.70   |
| Sewell, 1932                   | off Maldive Is.  | 0-366     | 4.8-5.3     |
| Lysholm and<br>Nordgaard, 1945 | 48°29'N, 13°55'W | 0-1500    | —           |
| Sewell, 1947                   | Arabian Sea      | 0-850     | —           |
| Vervoort, 1965                 | Gulf of Guinea   | 0-600     | 5.60        |
| Owre and Foyo, 1967            | Florida Current  | 584       | —           |
| Roe, 1972                      | off Canary Is.   | 570-800   | 5.12-5.60   |
| <i>Present record</i>          | Izu region       | 0-730     | 5.64        |

*Euaugaptilus longimanus* (Sars, 1905)

(Figs. 3j, 17a-k)

*Augaptilus longimanus* Sars, 1905, p. 17; Wolfenden, 1911, p. 340, text-fig. 73.

*Euaugaptilus longimanus* (Sars).—Sars, 1925, p. 282, pl. 92; Sewell, 1947, p. 223, figs. 60, 61; Tanaka, 1964b, p. 69, fig. 208; Tanaka and Omori, 1967, p. 253, fig. 5.

*Occurrence:* Sta. 95, 1 ♀; Sta. 97-2, 1 ♀; Sta. 115-1, 1 ♂.

*Descriptive notes:* Male, 5.62 mm. The cephalothorax and abdomen have proportional lengths 77:23. The cephalothorax is 1.2 times as long as wide. The dorsal surface of the head is much constricted at the level opposite to the oral region.

The abdominal segments and furca have the following proportional lengths:

| segment | 1  | 2  | 3  | 4  | 5 | furca    |
|---------|----|----|----|----|---|----------|
|         | 25 | 19 | 19 | 12 | 7 | 18 = 100 |

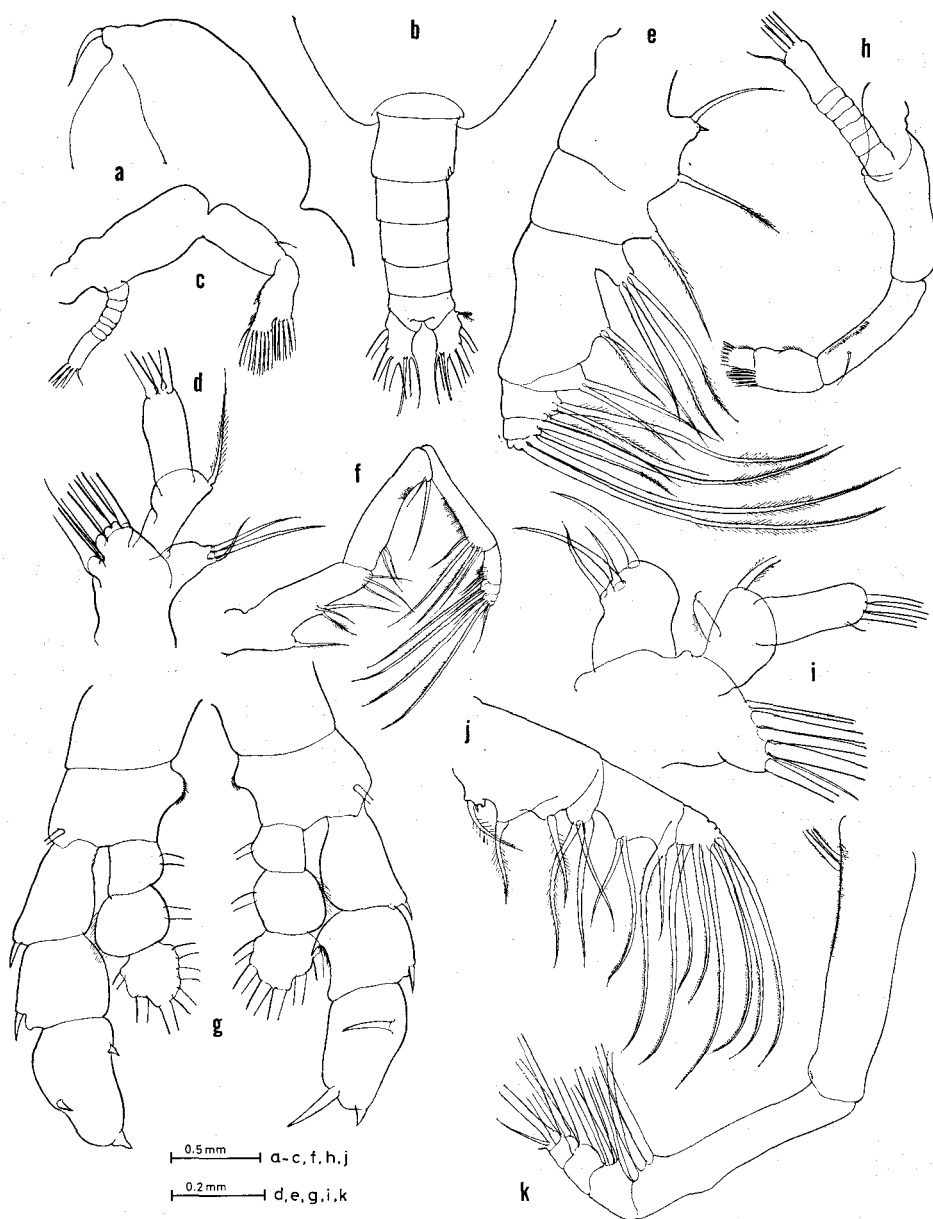


Fig. 17. *Euaugaptilus longimanus*, male: a, head, lateral view; b, last thoracic segment and abdomen, dorsal view; c, 2nd antenna; d, 1st maxilla; e, 2nd maxilla; f, maxilliped; g, 5th pair of legs, female (large form, 9.50 mm): h, 2nd antenna; i, 1st maxilla; j, 2nd maxilla; k, maxilliped (without 1st basal segment).



The 1st segment is wider than long: the furca is 1.6 times as long as wide.

The right 1st antenna, 8.01 mm in length, extends beyond the tip of the furca by 6 segments; the left antenna is geniculated.

The mouthparts agree in general with those of the immature male described by Sewell (1947). However, there are slight differences between the present specimen and Sewell's in the number of setae arising from various lobes of the mandible, 1st maxilla and maxilliped. The mandible agrees with that of the female (small specimen); it has 2 setae on the endopod and 6 setae on the exopod. The 1st maxilla has 5 long setae and 1 short seta on the outer lobe, 3 setae on the exopod, 1 seta on the 2nd basal segment, and 3 setae on the 1st inner lobe. The maxilliped is less slender than that of the female, and bears the following number of setae on the lobes and endopod:

|       | B1 |   | B2 |   |   | Ri      |   |   |   |   |   |
|-------|----|---|----|---|---|---------|---|---|---|---|---|
| lobe  | 1  | 2 | 3  | 1 | 2 | segment | 1 | 2 | 3 | 4 | 5 |
| setae | 1  | 3 | 3  | 2 | 2 |         | 4 | 3 | 2 | 2 | 3 |

The 5th pair of legs is like that described and figured by Sars (1925).

*Remarks:* This species is easily distinguished from other members of genus by unusually elongated maxilliped. Sewell (1947) reported on the great variability of the body length in the species. Previously, we showed that two size groups were seen even among the specimens taken from the similar locality, and mentioned briefly that there were slight differences between the large and small specimens in the number of setae on the various lobes of the 1st maxilla and maxilliped (Tanaka and Omori, 1967). In the large specimen (from Sta. 144-3), measuring 9.50 mm, the 1st maxilla has the following number of setae on the various lobes: 5 long and 1 short on the outer lobe; 3+1 on the exopod, 1 on the 2nd basal segment, 1 on the 2nd (or 3rd) inner lobe, and 4 on the 1st inner lobe. The number of setae in the small specimens collected from Stas. 95 and 97-2 is as follows: 4 long and 1 short on the outer lobe, 3 on the exopod, 1 on the 2nd basal segment, and 3 on the 1st inner lobe. The maxilliped has the following number of setae on the lobes and endopod.

|                 |       | B1 |   | B2 |   |   | Ri      |   |   |   |   |   |
|-----------------|-------|----|---|----|---|---|---------|---|---|---|---|---|
|                 | lobe  | 1  | 2 | 3  | 1 | 2 | segment | 1 | 2 | 3 | 4 | 5 |
| large specimen  | setae | 1  | 3 | 3  | 2 | 0 |         | 3 | 3 | 2 | 2 | 3 |
| small specimens |       | 1  | 3 | 3  | 2 | 2 |         | 3 | 2 | 1 | 1 | 2 |

Because of the shortage of materials, we cannot conclude yet if the large and small specimens really represent the single species. However, it is noteworthy that a copepodite V stage female from Sta. 67-5 in Sagami Bay (5.77 mm in length) has 1 tiny seta on the 3rd inner lobe of the 1st maxilla: its structure of the maxilliped, however, agrees perfectly with that of Sewell's specimen.

*Distribution and size variation:*

| Author                 | Locality             | Depth (m) | Length (mm) |          |
|------------------------|----------------------|-----------|-------------|----------|
|                        |                      |           | ♀           | ♂        |
| Wolfenden, 1911        | Tropical Atlantic    | 0-1200    | 5.30        | —        |
| Sars, 1925             | near Canary Is.      | 0-1500    | 5.80        | 6.30     |
| Sewell, 1947           | Arabian Sea          | 0-1500    | 9.5         | 8.57 (V) |
| Wilson, 1950           | off Galapagos Is.    | 0-5540    | —           | —        |
| Tanaka, 1964b          | Sagami Bay           | 0-1000    | 4.93        | —        |
| Vervoort, 1965         | Gulf of Guinea       | 170-600   | 4.30-5.21   | —        |
| Owre and Foyo, 1967    | Florida Current      | 348-684   | —           | —        |
| Tanaka and Omori, 1967 | South of Shikoku Is. | 0-1368    | 9.5         | —        |
| Roe, 1972              | off Canary Is.       | 350-940   | 5.12-5.92   | —        |
| <i>Present record</i>  | Izu region           | 0-921     | 5.30, 5.81  | 5.72     |

*Euaugaptilus luxus* sp. nov.

(Figs. 1k, 18a-m)

*Occurrence*: Sta. 122, 1 ♀.

*Descriptive notes*: Female, 8.00 mm. The cephalothorax and abdomen have proportional lengths 80:20. The head is separated from the 1st thoracic segment; the 4th and 5th segments are fused. The cephalothorax is 2.7 times as long as wide; it tapers gradually at both ends. The frontal margin of the head is produced. The lateral distal margin of the last thoracic segment is narrowly rounded. The rostral filaments are short.

The abdominal segments and furca have the following proportional lengths:

| segment | 1-3 | 4 | 5  | furca   |
|---------|-----|---|----|---------|
|         | 50  | 8 | 16 | 26 =100 |

The genital segment is rectangular in shape, and is 1.3 times as long as wide; the genital protuberance is large the furca is 1.6 times as long as wide.

The 1st antenna, 8.36 mm in length, extends slightly beyond the distal margin of the furca; the segments have the following proportional lengths:

| segment | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10    | 11 | 12 | 13 | 14 | 15 |
|---------|----|----|----|----|----|----|----|----|----|-------|----|----|----|----|----|
|         | 43 | 16 | 21 | 20 | 25 | 25 | 26 | 29 | 36 | 37    | 46 | 50 | 57 | 57 | 55 |
| 16      | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |       |    |    |    |    |    |
| 54      | 54 | 53 | 54 | 48 | 49 | 43 | 37 | 36 | 29 | =1000 |    |    |    |    |    |

The 1st segment has 8 setae, one of which is situated at the anterior proximal corner.

The endopod of the 2nd antenna is 1.3 times the length of the exopod; the endopod has 6 setae on the outer lobe and 4 long setae on the inner lobe; the exopod is 8-segmented; the 4th to 6th segments each have 1 seta. In the mandible the exopod and endopod are about the same length; the exopod has 5 setae and the

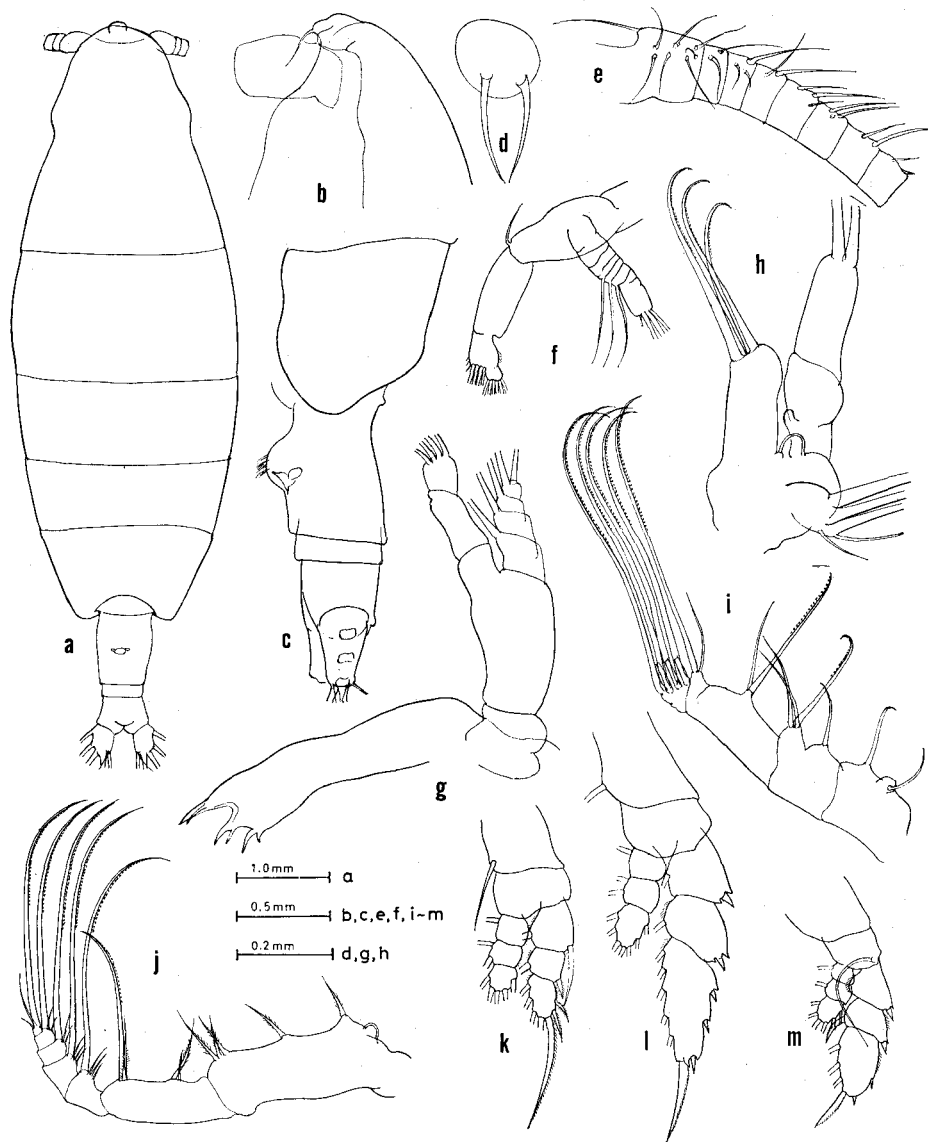


Fig. 18. *Euaugettilus luxus* sp. nov., female: a, whole animal, dorsal view; b, head, lateral view; c, last thoracic segment and abdomen, lateral view; d, rostrum; e, proximal part of 1st antenna; f, 2nd antenna; g, mandible; h, 1st maxilla; i, 2nd maxilla; j, maxilliped; k, 1st leg; l, 2nd leg; m, 5th leg.

endopod has 4 terminal setae; the gnathobase has 9 teeth including a marginal seta. The 1st maxilla has the following number of setae on the various lobes: 3 long and 2 short on the outer lobe, 2 on the exopod, 3 on the 1st inner lobe; the 2nd basal segment and the 3rd and 2nd inner lobes lack setae. The 2nd maxilla has the following number of setae on the lobes and endopod:

| lobe  | 1 | 2 | 3 | 4 | 5 | 6 | Ri |
|-------|---|---|---|---|---|---|----|
| setae | 1 | 1 | 1 | 3 | 2 | 2 | 7  |

The 1st basal segment of the maxilliped is 1.5 times the length of the 2nd basal segment; the lobes and endopod have the following number of setae:

| lobe  | B1 |   | B2 |   | segment | Ri |   |   |   |   |
|-------|----|---|----|---|---------|----|---|---|---|---|
|       | 1  | 2 | 3  | 1 |         | 2  | 1 | 2 | 3 | 4 |
| setae | 1  | 1 | 3  | 2 | 2       | 4  | 4 | 3 | 3 | 3 |

Distal setae on the 2nd maxilla and maxilliped are fringed with buttons.

Both rami of the 1st to 5th legs are 3-segmented. The outer marginal spine on the 1st exopodal segment of the 1st leg reaches the distal margin of the exopod; the outer marginal spines on the 2nd and 3rd segments of the exopod are striated on both sides. On the 5th leg the 2nd exopodal segment has an inner marginal spine which extends to the base of the 1st inner marginal seta on the 3rd exopodal segment.

*Remarks:* This species belongs to group V, but it can be distinguished from other members of the group by the structure of the mandible and number of setae on the 1st and 2nd maxillae.

### *Euaugaptilus magnus* (Wolfenden, 1904)

(Figs. 2f, 19a-d)

*Augaptilus magnus* Wolfenden, 1904, p. 122; Wolfenden, 1911, p. 341, pl. 37 figs. 4-9, text-fig. 74.

*Euaugaptilus magnus* (Wolfenden).—Sars, 1925, p. 262, pl. 79; Sewell, 1947, p. 213, fig. 57; Vervoort, 1957, p. 139; Tanaka, 1964b, p. 53, fig. 99; Tanaka and Omori, 1967, p. 253.

*Augaptilus fungiferus* Steuer, 1904, p. 597; Wolfenden, 1911, p. 336, pl. 36 fig. 8, text-fig. 71.

*Augaptilus validus* A. Scott, 1909, p. 138, pl. 43 figs. 1-10.

*Occurrence:* Sta. 83, 2 ♀; Sta. 84-2, 2 ♀; Sta. 94, 2 ♀; Sta. 107, 2 ♀, 2 ♂; Sta. 111-1, 1 ♀; Sta. 111-2, 2 ♂; Sta. 115-1, 3 ♀; Sta. 117-2, 1 ♀; Sta. 121-1, 1 ♀; Sta. 121-2, 3 ♀; Sta. 122, 1 ♀.

*Remarks:* This species is characterized by its large size and the rostrum which forms broadly rounded papillae without any filaments. The present collection showed a considerable variability in the body length ranging from 6.58 to 8.90 mm in the adult females. In some large specimens the 1st maxilla has 9 setae on the outer lobe and 2 setae on the 2nd basal segment; this structure is like that figured by

Sewell (1947) as *E. magnus fungiferus*. In the other specimens the structure of the 1st maxilla agrees exactly with *E. magnus magnus*. The lobes of the 2nd maxilla have the following number of setae:

|       |   |   |   |   |   |   |    |
|-------|---|---|---|---|---|---|----|
| lobe  | 1 | 2 | 3 | 4 | 5 | 6 | Ri |
| setae | 3 | 1 | 2 | 3 | 2 | 3 | 7  |

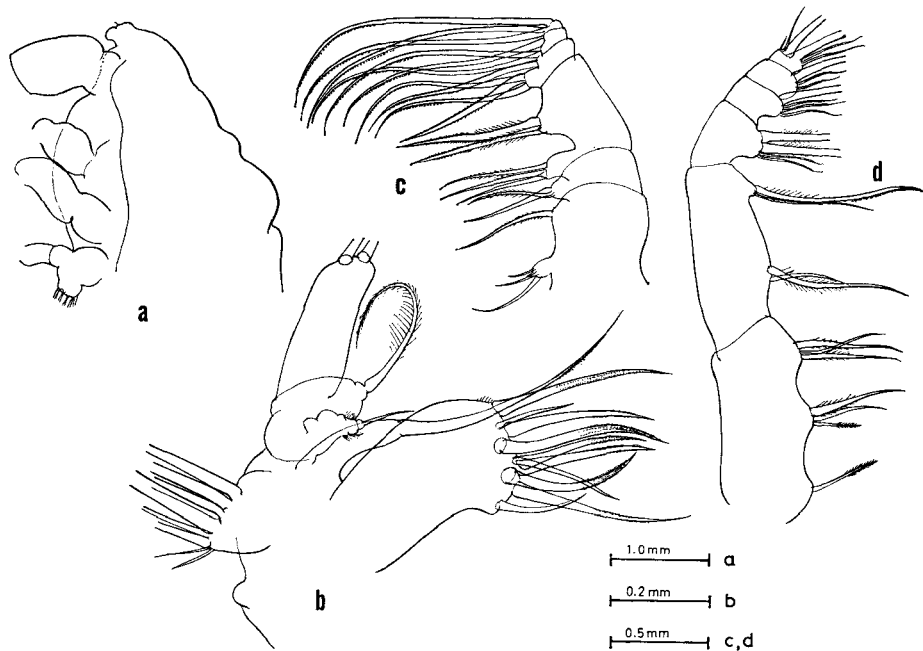


Fig. 19. *Eucauaptilus magnus*, male: a, head, lateral view; b, 1st maxilla; c, 2nd maxilla; d, maxilliped.

*Distribution and size variation:*

| Author                 | Locality             | Depth (m) | Length (mm) |           |
|------------------------|----------------------|-----------|-------------|-----------|
|                        |                      |           | ♀           | ♂         |
| Wolfenden, 1904        | West of Valentia     | 0-1500    | 6.65-7.0    | —         |
| A. Scott, 1909         | Malay Archipelago    | 0-700     | 8.77        | 7.60      |
| Sars, 1925             | Bay of Biscay        | 0-1500    | 8.40        | —         |
| Farran, 1926           | Bay of Biscay        | 450-720   | 6.96        | 6.96      |
| Sewell, 1947           | Arabian Sea          | 400-645   | 7.08-7.41   | 6.33 (V)  |
| Vervoort, 1957         | Antarctic waters     | 0-1570    | —           | —         |
| Tanaka, 1964b          | Sagami Bay           | 0-1000    | 7.92        | 7.75      |
| Vorvoort, 1965         | Gulf of Guinea       | 0-600     | 7.60-7.82   | 7.90      |
| Tanaka and Omori, 1967 | Northwestern Pacific | 0-1100    | 7.5-8.6     | 8.7-8.8   |
| Roe, 1972              | off Canary Is.       | 600-960   | 7.02-8.00   | —         |
| <i>Present record</i>  | Izu region           | 0-740     | 6.58-8.90   | 8.10-8.50 |

*Euaugaptilus matsuei* Tanaka and Omori, 1967

(Fig. 1g)

*Euaugaptilus matsuei* Tanaka and Omori, 1967, p. 254, figs. 6, 7.*Occurrence*: Sta. 111-2, 1 ♀.*Remarks*: Description and figures of a large female, 9.90 mm in length, are given by Tanaka and Omori (1967).*Euaugaptilus maxillaris* Sars, 1920

(Figs. 1d, 20a-j)

*Euaugaptilus maxillaris* Sars, 1920, p. 15; Sars, 1925, p. 287, pl. 95.*Occurrence*: Sta. 107, 1 ♀; Sta. 112, 1 ♀.*Descriptive notes*: Female, 5.57 mm. The cephalothorax and abdomen have proportional lengths 78:22. The rostral filaments are long.

The abdominal segments and furca have the following proportional lengths:

|         |     |    |    |       |      |
|---------|-----|----|----|-------|------|
| segment | 1-3 | 4  | 5  | furca |      |
|         | 59  | 10 | 11 | 20    | =100 |

The genital segment is twice as long as wide; the ventral surface of the segment is not swollen; the furca is twice as long as wide.

The 1st antenna, 7.22 mm in length, extends beyond the furca by 5 segments; the segments have the following proportional lengths:

|         |    |    |    |    |    |    |    |    |    |       |    |    |    |    |    |
|---------|----|----|----|----|----|----|----|----|----|-------|----|----|----|----|----|
| segment | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10    | 11 | 12 | 13 | 14 | 15 |
|         | 65 | 20 | 23 | 24 | 27 | 25 | 28 | 25 | 33 | 29    | 34 | 35 | 46 | 54 | 53 |
| 16      | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |       |    |    |    |    |    |
| 56      | 57 | 54 | 54 | 44 | 42 | 42 | 50 | 47 | 33 | =1000 |    |    |    |    |    |

The 2nd antenna has a 7-segmented exopod; the endopod is 1.8 times the length of the exopod; the outer lobe has 6 setae and the inner lobe has 4 long and 4 short setae on the distal margin. The mandibular palp is slender; both rami are about the same length. The 1st maxilla has the following number of setae on the various lobes: 6 large and 3 small on the outer lobe, 8 on the exopod, 5 on the endopod, 5 on the 2nd basal segment, 2 on the 3rd inner lobe 1 on the 2nd inner lobe, 10 on the 1st inner lobe. The two basal segments of the 2nd maxilla are about the same length; the number of setae on the lobes and endopod is as follows:

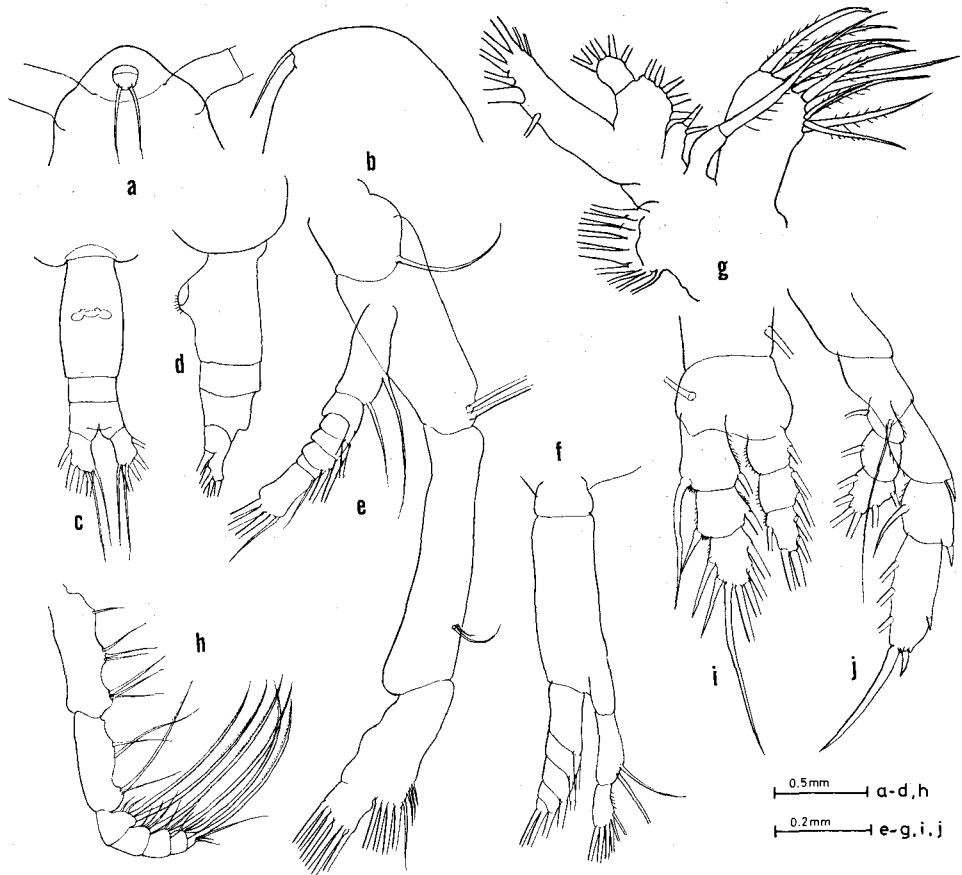


Fig. 20. *Euaugettilus maxillaris*, female: a, head, dorsal view; b, the same, lateral view; c, abdomen, ventral view; d, the same, lateral view; e, 2nd antenna; f, mandibular palp; g, 1st maxilla; h, maxilliped; i, 1st leg; j, 5th leg.

| lobe | 1 | 2 | 3 | 4 | 5 | 6 | Ri |
|------|---|---|---|---|---|---|----|
|      | 3 | 2 | 2 | 3 | 2 | 3 | 7  |

The number of setae on the lobes and endopod in the maxilliped is as follows:

| lobe | B1 |   | B2 |   | segment | Ri |   |   |   |   |
|------|----|---|----|---|---------|----|---|---|---|---|
|      | 1  | 2 | 3  | 1 |         | 2  | 3 | 4 | 5 |   |
|      | 1  | 3 | 3  | 2 | 2       | 4  | 4 | 3 | 3 | 4 |

On the 1st leg the 1st exopodal segment has a long, curved outer marginal spine which extends to the base of the 2nd outer marginal spine on the 3rd segment. On the 5th leg the 2nd segment of the exopod has a slender spine on the inner margin.

*Remarks:* The specimen agrees with *E. maxillaris* which was described by Sars (1925). The species had not been recorded in the Indo-Pacific region until Grice and Hulsemann (1967) found it in the locality 27°31'S, 80°08'E.

*Distribution and size variation:*

| Author                    | Locality           | Depth (m) | Length (mm)       |
|---------------------------|--------------------|-----------|-------------------|
| Sars, 1925                | South off Azores   | 0         | ♀<br>5.40 or 6.40 |
| Vervoort, 1965            | Gulf of Guinea     | 600       | 5.90              |
| Grice and Hulsemann, 1967 | South Indian Ocean | 1000-2000 | —                 |
| Roe, 1972                 | off Canary Is.     | 700-780   | 3.27-5.44         |
| <i>Present record</i>     | Izu region         | 0-1300    | 5.57, 6.65        |

*Euaugaptilus niveus* sp. nov.

(Figs. 3k, 21a-1)

*Euaugaptilus niveus* nom. nud. Tanaka, 1953, p. 135.

*Euaugaptilus mixtus* Brodsky.—Tanaka, 1964b, p. 58, fig. 202.

*Euaugaptilus brodskyi*.—Grice and Hulsemann, 1967, p. 30, figs. 178, 179 (— only).

*Euaugaptilus* species, Grice and Hulsemann, 1965, p. 249, fig. 18g-k.

*Occurrence:* Sta. 115-1, 1 ♀.

*Descriptive notes:* Female, 4.58 mm. The cephalothorax and abdomen have proportional lengths 77:23. The cephalothorax is 2.5 times as long as wide. The frontal margin of the head is evenly rounded in dorsal view. The lateral distal margin of the last thoracic segment is narrowly rounded. The rostral filaments are relatively strong.

The abdominal segments and furca have the following proportional lengths:

| segment | 1-3 | 4  | 5  | furca    |
|---------|-----|----|----|----------|
|         | 43  | 10 | 18 | 29 = 100 |

The genital segment is slender; it is 1.8 times as long as wide; the genital protuberance is not large; the furca is slightly asymmetrical; the right furca is 2.1 times as long as wide, and bears a large inner seta with inflated base; this characteristic structure is like that figured as *Euaugaptilus* species by Grice and Hulsemann (1965).

The 1st antenna, 4.66 mm in length, reaches the distal margin of the furca; the segments have the following proportional lengths:

| segment | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11     | 12 | 13 | 14 | 15 |
|---------|----|----|----|----|----|----|----|----|----|----|--------|----|----|----|----|
|         | 65 | 18 | 20 | 20 | 23 | 23 | 23 | 27 | 27 | 27 | 34     | 43 | 50 | 50 | 50 |
|         | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |        |    |    |    |    |
|         | 54 | 56 | 58 | 58 | 48 | 52 | 47 | 50 | 50 | 27 | = 1000 |    |    |    |    |



The endopod of the 2nd antenna is 1.3 times the length of the exopod; the exopod is 8-segmented and the 1st to 7th segments each have 1 seta; the endopod has the outer lobe with 6 long setae and the inner lobe with 5 long and 3 minute setae. The exopod of the mandible bears 6 setae; the endopod bears 4 terminal setae. The 1st maxilla has the following number of setae on the various lobes: 6 on the outer lobe, 4 on the exopod, 1 on the 2nd basal segment, 1 on the 2nd inner lobe, and 9 on the 1st inner lobe; the outermost setae on the outer lobe is very thick and is the longest of all. The number of setae on the lobes and endopod of the 2nd maxilla is as follows:

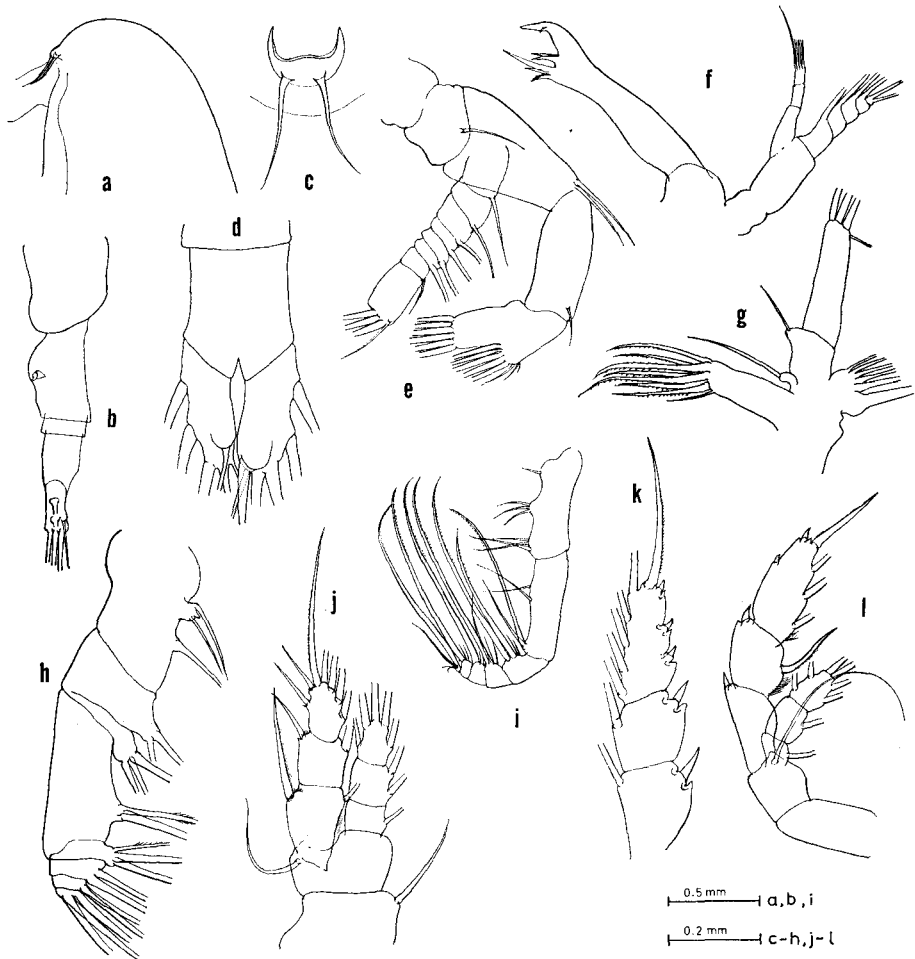


Fig. 21. *Euaugaptilus niveus*, female: a, head lateral view; b, last thoracic segment and abdomen, lateral view; c, rostrum; d, last abdominal segment and furca, dorsal view; e, 2nd antenna; f, mandible; g, 1st maxilla; h, 2nd maxilla; i, maxilliped; j, 1st leg; k, exopod of 2nd leg; l, 5th leg.

|       |   |   |   |   |   |   |    |
|-------|---|---|---|---|---|---|----|
| lobe  | 1 | 2 | 3 | 4 | 5 | 6 | Ri |
| setae | 2 | 1 | 2 | 3 | 2 | 3 | 7  |

The two basal segments of the maxilliped are about the same length; the number of setae on the lobes and endopod are as follows:

|       |    |   |    |   |   |         |   |   |   |   |   |
|-------|----|---|----|---|---|---------|---|---|---|---|---|
|       | B1 |   | B2 |   |   | Ri      |   |   |   |   |   |
| lobe  | 1  | 2 | 3  | 1 | 2 | segment | 1 | 2 | 3 | 4 | 5 |
| setae | 1  | 3 | 3  | 2 | 2 |         | 4 | 4 | 3 | 3 | 4 |

Distal setae of the 2nd maxilla and maxilliped have small button-like organs.

The 2nd basal segment of the 1st leg has an outer marginal seta on the posterior surface; the outer marginal spine on the 1st exopodal segment is long and reaches the base of the 1st outer marginal spine on the 3rd exopodal segment; 2 outer marginal spines on the 3rd segment are slender; there is a row of spinules near the base of each outer marginal spine on the exopod. The 2nd leg has 3 short outer marginal spines on the 3rd exopodal segment. On the 5th leg the 2nd segment of the exopod has a fairly long spine; the seta on the 2nd basal segment is as long as the exopod.

*Remarks:* This species was originally reported as *Euaugaptilus niveus* sp. nov. without giving any description (Tanaka, 1953). After-ward, it was described by Tanaka (1964b) as *Euaugaptilus mixtus* Brodsky. The name *E. mixtus* Brodsky was subsequently changed to *E. brodskyi*, because *E. mixtus* was preoccupied by another species described by Sars (1905) (Hulsemann, 1967). When the present specimen is compared with *E. brodskyi* described by Brodsky (1950) and Grice and Hulsemann (1967), we are convinced that it is not identical to *E. brodskyi*. The name *E. niveus* is, therefore, revived for the present new species.

*E. niveus* and *E. brodskyi* resemble each other in general appearance. However, the present new species is distinguished from the latter by the structure of the mandible and 5th leg and its small size. According to Grice and Hulsemann (1967), the endopod of the mandibular palp of *E. brodskyi* is reduced and has 1 seta, and Brodsky (1950) notes that the 3rd exopodal segment of the 5th leg has no outer marginal spines. We believe that the male specimens reported as *Euaugaptilus* sp. from the northeastern Atlantic (Grice and Hulsemann, 1965) and as *E. brodskyi* from the western Indian Ocean (Grice and Hulsemann, 1967) represent the male of *E. niveus*.

*Distribution and size variation:*

| Author                    | Locality             | Depth (m) | Length (mm) |      |
|---------------------------|----------------------|-----------|-------------|------|
|                           |                      |           | ♀           | ♂    |
| Tanaka, 1964b             | Sagami Bay           | 0-1210    | 4.70        | —    |
| Grice and Hulsemann, 1965 | Northeast Atlantic   | —         | —           | 3.07 |
| Grice and Hulsemann, 1967 | Western Indian Ocean | 1000-2000 | —           | 3.33 |
| <i>Present record</i>     | Izu region           | 0-921     | 4.58        | —    |

*Euaugaptilus nodifrons* (Sars, 1905)

(Figs. 1e, 22a-e)

*Augaptilus nodifrons* Sars, 1905, p. 13.*Euaugaptilus nodifrons* (Sars).—Sars, 1925, p. 267, p. 267, pl. 82; Sewell, 1932, p. 316, text-fig. 104; Sewell, 1947, p. 205, fig. 53; Tanaka, 1964b, p. 47, fig. 195; Tanaka and Omori, 1967, p. 256, fig. 8; Grice and Hulsemann, 1967, p. 33, figs. 201-203.*Augaptilus simplex* Esterly, 1913, p. 188, pl. 10 figs. 10, 28, pl. 11 figs. 34, 36, 41, pl. 12 figs. 50, 60.

*Occurrence:* Sta. 83, 1 ♀; Sta. 84-2, 3 ♀; Sta. 93-1, 1 ♀; Sta. 97-2, 2 ♀, 1 ♂; Sta. 98, 1 ♀; Sta. 107, 1 ♀; Sta. 108, 2 ♀, 1 ♂; Sta. 109, 1 ♂; Sta. 111-2, 3 ♀; Sta. 114, 2 ♀, 3 ♂; Sta. 115-1, 1 ♀; Sta. 115-2, 3 ♀, 1 ♂; Sta. 117-1, 1 ♀; Sta. 117-2, 1 ♀; Sta. 118, 1 ♀; Sta. 120, 1 ♀; Sta. 121-2, 1 ♀; Sta. 122, 1 ♀, 2 ♂.

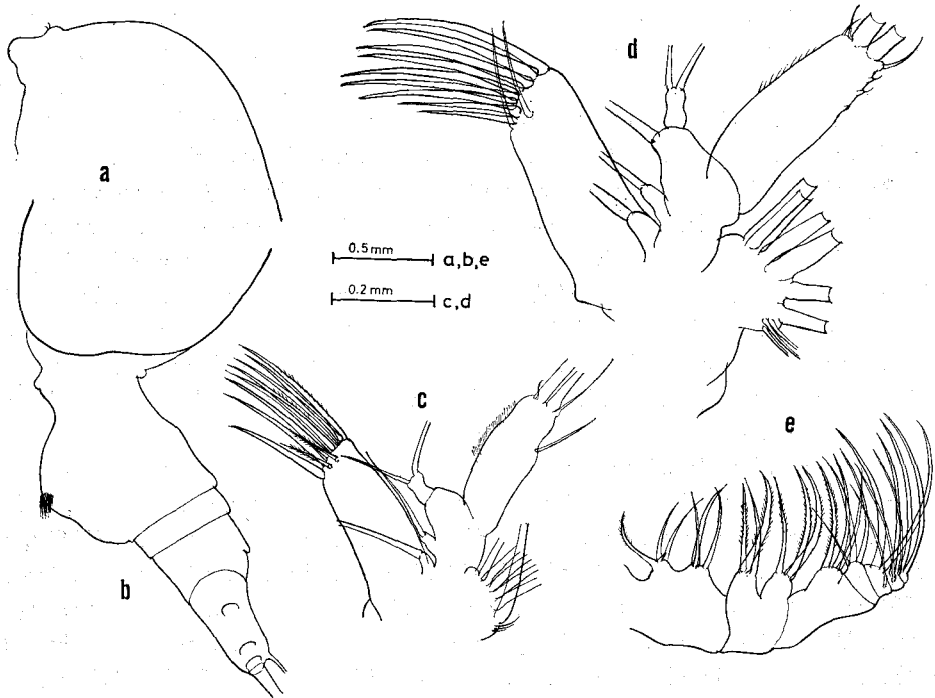


Fig. 22. *Euaugaptilus nodifrons*, female: a, head, lateral view (8.40 mm); b, last thoracic segment and abdomen, lateral view (8.40 mm); c, 1st maxilla (5.21 mm); d, the same (7.23 mm); e, 2nd maxilla (7.15 mm).

*Remarks:* The female specimens from the Izu region extended the size range of *E. nodifrons* from 4.85 to 9.50 mm. The rostrum is represented by a round knob without rostral filaments. The 1st maxilla has the following number of setae on the various lobes 6 large and 3 small on the outer lobe; 2 large and 2 or 3 small on the exopod, 2 on the endopod, 1 on each of the 2nd and 3rd inner lobes, and 10 on the

1st inner lobe. Among the present material, 2 females (6.80 and 7.23 mm) and 1 male have 1 seta on the 2nd basal segment of the 1st maxilla. The 2nd maxilla has the following number of setae on the lobes and endopod:

| lobe  | 1 | 2 | 3 | 4 | 5 | 6 | Ri |
|-------|---|---|---|---|---|---|----|
| setae | 3 | 3 | 3 | 3 | 3 | 3 | 7  |

There was no structural difference between the small and large specimens. If all the material really represents a single species, the variability in length in the species is extraordinarily wide. The body size of adult specimen might be related to life-span of the copepod, and possibly, the present samples contain several generations. However, the size-frequency histogram of the present specimens shows only one modal group. More detail morphological analysis with sufficient number of species may define the taxonomy and biology of *E. nodifrons*, as studied by Frost and Fleminger (1968) in the genus *Clausocalanus*. Until then, we include all the present specimens to *E. nodifrons*.

Report of 2 large males of *E. nodifrons* from Sta. 111-2 (Tanaka and Omori, 1967) is a case of mistaken identity of *E. magnus* (Wolfenden).

*Distribution and size variation:*

| Author                      | Locality             | Depth (m) | Length (mm) |           |
|-----------------------------|----------------------|-----------|-------------|-----------|
|                             |                      |           | ♀           | ♂         |
| Farran, 1908                | Irish Atlantic slope | 1530-2070 | 5.4-5.7     | —         |
| Esterly, 1913               | San Diego region     | —         | 6.1         | —         |
| Sars, 1925                  | near Azores Is.      | 0-1800    | 5.4         | —         |
| Sewell, 1932                | Bay of Bongal        | 0-360     | —           | 4.8-5.75  |
| Lysholm and Nordgaard, 1945 | off Canary Is.       | 770-1000  | —           | —         |
| Sewell, 1947                | Arabian Sea          | 0-200     | —           | —         |
| Tanaka, 1964b               | Sagami Bay           | 0-1000    | 5.47        | 6.32      |
| Vervoort, 1965              | Gulf of Guinea       | 0-600     | 4.85-5.70   | 6.30      |
| Tanaka and Omori, 1967      | Northwestern Pacific | 0-1368    | 8.7-9.5     | —         |
| Grice and Hulsemann, 1967   | Western Indian Ocean | 1000-2000 | —           | —         |
| Owre and Foyo, 1967         | Florida Current      | 0-259     | —           | —         |
| Roe, 1972                   | off Canary Is.       | 460-960   | 5.10-7.80   | 5.02-6.88 |
| <i>Present record</i>       | Izu region           | 0-740     | 5.39-9.50   | 4.89-6.90 |

*Euaugaptilus oblongus* (Sars, 1905)

(Figs. 2c, 23a-c)

*Augaptilus oblongus* Sars, 1905, p. 11.

*Euaugaptilus oblongus* (Sars).—Sars, 1925, p. 266, pl. 81; Sewell, 1947, p. 218, fig. 58; Tanaka, 1964b, p. 55, fig. 200; Grice and Hulsemann, 1967, p. 34.

*Augaptilus rostratus* Esterly, 1906, p. 73, pl. 9 fig. 19, pl. 11 fig. 42, pl. 12 figs. 57, 63, pl. 13 fig. 75.

*Augaptilus subfiligerus* Wolfenden, 1911, p. 343.

not *Euaugaptilus oblongus*.—Tanaka and Omori, 1967, p. 257, fig. 9.

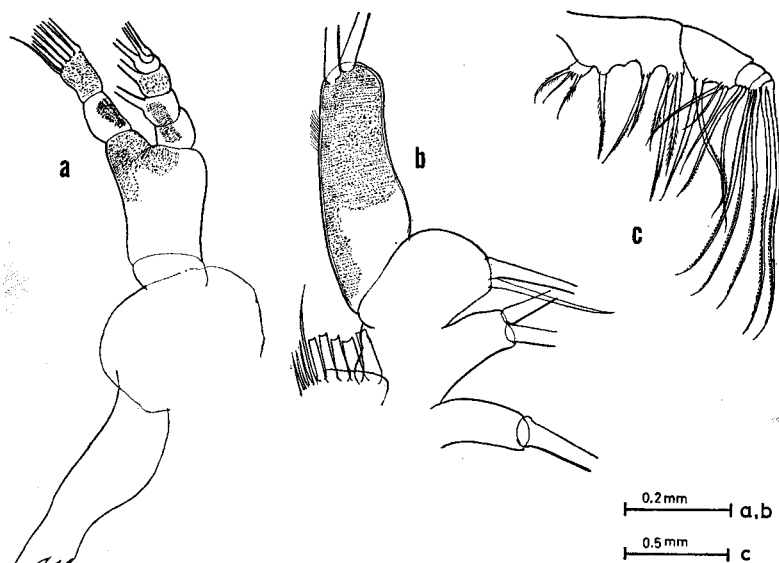


Fig. 23. *Euaugaptilus oblongus*, female: a, mandible; b, distal part of 1st maxilla; c, 2nd maxilla.

*Occurrence*: Sta. 98, 1 ♀; Sta. 107, 1 ♀; Sta. 109, 1 ♀; Sta. 115-2, 1 ♀.

*Remarks*: The 2nd basal segment, exopod and endopod of the mandible are ornamented with numerous fine bosses like that figured by Sewell (1947). The 1st maxilla has the following number of setae on the various lobes: 9 on the outer lobe, 2 on the exopod, 2 on the 2nd basal segment, 2 on the 3rd inner lobe, 1 on the 2nd inner lobe, and 11 on the 1st inner lobe; the exopod has numerous fine bosses. On the 2nd maxilla the lobes have the following number of setae:

| lobe   | 1 | 2 | 3 | 4 | 5 | 6 | Ri |
|--------|---|---|---|---|---|---|----|
| 1setae | 3 | 1 | 2 | 3 | 2 | 3 | 7  |

The large specimens described in our previous paper (Tanaka and Omori, 1967) as *E. oblongus* are identical to *E. rectus* Grice et Hulsemann.

*Distribution and size variation*:

| Author                | Locality           | Depth (m) | Length (mm) |
|-----------------------|--------------------|-----------|-------------|
| Esterly, 1906         | San Diego region   | —         | ♀<br>6.8    |
| Wolfenden, 1911       | off St. Helena Is. | 0-200     | 4.65        |
| Sars, 1925            | North Atlantic     | 0-5000    | 7.40        |
| Sewell, 1947          | Arabian Sea        | 0-850     | 6.15        |
| Tanaka, 1964b         | Suruga Bay         | 0-1260    | 6.06        |
| Vervoort, 1965        | Gulf of Guinea     | 0-600     | 5.40-6.90   |
| Grice and Hulsemann,  | Arabian Sea        | 1000-2000 | —           |
| Roe, 1972             | off Canary Is.     | 600-800   | 5.92-5.93   |
| <i>Present record</i> | Izu region         | 0-680     | 5.97-6.33   |

*Euaugaptilus palumbii* (Giesbrecht, 1889)

(Figs. 3h, 24a-d)

*Augaptilus palumbii* Giesbrecht, 1889, p. 813; Giesbrecht, 1892, p. 400, pl. 27 fig. 32, pl. 28 figs. 3, 15, 17, pl. 39 figs. 39, 50.

*Euaugaptilus palumboi* (Giesbrecht).—Giesbrecht and Schmeil, 1898, p. 122; Sars, 1925, p. 302, pl. 105, figs. 9–19; Tanaka, 1964b, p. 66, fig. 206.

*Occurrence*: Sta. 83, 1 ♀; Sta. 111–1, 3 ♀; Sta. 111–2, 1 ♂; Sta. 113, 1 ♀; Sta. 115–1, 2 ♀; Sta. 115–2, 1 ♀.

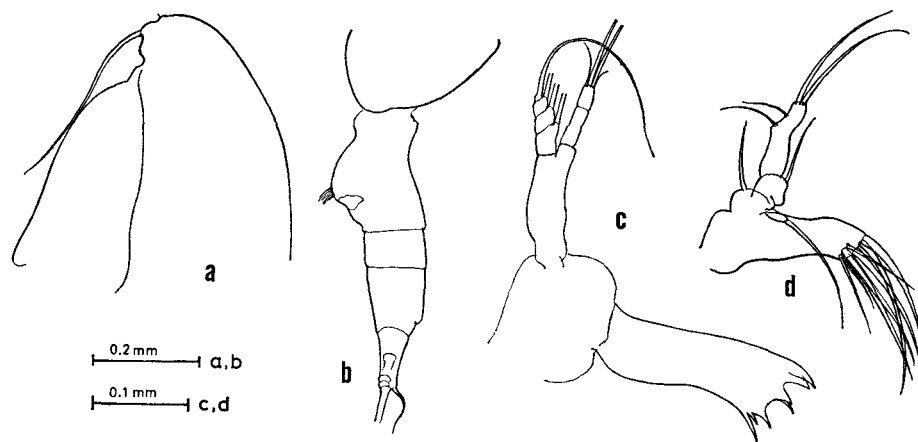


Fig. 24. *Euaugaptilus palumbii*, female: a, head, lateral view; b, last thoracic segment and abdomen, lateral view; c, mandible; d, 1st maxilla.

*Remarks*: The structure of the present specimens agrees with the description and figures given by Giesbrecht (1892). The 1st maxilla has the following number of setae on the various lobes: 1 on the outer lobe, 4 on the exopod, 1 on the 2nd basal segment, 1 on the 2nd inner lobe, and 8 on the 1st inner lobe. Sars' (1925) specimen has 3 setae on the exopod.

*Distribution and size variation*:

| Author                    | Locality                      | Depth (m) | Length (mm) |           |
|---------------------------|-------------------------------|-----------|-------------|-----------|
|                           |                               |           | ♀           | ♂         |
| Giesbrecht, 1892          | off Garapagos Is.             | 0–1800    | 2.25        | —         |
| Farran, 1908              | Irish Atlantic Slope          | 1080–1800 | —           | —         |
| A. Scott, 1909            | Malay Archipelago             | 0–700     | —           | —         |
| Sars, 1925                | near Canary Is.               | 0–2500    | 2.20        | —         |
| Farran, 1926              | Bay of Biscay                 | 360–900   | 2.04–2.30   | 1.9       |
| Farran, 1936              | outside of Great Barrier Reef | 0–500     | —           | —         |
| Wilson, 1950              | off Peru                      | 0–720     | —           | —         |
| Tanaka, 1964b             | Izu region                    | —         | 2.24        | 1.95      |
| Grice and Hulsemann, 1967 | Arabian Sea                   | 1000–2000 | —           | —         |
| Park, 1970                | Gulf of Mexico                | 203–1000  | —           | —         |
| Roe, 1972                 | off Canary Is.                | 500–960   | 1.98–2.28   | 1.82–1.98 |
| <i>Present record</i>     | Izu region                    | 0–520     | 2.08–2.70   | 1.96      |

*Euaugaptilus perodiosus* sp. nov.

(Figs. 2g, 25a-f)

*? Augaptilus antarcticus* Wolfenden, 1911, p. 334, pl. 36 figs. 6, 7, text-fig. 70.*? Augaptilus fungiferus* (non Steuer).—Wolfenden, 1911, p. 336, pl. 36 fig. 8, text-fig. 71.*Euaugaptilus laticeps*.—Sewell, 1947, p. 209, figs. 55, 56; Tanaka and Omori, 1967, p. 252.*Occurrence*: Sta. 111-2, 1 ♀.*Descriptive notes*: Female, 9.93 mm. The cephalothorax and abdomen have proportional lengths 80:20. The rostrum has slender filaments.

The abdominal segments and furca have the following proportional lengths:

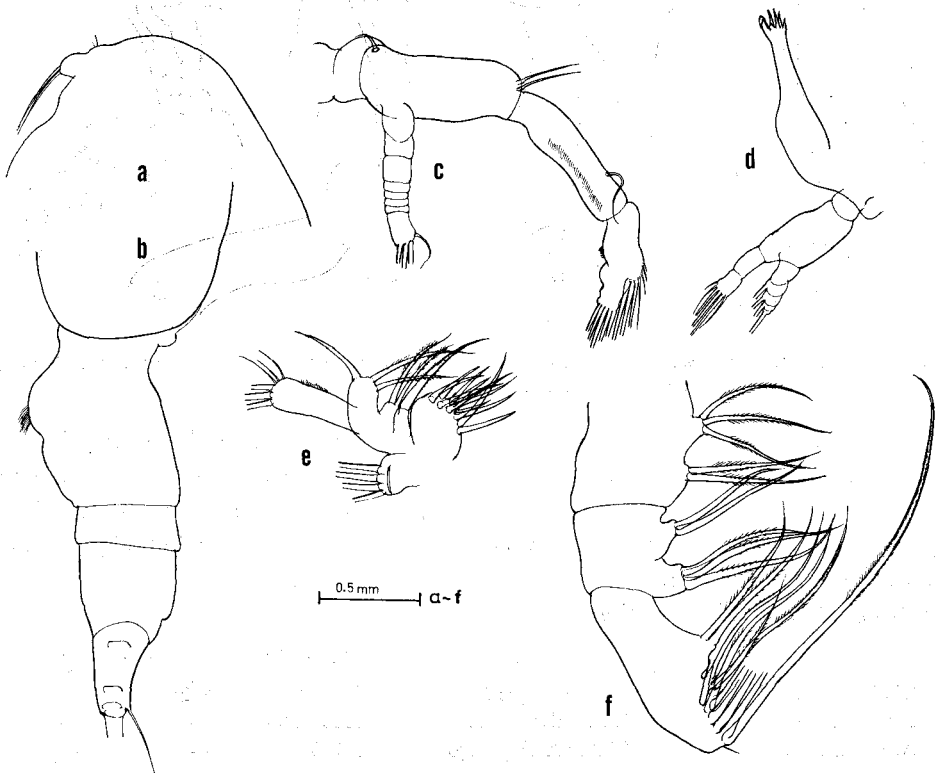


Fig. 25. *Euaugaptilus perodiosus* sp. nov. female: a, head, lateral view; b, last thoracic segment and abdomen, lateral view; c, 2nd antenna; d, mandible; e, 1st maxilla; f, 2nd maxilla.

| segment | 1-3 | 4  | 5  | furca  |
|---------|-----|----|----|--------|
|         | 43  | 10 | 22 | 25=100 |

The furca is nearly twice as long as wide.

The 1st antenna, 12.43 mm in length, extends beyond the end of furca by 5

segments; the segments have the following proportional lengths:

|         |    |    |    |    |    |    |    |    |    |       |    |    |    |    |    |
|---------|----|----|----|----|----|----|----|----|----|-------|----|----|----|----|----|
| segment | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10    | 11 | 12 | 13 | 14 | 15 |
|         | 47 | 14 | 18 | 22 | 22 | 25 | 32 | 32 | 32 | 36    | 40 | 43 | 47 | 55 | 51 |
| 16      | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |       |    |    |    |    |    |
| 54      | 54 | 58 | 54 | 47 | 43 | 51 | 54 | 40 | 29 | =1000 |    |    |    |    |    |

The endopod of the 2nd antenna is 1.9 times the length of the exopod; the endopod has 5 setae on the outer lobe and 7 setae on the inner lobe; the exopod is 8-segmented. On the mandible the exopod and endopod are nearly the same length; the exopod bears 4 setae; the endopod is 2-segmented, of which the distal segment has 6 setae. The 1st maxilla has the following number of setae on the various lobes: 4 on the outer lobe, 6 on the exopod, 3 on the 2nd basal segment including endopod, 2 on the 3rd inner lobe, 1 on the 2nd inner lobe, and 11 on the 1st inner lobe. The 2nd maxilla has a structure similar to that in *E. laticeps*: the lobes and endopod have the following number of setae:

|       |   |   |   |   |   |   |    |
|-------|---|---|---|---|---|---|----|
| lobe  | 1 | 2 | 3 | 4 | 5 | 6 | Ri |
| setae | 3 | 2 | 2 | 3 | 2 | 3 | 7  |

The maxilliped has the following number of setae on the lobes and endopod:

|       |    |   |    |   |   |         |   |   |   |   |   |
|-------|----|---|----|---|---|---------|---|---|---|---|---|
|       | B1 |   | B2 |   |   | Ri      |   |   |   |   |   |
| lobe  | 1  | 2 | 3  | 1 | 2 | segment | 1 | 2 | 3 | 4 | 5 |
| setae | 1  | 3 | 3  | 2 | 2 |         | 4 | 4 | 3 | 3 | 4 |

The 1st to 5th legs have a structure similar to those of *E. laticeps*.

*Remarks:* The present new species is closely related to *Euaugaptilus laticeps*, but can be distinguished easily from the latter species by its large size and number of setae on the exopod of the mandibular palp and on the outer lobe and 2nd inner lobe of the 1st maxilla. The specimens reported as *E. laticeps* from Antarctic waters by Farran (1929) and Vervoort (1957) may be *E. perodiosus*.

*Distribution and size variation:*

| Author                 | Locality             | Depth (m) | Length (mm) |      |
|------------------------|----------------------|-----------|-------------|------|
|                        |                      |           | ♀           | ♂    |
| Wolfenden, 1911        | Antarctic waters     | 0-1200    | 8.55        | 9.50 |
| Sewell, 1947           | Arabian Sea          | 0-1500    | 8.33        | —    |
| Tanaka and Omori, 1967 | Northwestern Pacific | 0-1430    | 9.0-9.9     | —    |
| <i>Present record</i>  | Izu region           | 0-1430    | 9.93        | —    |



*Euaugaptilus ? propinquus* Sars, 1920

(Figs. 3i, 26a-j)

*Euaugaptilus propinquus* Sars, 1920, p. 17; Sars, 1925, p. 297, pl. 102.*Occurrence*: Sta. 83, 1 ♀.

*Descriptive notes*: Female, 4.00 mm. The cephalothorax and abdomen have proportional lengths 75:25. The cephalothorax is robust: the frontal margin of the head is not produced in lateral view. The long rostral filaments are thick at the basal part.

The abdominal segments and furca have the following proportional lengths:

| segment | 1-3 | 4  | 5  | furca |      |
|---------|-----|----|----|-------|------|
|         | 47  | 12 | 18 | 23    | =100 |

The genital segment is about 1.6 times as long as wide; the genital area is produced ventrally; the furca is 1.5 times as long as wide.

The 1st antenna is broken off in the specimen. The 2nd antenna has a 8-segmented exopod; the 1st to 7th segments each have 1 seta respectively; the endopod is 1.5 times the length of the exopod, and has 7 setae on the inner lobe and 5 setae on the outer lobe. The mandibular teeth are divided into groups of 2, 2 and 3 teeth. The 1st maxilla has the following number of setae on the various lobes: 5 large and 2 small on the outer lobe; 6 on the exopod, of which 2 situated distally are strongest; 1 on the 2nd basal segment; 1 on the 2nd inner lobe; and 7 on the 1st inner lobe; the 3rd inner lobe and endopod are absent. The 2nd maxilla has the following number of setae on the lobes and endopod:

| lobe  | 1 | 2 | 3 | 4 | 5 | 6 | Ri |
|-------|---|---|---|---|---|---|----|
| setae | 2 | 1 | 2 | 2 | 2 | 1 | 7  |

Distal setae are fringed with button-like organs. The two basal segments of the maxilliped are about the same length; the 1st segment of the endopod is as long as the combined lengths of the 2nd and 3rd segments; the setation is as follows:

|       | B1 |   |   | B2 |   |         | Ri |   |   |   |   |
|-------|----|---|---|----|---|---------|----|---|---|---|---|
| lobe  | 1  | 2 | 3 | 1  | 2 | segment | 1  | 2 | 3 | 4 | 5 |
| setae | 1  | 2 | 3 | 2  | 2 |         | 4  | 4 | 3 | 3 | 4 |

On the 1st leg the outer marginal spine of the 1st exopodal segment is long and reaches the base of the 2nd outer marginal spine of the 3rd exopodal segment the 2nd basal segment has an outer marginal seta on the posterior surface. The 5th leg has 1 long seta on the 2nd basal segment.

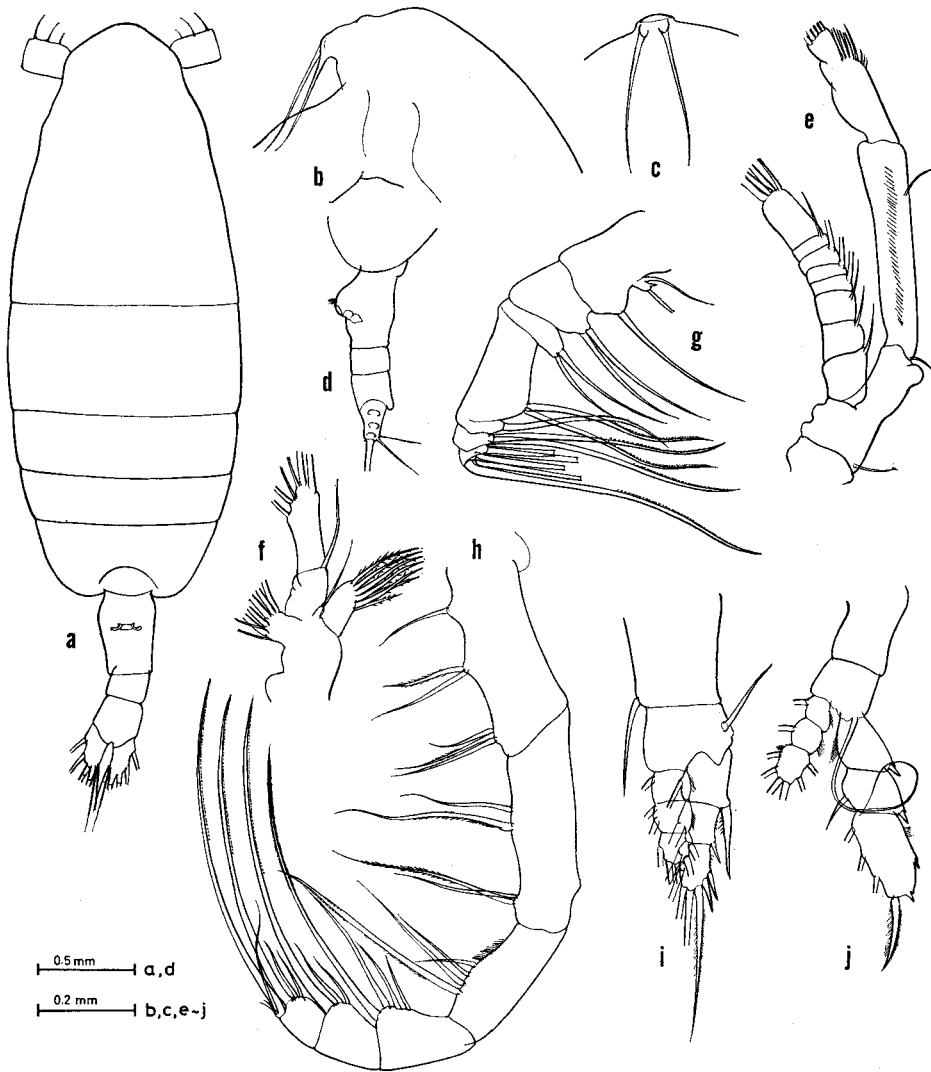


Fig. 26. *Euaugaptilus propinquus*, female: a, whole animal, dorsal view; b, head, lateral view; c, rostrum; d, last thoracic segment and abdomen, lateral view; e, 2nd antenna; f, 1st maxilla; g, 2nd maxilla; h, maxilliped; i, 1st leg; j, 5th leg.

**Remarks:** The present specimen differs from the description and figures of Sars (1925) in number of mandibular teeth and number of setae on the outer lobe, 2nd basal segment and 1st inner lobe of the 1st maxilla. Sars figures 5 or 6 teeth on the gnathobase and 5 setae on the outer lobe, 2 setae on the 2nd basal segment and 5 setae on the 1st inner lobe of the 1st maxilla. The outer spine of the 1st exopodal segment of the 1st leg of the present specimen is longer than that of Sars' specimen.

In these respects the present species has a structure similar to *E. mixtus* (Sars) which was redescribed by Hulsemann (1967). However, the shape of the forehead in dorsal view and the structure of other mouth appendages and swimming legs of the present specimen agree with those of *E. propinquus* rather than—*E. mixtus*.

The species has been described from deep water of the North Atlantic. This is the first record of occurrence in the Pacific Ocean.

*Distribution and size variation:*

| Author                | Locality     | Depth (m) | Length (mm) |
|-----------------------|--------------|-----------|-------------|
| Sars, 1925            | off Portugal | 0-1550    | 3.90        |
| <i>Present record</i> | Izu region   | 0-1260    | 4.00        |

*Euaugaptilus rectus* Grice et Hulsemann, 1967

(Figs. 3d, 27a-1)

*Euaugaptilus rectus* Grice and Hulsemann, 1967, p. 35, figs. 210-214.

*Euaugaptilus oblongus*.—Tanaka and Omori, 1967, p. 257, fig. 9.

*Occurrence:* Sta. 107, 1 ♀; Sta. 111-2, 1 ♀; Sta. 121-2, 1 ♂.

*Descriptive notes:* Female, 6.78 mm. The cephalothorax and abdomen have proportional lengths 80:20. The cephalothorax is 2.2 times as long as wide. The frontal margin of the head is produced dorsally. The head and 1st thoracic segment are separated; the 4th and 5th thoracic segments are fused. The lateral distal margin of the last thoracic segment is narrowly rounded. The rostrum is composed of 2 short cones without any filaments.

The abdominal segments and furca have the following proportional lengths:

| segment | 1-3 | 4  | 5  | furca   |
|---------|-----|----|----|---------|
|         | 51  | 13 | 18 | 18 =100 |

The genital segment is 1.4 times as long as wide; the genital protuberance is round; the furca is as long as wide.

The 1st antenna, 8.12 mm in length, extends beyond the end of furca by 5 segments; the segments have the following proportional lengths:

| segment | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11    | 12 | 13 | 14 | 15 |
|---------|----|----|----|----|----|----|----|----|----|----|-------|----|----|----|----|
|         | 40 | 14 | 22 | 25 | 27 | 28 | 29 | 31 | 31 | 35 | 38    | 48 | 49 | 53 | 55 |
|         | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |       |    |    |    |    |
|         | 59 | 62 | 58 | 58 | 46 | 47 | 37 | 41 | 39 | 28 | =1000 |    |    |    |    |

The 1st segment is swollen on the posterior margin.

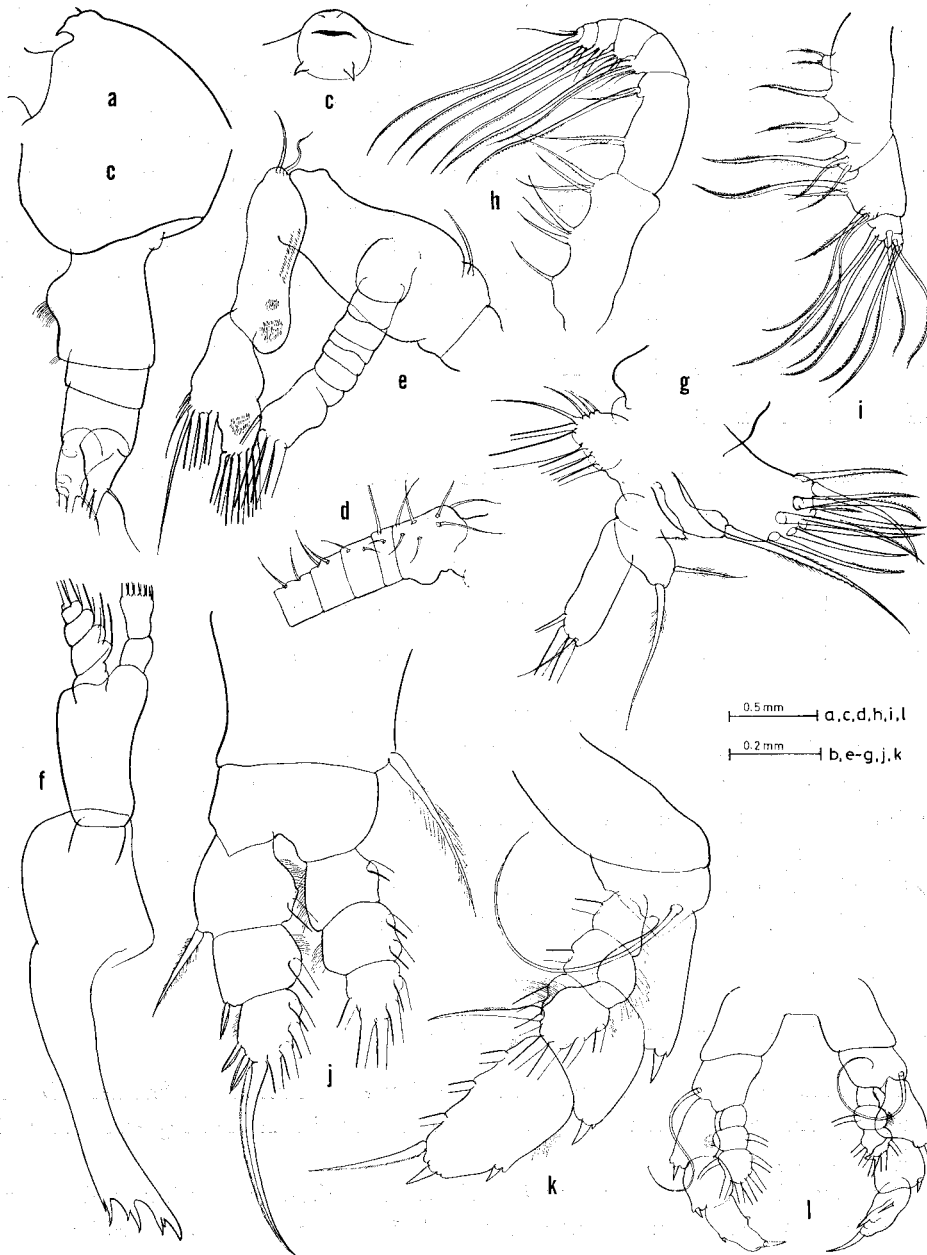


Fig. 27. *Euaugaptilus rectus*, female: a, head, lateral view; b, rostrum; c, last thoracic segment and abdomen, lateral view; d, proximal part of 1st antenna; e, 2nd antenna; f, mandible; g, 1st maxilla; h, 2nd maxilla; i, maxilliped; j, 1st leg; k, 5th leg. male: l, 5th pair of legs.

The 2nd antenna has a 8-segmented exopod; the 1st to 7th segments lack setae; the endopod is 1.5 times the length of the exopod; the outer lobe has 6 setae and the inner lobe has 7 setae; there is a clump of short hairs on the 2nd segment and on the distal margin of the 1st segment respectively. The mandibular palp has no setae; the exopod is 5-segmented, and has 5 setae; the endopod has 6 setae on the distal segment. On the 1st maxilla the outer lobe has 9 setae, of which the 6th setae is largest; the exopod has 2 large and 2 small setae; the 2nd basal segment has 2 setae; the 3rd inner lobe is terminated into a small projection; the 2nd inner lobe has 1 strong seta; the 1st inner lobe has 10 setae. The 2nd maxilla has the following number of setae on the lobes and endopod:

|       |   |   |   |   |   |   |    |
|-------|---|---|---|---|---|---|----|
| lobe  | 1 | 2 | 3 | 4 | 5 | 6 | Ri |
| setae | 2 | 1 | 2 | 3 | 2 | 3 | 7  |

The 1st basal segment of the maxilliped is 1.3 times the length of the 2nd basal segment; the number of setae on the lobes and endopod is as follows:

|       |    |   |    |   |   |         |   |   |   |   |   |
|-------|----|---|----|---|---|---------|---|---|---|---|---|
|       | B1 |   | B2 |   |   | Ri      |   |   |   |   |   |
| lobe  | 1  | 2 | 3  | 1 | 2 | segment | 1 | 2 | 3 | 4 | 5 |
| setae | 1  | 3 | 3  | 2 | 2 |         | 4 | 4 | 4 | 3 | 3 |

Distal setae are fringed with small button-like organs.

On the 1st leg the outer marginal spine on the 1st exopodal segment extends to the distal margin of the outer marginal spine on the 2nd exopodal segment the outer marginal seta is not seen on the 2nd basal segment.

Male, 8.80 mm. The cephalothorax and abdomen have proportional lengths 79:21. The rostrum forms 2 cones without filaments. The abdominal segments and furca have the following proportional lengths:

|         |    |    |    |    |    |       |      |
|---------|----|----|----|----|----|-------|------|
| segment | 1  | 2  | 3  | 4  | 5  | furca |      |
| setae   | 23 | 14 | 14 | 11 | 12 | 26    | =100 |

The mouth appendages have a structure similar to that of the female. On the 5th legs the 3rd segment of the endopod bears 5 setae in the left leg and 6 setae in the right leg respectively.

*Remarks:* Grice and Hulsemann (1967) state that *E. rectus* is similar to *E. angustus*. The species, however, resembles more closely *E. oblongus* and we have considered once that the present species was the large form of *E. oblongus* (Tanaka and Omori, 1967). However, *E. rectus* is distinguished from *E. oblongus* by the number of setae on the lobes of the 1st and 2nd maxillae and by the absence of small bosses on the mandible and 1st maxilla.

There are some differences between the present specimens and the holotype of

*E. rectus* in the number of setae on the 1st and 2nd maxillae. Grice and Hulsemann (1967) described that the 1st maxilla has 3 setae on the 2nd basal segment and that the 2nd maxilla has 2, 1, 1, 3, 2, and 3 setae on the 1st to 6th lobes respectively. The distal margin of the 3rd inner lobe of the 1st maxilla is fringed with fine hairs in the present specimens. Other characteristic features of our specimens are exactly same as those given by Grice and Hulsemann (1967). The type locality of the species is the equatorial Indian Ocean.

*Distribution and size variation:*

| Author                    | Locality                | Depth (m) | Length (mm) |      |
|---------------------------|-------------------------|-----------|-------------|------|
|                           |                         |           | ♀           | ♂    |
| Grice and Hulsemann, 1967 | Equatorial Indian Ocean | 275-2250  | 7.98        | —    |
| Tanaka and Omori, 1967    | Northwestern Pacific    | 0-1100    | 9.2, 9.3    | 8.8  |
| Roe, 1972                 | off Canary Is.          | 940       | 6.88        | —    |
| <i>Present record</i>     | Izu region              | 0-1100    | 6.78, 9.27  | 8.80 |

*Euaugaptilus squamatus* (Giesbrecht, 1889)

(Figs. 2d, 28a-f)

*Augaptilus squamatus* Giesbrecht, 1889, p. 814; Giesbrecht, 1892, p. 400, pl. 28 figs. 1, 12, 18, 22, 25, 34, pl. 39 fig. 38.

*Euaugaptilus squamatus* (Giesbrecht).—Sars, 1925, p. 261, pl. 78; Vervoort, 1965, p. 136.

*Augaptilus brevicaudatus* Sars, 1905, p. 12.

*Augaptilus californicus* Esterly, 1913, p. 186, figs. 4, 22, 31, 40, 43, 48.

*Occurrence:* Sta. 98, 1 ♀; Sta. 118, 1 ♀.

*Descriptive notes:* Female, 7.41 mm. The cephalothorax and abdomen have proportional lengths 80:20. The cephalothorax is 2.4 times as long as wide. The frontal margin of the head is narrowly rounded. The rostral filaments are relatively thick.

The abdominal segments and furca have the following proportional lengths:  
segment 1-3 4 5 furca 46 12 22 20=100

The genital segment is squarish in shape; the genital protuberance is large the furca is 1.6 times as long as wide.

The 1st antenna, 10.25 mm in length, extends beyond the furca by 6 segments. The segments have the following proportional lengths:

|         |    |    |    |    |    |    |    |    |    |         |    |    |    |    |    |
|---------|----|----|----|----|----|----|----|----|----|---------|----|----|----|----|----|
| segment | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10      | 11 | 12 | 13 | 14 | 15 |
|         | 51 | 15 | 21 | 23 | 28 | 30 | 31 | 28 | 39 | 37      | 43 | 54 | 51 | 51 | 51 |
|         | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25      |    |    |    |    |    |
|         | 53 | 54 | 53 | 54 | 52 | 41 | 37 | 41 | 38 | 24=1000 |    |    |    |    |    |

Segments 12 and 20 of the left antenna are brownly colored.

The exopod of the 2nd antenna is 8-segmented, and lacks setae on the inner margin; the endopod is 1.8 times the length of the exopod. The 2nd endopodal segment of the mandible has 6 setae on the distal margin. The 1st maxilla has the following number of setae on the various lobes: 9 on the outer lobe, 7 on the exopod, 3 on the 2nd basal segment including the endopod, 2 on the 3rd inner lobe, 2 on the 2nd inner lobe, and 11 on the 1st inner lobe. The 2nd maxilla has the following number of setae on the lobes and endopod:

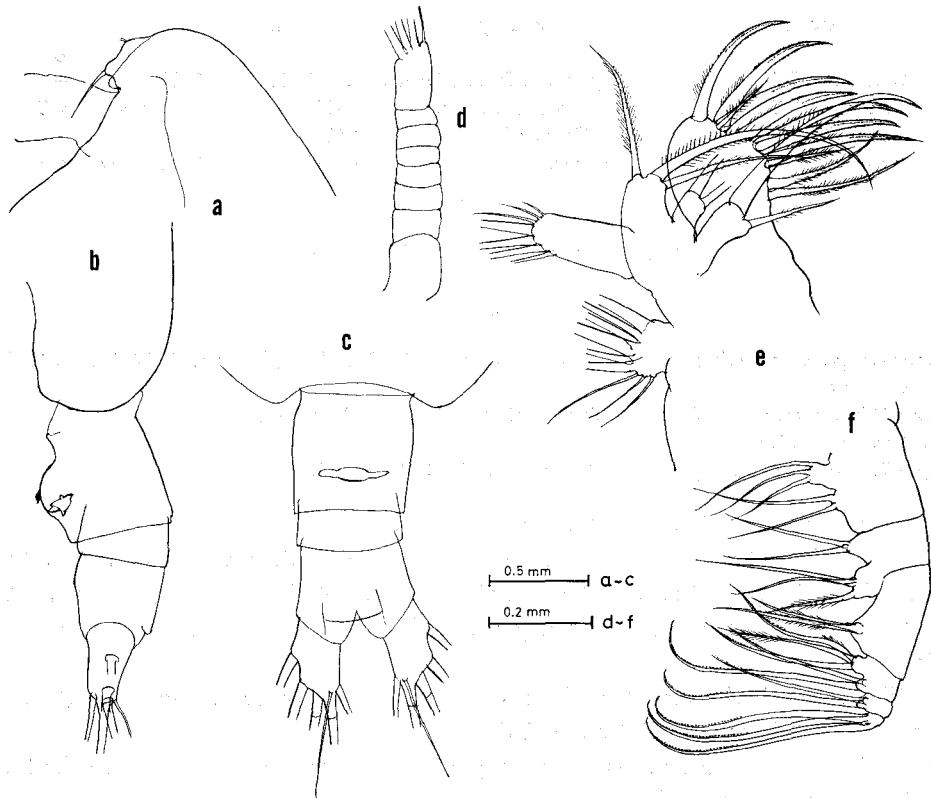


Fig. 28. *Euaugettilus squamatus*, female: a, head, lateral view; b, last thoracic segment and abdomen, lateral view; c, the same, dorsal view; d, exopod of 2nd antenna; e, 1st maxilla; f, 2nd maxilla.

| lobe  | 1 | 2 | 3 | 4 | 5 | 6 | Ri |
|-------|---|---|---|---|---|---|----|
| setae | 3 | 2 | 2 | 3 | 2 | 3 | 7  |

The 2nd basal segment of the maxilliped is a little longer than the 1st basal segment which has a group of spinules on the base of the 3rd lobe; the 2nd basal segment has a row of spinules along the anterior margin; the lobes and endopod have the following number of setae:

| lobe  | B1 |   | B2 |   | segment | Ri |   |   |   |   |
|-------|----|---|----|---|---------|----|---|---|---|---|
|       | 1  | 2 | 3  | 1 |         | 2  | 1 | 2 | 3 | 4 |
| setae | 1  | 3 | 3  | 2 | 2       | 4  | 4 | 3 | 3 | 4 |

The swimming legs agree with those figured by Sars (1925).

*Remarks:* This species can be characterized by the short 3rd abdominal segment and structure of the 1st maxilla. The occurrence of the present species is the first record in Japanese waters.

*Distribution and size variation:*

| Author                      | Locality              | Depth (m) | Length (mm) |           |
|-----------------------------|-----------------------|-----------|-------------|-----------|
|                             |                       |           | ♀           | ♂         |
| Giesbrecht, 1889            | North of Marshall Is. | 0-1000    | 6.8         | —         |
| Farran, 1908                | Irish Atlantic slope  | 630-2370  | —           | —         |
| Sars, 1925                  | off Canary Is.        | 0-3000    | 6.30        | —         |
| Lysholm and Nordgaard, 1945 | off Morocco           | 200-850   | —           | —         |
| Wilson, 1950                | off Peru              | 0-500     | —           | —         |
| Vervoort, 1965              | Gulf of Guinea        | 0-600     | 5.40-5.80   | —         |
| Roe, 1972                   | off Canary Is.        | 205-940   | 6.23-6.72   | 5.93-6.40 |
| <i>Present record</i>       | Izu region            | 0-1250    | 7.20, 7.41  | —         |

*Euaugaptilus? sublongiseta* Park, 1970

(Figs. 3c, 29a-m)

*Euaugaptilus sublongiseta* Park, 1970, p. 527, figs. 277-288.

*Occurrence:* Sta. 117-2, 1 ♀.

*Descriptive notes:* Female, 2.30 mm. The cephalothorax and abdomen have proportional lengths 79:21. The head is separated from the 1st thoracic segment; the 4th and 5th segments are fused. The cephalothorax is 2.6 times as long as wide. The frontal margin of the head is evenly rounded. The lateral distal margin of the thoracic segment is narrowly rounded. The rostral filaments are slender.

The abdominal segments and furca have the following proportional lengths:

| segment | 1-3 | 4  | 5  | furca |      |
|---------|-----|----|----|-------|------|
|         | 51  | 17 | 14 | 18    | =100 |

The genital segment is swollen laterally; it is 1.4 times as long as wide; the genital protuberance is large the furca is short, twice as long as wide.

The 1st antenna, 2.76 mm in length, extends beyond the end of the furca by 3 segments; the segments have the following proportional lengths:



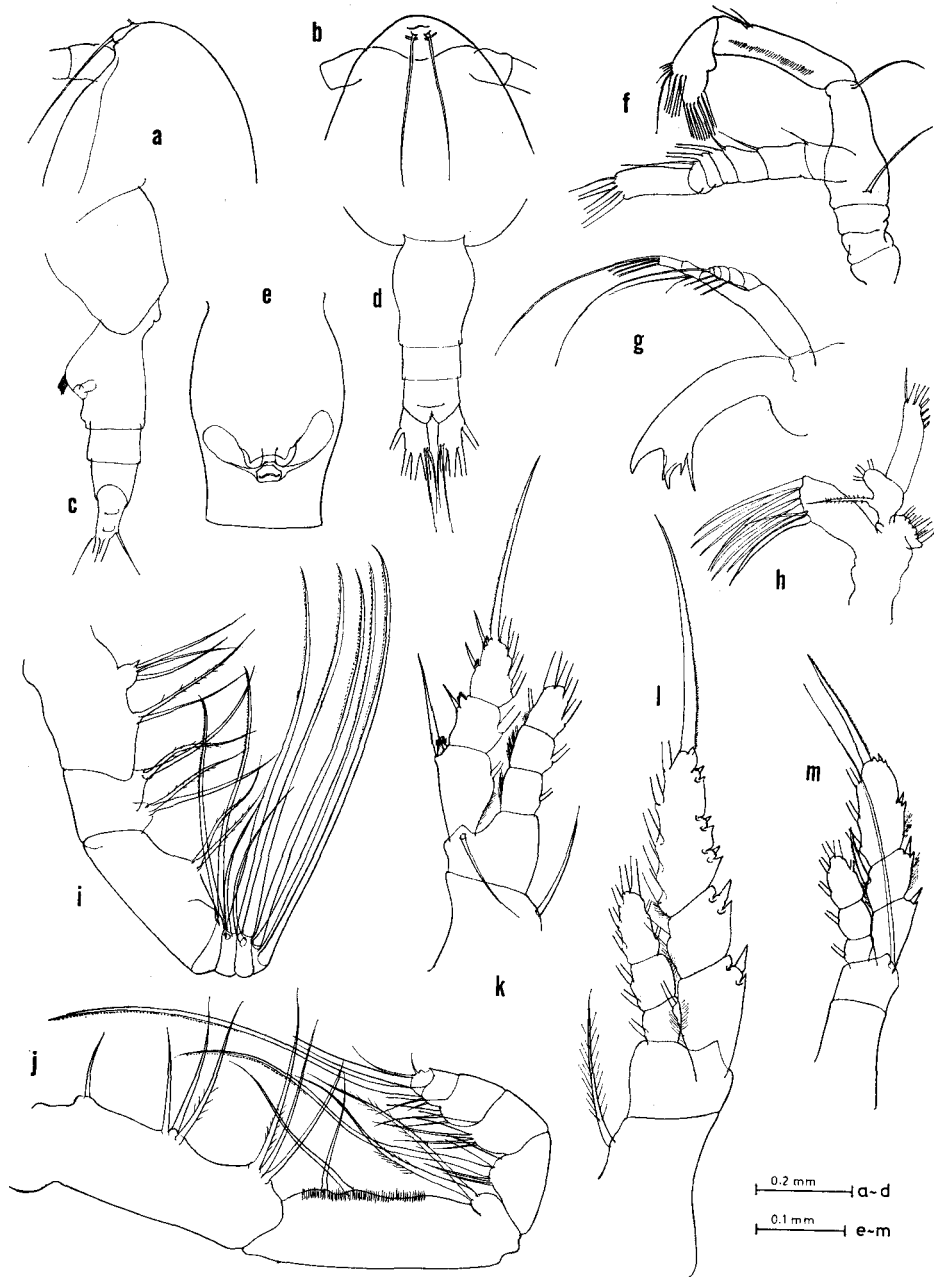


Fig. 29. *Euaugaptilus* ? *sublongiseta*, female: a, head, lateral view; b, the same, dorsal view; c, last thoracic segment and abdomen, lateral view; d, the same, dorsal view; e, genital segment, ventral view; f, 2nd antenna; g, mandible; h, 1st maxilla; i, 2nd maxilla; j, maxilliped; k, 1st leg; l, 2nd leg; m, 5th leg.

|         |    |    |    |    |    |    |    |    |    |         |    |    |    |    |    |
|---------|----|----|----|----|----|----|----|----|----|---------|----|----|----|----|----|
| segment | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10      | 11 | 12 | 13 | 14 | 15 |
|         | 45 | 15 | 19 | 15 | 22 | 26 | 26 | 26 | 26 | 30      | 30 | 34 | 49 | 52 | 52 |
| 16      | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |         |    |    |    |    |    |
| 52      | 52 | 56 | 60 | 60 | 50 | 49 | 41 | 45 | 49 | 45=1000 |    |    |    |    |    |

The segments 23 and 24 each bears a long plumose seta.

Both rami of the 2nd antenna are about the same length; the exopod is 7-segmented; the 1st to 6th segments each have 1 seta; the endopod has 6 setae on the outer lobe and 8 setae on the inner lobe. The mandible has a slender palp; the exopod is 5-segmented, and bears 4 setae; the endopod has 2 setae on the 1st segment, and 4 setae on the 2nd segment; the outermost mandibular tooth is very stout. The 1st maxilla has the following number of setae on the various lobes: 6 on the outer lobe, 7 on the exopod, 3 on the 2nd basal segment, 1 on the 2nd (or 3rd) inner lobe, and 9 on the 1st inner lobe. The 2nd maxilla has the following number of setae on the lobes and endopod:

|       |   |   |   |   |   |   |    |
|-------|---|---|---|---|---|---|----|
| lobe  | 1 | 2 | 3 | 4 | 5 | 6 | Ri |
| setae | 3 | 2 | 2 | 2 | 2 | 2 | 7  |

The maxilliped is strongly built; two basal segments are about the same length; the number of setae on the lobes and endopod is as follows:

|       |    |   |    |   |   |         |   |   |   |   |   |
|-------|----|---|----|---|---|---------|---|---|---|---|---|
|       | B1 |   | B2 |   |   | Ri      |   |   |   |   |   |
| lobe  | 1  | 2 | 3  | 1 | 2 | segment | 1 | 2 | 3 | 4 | 5 |
| setae | 1  | 3 | 3  | 2 | 2 |         | 4 | 4 | 3 | 3 | 3 |

Distal setae have small buttons.

Both rami of the 1st to 5th legs are 3-segmented. On the 1st leg the outer marginal spine of the 1st exopodal segment is long and straight, and extends to the base of the proximal outer marginal spine on the 3rd exopodal segment the 2nd basal segment has an outer marginal seta; there is a bunch of spinules on the base of outer marginal spines of the exopod. The 2nd leg has 3 small outer marginal spines on the 3rd exopodal segment the endopod has 7 setae on the 3rd segment. The 3rd leg has a structure similar to that of the 2nd leg. The 4th leg has 1 long seta on the posterior surface of the 2nd basal segment. A long seta on the 2nd basal segment of the 5th leg extends nearly to the tip of the outer marginal spine of the 3rd exopodal segment.

*Remarks:* The present specimen differs from the original description and figures of *E. sublongiseta* Park by the structure of the mandibular teeth, number of setae on the exopod of the 1st maxilla and on the 4th lobe of the 2nd maxilla. Park (1970) figures 2 setae on the 2nd exopodal segment of the 1st leg, but the present specimen has only 1 seta. Although the 1st antenna is short, the structure of the mandibular

teeth and 1st maxilla of the present specimen is more similar to *E. longiantennalis* Park (probably synonym of *E. marginatus* Tanaka—Matthews, 1972) than *E. sublongiseta*. The specimen also resembles *E. longiseta* Grice et Hulsemann but it can be distinguished from the latter by the length of the 1st antenna, the structure of the mandibular teeth and number of setae on the 1st and 2nd maxillae.

Matthews (1971) discussed about similarity among *E. sublongiseta*, *E. marginatus*, *E. longiseta* and *E. longiantennalis*. A great number of species must be collected for comparison of the present species with these 4 small species. Type locality of *E. sublongiseta* is the Caribbean Sea at 11°N, 79°W at a depth between 208 and 500 m.

### *Euaugaptilus tenuispinus* Sars, 1920

(Figs. 2h, 30a-j)

*Euaugaptilus tenuispinus* Sars, 1920, p. 16; Sars, 1925, p. 290, pl. 97; Sewell, 1947, p. 219, fig. 59.

*Occurrence*: Sta. 111-2, 1 ♀.

*Descriptive notes*: Female, 5.27 mm. The cephalothorax and abdomen have proportional lengths 80:20. The rostrum has a pair of small spines.

The abdominal segments and furca have the following proportional lengths:

|         |     |    |    |       |      |
|---------|-----|----|----|-------|------|
| segment | 1-3 | 4  | 5  | furca |      |
|         | 51  | 14 | 15 | 20    | =100 |

The genital segment is produced ventrally; the segment is 1.4 times as long as wide; the furca is 1.4 times as long as wide.

The 1st antenna, 6.39 mm in length, extends beyond the end of the furca by 4 segments; the segments have the following proportional lengths:

|         |    |    |    |    |    |    |    |    |    |    |       |    |    |    |    |
|---------|----|----|----|----|----|----|----|----|----|----|-------|----|----|----|----|
| segment | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11    | 12 | 13 | 14 | 15 |
|         | 40 | 11 | 18 | 19 | 21 | 24 | 24 | 27 | 35 | 35 | 42    | 55 | 56 | 60 | 60 |
|         | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |       |    |    |    |    |
|         | 56 | 56 | 60 | 52 | 43 | 47 | 40 | 47 | 43 | 29 | =1000 |    |    |    |    |

Both rami of the 2nd antenna are about the same length; the endopod bears 6 setae on the outer lobe and 7 setae on the inner lobe. The exopod of the mandible is 1.8 times the length the endopod is 2-segmented, of which the distal one bears 4 setae. The 1st maxilla has the following number of setae on the various lobes: 6+3 on the outer lobe, 6 on the exopod, 3 on the 2nd basal segment including the endopod, 1 on the 2nd and 3rd inner lobes and 10 on the 1st inner lobe. The 2nd maxilla has the following number of setae on the lobes and endopod;

|       |   |   |   |   |   |   |    |
|-------|---|---|---|---|---|---|----|
| lobe  | 1 | 2 | 3 | 4 | 5 | 6 | Ri |
| setae | 3 | 2 | 2 | 3 | 2 | 3 | 7  |

The two basal segments of the maxilliped are about the same length; the lobes have the following number of setae:

|       |    |   |    |   |   |         |   |   |   |   |   |
|-------|----|---|----|---|---|---------|---|---|---|---|---|
|       | B1 |   | B2 |   |   | Ri      |   |   |   |   |   |
| lobe  | 1  | 2 | 3  | 1 | 2 | segment | 1 | 2 | 3 | 4 | 5 |
| setae | 1  | 3 | 3  | 2 | 2 |         | 4 | 4 | 3 | 3 | 2 |

Distal setae are fringed with button-like organs.

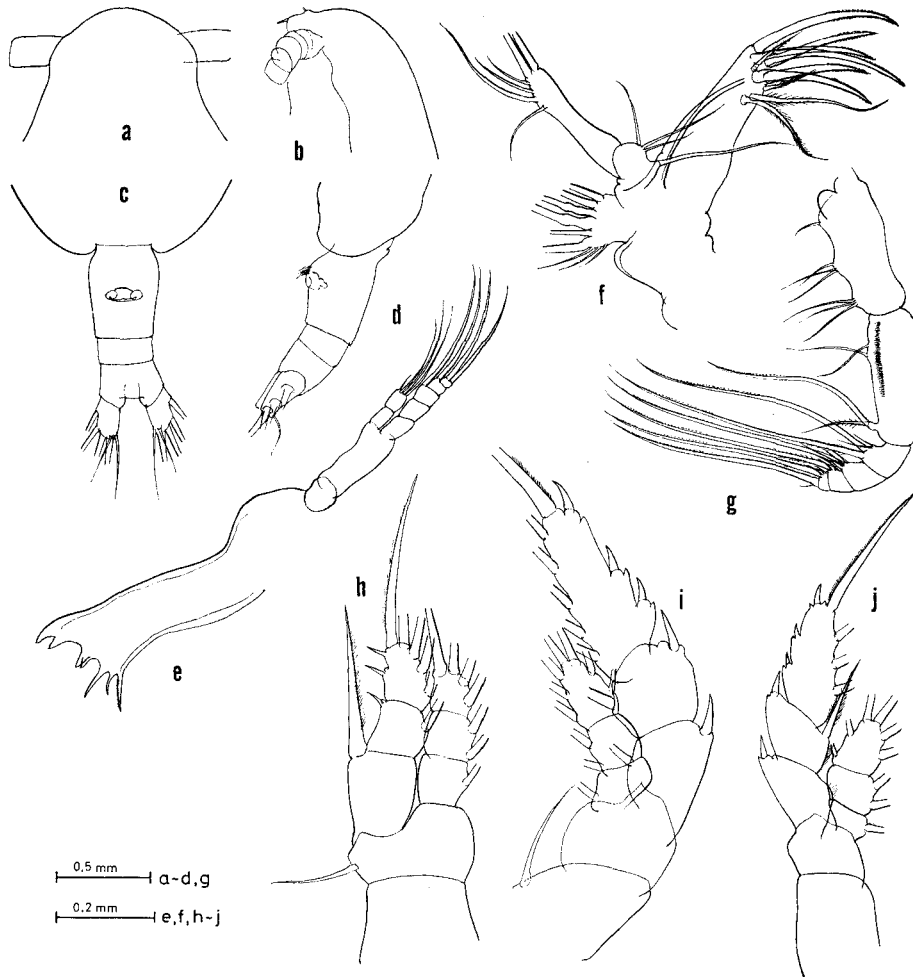


Fig. 30. *Euaugaptilus tenuispinus*, female: a, head, dorsal view; b, the same, lateral view; c, last thoracic segment and abdomen, dorsal view; d, the same, lateral view; e, mandible; f, 1st maxilla; g, maxilliped; h, 1st leg; i, 2nd leg; j, 5th leg.

On the 1st leg the marginal spine of the 1st exopodal segment is large, and extends beyond the end of the 3rd segment; the marginal spine on the 2nd and 3rd segments are small; the 2nd basal segment has an outer marginal seta on the posterior surface. The 2nd leg has a fairly long outer marginal spines on the 3rd exopodal segment. On the 5th leg the inner marginal spine on the 2nd exopodal segment extends to the base of the 2nd inner marginal seta on the 3rd exopodal segment.

*Remarks:* The present specimen has a structure more similar to Sars' (1925) description and figures than to Sewell's (1947). This is the first record of occurrence in the Pacific Ocean.

*Distribution and size variation:*

| Author                | Locality            | Depth (m) | Length (mm) |
|-----------------------|---------------------|-----------|-------------|
| Sars, 1925            | North of Azores Is. | 0-1500    | 4.90        |
| Sewell, 1932          | Laccadive Sea       | 0-1280    | —           |
| Sewell, 1947          | Arabian Sea         | 0-1500    | 5.30        |
| Vervoort, 1965        | Gulf of Guinea      | 0-600     | 4.50-4.90   |
| <i>Present record</i> | Izu region          | 0-1430    | 5.27        |

*Euaugaptilus* species 1

(Fig. 31 a-k)

*Occurrence:* Sta. 111-1, 1 juv.

*Descriptive notes:* Copepodite V stage female, 3.19 mm. The cephalothorax and abdomen have proportional lengths 75:25. The frontal margin of the head is produced and narrowly rounded in lateral view. The lateral distal margin of the last thoracic segment is squarish in shape. The rostrum has filaments.

The abdomen is 3-segmented, but there remains a line of demarcation in the 1st segment on the dorsal surface; the segments and furca have the following proportional lengths:

| segment | 1-3 | 4  | 5  | furca   |
|---------|-----|----|----|---------|
|         | 38  | 17 | 20 | 25 =100 |

The furca is 2.8 times as long as wide.

The 1st antenna, 4.22 mm in length, extends beyond the furca by 5 segments; the segments have the following proportional lengths:

| segment | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11    | 12 | 13 | 14 | 15 |
|---------|----|----|----|----|----|----|----|----|----|----|-------|----|----|----|----|
|         | 54 | 19 | 19 | 19 | 24 | 22 | 22 | 29 | 32 | 34 | 39    | 49 | 56 | 56 | 54 |
|         | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |       |    |    |    |    |
|         | 56 | 56 | 59 | 54 | 44 | 44 | 36 | 42 | 42 | 39 | =1000 |    |    |    |    |

Both rami of the 2nd antenna are slender; the 8-segmented exopod is about the same length of the endopod; the 1st, 2nd, 4th and 5th segment each have 1 seta; the endopod has 6 setae on the outer lobe and 7 setae on the inner lobe. The mandibular palp is slender; the exopod is 5-segmented and has 3 setae on the inner margin; the endopod bears 1 seta on the 1st segment and 4 setae on the 2nd segment. The 1st maxilla has the following number of setae on the various lobes: 6 on the outer lobe, 6 on the exopod, 2 on the 2nd basal segment and 9 on the 1st inner lobe; the 2nd and

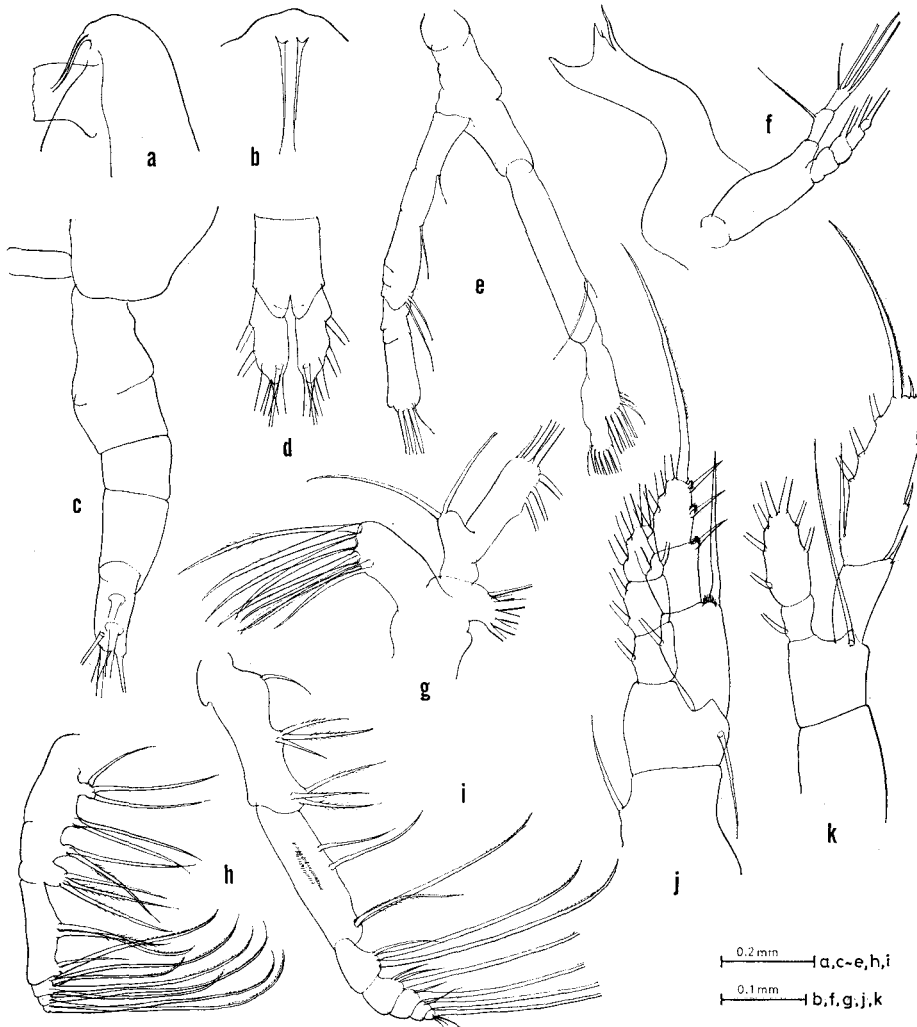


Fig. 31. *Euaugaptilus* species 1, copepodite V stage female: a, head, lateral view; b, rostrum; c, last thoracic segment and abdomen, lateral view; d, last abdominal segment and furca, ventral view; e, 2nd antenna; f, mandible; g, 1st maxilla; h, 2nd maxilla; i, maxilliped; j, 1st leg; k, 5th leg.

3rd inner lobes are absent. The 2nd maxilla has the following number of setae on the lobes and endopod:

|       |   |   |   |   |   |   |    |      |
|-------|---|---|---|---|---|---|----|------|
| lobe  | 1 | 2 | 3 | 4 | 5 | 6 | Ri |      |
| setae | 3 | 2 | 2 | 3 | 2 | 2 | 7  | =100 |

The two basal segments of the maxilliped are about the same length; the lobes and endopod have the following number of setae; distal setae on the 2nd maxilla and maxilliped are fringed with buttons.

|       |    |   |    |   |   |         |   |   |   |   |   |
|-------|----|---|----|---|---|---------|---|---|---|---|---|
|       | B1 |   | B2 |   |   | Ri      |   |   |   |   |   |
| lobe  | 1  | 2 | 3  | 1 | 2 | segment | 1 | 2 | 3 | 4 | 5 |
| setae | 1  | 3 | 3  | 2 | 2 |         | 3 | 3 | 2 | 2 | 4 |

The 1st leg has a 3-segmented exopod and endopod; the outer marginal spine on the 1st exopodal segment extends beyond the end of the 3rd exopodal segment the outer marginal spines on the exopod each have spinules at the base; the 2nd basal segment has an outer marginal seta. The 2nd to 4th legs each have a 3-segmented exopod and endopod. The 5th leg is not developed; both rami are 2-segmented.

### *Euaugaptilus* species 2

(Fig. 32 a-j)

*Occurrence:* Sta. 111-2, 1 juv.

*Descriptive notes:* Copepodite IV stage female (?), 4.79 mm. The cephalothorax and abdomen have proportional lengths 82:18. Frontal margin of the head is broadly rounded in the dorsal view. The rostrum is represented by a knob and has no filament.

The abdomen is 3-segmented; the proportional lengths of the segments and furca are as follows:

|         |    |    |    |       |      |
|---------|----|----|----|-------|------|
| segment | 1  | 2  | 3  | furca |      |
|         | 35 | 18 | 23 | 24    | =100 |

The furca is a little longer than wide.

The 1st antenna extends beyond the furca by 4 segments; the segments have the following proportional lengths:

|         |    |    |    |    |    |    |    |    |    |    |       |    |    |    |    |
|---------|----|----|----|----|----|----|----|----|----|----|-------|----|----|----|----|
| segment | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11    | 12 | 13 | 14 | 15 |
|         | 51 | 12 | 20 | 15 | 20 | 20 | 22 | 24 | 27 | 27 | 34    | 48 | 48 | 48 | 49 |
| 16      | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |    |       |    |    |    |    |
|         | 51 | 58 | 60 | 60 | 49 | 51 | 54 | 60 | 53 | 39 | =1000 |    |    |    |    |

The 2nd antenna has a 8-segmented exopod which is 1.1 times the length of the endopod; the exopod lacks setae on the segments. On the mandible the exopod has 6 marginal setae and the endopod has 3 terminal setae. The 1st maxilla has the following number of setae on the various lobes: 9 on the outer lobe, 3 on the exopod, 1 on the 2nd basal segment, 6 on the 1st inner lobe; the 3rd inner lobe is represented by a conical process. The 2nd maxilla has the following number of setae on the lobes and endopod:

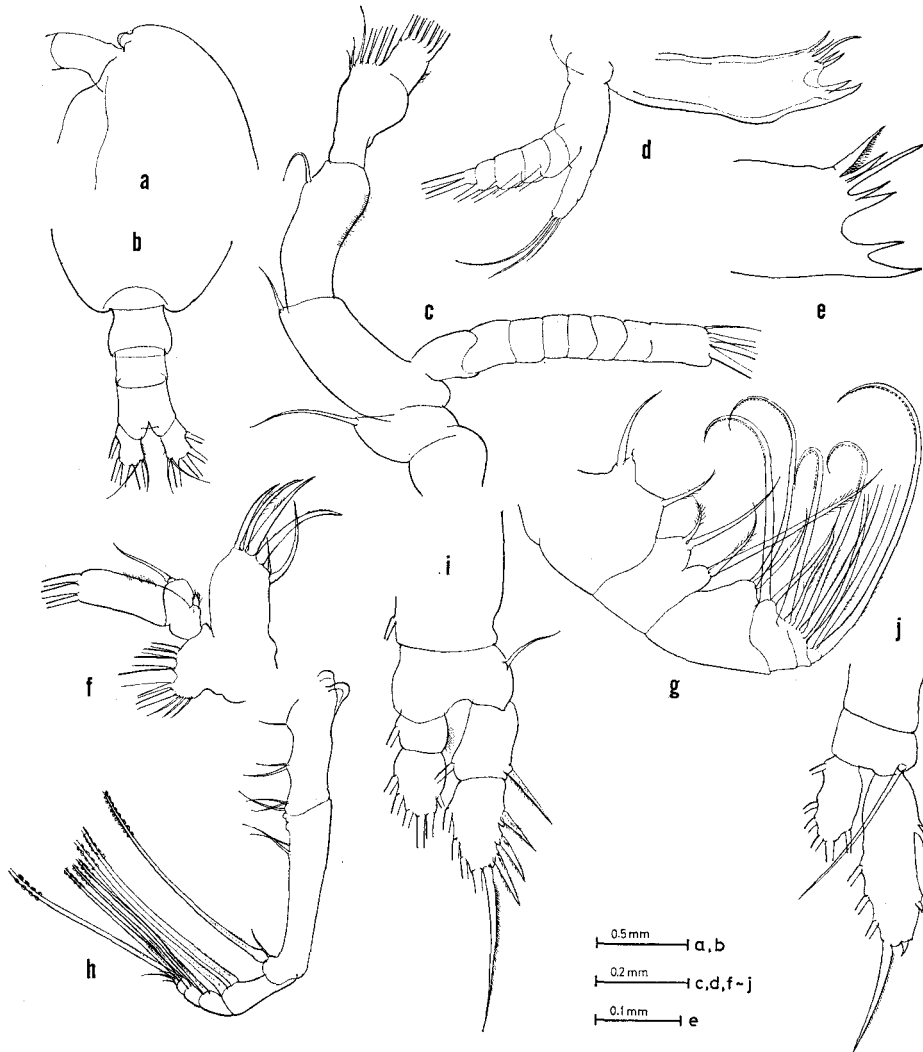


Fig. 32. *Euauaptilus* species 2, copepodite IV stage: head, lateral view; b, last thoracic segment and abdomen, dorsal view; c, 2nd antenna; d, mandible; e, cutting blade of mandible; f, 1st maxilla; g, 2nd maxilla; h, maxilliped; i, 1st leg; j, 5th leg.



|       |   |   |   |   |   |   |    |
|-------|---|---|---|---|---|---|----|
| lobes | 1 | 2 | 3 | 4 | 5 | 6 | Ri |
| setae | 1 | 1 | 2 | 2 | 2 | 2 | 7  |

The structure of the maxilliped is characteristic: the 1st basal segment is shorter than the 2nd basal segment, and has a conical process on the posterior proximal margin; the lobes have the following number of setae:

|       |    |   |    |   |   |         |   |   |   |   |   |
|-------|----|---|----|---|---|---------|---|---|---|---|---|
|       | B1 |   | B2 |   |   | Ri      |   |   |   |   |   |
| lobe  | 1  | 2 | 3  | 1 | 2 | segment | 1 | 2 | 3 | 4 | 5 |
| setae | 1  | 2 | 3  | 2 | 2 |         | 2 | 1 | 1 | 2 | 3 |

One of the setae on the 2nd lobe of the 2nd basal segment is minute, whereas the another is long and has elegant buttons.

The 1st to 4th legs each have a 2-segmented exopod and endopod. Both rami of the 5th leg are 1-segmented.

#### HALOPTILUS Giesbrecht, 1898

##### *Haloptilus fons* Farran, 1908

(Figs. 33 a-o)

*Haloptilus fons* Farran, 1908, p. 69, pl. 7, figs. 11-15; Sars, 1925, p. 245, pl. 71.

*Occurrence:* Sta. 116, 1 ♀.

*Descriptive notes:* Female, 5.14 mm. The cephalothorax and abdomen have proportional lengths 83:17. The cephalothorax is 2.5 times as long as wide. The head is swollen laterally; the frontal margin is evenly rounded. The lateral margin of the last thoracic segment is narrowly rounded in lateral view. The rostrum has fairly long filaments.

The abdominal segments and furca have the following proportional lengths:

|         |     |   |    |    |       |      |
|---------|-----|---|----|----|-------|------|
| segment | 1-2 | 3 | 4  | 5  | furca |      |
|         | 42  | 9 | 11 | 14 | 24    | =100 |

The genital segment is about as long as wide; the ventral surface of the segment is abruptly produced at the genital aperture; there is no hair around the protuberance; the furca is 1.4 times as long as wide.

The 1st antenna, 6.33 mm in length, extends beyond the end of the furca by 3 segments; the segments have the following proportional lengths:

|         |    |    |    |    |    |    |    |    |    |       |    |    |    |    |    |
|---------|----|----|----|----|----|----|----|----|----|-------|----|----|----|----|----|
| segment | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10    | 11 | 12 | 13 | 14 | 15 |
|         | 89 | 36 | 28 | 26 | 31 | 28 | 31 | 28 | 31 | 33    | 36 | 41 | 50 | 49 | 52 |
| 16      | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |       |    |    |    |    |    |
| 53      | 55 | 53 | 41 | 29 | 36 | 33 | 41 | 39 | 31 | =1000 |    |    |    |    |    |

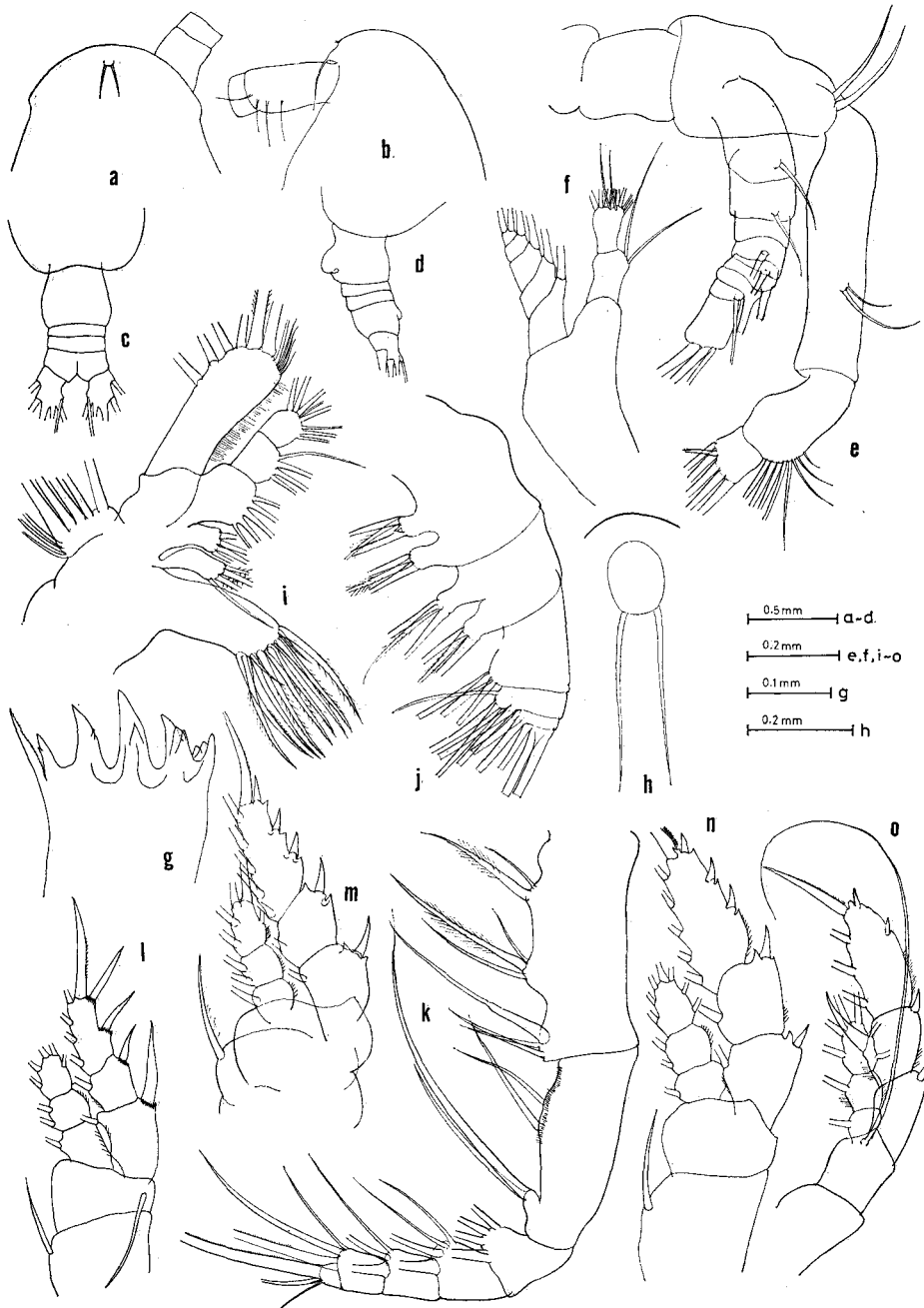


Fig. 33. *Haloptilus fons*, female: a, head, dorsal view; b, the same, lateral view; c, last thoracic segment and abdomen, dorsal view; d, the same, lateral view; e, 2nd antenna; f, mandibular palp; g, cutting blade of mandible; h, rostrum, ventral view; i, 1st maxilla; j, 2nd maxilla; k, maxilliped; l, 1st leg; m, 2nd leg; n, 3rd leg; o, 5th leg.

The endopod of the 2nd antenna is 1.4 times the length of the exopod; the exopod is 8-segmented, and each segment has 1 seta; the endopod has 8 setae on the inner lobe and 6 setae on the outer lobe. Both rami of the mandible are about the same length; the exopod has 6 setae; the endopod has 2 setae on the 1st segment, and 8 long and 2 short setae on the distal segment; the gnathobase is well developed and is provided with 5 groups of teeth. On the 1st maxilla the outer lobe has 5 long and 3 small setae, the exopod has 6 large and 4 small setae, the endopod is 2-segmented and has 12 setae, the 2nd basal segment has 5 setae, the 3rd inner lobe has 4 setae, the 2nd inner lobe has 4 setae, and the 1st inner lobe has 11 setae. The 2nd maxilla has the following number of setae on the lobes and endopod:

|       |   |   |   |   |   |   |    |
|-------|---|---|---|---|---|---|----|
| lobe  | 1 | 2 | 3 | 4 | 5 | 6 | Ri |
| setae | 3 | 3 | 3 | 3 | 3 | 3 | 7  |

The two basal segments of the maxilliped are about the same length; the lobes and endopod have the following number of setae:

|       |   |   |   |   |   |         |   |   |   |   |   |
|-------|---|---|---|---|---|---------|---|---|---|---|---|
| lobe  | 1 | 2 | 3 | 1 | 2 | segment | 1 | 2 | 3 | 4 | 5 |
| setae | 2 | 3 | 3 | 2 | 2 |         | 4 | 4 | 3 | 3 | 3 |

Distal setae on the 2nd maxilla and maxilliped are fringed with fine spinules.

Both rami of the 1st leg are 3-segmented; the outer marginal spine on the 1st exopodal segment extends to the base of the 1st outer marginal spine on the 3rd exopodal segment there are groups of spinules on the bases of outer marginal spines on the exopod; the 2nd basal segment has an outer marginal seta. The endopod of the 2nd leg has 6 setae on the 3rd segment. The 3rd and 4th legs each have 7 setae on the 3rd segment of the endopod. The 2nd basal segment of the 4th leg has a long outer seta which extends to the tip of the 2nd outer marginal spine on the 3rd exopodal segment. The 5th leg has a strong inner marginal spine on the 2nd exopodal segment the seta on the 2nd basal segment is long, and extends beyond the distal margin of the exopod.

*Remarks:* This is the first record of occurrence of the species in the waters surrounding Japan.

*Distribution and size variation:*

| Author                | Locality             | Depth (m) | Length (mm)  |
|-----------------------|----------------------|-----------|--------------|
| Farran, 1908          | Irish Atlantic slope | 1100-1830 | 5.7-6.6<br>♀ |
| Sars, 1925            | off Azores Is.       | 0-1500    | 4.80         |
| Wilson, 1950          | off Easter Is.       | 0-550     | —            |
| <i>Present record</i> | Izu region           | 0-1200    | 5.14         |

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